FY2010 Specialty Crop

Block Grant Program – Farm Bill

Idaho State Department of Agriculture

Prepared by: **Amanda Gibson,** Specialty Crop Block Grant Program Administrator

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Annual Performance Report

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*Final reports from these subrecipients were submitted and approved with the 2nd Annual Performance Report

Development of a Commercial Nesting Block for the Blue Orchard Bee, Osimia Lignaria Say

Subrecipient
Dr. Ron Bitner

Project Summary
Continuing issues with declining honeybee populations in the United States are creating greater urgency to find manageable alternative pollinators such as the Blue Orchard Bee, *Osmia lignaria* (www.epa.gov). There is a bottleneck to building up large populations of this bee until a demonstrated working nest can be produced. This nest needs to be economical and the larval cell contents need to be readily removed from it with some type of mechanical process. There is no nest currently on the market that is capable of this and an attempt will be made to survey a number of nesting materials that would lend themselves to solving this problem. The goal of this project is to develop a commercial nesting material for the Blue Orchard Bee that is attractive to the nesting females, one that will help minimize disease and pest build up, is easily capable of having the cocoons extracted, and economically viable for the producer. This is a long-term project, but a new industry of producers of the Blue Orchard Bee has begun in Idaho and the trend is expected to grow as it did with producers of the Alfalfa Leafcutting Bee.

Project Approach
The approach in developing a commercial nest for the Blue Orchard Bee was similar to that used by Dr. Bitner and others in finding a commercial nest for the Alfalfa Leafcutting Bee, *Megachile rotundata* which has been such a successful pollinator for alfalfa seed producers throughout the Western U.S. and Canada. The Blue Orchard Bee is a larger bee and requires a larger diameter nesting hole and more depth. One of the largest obstacles in testing different materials is the fact that the bee only has one generation per year and flies for an average of 30 days, thus limiting the time of exposure to different nesting types. A rather novel approach was developed that extended testing periods to different times during the season and this will be discussed later.

In the initial 2010 season, two types of polystyrene materials were tested that could be cut into various block sizes, depths, hole diameters, and colors. These criteria had been determined to be the most crucial factors in attracting nesting females that would produce the largest number of offspring. More than 400 nesting blocks with over 100,000 nesting holes of 4 different diameters and 3 different depths were produced. The blocks represented two types of foam (hot wire cut 1 #- pound expanded polystyrene and hot wire cut 2 #-pound polystyrene), with the2 #-pound foam colored in 6 different colors. The blocks were sent to nine different collaborators in Utah, Idaho, and California for placement in areas where they were releasing *Osmia lignaria* for propagation, or in areas where the bees were known to occur naturally and were exposed to a collecting activity known as trap-nesting, where the native bees will seek out supplied blocks in their search for their nesting holes. The test blocks were placed with the current industry standards of solid reeds or paper straws in card board tubes for comparisons. Flight activities typically are from mid-February in almond orchards in California, with later periods from early April to mid-July in Idaho depending on elevations of the locations. The blocks

were examined for acceptance and hole contents in October after the offspring were in the overwintering life stage.

The largest hurdle was beginning the studies in 2010. Because of the high industry demand, the Blue Orchard Bee was unavailable for purchase for use in trials in Idaho. This was addressed by converting some of the dollars for bee purchase to travel dollars to work with California collaborators. This has been quite successful for several reasons. The California collaborators already owned several hundred thousand *Osmia* bees they were using in their own propagation programs. They were more than willing to trial nest block prototypes, as they are looking for the most efficient nest to use on a commercial scale. California's season starts with almond pollination in February, which information to be discovered earlier, allowing for modifications for trials in Idaho. Additionally, the California collaborators are some of the largest almond growers in California and represent a huge market for sales of Idaho Blue Orchard Bees.

Unseasonable cool weather in 2011 again hindered nesting areas of the bee in its natural habitat, resulting again in poor overall nesting and unavailability to purchase cells for testing in Treasure Valley of Idaho sites, including the University of Idaho's orchard blocks in Parma, Idaho. October and November were spent examining tests blocks that had been placed in areas of Idaho where the Blue Orchard Bee nests naturally. Bees tended to nest in heavier polystyrene blocks, wood blocks and paper tubes.

During the 2012 nesting season, several new materials were constructed to test. A three-pound expanded polystyrene, blue-colored and pink -colored extruded polystyrene was produced. A single faced corrugated nest constructed of paper was also placed into the nest testing areas. In February 2012, the new prototypes with more than 50,000 nesting holes were sent to Paramount Farms in Paso Robles and to Dr. Steve Peterson in Ceres, California. The nests were placed in five-acre experimental nesting cages constructed to provide optimal bloom with no interference from honey bees. Nests for this project were tested along with several others. Several hundred thousand Blue Orchard Bees were released into the cages in April and allowed to nest in materials of their choice.

Several hundred new prototype nests with another 50,000 nesting holes were constructed to be placed in the naturally occurring sites identified from the previous fall's results. A 20-acre Idaho cherry orchard was identified to place bees captured and purchased from the previous season and allowed to nest in the prototype nests to begin to identify issues of placing bees in commercial orchards in Idaho. One five-acre field of mustard seed was also identified to work with.

Tables 1 and 2 are a summary of collaborators and locations for prototype nesting blocks from the 2011 and 2012 nesting seasons. Table 3 gives Idaho locations for prototype wood nesting blocks (made from alder, yellow pine and poplar) that have already been placed at higher elevation locations in Idaho that are unapproachable during springtime because of snow, ice, and mud. Table 4 is a summary of bee nesting for seasons 2011-12. The different nesting types compared with bee preference, cost per hole, reuse, parasite protection, ease of harvest, ease of clean up, and potential for automated harvesting. Cost of shelters for commercial use is also shown.

Collaborators: Buena Vista Farms took the lead in designing and manufacturing prototype nests, as well as with nest placement with the various producers. One continuing issue in working with *Osmia lignaria* is the fact that the bee has one generation per year and builds nests for only four to five weeks after emergence. This will always be an issue, but was addressed rather innovatively by working with producers in several regions. Collaboration with Dr. Gordon Wardell of Paramont Farms (one of the major almond farms in California) and Dr. Steve Peterson (a former postdoctoral researcher with the University of Idaho) of Ag Pollen, Inc. was very instrumental in allowing the use of their Blue Orchard Bee five-acre increase cages in central California in February, lending nest design changes before testing in Idaho later in the season. Dr. Craig Baird, retired entomologist with the University of Idaho is currently a museum curator at the College of Idaho's Orma J. Smith Natural History Museum and is working with students to identify bee species from the nesting blocks and cataloging them in their own section of specimens at the museum.

Information Dispersal: The project report has been sent to the following USDA Bee Researchers: Dr. Jim Cane, Logan Bee Laboratory; Dr. Theresa Pitt-Singer, Logan Bee Laboratory; and Dr. William Kemp-Biosciences Research Center, Fargo, North Dakota. The web-site www.pollination.com is currently being updated, and the report from this project will be posted there soon. A short version of the report has been sent to the Western Edition Country Folks Grower magazine, and other fruit grower magazines will be contacted soon as well.

The Orchard Bee Association has been recently formed to advance knowledge about non-Apis bees as pollinators in Orchards, especially the Blue Orchard Bee. They are hosting the first conference October 11, 2013 at the USDA Logan Bee Facility, and a tentative program is currently being worked out. Dr. Bitner is the Treasurer for this new organization and will be presenting the results from the project at this conference.

Goals and Outcomes Achieved

Table 4 summarizes advantages and disadvantages of the nesting materials compared during the seasons 2011-2012. The number one candidate appears to be grooved laminated wood. Cost of the material has been considered too high in the past, but use of different wood materials (poplar, yellow pine, and alder) and a new manufacturer helped reduce these costs. Wood materials will be placed in larger numbers for the 2013 season. The fluted corrugated paper and the extruded colored polystyrene also showed potential, but start up manufacturing costs for both was estimated at $100,000 for each, which is prohibitive at these early stages. The outcome measures are long-term, and despite availability of Blue Orchard Bee populations, enough information has been garnered to continue to refine a better nesting material for future seasons.

Beneficiaries

Much information was garnered, which provided enough direction each year to design newer prototypes with the goal of developing the nesting type that is needed if the commercialization of the Blue Orchard Bee is ever to be a significant pollinator to be used along with the Honey Bee, *Apis mellifera*. An organization of researchers and producers working on *Osmia* issues was formed in 2011 (Orchard Bee Association) to advance the use of this bee. A major goal of this project was to create jobs

in the State of Idaho. Idaho is blessed to have naturally occurring populations of the Blue Orchard Bees throughout the State. When the Alfalfa Leafcutting Bee was first found in Idaho during the 1960s, a whole cottage industry of nesting block manufacturers were founded and local individuals and groups began raising the bee for the major alfalfa seed production industry in Idaho. Raising and trapping leafcutting bees became a major source of income for many people. Dr. Bitner had personal knowledge and experience of the purchase of several thousands of dollars of leafcutting bees for several major seed companies during the 1980s and 90s. The Blue Orchard Bee has that same potential as improvements are made each year on how to economically produce more of these valuable little pollinators from Idaho.

Lessons Learned

Honey bee decline is still a global issue and the use of alternative pollinators such as the Blue Orchard Bee continues to be an issue of great importance. Lack of availability of the Blue Orchard Bee because of a commercially affordable nest that allows for buildup of bee populations was the key element of the research conducted. From previous experience with the Alfalfa Leafcutting Bee, it was known from the beginning that there would be obstacles. Working with an insect that has a four-week life cycle each year limits research throughout the rest of the year. Weather conditions also are the limiting factor in insect population growth and poor weather conditions also had a major impact on increasing the numbers of this bee.

Because access to large numbers of the bee from the beginning made it difficult to expose different nest designs that could be evaluated as to their acceptance and ease of use, several novel approaches were used to expose more bees to more nests. First was the collaborative work with researchers using this bee on almonds in California. These researchers allowed their bees to be used in the trial nests in February and March when the almonds were in bloom, which allowed for earlier decisions on changing materials and designs. These new designs were then trialed in May and June in the Treasure Valley in Idaho, and later in the summer at higher elevations in the bee habitats of Southeastern Idaho.
With more than 35 years experience with the Alfalfa Leafcuttng Bee, Dr. Bitner knew many of the problems he would face in working with the Blue Orchard Bee. In the two seasons of trialing the different nest designs enough knowledge has been gained to move ahead with a fledgling industry in Idaho that will allow Idaho producers to begin raising the Blue Orchard Bee for the pollinator market place. A western states organization has been formed to share information about raising and marketing the bee and potential markets have already been established in the almond and apple orchard industry. Ongoing research plans on nests have already been put into practice for next season. A cottage industry is being built around the raising and marketing of this bee and will continue to grow.

Contact Person

Ron M. Bitner, PhD
rmbitner@yahoo.com
(208) 454-0086

Paramount Farms Osmia increase cage

Corrugated paper/paper tubes

Almond Trials

Almond trials

Expanded polystyrene

Trailer with expanded polystyrene

Wood laminates/new version

Wood laminate/paper tubes

Unrolling corrugated paper

Corrugated paper with cocoons

Trap nesting in Idaho

Trap nesting site

Table 1. Bee Testing Blocks Areas Distribution for 2011.

Bee Testing Blocks Areas of Distribution 2011

Table 1

Collaborators	Phone	Company	Adress	City	State	Zip	est products sent							
							Blank holes	200 hole	300 hole	150 hole	25 tubes		3-May	
Mark Porath	801-277-4675 night work		2451 E 3900 S	Salt Lake City	UT	84124	110,000	2						
Matt Allen	661-302-5662		7205 Whitewater Falls D	Bakersfield	CA	93312		24	2	1				
Gerald Bodily	559-896-2355		2705 C St	Selma	CA	93662	500	2		1		7 heaters		
Paul McCormick	209-604-2080		34201 S McCracken Rd	Tracy	CA	95304		5	1					
Steve Peterson	209-338-7110	Ag Pollen	1736 Herndon Road	Ceres	CA	95307	400	8	4				3 nests w pink foam	
Dale Nielson	435-770-6272		281 Stewart Hill Dr	Logan	UT	84321	1000	2	1					
Gordon Wardell	661-477-0256	Paramount Farming Co	33141 E Lerdo Highway	Bakersfield	CA	93308							6 nests w pink foam	
			6775 Chardonay Rd	Paso Robles	CA	93446								
Charles LeFevre	541-513-4176		3977 Dillard Rd	Eugene	OR	97405		1	1			6 straws		
Doug Hammond	208-833-4218		Hammond Lane	Challis	ID	83226				2		60 bees	2 nests w pink foam	
				Salmon	ID		`			1		30 bees		
Andy Roche	(406) 961-3852		727 Orchard Drive	Hamilton	MT	59840				2		4 straws		
David Hedges	(801)648-8872		883 E 3000 S	Almo	ID	83312				21			10 nests	11pink/blue nests
Dave Hunter			14313 NE 177th Court	Woodinville	WA	98072	150			3			pink/blue/3# multihole	
							111900	0	0	0		111900		
			3585 W state St	Eagle	ID			2				seeded		
			5589 Bella Vista Lane	Eagle	ID				3			seeded		
			Lilac Lane	Eagle	ID			2				seeded		
		Cherry Orchard	Homedale Rd	Caldwell	ID			6			20	seeded		
			Deadwood Rs Rd	Garden Valley	ID			4				seeded		
			East Pine Cr	Garden Valley	ID			3				seeded		
			West Pine Cr	Garden Valley	ID			3			16	seeded		
		homestead	Brownlee Rd	Sweet	ID			6				seeded		
			Plum Rd	Caldwell	ID			6	1	1		seeded		
			Mann Creek	Weiser	ID									
								76	13	32	76			
								15200	3900	4800	1900	23900		
											Total holes	135800		

Table 2. Bee Testing Blocks Areas Distribution for 2012.

Bee Testing Blocks Areas of Distribution 2012

Table 2

Collaborator	Company	City	State	Zip	Test Products 6 inch Tubes			5 Gal			Foam			Wood Blocks			Reeds	Straw in Tubes	TOTAL
Mark Porath		Salt Lake C	UT	84124	6	120	720												
Matt Allen		Bakersfield	CA	93312															
Gerald Bodily		Selma	CA	93662	6	120	720												
Paul McCormick		Tracy	CA	95304															
Steve Peterson	Ag Pollen	Ceres	CA	95307	7	120	840	2	250	500	2	200	400						
Dale Nielson		Logan	UT	84321	6	120	720												
Gordon Wardell	Paramount Farmin	Bakersfield	CA	93308															
		Paso Roble	CA	93446	24	120	2880	18	250	4500									
Charles LeFevre		Eugene	OR	97405	4	120	480												
Doug Hammond		Challis	ID	83226															
		Salmon	ID																
Andy Roche		Hamilton	MT	59840															
David Hedges		Almo	ID	83312	24	120	2880	20	250	5000	40	300	12000	80	96	7680		800	
Jim Watts		Bothell	WA	98012	7	120	840												
Dave Hunter		Woodinville	WA	98072	7	120	840												
Glenn Trostle	(661)201-7829	Delano	CA	93215	5	120	600												
Steve Brustkern		Medina	WA	98039	2	120	240												
Craig Baird		Caldwell			6	120	720												
	Cherry Orchard	Caldwell	ID					40	250	10000									
	Canola Field	Caldwell	ID								1	100	100	1	96	96	30	150	
				gps															
		Garden Val	ID	2	2	120	240												
				3				1	250	250									
				4				1	250	250									
				5				1	250	250									
				6				1	250	250									
				7	1	120	120												
		Garden Val	ID	8	1	120	120				3	200	600						
				9				1	250	250	3	200	600						
				10				1	250	250									
				11				1	250	250	1	200	200						
				12				1	250	250	1	200	200						
				13				1	250	250									
				14				1	250	250	1	200	200						
	homestead	Sweet	ID	15	1	120	120	5	250	1250									
				16	1	120	120	5	250	1250									
		Weiser	ID	17				5	250	1250									
				17				5	250	1250									
				18				5	250	1250									
				19				5	250	1250									
				20				5	250	1250									
				21				5	250	1250									
				22	5	120	600												
				23	5	120	600												
		Eagle	ID		12	120	1440												
		Eagle	ID		1	120	120	8	250	2000	14	100	1400	24	96	2304			
		silver city	ID	25				5	250	1250									
				26				5	250	1250									
				27				11	250	2750							1 below 10 above		
				28	5	120	600										above road		
				29	2	120	240												
				30	2	120	240												
				31	1	120	120												
				32	1	120	120												
		Albion	ID	34							2	300	600					50	
				35							2	300	600					75	
				36							2	300	600					25	
				37							2	300	600					50	
				38							2	300	600					100	

Table 3. Bee Testing Blocks Areas of Idaho Distribution for 2013.

Bee Testing Blocks Areas of Idaho Distribution for 2013												
Table 3											Wood Blocks	
Name/ Location	GPS #	Lat	Long	Altitude	Phone	Company	Adress	City	State	Zip	56 Hole	96 Hole
Lyman #1	1											10
Lyman #2	2											30
Green Gate #1	3											5
Green Gate #1	4											10
Wildcat #1	5											5
Wildcat #2	6											5
Johnson Creek	7											5
Silver City Road	8	N 43.02.729	W 118.39.201	4313							5	
Silver City Road	9	N 43.02.423	W 116.39.418	4476							5	
Silver City Road	10	N 43.02.289	W 116.40.091	4820							5	
Silver City Road	11	N 43.02.206	W 116.41.207	5427							5	
Silver City Road	12	N 43.02.454	W 116.41.895	6039							5	
Silver City Road	13	N 43.00.188	W 116.43.758	6301							5	
Silver City Road	14	N 43.00.242	W 116.43.801	6317							5	
Silver City Road	15	N 43.01.648	W 116.43.226	6443							5	
Silver City Road	16	N 43.02.132	W 116.44.880	5924							5	
Silver City Road	17	N 43.02.620	W 116.46.554	5845							5	
Silver City Road	18	N 43.02.042	W 116.47.511	5734							5	
Silver City Road	19	N 43.01.438	W 116.43.169	5561								5
	20											
	21											
	22											
	23									**Total**	**55**	**75**
									x 56 Holes		**3080**	
									x 96 Holes			**7200**

Table 4. Bee Nesting Summary

Bee Nesting Summary

Table 4

	Reeds	Paper/ Cardboard Straws	Straws in Carboard Tube	Hot Wire 1 # expanded Oolystyrene	Hot Wire 2# expanded Polystyrene	Hot Wire 3 # expanded Polystyrene	Hot Wire Extruded Polystyrene	Routed Extruded Polystyrene	5/8" Corrugated Cardboard	Laminated Wood
Bee Preference	1	2	2	9	8	6	5	7	4	3
Cost Per Hole	0.1	0.032	0.14	0.005	0.01	0.03	0.06	0.223	0.0222	0.037
Reuse	no	no	tube only	no	no	yes	yes	yes	no	yes
Parasite Protection	no	no	yes	no	no	yes	yes	yes	no	yes
Ease of Harvest	good	poor	poor	fair	fair	fair	good	good	good	good
Ease of Cleanup	good	no	fair	fair	fair	fair	fair	fair	good	fair
Potential Automated Harvesting	no	no	no	fair	fair	fair	fair	fair	fair	good

Cost for Shelters	
2 gal plastic bucket	2.30
5 gal plastic bucket	2.75
Fiesta house	4.75
Corrugated plastic box	5.00
Corrugated plastic banded to lamin	0.50

Enhancing the Marketing and Sales of Idaho Apples through Cool School Café

Subrecipient
Idaho Apple Commission

Project Summary
"To take such action as to the commission deemed necessary or advisable in order to promote the sale of apples and to protect the apple industry" is one of the powers bestowed on the Commission through the Idaho Sate Code. Many commodity groups have the means available to employ full-time representatives to go out and promote their respective products. The Idaho Apple Commission works with a smaller budget and is not able to hire marketing representatives. The purpose of this project was to use the Cool School Café Program as a marketing arm for the Commission and to also provide incentives for the state and national schools to purchase Idaho apples. The project allowed the Idaho Apple Commission to provide nutritional and educational materials about apples to schools for distribution by the Commission and upon request from the schools.

Project Approach
The Idaho Apple Commission prepared information packets to be sent to schools, and these packets were sent to contacts received from CSC. In the course of the grant period, the Commission mailed 163 packets to schools in approximately 37 states. This was a direct marketing campaign the Idaho Apple Commission would not be able to perform without the grant money that allowed membership in CSC. The Idaho Apple Commission was included in catalogs for the CSC promotional seasons helping to build identity for Idaho Apples. The Idaho Apple Commission also had new promotional folders created, and upon receipt of the materials and new catalogs from CSC, 174 informational packets were mailed to Idaho schools. The Idaho Apple Commission staff has consistently received requests from CSC for Idaho Apple information, and these requests were fulfilled.

Goals and Outcomes Achieved
Although loyalty-based programs are not a new concept, participating in the program was a new concept for the Idaho Apple Commission. The opportunity to be involved with the Cool School Café was an important marketing objective for the Commission. The goals for this project were to increase the amount of apples sold through Idaho school systems and across the United States. To have the schools take advantage of the points offered through the program would have benefited the schools. Another goal was for the Commission to have educational and nutritional information available to be distributed to schools. When the CSC submitted the apple purchases for point verification, the apples were purchased from other states and did not qualify to be redeemed for points.

The first year of the grant the Idaho Apple Commission staff sent 113 packets of information to schools in 34 states, and paid a point redemption of $606.40. The second year of the grant the Idaho Apple Commission staff sent 60 packets to 37 states, and paid a point redemption of $230.60. In September 2012, 174 packets were sent to Idaho Schools.

Requests for informational packets from CSC will continue to be mailed until the end of the apple season. The link for the CSC website will remain on the Idaho Apple Commission web site. The Idaho Apple Commission will continually monitor requests for information to be sent to the schools, and will fulfill those requests even after the completion of the grant and is no longer a member of CSC.

Beneficiaries

The beneficiaries of this grant included approximately six shipping companies that are part of the Idaho apple growing region and approximately 50 apple growers. Increased use of the CSC program would have helped build recognition of the growing region giving the area shippers another avenue to market their product. With increased recognition the next logical step would have been increased sales in the school foodservice segment of the industry.

Lessons Learned

Because the Idaho Apple Commission did receive many requests for product informa-tion, the Commission still feels that being a member of CSC did bring additional aware-ness for Idaho Apples in schools in Idaho as well as across the nation. Because the Idaho Apple Commission is not able to fund a marketing program, CSC served a mar-keting arm for schools for the two years of the grant. What the Commission learned from being a member of CSC is that it is important to continually let people know about Idaho Apples to build increased awareness. Encouraging the foodservice directors at schools to use Idaho Apples will still be beneficial to the apple industry. However, be-cause most schools order apples on a per case basis rather than a truckload, it will be important to encourage schools to request Idaho Apples from their suppliers. This is a program that has to build on itself and two years wasn't enough time to build the sup-port and the understanding of the program to get the full effect.

Contact Person

Candi Fitch
(208) 722-5111
cbfitch@cableone.net

Additional Information

None.

Development of Market for Idaho Pinto Bean Seed in Chihuahua, Mexico

Subrecipient
Idaho Bean Commission

Project Summary
After a successful test and subsequent field day in the state of Chihuahua in 2006, Idaho exporters reported increased sales of pinto bean seed. But despite the success of several new U.S. pinto varieties in that test, growers in Mexico have continued to primarily plant locally produced non-certified seed. Also, Mexico growers are not accustomed to placing seed orders at least one year in advance so that Idaho exporters can adequately estimate their planting contracts ahead of shipping dates. Chihuahua grows more than 40,000 acres of beans, primarily pinto beans. This represents a very sizable market for Idaho.

Market research indicated that more education was needed on the value of investing in certified Idaho bean seed. The best way to educate the growers is to give them an opportunity to see the beans perform in their growing region, under their typical production practices, and alongside their traditional bean varieties. Thus a two-pronged marketing approach was developed to increase demand in Chihuahua for certified Idaho seed; field trials of Idaho beans seed, and exhibiting at a local agricultural trade show.

University of Idaho Plant and Soil Sciences researchers were involved in identification of pathogens (including viruses) limiting profitable bean production in Mexico. The ultimate goal was to include identified needs of Mexican growers into existing breeding programs in Idaho, to stimulate export of Idaho bean seed.

Project Approach
The Idaho Bean Commission (IBC) worked with the Idaho-Mexico Trade Office to identify a quality trial manager in the state of Chihuahua and organized bean seed trials for the 2011 growing season. The trial manager, Sr. Peter Stoesz, visited Idaho in the spring of 2011 to become more familiar with the Idaho bean seed industry and meet with bean seed exporters. The University of Idaho Foundation Seed Program Manager recommended several pinto bean seed varieties to be included in the tests and the seed was collected from local dealers.

Certified Idaho bean seed was planted alongside Mexican seed varieties in replicated trials in three environmentally-diverse bean growing areas of Chihuahua. A field day was held in October 2011 for local producers to come and learn about Idaho Certified Seed and see the performance difference for themselves. The field day was attended by approximately 100 growers. Education materials and variety descriptions were provided to each attendee. Presentations emphasizing the importance of using fresh, certified seed were given at field days by Kathy Stewart-Williams of the University of Idaho, and the manager of the tests.

IBC partnered with Union De Credito Agricultures De Cuauhtemoc to exhibit at Expo Agro Chihuahua in 2011 and with Agro Mesa 2012, promoting the results of the trials and providing education to local bean producers on the importance of purchasing certified Idaho seed

Diana Caldwell (IBC Administrator at the time) worked with a professional photographer and local bean dealers to photograph healthy disease and weed-free beans during the growing, cutting, and harvest stages of production. These photos were used in designing education and marketing materials for the Mexican market.

Two board members of the Idaho Bean Commission participated in the Idaho Lt. Governor's trade mission to Mexico City in December 2011. Although this activity was not funded by the grant, important contacts were made with SAGARPA officials, growers, and important importers of Idaho seed beans. The Commission learned that the drought had left Mexico with a shortage of commercial beans to feed their population and no seed beans to plant in the spring of 2013. As a result of this mission, SAGARPA promised to pay all expenses for a trade mission to Idaho and issue lines of credit so that sufficient seed could be purchased. SAGARPA supplied the Commission with a list of 17 eligible bean industry representatives, and invitations were issued. Finally, nine representatives from Durango, San Luis Potosi, Jalisco, and Zacatecas paid their own airfare and came to Idaho to negotiate purchases of seed from five exporters with production plants in Idaho in March of 2012. The Commission used grant funds to pay for accommodations, room rentals, ground transportation, and meals so that these negotiations could take place. Unfortunately, SAGARPA did not arrange lines of credit and no immediate sales were recorded, but many beneficial relationships were established.

During the course the of the SAGARPA trade mission, many growers had specific questions about the production practices in Idaho, environmental condition, and the certification standards. IBC had a small brochure explaining the benefits of certified seed, but it did not address these other items. The Commission chose to put the unused travel funds to use producing a comprehensive guide to the Idaho bean seed industry in Spanish. After working with a copy writer and graphic designer, a very nice booklet was printed. These will be used at trade shows, seed trial field days, and by Idaho seed distributors in Mexico to educate their customers and promote the value of using certified Idaho seed.

In the course of the project, Dr. Alex Karasev visited Chihuahua, Mexico, twice - in August 2011 and again in September 2012. Both visits were used to survey bean fields for pathology problems and for collection of samples for laboratory analysis. Due to phytosanitary restrictions, analysis of the samples had to be performed in Mexico, in the lab of cooperators from the University of Chihuahua. A reliable testing protocol was developed for three viruses affecting beans: *Beet curly top virus* (BCTV), *Bean common mosaic virus* (BCMV), and *Bean common necrosis mosaic virus* (BCMNV). This protocol was initially tested in Idaho, at the Plant Virology laboratory of UI, and then transferred to the Plant Pathology lab of the University of Chihuahua. BCTV was found in beans during the field survey in September 2012. BCMV and BCMNV are two aphid-transmitted potyviruses. Both BCMV and BCMNV are also transmitted by seed and represent a significant threat to bean production world-wide.

Goals and Outcomes Achieved

It was expected that eight U.S. varieties from Idaho could outperform Mexico's most popular pinto, Saltillo. Five of the nine Idaho certified Idaho varieties outperformed all three of the Mexico varieties in

the tests. Trial results were a little unreliable as one of the fields was not harvested to do the manager's medical emergency and all yields were lower than average due to a severe drought in Mexico during that growing season.

Two hundred and fifty-four tons (U.S.) of Idaho Certified bean seed were ordered by the Mennonite Co-operative after the tests.

Through the field day and Expo Chihuahua, over 600 growers were educated on the merits of purchasing Idaho bean seed. A goal of 500 was established in the original project plan.

Reliable export statistics are difficult to come by, especially for a landlocked state like Idaho. Our original base line numbers were based in international phytosanitary certificates from the Idaho State Department of Agriculture. Unfortunately, the state changed its tracking system in 2009 and the tabulations now are not consistent with those in the old system. However, if 2010 is established as the new baseline (the first full year under the new reporting system), significant growth can be shown. From 2010 to 2012 bean seed exports to Mexico increases 44%, far surpassing the 10% goal established in the project plan.

Year	Total Pounds of Bean Seed Exported to Mexico
2010	238,552
2011	245,359
2012	342,838

Although it's believed that much more bean seed from Idaho can make it to Mexico through means that will not be shown on the Federal Phytosanitary Certificate report from ISDA, it's still the best measurement of respective growth from year to year.

The Sonora pinto variety from Idaho was of particular interest. There were many questions regarding how quickly the bean would darken after harvest (the Mexican market highly values a light colored bean). A color study was scheduled for 2012, but arrangements were not made in time to ensure a reliable study.

2000 of the Spanish Bean Seed Guides were printed and were distributed in Mexico in July-November 2013.

Beneficiaries

Idaho has approximately 500 bean growers and 30 bean seed dealers. Twenty of the dealers currently export and ten offer Spanish-speaking customer service. Idaho bean dealers and growers are well positioned to benefit from an increased demand for Idaho bean seed.

As demand for bean seed in Mexico increases, bean dealers look to contract more acres of bean seed production with Idaho growers. Bean seed carries a premium over commercial dry beans and offers greater profit to the grower. The dealers also benefit from increased sales.

Growers in Mexico also benefit from the use of disease-free certified Idaho seed in term of higher yields and increased profitability.

Lessons Learned

The Chihuahua tests experienced some challenges. Language difficulties, a complicated chain of command with the contractor and the distance between the three test locations led to inconsistent progress reports and poor organization of the field days. In addition, the bean-growing season in Chihuahua coincides with the bean-growing season in Idaho. This made it impossible for Commission board members, all of whom were busy with their own farming activities, to attend the field days.

Nothing can be done about the conflict in the growing season and having IBC board member available to travel during harvest time continues to be an understandable challenge. In regards to trial management, the Commission has learned the value of having very detailed guidelines and clearly communicated expectations outlined in a signed contract. The Commission is repeating similar trials in 2013 and has developed a detailed contract requesting specific information be reported the Commission every month, including photos of the plots. This more hands-on approach with increased communication should help most complications to be avoided.

Contact Person

Lacey Menasco, Administrator, Idaho Bean Commission
(208) 334-3520
lacey.menasco@bean.idaho.gov

Additional Information

None.

Marketing Idaho-Eastern Oregon Onions through Brand Plus to Help Build Industry Identity and Increase Sales

Subrecipient
Idaho –Eastern Oregon Onion Committee

Project Summary
The onions grown in the Idaho-Eastern Oregon onion area are governed by a Federal Marketing Order (MO), and the MO maintains quality and size standards that exceed USDA standards. The IEOOPC was formed to promote this high-quality onion. Many commodity groups have the means available to employ full-time representatives to go out and promote their respective products. The IEOOPC continually looks for new ways to promote the area's onions, but the IEOOPC does not have the funds available to employ full-time marketing representatives. The purpose of this project was to use Brand Points Plus as a marketing arm for the Committee in order to encourage foodservice distributors and end users to purchase Idaho-Eastern Oregon Onions. The project was also designed to build awareness of Idaho-Eastern Oregon Onions by providing information about the onions and the Idaho and Eastern Oregon growing region. The membership with Brand Points Plus (BPP) was new for the Committee. BPP is a loyalty based program where members can earn points by using member companies' products and redeem those points for prizes.

Project Approach
It was determined at the beginning of the grant period that the committee staff would secure a list of members of BPP from the BPP staff. The approach for building awareness of BPP was done throughout both years of the grant. The IEOOPC staff worked closely with BPP staff to find avenues to introduce BPP members to Idaho-Eastern Oregon Onions. Onions were included in a BPP newsletter that was sent to its membership. The staff for the IEOOPC used various avenues to introduce BPP to prospective members. The BPP logo was included in national advertising that went to the foodservice sector. At various events, IEOOPC staff talked to members of the foodservice industry about the IEOOPC's membership in BPP. Educational material was printed and mailed during the two years of the grant as well as it being handed out at trade shows. At the end of the first year of the grant, the IEOOPC Office Staff received 14 requests from BPP for informational packets about Idaho-E. Oregon Onions, and during the second year, the staff mailed out 25 packets. During the two years of the grant there was not a request to pay points for Idaho-Eastern Oregon Onions. It was concluded that the end users were not requesting Idaho-Eastern Oregon onions from their suppliers and therefore not utilizing or not understanding the BPP Program.

Goals and Outcomes Achieved
To build awareness of this program, advertising was developed and put into many of the national trade publications. Information about the program was also listed on the IEOOPC web site during the grant period. The goal for this project was to increase the amount of onions sold to the foodservice distributors, to create awareness, and to build the identity of Idaho-Eastern Oregon onions and the growing region within the foodservice segment, and ultimately have the increased sales and awareness channeled down to the end user. Due to the lack of interest from the foodservice sector in the BPP

Program, this goal was not achieved. During the grant period, the IEOOPC partnered with another commodity group and was involved with a chef dining program within the universities system, and the IEOOPC Marketing Director used this as an avenue to discuss BPP and to encourage support and use of the BPP and Idaho-Eastern Oregon onions.

Lessons Learned

Because the IEOOPC did receive a few requests for product information, the Committee still feels that being a member of BPP did bring additional awareness on a limited measure for Idaho-Eastern Oregon onions, and being a member of BPP added to the Committee's annual marketing plan for the two years of the grant period. This is a program that has to build on itself and two years wasn't enough time to build support and understanding of the program to get the full effect.

What the Committee learned from being a member of BPP is that it is important for building more awareness of Idaho-Eastern Oregon onions at the operator, or end user level. Encouraging operators, or end users, to use Idaho-Eastern Oregon onions could have encouraged them to become members of BPP. The operator being a member of BPP could have shown an increase in usage of the area onions for them to have more points for redemption within BPP, creating a win-win for both the Idaho-Eastern Oregon onion shippers and the operator, or end user. This is a program that has to build on itself and two years wasn't enough time to build support and understanding of the program to get the full effect.

Beneficiaries

The beneficiaries of this grant were targeted to be the approximately 35 shipping companies that are part of the Idaho-Eastern Oregon Onion growing region, and had the program worked as originally anticipated, in the long run it would have benefitted all of the approximately 200 growers in the region area. Increased use of the BPP program would have helped build recognition of the growing region giving the area shippers another avenue to market their product. With increased recognition, the next logical step would have been increased sales in the foodservice and end-user segments of the industry.

Contact Person

Candi Fitch, Executive Direction
Idaho-Eastern Oregon Onion Committee
cbfitch@cableone.net
(208) 722-5111

Development of an Education and Outreach Program for Idaho's Seed Industry

Subrecipient
Idaho-Eastern Oregon Seed Association

Project Summary
The purpose of this project was to develop a virtual interactive website, a K-12 teacher's curriculum, and a marketing brochure for Idaho's seed industry that would result in better education and public awareness about Idaho's seed Industry. Motivation for this project came from members within Idaho's seed industry.

Project Approach
Little is known about Idaho's seed industry due to company proprietorship on varieties and species. Industry wanted to better educate the public about the seed industry and its importance to the state. The average age of farmers is growing, and education and outreach is an excellent way to enhance opportunities for agriculture and peak the interest of younger generations.

During the grant period, Roger Batt and Brad Elsberg went out into the field and shot eight (8) different species of seed crops with a video camera and a regular camera. Experts in the field were interviewed to explain these seed crops, their growth, the economics of each species for Idaho producers and the industry, and the areas where they are grown and exported to different markets. Panoramas, video and audio images were imported onto the Idaho Eastern Oregon Seed Association's Website to create a "virtual interactive" website for anyone to learn more about Idaho's seed industry, http://www.ieosa.org/portfolio.html. The website was presented during the 2011 IEOSA Annual Winter Convention and was very well received. Over 2,000 hits to the IEOSA website took place over the summer of 2012.

Development of a K-12 teacher's curriculum and a marketing brochure also took place. Rick Weiss (2010 Teacher of the Year) compiled a K-12 curriculum about seed production and the industry. This curriculum went through a review process and then was approved by the IEOSA's Board of Directors. The curriculum will be copied onto CDs and distributed in Idaho schools in 2013. The marketing brochure was put together by Roger Batt and EA Design and Services. The brochure resulted in a small pocket guide that folds out into about eight sections (front and back) and showcased Idaho's seed industry including production, biotechnology, exports to over 120 countries, the value of the Industry, and the need for the Industry. A total of 25,000 brochures were printed out in 2012 and over 5,000 of them have already been distributed at public forums. Although it was not possible to attend a job fair, over 10,000 copies of the marketing brochure were handed out to members of the public through county and state fairs and other symposiums conducted throughout 2012.

Goals and Outcomes Achieved
Virtual Interactive Website: Panoramas and photos of Turnip Seed, Pea Seed, Carrot Seed, Onion Seed, Sweet Corn Seed, Popcorn Seed, Bean Seed, and Radish Seed were shot and placed onto the IEOSA's

virtual interactive website. Experts on these seed crops were also interviewed to include video and audio footage about these seed crops and incorporated onto the IEOSA Website for the public to learn about Idaho's seed industry. There were two seed crops (Sunflower and Lettuce) which were not raised in the state of Idaho during the period of this grant. These seed crops were not filmed and more emphasis was placed on the other species. Over 2,000 hits to the IEOSA website took place over the summer of 2012 (many more than expected). The website will continue to grow and expand to incorporate more seed varieties and more education and outreach components for the public. Over 10,000 hits to the website were received, a substantial number considering the lack of knowledge regarding the seed industry prior to the project.

K-12 Curriculum: A K-12 teacher's curriculum was developed for Idaho classrooms. Curriculum is currently being fine-tuned for inclusion into schools, with reference to the virtual interactive website. CDs will be copied and mailed to classrooms across Idaho in 2013 for inclusion in classroom learning. Students will be able to learn about Idaho's seed industry and how valuable it really is, not only for farm-gate dollars, but to feed the world.

Seed Marketing Brochure: A marketing brochure for Idaho's Seed Industry was developed and 25,000 copies were printed. Approximately 6,000 of these brochures were already distributed to the public through state fairs and other symposiums over 2012. The remainder of the brochures will be passed out in 2013 at various job fairs, state fairs, conventions, and other symposiums.

Beneficiaries

Groups and operations that benefited from this project include Idaho seed companies and affiliate industry members and Idaho seed producers. Idaho has about 75 Seed Companies and hundreds of seed producers in the state, all of which benefit from the programs that were established by this grant. Idaho's seed industry is valued at $500 million based on industry input and estimates. Industry was very pleased at the outcome of the website, curriculum, and brochure and the amount of education and awareness developed and presented to the public in order to teach them about Idaho's seed industry.

Lessons Learned

What was learned from this project was that it was difficult to time the seed crops to be shot at a certain stage of growth for optimum footage. It was at times difficult to time schedules with experts in the field to conduct interviews for the website. Development of a seed industry teacher's curriculum also took much longer than expected. Development and distribution of the brochure went very smooth.

Contact Person

Roger Batt, Executive Director
Idaho-Eastern Oregon Seed Association
roger@amgidaho.com
(208) 888-0988

Idaho Mint Grower's Survey for Development of a Current Economic Analysis of Costs and Returns in the Mint Industry

Subrecipient
Idaho Mint Commission

Project Summary
The purpose of this project was to produce updated enterprise budgets for the Idaho mint industry. Cost of production information had not been updated since 2005. Significant changes in mint production and marketing have occurred since that time, and need to be incorporated in University of Idaho Extension publications that are kept current for all of the state's major commodities.

Idaho ranks third in the nation for both spearmint and peppermint production, in both cases after Washington and Oregon (ISDA, 2009). Idaho produced 22% of the nation's spearmint and 5% of the nation's peppermint in 2007. While all three states have published enterprise budgets for use by producers, the mint industry, policymakers, and bankers, only Idaho's budgets are updated on a regular basis (every other year). Declining state and federal budgets has reduced funding for producing this vital information. Oregon's budgets were produced in the mid-1990s while Washington's were produced in 2001. Without detailed and accurate information on production costs for different growers, the profitability of this crop in various regions cannot be accurately determined.

Project Approach
The University of Idaho worked with the Idaho Mint Commission to develop a list of growers to survey. A survey instrument was developed to gather information from growers and others on cultural practices, establishment costs, yields, equipment usage, fertility testing and fertilizer usage, pesticide and herbicide application, marketing, and other factors associated with the production of mint oil in the Treasure Valley area of Idaho. Given the confidential nature of the information that was gathered, surveys were administered face-to-face. A set of typical practices was created based on all responses; therefore, the final budgets do not represent any particular grower. The resulting enterprise budgets were sent to the Idaho Mint Commission to review for accuracy and representativeness. Since no feedback was received, no further modifications have been made. The final set of mint budgets was posted on the University of Idaho's Department of Agricultural Economics and Rural Sociology website. http://web.cals.uidaho.edu/idahoagbiz/enterprise-budgets/?crop_search=yes&livestock_search=no&crop_year=2011&crop_region=&crop_commodity=20&crop_format

Goals and Outcomes Achieved
Based on face-to-face surveys of eight producers, enterprise budgets were developed for peppermint production with and without fumigation for gravity-fed irrigation in Southwest Idaho. In addition, a budget was created for peppermint production with a center pivot irrigation system, without fumigation, in Southwest Idaho. These budgets include both variable (operating) and fixed (ownership) production costs, such as machinery depreciation and land rent, based on typical practices for this region. Each budget includes costs of production for mint establishment and a flexible number of years

of full production. If net returns are negative in the establishment year, these negative returns are amortized over future years of production. The budgets are prepared in an interactive format in Excel that allows users to change any of the prices or yield parameters to reflect their own situation, with the exception of machinery costs, as those are calculated in a different program using engineering data. These budgets are provided as spreadsheets and in a printable format (pdf).

As can be seen in tables 1 through 3, returns over total costs were highest for peppermint production without fumigation, averaging $309 per acre over the three-year period, using the price and yield assumptions listed in the tables below. If fumigation is required, for example, which will be necessary if the ground has been used for mint in the past, then the average returns over total costs decline by one-third, to $232 per acre over a three-year production period. Both of these budgets assume gravity fed irrigation systems. Some large mint producers are now using center pivot irrigation systems. It was assumed that mint yields under center pivot production are approximately 18 percent lower than yields under gravity irrigation. Given these assumptions, as well as the other assumptions listed in Table 3, net returns over total costs average -$17 per acre over a three-year production period. However, mint varieties and contract prices may well differ for the large producers with center pivot systems. The largest grower with center pivots declined to assist with this survey.

Table 1. Summary of 2012 Estimates of Annual Returns for Peppermint Establishment and Full Production ($/acre), SW Idaho, NO FUMIGATION

		Mint Oil Yield (lb/ac)	Mint Oil Price ($/cwt)	Revenue per acre ($/acre)	Total Operating & Ownership Costs (TC) ($/acre)	Returns over Total Costs (TC) ($/acre)	Total Variable Costs (VC) ($/acre)	Returns over Variable Costs (VC) ($/acre)
Years of full production =	**3**							
Year 1: Baby Mint Production*		**90**	**$21.00**	$1,890	$2,223	**$0**	$1,761	$129
Years 2+ on: Mint, Full Production		**110**	**$21.00**	$2,310	$1,898	**$412**	$1,343	$967
Average Returns		**105**	**$21.00**	**$2,205**	**$1,980**	**$309**	**$1,448**	**$725**

**Negative returns for Baby Mint Production are amortized over the subsequent years of full production.*

Table 2. Summary of 2012 Estimates of Annual Returns for Peppermint Establishment and Full Production ($/acre), SW Idaho, WITH FUMIGATION

		Mint Oil Yield (lb/ac)	Mint Oil Price ($/cwt)	Revenue per acre ($/acre)	Total Operating & Ownership Costs (TC) ($/acre)	Returns over Total Costs (TC) ($/acre)	Total Variable Costs (VC) ($/acre)	Returns over Variable Costs (VC) ($/acre)
Years of full production =	**3**							
Year 1: Baby Mint Production*		**90**	**$21.00**	$1,890	$2,490	**$0**	$2,021	-$131
Years 2+ on: Mint, Full Production		**110**	**$21.00**	$2,310	$2,001	**$309**	$1,343	$967
Average Returns		**105**	**$21.00**	**$2,205**	**$2,123**	**$232**	**$1,513**	**$725**

**Negative returns for Baby Mint Production are amortized over the subsequent years of full production.*

Table 3. Summary of 2012 Estimates of Annual Returns for Peppermint Establishment and Full Production ($/acre), SW Idaho, CENTER PIVOT IRRIGATION, NO FUMIGATION

		Mint Oil Yield (lb/ac)	Mint Oil Price ($/cwt)	Revenue per acre ($/acre)	Total Operating & Ownership Costs (TC) ($/acre)	Returns over Total Costs (TC) ($/acre)	Total Variable Costs (VC) ($/acre)	Returns over Variable Costs (VC) ($/acre)
Years of full production =	**3**							
Year 1: Baby Mint Production*		**70**	**$21.00**	$1,470	$2,119	**$0**	$1,607	-$137
Years 2+ on: Mint, Full Production		**95**	**$21.00**	$1,995	$2,018	**-$23**	$1,282	$713
Average Returns ($/acre/year)		**89**	**$21.00**	**$1,864**	**$2,043**	**-$17**	**$1,363**	**$534**

**Negative returns for Baby Mint Production are amortized over the subsequent years of full production.*

While the Idaho Mint Commission and the University of Idaho had hoped to produce a separate fertilizer guide for mint production, this was not done. Brad Brown, who authored these guides for University of Idaho Extension for many years, retired this past year. Fertilizer practices were included in the detailed enterprise budgets created for this project, but a separate fertilizer guide was not produced.

Beneficiaries

The mint industry and its growers benefit most directly from having updated economic data and UI Extension tools for mint production. The number of beneficiaries affected by the project would be the entire Idaho Mint Industry valued at around $50 million in revenues to Idaho's economy. There are currently 70 Idaho mint producers that would benefit from this research who produce nearly 18,000 acres of peppermint and spearmint varieties. In addition, the agriculture industries that support growers including chemical companies, the banking industry, farm machinery companies, benefit from updated information on this commodity. Landlords and those renting land need to know expected current returns from mint production. Occasionally, economic data are important when selling land that is under production, or for litigation purposes.

Lessons Learned

Mint producers, as well as other contract crop producers, may feel uncomfortable participating in a survey of costs and production practices. They may not wish to disclose special techniques they have developed to possibly give them a competitive edge. If they are willing to participate in a project like this that benefits the agricultural community, every effort must be taken to protect their privacy. A higher level of participation by growers could have been beneficial for the project.

Contact Person

Kathleen Painter, PhD
Agr Economics & Rural Sociology
University of Idaho
kpainter@uidaho.edu
(208) 885-6041

Plant This Not That: Alternates to Noxious and Invasive Plants in Idaho Awareness Campaign

Subrecipient
Idaho Nursery and Landscape Association

Project Summary
The initial purpose of this awareness campaign was to educate the nursery industry and general public so they may have the correct tools to choose proper plants that will not become invasive and harm the environment. The tools in this case were the 5,000 magazines printed and distributed for this project. This educational outreach is vital to the continued growth of the nursery industry.

Idaho has close to 800 of the nation's 2,000 noxious weeds/invasive plant species, most of which are alien to the state of Idaho. Noxious and invasive plants are overwhelming plant material and spreading into the consumer's landscapes in Idaho. Nursery operations were selling invasive plant species without even knowing it.

Project Approach
Additional funding from another ISDA Grant enabled the printing of 5,000 additional magazine copies. Distribution included 14 community events across the state, 3 botanical garden venues, and 36 individual businesses throughout the state. Many of these locations received hundreds of the magazines to distribute to their customers and the general public

The Idaho State Department of Agriculture was significant in contributing to the collection of the original versions of the articles included in the outer magazine, as well as providing the list of noxious weeds. Industry professionals and ISDA invasive staff collaborated to form the alternative plants included in the magazine. Other partners helped with the distribution of the magazine.

INLA contracted with Julie Jacobson to do the layout and design for all of the marketing flyers, hang tags and posters for the awareness campaign. In November 2010, Julie began to contact various distributors regarding the cost of the items. By doing so she could design the products to best fit the specification of the various items. A group of industry professionals was formed to make the initial invasive plant list as well as the suggested alternatives for both plant lists - noxious and invasive - followed by ISDA approval before publication.

In January 2011, a flyer was designed that illustrated material that would be available for the awareness campaign. The flyer was sent out to the approximately 1500 all businesses that held a state of Idaho nursery license. The flyer and cover letter explained that the material was available free of charge to anyone who requested the products. A webpage on the INLA website, www.inlagrow.org/PTNT, was designed for viewing the documents as online flip publications and offering all of the products free of charge.

The first product was a magazine, *Gardening and Landscaping In Idaho,* which included yard and gardening articles, and a center insert, *Plant This Not That: An Alternative For Noxious and Invasive Plants In Idaho.* The center insert was designed to be pulled out and used alone as a reference guide. It included a photo layout and description of a noxious plant and three suggested alternative choices; and a photo layout of an invasive plant and three suggested alternative choices on each page.

The second product was posters that presented the same plants featured in the magazine. Posters were coated with a laminate to help in durability and longevity. And thirdly, heavy duty plant tags where produced with the words "Plant This Not That" on both sides of the heavy duty yellow plastic tag, and elastic bands for attachment to the plant were included.

In March, 2011 two hundred noxious weed and invasive plant posters (100 of each type), as well as five thousand plant tags, were designed and printed. The posters and plant tags were distributed via postal service or hand delivered to member retail nurseries in Idaho, as well as anyone contacting the INLA requesting the free materials be sent to them. During the month of March, approximately 8,000 copies of the magazines were sent to home and garden shows across the state, county extension offices and educational seminars, and others contacting the INLA requesting magazines. The following is a list of locations: South Idaho Home and Garden Show, Jerome; Horticulture Symposium, Boise; Spring Home and Garden Extravaganza, Idaho Falls; Thaw and Awe, Idaho Falls; Pocatello Spring Expo, Pocatello; Boise Flower and Garden Show, Boise. The additional 3,000 magazines were delivered to members, Botanical gardens and those requesting them.

Spectrum Net Designs designed a web page that was added to INLA's existing consumer website beautifulbackyards.org. The webpage was designed so that the consumer could gain knowledge about which plants are harmful and endangering our landscapes and should be eradicated. They also designed a web page that was added to INLA's website at inlagrow.org informing growers, nurseries, landscape contractors and arborists about the alternative plant selections for noxious and invasive plants in Idaho. Blue Toad was the firm that posted the publication in a flip format to both websites. Both websites directed consumers on how they can obtain their copy of *"Plant This Not That: Alternatives to Noxious and Invasive Plants in Idaho"* publication.

Goals and Outcomes Achieved

The activities that led to the grant's outcome were the layout and design of flyers, posters, and hang tags, website design, magazine layout and design; followed by printing and distribution of each item. Pre- and post-surveys were completed to measure the success of the project.

The goal of this project was to expand the knowledge base of the consumer for choosing correct planting material and participate as part of the solution through a statewide noxious weed and invasive plant crisis. This was accomplished by providing 10,000 copies of the magazine statewide with the educational material for the consumer, and proved to be useful as garnered from the survey results.

Measurement of that goal was done by conducting a survey at the beginning of the project and then again at the end. Two different surveys were conducted. The first survey included people who are in the

nursery industry business. Primary businesses surveyed were: General Gardening; Retail Nursery; Landscape Contractor; Nursery Grower. This survey was conducted at the Idaho Horticulture Expo and where the following questions (followed by the answers in percentages) were asked:

Question 1: Can you identify a noxious weed?
88% yes 12% no

Question 2: Can you identify an invasive plant?
88% yes 12% no

At the end of the project, a survey was emailed to those who had completed the first survey, with the following questions (followed by the answers in percentages):

Did you find the magazine interesting/useful?
100% yes 0% no

Did it help you to educate your customers on noxious weeds and invasive plants?
100% yes 0% no

Did it help you find (to grow and/or sell) alternative plants for your customers?
100% yes 0% no

The second survey was conducted at the Boise Flower & Garden show which is for the general public. The following questions (followed by the answers in percentages) were asked:

Question 1: Have you ever seen a magazine describing noxious and invasive plants?
53% yes 47% no

Question 2: Can you identify an invasive plant?
55% yes 45% no

Question 3: Can you identify a noxious weed?
59% yes 41% no

A follow up survey was sent via email to those who had responded to our first survey. The following questions (followed by the answers in percentages) were asked:

After reading the magazine, did you feel that you now know more about noxious and invasive plants?
100% yes 0% no

Did this magazine help explain why everyone should plant alternatives to noxious and invasive plants?
100% yes 0% no

Did you feel this was a valuable publication?
100% yes 0% no

Can you now identify some noxious and invasive plants?
100% yes 0% no

Beneficiaries

University of Idaho Extension educators have been using the magazine as a reference and teaching tool in their community classes. These educators come from the University's 12 research and extension centers and offices in 45 counties. All nursery businesses have the publication available to use to educate their customers on choosing non-invasive plants for their local areas in Idaho, with the estimated number of businesses using the publication being greater than 60. They also used them to educate staff and customers about noxious weeds in Idaho. The magazine informed producers of nursery crops, which plants are no longer suitable to be produced, sold and planted in Idaho. The general public benefitted from this project by learning about acceptable alternatives to replace noxious and invasive plants in their landscapes.

Lessons Learned

INLA learned that having a colorful, eye-catching, informative resource was well received by everyone. The pull-out center section was used over and over again as a useful tool for identification and alternative plant material choices. However, the weight of the magazine caused the cost of distribution to be higher than expected. Further, the pre- and post-surveys should have been completed within a month of each other to keep recipients attention on the project and increase the number of respondents. Email was the only form that was used for the post-surveys, and perhaps a non-electronic mailing or personal phone calls would have received more responses.

Contact Person

Ann Bates, Executive Director
Idaho Nursery and Landscape Association
abates@inlagrow.org
(208) 681-4769

Idaho Wholesale Nursery Locator Map

Subrecipient
Idaho Nursery and Landscape Association

Project Summary
The initial purpose of this project was to encourage the production, sale and use of Idaho's specialty crop nursery products. The Idaho Wholesale Nursery Locator Map was a tool to enhance the marketability of Idaho specialty crop growers within the state of Idaho and beyond.

Idaho nursery crop growers had been experiencing a decline in sales since 2008, as high as 37% according to a study by the USDA National Agricultural Statistic Service field office. It was essential for these growers to reestablish their place in the market. The map was distributed to surrounding states and Colorado, given out at trade shows, mailed to all members and featured on the INLA website.

The objective of the project was to expand the knowledge base of buyers to the location of Idaho specialty crop growers. The project will benefit the entire Idaho nursery industry. The retail and landscape contractors will have a guide to find locally grown Idaho plant material. The distribution of the map reached out to new and existing customers purchasing plant material from Idaho growers.

Project Approach
This was a two-year project that allowed the opportunity to produce and distribute a map of Idaho growers twice in a row, each time using updated information on the businesses.

The first year, 6,500 copies were produced and 3,100 were sent to potential buyers in Idaho, Montana, Wyoming, Utah, Colorado, Eastern Washington and Eastern Oregon. The other 3,400 copies were given out at industry trade shows and mailed to potential buyers upon request. An online version of the map was also produced.

The second year 3,000 copies were produced and 2,500 sent to potential buyers in Idaho, Utah, Colorado, Montana and Wyoming. The remaining 500 copies were given out at trade shows and mailed upon request. A postcard was produced and mailed to other potential buyers with a link to the online version of the map.

Goals and Outcomes Achieved
By distributing over 3,000 copies the first year and 2,500 the second year, potential buyers were given a location and contact information for Idaho wholesale nursery crop growers. Many growers requested extra copies to send to their existing customers. Several growers commented at various INLA events how much they liked the map and how it was a very professional way in which to show buyers where growers were located and how to get in touch with them. According to the 2010 survey completed by the USDA National Agricultural Statistic Service field office, there was a 1% sales decrease for nursery crop growers. Up from a 37% decrease recorded before! A 2011 survey was not completed due to budget cuts in the department, however the INLA reports a sales increase among member grower firms

of 5-10%. Members also reported that they received orders from buyers in other states where they had not sold their products before, which brought them to the conclusion that the distribution of the maps directly corresponded to the increase in sales.

INLA retail/landscape members were surveyed soon after the 2011 map was released and 60 responses were received. The questions and responses are as follows:

Have you had a chance to look through the 2011 Idaho Wholesale Nursery Locator Map?
83.1% said yes 16.9% said no

Did you know the map has listings of Idaho nursery-grown products you may be looking for?
88.3% said yes 11.7% said no

Did you know the map has pinpoint locations of Idaho wholesale nursery growers to aid in selecting growers in a certain area of Idaho or for nursery visits?
91.7% said yes 8.3% said no

Do you think you might use this map when purchasing plants (for plant choices or nursery contact information)?
89.8% said yes 10.2% said no

Beneficiaries

The minimum number of beneficiaries of this project were the 65 nursery stock growers that chose to be featured on the map. Not only did the nursery crop growers benefit from the increase in exposure and sales, but the buyers were also able to increase their sales by at least 5-10 percent. As growers sales increased, so did the retail nurseries and landscape contractors. They sold or installed product for the consumer more than in previous years. Not only are all three previously mentioned segments of the nursery industry benefiting from the increased sales, but those that maintain landscapes both residentially and commercially have seen an increase, again by about 5-10 percent. In summary, the trickledown effect has been an increase for those that grow, sell, install, and maintain nursery and landscape products.

Lessons Learned

One of the lessons learned was that the cost to distribute the maps was more than anticipated. Because of the size of the map, due to the geography of the state, it had to be mailed in a larger envelope than first expected which increased the cost of both the packaging and the postage. This did not stop distribution to all of the surrounding states the first year. The second year marketing efforts were amended to send a postcard to areas that had purchased product in previous years (since it was believed they were aware of the map) and sent the actual map out to areas that had not purchased, anticipating an increase in awareness and encouraging sales in those areas.

Contact Person

Ann Bates, Executive Director
Idaho Nursery and Landscape Association
abates@inlagrow.org
(208) 681-4769

Idaho's Bounty Cooperative Online Food Distribution Market

Subrecipient
Idaho's Bounty – Local Food for Local People

Project Summary
Idaho's Bounty Co-op (IBC) created a niche market three years ago for small-scale food producers to sell available crops seasonally within the south-central region of Idaho including the Treasure Valley, Magic Valley, and Wood River Valley. The essential business of IBC is to provide a marketplace where members of willing buyers and sellers can connect. IBC customers have come to rely on purchasing safe, sustainably-grown food. Further, farmers depend on IBC as a viable market to sell their farm-grown products. Reviving the rural agricultural economy by increasing the production and sale of specialty crops grown in Idaho is important and IBC can have a positive impact to meet this need. Recent studies show that local food businesses are key to economic recovery and growth by keeping money from escaping rural communities, providing greater demand for food from the local agricultural communities, and conserving energy with local purchase and distribution of food. Consumer demand for local, sustainable, direct farm-to-market food is gaining strength. In the past several years, wholesale and retail sales have steadily grown by about 10-20% annually, making the creation of IBC timely. IBC is an innovative, direct-to-consumer, online food market where customers can purchase fruits and vegetables weekly from farmers to help meet a growing demand of fresh local food. Interest in IBC membership has steadily grown over the past three years, with more than 900 fully-paid consumer members interested in shopping for local food and 65 producer members interested in selling their products online.

Project Approach
Significant work accomplishments include ever-growing producer and consumer membership within the IBC. IBC has made significant strides since its inception, growing a market share in the Boise metropolitan area by substantially increasing wholesale accounts (restaurants, schools, hospitals) and offering a flat-rate delivery fee for many producers to get their product to market, which have made significant efficiencies in IBC's regional food delivery of locally-produced sustainable specialty crop food. IBC also made a significant investment in its website by hiring two contractors to work on upgrading both website aesthetics and coding to make the most important IBC tool faster, easier to use, and more effective for listing and selling products. The upgrades include the following:

- An integrated CMS site with shopping website for easier shopping and customer access, cutting down the time it takes to order
- Substantial improvements in the visual layout of the website, making it more attractive, allowing information to be easier to find and browse, and more appealing updates for users
- Redesign for prospective farmers and better display for current farmers' information
- Redesign of information for prospective wholesale customers
- Redesign to integrate key customer and potential funding attractors – membership/donate functions and features on each page

These changes have been very productive for IBC and customers have provided useful feedback on the benefits to these updates.

IBC's partnerships have paid off well for the project. Partnerships include local stores and restaurants that advertise products IBC offers, the Sustainability Center and storefront in Hailey, the Futures Food Group, and the Sawtooth Botanical Garden in Ketchum.

Partnerships with these organizations, stores, and restaurants have had an associated benefit of marketing and public relations improvements for IBC. IBC, along with these other organizations and groups, have invested in a local food brochure that provides a great deal of information about where one can purchase local food in the region, as well as provides information about partnerships that have developed to help make local food more accessible and identifiable at stores. Through IBC's efforts, more specialty crop products have been sold than if there were no local online food market.

The brochure serves as a great marketing tool for IBC and is titled "Eat Local Eat Well." Initially, 1,000 brochures were produced and distributed throughout the Wood River Valley in March and August. Later, another 1,000 brochures were produced. Partners for the brochure include Ketchum Community Development Corporation, Community Rising, Glow Live Food Café, The Hunger Coalition, NourishMe, Sawtooth Botanical Gardens, and Wood River Sustainability Center.

IBC's partners also help bring together interested parties to hold educational events and classes. IBC partnered with the Sawtooth Botanical Garden to put on their locavore food series. This series offered cooking and canning classes from April through September and featured local farmers so attendees could meet the growers of the local food they were using in class. Other healthy food awareness activities include potlucks, speaker series, and conferences in the Wood River Valley. IBC also partnered with The Hunger Coalition, a non-profit organization striving to end hunger in the Wood River Valley. This coalition receives specialty crop food (particularly potatoes, squash, and beans) at a discount from IBC to feed hungry families in need.

Two events were held in Ketchum: Taste of Idaho's Bounty in April and a Locavore Festival in September during the region's high harvest season. The Taste of Idaho's Bounty pulled in more than 200 people and serves as IBC's signature event, bringing chefs and farmer's together to pair products with cooking. A locavore food festival event was held in April at various restaurants serving dinners using products obtained through Idaho's Bounty. IBC partnered with the Sun Valley Harvest Festival committee that put on the September festival, which supplied event chefs with local food obtained through Idaho's Bounty. Several ads and posters were produced, distributed within the area, and printed in local papers: The Idaho Mountain Express and The Sun.

IBC has been very successful at keeping more locally-grown specialty crop food within Idaho rather than being exported to other states. Due to Idaho's Bounty efforts, demand for this food has significantly increased and has allowed farmers to grow and sell products to more closely meet the market demands. IBC producers have definitely increased overall sales of their products, have been able to sell products further into the slower shoulder seasons through building storage facilities, greenhouses, and other season-extending facilities and their planting has followed the demand that would not have been possible without IBC creating a niche market for products and directly bringing together producers and

consumers. IBC has successfully expanded on supply sourcing certain high demand food items. New producers that signed up during the grant cycle include:

- Apple Creek Farm, selling apples and apple juice
- It Takes a Village, selling kale chips and fruit sorbet
- Alchemist's Garden, selling sprouts from greenhouses
- Frostensen Specialty Farm, selling carrots
- Onsen Farm, selling greens and other vegetables and herbs in greenhouses
- Sweet Valley Organics, selling mushrooms and other vegetables
- Purple Sage, one of IBC's initial producers growing herbs in greenhouses. Due to Idaho's Bounty business, Purple Sage Farm was encouraged to grow greens throughout the winter and has increased their business tremendously, selling out of greens every week

Specialty crops sold through IBC makes up more than 50% of IBC products sold and income generated from the sale of IBC products. The grant money used for advertising, staff time, events held and computer program updates make up about 50% of funds allocated to those areas of IBC's business. The rest of money needed to run Idaho's Bounty and all the intricacies of the business has been supported by the additional income generated from food sold, fundraiser events held, private donations secured, and volunteer hours generated. The specialty crop category of sales in the business has far outgrown all other food categories sold through Idaho's Bounty, so while IBC does sell other products, the 25% growth this year in specialty crop products alone demonstrates meaningful promotion of these products.

Goals and Outcomes Achieved

Outcome 1: *Become self-sustaining by the end of 2012 from doubling weekly ordering by the end of fiscal year 2012 from 125 to 250 customers and increasing sales. Customer numbers are easily tracked from the online ordering program.*

In more recent months of the ordering cycle, IBC has come much closer to meeting its goal of self-sufficiency. Last year, IBC showed a monthly loss of about $8,000 during most months, but this year numbers equal only about $300 monthly loss. This is great growth for IBC and it shows how successful IBC has been over the past 6 months. This is due to several things including:

- Growing the wholesale business
- Implementing a flat rate transport fee for products not sold by IBC, which increased the number of producers using IBC services
- Increasing membership and the amount of weekly retail orders
- Creating efficiencies in staffing to conserve money

Outcome 2: *Expand membership from 1100 in 2009 to 2000 by the end of 2012. Each member has a co-op number that is tracked with information on when members join. IBC can show progress towards reaching this goal by reporting membership numbers at anytime. The Board of Directors requires bi-annual reports on member numbers and sales information.*

The Taste of Idaho's Bounty event, which brought together producers and chefs to demonstrate and prepare or cook locally-grown food for participants to sample, brought approximately 250 people from

the community to partake in the celebration of local food. Membership increased as a result of the event, and awareness of local food and IBC's role in bringing local food to the valley improved. IBC has continued to enjoy an ever-expanding membership that now swells at close to 1400 consumer and producer members who have come to depend on a year-round online market to buy and sell products.

IBC maintains a large membership and steady weekly consumer shopping. On average, approximately 185 customers order from IBC each week, an increase of about 65 weekly orders over last year averages. While IBC staff has worked hard to increase that number to 250 weekly orders, with a larger increase in wholesale orders, IBC was able to increase income with fewer overall orders than had been projected. The more detailed weekly ordering breakdown by location is as follows:

- Treasure Valley - average of 17 retail consumers and 18 wholesale consumers
- Magic Valley - 12 retail shoppers and 1 wholesale customer
- Wood River Valley - 127 retail customers and 12 wholesale customers on average

Approximately 53 producers receive orders each week on average. The weekly wholesale orders total about $8,500 and average weekly retail sales is about $7,500. Gross sales projections for 2011 based on goods sold throughout the year were approximately $600,000 versus $482,000 for 2010, which is a growth of 25% for both retail and wholesale orders. Of these totals, more than 50% of products sold are specialty crops. Both staff and Board members are very proud of this significant increase in sales. In addition, IBC has significantly beneficially impacted the sale of locally grown specialty crop foods by developing these NEW market places for local foods throughout south central Idaho that did not exist before IBC created this cooperative business.

Outcome 3: *Increase wholesale from 2 to 8 accounts in the Treasure Valley by the end of 2012. Improve wholesale ordering system, add new accounts, improve price structure for wholesale accounts, and develop relationships with potential wholesale customers. Wholesale account numbers are tracked and reported from the website ordering program.*

There are currently 18 wholesale accounts in the Treasure Valley area, which has far exceeded the initial goal to increase wholesale accounts to 8. These accounts include restaurants, grocery stores, and a flat-rate delivery fees for producers to encourage the sales and distribution of more local food to the market place. There is also a new wholesale account in the Magic Valley and additional wholesale accounts added in the Wood River Valley. The increase in the wholesale business is not only due to the addition of new accounts but also some of the older accounts are moving more food through IBC and have more reliability of selling more food through the market IBC has developed. This increase has come far earlier than predicted, it is the beginning of 2012 and the goal was set to reach these numbers by the end of 2012.

Two trucks deliver food now, one begins in Boise and drives products from the Treasure Valley to Hagerman in the Magic Valley, then exchanges products from a second truck that starts its delivery in the Wood River Valley and transfers products to the Boise truck for members in the Treasure Valley. This has made deliveries more efficient, has expanded products to the various regions, and allowed the delivery to wholesale accounts several times a week rather than just once a week as is done for retail

customers. Because IBC can now deliver to wholesale customers multiple times a week, which their business demands, IBC has expanded its whole customer base.

Beneficiaries

People who currently and directly benefit from IBC include the 1400 members purchasing or selling products on the IBC website within the Magic Valley, the Treasure Valley, and the Wood River Valley. The impact would potentially include all those people within the communities IBC serves who truly are potential customers and as membership expands to include new people, so does IBC purchasing and selling power. Currently, IBC sells to and buys from people and establishments in the following towns: Twin Falls, Hagerman, Buhl, Gooding, Shoshone, Fairfield, Richfield, Bellevue, Hailey, Hazelton, Picabo, Ketchum, Sun Valley, and Stanley. Beneficiaries of IBC actually go well beyond the direct impact of IBC member producers and customers. There are currently 31 wholesale accounts in the three valleys served including St Luke's Hospital, numerous restaurants, Boise Co-op, Boise State University, and numerous storefronts. With these establishments using IBC products in their food preparation and their advertisement of IBC providing certain products used in their establishments, the impact goes well beyond direct member benefits to include all those people who patronize those establishments.

Lessons Learned

IBC staff has learned a lot over the past three years about the different needs between retail and wholesale accounts. Wholesale accounts have grown particularly in the Treasure Valley, while retail accounts have been much slower to expand in the Boise Metropolitan Area. This expansion is important to the overall goal of becoming self-sufficient as margins per order are greater from retail customers than from wholesale customers. Although the wholesale customer requires far greater assistance in the initial ordering process, some of the benefits of wholesale orders are that they are generally much larger orders, require less handling to the final destination, and delivery is several times per week. Once the ordering cycle is closed and the food is packed by the producers, retail orders require more handling to get the correct food to each retail account.

To help service wholesale accounts, IBC hired an additional staff person solely dedicated to attending to the wholesale accounts. IBC also had to invest a significant amount of resources to update the web-based food-ordering program to fit the needs of the wholesale accounts. The IBC website greatly needed updates and improvements to make it a better web experience for all customers, and the updates made during 2011 with the help of grant funds has led to increased ordering, additional members joining IBC, and increased overall sales of specialty crop food.

Additional lessons learned include:

- In order to grow into a larger cooperative effort where consumers can buy direct from producers and to better serve the entire membership, IBC needs to invest a significant amount of resources to improve its software to handle the food networks developed, continuing to expand upon what currently exists. Web coding and development for the coding system specifically developed for Idaho's Bounty to allow for invoicing structures, margin-specific customer accounts, trucking route lists, etc. is very costly to create, but much needed. From the research done by IBC staff, this capability does not currently exist, so it must be developed for IBC. This immediate need must be solved in the near future to keep improving and growing the business and becoming self-sustaining.

- Adequate training is needed for both farmers and customers. Training would show vendors how to use the computer interface, so that it can serve as an easy tool and be more effectively used. IBC has not spent enough time with the producers in particular, and with its current infrastructure, IBC lacks the staffing and funding to make this happen. Some of the producers, because of the nature of their lifestyles, are more challenged using modern technologies.
- IBC's business is ultimately dependent on strong personnel and close communication with its members, vendors, and staff. Members are generally very patient with the steep learning curve of this business and all the specific details it takes to run the program and efficiently move food. IBC truly is leading the charge and setting the bar for online food distribution business. IBC staff and board members have done a significant amount of research to identify other businesses in the field, and no other businesses or co-ops that have been identified that have created a similar businesses and demand for online food distribution. Other start up online food businesses have inquired with IBC to learn how best to set up a business like IBC and IBC has offered training to others. IBC will continue to advance this buying/selling network and identify further needs to enhance the businesses success.
- Shopping tailored to individual wants and needs creates a lot of individualized and non-standardized sorting and shipping situations. This takes more people than one would think to sort through orders and get everything to the right customer and the right place. The co-op believes that this might be simplified if IBC offered standardized orders, similar to a CSA style with not as much individual variety, but that is not the nature of the business that was created. Demand was for individualized ordering with a diverse selection of products, with the ability to choose what to order and how much to order. IBC has worked diligently to fine tune this complex system and meet the demands of its customers.
- Tracking accomplishments and failures for each week requires a big commitment to organization and chart-making. Tracking statistics has given IBC a much better picture of how the business is doing and has enabled the co-op to project expectations into the future as IBC's business grows.

Unexpected outcomes and results as an effect of implementing this project:

- Farmers who participate in IBC are able to use the system to meet needs not previously identified on a case-by-case basis (i.e. use just shipping and/or use the entire sales/invoicing/shipping service)
- Wholesale buyers are able to conduct a one-stop-shopping model by using IBC to order and transport their food in a format that is similar to larger companies. This creates new and diverse direct relationships between local farmers and buyers, and puts pressure on producers and consumers to coordinate more quickly to get a product in limited supply. This relationship between customer and vendor has added benefits for both parties. It also creates a market for farmers, and if they want to continue to grow along with IBC, there is an incentive to grow more of what is in high demand. Several of IBC 's farmers have heeded this call, growing more carrots, beets, and greens in greenhouses during the off-season.
- Farmers have not put real value on food transportation, which would allow them to see and understand the value of the distribution of food. Farmers have not necessarily built in the cost of driving their specialty goods to markets, and have done this inefficiently throughout our

region, making numerous individual trips. IBC has made this a more efficient system for some farmers.

- Farmers can use technology differently and more efficiently to their benefit. IBC can implement different labeling, different packaging for certain products or certain locations so the food gets to where it needs to go and orders are filled correctly. IBC also charges different delivery rates depending on how perishable a product is or how difficult it is to transport (i.e. milk in bottles costs more to transport than milk in plastic but the bottles are valued higher by customers).

Contact Person

Kaz Thea
Founder, Board Member, Grant Writer
kazthea@mac.com
(208) 710-7805

Additional Information

Website: www.idahosbounty.org

The IBC website includes much more information of the kinds of programs and information offered to IBC customers such as recipes, information regarding legislative initiatives that may help or hurt local small-scale producers, activities that are happening throughout the communities IBC reaches, other educational opportunities and events, and much more. A member can also get a sense of how the online food distribution network and ordering system actually work once a customer or producer goes online to take a look at the IBC website. Customers can learn a lot about each of the producers' products offered, the methods employed by each farmer to grow the food, and information about where each farmer is located. This helps influence some of the choices customers make - i.e., if the food grown using organic methods, if the location if preferable, etc. This information becomes particularly important for some customers when choosing the products they buy.

Promoting Specialty Crops through the Idaho Preferred Program

Subrecipient
Idaho Preferred

Project Summary
Idaho Preferred® is a program managed by the Market Development Division of the Idaho State Department of Agriculture to identify and promote Idaho food and agriculture products. The Idaho Preferred® program conducts television and radio advertising, retail and foodservice promotions, public relations activities, consumer events and educational programs to promote locally grown or processed products.

In 2009 the Idaho State Department of Agriculture conducted a specialty crop industry survey to identify needs and set priorities. The top priority as identified by the specialty crop industry was "Increasing Marketing and Promotion." Idaho Preferred® was and is well positioned to meet this need by expanding current marketing and promotion programs that have successfully increased consumer awareness of Idaho products.

As part of a comprehensive media plan, Idaho Preferred had been promoting specialty crops through radio and television for 10 years. USDA Specialty Crop grant funds have been used to help fund this campaign, which is also supported by state funds and Idaho Preferred participant fees. The campaign fortuitously launched just as the national locavore movement was emerging, and has been very successful. Consumer market research shows that consumer awareness of the Idaho Preferred logo, intent to purchase local foods, and willingness to pay more for local products increased throughout the duration of this grant as it built on early awareness established with prior Specialty Crop Grant funding.

This 2010 Specialty Crop Block grant provided funding for 13 weeks of television placed in 2011-2012 to build on and extend a media campaign funded through previous Specialty Crop Block grants. In addition, the grant provided funding to conduct consumer market research to evaluate the effectiveness of the media campaign. Finally, the 2010 Specialty Crop Block Grant allowed the extension of a grant-funded staff person to carry out retail and foodservice programs and consumer and education events designed to increase demand for Idaho specialty crops. Actual cost of programs was funded through non-grant sources – only salary and fringe were charged to this grant.

Originally designed to be completed December 1, 2012, the project was extended to December 2013 as all funds had not been expended for staff and advertising programs.

Project Approach
The purpose of this project was to increase consumer awareness and demand for Idaho fruits, vegetables, wine, herbs, and nursery products through statewide television advertising. In July 2011, a thirty-second specialty crop television ad was created. Based on consumer market research that found that consumers were buying more local products to support local farmers, the ad features local producers and was filmed entirely in Idaho with local products. The ad includes images of sweet corn, green beans, dry beans, cherries, apples, pears, onions, grapes, and summer squash as well as local farmers and fruit growing families. The ad aired six weeks in 2011 during the height of the harvest

season and in conjunction with Idaho Preferred month in September, concluding in October. A partnership with Paul's Markets in October 2011 provided an additional opportunity to promote dry beans through four weeks of television advertising. In May 2012, three weeks of television ads promoting Idaho nursery products aired statewide. This ad was filmed in its entirety in Idaho using local nursery materials and production was funded through a previous Specialty Crop grant. The new Specialty Crop food ad was placed in Boise, Twin Falls, Idaho Falls/Pocatello, and Lewiston television markets for four weeks August-September 2012 and again beans were featured in a Paul's Market cooperative television schedule in October 2012.

In the fall of 2012, the University of Idaho Social Sciences Department was contracted to conduct consumer market research to evaluate the effectiveness of the specialty crop media campaign. The telephone survey of 774 households occurred in November 2012 and results were reported to the Idaho Preferred Advisory Board and membership at their annual meeting in January 2013. Research findings will be discussed Goals and Outcomes Achieved section below.

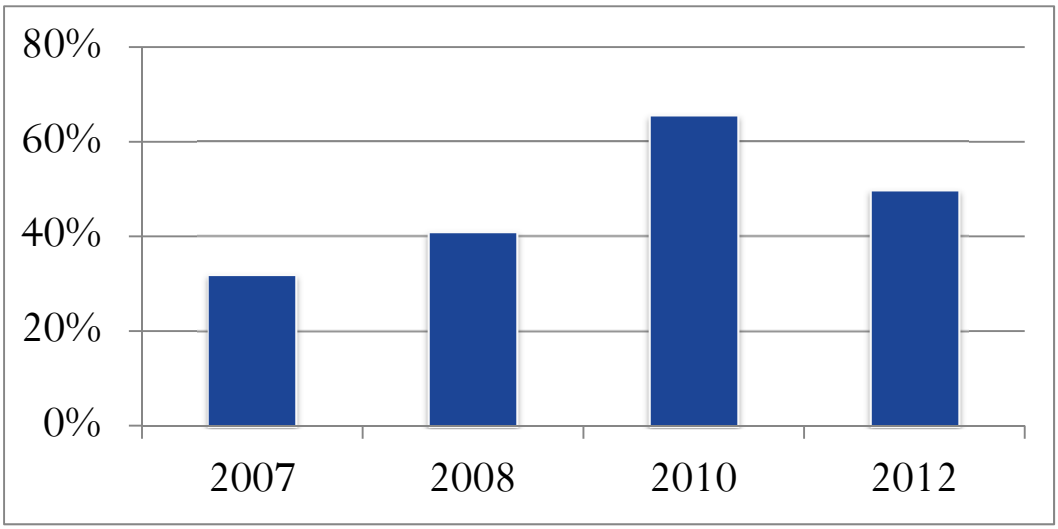
Finally, funding from this grant allowed continued employment of Skylar Jett, Marketing Specialist in the ISDA Marketing Division. Skylar works to promote Idaho specialty crops through retail promotions and one-on-one meetings with current and prospective Idaho Preferred grocers. In addition, she plans and carries out events to connect producers with chefs and restaurants and meets with restaurants to encourage use of local specialty crop items on the menu. Skylar's duties include planning and coordination of events that bring producers and consumers together, in addition to assisting with Farm to School programs. Finally, Skylar Jett is responsible for social media efforts and also works to seek out local producers of specialty crops to take part in programs designed to raise awareness and availability of locally grown fruits, vegetables, nursery products, and wine.

Goals and Outcomes Achieved

One goal of the television campaign was to attain predetermined reach and frequency numbers. While on air, the ads should reach approximately 85% of consumers an average of 14 times at the conclusion of the ten week period. In 2012, when ads were spread over three quarters, reach and frequency did not meet goals with reach of 72% in Q2, 82% in Q3, and 51% in Q4. However, when all ads were consolidated into one 6 week period in 2013, reach surpassed the goal at 95.8% reach and frequency of 15.4 times.

Consumer market research continues to evaluate the effectiveness of the Idaho Preferred Specialty Crop media campaign. Using 2008 data as a baseline, surveys were conducted in 2010 and 2012 to measure progress. Data was not collected in 2011. Due to cost of conducting research, it was decided to conduct research every other year. The following goals were set for measuring awareness of the campaign:

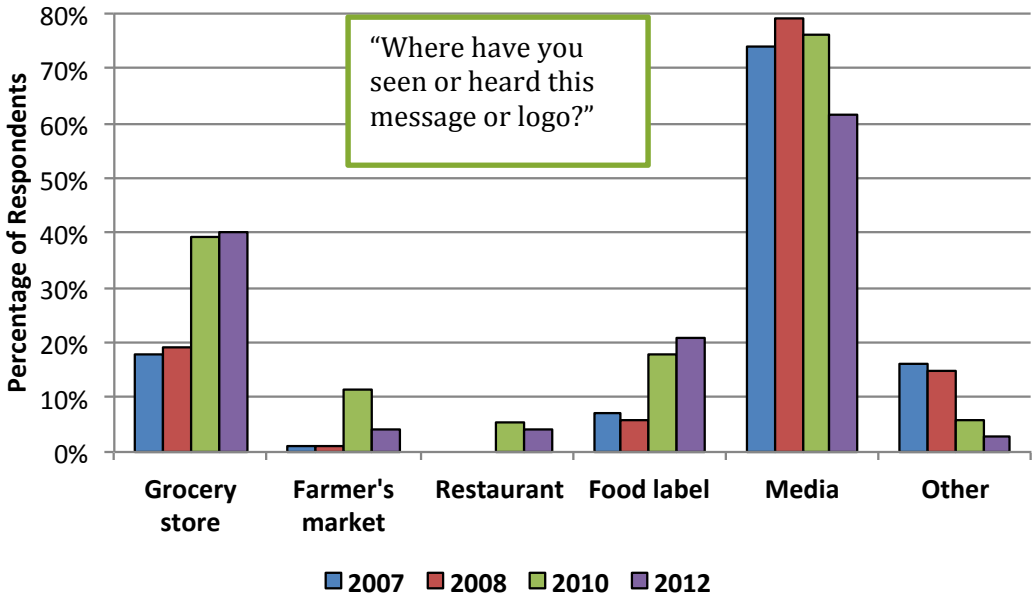
- Awareness – 2008 Baseline 41% 2010 Target 50% 2011 Target 58%



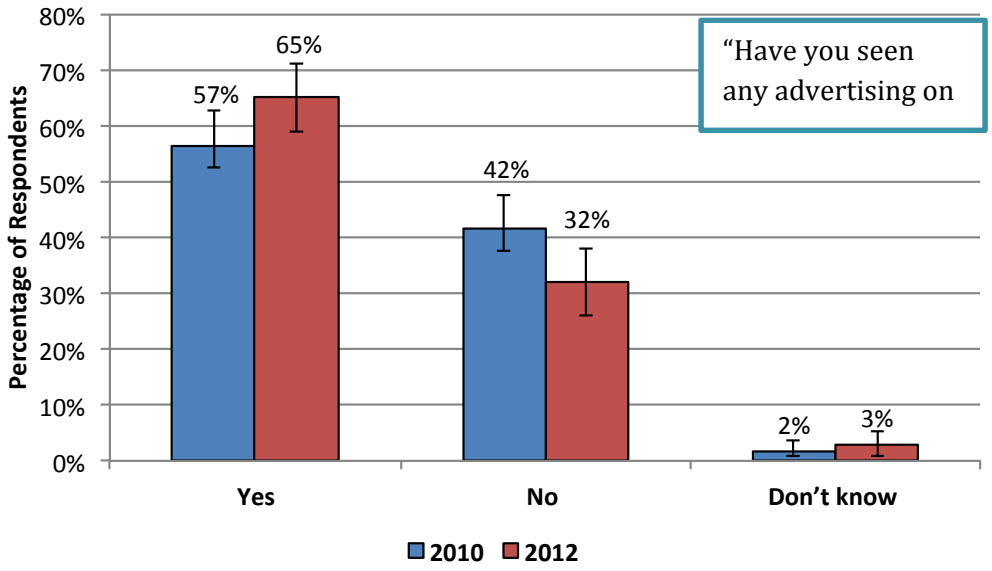
"Have you heard or seen any advertising messages using the phrase Idaho Preferred or seen its logo, featuring a blue oval with a yellow sunrise behind the mountains?"

The graph above shows that awareness to 66% in 2010 met and exceeded the goal of 50% awareness. However, awareness of 50% in 2012 did not meet 2011 goal of 58% awareness.

The 2012 study also asked specifically where consumers were seeing the message to evaluate the effectiveness of both nursery and food-related specialty crop television ads.

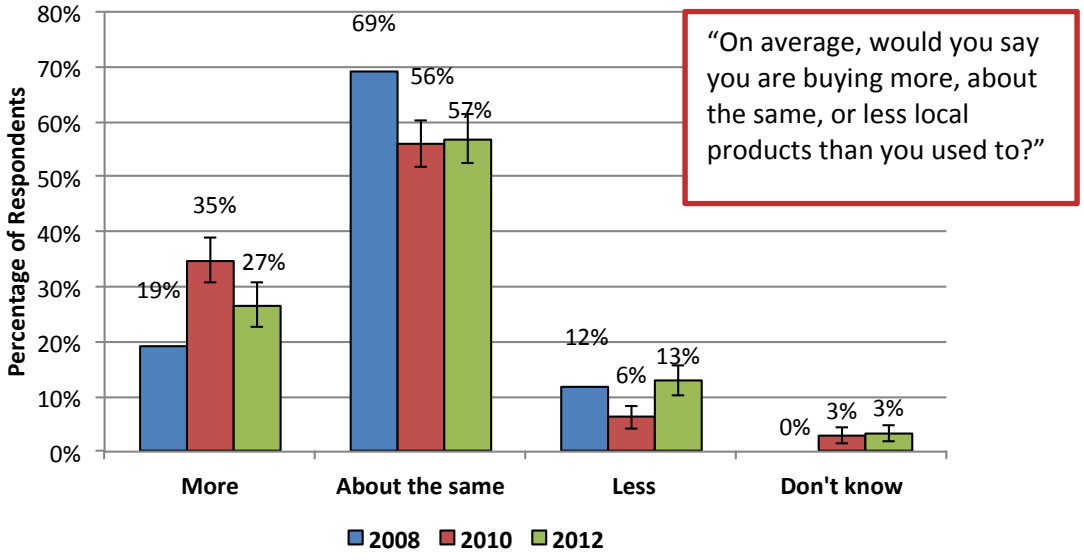


The graph above shows consumers are seeing the message in the media, and the graph below shows that consumers recall seeing the TV adsspecifically and that more respondents recall having seen them in 2012 that in 2010.



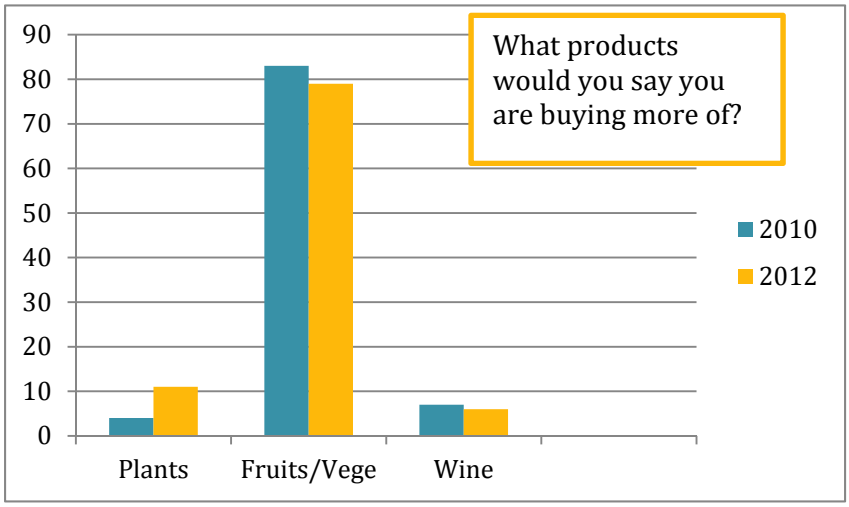
Another measurement of results is to look at reported purchasing behavior. Research in December 2008 found that 69% of respondents said that they were buying the same amount of local products while 19% reported buying more local products. The data was again collected in a 2010 and 2012 at the conclusion of the airing of specialty crop television commercials funded through this grant.

- Buying more local product - 2008 Baseline 19% 2010 Target 25% 2011 28%



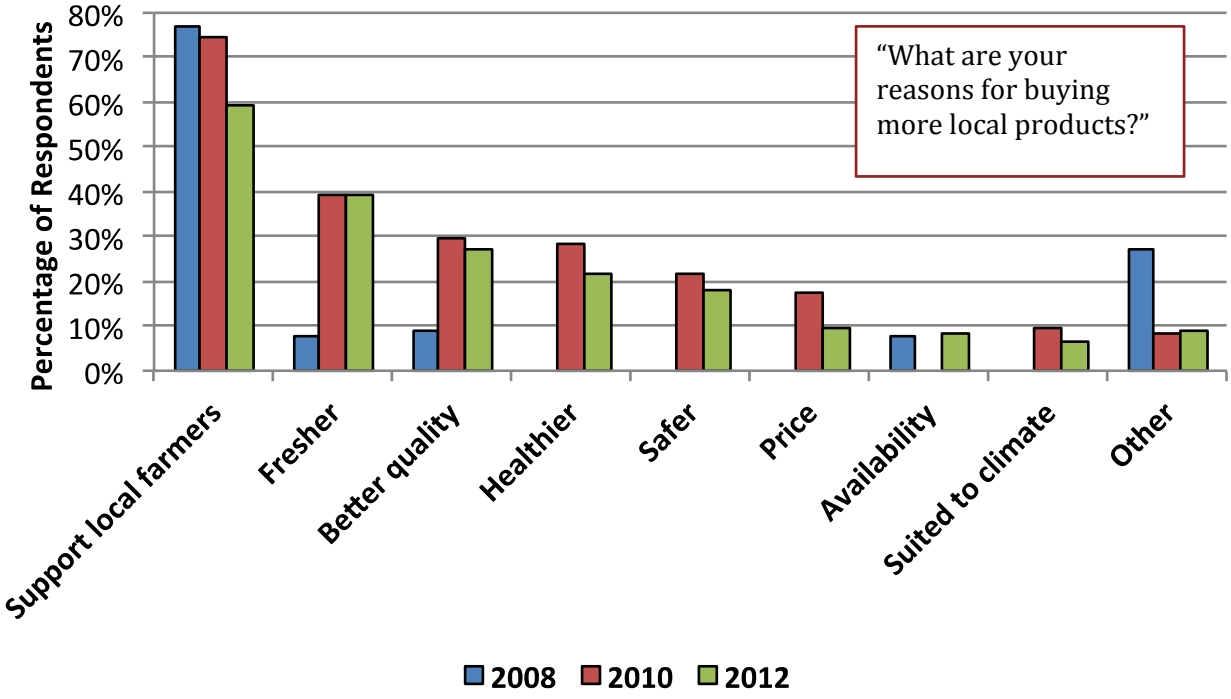
The 2010 target of 25% of consumers reporting they are buying more local products was surpassed with 35% reporting increased local purchases. However, the 2011 goal of 28% fell just short in 2012 at 27% reporting increased local food purchases.

In 2010 and 2012, the question was further defined to query whether respondents are buying more local fruits, vegetables and nursery items as a result of specialty crop ads with a goal of 25% of consumers reporting that they are buying more fresh local produce and nursery items in 2010 and 28% in 2011.



The goal of 25% of consumers saying they are buying more fresh produce was met in 2010 as well as goal of 28% in 2012. However, number of consumers buying local nursery products did not meet goals in 2010 or 2011.

The final piece of information gathered gives insight into why consumers are buying local. This information is useful in creating future media messaging. The 2008 study found that 77% of those who were buying more local products were doing so to "support local farmers and the local economy." Subsequent surveys were intended to confirm whether this is still the case or if there are other issues driving local purchases of specialty crops such as flavor, freshness, or other quality factors.



This data shows that supporting local farmers is still the most often reported reason for buying local products. However, freshness, better quality, health and safety were increasingly important in 2010 and 2012. The attributes of availability and climate suitability had to do with reasons for buying local nursery products specifically.

Goals and outcomes achieved by staff funded by this grant are as follows:

- Three Farmer Chef Collaborative events were conducted in Sandpoint, Moscow and Victor, Idaho in 2012 to connect growers to restaurants and chefs.

  The 2012, a North Idaho Farmer Chef Collaborative took place November 12 in Sandpoint, Idaho. The collaborative event fostered profitable, lasting relationships between local producers and area restaurants. The event attracted over 20 producers that showcased potatoes, greens, berries, wine, and onions. There were also several chefs at the event from local restaurants and resorts. This year there were several new producers and chefs that participated in the event due to the continued interest in supporting local producers.

  Prior to the consumer event at the Locavore's Night Out in Victor, Idaho there was a trade hour that was open to chefs, distributors, and other buyers. Idaho Preferred hosted 3 specialty crop producers that met with buyers from the area. There was a great turnout from restaurants, resorts, and grocery stores. Distribution to the Eastern part of Idaho is still an obstacle.

  In Moscow, Idaho Preferred collaborated with the University of Idaho students to coordinate a Farmer Chef event. During the event two guest speakers, a producer and a buyer discussed how to buy and sell fresh produce to restaurants.

- Two interactive events for producers and retailers were conducted with Rosauers and Whole Foods to assist food-related specialty crop producers find new market opportunities.

  Retail markets, from farmers markets to big retail chains, are great outlets for local producers. In 2011-12 Idaho Preferred staff worked with several local retailers to help them source local products. Whole Foods and Rosauers both entered the Treasure Valley in 2012. Idaho Preferred helped connect Specialty Crop producers with buyers from these two great retailers that support local producers. Over 50 specialty crop members met with Whole Foods during their buying visits. Local specialty crop producers are recognized throughout Whole Foods.

  To celebrate Idaho Preferred® month, Walmart created a 10 day outdoor "farmers" market offering fresh, locally grown produce at its Meridian store. To draw attention to the great variety of fresh fruits and vegetables available, Walmart hosted a special event on September 1st, called a "Ticket to Healthy Snacking." Around 3,000 Meridian students at select schools received a ticket to visit the Meridian store from 4 p.m. to 6 p.m. to receive a free bag of Idaho-grown produce. Kids went through the market "trick-or-treat" style and were given apples, pears, peaches, nectarines, potatoes, and sweet corn by farmers and industry representatives. (September 2011)

- Promotions with Albertsons and Zamzows were conducted to promote locally grown nursery items. Custom POS materials, co-op radio ads and promotion through the Idaho Preferred website and Facebook page helped promote local nursery items at retail. Poinsettias were featured in one of seven "Farm to Fork" series produced and aired by the NBC affiliate in Boise. TV reporter and cameraman followed pointsettias from geothermally heated greenhouses directly to local Albertsons stores where they were displayed with "local" signage.
- Retail promotions were conducted promoting fresh fruits and vegetables including a Winco promotion in conjunction with TV Farm to Fork Series and annual Walmart Idaho Preferred Month produce promotion. In addition, Idaho Preferred produce bins were distributed to 70 stores to assist in displaying and promoting local fruits and vegetables.

  ISDA has placed priority in building relationships with retail partners throughout the state to expand the reach and visibility of the Idaho Preferred® brand. As part of the retail promotion specialty crops were highlighted in a Farm to Fork TV series with the top rated television station in the Boise market. Seven segments were included in the series. The first segment followed sweet corn and green beans from Wissel Farms through the local distribution center and to a Boise area Winco grocery store. Once in the store at Winco, these local vegetables were identified with Idaho Preferred POS materials.

  The following segment featured peaches from Symms Fruit Ranch. The segment began with filming at Symms Fruit Ranchshowed the peaches growing on the tree, being harvested, going through the packing shed and trucked to a foodservice distribution center. The peaches were then delivered to a local highschool as part of their farm to school efforts.

- Consumer events including Savor Idaho in Boise, Locavore's Night Out in Victor and Sun Valley Harvest Fest were conducted to increase consumer awareness and provide opportunities for consumers to purchase specialty crop items directly from growers and processors.

  Several Idaho Preferred specialty crop companies including 3 Horse Winery and two vegetable growers were represented at Victor's "A Locavore's Night out", an important local foods event for the Eastern Idaho area. Each company was able to promote and samples their products to over 500 attendees including consumers, distributors and buyers from restaurants, hotels, grocery stores.

  The Indian Creek Festival, held in Caldwell on September 17th, 2012 offered the community a chance to enjoy Idaho's harvest. The event had many different activities throughout the day including a farmers market. Booths included a variety of fresh Idaho produce. At the Idaho Preferred® booth, consumers were given samples of fresh Idaho peaches and brochures on farmers markets, recipes highlighting specialty crops, and other information.

  Over 300 consumers visited the Idaho Preferred® booth at the 2nd annual Sun Valley Harvest Festival September 24, 2012. This was the first year that the Harvest Festival included a marketplace where consumer could walk through a farmers market type setting. Four Idaho Preferred® members came to sample and sell their products including fresh produce, Idaho

grown nursery items, and wine. Other events at the Harvest Festival included a restaurant tour and cooking demonstrations.

- A statewide Farm to School conference was held in July 2012 to increase the use of Idaho specialty crops, primarily fruits and vegetables, in school cafeterias.

  The first Idaho Farm to School conference was held in Boise July 23-23, 2012. The purpose of the conference was to help encourage and enable more local products to be served in school cafeterias across the state. The two-day event included tracks for School Foodservice personnel, producers and educators and included workshops on procurement, bids, vendor requirements, distribution options and more. Special events included chef demonstrations, cooking competitions and field trips to local farms and school gardens.

- All "Incredible Edible Idaho" posters have been updated and are being sent monthly to a total of approximately 1000 teachers and school cafeterias. These food-of-the-month posters feature a different food each issue. Specialty crop posters include cherries, apples, peaches, pears, apricots, melons, grapes, berries, pumpkins, beans, potatoes, lentils and legumes.
- 15 new specialty crop producers have been recruited to take part in demand-building programs.
- Broulims, M&W, Rosauers and Whole Foods are new retailers identifying local specialty crop items in their stores.
- Fork, Riverside Grill, CastleRanch Steakhouse, Brick 29, BitterCreek, Coeur d'Alene Resort properties are recognizing local specialty crop and wine producers on their menus. The restaurant menu promotion was cancelled due to the difficulty of getting restaurants to continually update their menu with seasonal local foods. Restaurants were also reluctant to share sales information that was required to evaluate the success of the menu program.

Beneficiaries

Data from the 2013 Idaho Agriculture Statistics bulletin estimates the value of specialty crops grown in Idaho at over $1.25 billion dollars in 2012. This estimate includes cash receipts from potatoes, fruits, vegetables, mint, and nursery crops. All producers engaged in the production of specialty crops in Idaho could potentially benefit from an effective television advertising campaign that increases consumer's awareness and intent to purchase Idaho fruits, vegetables, and nursery products. Unfortunately, as is the case with most perishable fresh products, it is very difficult to measure the effect of advertising on sales as all product will be sold at some price, and price becomes more a reflection of supply than of demand. However, awareness and *intent* or *reported* purchase of local products can be measured as detailed above.

Idaho Preferred® currently includes 300 members, 88 or approximately 30%, of which produce and/or process specialty crops. All of these members, will directly benefit from the promotions linking growers and processors to retail and foodservice buyers and from consumer education programs designed to build long term demand and "brand loyalty" for local specialty crop products.

Lessons Learned

Television advertising continues to be an effective medium for reaching our target consumers with messages about local specialty crops as confirmed by market research data. However, the decline in

some indicators from 2010 to 2012 was disappointing. On the positive side, over time, awareness of Idaho Preferred continues to trend up with half of the respondents indicating they had seen or heard advertising messages with Idaho Preferred or seen the logo, and awareness of Idaho Preferred in the media and awareness of TV ads, is trending up. However, declines from 2010 to 2012 are concerning. One factor that might have affected consumer response to research questions was in methodology. In 2010 the questions were asked as part of a bigger study of other local issues whereas in 2012 the questionnaire only included Idaho Preferred specific questions. Additionally, the 2012 study was conducted in the midst of election year media frenzy which may have negatively affected consumers overall opinion of media of any type. Also, as the economy rebounded in 2012, overall media spending increased, making it harder to capture "share of voice" in the media. Finally, spending by Idaho Preferred for media to promote specialty crops doubled from 2008 to 2010 which may have caused the spike in 2010 awareness response. With media spending in 2011-2012 flat, additional extreme increases in awareness would not be expected. Continued market research, currently planned for 2014, should help better define the overall trend in consumer awareness, intent to purchase and other evaluation measures associated with advertising funded through this and subsequent specialty crop grants.

Contact Person

Leah M. Clark
Trade Specialist and Idaho Preferred Program Manager
Idaho State Department of Agriculture
208.332.8684
leah.clark@agri.idaho.gov

Additional Information

The specialty crop ad aired as a result of this grant can be viewed at www.idahopreferred.com. Note that there are two commercials on the site, one specialty crop and one that includes non-specialty crop foods. Only the 100% specialty crop ad was created and aired with specialty crop grant funds.

Biological Control for Disease and Virus Management in Beans and Potatoes

Subrecipient
Northwest Coalition for Alternatives to Pesticides

Project Summary
This project addressed the number two priority of the Idaho specialty crop industry: enhancing pest and disease control. Potato Virus Y (PVY) in potatoes and white mold in dry beans are diseases in key specialty crops in Idaho, where the biological control agent *Bacillus mycoides* isolate J (BmJ) could be an important addition to the current control programs. BmJ induces a plant's natural defense response in a diverse range of specialty crops for control of several diseases. Prior to launching this project, field results from Oregon State University and Montana State University showed significant PVY control in potatoes with BmJ. University of Idaho trials of BmJ use in potatoes showed significant control of white mold caused by the fungal pathogen *Sclerotinia sclerotiorum*. This is the same organism that causes the principal fungal disease, white mold, of dry beans.

This project conducted field tests to develop applications of BmJ for disease and virus control in two key Idaho specialty crops. The project evaluated PVY control in potatoes to determine the percent reduction in virus levels through three years of research trials at the Kimberly R&E Center and two years of on-farm trials. Second, this project conducted three on-farm trials to incorporate biological control agents into an integrated pest management approach for white mold in both conventional and organic dry beans.

Project Approach
Outcome 1: Decrease by half the incidence of PVY infection in susceptible potato varieties grown for seed, with the use of the biological control BmJ.

Activity Summary

- <u>Conduct small plot research trial at Kimberly R&E Center, including winter grow out of daughter tubers.</u>

While the original plan was to conduct trials over two seasons in 2011 and 2012, additional funds were secured for a third year of trials in 2013. PVY levels were analyzed in potato leaf tissue during the growing season (Table 1). At harvest, daughter tubers were collected from each treatment and then grown out in California to determine PVY levels in the leaf tissue (Table 1). Results from the grow out of the 2013 daughter tubers will be available in May 2014.

- <u>Conduct on-farm trials.</u>

The original plan was to conduct on-farm trials with three potato growers. This plan had to be modified when the registration process for BmJ with the Environmental Protection Agency (EPA) was stalled and the experimental use permit allowing on-farm trials was not renewed. The plan was modified and small plot, on-farm trials were conducted in 2012 and 2013, with a crop destruct at the end of the trial to meet EPA requirements. PVY levels were analyzed in the potato leaf tissue,

similar to the research trial conducted at the Kimberly R&E Center (Table 2). Results from the grow out of the 2013 daughter tubers will be available in May 2014.

- Share results with growers at University of Idaho Potato Conference.

The original plan included a presentation at the 2012 University of Idaho Potato Conference. This had to be modified, since only initial results were available. The results from the winter grow out were not available until months later. Instead, the focus was placed on educational outreach through field days at the Kimberly R&E Center in August 2012 and Aberdeen R&E Center in September 2013, a workshop session at the Pacific Northwest Vegetable Association meeting in November 2012, and articles in newspapers and trade magazines. The project team prepared an article, which appeared in the trade magazine *Potato Grower* in November 2013. *Potato Grower* has a circulation of 2,300 addresses in Idaho and 9,900 nationwide.

Table 1. Average % PVY infection in potato plants treated with two different rates of BmJ, Actigard, Belay, and Belay + BmJ. Research trials were conducted at the Kimberly R&E Center. Different letters represent significant difference at the p = 0.05.

	Average % PVY					
	2011		**2012**		**2013**	
Treatment	**In-Season Virus Spread**	**Winter grow out**	**In-Season Virus Spread**	**Winter grow out**	**In-Season Virus Spread**	**Winter grow out**
Untreated check	8.13 a	29.13 a	21.30 a	64.08 ab	25.90 ab	*later*
BmJ .88 oz/ac	7.70 a	31.25 a	10.63 bc	54.13 ab	24.83 ab	*later*
BmJ 2.64 oz/ac	6.32 a	20.65 a	12.68 ab	67.40 a	29.45 a	*later*
Actigard 12.2 oz/ac	3.89 a	26.10 a	1.90 c	27.80 c	7.43 b	*later*
Belay 3 fl oz/a	8.13 a	21.40 a	17.08 ab	48.85 ab	30.55 a	*later*
Belay 3 fl oz/a + BmJ 0.88 oz/ac	5.00 a	35.13 a	16.08 ab	48.63 ab	13.53 ab	*later*

Table 2. Average % PVY infection in potato plants treated with two different rates of BmJ from the on-farm trials. Different letters represent significant difference at the p = 0.05.

	Average % PVY			
	2012		**2013**	
Treatment	**In-Season Virus Spread**	**Winter grow out**	**In-Season Virus Spread**	**Winter grow out**
Untreated check	2.50 a	23.28 a	23.53 a	*later*
BmJ .88 oz/ac	8.23 a	27.30 a	23.20 a	*later*
BmJ 2.64 oz/ac	0.63 a	25.30 a	29.90 a	*later*

Outcome 2: Develop an integrated pest management program in conventional production and a biological control program in organic production for white mold in beans.

Activity Summary

- Conduct on-farm research trials with an organic and a conventional dry bean grower.

The plan to conduct trials on an organic dry bean farm had to be modified since the organic certification program at ISDA would have required an extensive approval process to allow use of BmJ on a certified organic field. Consequently, trials with the products for organic production were conducted on conventional acreage. Two trials, one with the products for conventional production and another with products for organic production, were conducted on a grower's farm in 2011. Trials were launched again in 2012, but were halted after difficult weather conditions affected the trial fields. In 2013, two sets of trials were conducted on two different growers' farms. Each year, white mold severity was rated near the end of the growing season (Tables 3 and 4).

- Present results during field day and winter commodity school.

Methods for managing white mold and this project were presented to growers during the winter bean school in February 2012 and the Pacific Northwest Vegetable Association meeting in November 2012. The project was also presented at field days, including one held at a bean grower's farm near Twin Falls in August 2011 and at the Kimberly R&E Center in July 2012. Plant disease management reports were prepared for the 2011 trial and posted to the Plant Management Network. Two more reports for the 2013 trials will be prepared and posted, following full analysis in the coming months. The original plan included publication of a research article in a plant pathology journal, but this is unlikely due to the low levels of white mold and lack of a strong response to the treatments.

Table 3. White mold infection in dry beans following treatment with BmJ alone or in rotation with synthetic fungicides, Endura and Luna Tranquility. Trials were conducted on three different dry bean farms. Treatments were made at A = before bloom, B = bloom onset (10-30%), C = full bloom (100%), or D = 10 days after the last application. AUDPC = area under the disease progress curve calculated based on two ratings. Only one severity rating was conducted in 2013.

	AUDPC	**Percent Severity Rating (0 - 100 %)**		
Treatment	**2011**	**2011**	**2013 - north farm**	**2013 - south farm**
Untreated check	83 a	5.45 a	16 a	4 a
Endura - B,C	54 ab	3.11 a	7 a	2 ab
BmJ - A,B,C,D	48 ab	1.77 a	7 a	1 bc
BmJ A - Endura B,C	40 ab	1.67 a	4 a	1 bc
Endura B,C - BmJ D	31 b	1.42 a	2 a	0 c
Endura B,C - BmJ B	42 ab	2.66 a	4 a	1 bc
Endura B - BmJ CD	-	-	5 a	1 bc
Luna B,C	-	-	4 a	0 bc
Luna B - BmJ C,D	-	-	5 a	1 bc
Luna B,C - BmJ D	-	-	4 a	1 bc
	P = 0.1	P = 0.05	P = 0.05	P = 0.05

Table 4. White mold infection in dry beans following treatment with BmJ and other biopesticides used in organic production. Trials were conducted on three different dry bean farms. Treatments were made at

A = before bloom, B = bloom onset (10-30%), C = full bloom (100%), or D = 10 days after the last application. AUDPC = area under the disease progress curve calculated based on two ratings. Only one severity rating was conducted in 2013.

	AUDPC	Percent Severity Rating (0 - 100 %)		
Treatment	**2011**	**2011**	**2013 - north farm**	**2013 - south farm**
Untreated check	187 a	11.67 a	10 a	1 a
BmJ - A,B,C,D	161 ab	11.50 a	8 ab	1 a
Serenade Max - A,B,C,D	78 b	5.33 a	3 d	1 a
Bio-Tam - A,B,C,D	145 ab	8.83 a	4 bcd	1 a
Bio-Tam - A,C BmJ B,D	191 a	12.50 a	3 cd	0 a
Double Nickel A,B,C,D	-	-	7 abc	1 a
Double Nickel A,C - BmJ B,D	-	-	3 d	2 a
BmJ A,C - DoubleNickel B,D	-	-	5 bcd	1 a
	P = 0.1	P = 0.05	P = 0.05	P = 0.05

Project Partners

Northwest Center for Alternatives to Pesticides (NCAP): Dr. Jennifer Miller provided overall coordination of the project with partners, organized and conducted educational field days, and reported progress to ISDA.

Montana Microbial Products (MMP) and Certis USA: MMP was the original company developing BmJ for commercial sale. Cliff Bradley of MMP assisted in trial design and monitoring, provided BmJ for trials, presented at the first field day, and provided cash and in-kind matches to the project. Certis USA took over these roles, when MMP entered into an agreement with Certis to complete commercial development of BmJ. Scott Ockey with Certis assisted in trial design, supplied BmJ for the trials, presented at the field day, and provided funding for additional trials.

University of Idaho: Dr. Oliver Neher, extension plant pathologist, conducted the BmJ trials for control of white mold with three bean growers and the small plot research trial of BmJ for control of PVY in potatoes at the Kimberly R&E Center. He regularly presented information on the project through multiple winter workshops and summer field days. Dr. Phil Nolte, extension seed potato specialist, and Melissa Bertram, scientific aide, conducted the trials of BmJ for control of PVY in potatoes with two potato growers and conducted the virus testing, yield ratings and winter grow out for the small plot research trial of BmJ at the Kimberly R&E Center. Dr. Nolte also assisted in educational outreach through a field day.

Dry Bean and Potato Growers: Three dry bean growers in the Twin Falls area and two potato growers in the Rexburg area participated in this project by hosting the on-farm trials.

Goals and Outcomes Achieved

Expected Measureable Outcome 1: Decrease by half the incidence of PVY infection in susceptible potato varieties grown for seed, with the use of the biological control BmJ, by September 2012. The current level of infection in susceptible varieties grown for seed ranges from less than 2 to more than 50%. To increase growers' awareness, information on the biological control and management of PVY will

be shared with 100 potato growers at the University of Idaho Potato Conference as measured by attendance numbers. The project will produce a technical bulletin at the end of the project and coordinate with the University of Idaho in reaching seed growers with information on using BmJ in managing PVY.

Expected Measureable Outcome 2: Develop an integrated pest management program in conventional production and a biological control program in organic production for white mold in beans by September 2012. Disease programs using a biological control agent for white mold in beans do not currently exist. To increase growers' awareness, information on the management programs for white mold will be shared with 150 bean growers at winter commodity schools, summer field days, the annual winter commodity school proceedings, and an extension bulletin. This outcome will be measured by the number of growers attending and the number of bulletins mailed.

PVY in Potatoes

To measure this outcome, the project team analyzed PVY infection levels in leaves of potato plants during the growing season and in the leaf tissue that grew out of the daughter potatoes. PVY levels in the daughter potatoes were analyzed during a winter grow out following the harvest season. Consequently, the third trial year results are not yet available. Trials were conducted in 2011, 2012 and 2013.

Based on results from initial trials at Oregon State University and Montana State University, it was expected that the PVY incidence would decrease by half with the use of BmJ. This outcome was not achieved based on three years of small plot trials at the Kimberly R&E Center and two years of on-farm trials. The Oregon and Montana studies only analyzed in-season PVY levels, whereas trials in this project provided a more complete analysis by testing leaves from the winter grow out of daughter tubers. If this project had only tested in-season PVY levels, one year (2012) did show a reduction by half (Table 1). Instead, this project was designed to provide more detailed information about the potential role for BmJ in managing PVY.

The Actigard treatment met the expected outcome of reducing PVY infection by half, according to the in-season leaf sampling (Table 1). Further, PVY levels in the leaves of daughter tubers were also reduced by treatment with Actigard in one of the two trial years. (Further results from the winter grow out of 2013 daughter potatoes will be available in spring 2014.) Actigard is a chemical inducer of systemic acquired resistance, causing some of the same biochemical pathways to be activated as BmJ. The reduction of PVY by half with use of Actigard indicates there is potential for BmJ to also meet the expected outcome. Further testing is needed to refine application rates and timing.

While not a focus of this project, other research and grower trials with the University of Idaho have shown BmJ to be highly effective for managing early blight and white mold in potatoes. Growers may decide to use BmJ primarily for the management of these diseases, but also because of the role it can play in reducing PVY levels.

The educational outreach objectives are ongoing, although there were some modifications to the original plan. A September 2013 field day was held at the University of Idaho Aberdeen R&E Center. Because it was in the middle of the harvest season, the focus was on members of the media and agriculture suppliers. As a result, media coverage was secured in the *Capital Press* and Blackfoot *Morning News*. An article will also appear in the Idaho Falls *Post Register's Intermountain Farm and Ranch.* In addition, the project team prepared an article for the trade magazine *Potato Grower*, which will appear in the November issue and reach Idaho growers. *Potato Grower* has a circulation of 2,300 addresses in Idaho. An article in another trade magazine is also expected. The managing editor of *Spudman* interviewed Scott Ockey at Certis and plans to run the article once BmJ is closer to completing registration.

White Mold in Dry Beans

To meet this goal, the project team conducted trials of BmJ and other microbial control agents in dry beans. The trials were conducted on farms with three dry bean growers in 2011 and 2013. Since white mold is a soil-borne disease, fields with a history of white mold were selected. While the fields included in the trials had a history of white mold, disease levels were not high. This presented a challenge for detecting differences among the treatments.

Based on results from these trials (Tables 3 and 4), the following biopesticides can be added to an integrated disease management approach for managing white mold in dry beans: BmJ, Serenade Max, Bio-Tam and Double Nickel 55 in combination with fall applications of Contans for breakdown of the sclerotia. Sclerotia are the dormant fungal structures formed on the host plant, which germinate in spring to produce spores and re-infect the host plant.

Mode of action:

Bio-Tam – *Trichoderma gamsii* and *Trichoderma asperellum* are naturally occurring, non-pathogenic soil fungi that colonize the soil and compete with plant-pathogenic fungi. These fungi also produce enzymes that attack the cell walls of pathogens.

BmJ – *Bacillus mycoides* isolate J is a naturally occurring, nonpathogenic soil bacterium that induces systemic acquired resistance in the crop plant.

Contans – *Coniothyrium minitans* is a naturally occurring, nonpathogenic, mycoparastic soil fungus used to break down the sclerotia.

Double Nickel 55 – *Bacillus amyloliquefaciens* (strain D747) is a naturally occurring soil bacterium that produces antimicrobial compounds which disrupt microbe cell walls and membranes, inhibits infection through competitive exclusion of plant pathogens and triggers plants natural defense response through systemic acquired resistance.

Serenade Max – *Bacillus subtilis* (strain QST 713) is a naturally occurring, nonpathogenic soil bacterium that induces systemic acquired resistance in the crop plant and produces pathogen-destroying lipopeptides.

Incorporation of biopesticides into a white mold management plan for conventional production:

- Overspray crop residue with Contans in the fall to breakdown sclerotia.
- Reduce sclerotia in fields by managing crop residue. This reduces the food source for the fungus and as a result the number of sclerotia that the fungus can produce.
- Select varieties with an upright growth habit to prevent humid conditions in the canopy, which favors while mold development.
- Avoid excessive vine growth by not over fertilizing to prevent humid conditions in the canopy.
- Manage irrigation water to prevent humid conditions.
- Incorporate a systemic acquired resistance inducer, such as BmJ, Double Nickel or Serenade Max, into a fungicide program for resistance management and to replace one or more applications of the conventional fungicide. Conventional fungicides Endura or Luna Tranquility are often applied at 10 to 30% bloom and full bloom. BmJ, Double Nickel or Serenade Max would be applied prior to bloom and after treatment with conventional fungicides.

Incorporation of biopesticides into a white mold management plan for organic production:

- Overspray crop residue with Contans in the fall to breakdown sclerotia.
- Reduce sclerotia in fields by managing crop residue. This reduces the food source for the fungus and as a result the number of sclerotia that the fungus can produce.
- Select varieties with an upright growth habit to prevent humid conditions in the canopy, which favors while mold development.
- Avoid excessive vine growth by not over fertilizing to prevent humid conditions in the canopy.
- Manage irrigation water to prevent humid conditions.
- Prior to bloom, apply the systemic acquired resistance inducer Serenade Max, the mycoparasitic fungus Bio-Tam, or the systemic acquired resistance inducer/biofungicide Double Nickel 55 in rotation with BmJ. Repeat applications on a two-week schedule.

The project met the outreach targets through workshops, field days and disease management reports. Dr. Oliver Neher presented workshop sessions on white mold at the 2012 Idaho bean school and the Pacific Northwest Vegetable Association meeting with 208 growers and crop consultants attending. Field days were held in summer 2011 and 2012 to reach an additional 70 people, of which 14 grow beans. Two plant disease management reports (attached) were prepared and posted to the Plant Management Network site (www.plantmanagementnetwork.org, Volume 6, August 2012), where crop consultants and researchers view the trial summaries. Additional growers will be reached during a November 2013 presentation to the Pacific Northwest Vegetable Association meeting and through plant disease management reports for the 2013 trials.

Beneficiaries

Potato and dry bean producers in Idaho will benefit from the completion of this project once BmJ is commercially available. The registration process with EPA was delayed due to impacts of the economic recession on the ability for Montana Microbial Products (MMP) to complete the final rounds of testing. MMP reached an agreement with Certis USA to complete registration and bring the product to market. Further testing requirements by EPA have slowed the process, since Certis has taken the lead. It is expected that BmJ will be commercially available for the 2015 growing season.

Idaho's 75 potato seed growers on 30,000 acres (Dr. Phil Nolte) and 640 bean growers on 80,000 acres (2007 Ag Census) are the specialty crop industries to benefit from this project. The Idaho potato seed industry represents approximately $60 million in farm income, according to estimates by Dr. Nolte. Idaho's bean growers generate $57 million in farm income, according to the 2009 USDA NASS State Agriculture Overview.

While treatment with BmJ did not meet the expected outcome of reducing PVY incidence by half, it could still provide an economic impact by reducing the percentage of PVY infection. The value of meeting specifications for certified seed is that seed can be sold for $10-12 per hundredweight (cwt) versus $2 per cwt, if the seed potatoes do not meet specifications and are sold for dehydration. For every cwt that meets specifications, seed growers can increase their return by $8-10. On a seed potato field yielding 250 cwt per acre, this would mean an increased return of $2,000-$2,500 per acre. For a 50-acre seed lot, this would mean $100,000 to $125,000. Seed growers currently use sticky oil sprays to impact transmission and systemic insecticides to control vectors, but these treatments provide only limited control. Use of BmJ or Actigard to provide additional reductions in PVY infection and thus an increase in seed lots meeting certified seed requirements will increase seed growers' economic return.

This project also provided information on a cost-effective fungicide resistance management tool for controlling white mold in dry beans. According to USDA NASS, Idaho is expected to harvest 119,000 acres and 2.5 million cwt of dry beans in 2013. Depending on cropping practices and location, the average production costs can reach $400 per acre (Fuchs et al. 2003), with $55 to $100 for fungicides. In 2012, statewide yields were 1,900 pounds per acre. Price per pound has ranged from 36 to 50 cents per pound in recent years for a gross of $684 to $950. South central Idaho produces about 80% of Idaho's dry beans, mostly under sprinkler-irrigated conditions. Poor management of irrigation water can lead to an increase of white mold, which can cause yield losses up to 25 to 50% (Fuchs et al. 2003). Project partner Dr. Oliver Neher reports losses of 50 to 75% in south central Idaho depending upon the year and variety grown. By replacing one or two treatments of a conventional fungicide with BmJ, it is anticipated that growers will be able to reduce costs per acre. Exact pricing for BmJ is not known, since it is not yet commercially available. On a season long program, such as for potato, a grower can reduce fungicide costs for white mold by up to 10%. BmJ use can also help prevent the loss of conventional fungicides to resistance development and thus prevent production costs from increasing. Sclerotinia species, which includes the white mold disease-causing organism, are listed as a medium risk pathogen for fungicide resistance development by the Fungicide Resistance Action Committee.

Lessons Learned

Three lessons resulted from this project. First, further studies are needed to refine the timing and application rates of BmJ to reduce PVY infection in potatoes. Second, the low level of white mold in the trial bean fields created challenges for assessing the biopesticides. Third, the acceptance of systemic acquired resistance as a component of a disease management plan has grown among the university research community.

The results here show that additional studies on BmJ for managing PVY infection are needed. The trials in this project did not show a significant reduction, unlike previous studies at Oregon State University

and Montana State University. This project did show that Actigard, a chemical inducer of systemic acquired resistance, was effective in reducing PVY infection. These findings suggest that further studies adjusting the timing and application rates of BmJ could reduce PVY infection and meet our expected outcome.

While dry bean fields were selected that had a history of white mold, overall disease severity was not very high in these trials. This made it difficult to fully assess the effectiveness of the different treatments. The trials were not conducted at the Kimberly R&E Center because of previous difficulties ensuring white mold infection in the plots. Despite the project team's effort to identify fields with a white mold history, the trials could have benefited from higher infection. Originally the project only conducted two trials. But by securing additional funds, the project team was able to add an important third trial. In addition, it would have been beneficial to rate the effectiveness of the different treatments on bacterial blight and beet curly top virus. These diseases were not present in the growers fields, so could not be rated.

During the timeframe of this project, there was an unexpected increase in acceptance of using systemic acquired resistance as a tool in disease management. When this project was conceived, few within the university research community were looking to systemic acquired resistance as a component of a disease management plan. There has been growing acceptance of this strategy within the research community during the timeframe of this project and work on BmJ is helping to make that change.

Contact Person

Jennifer Miller
Northwest Center for Alternatives to Pesticides
208-850-6504
jmiller@pesticide.org

Additional Information

Plant Disease Management Reports (attached)
Photos – Bean trial, Potato trial, Field days (attached)

Biological Control for Disease and Virus Management in Beans and Potatoes

Final Performance Report - Photos

Integrated Disease Management of White Mold in Dry Beans Trial - 2011

BmJ for the Control of PVY in Potatoes Trial - 2012

August 2011 Field Day at a Joslin Farms near Twin Falls

July 2012 Field Day at the Kimberly R&E Center

September 2013 Field Day “Induced Resistance as a Component of Potato Disease Management” at the Aberdeen R&E Center

 Felicia Gillham

Bio-Advancements in Pest Control

New product shows promise against common diseases

Certis USA's Scott Ockey discusses how BmJ can be used to fight early blight, late blight and white mold.

IT WAS A FIELD DAY much like any other. The event that took place Sept. 4 at the University of Idaho's Research and Extension Center in Aberdeen, Idaho, highlighted the findings of Dr. Phillip Wharton's trials on a prospective disease control product for potatoes. But as the data were examined by academics, crop consultants, pesticide distributors and growers, it became clear that this field day offered a look into the future of pest management and the major advancements introduced by biopesticides.

Under study is a biopesticide currently called BmJ. Wharton's findings, as well as those of Dr. Oliver Neher of the University of Idaho's Kimberly research center and Dr. Phil Nolte of the university's Idaho Falls center, show that BmJ provides good control of white mold, late blight and early blight. Of great news to seed potato producers, the researchers have seen good control of potato virus Y (PVY). Preliminary results from Dr. Wharton show positive results in the control of Rhizoctonia.

Biopesticides have come of age. Once considered products fit only for organic production, biopesticides today have a clear fit in conventionally produced potato fields. Biopesticides offer efficacy, resistance management, export friendliness due to MRL exemptions, and environmental, plant and people safety.

Biopesticides have also become big business. Well-known pesticide companies are investing in the technology. Syngenta has purchased a number of biopesticide companies, including Pasteuria Biosciences. Bayer CropScience acquired biopesticide company AgraQuest, Inc. Marrone Bio Innovations, Inc. had a successful public offering in August, and Certis USA, a biopesticide manufacturer since 1996 with the industry's largest product line, introduced five new biopesticides last year alone.

Certis USA is also the manufacturer of BmJ. The company co-sponsored the Aberdeen field day with the nonprofit organization Northwest Center for Alternatives to Pesticides (NCAP). Jennifer Miller, sustainable agriculture associate with NCAP, says her group works to protect community and environmental health and inspire the use of ecologically sound solutions to reduce the use of pesticides.

"We are concerned about the lack of investment in alternatives to synthetic pesticides," Miller says. "When NCAP secured funding, we were excited to work with Certis, as well as growers and University of Idaho researchers, to develop this biological-based product.

"This is a win-win," she continues. "We are interested in reducing the number of fungicide treatments and showing how biological products are an effective part of a management program.

Miller says the field day featured trials supported by the Idaho State Department of Agriculture (2010 Specialty Crop Block Grant) and the Natural Resources Conservation Service, USDA (under number 68-0211-10-030).

BIOPESTICIDES AND THEIR UNIQUE CHEMISTRIES

What's under the hood of BmJ particularly interests the researchers. It contains Bacillus mycoides isolate J, a bacterium discovered by Montana State University. BmJ has been shown to trigger a potato plant's immune response to pathogenic fungi, bacteria and viruses. This response is called systemic acquired resistance, or SAR.

Scott Ockey, Western field development manager for Certis USA, says that when plants are attacked by insects or disease, they activate what's often called a plant immunity or hypersensitive response. The plants, not BmJ, release a cascade of metabolites or enzymes that fight off the attacking pests.

Novel modes of action are characteristic of other biopesticides used in potato production. Ockey points to Cueva, a copper octanoate product that controls foliar and bacterial diseases. The octanoate, he says, is a fatty acid that allows the copper to be effective at lower rates and reduces phytotoxicity. Another biopesticide, Double Nickel, contains Bacillus amyloliquefaciens (Ba). It controls foliar and root pathogens by excluding the disease pathogens to keep them from entering the potato plant. It also

outcompetes the pathogens for space on the plant's tissue, so the disease cannot enter the tissue and infect the plant. Finally, Ba produces metabolites that can kill the pathogen on contact.

BIOPESTICIDES AND THE MANAGEMENT OF RESISTANCE

One of the biggest threats to pest management is when a pest develops resistance to a pesticide. Recently, populations of early blight that are resistant to a valuable fungicide have been reported. That makes BmJ's eventual registration of paramount importance because of the role the product is expected to play in resistance management. Fungal pathogens are not anticipated to develop resistance against BmJ, because it elicits a reaction from the plant to control the pests. Pests cannot develop a strategy against BmJ. But most importantly, the product's unique mode of action may help increase the useful life of the early blight fungicide.

"The introduction of BmJ will hopefully slow the development of resistance, and it might be able to reverse resistance in some of the fields," says Ockey.

"Biopesticides have come of age. Once considered products fit only for organic production, biopesticides today have a clear fit in conventionally produced potato fields."

He explains that one fungus can produce thousands of spores. If one of those spores is resistant to a specific pesticide, it can produce thousands of resistant spores and very quickly the fungal population in a field can become resistant.

"Biopesticides can help lengthen the life of synthetic chemistry by allowing growers to mix up the modes of action that they use to kill pests," says Ockey.

Potato growers should expect to use BmJ in a program with other chemistries. "What we've been doing in the trials is eliminating an application of a synthetic fungicide or reducing the rate of a fungicide," Ockey says. "The overall effect is that by employing BmJ, we are presenting a cost-effective fungicide program that helps manage resistance."

BIOPESTICIDES AND MAXIMUM RESIDUE LEVELS

For growers who raise crops for export, biopesticides play an increasingly important role. Maximum residue levels, or MRLs, are impacting the marketability of export potatoes. Different countries have different limits on the levels of pesticide residues that are allowed. A load of export potatoes can easily be turned down if the crop is raised using pesticides that leave residues higher than the importing country's guidelines.

Biopesticides can be a boon to growers who export, because most of them are legally exempt from residue tolerances.

A TROUBLESOME FOE. Sclerotia, which carry the white mold fungus, can survive in a dormant state for long periods and develop a resistance to many common synthetic pesticides.

BIOPESTICIDES AND SAFETY

Biopesticide materials offer a high degree of safety to pest management. For example, when registered, BmJ is expected to have a minimal personal protective equipment requirement (PPE) and is anticipated to have a four-hour re-entry interval and zero-day pre-harvest interval. Although testing continues, BmJ has shown no danger to farm workers, beneficial insects, wildlife, livestock or the environment. Many biopesticides have similar safety features.

Ockey points out that the safety of biopesticides is often marginalized because people call them "soft" materials. "There is nothing soft about the way many biopesticides work," he says, pointing to a biopesticide that is used to control codling moth. "Cyd-X is an insecticidal virus that is virulent to codling moth larvae. The larvae are infected by the virus that replicates in the gut, killing and liquefying the pests. The biopesticide is absolutely devastating to larvae, but because it is specific to codling moth, that virus cannot infect and harm humans, animals or the environment."

BmJ is expected to receive EPA registration in the first half of 2015. Once registered, Ockey says there should be no learning curve in the use of BmJ. Growers will be able to easily integrate BmJ into their growing programs, and compatibility with other products does not appear to be a problem. "That's why field events like this one are so valuable," Ockey says. "The pesticide dealers are here and in contact with the extension folks who have experience with the product and will produce application guidelines for growers to use. BmJ is an advancement in pesticide technology, but when it becomes available, the industry will be fully aware of the product and how to use it."

Asked what BmJ and other biopesticides offer growers, Ockey says, "Growers are business people. They are on top of every aspect of growing potatoes—from labor to nutrition to insurance to seed potatoes to moisture levels. Biopesticides take a lot of stress off of one portion of growing—insect and pest control.

"Biopesticides remove stress, because they are safe to use and concerns about MRLs aren't there. They are effective, and they help keep other chemistries effective, too." PG

DRY EDIBLE BEAN (*Phaseolus vulgaris*)
White mold: *Sclerotinia sclerotiorum*

O.T. Neher
University of Idaho
Department of PSES
Kimberly, ID 83341

Comparison of OMRI listed bio-pesticides for control of white mold of dry edible beans, 2011.

Research plots were located in a certified organic dry edible bean field 17 km north of Paul, ID. Plots were established on 25 Jul 11 in a randomized complete block design with six replication with individual blocks separated by a 0.6-m wide alley. Plots consisted of two rows (1.1-m by 7.6-m). Treatments were applied to one row using a backpack (pressurized CO_2) sprayer with an 81-cm wide boom equipped with three 11002E even fan spray tips at a pressure of 28 psi. Applications were made on 25 Jul before bloom, 1 Aug at bloom onset (10-30% of flowers open), 15 Aug at full bloom (100%), and 26 Aug 10 days after last application. Plots were rated for the occurrence of white mold symptoms on the 1, 15 and 26 Aug. On 21 Sep, plots were harvested by hand and collected plant material was laid out to allow for complete desiccation. To determine treatment efficacy, sclerotia were separated from stems (outside and inside by splitting stems lengthwise), their numbers and weight determined. In addition, diseased beans were separated from healthy beans and weighed independently. Data were analyzed by ANOVA using the GLM procedure of SAS (Ver. 9.2), and treatment means were separated using Fisher's protected LSD test ($P \leq 0.05$).

Symptoms appeared late and first signs of white mold were observed on 15 Aug. No other disease problems were evident in the field and no phytotoxicity from foliar treatments was observed. Neither disease nor yield parameters were statistically significant, and none of the tested treatments were significantly different from the untreated control. Serenade Max ranked first with the lowest AUDPC (58% lower than the untreated check), the lowest number and the lowest total weight of sclerotia (a reduction of 48% and 50% respectively when compared to the untreated control) and the highest weight for harvested healthy beans (a 12 % increase when compared to the untreated control. .

Treatment [z]	Timing	AUDPC [y]	# sclerotia	total sclerotia (g)	healthy beans (g)	diseased beans (g)	total weight (g)
Untreated Check……		186.7	67.8	1.4	500.4	8.4	508.8
Bacillus mycoides isol. BmJ	ABCD	161.2	95.3	1.7	484.1	13.6	497.7
Defensor……..	ABCD	81.2	59.0	1.4	442.6	10.8	453.5
Serenade Max……..	ABCD	78.3	35.2	0.7	561.2	4.0	565.2
Tenet WP…….	ABCD	145.4	50.5	1.0	559.9	13.7	573.6
Tenet WP *B. mycoides* isol. BmJ ……	AC BD	191.2	77.2	1.4	529.8	7.8	537.7
$P > F$		0.2545	0.4322	0.5393	0.4956	0.4366	0.4923

[z] *Bacillus mycoides* isol. BmJ at 1 g/L, Defensor (*Bacillus subtilis* (CM-5 strain)/ *B. cereus* (BCE-2 strain)) at 2.34 L/ha, Serenade Max (*B. subtilis* (QST 713 strain)) at 2.8 kg/ha, Tenet WP (*Trichoderma asperellum* (ICC 012) / *T. gamsii* (ICC 080)) at 2.8 kg/ha; A = before bloom, B = bloom onset (10-30%), C = full bloom (100%), D = 10 days after last application.

[y] AUDPC = area under the disease progress curve calculated based on three ratings.

[x] $P > F$ was the probability associated with the F value.

DRY EDIBLE BEAN (*Phaseolus vulgaris*)
White mold: *Sclerotinia sclerotiorum*

O.T. Neher
University of Idaho
Department of PSES
Kimberly, ID 83341

Comparison of fungicide – *Bacillus mycoides* combinations for control of white mold of dry edible beans, 2011.

Research plots were located in a conventionally managed dry edible bean field 17 km north of Paul, ID. Plots were established on 25 Jul 11 in a randomized complete block design with six replication and individual blocks were separated by a 0.6-m wide alley. Plots consisted of two rows (1.1-m by 7.6-m). Treatments were applied to one row using a backpack (pressurized CO_2) sprayer with an 81-cm wide boom equipped with three 11002E even fan spray tips at a pressure of 28 psi. Applications were made on 25 Jul before bloom, 1 Aug at bloom onset (10-30% of flowers open), 15 Aug at full bloom (100%), and 26 Aug 10 days after last application. Plots were rated for the occurrence of white mold symptoms on the 1, 15 and 26 Aug. On 21 Sep, plots were harvested by hand and collected plant material was laid out to allow for complete desiccation. To determine treatment efficacy, sclerotia were separated from stems (outside and inside by splitting stems lengthwise), counted and their weight determined. In addition, diseased beans were separated from healthy beans and weighed independently. Data were analyzed by ANOVA using the GLM procedure of SAS (Ver. 9.2), and treatment means were separated using Fisher's protected LSD test ($P \leq 0.05$).

Symptoms appeared late and first signs of white mold were observed on 15 Aug. No phytotoxicity from foliar treatments was observed and other disease problems were not evident in the field. Neither disease nor yield parameter was statistically significant and none of the tested treatments were significantly different from the untreated control. A reduction of the area under the disease progress curve (AUDPC) and the total number of collected sclerotia was noticeable for combined applications of Endura and *B. mycoides* isolate BmJ (BmJ). Endura followed by BmJ showed better control results than the application the other way round or Endura alone. It appears that combining a fungicide (Endura) and a systemic acquired resistance inducer (BmJ) can enhance the control of white mold.

Treatment [z]	Timing	AUDPC [y]	# sclerotia	total sclerotia (g)	healthy beans (g)	diseased beans (g)	total weight (g)
Untreated Check……..		83.3	47.7	0.71	508.5	4.95	513.5
Endura…….	BC	54.2	22.8	0.41	528.4	3.39	531.8
B. mycoides BmJ…….	ABCD	47.9	24.8	0.66	389.3	5.30	394.6
B. mycoides BmJ Endura,…….	A BC	39.6	12.8	0.20	536.8	3.74	540.5
Endura *B. mycoides* BmJ…….	BC D	31.2	12.0	0.18	554.2	4.00	558.2
Endura *B. mycoides* BmJ Endura…….	B B C	41.7	18.3	0.29	534.0	4.51	538.5
$P > F$ [x]		0.4762	0.4067	0.6275	0.1435	0.8346	0.1521

[z] Endura @ 3.2 oz/A, *Bacillus mycoides* isolate BmJ @ 1g/L; A = before bloom, B = bloom onset (10-30%), C = full bloom (100%), D = 10 days after last application.

[y] AUDPC = area under the disease progress curve calculated based on three ratings.

[x] $P > F$ was the probability associated with the F value.

Idaho-Oregon Bi-State Food Processors Specialty Crop Sustainability Initiative

Subrecipient
Northwest Food Processors Association

Project Summary
Many specialty crop producers and processors are not prepared to meet their key customers' sustainability criteria. For the specialty crop industry, meeting these requirements are vital its continued growth and survival. The Idaho- Oregon Bi-State Food Processors Specialty Crop Sustainability Initiative is an industry-driven sustainability support structure to help specialty crop producers and processors design and implement company-specific sustainability plans.
The initiative provides companies written materials and online resources needed to create company-specific sustainability plans. The project enables the development of sustainability tools that companies are unlikely to develop on their own. This was a multi-state project between Oregon Department of Agriculture (ODA) and Idaho Department of Agriculture (IDA). The ODA was the lead state for this project. This multi-state specialty crop grant project has not been funded by other federal or state programs.

Project Approach & Goals and Outcomes Achieved
Sustainability Committee
Project Approach
The vision was to create a Sustainability Task Force that would conduct research with Idaho and Oregon focused surveys. The task force will also develop actions plans with metrics, curricula and educational plans.

Goals and Outcomes Achieved
The goal of the task force was to create a sustainability framework for the Northwest food processing industry. It was instrumental in the planning of both the 2011 and 2012 Sustainability Summits. Members provided input in the creation Sustainability Readiness Questionnaire and the Sustainability Readiness and Insight Assessment. The Sustainability Task Force was formalized into a committee at the 2012 NWFPA Executive Business Summit (EBS) in May 17, 2012. Membership increased from 9 Sustainability Task Force members to 11 Sustainability Committee members from Oregon, Washington, and Idaho food processing companies. In addition to providing input for the Sustainability Guide, Sustainability Readiness Questionnaire and Assessment, the Micro-Case Studies project, and the Go-Green Transportation Project, the committee has continued its involvement in planning the 2013 Sustainability Summit.

Sustainability Summit
Project Approach
The concept of the NWFPA Sustainability Summit is to bring the food processing industry together in one location and generate a dialogue focused on environmental, economical and social sustainability. It is a peer-to-peer learning opportunity.

Goals and Outcomes Achieved

NWFPA has successfully held 2 Sustainability Summits bringing together representatives from the food processing industry, food processing suppliers, and other interested parties. The first summit had 90 people in attendance and the second summit had 87 attendees. What made the second Sustainability Summit different than the first was the opportunity for suppliers to share with the industry their company's efforts to become more sustainable while offering solutions. Presentations from industry and supplier representatives were well received due to their educational content. At the 2012 Sustainability, Bill Graham, a professional communications expert, conducted a training session for 50 participants in " How to Communicate your Sustainability Efforts". The Sustainability Summit has become a yearly knowledge exchange event focused on economic, environmental, and social sustainability. The summit is revenue generating, making it financially self-sustaining beyond the grant. Planning for the 2013 Sustainability Summit is on track for April 17, 2013.

Readiness Questionnaire and the Sustainability Readiness and Insight Assessment:

Project Approach: In collaboration with DM Strategies, NWFPA completed two electronic assessment tools that food processors can utilize to evaluate themselves on their environmental, economic, and social sustainability efforts. Both the questionaire and assessments were designed to help guide companies with their strategic planning in setting their sustainability goals and executing them yearly.

Goals and Outcomes Achieved: The goal of both the questionnaire and assessments was to create a self-evaluation resource for food processing companies. In terms of usage, the Readiness Questionnaire has been more widely adopted than the Sustainability Readiness Questionnaire. Due to its intensive and fee-based nature, the assessment was not as widely accessed.

At both the 2011 and 2012 Sustainability Summit, Readiness Questionnaire was conducted to gain feedback from attendees. The responses from both years, shown below, highlight opportunities for industry development and illustrate the stark disparity between the widely acknowledged need and strong commitment to pursue sustainability, and the lack current training resources available. The results clarified the direction for NWFPA's future training material development, having a direct impact on enhancing the Sustainability Guide, developing three industrial water resource training workshops, and creating the Sustainability Micro-case Studies.

2011 Sustainability Summit Sustainability Readiness Questionnaire Results	2012 Sustainability Summit Sustainability Readiness Questionnaire Results
Among companies represented at the Summit: 89% have a leadership commitment for sustainability 73% have policies that demonstrate commitment to sustainability 60% either have a sustainability leader and /or steering team Yet only: 43% have a sustainability action plan 32% have identified objectives with a timeline 9% have available sustainability training	Among companies represented at the Summit: 88% have a leadership commitment for sustainability 82% have policies that demonstrate commitment to sustainability 88% either have a sustainability leader and /or steering team Yet only: 35% have a sustainability action plan 41% have identified objectives with a timeline 31% have available sustainability training

Sustainability Guide

Project Approach

The purpose of the Sustainability Guide is develop a tool, available in print and electronic format, that would help food processors initiate their sustainability projects, set goals, and assist in the development of metrics and reporting standards.

Goals and Outcomes Achieved

NWFPA accomplished its goal of creating one guide. Two versions, the original and updated version, of the Sustainability Guide was developed and distributed. The first version was initially distributed at the 2011 Sustainability Summit. It was so well received as a resource that 2 food processing companies paid for 50 copies each. With the help of a contractor, the guide was redesigned and updated with more current and relevant content. Over 300 copies of the second version were distributed at the 2013 NW Food Manufacturing & Packaging Expo.

Go-Green Shipper Transportation

Project Approach

The Go-Green Shipper Transportation project is a pilot program that uses a web-based tool to create better processing and routing efficiencies. The project's aim was to demonstrate best practices for operational efficiencies, freight cost reductions, fuel savings, and CO2 emission reduction using this tool.

Goals and Outcomes Achieved

NWFPA identified a pilot plant and began shipments with a major Idaho Food Processor, using web based software to expand their freight network beyond their current base. The results illustrated that the concept works. With the addition of intermodal, the environmental impact is sizable and the project has resulted in a 69.86% reduction in greenhouse gas emissions and consumption of diesel in those loads. NWFPA can develop outreach through its training center.

Sustainability Micro-case Studies

Project Approach

An outcome of the Sustainability Readiness Questionnaire was the development of the Sustainability Micro-Case Studies project. A contractor was hired to research and develop a 6"x9" book that benchmarks industry practices. The book is created to inspire and encourage other companies to either adopt similar practices or initiate their own.

Goals and Outcomes Achieved

The goal was to compile 50 case studies and to update the studies yearly to continue beyond this grant. The project is on track and to date NWFPA has 59 case studies. In addition to the 6"x9" book, a downloadable version will be available online in the Sustainability website once the final edits are complete in spring 2013.

Industrial Water Use Training Course

Project Approach

With the support and input of the Sustainability Committee, contract with Gannett Fleming & Cascade Earth Sciences was created to develop three "Industrial Water Use" training courses. The first course focuses on watershed and water balance. The second course is focused on water economics, risks, and quality. The third course is focused on water and energy management opportunities.

Goals and Outcomes Achieved

The goal was to create a sustainability training workshop involving 15 companies in ID and OR. NWFPA accomplished that goal by conducting the training course twice. The first workshop included 20 participants at NWFPA Assembly of Committees in September 2012. A second training course was conducted with 45 participants in the January 2013 Expo in Portland, Oregon.

EXPO Activities

Project Approach

Sustainability-focused sessions were held at both 2011 and 2012 NW Food Manufacturing & Packaging Expo.

Goals and Outcomes Achieved

The goal was to publicly launch the sustainability initiative focus at NWFPA Expo with education and training involving at least 200 ID and OR participants. The 2011 launch was accomplished as planned with three program sessions: "Sustainable Transportation - Is it Worth the Cost?", "Green Packaging: Shifting Markets, New Opportunities", and "Lean to Green: A Process for Sustainability", all primarily focused on the specialty crop industries. A total of 66 people attended the sessions. In addition, a focus group session of 20 people was conducted to review the Sustainability Guide draft and Assessment Tool. Besides the Green Transportation workshop, "Shipper, Customer, 3PL Supply Chain Demands" was held, a session focused on logistics partners and issues in cost control. EXPO 2012 continued these efforts with a sessions on "Communicating your Sustainability Efforts", "Sustainability Measurement and Reporting", and "Energy Data Management" sessions with 81 total attendees.

Beneficiaries

The beneficiaries of the Idaho- Oregon Bi-State Food Processors Specialty Crop Sustainability Initiative are the specialty crop producers and processors in Idaho and Oregon who have participated in or received a product funded by this grant.

These beneficiaries include but are not limited to those who:

- received and use the Sustainability Guide
- utilized either the Sustainability Readiness Assessment or Questionnaire
- participated in the Go-Green Shipper Transportation project
- are a member of the Sustainability Committee or attended one its meetings
- attended any of the Sustainability-focused events:
    - 2010 and/or 2012Sustainability Summit
    - Industrial Water Use Training Workshops
    - Sustainability-focused sessions at the 2011 or 2012 NWFPA Expo

- "Communicating your Sustainability Efforts" Training Session (Expo 2012, Executive Business Summit 2012, Sustainability Summit 2012)
- will read the Micro-case Studies

Lessons Learned

There were various lessons learned by the NWFPA staff and contractors as a result of completing this project.

- In-depth sustainability assessments are not easily adopted. In order have greater impact, finding a way that makes the assessments easier to use will be instrumental.
- It is important to listen to the industry's needs via surveys prior to submitting project proposals. For example, NWFPA discovered that obtaining training resources are more important to the industry than funding transportation projects.
- Challenges with the Go-Green Transportation Project: Resistance to change-Any change to the established patterns in work will be resisted. When any change is proposed, affected employees feel their job is being threatened or that the quality of work is being questioned. Instant defenses can range from unwillingness to share information to a determined effort to make the changes fail. Though the changes may benefit the Company, the employee may believe that they will not benefit, may have their status within the organization affected, or may even be harmed in some fashion. This is typically caused by poor communication with employees involved about the benefits of the change. We need the help of upper management to help demonstrate why the changes are important.

Contact Person

David McGiverin, Project Manager
Northwest Food Processors Association
(503) 327-2207

Additional Information

None.

Increasing Berry Size of Organic Table Grapes

Subrecipient
Rocky Fence Vineyard

Project Summary
The main market for table grapes is through retail outlets to which California grapes set the standard. Consumers now prefer large, seedless grapes. Growing a consistently large seedless grape is difficult. Idaho grows quality grapes, but struggles to match California berry size and consistency. To increase consumer demand and price for Idaho table grapes in the retail markets, larger berries are essential.

Recent research by Dr. Essie Fallahi at the University of Idaho has shown that acceptable berry size can be attained for Southwest Idaho table grapes. Dr. Fallahi supported this project by indicating that "we (Idaho) urgently need to check...recommended (sizing) methods under an organic setting. Your ideas and treatments in this proposal...will perfectly supplement our existing knowledge on non-organic table grapes."

With the increase in acres being planted in table grapes in Idaho, and limited local and niche markets, it is urgent that organic and non-organic growers master the techniques needed to grow large grapes so as to compete with California in the retail markets.

Project Approach
The approach to achieve the targeted berry size was to focus on canopy management, cluster preparation, girdling and "sizing sprays." Various suggestions from qualified agricultural sources were tested in this process which included the use of kelp, horticultural oil, hand bloom-thinning, and organically sourced gibberellic acid (GA) The project activities and detailed practices are outlined in attachments 1 and 2.

The test rows included four grape varieties: Alborz (red seedless), Emerald (green seedless), Glenora (blue seedless), and Red Globe (red seeded). One row for each variety was designated as the control row.

At harvest time, containers holding 10 clusters from each plant in test and control rows were weighted and the berries were measured.

Minimal skill levels and tools adequately accomplished most of the tasks. However, an expensive 300 gallon air-blast sprayer that runs off a tractor PTO was used on all the spray applications. It is highly recommended to ensure thorough spray penetration.

Girdling a 3/16" cut around the trunk proved effective in most cases but not necessary to meet the size goals, and definitely proved too risky to use on Emeralds. The second year girdling of Emeralds discolored and disfigured the clusters. Approximately one third of the berries shriveled to raisins.

The GA spray application were the most effective and economical sizing techniques. Four applications of GA for sizing sprays instead of the recommended label of three worked well.

Rocky Fence Vineyard Inc. published and distributed a brochure to over 400 people, organizations, and companies. It summarizes the results of this Specialty Crop grant, including photos, techniques, results, and contact information.

A field day was held September 21, 2012 at the project vineyard. Over 50 people attended including Ms. Celia Gould, Director of the Idaho State Department of Agriculture, who addressed the attendees. Dr. Jennifer Miller with the Northwest Coalition for Alternatives to Pesticides (NCAP) assisted in promoting the field day and pre-registration. Also present were members of the local NCRS, as well as additional personnel from NCAP and the University of Idaho Extension.

Most of the sizing methods used in this project were recommended by Dr. Essie Fallahi, University of Idaho Pomologist. Mr. Peter Rethans, sales manager of Fine America, is very experienced with Gibberellic Acid in California vineyards and shared important tips for its use in this project.

John Davis of The Dirt Doctor, Inc. inspected the project grapes, measured the berries and recommended the sub-goal of two-pound clusters. He also provided valuable suggestions on reaching the weight goal.

Tony McCammon, University of Idaho Extension Educator, was very proficient in providing needed horticultural information.

Elizabeth Medes of Rocky Fence Vineyard Inc. produced the project publication.

Goals and Outcomes Achieved

This project relied on table grape brokers and distributors to provide the industry size standards. Brian Frost of Sun River, a fruit broker, indicated that 19mm was the berry size standard in 2010 for seedless table grapes. He also said the 16mm was the average size of seedless Idaho grapes that he brokered that year.

Three of the project grape varieties hit the size target: Emerald, Alborz, and Red Globe. The largest berry size for the Glenora was 18mm; just 1mm short of the goal but the project techniques greatly improved the quality and appeal of their clusters. Attachments 1 and 2 show the size goals and outcome for 2011 and 2012.

Beneficiaries

The Snake River Table Grape Growers Association (SRTGGA) is a large, enthusiastic, and fledgling group of vineyard owners operating in an area which is flooded with oversized California grapes. These grant results will serve as an educational resource for the SRTGGA and other grape growers, organic and conventional, in their endeavors to expand their markets.

Implementation for the Idaho growers of the sizing techniques outlined in this report will result in increased sales and prices. The harvesting of the project grapes was ideal with even ripening, uniform large berry size, vines fully harvested, minimum waste, and a high yield. The total number of Idaho table grape growers with potential to benefit is 14, and the sizing techniques gained from the research will increase net income to these growers by $600 per acre.

Silver Leaf Organics, Idaho's largest organic table grape vineyard, attended the project field day. Joe Morton, owner, and former president of the SRTGGA, stated, "we are going to change our practices" to conform with those used in this report. Two other members of the SRTGGA were also present and were impressed with the results of the sizing techniques.

Larry Nielson and his brothers in Parma, Idaho own and operate the largest conventional table grape vineyard in Idaho. Mr. Nielson indicated that they see the importance of focusing on berry sizing. He acknowledged that the work done in this project can benefit his company and will consider using the projects techniques in 2013.

Lessons Learned

Never has the Lead Partner or his crew ever experienced such a high level of pride, satisfaction, and relief that came from harvesting rows of solid, gorgeous, plump grapes. Ripeness peaked simultaneously, clusters and rows were uniform, packing was easy, and most importantly, there was hardly any waste. The intensive attention to canopy management, cluster preparation, and GA applications was well worth the effort. Both prices and customer satisfaction increased.

Some unexpected outcomes occurred during this project. The seeded variety, Red Globe, grew much better and exceeded the target size without using the project's techniques. The Alborz variety has a tendency not to color fully when increasing the berry size with GA. The Emeralds experienced the most impressive improvement from the sizing methods. Their clusters are normally huge with very small berries. The project clusters easily packed into two-pound bags and had wonderful large berries. However, the project vineyard experienced normal discoloration with all the emeralds (ambering) resulting in poor sales and subsequent removal of the plants.

The Lead Partner learned from listening to other Idaho grape growers during the past two years that many are struggling to profit from table grapes. A large number of growers are overwhelmed and discouraged by the unexpected amount of intensive labor and marketing involved. Some have quit, some want "to give it one more year," and some have downsized. The Lead Partner has found it difficult to convince these growers to invest more in new techniques when they struggle to maintain what they have. The Lead Partner, however, is encouraged by the response of a few lead growers, and believes that working with them and the few other receptive growers that the table grape industry can grow, however slowly, by the implementation of the project's sizing methods.

Contact Person

Mike or Elizabeth Medes, Owners
Rocky Fence Vineyard
mike@rockyfence.com; lmedes@rockyfence.com
(208) 365-1617

Additional Information

Attachments:

1. 2011 Activity and Goals
2. 2012 Activity and Goals
3. Field Day Brochure 9/27/12

Attachment 1

Increasing Berry Size of Idaho Organic Table Grapes - a Specialty Crop Grant Administered by the ISDA, 2011 Data

EMERALD	Shoot Thinning	Cluster Thinning	Cluster Stretch	Bloom Thinning	Girdling	Tipping	Sizing	Size Goal	Size Results
Blue Row	24 shoots per plant	16 clusters per plant	10 oz Gib/A pre-bloom	Hand brushed	3/16" cut full & 2/3 @ berry set	1/2 pre & post bloom	3x 25 oz Gib/A every 7 days at berry set	19 mm	21 mm
Yellow Row	24 shoots per plant	16 clusters per plant	10 oz Gib/A pre-bloom	1x 25 oz Gib/A	N/A	1/2 pre & post bloom	3x 1 gal Kelp/A every 7 days at berry set	19 mm	18.5 mm
Green Row	24 shoots per plant	16 clusters per plant	1 qt Kelp/A pre-bloom	3x 10 oz Gib/A	3/16" cut full & 2/3 @ berry set	1/2 pre & post bloom	3x 25 oz Gib/A at berry set	19 mm	19 mm
White Row	24 shoots per plant	16 clusters per plant	1 qt Kelp/A pre-bloom	2x 3% oil	N/A	1/2 pre & post bloom	3x 1 gal Kelp/A every 7 days at berry set	19 mm	18.5 mm
Control Row	24 shoots per plant	16 clusters per plant	N/A	N/A	N/A	1/2 pre & post bloom	N/A		17 mm

GLENORA	Shoot Thinning	Cluster Thinning	Cluster Stretch	Bloom Thinning	Girdling	Tipping	Sizing	Size Goal	Size Results
Blue Row	24 shoots per plant	N/A	N/A	1x 25 oz Gib	3/16" cut full & 2/3 @ berry set	N/A	3x 25 oz Gib/A every 7 days at berry set	19 mm	18 mm
Yellow Row	24 shoots per plant	N/A	N/A	2x 10 oz Gib/A	N/A	N/A	3x 1 gal Kelp/A every 7 days at berry set	19 mm	17 mm
Green Row	24 shoots per plant	N/A	N/A	Hand brushed	3/16" cut full & 2/3 @ berry set	N/A	3x 25 oz Gib/A every 7 days at berry set	19 mm	17 mm
White Row	24 shoots per plant	N/A	N/A	2x 3% oil	N/A	N/A	3x 1 gal Kelp/A every 7 days at berry set	19 mm	16 mm
Control Row	24 shoots per plant	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16 mm

ALBORZ	Shoot Thinning	Cluster Thinning	Cluster Stretch	Bloom Thinning	Girdling	Tipping	Sizing	Size Goal	Size Results
Blue Row	24 shoots per plant	20 clusters per plant	10 oz Gib/A pre-bloom	Hand brushed	3/16" cut full & 2/3 @ berry set	1/3 pre & post bloom	3x 1 gal Kelp/A every 7 days at berry set	19 mm	18 mm
Yellow Row	24 shoots per plant	20 clusters per plant	10 oz Gib/A pre-bloom	1x 25 oz Gib/A	3/16" cut full & 2/3 @ berry set	1/3 pre & post bloom	3x 25 oz Gib/A every 7 days at berry set	19 mm	19.5 mm
Green Row	24 shoots per plant	20 clusters per plant	1 qt Kelp/A pre-bloom	3x 10 oz Gib/A	N/A	1/3 pre & post bloom	3x 1 gal Kelp/A every 7 days at berry set	19 mm	17.5 mm
White Row	24 shoots per plant	20 clusters per plant	1 qt Kelp/A pre-bloom	3% oil	N/A	1/3 pre & post bloom	3x 25 oz Gib/A every 7 days at berry set	19 mm	18 mm
Control Row	24 shoots per plant	20 clusters per plant	N/A	N/A	N/A	1/3 pre & post bloom	N/A	N/A	17 mm

RED GLOBE	Shoot Thinning	Cluster Thinning	Cluster Stretch	Bloom Thinning	Girdling	Tipping	Sizing	Size Goal	Size Results
Blue Row	24 shoots per plant	16 clusters per plant	10 oz Gib/A pre-bloom	Hand brushed	3/16" cut full & 2/3 @ berry set	1/2	1x 25 oz Gib/A every 7 days at berry set	21 mm	21.5 mm "shot" berries
Yellow Row	24 shoots per plant	16 clusters per plant	10 oz Gib/A pre-bloom	1x 25 oz Gib/A	N/A	1/2	1x 25 oz Gib/A every 7 days at berry set	21 mm	21.5 mm "shot" berries
Green Row	24 shoots per plant	16 clusters per plant	1 qt Kelp/A pre-bloom	2x 10 oz Gib/A	3/16" cut full & 2/3 @ berry set	1/2	1x 1 gal Kelp/A every 7 days at berry set	21 mm	21.5 mm "shot" berries
White Row	24 shoots per plant	16 clusters per plant	1 qt Kelp/A pre-bloom	2x 3% oil	N/A	1/2	1x 1 gal Kelp/A every 7 days at berry set	21 mm	23 mm
Control Row	24 shoots per plant	16 clusters per plant	N/A	N/A	N/A	1/2	N/A	N/A	24 mm

Attachment 2

Increasing Berry Size of Idaho Organic Table Grapes - a Specialty Crop Grant Administered by the ISDA
Lead Partner Rocky Fence Vineyard Inc. 2012 Data

ALBORZ	Shoot Thinning	Cluster Thinning	Pre-Bloom Cluster Stretch	1x Bloom Thinning	Girdling	Tipping	Sizing 4x W/I 15 days	Berry Size Goal	Berry Size Results	Weight per cluster
G.A.	20 per plant	20 per plant	10 oz G.A.	25 oz G.A.	N/A	1/3 post bloom	20 oz G.A.	19 mm	19 mm	2 lb
G.A./Girdle	20 per plant	20 per plant	10 oz G.A.	25 oz G.A.	3/16" full	1/3 post bloom	20 oz G.A.	20 mm	20 mm	2.4 lbs
Control	20 per plant	20 per plant	N/A	N/A	N/A	1/3 post bloom	N/A	N/A	17 mm	1.7 lbs

Grower's Notes: G.A. extends ripening time. Heavy tipping, at least by 1/2, is essential. Better coloring was achieved in 2nd year due to less nitrogen, reduced G.A. and more open canopy. Achieved berry size goal and 2 lb. clusters w/out girdling. For certified organic production, an organic formulation of G.A. is required.

EMERALD	Shoot Thinning	Cluster Thinning	Pre-Bloom Cluster Stretch	1x Bloom Thinning	Girdling	Tipping	Sizing 4x W/I 15 days	Berry Size Goal	Berry Size Results	Weight per cluster
G.A.	24 per plant	16 per plant	10 oz G.A.	25 oz G.A.	N/A	1/2 post bloom	25 oz G.A.	19 mm	19 mm	2.7 lbs
G.A./Girdle	24 per plant	16 per plant	10 oz G.A.	25 oz G.A.	3/16" full	1/2 post bloom	25 oz G.A.	19 mm	20 mm	1.9 lbs
Control	24 per plant	16 per plant	N/A	N/A	N/A	1/2 post bloom	N/A	N/A	17 mm	1.6 lbs

Grower's Notes: Thorough bloom thinning and heavy tipping were critical to achieving berry size. The size goal was achieved and 2 lbs clusters yielded w/out girdling; a practice that runs the risk of damage to clusters i.e. raisining. For certified organic production, an organic formulation of G.A. is required.

GLENORA	Shoot Thinning	Cluster Thinning	Pre-Bloom Cluster Stretch	1x Bloom Thinning	Girdling	Tipping	Sizing 4x W/I 15 days	Berry Size Goal	Berry Size Results	Weight per cluster
G.A.	20 per plant	16 per plant	N/A	N/A	N/A	N/A	30 oz G.A.	19 mm	18 mm	9.2 oz
G.A./Girdle	20 per plant	16 per plant	N/A	N/A	3/16" full	N/A	30 oz G.A.	19 mm	18 mm	9.8 oz
Control	20 per plant	16 per plant	N/A	N/A	N/A	N/A	N/A	N/A	16 mm	5.2 oz

Grower's Notes: G.A. extends ripening time. The G.A. also yields a far superior cluster (large uniform berries in a packed cluster) compared to control rows. While berry size of 19 mm was not achieved, the 18 mm berry yield was impressive. For certified organic production, an organic formulation of G.A. is required.

Field Day Brochure

PROJECT PURPOSE

To test and implement organic techniques to maximize berry size of Idaho table grapes, which in turn will allow Idaho organic growers to compete successfully with California grapes in the local, regional, and international markets.

PROJECT RESULTS

A berry size goal of 19 mm was determined necessary to meet the project goal. The seedless varieties Emerald and Alborz exceeded 19 mm, Glenora reached 18 mm with far superior clusters, and seeded Red Globes exceeded 19 mm naturally. Successful sizing was obtained by intensive canopy management, cluster preparation, and applications of Gibberellic Acid (G.A.), an organic growth regulator. Visit www.rockyfence.com for further technical Specialty Crop grant data.

PROJECT PARTNERS, PARTICIPANTS, AND TECHNICAL ADVISOR

Mike Medes, Lead Partner
Rocky Fence Vineyard, Inc.
Emmett ID 208-365-1617
www.rockyfence.com

John Davis
The Dirt Doctor, Inc.
Caldwell ID

Dr. Essie Fallahi, Pomologist
University of Idaho
Parma Research and Ext. Ctr.
Parma ID

Tony McCammon
Area Horticulture Educator
University of Idaho Extension
Twin Falls ID

Dr. Jennifer Miller
Northwest Center for Alternatives to Pesticides
Boise ID

University of Idaho Extension

Northwest Center for Alternatives to Pesticides

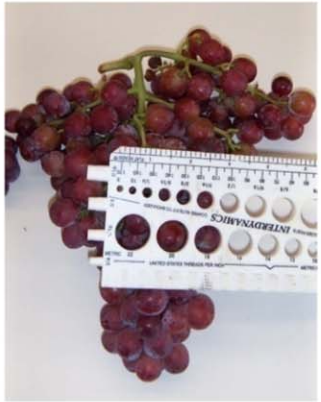
Idaho State Department of Agriculture

INCREASING BERRY SIZE OF IDAHO ORGANIC TABLE GRAPES

…a USDA Specialty Crop Grant administered by the Idaho State Department of Agriculture, 2010-2012.

Rocky Fence VINEYARD
Idaho Organic Grapes, USA

ALBORZ – Goal size attained = 20mm berry with G.A. + girdling.



Control G.A. G.A. + Girdling

John Davis, The Dirt Doctor, Inc.

EMERALDS – Goal size attained = 20mm berry with G.A. + girdling.

Control G.A. G.A. + Girdling

Tony McCammon, U of I
Horticulture Educator

GLENORA – Goal size attained = 18mm berry with both G.A. and G.A. + girdling.

Control G.A. G.A. + Girdling

Mike Medes, Lead Partner,
Rocky Fence Vineyard, Inc.

Grower Training, Quality Control and Buyer Promotion Program: Snake River Valley AVA Table Grape Industry

Subrecipient
Snake River Table Grape Growers Association

Project Summary
There is an area of southwestern Idaho and eastern Oregon which has been shown to be capable of growing table grapes. This 8,000 square mile area is drained by the Snake River and its tributaries. Growers have established vineyards. Researchers have focused on varietals that will do well in the local high-desert climate. A burgeoning wine industry led to the designation of the Snake River Valley American Viticulture Area. People want to grow grapes!

As an unprocessed commodity, table grapes have cultivation and handling requirements that differ from wine grapes. Table grapes must be pruned, harvested, and cleaned with the food-buying consumer in mind, unlike wine grapes which are pressed and fermented. Table grapes must look pretty, ergo palatable, and meet health standards that wine grapes do not.

The Snake River Table Grape Growers Association saw a need for educating and assisting growers in viticultural practices that would result in production of high-quality table grapes. A marketing plan to ensure a sustainable specialty crop industry was also needed. Beautiful, delicious grapes are the best advertisement for the product. To this end, the Association determined a program aimed at Good Agricultural Practices and Good Handling Practices (GAP and GHP), training in proper cultivation, pruning and harvesting techniques, and a marketing program would benefit and sustain the young industry.

Project Approach
Work Performed by SRTGGA Administration
- Monthly Meetings 2010, 2011 and 2012 -- SRTGGA administration had meetings and phone conferences frequently during the first months (four times in November and December of 2010; monthly during the first quarter of 2011) of this project to coordinate with cooperators. By April 2011 the majority of the planning and groundwork was completed, and meetings occurred on a quarterly basis thereafter. These subsequent meetings were to plan project events and assess whether project goals were being met.
- 1st Quarter 2011, 2012 -- Field training (preventative maintenance for insect disease, rough, fine and shoot pruning) was scheduled for, and occurred during, the first quarters of 2011 and 2012. This training was able to be provided following an extension SRTGGA received on the original two-year project.
- Good Agricultural and Good Handling Practices (GAP and GHP) materials and training were provided by Sunriver, Inc., in 2010, on a vineyard-specific basis. A presentation was made at the Growers Symposium in 2011.
- The Association determined that educating members about the Food Safety Modernization Act was advisable and provided that training in June 2013.

- 2nd Quarter 2011 and 2012 -- Grower training programs for pre- and post-harvest strategies (cultural practices, weed control, cluster pruning, nutrition, and water management) were developed and presented in the second quarters of 2011 and 2012. Again, because of the extension, this training was able to be given in 2013.
- 3rd Quarter 2011 and 2012 -- Vineyard site inspections took place during the third quarter of 2011 and the second and third quarters of 2012. These inspections included pre-harvest assessments, quality evaluations, and training in packaging preparations.
- 2011 and 2012 -- The Snake River Table Grape Growers Association is a member of Buy Idaho and Idaho Preferred. The SRTGGA was represented at the Northwest Center for Small Fruits Research annual conference in 2010, 2011, and 2012, and the Idaho Farmers Market Symposium in 2011, using marketing materials to promote SRAVA table grapes.
- February 2011 and 2012 -- In February 2011, 2012, and 2013, the SRTGGA organized and hosted a Table Grape Symposium, where growers were educated on quality control, marketing venues and distribution options, and promoted the SRAVA table grape industry as a viable and sustainable specialty crop.
- December 2010, 2011 and 2012 -- Annual meetings of the SRTGGA have occurred in December of 2010, 2011, and 2012. Members and guests have led discussions addressing issues for pre- and post-harvest practices, including good agricultural practices. Manufacturers of grape-picking equipment were also provided with feedback. An annual meeting will also occur in fall 2013.

Work Performed by O'Reilly Administration

December 2010-February 2011 –Abanner (used primarily for signage at events) and logo (used on stationery products and the banner) were developed by Reilly O'Reilly, Inc. Brochures were also developed aimed at potential growers and/or consumers of table grapes. A thousand copies of each brochure were printed, and they have been distributed at public functions since they were printed in 2011.

Work Performed by Dr. Essie Fallahi, Professor of Pomology and Viticulture

Jan-Feb 2011 and 2012 -- Dr. Fallahi was critical to the success of this grant, as he was instrumental in the development and presentation of training programs (quality control, pre- and post-harvest techniques) throughout 2011, 2012, and 2013. He also assisted with planning and made presentations at the annual symposia in those years.

Work Performed by Dr. Carlos Cisosto, Professor of Pomology and Viticulture

Jan 2011 – No training for quality control and pre- or post-harvest techniques was performed by Dr. Cisosto. However, existing cold-storage facilities within the SRAVA were surveyed by SRTGGA members and evaluated for potential conversion to SO2 applications. It was determined that a dedicated cold-storage facility could not be supported by current and foreseeable production. Discussions regarding a strategic plan for the development of a grower co-op cold storage facility continue.

Most importantly, none of this would have been possible without the dedication and time provided by volunteer members of the Snake River Table Grape Growers Association.

Goals and Outcomes Achieved

Outcome 1

An updated, more user-friendly website was organized by Cheryl Marden: http://www.srtgga.org/. This new version is easier to navigate and has photographs for a more pleasing viewing experience while retaining access to information regarding pre- and post-harvest practices. Due to the original SRTGGA administrator leaving the position, baseline data or information regarding increased usage of the website is unavailable.

Outcome 2

Existing data on brix indicate a superior sweetness in Snake River table grapes. SRTGGA's marketing phrase, "Taste the Sweetness," captures that essence. And a market-desirable size of grape has also been achieved. Establishing production quality control standards is almost intuitive, as clearly buyers will not purchase an inferior product. Growers have succeeded in meeting industry standards, and formalization of a production quality control program continues.

Outcome 3

GAP training was provided to several SRTGGA members in 2010. However, the Food Safety Modernization Act appears more likely to have an impact on food safety standards, so an educational session focused on this subject was held in June 2013. This food safety training should enable growers to meet national standards, producing safe-to-eat grapes which can be sold in major markets.

Beneficiaries

As current SRTGGA president Margaret Scott recently said, "This grant was critical in helping the Snake River Table Grape Growers Association establish itself." Participation at events was not limited to SRTGGA's more than 50 members only because educating all growers was beneficial. To that end, invitations were extended to master gardeners, students (past and present) of Living on the Land classes, local nursery owners, and generally announced to the public that training and educational sessions were open to all. Over 60 people were in attendance at the 2011 symposium, just half of which were members.

Growing table grapes is an intensive undertaking requiring specialized labor, equipment, and facilities. SRTGGA members have contributed to the local economy by hiring managers and crews to maintain and harvest the crop. A local owner of a cold-storage facility has rented space to SRTGGA growers. One member has developed a thriving business supplying trellis materials, vineyard supplies, and irrigation systems.

Members have developed relationships with, and provide product to, local grocery stores, schools, and farmers markets. Informal cooperative agreements have also been created between growers. SRTGGA membership in Idaho Preferred and Buy Idaho adds an additional outlet for product, and two SRTGGA members have been developing a value-added market for raisins.

Lessons Learned

The Snake River Table Grape Growers Association has succeeded in training and educating its members in improved viticultural and safe handling practices, as well as quality control. The greatest challenge, however, continues to be marketing. It is difficult to promote product as SRTGGA remains a small organization, run by volunteers, while having only a nominal membership fee. How are growers

attracted to produce enough grapes to provide the economies of scale necessary to generate a market beyond the local area? The grant monies enabled forward movement, but it is clear that there is much more to do.

Funds for administration of the grant were in the original budget but were reallocated because members were doing the work gratis. This made it easy to meet matching funds goals (and enabled SRTGGA to provide more training opportunities), but resulted in a steep learning curve when a different member was tasked with administration duties. Having paid staff would be helpful for the organization. The possibility of establishing a table grape commission (similar to those for other crops such as wine grapes, apples, onions, beans, etc.) should also be looked at, which would provide support for our specialty crop industry.

Difficulties arose when the person who initiated the grant was no longer able to serve as administrator. Because few members of the organization were familiar with the grant it took some time to organize and pick up where the previous administrator left off. The multi-year grant was administered by at least three individuals, and the focus on outcomes and collection of data was weak.

Contact Person
Linda Henderson
(541) 262-3328
henny-penny@earthlink.net

Additional Information
None.

Evaluation of Adaptability, Bloom and Harvest Dates, Yield, Fruit Quality, Mineral Nutrition and Introduction of Modern Cultivars to Increase Global Competitiveness of Idaho Stone Fruit

Subrecipient
University of Idaho

Project Summary
Presence of excellent climate and soil conditions make Southwestern Idaho an outstanding region for production of high-quality stone fruits including peaches, nectarines, and pluots. Idaho ranks high in fruit production in the nation, and the state has a unique opportunity to capture a big share of the national and international market for stone fruits if suitable cultivars are selected and grown. Among the factors contributing to this unique opportunity are the presence of warm summer days, cool nights, and sandy loam soils with good drainage. This combination of factors helps maintain color pigments and flavor components that are produced through photosynthesis and other physiological processes. Due to advancements in genetic engineering and traditional breeding, numerous genotypes of peach, nectarines, and pluots with widely different characteristics are developed during the past four to six years.

In this project, different genotypes/cultivars of modern peaches, nectarines, and pluots were studied for tree growth and characteristics, yield, fruit quality, bloom and harvest dates, and mineral nutrition under the climatic conditions of Idaho. This study identified and recommended cultivars or genotypes of stone fruit that would perfectly fit the schedule of Idaho growers who grow either stone fruit alone or in combination with apples and other fruits. Tables 1 through 3 show detail information obtained on each variety. In the study, these varieties were found to be outstanding cultivars for commercial production including: Honey Fire nectarine, Royal Bright nectarine, Giant Snow peach, PF 35-007 peach, PF Lucky 13, PF11 peach, Rich Lady peach, Sierra Snow peach, Dapple Dandy and Flavor Queen plout, and Flavor King pluots. September Bright matures too late for Idaho.

The future is bright and the demand and interest in these new stone fruits production is increasing. In addition to the potential for capturing a major share of market place for Idaho commercial fruit growers, some of these cultivars/genotypes such as Arctic Jay, Arctic Queen, and Majestic Pearl will also be excellent for small-scale farming and farmer's market for Idaho residents and could be excellent sources of healthy nutrition for school lunch.

Project Approach
Two previously-established orchards were used for various objectives of this project, located at the University of Idaho Parma Research and Extension Center near Parma, Idaho. These orchards represent most fruit-producing orchards in Southern Idaho and other similar regions with annual precipitation of about 10.8 inches, lat. 43°48' 00"N, long.116°56'00", an average minimum daily temperature of -17.6 F^{o} in January and an average maximum daily temperature of 93.2 ^{o}F in July, and elevation of 2305 ft.

In one of these orchards, uniform peach and nectarine trees on 'Nemaguard' rootstock, with an average of 0.5 inches diameter, were obtained from various nurseries in California and Washington and planted in April 2008. In this study, fifty peach and nectarine cultivars or selections were planted at 8 x 16 ft spacing. In another orchard of this study, nine modern cultivars of pluots on 'Nemaguard' were planted in spring of 2006. Since these orchards were mostly established, it was possible to obtain data and achieve the goals set within the timeframe of this proposal. Trees were trained into a four-leader vase-shaped system. These genotypes were vastly different in phenotypes, tree performance, fruit color and flavor. Fruit skin and flesh colors range from deep yellow to white to red and purple. In addition to dormant pruning in March of every year, trees were pruned during the summer to facilitate light penetration through the canopy. The soil is sandy loam with a pH of 7.1 to 7.3.

Urea nitrogen mixed with potassium chloride and P was applied during the month of May annually to provide N, P, and K at rates of 110, 50, and 60 lb/acre, respectively. This mixed fertilizer was injected through drip fertigation on both sides of the tree rows. Trees were irrigated weekly with drip system to match the evapotranspiration requirement for peach crop (ET c). Annual pruning, spray and other cultural practices in this experiment were similar to those of commercial orchards in the region.

Dates of full bloom (about 80% blooms open) and commercial harvest (when most of the fruits were ready to be harvested) for each tree were recorded every year. In addition to the actual dates, the number of "days from 1 Jan. (DJ)" to full bloom will also be computed.

Between the period of July 1 through October 15, fruit color were described visually and total yield per tree was measured at harvest time every year. At commercial harvest time, 15 fruits were randomly sampled from each tree and average fruit weight was measured and fruit sugar or soluble solids concentrations (SSC) was measured with a hand-held temperature compensated refractometer every year. Fruit skin and flesh color were inspected visually and described. Fruit of each cultivar was evaluated by several people at harvest and the flavor was described objectively in each year.

The experimental orchards were arranged as a completely randomized design with seven replications per cultivar.

Goals and Outcomes Achieved

Justification and Goals

Commercial peach production in Idaho dates back to 1870. Cultivars Early Red Haven, Late Redhaven, Redglobe, Early Hale, J.H. Hale, and Improved Elberta are among the popular cultivars of peaches that are still in production after many decades of their initial planting in Idaho. Peaches *(Prunus persica L.)* and nectarines (*Prunus persica* var. nectarina) constituted 18 percent of the total fruit production in Idaho in 2006. Similar to the situation in other peach-producing states, the best orchard sites are taken for development and urbanization in Idaho. However, new peach orchards are often planted in old apple orchard sites. This increase is due to the national and international market demands for high quality peaches, nectarines, and pluots produced under high desert conditions of Southwestern Idaho. Warm and dry days and cool nights during the growing season create suitable conditions for growing high quality stone fruit in this region. The pressure for urbanization and competitive nature of the world market mandate identification of new cultivars with high quality that mature over several weeks for a wide market window. California Tree Fruit Agreement classified peaches into five categories according

to their period between full bloom and harvest. 1) “very early cultivars”, which have less than 65 days from full bloom to harvest, 2) “early cultivars”, which have 66 to 90 days from full bloom to harvest, 3) “mid-season cultivars”, which have 91 to 120 days from full bloom to harvest, 4) “late-season cultivars”, which have 121 to 150 days from full bloom to harvest, and 5) “very late cultivars”, which have more than 151 days from full bloom to harvest. Cultivars in each group have their advantages and disadvantages, and they are planted according to the market outlet and strategy of each grower.

Preference for white-fleshed nectarines and peaches may vary according to individual consumer taste and ethnic background, while yellow-fleshed peaches and nectarines are generally accepted by most consumers. In general, white-fleshed peaches and nectarines are popular among consumers of Asian ethnic background, but these cultivars are not well known by other American consumers. Many white-fleshed peaches are highly susceptible to bruising and have low acid content. White-fleshed peaches and nectarines can be eaten when still firm if hard texture is not a concern.

During the first round of peach and nectarine evaluation at the University of Idaho Pomology Program in Parma, several cultivars for Idaho were introduced, and these cultivars are now being planted at commercial scale and sold in the world markets. Earlier evaluation has opened the door to oriental market and our peach and nectarine growers are selling a large volume of these new cultivars to Taiwan and other countries, and thus production of white peaches and nectarines in Idaho has increased during the recent years. Some of the new white flesh peaches from the study are sold for over $4 each in the oriental market, making these cultivars extremely profitable for Idaho growers. Traditional yellow peaches are sold at about $12 per box of 36 pieces of fruit (about 33 cents/piece). Thus, opening the oriental and other markets to Idaho peach and nectarine can potentially increase profitability by 12 times. However, many additional new cultivars need to be evaluated for Idaho in order for the state to stay competitive with other stone fruit-growing regions in the nation and the world.

The goals of this proposal were to investigate bloom date, maturity, harvest date, yield, and fruit quality of various yellow-fleshed, red-fleshed, and white-fleshed peaches, nectarines, and pluots under conditions of Southwest Idaho. Thus, the objectives in this proposal were as follows:

1. Study tree performance, yield, growth, bloom dates, degree-days to bloom, cold tolerance, maturity dates, fruit size, sugar, color, and other fruit quality attributes in 50 new cultivar/gentotypes of peaches and nectarines and seven cultivars of pluots in Idaho.
2. Study the sustainability and performance and russetting susceptibility of mature peaches and nectarines under conditions of Idaho.
3. Evaluate consumer preference of new peaches, nectarines, and pluots and 3.ultimately recommend the top most favorite cultivars for commercial planting by the fruit growers of Idaho.

Highlights of Outcomes Achieved in Comparison with Initial Goals

Outcomes for Objective 1

Objective 1 was to study yield, fruit quality, and other characteristics of various genotypes of stone fruit, and impressive results for this objective were achieved. Results for this objective are reported in Tables 1-3.

In the study, varieties that had commercial harvest in July were called “Early Varieties” and they included: E8.004 same as Bp14, E45.002 same as BP12, E8.010 same as BP19, PFD Big, PF8Ball, Honey Fire, Honey Blaze, PF11, and Sierra snow. Varieties that had commercial harvest in August were called

“Mid-Season Varieties” and they included: Rich lady,PF9a-007,PF11PL, PF Lucky 13, Bright Princess, Sierra Rich, Diamond Candy, Candy Pearl, Diamond Princess, Ice princess, Klondlike, Arctic Jay, E25-069 Same as BP21, Grand bright, Arctic Belle NL, Flame, BN-7 Same as C7.053, PF28-007, and Honey Royal. Varieties that had commercial harvest in September were called “Late Varieties” and they included: Majestic Pearl, Washington Pride, PF22-007, PF24 C cold hardy, Giant Elberta, Snow Princess, 14.120 Same as BN17, Giant pearl, Valley Sweet, August Bright, Snow Giant, Royal Bright, PF35-007, Glacier, Arctic Blaze, O’ Henry, C2.092 Same as BN4, Honey Diva, and Flaming Red. Varieties that had commercial harvest in October were called “Very Late Varieties” and they included: September Bright and August bright9P89. Varieties harvested in October would be too late for Idaho.

During the study, average fruit weight between 100-200 grams was called small and included: E8.004 same as Bp14, E45.002 same as BP12, E8.010 same asBP19, PFD Big, PF8Ball, Honey Fire, Honey Blaze, PF11NL, and Arctic Blaze. Varieties with an average weight between 201-250 g were considered medium size and they included: Sierra snow, Rich lady, PF9a-007, Lucky 13, Sierra Rich, Candy Pearl, Arctic Jay, Grand bright, Arctic Belle NL, Honey Royal, 14.120 Same as BN17, Royal Bright, Honey Diva, September Bright, and August Bright9P89. Varieties with an average weight over 250 g were considered to be large size and they included: with PF11PL, Bright Princess, Diamond Candy , Diamond Princess, Ice princess , Klondlike, E25-069 Same as BP21, Candy princess, Flame, BN-7 Same as C7.053, PF28-007, Majestic Pearl, Washington Pride, PF22-007, PF24 C cold hardy, Giant Elberta, Snow Princess, Giant pearl, Valley Sweet, August Bright, Snow Giant, , PF35-007, Glacier, O’ Henry, C2.092 Same as BN4, and Flaming Red .

E45.002 same as BP12, PFD Big, PF8Ball, Rich lady, PF9a-007, PF11PL, and Lucky 13 had average sugar between10.0-11.5% were called low sugar. Varieties with sugar levels between 11.51 and 12.5% were called varieties with medium sugar level and they were E8.004 same as Bp14, Sierra snow, Bright Princess, Sierra Rich, Diamond Candy, E25-069 Same as BP21, PF28-007, and Flaming Red. High sugar varieties had greater than 12.5% sugar and they included: E8.010 same as BP19, Honey Fire, Honey Blaze, PF11NL, Candy Pearl, Diamond Princess, Ice princess, Klondlike, Arctic Jay, Grand bright, Candy princess, Arctic Belle ,Flame, BN-7 Same as C7.053, , Honey Royal, Majestic Pearl, Washington Pride, PF22-007, PF24 C cold hardy, Giant Elberta, Snow Princess, 14.120 Same as BN17, , Giant pearl, Valley Sweet, August Bright, Snow Giant, , Royal Bright, Pf35-007, Glacier, Arctic Blaze, O’ Henry, C2.092 Same as BN4, Honey Diva, September Bright, and Autumn bright9P89. Varieties with different levels of yield are reported in Tables 1-3.

Low yielding varieties with average yield per tree between 5.9-16 Kg were E8.010 same asBP19, Honey Blaze, Rich lady, Bright Princess, Honey Royal, and Giant Elberta.

Medium yielding varieties with average yield per tree between 16.1-29.0 Kg were E8.004 same as Bp14, E45.002 same as BP12, PFD Big, PF8Ball, Honey Fire, PF11NL, Sierra snow, PF11PL, Lucky 13, Sierra Rich, Diamond Candy, Candy Pearl, Ice princess, Klondlike, Candy princess, Arctic Belle NL ,Flame, Majestic Pearl, Valley Sweet, Glacier, Arctic Blaze, O’ Henry, and September Bright.

High yielding varieties with average yield per tree 29.5 Kg and higher were PF9a-007, Diamond Princess, Arctic Jay, E25-069 Sam as BP21, Grand Bright, BN-7 Same as C7.053, PF28-007, Washington Pride, PF22-007, PF24 C cold hardy, Snow Princess, 14.120 Same as BN17, Giant pearl, August bright, Snow Giant, Royal Bright, PF35-007, C2.092 Same as BN4, Honey Diva, Flaming Red, and Autumn bright9P89.

Outcomes for Objective 2

Average russet per tree for nectarines were ranked from 1-10, where 1 was the lowest and 10 was the highest. Low russet varieties which had russet reading between 0.20-2.5 were Honey Fire, Honey Blaze, Grand Bright, Giant pearl, August bright, C2.092 Same as BN4 Flaming Red, September Bright, and Autumn bright9P89.

If average russet reading per tree was between 2.51-5.5, they were categorized as medium russet varieties which included; Candy Pearl, Arctic jay, BN-7 Same as C7.053, Washington Pride, and Royal Bright.

Trees with an average russet ranking of higher than 5.5 was considered high-russet category that included; E45.002 same as BP12, PF11NL, Arctic Belle ,Flame, Honey Royal, Majestic Pearl, 14.120 Same as BN17, Arctic Blaze, and Honey Diva.

Outcomes for Objective 3

The objective of each grower for a fruit quality character may vary depending on the market's demand. For example, a certain market may demand for small size but sweeter stone fruit but another one may demand for large size and high sugar yield. By looking at these factors, each grower can find the optimum Varity in Tables 1-3 that he/she is looking for.

Measureable Outcomes

1. A traditional peach or nectarine tree in Idaho produces about 2 to 4 boxes of fruit, but they are sold in a narrow window of season because most of the existing cultivars mature at the same time. But, as seen in Tables 1-3, cultivars/selections that have superior quality with a wide range of maturity have been introduced. Some of them would be for early, some for mid-season and some for late-season markets.
2. Peach, nectarine, and pluot cultivars with later bloom dates have been identified, and thus the chance of early spring frost that usually occurs during bloom is minimized.
3. Some of these cultivars are excellent for small-scale growers and for famers market.
4. The Pomology Program (Fruit Physiology) at the University of Idaho Parma Research and Extension Center worked closely with Idaho stone fruit growers and Idaho State Horticultural Society. Every step of this project was demonstrated during various educational tours to growers, several times a year. Positive research results of this project are expected to be practiced and followed by peach, nectarine, and pluot growers immediately. Some of the superior cultivars in the study are being planted by Idaho stone fruit growers. It is estimated that 50 acres were planted in 2013 and 60 acres will be planted in 2014.
5. The Pomology Program (Fruit Physiology) at the University of Idaho also sponsored educational and 'taste-testing" tours for Idaho school supervisors and students. During these tours, the health benefits of stone fruit consumption were discussed while participants tasted different cultivars.
6. Some of the white flesh peaches and nectarines which are planted or being planted will be sold at about $4 each in some foreign markets.

Table 1. *Yield and fruit quality of various peaches and nectarines.*

Harvest	Variety	Fruit	Fruit Wt (g)	Sugar (%)	Stone Free	Yield/tree (kg/tree)
7/5	E8.004	Peach	117.25	11.80		18.60
7/13	E45.002	Nectarine	123.58	11.35	Yes	26.16
7/13	E8.010	Peach	186.53	12.49		9.75
7/16	PF D Big	Peach	174.58	10.04		27.74
7/26	PF8 Ball	Peach	181.08	8.87	Yes	28.99
7/26	Honey Fire	Nectarine	198.53	12.36		18.79
7/26	Honey Blaze	Nectarine	180.46	12.78		14.99
7/28	PF11NL	Nectarine	188.26	13.56	Yes	18.88
7/30	Sierra Snow	Peach	238.71	11.17	Yes	23.40

Table 2. *Yield and quality of stone fruits harvested in August.*

Harvest	Variety	Fruit	Fruit wt (g)	Sugar (%)	Stone Free	Yield/tree (kg)
8/8	Rich Lady	Peach	236.66	11.32	*	15.72
8/12	PF9A-007	Peach	247.74	9.91	*	44.63
8/12	PF11 PL	Peach	256.52	10.76	*	22.53
8/13	PF Lucky 13	Peach	244.09	10.94	*	27.43
8/13	Bright Princess	Peach	266.70	12.54	*	5.90
8/13	Sierra Rich	Peach	249.97	11.82	*	27.62
8/14	Diamond Candy	Peach	260.77	12.13	*	17.82
8/16	Candy pearl	Nectarine	220.53	15.07		28.46
8/17	Diamond Princess	Peach	274.06	12.50	*	33.28
8/17	Ice Princess	Peach	252.88	12.64	*	19.82
8/19	Klondlike	Peach	267.08	12.38	*	27.80
8/20	Arctic Jay	Nectarine	204.37	15.77	*	35.82
8/22	E25-069	Peach	342.43	11.88		34.32
8/24	Grand Bright	Nectarine	244.48	12.31		30.26
8/24	Candy Princess	Peach	289.79	13.44	*	16.09
8/24	Artic Belle NL	Nectarine	209.15	17.30	*	28.39
8/26	Flame	Nectarine	250.55	14.53	*	26.57
8/27	BN-7	Nectarine	260.71	14.47		47.88
8/27	PF28-007	Peach	367.77	11.78		33.57
8/30	Honey Royal	Nectarine	238.50	16.57	*	12.21

Table 3. *Yield and Fruit Quality of Stone Fruit Harvested in September and October.*

Harvest	Variety	Fruit	all H Fruit wt (g)	Sugar (%)	Stone free	Yield/tree (Kg)
9/2	Majestic pearl	Nectarine	336.46	16.17		18.27
9/4	Washington Pride	Nectarine	250.85	14.80	*	34.28
9/5	PF22-007	Peach	262.91	13.03	*	37.92
9/6	PF24 C Cold Hardy	Peach	275.96	13.44	*	41.44
9/7	Giant Elberta	Peach	395.17	12.60	*	8.45
9/15	Snow Princess	Peach	333.33	16.70	*	30.62
9/17	14.120	Nectarine	212.43	14.33		32.43
9/18	Giant Pearl	Nectarine	348.69	15.67		33.39
9/18	Valley Sweet	Peach	287.92	14.92	*	28.65
9/19	August Bright	Nectarine	284.91	14.43		30.21
9/20	Snow Giant	Peach	409.80	13.37	*	34.14
9/21	Royal Bright	Nectarine	232.32	14.10		32.43
9/22	PF35-007	Peach	324.56	12.44	*	40.95
9/22	Glacier	Peach	303.88	13.73	*	19.95
9/23	Artic Blaze	Nectarine	187.95	19.96		16.57
9/23	O'Henry	Peach	338.00	12.80	*	27.27
9/24	C2.092	Nectarine	258.92	13.00		30.28
9/24	Honey Diva	Nectarine	247.48	15.43		33.71
9/25	Flaming Red	Nectarine	319.55	12.23		39.55
10/1	September Bright	Nectarine	237.65	13.63		28.38
10/3	Autumn Bright	Nectarine	239.59	14.00		37.52

Working with Cooperators (Growers and Scientists)

Several stone fruit growers have started growing varieties that had outstanding results in the study. Among these cultivars are Snow Giant', Majestic Pearl, ;Arctic Jay' and many others. Growers have also started growing pluots that were shown to be superior in our study such as 'Dapple Dandy, Flavor Supreme, Flavor Queen.

Beneficiaries

Stone Fruit and Other Potential Growers

Over 45 growers in Idaho, Washington, and Oregon are using the results of this project to establish stone fruit in their areas. Growers now have a clear choice to select early, medium, or late-maturing variety and fit in their farming schedule.

Public Education

At least 15 meetings were with cooperators and commercial growers at the research sites and in their orchards. Nine workshops and tours were presented to growers on March 10, 2010, March 12, 2011, March 14, 2012, July 29, 2010, July 30, 2011, August 1, 2012, September 7, 2010, September 20, 2011, and September 14, 2012. At each tour, growers were provided with detailed information of the study. In each of these tours, between 80 and 900 people from Idaho and other states participated.

In 2010, 2011, 2012, and 2013, five classes for stone fruit and variety selections were offered to different Idaho audiences in various counties, including Lewiston, Ada, Canyon, Gem, and Adam counties. Between 110 and 150 people participated in each of these classes.

Lessons Learned

Based on the study, several outstanding cultivars were identified that are excellent for commercial production including: Honey Fire nectarine, Royal Bright nectarine, Giant Snow peach, PF 35-007 peach, PF Lucky 13, PF11 peach, Rich Lady peach, Sierra Snow peach, Dapple Dandy and Flavor Queen plout, and Flavor King pluots. September Bright matures too late for Idaho. The future is bright and the demand and interest in these new stone fruits production is increasing.

Contact Person

Dr. Esmaeil "Essie" Fallahi, Professor and Director of Pomology and Viticulture

University of Idaho

(208) 722-6701 ext. 225

efallahi@uidaho.edu

Additional Information

None.

Improved Tolerance of Drought, Salinity, and Disease in Idaho Potatoes

Subrecipient
University of Idaho

Project Summary
Crop plant growth and development are frequently threatened by environmental and biological stresses, such as drought, salinity, or plant pathogens. Transcription factors respond to environmental and/or biological stress by initiating target gene(s) expression. The expression of these target genes is part of a plant's adaptive response to stress, ideally resulting in increasing tolerance, and in most cases is the result of many different genes contributing to part of a multifaceted response. It is the combination of many genes that is responsible for the overall response, with individual genes contributing little or no effect on their own. Thus, modification of a transcription factor provides a novel strategy to manipulate all of these genes at once resulting in an altered response.

NAC transcription factors in plants are comprised of a large number of family members, with a diversity of different functions. Family members have been implicated in various roles of plant development and adaption to biotic and abiotic stress. A subset of NAC transcription factors have been shown to be induced by drought, salt, and pathogens, and when over-expressed in plants, convey improved stress tolerance. Recently, the University of Idaho has identified a NAC transcription factor, NAC1, which is highly conserved in both tomato and potato (tomato NAC1 protein and potato NAC1 proteins are nearly identical, sharing 97% identity on amino acid level). In tomato, the *NAC1* gene is induced by salt and pathogen, but the corresponding protein is degraded via the ubiquitin-proteasome pathway. Significantly, over-expression of this NAC transcription factor in transgenic tomato plants exhibited enhanced tolerance to salt (tested by germinating seeds in medium with high salinity) and enhanced resistance to *Pseudomonas* pathogen. Taken together, preliminary experiments suggest a novel approach to improve tolerance to biotic and abiotic stress in Solanaceae crops, especially potato, by engineering a stable NAC1 transcription factor only expressed under drought/salt/pathogen stress.

Potato growers utilize many different potato cultivars for a wide range of end products, from French fries to baked potatoes. The focus of this work is on Idaho russet potatoes. Numerous different russet cultivars are produced in Idaho, including GemStar Russet and Alturas, which show contrasting low and high water requirements for maximum performance, respectively. Contrasting water requirements make these two cultivars ideal candidates for expressing a modified potato NAC transcription factor NAC1, and will provide insight into the qualitative and quantitative effect of tolerance in different genetic backgrounds.

Drought and salinity are major abiotic stresses to crop production. NAC transcription factors have been shown to increase tolerance to drought and salinity in rice and tolerance to *Pseudomonas* pathogen in tomato. Using a genetic engineering approach, a modified potato NAC transcription factor NAC1, which is only stably expressed in the drought/salt/pathogen condition, will be evaluated for drought, salinity and disease tolerance in cultivated potato. These results will provide insight on the contribution of the NAC signaling pathway to stress tolerance in Idaho russets. Whether increased tolerance is observed or not, information of the role of the NAC transcription factor in cultivated potato will be highly informative, and provide key insight relating to improved drought, salinity, and disease.

Project Approach

The initial strategy was to generate a stable version of NAC1 by disrupting the degradation mechanism, ubiquitination. Research has demonstrated instability of NAC1 contributes its activity, which is a new discovery for plant-specific transcription factors, and means that by generating a stable NAC1 it loses activity and is not suitable for transformation. Further research identified a truncated version of NAC1 that shows partial stability and partial activity. Based on these findings, a moderately stable NAC1 retaining some cellular functionality was successfully generated. Isolation of the native promoter was accomplished. The newly completed construct using the potato native promoter and truncated *NAC1* is currently being used for transformation of GemStar Russet, Alturas, and Desiree. As more is learned about how NAC1 is regulated/activated, new ways are discovered for taking advantage of this system to generate new lines with increased stress tolerance in potato.

Cultivar-specific transformation protocols have been established for cultivars GemStar Russet and Premier Russet, and transformation experiments are being conducted on a regular basis. Although these protocols have led to improved transformation efficiency, they still lag behind the transformation standard, Desiree. However, protocols continue to be refined in order to increase efficiencies.

When the initial strategy to stabilize NAC1 led to inactivity, it was decided to temporarily focus on an alternative approach which has proven successful in other crops, transform wild-type NAC1 under control of the constitutively active promoter 35S. Transformed lines with the potato cultivar, Desiree, have been positively identified with both the empty vector and *35S::NAC1* constructs, approximately eight and twenty lines have been identified, respectively.

A five week salinity evaluation has been conducted with four Desiree lines containing *35S::NAC1,* and two with an empty vector. Over the evaluation period, chlorophyll levels were monitored with a handheld SPAD meter. Figure 1 shows a greater decline in chlorophyll levels over time in the control empty vector line 5, compared to line 4 containing *35S::NAC1.* The other three lines containing *35S::NAC1* behaved similarly. This provides evidence that modification of NAC1 levels at the cellular level can lead to increases in salinity tolerance and that the NAC1 signally pathway in potato is involved in abiotic stress response.

Part of this work was presented at the Annual Meeting of the Potato Association of America in Denver, Colorado in August 2012. A manuscript was recently accepted by the New Phytologist documenting other parts of this research. Funding from the Idaho Potato Commission has contributed to this work and additional funding is being sought at the federal level.

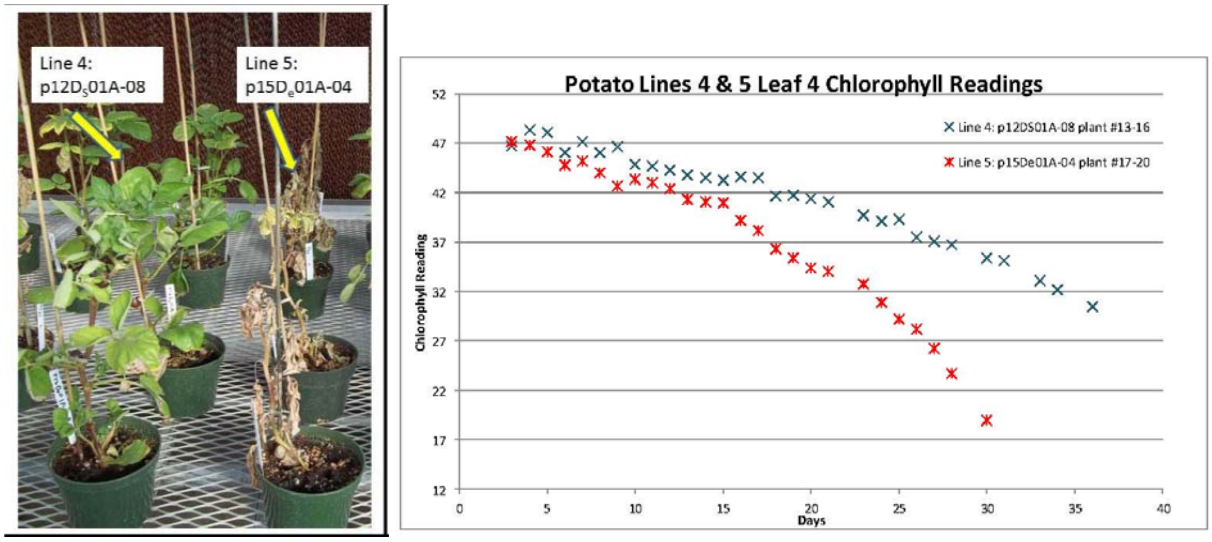


Figure 1. Left, photo of potato lines 4 and 5 after five weeks of salt stress (four pots per line).

Right, chlorophyll levels over time (days) in the empty vector line 5 and *35S::NAC1* containing line 4.

Drs. Kuhl and Xiao have equally contributed to the above activities.

Goals and Outcomes Achieved

Timeline: October – December 2010, Generate ubiquitination-resistant NAC1Ub-Re mutant gene
Activity: Research was conducted to determine how to generate ubiquitination-resistant (stable) NAC1 mutants. The initial strategy successfully generated ubiquitination-resistant NAC1, unfortunately it also decreased/eliminated NAC1 functionality. A new strategy was pursued to generate a modified NAC1 that would be moderately resistant to degradation and also demonstrate some functional activity. This strategy has been completed and shown to function as expected. A third strategy, fusing ubiquitin to the functional NAC1 mutant, is being adopted to stabilize NAC1 in plant cells without decreasing functionality, this strategy is currently being testing in the lab.

Timeline: November 2010 – March 2011, Establish potato transformation protocol for GemStar and Alturas
Activity: Significant progress was made to optimize a general potato transformation protocol for Idaho potato cultivars GemStar Russet and Alturas. Separate protocols for each cultivar were used with the empty vector to further evaluate transformation efficiency. Additional modification may be needed, but it was expected that current protocols would suffice to generate transformed lines. Even with these new protocols, a third potato cultivar, Desiree, was included in all transformation experiments to ensure recovery of some transformed lines.

Timeline: January – April 2011, Clone the *NAC1Ub-Re* mutant gene into a plant expression vector under the control of its native stress-inducible promoter
Activity: The native stress-inducible potato promoter has been successfully recovered. It has been fused with the modified *NAC1* gene mentioned above showing moderate resistance to degradation and partial activity. This new construct is now being used in transformation experiments. While this work was being

pursued the constitutive promoter, CaMV 35S promoter, was fused to wild-type potato NAC1 and used in transformation experiments.

Timeline: April – November 2011, Transform *ProNAC1*::*NAC1Ub-Re –HA* construct into two Idaho potato cultivars, GemStar and Alturas
Activity: As mentioned above, additional time was required to identify a stable and functional version of NAC1. Meanwhile, an alternative approach was initiated, transforming potato with NAC1 under the strong, constitutive 35S promoter. Recent research suggests that this strategy might convey pathogen resistance and stress tolerant lines similar to those in the original proposal. Moreover, research on manipulation of NAC1 gene in tomato plants demonstrates no growth defect is caused by using the 35S promoter. Transformation experiments with the *35S::NAC1* construct were completed and the focus shifted to transformation using the native promoter with modified NAC1.

Timeline: December 2011 – January 2012, Identify plantlets containing *ProNAC*::*NACUb-Re –HA* and provide molecular characterization
Activity: Transformed lines with the potato cultivar Desiree were positively identified carrying both the empty vector and *35S::NAC1* constructs, approximately eight and twenty lines, respectively. Desiree transformed lines are being evaluated in phenotypic assays to detect changes in tolerance to salinity, draught and biotic stresses.

Timeline: February – June 2012, Evaluate salt, drought and disease tolerance of the transgenic potato plant
Activity: A five week evaluation assay was conducted to determine the effect of *35S::NAC1* on salinity tolerance. All four lines containing *35S::NAC1* proved to maintain cholorphyll levels longer under salt stress compared to the empty vector control lines, although two of the lines appeared to be more tolerant than the others. Further characterization of these lines for draught and biotic stress was planned for later periods when plants were propagated.

Timeline: July 2012, Report results at 2012 ASPB meeting in Austin, Texas
Activity: Results related to this research were reported to the approximately 300 attendees of the annual meeting of American Society of Plant Biologists (ASPB) in Austin, TX in July 2012, as well as to the approximately 50 attendees of the annual meeting of the Potato Association of America in Denver, CO in August 2012.

Timeline: August-September 2012, Submit manuscript to peer-reviewed journal for publication
Activity: A manuscript titled "*Sl*NAC1, a Stress-Related Transcription Factor, Is Fine-Tuned on Both Transcriptional and Post-Translational Levels" was accepted by the scientific journal New Phytologist.

Timeline: July 2012 – January 2013, Apply for state and federal grants
Activity: Two consecutive years of funding related to this work were secured from the Idaho Potato Commission. Funding is currently being sought from federal competitive sources.

Beneficiaries

Idaho was ranked number 1 among states in all potato production in 2011, generating 30 percent of total U.S. production. Idaho potato production is focused in the southern part of the state, an area with increasing demands on water resources. The majority of potato production in Idaho is under irrigation, and has the potential to benefit from potato lines which require lower water input. Efficient utilization of water through reduced irrigation would provide growers with an alternative management approach. Irrigation water and the use of manure fertilizers and compost can lead to increasing salt levels in soil, resulting in decreased yield and/or quality. Increased tolerance in Idaho potato cultivars would provide growers additional management strategies while continuing to produce potatoes. Identification of increased tolerance to drought, salinity and/or potato diseases either individually or combined will contribute to sustainable potato production in the state of Idaho and provide a reliable, quality product for the processing industry. Growers may also benefit from salinity tolerant potato lines as irrigation and nutrient management practices change. Idaho has over 50 potato growers and processors that can benefit from the study.

Lessons Learned

Efforts to isolate the promoter region of *NAC1* were delayed due to unforeseen technical difficulties, i.e. inefficient recovery of PCR products from this region; however, this issue was resolved by using nested primers. The initial strategy to generate an ubiquitination-resistant (stable) NAC1 was successful, but it caused decreased transcriptional activity, and an alternative strategy was pursued and has proven successful. As a result of this unexpected result, transformation efforts were significantly delayed, and therefore lines were not available for phenotypic evaluation until summer 2012. However, this result has led to a greater understanding of NAC1 regulation and functionality in the cell, and therefore to a more elegant method for manipulating plant stress tolerance.

Although modified transformation protocols have been developed for GemStar Russet and Alturas, neither protocol has the same transformation efficiency as Desiree, a standard line used in transformation experiments. As a result, genetically modified Desiree has been generated, but a positively transformed GemStar Russet or Alturas has yet to be confirmed.

Contact Person

Joseph C. Kuhl
jkuhl@uidaho.edu
(208) 885-7123

Additional Information

Project funding became available on November 22, 2010, approximately seven weeks after the expected start date of October 1, 2010, thus delaying progress.

A research proposal intended to supplement this grant was submitted to the Idaho Potato Commission (IPC) in December 2010 and was selected to receive funding, starting July 2011. This IPC grant was renewed in July 2012. These additional funds secured from the IPC have contributed to additional labor related to characterization of transformed potato lines and the continuing need to generate new transformed lines with different transgenes. The additional funds will allow continuing efforts to phenotypically evaluate existing lines and lines that may be generated in the near future.

Dry Farmed Vineyards in the Boise Front Foothills

Subrecipient
West Foothills TIC

Project Summary
The purpose of the project was to provide crop research to document that wine grape establishment is possible in the microclimates in the Boise foothills. The issues arise from lack of available irrigation water and wider changes in weather due to elevation and topography. The need and importance of the project arises from the increasing number of wineries with limited wine grape crop availability (due to the length of time required for establishment) as well as the need for individual use/production.

The lower foothills surrounding Boise, Eagle, and Emmett provide the greatest potential for establishment of vineyards. The concept of the study was to document that adequate water levels would be available through selection of deep rooting varietals, lower density, and traditional vine training to support the establishment of non-traditional vineyards.

Project Approach
Exactly 1500 Tempranillo vines were planted in the spring of 2011. The plants were own-rooted clone 1 received from Inland Desert Nursery. An estimated 60 plants did not grow during the first leaf. During the summer of 2011, the three blocks were watered with one drip emitter (1gph/pressure compensating) placed approximately 15 inches uphill from the plant. The assumption was that the water would disperse through the soils in a uphill to downhill plume, contacting the root zone. The amounts of water were varied by three blocks. During the summer heating period, many plants succumbed to the heat, and some of those at the highest elevations died. The time to pressurize the irrigation lines was greatest, and these plants received the longest periods of sunshine and were exposed to several wind events.

The plants leafed in mid-April 2012 and started growing rapidly; however, three consecutive days of freezing temperatures the first week of May destroyed the initial leafing. Plants that were not strong enough to have a second leaf died during the freeze. As noted in the reporting, many plants with a high growth index in the fall of 2011 were reported dead in the summer of 2012, the majority of these plants were in block 1. An estimated 20-30% of plants experienced damage due to the freeze, many never recovered. Plants which were able to recover or were not damaged grew very well in the summer of 2012.

Ms. Jenna Duffin and Dr. Wilkins, both from Boise State University, established the methodology and application of monitoring equipment for recording, monitoring, and determining results of the study. Mr. Joe Guenther of West Foothills TIC administered the grant funds, contracted with specialized help, and managed the purchasing of supplies and preparation of the vineyards grounds for the study. Mr. Guenther also maintained the vineyard during the study and delivered the regimented amounts of water for the duration of the study.

The results of the research were presented to the Idaho Grape Growers and Wine Producers Commission, which has three staff members. This commission also received the poster presentation and summary created as a result of the grant, and distributed it to their 150 members.

Goals and Outcomes Achieved

While the measures were less than desirable (48% mortality), and only one in three plants would be considered healthy, those that are considered healthy and productive meet the desired outcomes of the study. Outcomes could have been changed with several modifications to the study. First, multiple drippers per plant would expand the rooting zones during summer dry down while the plants have yet to establish roots below the upper dry soil profile. Second, watering could be adjusted to lower levels multiple times per week. There was little difference in the plants between block 1 and 2, showing that the amounts applied were sufficient to irrigate the plants even during temperatures reaching 109 degrees in the summer of 2012. Other than mortality due to freezing in 2012, few plants died during the summer of 2012 in any of the blocks showing that if the plants are able to establish in the first 18 months of being planted, that it is possible to establish in these microclimates.

Beneficiaries

The state wine grape crop contributed over 75 million dollars to Idaho's economy in 2009. With over 28 vineyards and over 1600 acres of vineyards, established vineyards in the Boise Front Foothills would add an additional supply of acreage available to meet the continued pressure for wine production in the Snake River AVA. Second to commercial production, and with the growth of estate density properties in the Boise Foothills, production of small acreage farms (5-10 acres) has become popular for individuals wishing to establish private labels. The process, lessons learned, and recommendations will assist in those wishing to establish traditional grape crop in the variable conditions the Boise Foothills present.

Lessons Learned

Three unexpected complications unrelated to the study of irrigation were encountered during the study. The property was prepared prior to planting with both pelletized fertilizer and composted steer manure. During the study, it became evident that the soils (homogeneous medium sandy/loamy) did not retain the nutrient loads for long. It would be recommended that soils manipulation using composted humic material instead of pelletized fertilizer in order to retain both moisture and nutrient in the rooting profile. Second, wildlife (both deer and gophers) were more problematic than anticipated. During review of the plant condition in 2012, all dead plants were pulled from the ground, and approximately 15 plants showed evidence of gophers eating the entire root system to the base of the plant. Any future vineyards would also require deer fencing. Prior to enclosure with the deer fence, damage to other parts of the vineyard in 2010-2011 limited the year to year growth. Lastly, the drip emitters both number and frequency will be modified going forward with the remaining plants. A soil dye was placed in the irrigation lines to profile the movement of irrigation water through the rooting zones in 2011. The dye showed that the water moved more vertical through the soil with less horizontal movement than anticipated. The movement is likely due to the porous nature of the sandy-loamy soils being moderately coarse. Additional drippers on the line would remedy the lack of horizontal water movement. For further information, see attached production report prepared by BSU.

Contact Persons

Joe Guenther, West Foothills TIC
jrguenth@gmail.com
208-319-1906

David Wilkins, BSU Department of Geosciences
dwilkins@boisestate.edu
208-426-2390

BOISE FOOTHILLS
RESTRICTED IRRIGATION STUDY

PURPOSE: This study investigates the ability to establish productive wine grapes using different levels of limited irrigation in the Boise Foothills located in an arid climate.

SITE DESCRIPTION:

The West Foothills TIC Vineyard (TIC) is located in the Boise Foothills (Figure 1) in a climate zone receiving less than 300 mm of annual precipitation. The area consists of steep to moderate slopes with grades from 15 to 30 percent. TIC is situated on a west-northwest-facing slope. The natural vegetation is dry and predominately cheatgrass and rush skeletonweed along with some native grasses and shrubs. A textural analysis of the soils across the vineyard shows a homogeneous medium sand soil throughout.

About 1,000 Tempranillo vines are spaced 3.0 m by 3.0 m apart. This cultivar was selected because of its ability for head training, similar to dry farming practices in Spain, the native origin of Tempranillo, and it naturally roots deep in sandy soils. The relatively low planting density allows the plants to find and use water free from competition.

STUDY SETUP:

The vineyard is divided into three test blocks on a west-northwest-facing slope. Traditional vineyard performance factors, such as planting densities, soil type, rootstock, and climate, are standardized and serve as constants in this study. Thus, the limiting factor for vine performance is the difference in irrigation on each block. Each block is about an acre in size. Decagon EC-5 sensors were installed at two sites in each block-- one at a higher elevation (denoted A), and one at a lower elevation (denoted B). There were also sensors installed at a control site located upslope (Figure 1).

2011: Sensors were installed at depths of 0.25 m and 0.50 m at high (Figure 1, A) and low elevations (Figure 1, B). The sensors are located 0.50 m downhill from a vine and the emitters vary from 5 to 20 cm uphill from each vines.

2012: Additional sensors were installed at depths of 0.25 m and 0.50 m at the higher elevations in each plot (Figure 1, A). These sensors are located directly next to the plants. All of the emitters were adjusted so they are about 5 cm uphill from each plant.

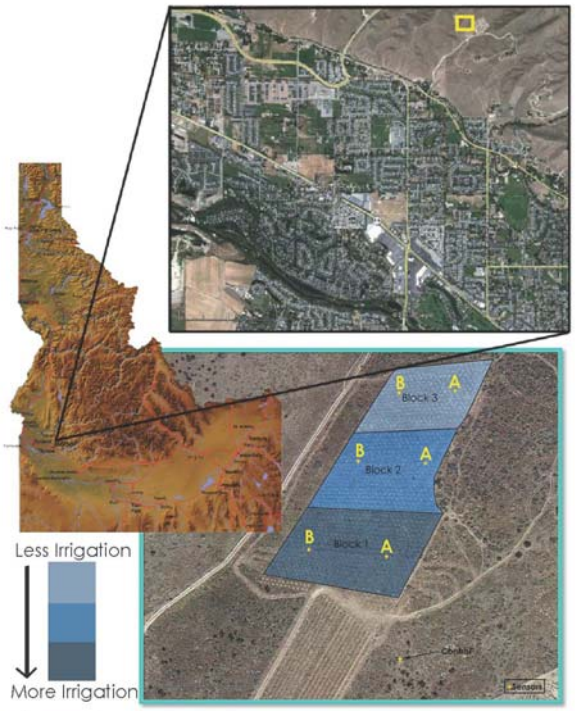


Figure 1: Location Map and Study Area. Sensor locations are shown; those labeled A are at higher elevations and those labeled B are at lower elevations. Those labeled A have paired sensors, a set at the plants and a set 0.50 m downhill. The difference in irrigation is noted by varying shades of blue. Map source: Google Earth

IRRIGATION:

A gravity-fed drip irrigation system feeds from a tank at the top of the hill. Each vine has access to water from one pressure-compensating drip emitter. The area was irrigated from June to October in 2011 and mid-April to October (with a break from late April to mid-May) in 2012.

Block 1: 1 gallon of water twice a week or 2 gallons total

Block 2: 1 gallon of water once a week

Block 3: 0.50 gallon of water once a week

BOISE FOOTHILLS
RESTRICTED IRRIGATION STUDY

SOIL MOISTURE FOR HIGH AND LOW ELEVATIONS IN EACH BLOCK

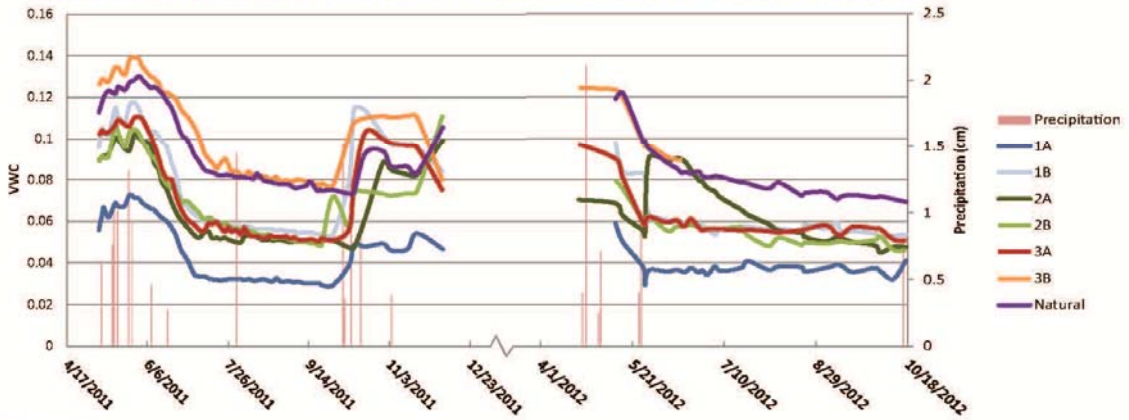


Figure 2: The volumetric water content (VWC) is plotted over the 2011 and 2012 growing seasons across all blocks. Each line represents the mean VWC values of the sensors at 0.25 m and 0.50 m depths at each site. The sensors used for this graph were all located 0.50 m downhill from the vines. Precipitation events greater than 2.54 mm are also shown.

SOIL MOISTURE:

Soil moisture is reported as volumetric water content, which refers to the fraction of water in the soil. Monitoring occurred approximately three times a week for all sensors. Some data are missing due to equipment complications.

Figure 2 displays the data for the soil moisture 0.50 m downhill at each site. The irrigation does not have a great effect on the soil moisture at that point. Based on the consistently drying-down trend during the summer season at all sensors, there appears to be very little change in the soil moisture at those sites resulting from irrigation. Minor increases resulting from precipitation events support this, especially in the spring when the evaporation rates are lower. This indicates that the water delivered through limited drip irrigation input was dispersing as far as the sensor, which implies the plants are not being overwatered. The sensors appear to show, instead, the natural dry-down of the soil as opposed to the effects of irrigation. The lower elevations contained more moisture averaged over the season. Results show this soil moisture difference, with elevation difference, in each block to be consistent.

CHANGES IN SOIL MOISTURE AT PLANT AND DOWNHILL OF PLANTS

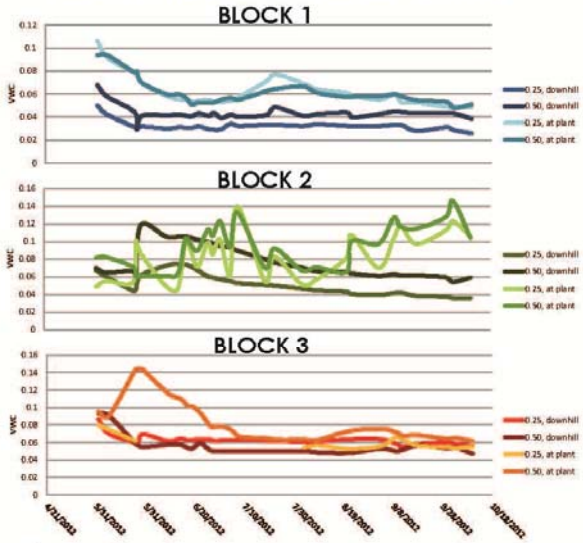


Figure 3: The volumetric water content (VWC) is plotted over the 2012 growing seasons across all blocks for the higher elevation paired sensors. Each line represents the VWC values of the sensors at either 0.25 m and 0.50 m depths and either 0.50 m downhill of the vine or at the vine.

BOISE FOOTHILLS
RESTRICTED IRRIGATION STUDY

SOIL MOISTURE:

Figure 3 shows the difference in soil moisture from higher to lower elevations. Overall the soil moisture is higher at the vine than it is downhill from the vine, which shows the diffusion of the water as it moves downslope through the soil profile.

Block 1: VWC values do not vary drastically in this block. Lack of moisture variations could be due to the frequency of watering. The block is watered twice a week as opposed to once a week like the other blocks allowing for more stable soil moisture.

Block 2: The values for sensors at the vines at both depths are very variable. The values appear to be responding to irrigation inputs because the days where the soil moisture is high correspond to days directly following irrigation.

Block 3: Very little variation occurred in soil moisture values for all sensors in Block 3. This disregards the high values in the 0.50 meter-deep sensor at the plant, which are probably due to the sensor adjusting or a local variation in the soil after the sensors were installed. The peak corresponds to the time the 0.25 meter-deep sensor stopped reporting data most likely due to a gopher chewing through the wire. The presence of gopher tunnels could have disrupted the flow of water in the soil as well. The data appear to show low variation in the soil moisture at the plant and downhill from the plant because there is not enough irrigation input to have a visible effect on the soil moisture at those depths.

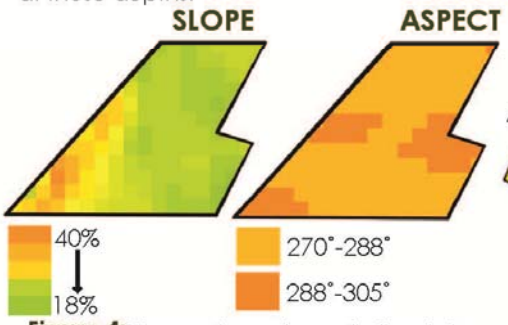


Figure 4: Slope and aspect maps for the whole vineyard showing the local variations throughout.

MEASURES OF PRODUCTIVITY:

Productivity of the plants was measured by plant health and mortality for each year. Figure 5 shows the health of the plants near the end of each growing season. Productivity rate statistics are displayed in the tables for each block of differing irrigation and the vineyard as a whole.

MORTALITY RATES BY YEAR:

	Block 1	Block 2	Block 3	Whole Vineyard
2011	11.23 %	6.30 %	27.19 %	13.86 %
2012	34.19 %	33.63 %	63.52 %	40.71 %
Total	41.58 %	37.81 %	73.44 %	**48.61 %**

MEASURES OF PRODUCTIVITY:

	Block 1	Block 2	Block 3	Whole Vineyard
Healthy	35.96 %	36.16 %	15.00 %	30.68 %
Stressed	22.81 %	26.30 %	10.63 %	20.71 %
Total Alive	58.77 %	62.47 %	20.17 %	**51.39 %**

VINEYARD PRODUCTIVITY:

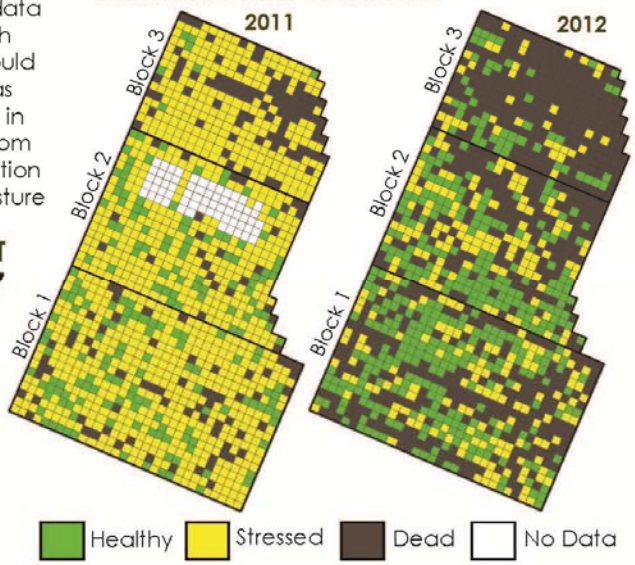


Figure 5: Productivity across all irrigation blocks for 2011 and 2012

BOISE FOOTHILLS
RESTRICTED IRRIGATION STUDY

PRODUCTIVITY RESULTS:

- The higher mortality rates in Block 1 over Block 2 suggest that other localized factors within the vineyard (perhaps due to slope or aspect shown in Figure 4) are having an effect on soil moisture along with irrigation input. Greater injury to plants during the spring freeze was observed in Block 1 because these plants budded early (~May 20) and were unable to recover from loss of first growth.
- The high mortality rates for Block 3 (73.44% total mortality) and the very little difference in the paired soil moisture sensors (Figure 3) at that site suggest that 0.50 gallon of water per plant per week was not enough to keep the vines alive.
- The overall survival rate of the vines across the vineyard (51.39%) suggests the current model for the vineyard is not productive. Vine establishment (or lack of) was affected by annual weather events, which cannot be controlled. Nonetheless, with some changes to methodology there exists a possibility to establish a productive limited irrigation vineyard in the lower Boise Foothills.

SETBACKS AND POSSIBLE SOLUTIONS:

Year-to-year climate variability added difficult conditions in predicting plant productivity with limited irrigation input. The two growing seasons for this study both had very different seasonal weather. Spring of 2011 was exceptionally wet, where 2012 was dry. Both summers were very dry with almost no precipitation from July to September. In 2012 the summer temperatures were very high and exceeded 100°F for longer than a week, peaking at 109° on July 12. Precipitation and temperature variations add stress to the plants and, in addition to the stress they experience from limited irrigation, could result in mortality.

Another climate complication was the 2012 late spring freeze. Temperatures rose in mid-April and many of the healthy plants from 2011 started growing. A series of freeze events from May 4-7 severely damaged many of the plants. The mortality rate of 13.01% for the healthy vines from 2011 to 2012 is likely a result of frost damage and weather stress as opposed to the limited irrigation.

One of the complications with the current setup is that one emitter per plant limits the watering zone. The plants would likely respond better with low irrigation if they were watered with two or more emitters per plant to increase the watering zone, and watered less, but more frequently. This would maintain more stable soil moisture values over a larger zone for each vine, hopefully reducing water stress to the vines. Watering the vines more as they are being established and then less in following years may also reduce mortality. This allows the plants to develop good root stocks and more vigor to endure greater water and climatic stresses.

Joseph Guenther, West Foothills TIC Vineyard
David Wilkins, Boise State University
Jenna Duffin, Boise State University

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