



Specialty Crop Block Grant Program

**Colorado Department of Agriculture
FY10 Final Performance Report
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(Projects in bold were previously approved in the **2011** Annual Report. Non bold projects (5 total) are new final reports.)

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Background

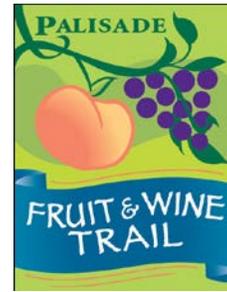
The United States Department of Agriculture (USDA), through the Agricultural Marketing Service (AMS), awarded FY2010 Specialty Block Grant Program funding in the amount of \$773,535.26 to the Colorado Department of Agriculture (CDA). CDA allocated the funds into 17 projects. These projects supported CDA's over-arching goal of increasing the competitiveness of Colorado's specialty crops. The projects, as well as the start and end dates for each are:

- Colorado Fruit & Wine Trail (*January 1, 2011 – March 1, 2012*)
- Colorado Proud (*January 1, 2011 – December 31, 2011*)
- Colorado Pavilion at the Fresh Summit Expo (*January 1, 2011 – December 31, 2011*)
- Greenhouses in Colorado Reader (*October 1, 2010 – October 3, 2011*)
- Long Term Potato Storage Efficacy Study (*January 3, 2011 – June 30, 2013*)
- Nursery Tree Research (*January 3, 2011 – June 30, 2013*)
- Marketing, Research & Technical Support for Colorado's Small Acreage, Socially Disadvantaged & Beginning Specialty Crop Producers (*October 1, 2010 – June 30, 2013*)
- Stock Seed Variety & Market Development (*January 1, 2011 – December 31, 2011*)
- Farmer Approved Marketing & Distribution (*October 1, 2010 – December 31, 2011*)
- Plant Select® Market Development (*October 1, 2010 – May 31, 2012*)
- Specialty Bean Marketing Plan (*October 1, 2010 – November 30, 2012*)
- Educating Consumers about the Benefits of Sod (*January 1, 2011 - December 31, 2011*)
- Enhancing Specialty Crops for Youth in Food Deserts (*October 1, 2010 – December 31, 2011*)
- Specialty Crop Test Plots (*January 1, 2011 – December 31, 2011*)
- Farm To School – Year 2 of 3 (*January 1, 2011 – December 31, 2011*)
- Development & Commercialization of a “Branded” Colorado Potato – Year 2 of 3 (*January 1, 2011 – December 31, 2011*)
- Efficacy of Irrigation Systems on Diverse Market Classes of Dry Beans in Colorado – Year 2 of 2 (*January 1, 2011 – December 31, 2011*)

Project Title: Fruit & Wine Trail – Final Report

Project Summary

The Palisade area is a small traditional, fruit-growing community in the Grand Valley of western Colorado. It is also adjacent to the larger transportation and economic hub of Grand Junction, and lies on one of nation's busiest east west interstate highways- I-70m which has a mix of businesses all along I-70. Despite this access, many thousands



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tourists pass the Palisade exit on I-70 without visiting the rich array of orchards, vineyards, wineries, value-added farm markets, hotel, bed and breakfast establishments, and local retailers who promote themselves with an image of a small and friendly fruit-growing and winemaking community. There were definite needs for better identification and promotion of area agriculture businesses, for dispersion of tourists and other customers throughout the greater Palisade area, and for a comprehensive marketing effort to maximize the integration and sustainability of local value-added and agritourism efforts.

The goal of this project was to create a local marketing plan and travel information mechanisms to enhance the tourist and consumer awareness of local agriculture and agritourism businesses. This will enable area value-added agriculture and agritourism businesses to draw more customers and increase awareness of the Palisade area as an agricultural tourist destination. Long-term, this project will become a model for coordinating, enhancing, and sustaining rural communities that have a good mix of agriculture, tourism, and community growth.

Project Approach

The approach for this project was to create a Study Group, from this group three actual working groups emerged to accomplish the goals. The three working groups were a Vision Study Group, a Signage Group and a Marketing Group. With 30 participants from the Palisade and Grand Junction areas it was evident that there was strong community desire for the success of the project. The Vision Study Group created the Palisade Fruit & Wine Byway Vision document that provided the history, character and future desires of the community in order to coordinate with other participating businesses and government entities to ensure a common goal. The efforts of the Signage Group resulted in 100 way finding signs on county roads, 4 TODS signs on CO Hwy 141 and 3 Tourist Oriented Directional Signs (TOD) on I-70 identifying the Palisade Fruit and Wine Byway.

Goals and Outcomes Achieved

The Marketing Group signed up the expected goal of 30 businesses to participate and conducted two surveys. The pre -byway survey showed area businesses believed the signage would help to address their needs post-byway survey showed that visitors to their businesses noticed the and it increased awareness. Although the performance measure was to 35% of businesses showing an increase in sales, sales questions were developed at this time. A focus group showed that it was beneficial to the name from "trail" to "byway" and developed a brochure for distribution. A Facebook page www.facebook.com/PalisadeFruitandWineByway was also developed and has seen over 174 likes as of September 2012.



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Desired Outcome	Performance Measure	Baseline	Goals	Actual
			2011	2012
To increase number of businesses that participate in the Fruit & Wine Trail	Develop Market Study Group, road signage and marketing materials	No baseline exists	30 businesses to participate	30
Number of businesses that report increased sales by participating in the Fruit & Wine Trail	Survey participating businesses fourth quarter 2011	No baseline exists	35% of participating businesses to show an increase in sales	Increased awareness noted

Beneficiaries

The primary beneficiaries are the 30 participating listed businesses. However, tourists, visitors and the cities of Palisade and Grand Junction have also benefitted from the Palisade Fruit and Wine Byway.

Lessons Learned

- Getting signage that fits county planning and transportation policies required changing the name from Palisade Fruit and Wine Trail to Palisade Fruit & Wine Byway (PFWB). However, this became a huge plus, as the county linked the PFWB to a new pedestrian/cycling bridge over the river that then linked much more safely to the Mesa County Riverfront Trail and CO Hwy 141 north of the Colorado River.
- Assessing impact of signage on business visitation and sales was difficult, as the signs were only in place for a few fall months prior to the post-signage survey. Also, many businesses had already finished their tourist season prior to PFWB signage being put in place.
- The Vision Study Group has not maintained enough grassroots momentum to yet form a permanent self-funded entity. The purpose of such an entity would be to become a permanent planning body to address the future needs of the area and remain effective at drawing in tourists. The desire was there initially, but not enough communication and meetings were done to sustain momentum. Momentum slackening is not yet fatal to establishment of a permanent entity, but needs to be reinvigorated.

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Project Title: Colorado Proud - Final Report

Project Summary

Since its inception by CDA in 1999, *Colorado Proud* has served as the state’s primary program to promote agricultural food products that are grown, raised or processed in Colorado. The program is a great fit with the Colorado consumer’s desire to buy local products. Surveys, as recently September 2011, have found that 92 percent of Colorado consumers would be more likely to buy food that was produced in Colorado than outside of the state. The appeal for local products also lies with restaurants, chefs and retailers. A National Restaurant Association survey conducted in October 2011 found that 86 percent of chefs surveyed believe local produce is one of the “hot” new trends for restaurants.



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The purpose of this project was to continue to educate consumers, retailers, and restaurants about the wide range and availability of Colorado specialty crops, resulting in increased purchasing of locally grown products. Program funds were used solely on television advertising and online components associated with promoting Colorado specialty crops. The television ad itself featured Governor John Hickenlooper in a cabbage field promoting Colorado’s specialty crops. The television and online ads were strategically aired during the summer months, August-October, to coincide with Colorado’s produce growing season. The Colorado Department of Agriculture contributed \$44,754.64 in cash to the campaign to promote non-specialty crop products. In addition the partner television station contributed \$470,542 worth of in-kind services including bonus air time to promote the non-specialty crop portion of the advertising campaign.

The funds provided the resources for CDA to implement an advertising campaign during the summer of 2011 aimed at encouraging consumers to “buy local” and emphasizing Colorado’s fresh fruits and vegetables.

Project Approach

Approximately 1,500 companies, many of which are suppliers, processors and buyers of fresh fruits and vegetables, were participating in the Colorado Proud program when the advertising campaign with Channel 9 KUSA-TV was implemented in the summer of 2011. Project funds were utilized to continue the successful summer television advertising campaign. The television ad featured Governor John Hickenlooper in a Colorado cabbage field. Sakata Farms in Brighton provided the backdrop for the new ad. The advertising, which prominently featured Colorado’s bountiful array of fruits and vegetables, was timed to coincide with harvest beginning in August and running through early October 2011.



Proud

Colorado Proud ran 1,379 ads, and based on viewer tracking survey household advertising reach and frequency for Colorado ads only, was 99.9 percent with an average frequency of 14.7 times, resulting in 23,079,000 household impressions. Among the program’s target audience, adults 25-54, reach and frequency totaled 99.6 percent an average of 7.4 times, generating 13,017,000 target audience impressions.

In addition to the on-air campaign, Colorado Proud had a dedicated section on the www.9news.com website featuring recipes, a crop calendar, produce picking tips and other consumer information. Online campaign impressions totaled 51,145,838.

Findings from telephone surveys conducted by Survey USA of consumers in the Denver metro area found that 76 percent of consumers are aware of the Colorado Proud program and logo, up from 68% in 2010 and 59% in 2008, and 58 percent indicated they are looking for the logo when shopping more now than they used to. The survey also found that 84 percent of consumers had knowingly purchased at least some Colorado products in the prior 30 days.

Goals and Outcomes Achieved

Performance Measure	2011 Goals	Actual Result			
		2008 (Baseline)	2009	2010	2011
Percent of consumers aware of the Colorado Proud logo	72%	59%	67%	68%	76%
Percent of consumers reporting purchases of Colorado products in the past month	86%	77%	84%	84%	84%
Number of Colorado Proud members	1,483	1,050	1,160	1,392	1,570

Beneficiaries

Besides impacting consumers across Colorado, the television advertising and online communications brought broad benefit to the more than 1,500 Colorado companies that are licensed members of Colorado Proud, especially the more than 150 members that are specialty crop producers and the nearly 400 members that operate restaurants, retail stores and farmers markets selling Colorado specialty crops. (No SCBGP dollars were used to promote non-SCBGP products.)

Lessons Learned

The continued increase in awareness of the Colorado Proud logo demonstrates the effectiveness of this annual television advertising campaign. Although the percent of consumers reporting purchases of Colorado products remained level, the overall impact to consumers with the message continues to grow beyond our expectations. We acknowledge that at some point we will reach a level of awareness saturation and will see a leveling off of the “percent of consumers aware of the Colorado Proud logo,” however we still expect to see growth in awareness for the next several years.

We also continue to recognize the importance of developing a year-round and more statewide marketing plan to keep Colorado Proud “top of mind” with consumers across Colorado year-round. We hope to secure additional funds from non-Specialty Crops resources to expand marketing efforts to include public relations, events, social media and foodservice merchandising.

Contact Person

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Project Title: 2011 Colorado Pavilion at PMA Fresh Summit – Final Report

Project Summary

PMA's Fresh Summit Expo is the largest US based produce show and presents a unique opportunity for the Colorado Department of to partner with Colorado's specialty crops produce industry. First created in 2008 with only 2 associations and 3 growers, the Colorado Pavilion provided much needed marketing support to growers by creating an expanded venue at which to promote their individual production and sales. Additionally, the Pavilion has helped to create greater awareness among buyers as a supplier of a wide array of fruit and vegetables, encourages broader industry participation in the Expo and assists exhibiting companies and growers to initiate and/or expand sales.



Agriculture

Primary objectives included:

- Demonstrating to the Colorado specialty crops produce industry the benefits of marketing under a broader umbrella of “Colorado”.
- Assisting our exhibiting companies to expand and/or initiate export sales by “Internationalizing” their domestic trade show presence.
- Increasing the awareness of produce buyers throughout the U.S. and the world of Colorado as a produce supplier state.

This project builds upon similar Colorado Pavilion projects that were funded in FY06, FY08 – Competitiveness Act, and FY09 SCBG programs.

Project Approach

A Colorado Pavilion was created within the PMA show, the pavilion format provided space for commodity associations as well as booths for individual growers and enabled them to hang signs and other graphics in the space which is not allowed with individual booths. Videos of the participating companies were produced and showcased in the area and were also posted on YouTube. Included in the pavilion space was also a shared conference room providing an enclosed meeting room to allow all exhibitors to have private space for individual meetings without leaving the show floor.

Grower participation within the pavilion represented 70% of all specialty crops production in Colorado and association participation represented 58%. PMA was a critical venue for the Rocky Ford Melon producers who had just experienced a listeria outbreak (from Colorado but not the Rocky Ford area). Having a presence at this show was critical in communicating the industry's commitment to address issues and work with the trade to return to the market in 2012.

The participating commodity groups and industry representatives contributed over \$103,000 versus the total grant of \$69,850. Their contribution was both in time, travel costs, and booth rentals within the Colorado Pavilion. One association and all other companies paid for their booth costs, as well as travel and show expenses.

Goals and Outcomes Achieved

Desired Outcome	Performance Measure	Baseline	Goals	Actual
			2011	2011
To increase the number of participants exhibiting at the Expo	The number of produce associations and/or produce growers participating in the Colorado Pavilion	3 produce associations and 5 produce growers participated at the 2009 Expo	4 produce associations and 6 produce growers	12
To generate domestic and international sales	Value of “at Expo” sales reported by produce growers and companies participating in the Colorado Pavilion	“At Expo” sales of \$.5 million were reported at the 2009 Expo	\$.6 million	\$1.5 million

Our sales goal is a challenge to accurately track. The show is connecting companies for the next full year, so post show surveys cannot reflect the full impact of the show. Immediate results indicated sales of \$1.5 million.

Beneficiaries

The Colorado Pavilion targeted assisting two core groups, the produce commodity associations and the individual produce shippers/growers. The association participation grew in 2011 from 2010 with the addition of the Arkansas melon growers, who were facing a market disruption due to a listeria outbreak in Colorado cantaloupe (not from the Rocky Ford melon region).

Participating companies report making contact with existing and new buyers each year. Immediate sales results indicate the importance of the pavilion and value of the booth space for participants.

Company and association support grew in 2011 to include 40 industry travelers who attended the show. This would indicate the industry in-kind contributions for this activity was greater than the \$103,250 projected in the budget. Within the \$103,250, \$24,000 was included for travel expenses, a more accurate projection with 40 travelers would be over \$50,000.

Lessons Learned

- The association goal might be high. All of the associations representing many of the large, US and global market crops are participating. The smaller associations have not seen value for their association to invest in participating with a booth within the Colorado Pavilion. The Pueblo Chili Growers, Dry Bean and Organic Association will be contacted for future participation.
- Grower participation is also stabilizing at the current level. Other grower/handlers will continue to be recruited, but this current level appears to be the base for this show.
- Work will continue to develop a more effective and meaningful post event survey that captures pertinent data to judge and direct future Colorado Pavilions.

Contact Person

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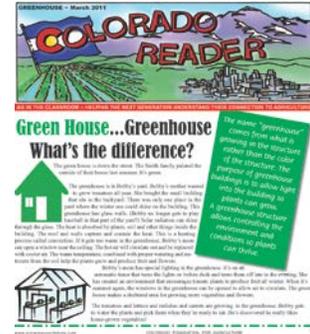
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Project Title: Greenhouses in Colorado Reader – Final Report

Project Summary

Since 1991, Colorado Foundation for Agriculture (CFA) has been providing materials and resources to Colorado schools and educators help address the lack of understanding about agriculture's importance our society. With today's students and educators often three to four generations removed from the land, bridging this gap is more important than ever. CFA has distributed over five million Colorado Readers on various topics including corn, dairy, eggs, general agriculture, food safety, livestock, ranching, soils and wheat. This project provided educational materials and opportunities to promote understanding of Colorado's specialty crops with a specific focus on Colorado's greenhouse industry. CFA developed tools ~ the Colorado Reader, Summer Agriculture Institute, and Colorado Kids to create a statewide educational outreach effort to help develop an understanding about the importance of greenhouses to the state. The projects encouraged "buy local" and encourage people to explore local greenhouses.



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Each year a new crop of students enters a new grade. These students are three to four generations removed from the land. They no longer have a parent, grandparent, aunt or uncle involved in agriculture. Less than 5% of the information in school textbooks is related to agriculture. Agriculture illiteracy is becoming the norm for these students and unfortunately, for their teachers as well. This project provided current information about Colorado's greenhouse industry for use in 4th, 5th and 6th grade Colorado Classrooms. This issue was published and distributed in March 2011 so the Greenhouse Association and others could use it at Garden Shows, Home Shows and other spring events. If students are to understand their connection to agriculture then it is important to provide resources to educators so they can teach their students about this industry.

This project built on and enhanced previously fund projects. The previous projects focused on an introduction to specialty crops, followed by focusing on vegetable crops grown in Colorado. They involved the production of a Colorado Reader on Specialty Crops and Veggies of Colorado. The Food, Fiber & More Summer Institutes also presented information on both of these topics to educators.

Project Approach

CFA produced and distributed 55,000 copies of the Greenhouse Reader across Colorado, held two "Food, Fiber and More" Summer Institutes presenting information to 48 educators and distributed an edition of Colorado Kids on Greenhouses to approximately 300,000 households through the Denver Post.

The Colorado Department of Agriculture, the Colorado Greenhouse Association and Jordan Designs all partnered in the production and distribution of the materials in addition to the work done by the CFA staff.

Goals and Outcomes Achieved

Desired Outcome	Performance Measure	Baseline	Goals	Actual
			2011	2011
To educate students about specialty crops grown in Colorado, and identification of the crops	Percent of teachers reporting that the Reader was beneficial to helping students understand what vegetables are grown in Colorado greenhouses, identify greenhouses as part of the ag industry and at least one job	75%	80%	90%
To positively enhance the general public's understanding of Colorado specialty crops	Percent of online visitors that visit for greenhouse quiz answers that correctly recognize greenhouses as part of ag industry and identify at least 4 greenhouse crops	No baseline currently exists	90%	Only 4 participants in the online quiz, too little to measure – 0% -
To provide SAI attendees with an understanding of the diversity of Colorado's ag industry while introducing them to different segments such as the greenhouse industry	Percent of SAI attendees that understand greenhouse industry as part of Colorado ag, the economic impact and will develop an activity they can use in the classroom	No baseline currently exists	90%	80%

Should CFA do this again a larger reward or incentive for taking the quiz will be offered.

Beneficiaries

The primary beneficiaries of this project were 4th, 5th, 6th grade students across Colorado as well as the K-12 educators attending the summer institute.

Educators reported that after working through the Greenhouse Reader, 100% of the students could identify greenhouses as places to grow plants. However, only 77% of the students could identify businesses that make up the green industry. 91% of the students recognized that photosynthesis is a chemical process. 82% of the students recognized the difference between an annual and perennial while 94% can describe at least one way to propagate a plant. 93% of the students could identify a career in the greenhouse industry, 86% could describe the difference between agriculture and floriculture and 88% could describe the difference between wholesale and retail sales.

The SAI provided educators with an understanding of the diversity of Colorado's agricultural industry while introducing to them the values of the different segments, like greenhouses, to Colorado's economy and our society. The SAI will now provide educators with resources and understanding of how to use agriculture as a theme to teach other academic subjects.

Lessons Learned

The number of responses to the "Colorado Kids" greenhouse quiz was disappointing. People were asked to take the quiz online after reading the "Sunny Side Up" and they would receive a free comic. There were only 4 quiz submissions, in the future there may be a larger award.

Contact Person

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Project Title: Long Term Potato Storage Efficacy Study – Final Report

Project Summary

Potatoes remain dormant for a set period of time after harvesting depending upon the cultivar. Tuber dormancy, sprouting, and wound healing are very important processes for maintaining quality in postharvest storage. Sprouted tubers are not marketable and tend to lose water by evaporation resulting in lost weight.



To ensure a constant supply of acceptable quality potatoes from storage, tuber dormancy needs to be extended beyond the winter months. Physiological dormancy of the potato tuber is extended by creating an artificial environment consisting of lowered temperature, high relative humidity, adequate oxygen and application of chemical sprout inhibitors. The purpose of sprout inhibitors is to prevent sprouting in storage as tubers age. Sprout inhibitors work by inhibiting cell division within the eye region.

Some of the newly released specialty cultivars from the Colorado breeding and selection program have relatively short natural dormancy periods. These cultivars, such as Purple Majesty and Masquerade, have high nutritional value. (Perla et al 2012a; Perla et al 2012b) They are rich in antioxidants and accumulate beneficial elements such as Selenium and sulfur. Determining sprout inhibition techniques that extend dormancy to provide a larger window of time for marketing these new cultivars was a goal of the project.

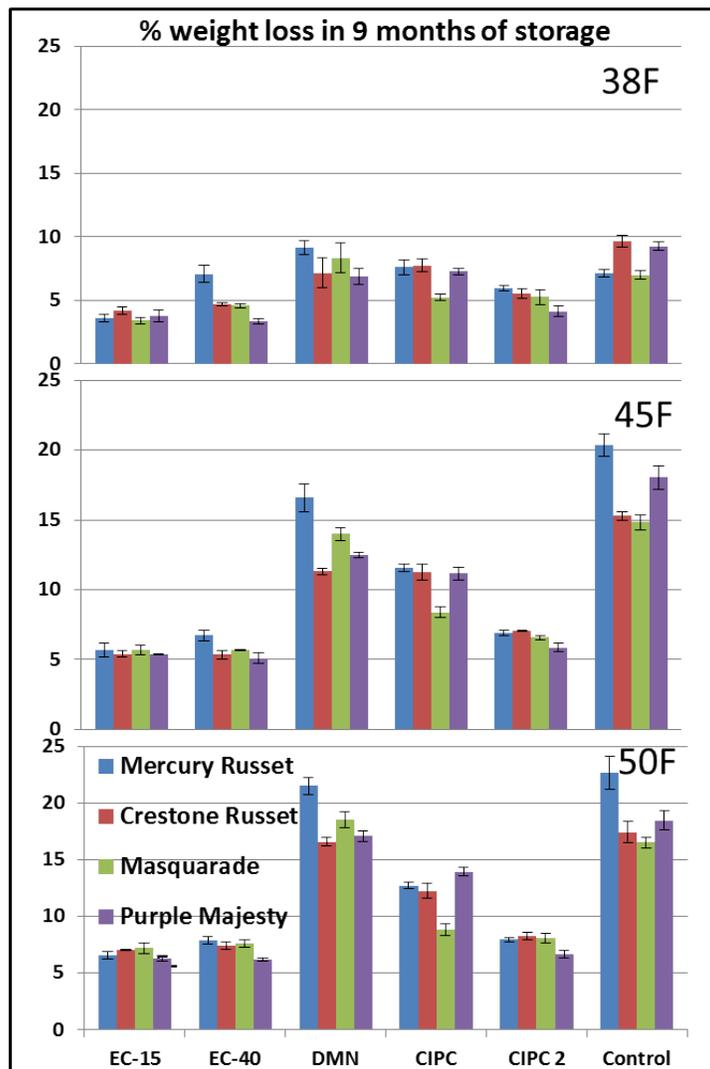
The potato breeding and cultivar improvement program at San Luis Valley Research Center has developed a number of new cultivars some with long natural dormancy and others with short term dormancy. Most of these new cultivars have good market potential

with excellent flavor and culinary attributes. Our idea is to extend the storage duration of short-term dormancy cultivars for both organic conventional markets. This study generates treatment and dosage guidelines and develops recommendations for different sprout inhibitor treatments.

This project complemented the earlier work carried out on another SCBG proposal on branding. The earlier proposal is on branding some of the specialty cultivars for their unique characteristics. Nevertheless, some of these new cultivars have storage issues due to short-term dormancy.

Project Approach

We selected four cultivars; two russets (CO99053-1RU (Crestone Russet), CO99100-1RU (Mercury Russet),

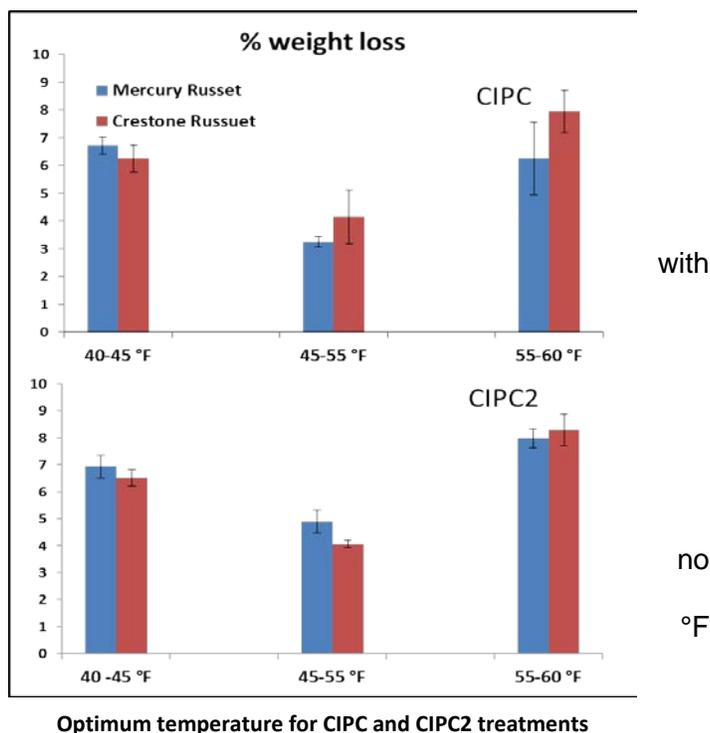


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Russet)) and two specialties (Purple Majesty, AC99329-7PW/Y (Masquerade)) to study sprout inhibition. These cultivars are either advanced selections or recently released cultivars with great potential in terms of their unique characteristics. They are early maturing, possess good flavor, or are higher in nutritional quality because they contain increased levels of anthocyanins and polyphenolics. We tested them with two organic and three synthetic sprout inhibitors. The aims of this project, are; determining the efficacy of sprout inhibitors, and the optimal timing for application of sprout inhibitors and optimal storage temperature. We collected data on sprout length and sprout weight, shrinkage and weight loss during 3, 6 and 9 months of storage. We tested sprout inhibitor compounds at three different storage temperatures 38 °F (3.3°C), 45 °F (7.2 °C) and 50°F (10°C). The sprout inhibitors we tested were (EC-40, EC-15 - Biox sprout inhibitors (Pace International); DMN (1,4 ethyl naphthalene; Dimethyl naphthalic); CIPC (chlorpropham). All sprout inhibitors were applied based on manufacturers dosage and rate recommendations. In case of the organic short-term sprout inhibitors we also tested sprouting in simulating shipping and store displays after storing at 38°F. Conventional sprout inhibitors were tested mainly for appropriate tuber pulp temperature for sprout inhibitor application to improve efficacy. We initially tested four Colorado selections and released cultivars in small bags. In subsequent years we expanded to 100 pound containers instead of storage bins to avoid cost overruns.

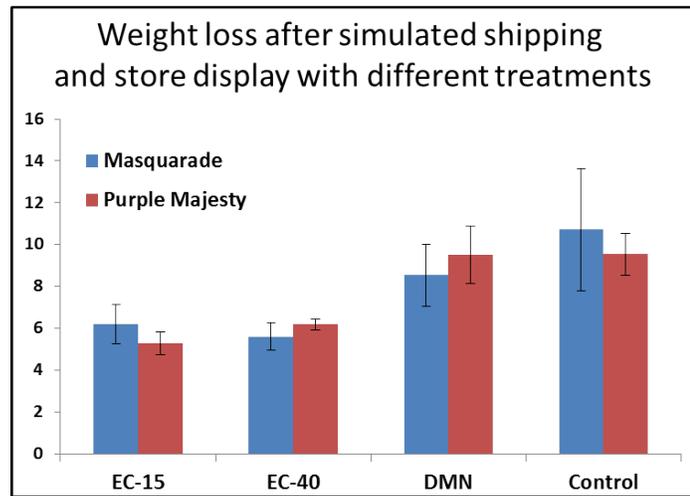
Conclusions and recommendations

- Potato cultivars respond differently to sprout inhibitors especially with short-term inhibitors.
- Colorado cultivars and advanced selections treated with CIPC had no significant sprouting at any given temperature and lost more weight as temperature raised.
- Crestone Russet lost the least weight at 38°F when treated with Biox®-15 EC and had no sprouting in either treatment. Conventional sprout inhibitors such as CIPC2 and CIPC allowed minimum sprouting even at 50°F in first 3 months of storage.
- When all the cultivars were treated with sprout inhibitor Biox-15 EC and maintained at 38°F they lost less weight. We applied two times to control sprouts in our 6 month storage duration on Masquerade and Purple Majesty when maintained at 38 °F.
- At 38 °F Purple Majesty lost the least weight with EC-40 and CIPC2 and had sprouting in either temperature. Purple Majesty had minimum sprouting at 50 with CIPC2 and CIPC; and lost the least amount of weight with CIPC2.
- DMN is not an effective sprout inhibitor even at 38°F storage temperature.
- In simulated shipment and store display studies Biox-15 EC and 40EC did well and inhibited sprout suppression for 4 weeks at room temperature in Masquerade and Purple Majesty.



Recommendations for commercial storages

- All four cultivars when treated with CIPC and CIPC2 after wound healing and subsequent long-term storage at 38 °F (3.3°C) temperature performed better.
- CIPC and CIPC2 applied when tuber pulp temperature is at 45 55°F had less weight loss and shrinkage.
- Organic sprout inhibitor Biox®- performed better at 38 °F storage temperature on all cultivars.
- Tubers that are stored at 38 °F treated with Biox®-15 or Biox®-40 can extend shelf life 4 weeks
- Masquerade and Purple Majesty treated with Biox®-15 Biox®-40 performed better at room temperature during shipping and store display simulations in terms of weight loss



Recommendations for seed storages

- Short-term organic sprout inhibitors (Biox®-15 or Biox®-40) and synthetic sprout inhibitors DMN tested for seed viability for next season planting. These studies are currently in progress.

Goals and Outcomes Achieved

In the last two years, replicated trials were conducted using organic and conventional sprout inhibitors with appropriate controls. Tubers were evaluated for weight loss, sprout inhibition and sprout length, sprout weight and other storage disorders at 3, 6 and 9 months of storage. We have identified the precise pulp temperature for application of conventional sprout inhibitors in russet cultivars. We evaluated the efficacy of organic sprout inhibitors for the long-term storage.

Long-term outcomes of this project are to develop the market potential of newly developed short-term dormancy cultivars. By extending dormancy, the potatoes could be stored longer, shipped longer distances, and be available to new markets. This should position Colorado's potato industry as more competitive, and enhance overall profitability as a result of increased sales and pricing of the new cultivars.

This project helped in understanding sprout suppression and effective storage management in short dormancy cultivars. We tested and validated information in large size storages for one year. We did not test sprout inhibitors in actual potato storage bins because of volume of potato tubers and the cost associated with it. We need to validate the results in the third year before publishing cultivar specific storage management guidelines for web and grower magazines. Potato packaging warehouses are using Biox® based sprout inhibitors as inline sprays for short-term sprout inhibitors. There is an increase in acreage for three out of four cultivars that we are testing. Last year we experienced severe disease issues resulting in loss of certified seed. But clearly there is a trend indicating an increase in acreages. Soon there will be a need for information on sprout inhibition for long-term storage.

Cultivar	2011 Acres	2012 Acres	2013 Acres
Crestone Russet	13.2	72.13	151.4
Mercury Russet	43.4	263.5	68.3
Purple Majesty	142.9	177.3	83.31
Masquerade	1.37	7.87	2.94

Beneficiaries

The beneficiaries are potato growers of Colorado. When seed growers sell and export these new cultivars to different states those growers will be benefitted. Sprout inhibitor data was presented to growers on a field day at San Luis Valley Research Center. About thirty five potato growers attended the field day along with crop consultants. Recently full report was distributed to the Colorado Potato Administrative Committee subcommittee on Research.

Lessons Learned

1. Tuber weight loss and shrink in russet cultivars s can be minimized if sprout inhibitor is applied at appropriate tuber pulp temperatures.
2. Storing short dormancy specialty cultivars in long term storage can be a real challenge especially when selling for seed.

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Project Title: Nursery Tree Research - Final Report

Project Summary

Above-ground container tree production is a popular way to grow ornamental trees and is used more commonly than field production in many parts of the United States. Some advantages of container production include ease of mobility and handling, less space needed than field-grown trees, greater

consumer acceptance, increased productivity attributed to increased production density and shortened rotation times, year-round harvest, and production of difficult-to-transplant taxa. Container production has also expanded the types of taxa that can be economically produced. A major reason for the adoption of container production is reduced transplant shock expressed as increased transplant survival and reduced establishment time. Transplant shock associated with field-grown material results from the loss of root mass associated with harvesting; up to 95% of the original root volume is lost when field grown trees are harvested according to national standards. Disadvantages of container production include: additional costs for substrates, fertilizer, water, labor and efforts to overwinter materials. Circling and/or malformed roots are often seen with container-grown trees, which can negatively impact the tree health and stability many years following transplanting into the landscape. Finally, it is estimated that 350 million pounds of black plastic (BP) containers are thrown away each year. Traditionally, the majority of container nursery stock has been grown in BP containers. There are numerous production challenges associated with container nursery stock, the most important being the prevention of root malformation caused by circling and matting roots and root injury resulting from extreme winter and summer substrate temperatures. Post-production challenges associated with production in plastic containers include transplant survival and establishment success in the landscape. Poor transplant success (root malformation and poor growth into the native soil) can often be attributed to root-related problems that occur during the production process—especially when trees are grown in plastic containers.

Project Approach

The most commonly used container type for nursery tree production is the black plastic (BP) container. Roots of plants grown in BP can be injured by the wide diurnal temperature fluctuations which occur during most of the growing season. The longer trees remain growing in BP, the greater the potential for the development of circling and malformed roots. Root injury sustained during production may negatively affect tree health when planted in the landscape. Our research used *Pyrus calleryana* Decene. 'Glen's Form' (Chanticleer®) to compare tree production using two non-conventional fabric container types (Root Pouch® (RP), Avera & Associates, Hillsboro, Ore., and Smart Pot® (SP), High Caliper Growing-Root Control, Inc., Oklahoma City, Okla.) along with BP containers. In addition to container type, two overwintering treatments were examined – trees were either consolidated pot-to-pot in a block, or left "lined out" in rows. We hypothesized that the use of fabric containers will reduce the severity of root zone temperature fluctuations seen with BP, promote the development of healthier root systems, enhance tree growth rate, produce trees that show less stress and establish more quickly when planted in the landscape, and eliminate the need for expensive consolidation of nursery stock often done prior to winter in northern production areas.

Trees, planted bareroot in #15 containers, were grown in a nursery production setting using current industry standards. Height and caliper were measured monthly throughout the growing season. A portion of the trees were destructively harvested four and 16 months (September 2010 and September 2011) after planting in containers (May 2010). Trees were planted into the landscape in September 2010 and March 2012; another set of trees was planted in March 2013. The landscape trees will be fully excavated and harvested (after one, two and three growing seasons) through air spading to evaluate transplant root and shoot growth. Post-transplant stress of trees was determined during the growing season using pre-dawn leaf water potential.

Goals and Outcomes Achieved

After the first growing season, there were no differences in height or dry leaf, shoot and root weight among the three containers. Following the second growing season, caliper, height, leaf area, percent leaf moisture, and root ball quality differed among container type. After the 2010–2011 winter, consolidated trees produced larger

root and shoot systems (35.3 and 36.4%, respectively) than trees that were lined out. Substrate temperature maxima and fluctuations during winter and summer were greatest for BP containers compared to RP and SP. At the conclusion of the 2010 growing season, trees in the nursery production study did not differ significantly in subsample leaf area, dry leaf weight, dry shoot and root weight, leader and branch growth measurements, and root ball integrity (how well the root ball held together after removal from the container) among the three container types. There were significant differences for bottom root ball matting, with trees grown in BP having greater matting on the bottom of the root ball than trees grown in RP and SP. In addition, there were significant container effects on the occurrence of visible deflected roots on the outer periphery of the root ball. Trees grown in BP showed greater incidence of deflected roots than trees grown in RP or SP containers.

Overwintering treatments significantly affected tree growth in the second (2011) growing season. Consolidated trees had greater leader growth (67.7 cm) compared to the lined out trees (29.5 cm). Trees in the consolidated group also showed greater dry leaf weight, dry root weight and average twig growth. While there were no overwintering differences on leaf area in 2011, consolidated trees had significantly greater leaf weight (407.8 g) compared to lined out trees (252.9 g). Consolidated trees had 36.4% greater dry shoot weight (1491.1 g) compared to lined out trees (1093.3 g).

Nursery producers are under increasing pressure to maintain production efficiency and grow high-quality plants in a cost effective manner. One cost saving measure may be to switch from solid plastic containers to fabric containers. Due to increasing costs of materials and petroleum, growing consumer interest in sustainable or recyclable products, and awareness that black plastic containers may negatively affect root system structure, nursery growers are looking for alternatives to black plastic containers. We evaluated Chanticleer pear trees in two fabric container types relative to standard black plastic containers over two growing seasons. Pears grown in the fabric containers had greater height and caliper growth and fewer circling roots. Trees not consolidated into a block for overwintering suffered more damage compared to trees that were placed in a consolidated block. Fabric containers should be considered as a production alternative to solid plastic containers.

Beneficiaries

Beneficiaries of this research have included nursery producers who, by using the alternative containers tested in this study, can produce larger plants more quickly, and plants that have healthier root systems. In addition, green industry professionals, including landscapers, arborists, foresters and maintenance individuals, have benefitted from this study. Consumers can benefit from adoption of these alternative containers by the nursery industry, since tree and shrub stock produced using these containers will be healthier and will transplant more rapidly into the landscape – ultimately resulting in healthier landscape plants. Specifically, this research has been presented to the following audiences and venues:

Date	Location	Venue	Audience Type	# of Contacts
March 2010	Fort Collins, Colorado	Horticulture Seminar: Introductory Seminar	Graduate students, CSU Faculty and Staff	12
February 2011	Denver, Colorado	ProGreen Expo: CSU Research Updates	Green Industry	75
September 2011	Hilo, Hawaii	American Society of Horticultural Science: Poster	Horticulture Researchers	20

		Presentation		
February 2012	Denver, Colorado	ProGreen Expo: CSU Research Updates	Green Industry	100
March 2012	Loveland, Colorado	International Society of Arboriculture: Regional Meeting	Arborists, City Foresters, Green Industry	45
July 2012	Miami, Florida	ASHS: Oral Presentation	Horticulture Researchers	25
August 2012	Portland, Oregon	International Society of Arboriculture: AREA student presentation	Arborists, City Foresters, Nursery Producers, Students, Researchers	125
February 2013	Denver, Colorado	ProGreen Expo: CSU Research Updates	Green Industry	65
July 2013	Palm Springs, California	ASHS: Oral and Poster Presentation	Horticulture Researchers	45
August 2013	Toronto, Canada	International Society of Arboriculture: AREA student presentation	Arborists, City Foresters, Nursery Producers, Students, Researchers	120

In addition, the following article has been published in the June 2013, *Journal of Environmental Horticulture*:

O'Connor, A.S., J.E. Klett and A.J. Koski. 2013. Container type and overwintering treatments affect substrate temperature and growth of Chanticleer® pear (*Pyrus calleryana* 'Glen's Form') in the nursery. *J. Environ. Hort.* 31(2): 117-123.

Lessons Learned

1. Growing trees in any container for more than 2 growing seasons produces trees with root systems that are less healthy than trees with shorter production cycles.
2. These alternative containers begin to degrade after two years of production, resulting in tears and broken handles.

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Project Title: Marketing Research & Technical Support for Colorado's Small Acreage, Socially Disadvantaged and Beginning Specialty Crop Producers - Final Report

Project Summary

Efforts to develop local food systems are becoming increasingly prevalent across the United States, and particularly so in Colorado. To effectively develop local food systems, producers require support for on-farm research allowing them to supplement and/or build on research conducted by CSU, as well as to have access to technical support and other resources available across CSU's state-wide academic, research and extension networks.

To continue to drive innovation among Colorado's specialty crop producers, SCBGP funds were utilized to help support a Specialty Crops Coordinator position within CSU's Specialty Crops Program. As part of a full-time faculty position established in 2009 and funded in part by CSU, the Coordinator is central to addressing the needs of Colorado's specialty crop producers and creating synergies within CSU to help realize the substantial potential for specialty crops across Colorado.

The overall purpose for the Specialty Crops Coordinator is to conduct and facilitate research in specialty crop production and utilization, including the application of organic methods, especially for organic and small farm producers. The Coordinator's focus is on solving problems with current crops and on the identification and development of new specialty crop opportunities. Primary emphasis continues to be on vegetable and small fruit crops because of the state's need in this area, and especially because such producers are relatively underserved by current research programs. Research results were delivered to growers through demonstrations, field days, workshops, written and electronic communications and farm visits. Operating costs for cultivar and variety trials research conducted by the Coordinator were funded by CSU.

SCBGP funds were utilized to implement a research and marketing grants program targeted to small acreage, socially disadvantaged and beginning specialty crop producers. Grants were awarded on a competitive basis for purposes of conducting on-farm production and enterprise feasibility studies, and research to complement prior and ongoing research conducted by CSU. Grants were also awarded for the development and implementation of direct marketing and farm-to-market demonstration projects. Producers seeking these grants worked in cooperation with CSU research and extension experts to develop project proposals. Similarly, grant proposals were developed by CSU research and extension experts to work with targeted producers to advance specialty crop cultivar and varietal research and/or demonstration marketing projects.

This project built on specialty crop research and grant programs that has been part of prior CDA SCBGP applications. More specifically, specialty crop funds allocated to Colorado in 2001 as part of a supplemental agriculture appropriations bill were targeted to a grower grants program in cooperation with CSU. More recently though, cultivar trials projects were included in CDA's FY06 and FY07 SCBGP applications and CDA's FY08 SCBGP-Farm Bill application included a project establishing the Specialty Crops Coordinator position. The Coordinator position was continued in the FY09 SCBGP application and included small ,beginning, and socially disadvantaged producer grants.

Project Approach

The CSU Specialty Crops Program approach has been based on three complementary strategies: applied research and demonstration projects; outreach; and applied research and demonstration projects.



Applied research and demonstration of organic production methods for small organic farmers continues to be a focal area of work in the CSU Specialty Crops Program. Projects addressed these needs; including variety trials, experimentation and demonstration of high tunnels and production techniques of hops – a relatively new crop in Colorado. A prototype CSA (Community Supported Agriculture) project also provided small farmers with information about varietal choices, planting dates and expected yields on a wide range of vegetables as well as logistics required for the successful operation of a CSA farm. All work was done on certified organic research facilities (Rocky Mountain Small Organic Farm Project) at the CSU Horticulture Field Research Center (HFRC) near Ft. Collins.

High tunnel demonstration plantings of were evaluated during this period included 21 varieties of tomatoes, 10 cultivars of cucumber, 5 cultivars of asparagus (yard-long) bean, 5 cultivars of okra, and 8 cultivars of pepper. Mitigation of insect vectored diseases and hail damage are two primary benefits of high tunnels, as well as season extension and provision of microclimates amenable to heat loving crops such as okra and asparagus bean.



Demonstrations of market farm scaled crops were done at CSU's Rocky Mountain Small Organic Farm Project site. Artichoke, bean, beet, broccoli, cabbage, carrot, cauliflower, celery, eggplant, kale, lettuce melon, onion, pepper, potato, pumpkin, radish, shallot, spinach, squash, sweet corn, Swiss chard, tomato, cover crops, raspberry, table grape and culinary herbs were grown for demonstration and cultivar evaluation purposes and fed into the CSU CSA. The CSU CSA served as a production and marketing training platform for students, outreach to the local community, and provided valuable

information to local CSA operators regarding cropping systems, variety performance and consumer dynamics.

Demonstration/evaluation of biodegradable plastic mulch (corn starch polymers) used for weed control, soil warming, and moisture retention was added to the production systems component of this project, because of inquiries by local farmers.

Hop variety trials continue to attract considerable attention as a growing number of specialty crop producers consider this new crop. In addition to yield data of well-established plants, a new planting evaluating different fall planting dates of tissue-cultured virus-indexed plants promises to provide interesting new information about use of tissue cultured plantlets rather than traditional rhizome plantings. This information is critical for initiating a clean stock hop program in Colorado and reducing the likelihood of importing diseased planting stock (rhizomes) to Colorado. Colorado produced tissue-cultured hop plantlets represents a support industry responding to the need for disease-free plant material in Colorado and elsewhere.



Selected field research results may be found on the CSU Specialty Crops Program web site: <http://hortla.agsci.colostate.edu/research-programs/specialty-crops/>

CSU SCP engaged in a variety of outreach efforts, including presentations to audiences of over 1500 growers, extension personnel, students, international policy makers and educators. On a

daily basis there is a steady stream of telephone and e-mail requests for specific information about specialty crop production and marketing.

Presentations in 2011 to deliver research results from CSU SCP work included:

- “Organic Winter Vegetable Production in Unheated High Tunnels”
(This program was presented at two separate on-farm short courses in Garfield and Boulder counties in February and March 2011 respectively)
(This project was primarily funded by WSARE (Professional + Producer Research & Education Grant Funded Project) and built on the CSU SCP foundation of work on high tunnels in previous years.)
- “High Tunnels at CSU SCP, 5 years of Trials”
Colorado Big and Small Farm Conference, Adams County: 2/17/11
- “Rocky Mountain Small Organic Farm Project”
Colorado Big and Small Farm Conference, Adams County: 2/17/11
- “Organic Hops Research at CSU”
Rocky Mountain Microbrewers Symposium, Colorado Springs, 2/18/11
- “High Tunnel Specialty Crop Production”
Webinar, (broadcast by CSU extension)
F. Stonaker and Dan Goldhamer, 4/13/11
- “Season Extension Techniques”
High Altitude Gardening Workshop, Nederland, CO
- “IPM for Colorado Hops”
Colorado Hop Growers Association Conference, Longmont, 7/9/11
- “Winter Growing”, Ft. Collins Sustainable Living Fair, Sept, 2011
- “Organic Farming”, Front Range Community College, 11/28/11

Presentations in 2012 to deliver research results from CSU SCP work included:

- “Fertigation Using Drip Irrigation”, Agriculture Big and Small Conference, Brighton, CO, 2/16/12
- “High Tunnel Production Panel: Pest Management”, Ag Big & Small, 2/16/12
- “Organic Vegetable Production”, Front Range Organic Growers, Denver, 4/16/12
- High Tunnel Field Day, HFRC, CSU, 4/21/12
- “Garlic Production”, Montrose Farmers Market Association, 9/8/12
- “Soil Fertility in Organic Systems”, Montrose Farmers Market Assoc., 9/8/12
- Rocky Mt Small Organic Farm Field Day, HFRC, CSU, 10/

The CSU SCPGP Grower Research and Education Grant (GREG) program was launched in 2002 with USDA SCPBG funds allowing specialty crops farmers and marketing interests to study a wide array of opportunities to enhance their competitiveness. Including the 2012 round of awards, CSU SCP has awarded 88 GREGs. These projects have been very impactful for nearly all of the participants and other producers that have utilized the information resulting from these farmer-driven research projects. In 2010 the target audience for CSU SCPGP GREGs narrowed to target “small, new or socially disadvantaged farmers”.

In February 2011, a panel of CSU faculty reviewers awarded six GREGs after a call for proposals resulted in 11 proposals submitted from around the state. The relatively low response rate was attributed to the narrow target audience of this RFP.

The following projects were awarded for 2011:

- Recruiting, curriculum and mentoring program development: Boulder county farmer cultivation program, Dave Georgis, PI. The award was \$10,000.
- Growing root crops for vegetable storage and wholesale market, Mike Nolan, PI. The award was \$10,000 and has been extended from 1 to two years because of weather related interruptions in the project plan.
- Youth led urban farming and produce marketing initiative, Leah Bry, PI. The award was \$10,000.
- Best practice development for micro farms: making urban CSAs sustainable, Tracy Sweeley, PI. The award was \$7,400.
- Profitable berry production in Colorado, Beki Guion, PI. The award was \$10,000.
- Low tunnel shade project, Kevin Lindahl, PI. The award was \$2,600.

The following projects were awarded for 2012:

- The effectiveness of a frost free zone in high tunnel growing in winter, Sandy Charles, PI. The award was \$7,500.
- Development of a locally grown, sustainable potato market in Colorado utilizing on-site farm education, U-pick programs, farmer’s markets, and organic production coupled with innovative marketing, Dawn Jump, PI. The award was \$15,000.
- Chicken moat for pest management, Karen Spencer, PI. The award was \$4,182.
- Risk mitigation and season extension for direct market crops using caterpillar tunnels in northern Colorado, Katie Slotka, PI. The award was \$5,818.
- GreenLeaf 2012 consumer education and outreach project, Lea Bry, PI. The award was \$7,500.
- Market and marketing potential for northern Colorado specialty crops producers through the Fort Collins Food Cooperative. The award was \$10,000.

Copies of the GREG final reports are posted on the CSU SCP web site:<http://hortla.agsci.colostate.edu/research-programs/specialty-crops/>

Specialty crop projects supported by GREG program grants are monitored through: 1. the involvement of the Technical Advisor, and 2. site visits made by the CSU SCPGP Coordinator. The CSU SCPGP Coordinator made annual farm visits to all SCP GREG recipients, as well as GREG recipients from previous years. During these trips around the state he also met with regional extension agents and CSU AES scientists participating as technical advisors on these projects to

discuss the progress being made. These linkages between CSU SCP, grower, and extension personnel around the state have become valuable connections for all involved – leading to collaborations and improved communication.

The site visits are particularly important in assuring that all projects not only are focused on the agreed upon objectives, but also that all USDA program guidelines are followed. For example, certain projects, while clearly designed to enhance specialty crop production in Colorado, may have approaches, titles, etc., that might raise questions in this regard. Examples include “Recruiting, Curriculum and Mentoring Program Development”; “Greenleaf 2013 Consumer Education and Outreach”; and “Chicken Moat for Pest Management”. The site visits help confirm that these and other projects are focused solely on Specialty Crops per se. SCP Coordinator visits to the sites also provide assurance about appropriateness of expenditures and project management that accounting information may not provide.

Goals and Outcomes Achieved

The objectives of the CSU SCP are to increase competitiveness of specialty crop producers in the state by facilitating farmer-driven innovation, providing technical expertise, and by conducting applied research and demonstration projects, expose specialty crop producers to new and innovative methods in production and marketing. The three-faceted approach, i.e. applied research and demonstration, outreach, and providing funding for on-farm research and innovation through the GREG program, has helped achieve program goals.

Among the Expected Measureable Outcomes has been sustained effectiveness of grower education, especially through the annual CSU Specialty Crops Field Day (a range of participants from 110 to 146 over the reporting period), and Colorado Agriculture Big and Small presentations (to audiences ranging from 70 to 120 producers).

Beneficiaries

Beneficiaries of the CSU Specialty Crops Program activities from 2011 – 2013 include the GREG recipients; new, small or socially disadvantaged operators that have far fewer resources and support than many of their larger, well established competitors. This group of producers needs to be especially creative and innovative in order to find profitable and sustainable paths. Just as importantly, it needs to have technical expertise available, founded on applied research that is appropriate for their scale and regional uniqueness.

Beneficiaries also include those students and guests attending outreach functions of the GREG recipients. Remotely, web browsers search for and find useful information provided by the GREG participants and by the CSU SCP. Through this overall approach, the number of beneficiaries quickly multiplies into the thousands.

Lessons Learned

Perhaps the clearest lesson learned during the reporting period is the high value of the CSA, especially as a platform for reaching an engaged audience and clientele. Its demonstration, as well as research importance became most obvious when it was discontinued. Accordingly, we are planning to re-institute the CSA for the 2014 growing season.

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Project Title: Stock Seed Variety & Market Development – Final Report

Project Summary

Colorado's organic farmers are faced with limited choices of high quality organic seed. The Family Farmers Seed Cooperative requested funding to establish a stock seed variety program, encompassing product development, a marketing campaign and possible sales. Long term FFSC would like to become a national supplier for premium organic specialty seeds which will return better prices for its farmer members, create rural jobs, assist organic vegetable growers in coming into compliance with the National Organic Program seed rule and place new vegetable seed varieties in the public domain.

Project Approach

The first step to the program was to establish stock seed guidelines with the assistance of the Organic Seed Alliance. All FFSC stock seed growers are required to follow the established procedures such as population sizes and isolation distances throughout the growing season.

In 2011, variety trials were conducted by growers in Colorado and Maine for 14 vegetable crop types, and included nearly 100 varieties at each site. For each crop type, there was at least one, and sometimes several varieties that FFSC is currently producing, or interested in producing in the future. These varieties were compared with industry standards in each crop type. These trials are helped to decide which varieties needed more selection, and which ones were ready for stock seed production. To date FFSC has identified 20 varieties from 14 crop types that will be undergoing selection in 2012. Many will require 2 or 3 more selections before they are ready to produce stock seed.

Quality Assurance trials conducted by FFSC members focused on evaluating vigor and true-to-typeness. Of the 38 lots produced in 2011, 28 were placed in QA trials in winter sites with a December, 2011 planting. This enabled management to have seed available for sale in Spring, 2012. These sites were in Mexico (bean, melon, pumpkin, squash, tomato), New Mexico (kale, lettuce, Swiss chard) and California (carrot).

FFSC displayed advertisements in several publications, sent emails to NOP certified farmers nationwide updated the www.organicseedcoop.com website, and created a website store to promote sales.

Goals and Outcomes Achieved

As a result of the funding the Family Farmers Seed Cooperative was able to substantially build its seed offerings, engage and retain staff, expand membership and begin to market its products.

Due to the long distances and busy schedules of the members during the growing season it was not possible to determine variety release terms.

Desired Outcome	Performance Measure	Baseline	Goals	Actual
			2011	2011
To develop a stock seed program through variety development and grower training	Follow research and development stringent stock seed protocols	No baseline exists	Produce 15 stock seed varieties and train manager and 10 growers in stock seed management	20 varieties produced
Establish quality assurance trials	Utilize industry standard replicated trials	No baseline trials exist	Trial 30 member varieties with standards	28
To increase Colorado member's customers through development of a farmer to farmer marketing campaign	Survey members in fourth quarter 2011	No baseline data exists	Identify baseline number of customers	200
To determine variety release terms	Review Open Source software with other models and create draft licensing agreements. Review through legal experts and organic stakeholders	No model exists in the state	Create model for investment and ownership that enhances agro biodiversity	Release terms were not determined due to members schedules

Beneficiaries

The beneficiaries of the project are the cooperative members, the Organic Seed Alliance, other breeders and the eventual customer who can purchase online.

Lessons Learned

Many of the objectives were accomplished but the time it took to share information among the members was not factored into the initial proposal. Marketing efforts will be continued and working capital raised to recruit new members.

Contact Person

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Project Title: Farmer Approved Marketing & Distribution – Final Report

Project Summary

Farmers of fresh, organic Colorado-grown produce find themselves competing against one another and duplicating marketing and distribution efforts because there was not a distribution method or model to adequately serve their needs.



Working together for production planning, coordinated marketing and distribution farmers can plan their production in a way that will avoid duplication, allow them to jointly offer a wider variety of produce and develop sufficient economies of scale to sustain an integrated long term, farmer driven cooperative system.

Project Approach

To make this project successful it was necessary to create a campaign with a guide, logo, website and the purchase of a delivery truck.

NewFarms and the Arkansas Valley Organic Growers (AVOG) designed a professional logo and website at www.arkvalleygrowers.com. A basic toolkit was created that included 15 annual deliveries from AVOG, numerous issues of the newsletter “Farm Beet”, menu decals and posters. Sixteen accounts were registered for the toolkits, most participants were restaurants in the Colorado Springs area. The materials and participants were supported by press releases, public radio advertisements and logos.

The infrastructure analysis showed an immediate need for a delivery vehicle, access to a commercial kitchen and future need for cold, frozen and dry storage. Previously the cooperative utilized a third party distributor but found that problems with customer service and quality were too numerous. Financing was secured and NewFarms purchased a refrigerated truck and leased to AVOG. In the future the construction of a Farm Service Center may be possible as well.

Finally a distribution guide outlining tips for a low overhead farmer marketing and distribution cooperative was created. To date two producer start up groups have utilized the information.

Goals and Outcomes Achieved

Desired Outcome	Performance Measure	Baseline	Goals	Actual
			2011	2011
To develop marketing and distribution plan	Conduct a SWOT analysis (strengths, weaknesses, opportunities and threats)	No baseline has been established	Marketing & Distribution Producer Group Established	Created Toolkit and SWOT analysis
To increase member sales	Track annual sales	\$42,300 (2009)	Maintain same sales level	16 accounts were enrolled which accounted for a 44% increase

To develop and distribute Resource Guide	Document operational processes and examples	No baseline has been established	Distribute through state and regional channels*	Resource guide assisted in 2 start-up groups (15 producers)
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Beneficiaries

The beneficiaries for the project are the participating farmers (8), the restaurants (16) receiving the shipments, customers at those restaurants (unknown number), and new farmers coming into the program (3).

Contact Person

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Project Title: Plant Select Marketing Development – Final Report

Project Summary

Though Plant Select® officially began promoting plants in 1997, little in the way of paid advertising or marketing efforts had been undertaken prior to 2009, primarily because there was no one person responsible for administration of the program. Once an Executive Director was hired in 2008, more programs and marketing projects became manageable, but additional funds for marketing were necessary in order to have a strong impact on the market already established. At the time of this grant proposal, Plant Select® had 38 growers and just over 30 participating retail members, and over a million plants were reported sold. As most of the growers and retailers were Colorado-based, it was hoped that new and increased marketing efforts from grant-funding would lead to increased sales for all Plant Select® members/partners.



Project Approach

The marketing strategy for this grant included a variety of efforts including paid print & radio advertising, booth displays and presentations at regional trade shows, new point of sale materials, increased and enhanced plant displays at regional demonstration gardens, an enhanced website, hosting an industry-wide event at Denver Botanic Gardens, official partnerships with statewide related associations, and development and production of brochures.

Radio advertisements were done on KEZW's "Ask the Garden Pros" in Denver, and KSL's "Larry Sagers Greenhouse Show" based in Salt Lake City. Overall the listeners were older and not as interested in the web as expected. Print ads were done in Zone 4 magazine and Colorado Gardener. The print ads were well received and worthwhile for the markets targeted.

The booth displays and POS materials provided a positive venue for Plant Select displays but the presentations provided the best opportunities to discuss products.

Utah Nursery & Landscape show, January 2011



ProGreen (Denver), 2011



High Plains Landscape Conference (Fort Collins), 2011



The new website design has increased visits by 11% in 5 months over the previous year. The time visitors are spending on the website has also increased. Combined with Facebook and the photo contest these have been successful parts of the marketing strategy. The enhanced website address is www.plantselect.org.



The print brochure continues to be very popular and is the single most widely distributed marketing piece for Plant Select. Each of the marketing strategies provided a good beginning to new partnerships and relationships formed through the activities.

Goals and Outcomes Achieved

Unfortunately the new web design did NOT include Search Engine Optimization (SEO), so Google did not pick up many pages for 4 months until that lack was realized. Web visits goal was not realized, though the new e-newsletter subscriptions were well above the stated goal. (With new SEO in place, web visits have increased over past history at this point.)

The goal to increase consumer demand (measured by grower sales reports) by 22% was not met, suspected to be due to the recessionary economy and unsettled, wet spring. Reported sales increased by 8.5%.

Desired Outcome	Performance Measure	Baseline	Goals	Actual
			2011	2011
To increase member base (retail, wholesale and affiliates)	Track Plant Select members	38 (2009)	48	61 (54 + 7 Landscape Professionals= +60.5%)
To increase nursery/landscape professional brand awareness	Survey green industry professionals before and after campaign	Initial survey will establish baseline	Increase awareness by 5%	No survey was conducted; website & e-newsletter analytics were used instead
	Number of professional e-newsletter subscriptions	140	175	245 (+75%)
To increase consumer brand awareness	Track annual website hits	40,165 visits	50,206 visits	48,813 (up 21.5%)
	Number of regular e-newsletter subscriptions	270	338	611 (+126.3%)
To increase consumer demand	Track annual unit sales	1.5 million units	1.8 million units	1.59 million units (+8.5%)

Beneficiaries

Primary beneficiaries of this project are the Colorado propagators, all retail and wholesale sellers as well as the demonstration garden partners and the end consumer.

Lessons Learned

- The new website design should have been reviewed by an SEO web expert before launching in spring.
- The internet, including e-newsletters, enhanced website, Facebook and Pinterest participation, blogs and more are the most effective means of reaching the greatest number of people.
- Understanding that the target market includes somewhat experienced gardeners in their prime earning years, Colorado Gardener and Zone 4 are effective avenues for print advertising. Radio listeners are generally older, less tech-savvy, and are in their declining earning (spending) years (or retired) and less likely to be investing in their landscapes.
- The goal to perform trade surveys for brand awareness was over zealous. Surveys are costly and difficult to perform, and participation is often too low to be reliable.
- Out-of-state efforts were time-consuming and did not lead to results as great as expected. With ongoing efforts, out-of-state retail membership would eventually increase (leading to increased sales), but the efforts are not cost effective at this time. It has taken 15 years of dedicated efforts from many individuals and companies to reach such great success in Colorado – it will take similar efforts in the rest of the region to mirror that success.
- Advertisements in national trade publications are cost prohibitive and have limited impact.
- Efforts to increase professional brand awareness are very difficult. The nursery and landscape industry is fragmented and consists of many smaller organizations who are extremely busy and inundated with information. The challenge still is to find effective methods to work with professional landscape designers and architects to increase their use of Plant Select® plants. At this point, trade show presentations are probably the best means of reaching the largest number of engaged professionals.

Contact Person

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Project Title: Specialty Bean Marketing Plan- Final Report

Project Summary

In December 2010, Rio Culebra Agricultural Cooperative (RCAC) of San Luis, Colorado, launched a line of heirloom specialty crops raised by producer-owners of the cooperative. The resulting products are produced on a small scale by individual producer owners of the cooperative. These crops are culturally significant to Colorado's food traditions and have been adapted to the region's high mountain climate and elevation over the past 160 years. To adequately market and promote these products, the Cooperative used funds from the specialty crop grant to expand sales and distribution of its specialty products.

Bolita and Haba beans are varieties of specialty beans adapted for high elevation growth and short growing season. These bean varieties were first planted in the area in the 1850s, having been brought by the town's original Hispano settlers. The beans are presently planted by hand and harvested by combine, although appropriate technology improvements are underway. RCAC purchases the beans from the producers, packages them, and then markets most direct to consumers.

Project Approach

Summary of activities and tasks covered, as detailed in the Work Plan.

Expansion of Distribution. The new products have been introduced at 3 farmers markets, 2 in Colorado and one in New Mexico. Sales of the products are steady, with many repeat buyers. The Coop has also launched an online marketing presence at www.rioculebra.com, with bolitas and habas sold direct to consumers. The Coop has also been selling bolita and haba beans through regional specialty shops and grocers. RCAC has been involved in networking through other groups whose participants may purchase the product, including Slow Foods and The San Luis Valley Food Coalition.

Development of Marketing Materials. RCAC used funds from the grant to develop packaging and sell sheets for the products. Funds were spent to develop marketing material, including packaging design. Funds were also used for the purchase of labels, bags and delivery cartons.

Public Relations. Funds were used to get articles about the products to the print media. A newsletter with updates for producers and on products has been created and an email contact sheet is being created to update customers and project contacts regarding the progress of crops and other pertinent information. Along with this, Facebook and other online marketing tools were developed.

Goals and Outcomes Achieved

Initially our goal was:

- to have product distributed in 30 markets.
- to increase the number of producers from 10 to 30.
- to increase annual on-farm returns from \$2,000 to \$25,000.

In total, including farmers' markets, local food shops and other local retailers, we are about 80% of our distribution goal. We are continuing to service accounts. We are steadily increasing online

sales of products as well as retail distribution. We will continue to collect data on sales by outlet through our planning and budgeting processes.

Growth in the production base has been significantly hindered because of the drought. Initially, we had hoped to expand our production base from 10 producers to 30. Further, we had hoped to expand output per farm from about \$2,000 per farm to \$25,000 per farm. We track purchases and farm output through our cooperative's accounting process. We will continue to monitor.

Some of the farm operations participating in the pool have been able to supply amounts of product valued at slightly more than the baseline. Others have been devastated. This year, with water, we anticipate about 20% greater output than the baseline.

In 2011 and 2012, adequate supply has not happened because of limited water availability in the region. The drought has significantly reduced the available supply of water for the farm families. Growing legumes at a high elevation with the resulting short growing season requires an adequate supply of water.

However, we are hopeful for this next year. In 2013-14, we intend to expand the product line to include a cultural heirloom—a dried legume, *al'berjon maduro*. Having multiple facings at the retail level is beneficial.

Beneficiaries

This project benefitted specialty crop producers of the Rio Culebra Agricultural Cooperative. Members of the Cooperative raise specialty legumes. Specifically, about 10 different members supplied specialty crops to the project over the two-year period of the grant.

Fundamentally, though, the project helped set the stage for future growth of the Cooperative and its membership base. This project was important because it allowed us to develop high-quality packaging materials, develop sales and marketing tools, and “get the word out” through public relations efforts about our products and our region.

Lessons Learned

1. Severity of Impact from drought. We knew that there was the possibility of drought, but could not forecast the impact on this project. It had a material impact on the availability of raw materials. If anything, we learned which producers were able to pull through and deliver product because of their access to water.
2. Public relations were more difficult than anticipated. It made us realize that long-term media relationships need to be cultivated and fostered. It is difficult to simply submit articles for publications, or article topics.
3. We did learn the importance of “allocating” our product through different markets. During the summer months we could sell a lot of product through the farmers' markets and then have little left for our retailers and specialty shops.

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Project Title: Educating Consumers about the Benefits of Sod – Final Report

Project Summary

The purpose of the specialty crop grant received by the RMSGA was to develop an online outreach program to educate consumers about the benefits of sod and how the use of sod can serve to conserve water resources. This project was aimed to position RMSGA as the "go-to" experts in their field which will help drive sod sales, as well as promote conservation of water resources.



Project Approach

Step one of the grant focused on updating the official website of the RMSGA to enhance search engine optimization. The website is the RMSGA educational conduit to the general public. In April of this year, the RMSGA completed the successful upgrade to include coding and keywords that would increase the number of hits the website receives. Dr. Tony Koski, with Colorado State University, worked with the RMSGA to ensure that the content was accurate as well as providing expert advice and input. He also provides information for articles that appear on the website.

Google Analytics was utilized to have a better understanding of how people are using the site, where they are coming from, and how many visitors view the website each week. Information was updated and the site was made more visually interesting, with new information. A feature that was added last year, allowing individuals to submit questions, was included but did not draw significant activity. The questions that were received were put out to members who are encouraged to make direct contact with the individuals.

Last year, in order to create a baseline concerning possible increased sod sales, Dr. Tony Koski conducted a survey of all Colorado sod growers. Questions concerned current and past production acreage, total acres sold and total sales figures for 2009. This year Dr. Koski again conducted the survey to determine any changes. The survey was sent out in October asking about sales in 2010 and 2011 with predictions for 2012. Due to funding issues resulting in time constraints on Dr. Koski the survey has not been fully completed. There are approximately 40 sod growers in the state of Colorado, surveys have been received from 10. Last year, 20 surveys were returned. The survey will be done each year and comparison data will be built to better understand what is taking place in the sod industry in Colorado. .

Goals and Outcomes Achieved

Although the overall numbers were down from 2010, it is interesting to note that there was a significant increase in the percentage of visitors who found the RMSGA website through search engines. This year 21% of the visitors arrived through search engines. This reflects the effort made to increase search engine optimization, a low cost means of increasing the hits on the website.

Due to the implementation of Google Analytics, we were able to see where visitors were spending most of their time. Other than the home page, visitors were viewing the watering tips page the most. Through this it was learned which of the campaigns was working most effectively. This information will be useful to RMSGA for future advertising.

The RMSGA issued RFPs in early April to Denver area television stations. Media outlets were selected based on the effectiveness of campaigns from the previous year. As the RMSGA had

only \$10,000 in funding this year, only the top two stations were selected based on monitoring of the campaigns and information received through Google Analytics.

KMGH - http://images.ibsys.com/prod/den/2011/rmsga/278204/rocky_mtn_160x600.html

KUSA - <http://www.9news.com/sales/sod/default.asp>

Note: The baseline number of 15,000 in 2009 was in error based upon faulty calculations concerning weekly hits. The average was actually 540 hits per week on average.

Desired Outcome	Performance Measure	Baseline	Goals	Actual
			2011	2011
Increase visits to the RMSGA website	Number of average weekly visits to the RMGA website when supported with online advertising	Tracking at around 15,000 in 2009 *see note above	Goal was listed at 30,000, but this was based on inaccurate numbers. We achieved average of 652 per week and increase over last year	Used Google Analytics for 2010 and 2011. 2011 experienced significant decrease
Increase prospective business referrals to members	Number of click throughs from RMSGA website to member sites	No baseline data currently exists	180 was the goal. We had 15 referrals.	This year we received 20 inquiries referred out to members
Develop awareness of, and credibility for RMSGA members as the "go-to" experts in their field	Number of queries received through RMSGA function where visitors may ask questions	12 queries in 2009	100 - again, our goal was too large as we had 15 contacts	This year we received 20 inquiries as stated above. However, in addition to this we received contacts from reporters inquiries from other organizations and continued support from the media in terms of contacts for information
To increase the credibility of the RMSGA by consumers, government entities and other related organizations	Number of related industries utilizing the RMSGA website and/or referring others to the website	6 industries in 2009	20 We tracked a total of 8 different organizations actively using the site	We continue to work with CSU, Green CO, ALCC and others

Beneficiaries

In addition to supporting the sod industry, the beneficiaries of this project are those individuals who learned how to properly care for their sod while conserving water. All of us benefit from water conservation. The Rocky Mountain Sod Growers estimates that there area between 40 -

50 sod farms in the state of Colorado. They should have all received positive benefit as well as seed providers, fertilizers, equipment, workers, etc. This would also include landscapers who use sod.

Lessons Learned

While it was understood at the beginning of the project how difficult it is to educate individuals who have received misinformation for so long, it was surprising how difficult it actually is in the current economic climate.

Looking forward, the RMSGA will be making decisions soon concerning how to best promote the industry in 2012 without a grant. In previous years, members have been asked to donate additional funding to promote the sod industry. It is unclear if this will be feasible in 2012 due to the poor economy. Plans are being developed to continue to maximize search engine optimization as the RMSGA. Earned media opportunities will become a greater focus as well.

Funding has enabled the organization to again put out the message that sod is not bad for the environment. However, once again, sod sales are down. A continuing poor economy, less funding for RMSGA promotion as well as individual members' promotion and continuing attacks on grass have made it a very difficult year. Housing permits are the lowest they've been in most of our lifetimes. Even when the economy begins to turn around, and more permits are pulled, sod growers generally experience an 18 month delay before their product is purchased.

Additional Information

The original website was www.rockymountainsodgrowers.com. A new website has been developed so the old site is no longer available. The new website as of January 2012 is www.sod-growers.com.

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Project Title: Enhancing Specialty Crops for Youth in Food Deserts – Final Report

Project Summary

A recent study by The Food Trust (funded by the Colorado Health Foundation) found that a high number of areas in Colorado are without supermarket access. These “food deserts”, especially those in lower income neighborhoods, negatively impact people’s ability to obtain fresh fruits and vegetables that are necessary for a nutritionally adequate diet. Increasing access to nutritious food in low-income, food desert communities is a stepping-stone toward reducing the rate of chronic disease found among these residents.



Slow Food Denver has cooperated in the Denver School Garden Coalition with Denver Urban Gardens, Colorado University’s Learning Landscapes and Denver Public Schools for 10 years to build and conduct school garden programs in Denver Public Schools. This program teaches students how fruits and vegetables are grown, how to enjoy them using many ethnic recipes and the health benefits from eating fresh produce.

The lack of supermarkets in low-income neighborhoods means that residents must shop at convenience and corner stores. These “mom and pop” storefronts do not have the infrastructure necessary to sell produce. These operations do not have dedicated refrigeration for storage of fresh produce and their shelf space is committed to products like candy, snacks and canned goods.

Project Approach

Activities included using the Youth Farmers Market (YFM) model at DPS schools in low-income neighborhoods to increase the access of Colorado grown produce, the awareness of the health and economic benefits of purchasing Colorado-grown produce. The goal was to build upon the successful YFMs to create a low-cost, accessible model that included school community outreach, marketing initiatives, education and innovative approaches to produce sales. Several low-income neighborhoods identified by the Food Trust study as being “food deserts” with little or no access to fresh produce were targeted. There were also 10 schools that have been defined as being food deserts by The Food Trust study. While in the past all YFM leaders were volunteers, the specialty crops grant allowed a stipend to be offered to the YFM leader at each school as an incentive to host YFMs.

To prepare the schools to host YFMs, Slow Food Denver and Denver Urban Gardens teamed up to deliver a 2-hour training program. In this program, details were provided on: 1) how to recruit students to help in the YFMs; 2) how to design a YFM farm stand; 3) how to market and promote the YFMs to the community; 4) how to order farm produce from the produce truck; 5) how to price and sell the produce; and, 6) how to track sales and community participation in the YFMs. A big part of the training was how to market the YFMs in the community. The most successful marketing strategies came from the school and were targeted to their immediate community. Efforts like announcements in the school newsletter or electronic mailings, student-created posters, flyers to local businesses and postings in neighborhood newspapers have been the most successful and within the capacity of most schools to implement.

To supplement the school garden produce and to provide for a full-scale market stand, Slow Food Denver and Denver Urban Gardens worked together to execute a distribution system of local farm products. Briefly, Slow Food Denver would post availability of local farm products to the school sites, which would order produce items from Slow Food Denver. During the YFM

season, a volunteer from Slow Food Denver would drive a rental truck to 3-4 farm sites north of Denver to pick up necessary produce and pay whole sale prices. The truck would return to a central cooler operated by Denver Urban Gardens and volunteers would meet to help sort the produce into individual school orders. YFM leaders would then pick up their produce orders from the cooler on the day of their market and would pay Slow Food Denver for the produce.

For the schools, one of the challenges is to develop an awareness of the value of purchasing Colorado produce. To increase participation, vouchers were given to exchange at the next YFM for a bag of produce (value \$5) in the neighborhoods around all our targeted schools. At their first visit to the YFM, families could also sign up for a Frequent Visitor punch card. With the punch card, after the 4th and 8th visit, families would receive a free bag of produce (value \$5).

An important component of the project involved educational materials and opportunities for YFM participants. With the help of chefs from Slow Food Denver, Johnson & Wales culinary program, restaurants like Noodles & Co. and community members, cooking demonstrations and tastings were held at a large number of the YFMs. In addition, nutrition education programs like Cooking Matters Colorado provided handouts and displays to bring the message of the health benefits of locally grown produce. Recipe cards were available for most produce items so that families could try new items at home. The work plan included YFM marketing packages, training workshops, a truck ordering and delivery system and tracking of data.

Goals and Outcomes Achieved

*Produce was from local farms, the total value from Colorado farms in 2011 was \$16,744 and represented 21,508 pounds of produce sold.

Desired Outcome	Performance Measure	Baseline (2009)	Goals	Actual
			2011	2011
To increase YFMs in food deserts	Number of YFMs held	32	64	141
To increase specialty crop producers that participate	Number of CSA participants	20	40	Produce was from local farms, the total value from Colorado farms in 2011 was \$16,744 and represented 21,508 pounds of produce sold
To increase specialty crop sales	Value of sales at FYM's	\$14,000	\$20,000	\$26,312.73

Beneficiaries

The beneficiaries of the project are numerous, the local farmers selling produce, the YFM and its customers, the participating schools, chefs and the communities where the YFM's are located.

Lessons Learned

At least one of the marketing efforts did fail to produce positive results in YFM attendance. The frequent visitor Punch Card system would reward at least four visits to the markets with free produce. Many of the YFM leaders found this program hard to implement as a number of customers would lose or forget their punch card each week. Or if the YFM kept the card, the rapid business made it difficult for the students to manage the card file. Several YFMs got creative and used the punch card money as a reward for impromptu YFM Quiz games to test the knowledge of customers about fresh fruits and vegetables. These games about healthy eating could be used in future markets as an incentive to bring customers to the markets.

At one site, Johnson Elementary there were difficulties attracting customers. This put a financial burden on the market leader because the market was not able to cover all of its costs. Johnson Elementary is located in a low-income community with 96% of their students qualifying for the Free and Reduced Lunch program. However, it is located on the edge of a food desert and many of the residents travel to the reduced price grocery stores in the neighboring area. This creates a competition for the market, which limits the number of customers. This problem was partially solved by the Coalition members helping the market leader make price-conscious purchases of local produce.

It will be a challenge to fund the YFM truck and the people to run the farm pickups. It is ideal to have the same crew on the truck each week to be consistent with the pickups and selecting quality for the markets. A stipend of some sort will make it easier for this crew to be available each week.

The capacity of DUG's central cooler presented another lesson. This cooler has been an important part of the YFM truck system as it allows us to make one trip to the farms each week and then store the produce at one central place. This year there were weeks when the cooler was packed to the limit with produce waiting to be picked up.

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Project Title: Specialty Crop Test Plots – Final Report

Project Summary

In the Republican River Basin of Colorado water supply is dependent on one main source; the Ogallala Aquifer, continuing depletion presents a serious threat to agriculture in northeast Colorado. Nearly one-half of all acres in crop production in the District are irrigated, so any restrictions on water use significantly and negatively impacts yields and producer profitability. In recent years there has been increased pressure on irrigators to conserve water to assist in efforts to achieve compliance with the Republican River Compact Settlement Agreement of 2002 and decrease their dependency on the declining aquifer. Producers have developed a heightened awareness and willingness to make changes to traditional cropping systems. At the district's local workgroup and focus group meetings there has been significant interest in lower water use, value added specialty crops. In response to these issues, the Yuma Conservation District began the Low Water Use/High Value Specialty Crops Test Plots in 2009.

Project Approach

In 2011 twenty four crops and fifty two varieties were grown. The District hoped to find several new crops for the area which were regionally & economically feasible for producers to adopt. Since the success of the 2010 Specialty Crop Test Plots three area producers grew a variety of crops featured at the test plots in the 2011 growing season. Crops included heirloom tomatoes, egg plants, shallots, garlic, peppers, and one producer started some green house plants to sell to local gardeners. After the growing season the Test Plot Coordinator visited with growers and they plan on continuing with specialty crops for the 2012 growing season. These growers took advantage of the Yuma Farmers Market to sell their produce. Crops were researched, seeds, plant stock and rhizomes were ordered, some crops were started at a local greenhouse, planting was completed, weeding and data recording are ongoing. Field day was held Friday, August 19th at 9:00 a.m. Harvest was ongoing as appropriate throughout the growing season. Finally a Test Plot results book was published and distributed.

Goals and Outcomes Achieved

The main goal was to identify specific specialty crops that were viable in the region. Crop varieties were selected, ordered and planted for research. The general care of the crops is ongoing. Inputs are being tracked and not all outcomes are measurable at this time.

Desired Outcome	Performance Measure	Baseline	Goals	Actual
			2011	2011
To identify specialty crops with potential for production in eastern Colorado production systems	Number of specialty crops determined to have potential for production	No baseline data currently exists	At least 5 crops	6
To increase local producer awareness to the economic potential for incorporating vegetable, floral and nursery crops into their operation	Number of producers that log in to access yield data on REACH Hub online database	N/A	25	There were problems with the database, however 60 people attended annual meetings
To increase producer trial of new vegetable, floral or nursery crops	Number of producers planting at least a test plot of a vegetable, floral and/or nursery crop	0	3	5

Beneficiaries

There are currently 5 producers that have begun specialty crop production as a result of the research, more are expected in the future.

Lessons Learned

The majority of plants selected are going to prove to be a good fit for the region. The largest obstacles for increasing the production of specialty crops for the region will be marketing, insurance, lending practices, packaging and processing facilities and an overall willingness to step away from the production of commercial commodities.

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Project Title: Farm to School (Year 2 of 3) - Final Report

Note: This is the final report for Year 2 of this project. Work completed in Year 1 was used to complete objectives in Years 2 and inform Year 3 as well, under separate contracts. Year 2 is funded through FY10 SCBGP and Year 1 and Year 3 through FY09 SCBGP (please see progress report submitted to USDA). Years 2 and 3 have different goals and objectives from Year 1. Information from Year 2 is reported here and information from Year 3 will be reported in the FY09 Final Report.

Project Summary

The time has never been better to create local specialty crop markets aimed at the one of the largest public institution entities: Colorado K-12 schools. Research shows that schools across the nation and in Colorado are ready to change their school food services to offer local, fresh produce in school breakfast and lunch programs. The impetus for change is the escalating health epidemic of childhood obesity, which is now considered one of the most pressing health problems facing the U.S. Across the nation, state efforts to address the epidemic include curriculum standards for physical education, increased support for local agriculture (including transportation infrastructure to move local produce to local markets), marketing/advertising of local foods (e.g., via farmers markets, or labeling such as “Colorado Proud”), and K-12 school meals. By far, the most common efforts are aimed at building local agricultural markets to provide fresh, nutritious foods for K-12 school lunches and snacks.

Colorado research demonstrates an untapped market for local producers specific to FTS. In a 2006 survey of over 100 school food managers, 53% percent stated they had a very high interest in FTS. Another 36% were moderately interested. Of these, 26 requested help in identifying local producers and technical assistance in setting up a FTS. On the supply side, the 2007 survey of 344 Colorado producers found 40% were interested in selling to Colorado schools, but only 5% were directly selling to schools, and nearly all of those 5% wanted to increase their sales to schools.

The work of Year 2 (completed in 2011) built upon the foundation laid in 2010, under the first year of SCBGP funding. In Year 1, the *Farm to School: New Markets for Colorado Specialty Crops* initiative (Colorado Farm to School, or COFTS) focused on identifying partner communities, developing initial tools and resources for farm to school toolkits, collecting baseline information from producers and school districts, and initiating partnerships and channels of communication for the dissemination of tools created. In Year 2, Colorado Farm to School has focused on adding tools and exploring new ways to disseminate tools through expanded partnerships that make farm to school more accessible across the state, rather than only to individual districts or communities. Specifically, Year 2 has focused on finalizing and broadly disseminating farm to school toolkits, expanding communications and partnerships, collaborating with existing and new state-wide food systems entities, and continuing technical assistance to producers and school districts through new tools and approaches.

Project Approach

The project is implemented in three phases, each approximately one year in duration. This is Year 2 and included the following tasks:

1. Putting finalized Farm to School (FTS) toolkit online for accessibility;
2. Developing stakeholder dialogues for partnership with local producers and schools;
3. Collecting baseline FTS data while providing technical assistance to schools and producers;
4. Working with other aligned state and local initiatives such as Colorado MarketMaker, Colorado Food System Advisory Council and Wellness Councils; and,
5. Distributing updates on FTS Toolkit and maintaining ongoing dialogue with all stakeholders.

TASK #1: Farm to School (FTS) Toolkit Available on the Internet

In Year 2, COFTS completed the development of the FTS Toolkit and placed all toolkit elements on the COFTS website, www.coloradofarmtoschool.org. While the COFTS Toolkit is available, COFTS continues the process of rolling out a series of training and educational webinars, which will also be housed on the website. Specific products completed and made available on the website included:

- "How to...Resources": On-line links for starting and growing Farm to School in your community.
- Finding & Knowing Local Farmers (a tip sheet)
- Choose Your Own Farm to School Adventure: A Tool to Help Schools Review their Interest and Readiness
- Integrating Local Foods into Colorado's Schools: Case Studies, Promising Practices and Resources, a collection of case studies with linked resources:
 - How Do I Ensure Food Safety of Local Foods in Schools?
 - How Do I Establish Salad Bars to Showcase More Fresh Food?
 - How Do I Start a School Garden and Use Its Produce in the Cafeteria?
 - How Do I Establish Relationships with Local Producers?
 - How Do I Contract with Local Farmers at a Competitive Price for Both Them and Me?
 - How Do I Engage My Community Around Farm to School?
 - How are Youth Farmers' Markets Helping Eliminate 'Food Deserts'?
- Farm to School/Food Systems curricula from the Colorado Foundation for Agriculture
- Announcements and archives of Colorado Farm to School Webinars
- COFTS Newsletter

Based on these activities and experiences, conclusions include:

COFTS continues to collect feedback from across the state that districts and producers are still not always aware of what resources and tools already exist and are eager to not “reinvent the wheel” when initiating FTS efforts. The need for these Toolkit elements has been repeatedly reinforced as more and more stakeholders want to begin FTS efforts. It has become clear how critical it is to find new and diverse ways to communicate with producers and districts of all sizes in every corner of the state, whether they are known to be interested in FTS or not, since new efforts are popping up all the time. Thus, a major focus of COFTS in 2011 was statewide communication and broad disseminating the Toolkit elements.

Outcomes include numerous activities to disseminate the Toolkit. These are detailed under Task #5.

TASK #2: Develop Stakeholder Dialogues for Partnership with Local Producers and Schools

COFTS's goal for 2011 was to conduct outreach to a minimum of 3 new school districts and 3 new producers through partnerships with LiveWell Communities and other means. In all, COFTS conducted outreach to and presented on the COFTS Toolkit and the School District Self-Review Tool to all 22 LiveWell communities, a minimum of 20 school districts, and at least 10 producers. COFTS took a multi-pronged approach to finding and engaging school districts. COFTS conducted this outreach through the following activities:

- Presentation to school administrators - Integrating Fresh, Local Foods in Colorado Schools, at the Real Food Colorado January 2011 Connecting Local Farms and Schools Conference, <http://www.realfoodcolorado.com/resources.html>
- Development and dissemination of inaugural COFTS Newsletter, March 2011 (made available to hundreds of participants at the annual Colorado food service directors conference and the Colorado Food System Advisory Council meeting in March 2011)
- Presentation at the LiveWell Colorado Quarterly meeting (attended by LiveWell communities across the state)
- Presentation alongside LiveWell staff at the Colorado Legacy Foundation's June 2011 Putting Policy into Practice for Healthy School Districts conference
- One-on-one calls with LiveWell communities that were initiating farm to school work with their districts.
- Announcement at COFTS's inaugural webinar in August 2011 (see more information below)
- Working with Real Food Colorado to help plan farm to school presentations and workshops at the second summit, Connecting Local Farms and Schools (January 27, 2012)
- Based on these activities and experiences, conclusions include:
- It has become evident that direct partnerships with districts may not be the most strategic role for COFTS. The focus of COFTS is shifting to creating an environment conducive to farm to school and supporting the efforts of local partners, rather than on direct service. COFTS has reached more schools than its targeted goal by disseminating tools, guidance, models, and best practices to these community partners to start and enhance farm to school efforts.
- The focus will be increasingly placed on being an entry point for information for districts, producers, and community partners interested in starting farm to school efforts, but also for "advanced" districts looking for specific tools, such as protocol and food safety guidelines on introducing garden produce into cafeteria meals.
- COFTS believes that this focus on diffusion of information and knowledge is the most effective way to use the Toolkit, support a broad and deep farm to school movement, and support the work of school districts and their local partners.

Primary outcomes from Task #2 efforts include:

- As demonstrated under Task #1, COFTS has been successful at disseminating FTS information through a wide variety of venues.
- In 2011, COFTS also worked more closely with the Colorado Department of Education-Nutrition Unit to integrate training and information around farm to school and also to conduct outreach to school districts. CDE now sends updates and information about farm to school directly to their list of all food service directors in the state (almost 200).
- In 2011, COFTS efforts have been disseminated through a variety of channels, including monthly e-newsletters of LiveWell Colorado, CSU Extension Local Food Systems, and CDA's Colorado Proud.

TASK #3: Collect Baseline FTS Data while Providing Technical Assistance to Schools and Producers

COFTS also continued to assess technical assistance needs, share the Toolkit, and request feedback on the School District Self-Review Tool with all district partnerships from Year One, as well as from any and all additional districts that COFTS communicated with throughout the year. Primary work products completed to capture technical assistance needs include:

- Capturing specific information and technical assistance requests from school districts participating in the Colorado Legacy Foundation conference, *Putting Policy into Practice for Healthy School Districts*, June 2011.
- Capturing specific information and technical assistance requests from LiveWell communities attending LiveWell Colorado quarterly meeting.
- Requesting a comprehensive list of producers working with school districts in LiveWell Communities.
- Post-webinar (see Task #5) surveys for evaluation purposes and to identify interest in future topics.
- Survey of producers to collect their interest in selling to schools and invite them to participate in the Connecting Local Farms and Schools 2012 conference. *Note: this survey is not yet closed so the survey itself and results are not included in this report.*
- COFTS continues to collect baseline information from conversations with community partners around the state. COFTS has met with the Colorado Farm to School Task Force, Colorado Food Systems Advisory Council, CSU faculty, CSU Extension staff, Colorado Department of Education-Nutrition Unit, Real Food Colorado, leaders of the Northern Colorado Regional Food Assessment, and many others to more fully understand the opportunities and barriers to advancing FTS.

Based on the above activities and experiences, key conclusions include:

COFTS intends to continue to centralize and coordinate FTS resources. COFTS will also continue to collect statewide trends and data, including either re-issuing a statewide survey or gather relevant information through USDA's national FTS survey. In the next year, we will work with CDE-Nutrition Unit to integrate questions about local purchasing into existing district surveys.

Primary outcomes from Task #3 activities included:

- In response to feedback and to specific requests provided at the events listed above, COFTS has followed up via email with participants with links to resources and tools. COFTS also used feedback captured about needs to advance farm to school at these events to inform additions to the website and to inform the development of the webinar series.
- COFTS and other partners also continue to use results from Year One baseline data, specifically the statewide food service director survey completed in June 2010 by over 70 directors. The survey results have been used to inform the development of the Farm to School Primer (www.livewellcolorado.org/FTSPrimer), to inform the Case Study topics of the Toolkit, to inform the agendas of Regional Networking portions of the ARRA-funded food systems project to advance regional farm to school chapters, and also informed the content of LiveWell Colorado's school procurement analysis
- (http://about.livewellcolorado.org/sites/default/files/An%20Overview%20of%20School%20Food%20Procurement%20in%20CO_March%202011dd.pdf).
- COFTS staff has also met with Colorado Department of Education-Nutrition Unit staff to begin identifying and exploring options for integrating questions on local food procurement and local producer partners into existing surveys. COFTS has focused on identifying such opportunities for institutionalizing data collecting within state agencies.

TASK #4: Work with Aligned State and Local Initiatives

2011 afforded COFTS many additional opportunities for collaborating with Colorado-based initiatives, particularly state-level efforts. Due to the growing success of FTS programs and building on the movement that COFTS helped fuel in 2010, state agencies and coalitions are paying increasing attention to FTS -- how to support it, how to institutionalize FTS programs

within their organizations, and how to remove regulatory barriers and incentivize more local purchasing. Given this rising interest, COFTS has had ample opportunities to collaborate with and inform multiple state agencies and organizations. Specific examples of partnerships include:

- Provided input on the questions and design of USDA's national Farm to School survey.
- Worked with Colorado State University and CDA to create a farm to school search option on Colorado MarketMaker.
- Worked closely with LiveWell Colorado to develop and initiate a monthly FTS-focused webinar series hosted by LiveWell.
- Provided feedback during the development of the Colorado Farm to Market website.
- Worked with the Colorado Farm to School Task Force to inform:
 - Identification of FTS activities underway to facilitate long-term planning of the Task Force.
 - Development of a FTS Information Hub & Peer Networking Site.
- Provided monthly updates to the Colorado Food System Advisory Council.
- Worked with Real Food Colorado (www.realfoodcolorado.com) to provide input on the development of Food Hubs.
- Worked with Durango school district and Slow Food Denver to provide input and resources for a southwest regional producer/school farm to school workshop.
- Tracked local FTS activities around the state and shared this information with interested partners.
- Worked with the Colorado Legacy Foundation's Healthy Schools Champions initiative.
- Based on these activities and experiences, conclusions include:
- Farm to School efforts in Colorado have taken off and a major challenge now is keeping abreast of the activities so that we can learn what is and what isn't working. COFTS will continue to work closely with the FTS Task Force to inform the development of a one-stop resource FTS Information Hub & Peer Networking Site to stay current with the rapidly expanding movement.

COFTS efforts have contributed to the following outcomes:

- Colorado Farm to Market website launched: <http://cofarmtomarket.com>.
- Functional FTS platform on CDA's MarketMaker (<http://co.marketmaker.uiuc.edu/>) and COFTS webinar showcasing the new MarketMaker tools.
- Increasing focus on regional economic development and food safety issues within the CO Food Systems Advisory Council in order to promote direct markets of all kinds, including farm to school.
- Two Food Hub pilot projects underway by Real Food Colorado.
- FTS Information Hub website in beta/design mode.
- On-going FTS webinar series hosted by LiveWell Colorado as well as additional LiveWell communication tools (e.g., blogs, newsletters) focused on the potential of farm to school to grow local markets and increase healthy food options.

TASK #5: Distribute Updates on the FTS Toolkit and Maintain Ongoing Dialogues with all Stakeholders

COFTS has focused increasing attention on broad communication through further development of www.coloradofarmentoschool.org, which is kept very current with news articles and tools and models from across the state and country. Additionally, COFTS initiated a 2011-2012 series of webinars in August 2011 that are hosted by LiveWell Colorado. The webinars are intended to showcase and disseminate tools from the series of case studies developed in 2010 as well as

highlight new partners and new efforts in farm to school. COFTS intends to use the webinars to increase participation not only in farm to school, but in the implementation of the Toolkit and the School District Self-Review Tool. Webinar participants will be reminded of these tools, at times asked to complete sections of the review tool related to a webinar, and will be directed to certain sections of the tool that may directly relate to the webinar topic and help districts think through their approach. Specific activities to add to and disseminate the Toolkit in 2011 included:

Launched the COFTS webinar series. Webinars conducted in 2011 include:

- *Integrating Local Foods through Colorado Proud School Meal Day* (August 1, 2011)
- *Introducing the School Food Primer!* (September 27, 2011)
- *Choose Your Own Farm to School Adventure* (November 17, 2011)
- *Introducing the Farm to School Applications on MarketMaker* (December 14, 2011).

Table 1 below shows the producers that have added “Farm to School” to their Colorado MarketMaker profiles since the December webinar. Table 2 shows the school districts that created new Institutional Buyer profiles on MarketMaker and indicated “Farm to School” market of interest since the December webinar. *Please note that the information in these tables reports the categories of products schools indicated they are interested in buying as they listed in Colorado MarketMaker (CMM) and the types of products sold by producers who want to sell to schools as they listed in CMM. No SCBGP funds were used to promote non-specialty crop products or Colorado MarketMaker on this project.

Table 1. Producers using the new “Farm to School” method of sale on Colorado Market Maker (n=8)

Products Sold	Producers
Vegetables	Circle Fresh Farms
	Fossil Creek Farms
	Leffler Family Farms & Local Motion CSA
	Milberger Farms
	Red Shed Produce
	Two in Tents
Specialty Products	Two in Tents
Dairy	Two in Tents
Fruits & Nuts	Fossil Creek Farms
	Red Shed Produce
	Two in Tents
Grains	Two in Tents
Herbs	Fossil Creek Farms
	Two in Tents
Meat & Poultry	Potter Farms
	Rock River Ranches
	Two in Tents

Table 2. School Districts using the Institutional Buyer “Farm to School” identifier on Colorado Market Maker (n=8)

School Districts	Products wanting to Buy
Alamosa School District	Fruit & Nuts, Grains, Herbs, Vegetables
District 11 Food and Nutrition Services	Dairy, Fish/Shelfish/Seafood, Fruit & Nuts, Grains, Herbs, Meat & Meat Products, Specialty Products, Vegetables

School Districts	Products wanting to Buy
Northern Colorado Coop	Not specified
St. Vrain Valley School District	Dairy, Fruit & Nuts, Grains, Meat & Meat Products, Vegetables
WCSD RE-1 (Gilcrest, CO)	Fruit & Nuts, Vegetables
Weld County School District (Greeley, CO)	Dairy, Fruit & Nuts, Grains, Herbs, Meat & Meat Products, Vegetables
Weld County School District RE3J (Keensburg, CO)	Grains, Herbs, Meat & Meat Products, Vegetables
Weld RE-7 Platte Valley Schools	Fruit & Nuts, Grains, Herbs, Meat & Meat Products, Vegetables

Directly informed and added content to multiple partner tools and documents including:

- Overview of School Food Procurement in Colorado (www.livewellcolorado.org/schoolfood)
- Colorado Farm to School Primer (www.livewellcolorado.org/schoolfood)
- Glossary of Farm to School Procurement Terms (www.coloradofarmtoschool.org)

Based on these activities and experiences, conclusions included:

While COFTS has consistent communication with districts and producers and has captured anecdotes on where and how its tools are being used, COFTS does not require any reporting from districts that are using the School District Self-Review Tool and it is intentionally developed to be self-administered. Thus, COFTS knows little about which or how many districts have used and benefited from what aspects of the tool, or from other elements of the Toolkit. This has prompted COFTS to integrate Toolkit elements into each webinar and COFTS has planned a comprehensive strategy to follow-up with all webinar participants in 2012.

Outcomes of Task #5 include the communication and dissemination of the Toolkit through a variety of means including:

- There was strong webinar interest and participation for the inaugural webinars. 216 people participated in the four COFTS webinars held in 2011. Table 3, below, lists numbers of participants from different stakeholder groups who registered or attended at least one of the four webinars. As would be expected, most registrants are from Colorado; however, the webinar series is also picking up viewers from USDA and other states.

Table 3: Webinar Attendance¹

Affiliation	Total Registrants Across all 4 Webinars	Registered but did not Attend at Least One Webinar	Attended at least One Webinar
Producers	20	12	10
School Districts	62	51	33
Higher Education	3	3	0
State & Local Health	47	33	36

¹ Note that the number of those who registered but did not attend the live webinar and those who did attend the live webinar do not equal the total number of total registrants in each group since, in many cases, one person registered for multiple webinars.

Affiliation	Total Registrants Across all 4 Webinars	Registered but did not Attend at Least One Webinar	Attended at least One Webinar
Partners			
Community Food Organizations & Partners	42	27	28
Federal, State or Local Agencies	20	7	18
Other Interested Stakeholders	22	12	11
TOTAL	216		

- Additionally, the four webinars held in 2011 have had over 210 asynchronous viewings since they have been posted on line.
- COFTS email announcements and updates (with hyperlinks to the COFTS website) went to all food service directors in the state; multiple producers; multiple state agencies; agricultural associations; local food and farm to school groups and listservs; parent and community groups; and more.
- Email announcements and updates (with hyperlinks to COFTS resources) were sent from other partners, including: CSU Extension Local Food Systems e-Newsletter, Southwest Marketing Network Newsletter, LiveWell Colorado Newsletter, and, the Colorado Proud Newsletter.
- Hyperlinks to the COFTS website were placed on partner websites, including the national Farm to School Network, Colorado Department of Agriculture, Colorado Department of Education, Colorado Foundation for Agriculture, LiveWell Colorado, Colorado Farm to Market, Spark Policy Institute, Healthy Community Food Systems, Southwest Marketing Network, WPM Consulting, Weld County School District 6 Nutrition Services, Real Food Colorado, Farm to School & School Garden Research Consortium, Colorado Department of Public Health and Environment's COPrevent.
- COFTS was invited to present on the FTS Toolkit at the following gatherings:
 - *Integrating Fresh, Local Foods in Colorado Schools* at the January 2011 Connecting Local Farms and Schools Conference <http://www.realfoodcolorado.com/resources.html>
 - Colorado Legacy Foundation's June 2011 *Putting Policy into Practice for Healthy School Districts* conference
 - LiveWell Colorado July 2011 Quarterly meeting (attended by LiveWell communities across the state)
 - Valley Food Forum, *Connecting Local Farms to Forks*, Montrose, CO, December 8, 2011
 - Mountain Roots Food Project & Gunnison School District, Gunnison, CO, December 9, 2011.
 - Reports from other organizations highlighted the COFTS Toolkit including *Preventing Childhood Obesity: Policy and Practice Strategies for North Carolina*.

Goals and Outcomes Achieved

Desired Outcome	Performance Measure	Baseline	Goal	Actual	Activities Completed Toward 2011 Goals
			2011		
To increase purchasing of locally grown specialty crops by school districts	Number of school districts contracting with local producers for the purchase of specialty crops	There are currently no formal district-wide FTS contracts in Colorado	Five school districts	Exceeded; More than 5 districts initiated standing contracts in 2011	Distribution of FTS Toolkit elements, case studies, webinars, school conference presentations, and targeted technical assistance (e.g., how to use the school district self-review tool). Eight schools now have institutional profiles on Colorado Market Maker indicating they have a farm to school program
To increase producer participation in Farm to School programs	Number of producers with formal contracts to supply specialty crops to a school district	There are currently no producers with formal district-wide FTS contracts in Colorado	Five school districts	Exceeded; there are at least 10 producers known to have contracts	Distribution of FTS Toolkit elements, attendance & presentations at producer events, implementation of producer survey, integration of producers in webinars, targeted outreach through CSU, Extension, and others. Eight producers now list Farm to School as a method of sale on Colorado Market Maker.

<p>To expand the educational curriculum of Colorado school districts to include nutrition programming and seed-to-table information about locally grown fruits and vegetables</p>	<p>The number of school districts that offer an integrated nutrition curriculum</p>	<p>There are currently no school districts offering an integrated nutrition curriculum</p>	<p>Five school districts</p>	<p>Goal not met; Currently no districts offer district-wide curriculum; however 36 districts sourcing locally have at least one using the <i>Colorado Reader</i>. Due to budget cuts the Integrated Nutrition Education Program was cut from most schools in 2011.</p>	<p>Identified seven <i>Colorado Reader</i> editions with relevant FTS materials. Produced by the Colorado Foundation for Agriculture, the materials are available on the COFTS website and the CFA's website. Working with the Colorado Farm to School Task Force to bring FTS curriculum into university course work for training K-12 teachers and through in-service training required of current teachers.</p>
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Beneficiaries

The primary beneficiaries are school districts and producers, particularly those that had not yet developed contracts related to FTS, or had even been aware of FTS opportunities at all.

While COFTS activities alone cannot be credited with a significant increase in contracts between Colorado producers and nearby school districts, COFTS activities regarding school districts have been credited with increasing awareness of where and how to identify producers; increasing awareness of what is “allowed” or not in terms of local purchasing; demonstrating to districts how to identify internal opportunities to include more local produce; and, increasing district knowledge and awareness of the benefits of working with local producers.

For producers, the benefit of these activities has been an opening and expansion of new, consistent markets with large institutional buyers – area school districts. Precise economic benefits to Colorado producers are still being calculated but each year brings more interest from more producers in securing school district contracts because of the significant, consistent income they provide, as well as other community benefits and new partnerships.

COFTS has made numerous resources available to schools and producers across the state through its website and presence at multiple events and conferences. This makes a true estimate of the number of beneficiaries difficult, but it easily far exceeds our known partners.

Lessons Learned

COFTS learned much in 2011 about how to effectively help grow and support a movement that requires both grassroots modeling and implementation as well as state-level support and institutionalization.

It became evident by the end of year one that direct partnerships with school districts was helpful but not most strategic role for COFTS. The focus of COFTS shifted to include the development of statewide environments conducive to farm to school by engaging in strategic

statewide and agency partnerships and supporting the efforts of local partners. COFTS is best used to identify and disseminate tools, guidance, models, and best practices to these community partners, rather than solely assisting school districts.

Additionally, it has become clear how critical it is to find new and diverse ways to communicate with producers, particularly since producers have limited time and do not always use email or other communication tools we rely upon. Moreover, producers vary in their willingness to publically share information about their farm to school efforts, which has made it challenging to track producer involvement and engagement. Nevertheless, we do know there are many more Colorado producers selling to schools in just the past year based on the increase in the number of schools that are sourcing local. COFTS will continue to focus on webinars of interest for producers looking to expand their markets as well as having a presence at events where producers are already attending, including the Governor's Agriculture Forum, Colorado Big & Small Conference, and other agricultural events.

Another lesson is just how challenging it can be to keep up with a movement that is moving as quickly and successfully as this one. Districts and producers continue to ask for a "one-stop shop" that convenes existing tools, models, and resources. COFTS will continue to work closely with the FTS Task Force to inform the development of a FTS Information Hub & Peer Networking Site to stay current with the rapidly expanding movement.

The most challenging component of the COFTS has been incorporating farm to school and/or food systems curriculum into K-12 schools. In year one, we identified a variety of FTS curriculums; however, most were piecemeal and untested except for those that charged a substantial fee. The Colorado Foundation for Agriculture produces a curriculum enhancement called the *Colorado Reader*. We identified seven *Colorado Reader* editions that address agricultural issues directly relevant to farm to school. These seven Readers are posted on the COFTS website. We know from interviewing teachers who use the Readers that the units are a good companion to farm to school efforts occurring at a school, and that the students have a variety of hands on experiences. Currently, the Colorado Reader reaches over 1400 classrooms per month. Thirty-six of the 41 school districts (88%) sourcing locally have at least one school within their district using the *Colorado Reader* lesson plans. We are working with the Colorado Foundation for Agriculture to coordinate the recruitment of more schools within districts with farm to school programs to use the *Colorado Reader* to support FTS and food system classroom education. In addition, we are working with the Colorado Farm to School Task Force to pursue comprehensive Farm to School/Food Systems curriculum and training of new teachers on its use.

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Project Title: Development & Commercialization of a “Branded” Colorado Potato- Final Report

Project Summary

Potato producers in Colorado are among the most progressive potato producers in North America and have been very supportive of trialing new potato cultivars in their operations. Currently Colorado producers raise over 100 cultivars annually. A concern that has developed recently deals with minimizing the risk in commercialization of these new cultivars. This project is attempting to determine the correct marketing mechanisms to bring new varieties to market, especially varieties with unique health and/or nutritional attributes. Using consumer research to create a model for commercialization of the four new varieties selected in this project will facilitate the transfer of knowledge about resistant starch levels, higher levels of antioxidants and Vitamin C in these varieties to potential consumers. This information will allow tailored branding of the varieties based on the marketing analysis information derived from this project. The intention is to insure all FDA nutritional guidelines are met to insure the validity of all marketing claims. This project when completed should allow Colorado producers the knowledge to be more competitive in the marketing of new, improved potato cultivars with less risk. This would be a huge step in our strategic goal of promoting the growth of new potato varieties that can be differentiated and branded as “unique to Colorado”.

Project Approach

There are essentially three components of this project; the agricultural production and best management practices of the four potato varieties, the nutritional assay of the health attributes within the four varieties, and the consumer and marketing research necessary to understand how these varieties can be best be branded and marketed. Each of these components was met with varying degrees of success which are outlined below in the next section.

Goals and Outcomes Achieved

1. Agricultural Production and Best Management Practices (BMP)

The table below summarizes the various timelines for the project.

Production and BMP's	Timeline	Status
Identify the cultivars	2009-2010	Completed, 4 varieties identified
Develop acreage for production	Summer of 2010	Seed production completed, commercial production being identified for 2012
Develop production strategies	Production season 2010-2011-2012	Ongoing- Currently analyzing harvest results and field notes to develop cultural BMP's
Develop Post Harvest strategies	Storage season 2011-2012	Ongoing- Plot samples undergoing storage testing

Identifying cultivars and meeting the seed supply needs for the project

The four varieties utilized for this project were: Rio Grande Russet, Purple Majesty, Crestone Russet (CO99053-3RU), and Masquerade (AC99329-7PW/Y).

Each of these varieties was selected for unique characteristics that make them appropriate for the project.

The cultivars identified which fit the specific parameters of this project, each with a unique combination of traits for the marketplace. Rio Grande Russet is a very smooth, high yielding russet with low inputs like water and Nitrogen and excellent flavor and high levels of antioxidants. Crestone Russet is another very smooth, medium to late maturing russet with low inputs, high yields and excellent flavor. Additionally, it has some significant disease resistance to certain problems including powdery scab and *Fusarium* dry rot. Purple Majesty is the first really good tasting purple skin, purple flesh cultivar to make it to the market. It has exceptional health attributes, fits well into the specialty market and has a very smooth, consistent tuber type with excellent yields and few disease issues. Finally, Masquerade is a bi-color skin (purple/yellow) with yellow flesh. It has great production potential with excellent yields of medium sized tubers, is very pretty, striking in appearance, and has phenomenal flavor and health attributes. Its only disadvantage is the rapid germination of the tubers when removed from storage due to a very short dormancy.

Seed acreage was developed at the SLV Research Center for each of the cultivars to meet the requirements for part of the grant. In 2012 there were 10.2 acres of Rio Grande Russet (G1-G4), 7.4 acres of Crestone Russet (G1 and G3), 2.0 acres of Purple Majesty (G1-G3) and 1.4 acres of Masquerade (G1-G3) providing a stable seed supply for interested potato growers in Colorado. Producers in the certified seed program have begun to adopt these cultivars as part of their routine growing operation as seen in Table 1.

Table 1. Cultivar acreage by year in the Colorado seed potato certification program.

Cultivar	2009	2010	2011	2012
Rio Grande Russet	1758	1252	1284	1171
Crestone Russet	3	3	10	64
Purple Majesty	67	85	143	177
Masquerade	0.1	0.1	1	8

Nutrient Management (Samuel Essah)

Nutrients being evaluated include nitrogen, phosphorus, potassium, and compost rate, along with nitrogen and calcium application timing. Weekly petiole samples were analyzed for nitrogen, phosphorus, and potassium. This data was used to establish optimum petiole nutrient concentration levels to achieve maximum yield and quality goals in production.

The last two years field studies were laid down as a randomized complete block design. Each treatment was replicated four times. Treatments included nitrogen application rates at 60, 120, and 180 lb N/ac. A control treatment was included where no nitrogen fertilizer was applied. During the spring of each year, soil samples were taken from the experimental site and analyzed for residual soil nitrate nitrogen (N). Water samples were taken from the irrigation well and analyzed for nitrate nitrogen concentration. The residual soil N and irrigation water N added up to 28, 68, 61, and 80 lb N/ac, for Rio Grande Russet, Crestone Russet, Purple Majesty, and Masquerade, respectively. Knowledge of the residual soil and irrigation water N is important to help estimate how much nitrogen fertilizer is needed to apply for maximum tuber yield and quality.

Plant Population and Density

Tubers were sampled weekly after tuber initiation to determine bulking rates. The harvested plots were graded and sized. The objective of these studies was to evaluate the optimum plant population needed for maximum tuber yield and quality of four Colorado cultivars. Plant

population varied depending on the in-row seed spacing treatment. Seed spacing treatments included planting potato seed tubers at 10, 12, and 14 inches.

The field studies were laid out as randomized complete block design. Each treatment was replicated four times. Specific gravity testing from plot samples was conducted in December.

The following is a list of the specific production guidelines for each of the four cultivars:

1. Rio Grande Russet:

Available Nitrogen (residual soil N + well water N + applied N) rate required for maximum tuber yield and quality was observed to be between 150 to 160 lb N/ac. With a soil test of 264 ppm potassium (K) in the spring, maximum total and marketable tuber yields could be achieved when 120 lb K₂O/ac is applied. The use of potassium sulfate as source of K fertilizer is preferred to muriate of potash, because potassium sulfate tends to increase marketable tuber yield and also help increase tuber specific gravity. To obtain maximum marketable size tubers, seed tubers should be planted at in-row spacing of 12 inches, with row spacing of 34 inches. To gain early plant vigor, apply 90 lbs available N/a pre-plant or at planting. Apply the remaining N requirement in three split applications at approximately 7 days interval. Start in-season N application at tuber initiation. Vines should be killed at 110 days after planting to allow tubers to mature and to avoid tuber bruising at harvest. Pre-cut seed to a size of 2.5 to 3.0 oz. and allow it to suberize before planting.

2. Crestone Russet:

Available nitrogen needed for maximum tuber yield and quality of Crestone Russet should be between 120 to 140 lb N/ac. Increasing the available N rate above 140 lb N/ac. can reduce tuber specific gravity and increase the production of more tuber misshapes. In-season petiole nitrate nitrogen concentration should range from 12000 ppm at 67 days after planting (DAP) down to 5000 ppm at 88 DAP. To obtain maximum marketable tuber yield with reduced seed input, Crestone Russet should be planted at in-row spacing 13 to 14 inches, with row spacing of 34 inches. Pre-cut seed to a size of 2.5 to 3.0 oz. and allow it to suberize before planting.

3. Purple Majesty:

Available nitrogen rate required for optimum production of purple majesty was observed to be between 140 to 150 lb available N/ac. When available N is within the 140 to 150 lb/ac. range, there is an increase in marketable tuber yield, reduced tuber external and internal defects, and an increase in Nitrogen Use Efficiency. For in-season N management, petiole nitrate N concentration should range from 4000 ppm at 70 DAP down to 3000 ppm at 84 DAP. Calcium can be applied at a rate of 30 lb/ac in two split applications during tuber formation to increase tuber yield. Seed piece should be planted at in-row spacing of 13 to 14 inches to obtain maximum tuber size. Vines should be killed between 100 and 105 DAP to allow tubers to mature, and for tubers to develop high specific gravities.

4. Masquerade:

Masquerade responds to high nitrogen application rate. For maximum tuber yield, available N rate should range between 210 to 220 lb/ac. For in-season nitrogen management, petiole nitrate N concentration should range from 8000 ppm at 60 DAP to 19000 ppm at 75 DAP. Seed tuber should be planted at 14 inches within rows, with row spacing of 34 inches, to achieve high yields of marketable size tubers.

Disease Resistance (Robert Davidson)

All variety plots were inspected weekly and screened for diseases during the growing season. No major problems were noted.

Each of the four cultivars show differing levels of susceptibility to common disease problems found in the San Luis Valley (Table 2), but all have relatively good levels of disease resistance and/or tolerance and few major problems have been seen under field growth. It is of note that each of the cultivars has been repeatedly screened for several years and under very different environmental conditions with few problems demonstrated.

Table 2. Ranking of major disease issues by cultivar

Disease	Rio Grande Russet	Crestone Russet	Purple Majesty	Masquerade
BRR ¹	9	8	9	8
PLRV	5	7	5	4
PVY	6	7	5	4
Powdery Scab	2	1	5	5
Pink Rot	4	4	7	4
Soft Rot	7	4	7	4
Dry Rot	4	5	4	5

¹Rankings for disease are from 1-10 with 1-3 resistant, 3-4 moderately resistant, 5-6 moderately susceptible and 7-10 susceptible. BRR - bacterial ring rot, PLRV - potato leaf roll virus and PVY - potato virus Y.

Results of this work have been communicated to producers raising these cultivars on a one-on-one basis and during the Southern Rocky Mt. Ag Conference over the last two years.

Two abstracts were submitted to the annual PAA meeting in 2012 and presentations made during the conference; "Cultivar improvements for powdery scab resistance in the Colorado Cultivar Development program" and "Evaluation of potato cultivars in a greenhouse for determining potential to reduce powdery scab inoculum levels in soil".

Post-Harvest/Storage Management (Sastry Jayanty)

After harvest plot samples were tested using different storage regimes. Information gathered from 2010 and 2011 storage testing was incorporated into 2012 testing. One problem encountered in the storage results was discovering that Masquerade has a very limited natural dormancy and will require special care in storage handling to insure an extended marketability window. If they are stored at 38°F (3.3°C) with 95% relative humidity, they can maintain four to six months without sprouts. But after leaving storage they quickly develop sprouts at room temperature within days. Four different sprout inhibitors were tested (two organic and two conventional) to extend dormancy in these two cultivars after removing from long-term commercial storage. Conventional sprout inhibitors such as CIPC have proven more effective than of all other sprout inhibitors available. The organic sprout inhibitor L-Carvon was more effective than clove oil in reducing sprouting in Masquerade and Purple Majesty for 30 days in 2010 testing. During the 2011-2012 storage season we tested both organic and conventional inhibitors at three different temperature regimes and multiple application timings to extend dormancy.

The results when the efficacy of sprout inhibitor treatments were tested to increase storage time follow. The conventional and organic sprout inhibitors tested included: Clove Oil, EC-40, EC-15, CIPC with DMN (CIPC2), DMN alone, and CIPC alone. Organic treatments include Clove Oil, EC-40 and EC-15. CIPC with DMN, DMN alone, and CIPC alone are conventional treatments. We tested these compounds at three different storage temperatures 38 °F (3.3°C), 45 °F (7.2 °C) and 50°F (10°C). We measured shrinkage, sprout length and sprout weight for all the cultivars advanced selections tested after 3 months of storage. Organic sprout inhibitors were applied again after observing sprout initiation during storage period to extend dormancy and to study their efficacy in sprout inhibition. (EC-40, EC-15 - Biox sprout inhibitors (Pace International); DMN 1,4 ethyl naphthalene; Dimethyl naphthalic; CIPC chlorpropham). All sprout inhibitors were applied based on manufacturers dosage and rate recommendations

Highlights

- Masquerade and Purple Majesty, when treated with sprout inhibitor EC-15 and maintained at 38°F, lost less weight than untreated controls.
- CIPC treated tubers had no significant sprouting at any temperature and tubers lost more weight as temperature increased.
- Masquerade lost the least weight at 38°F when treated with EC-15 and Clove Oil and had no sprouting in either. Conventional sprout inhibitors such as CIPC2 and CIPC allowed minimum sprouting even at 50°F during initial 3 months.
- At 38°F Purple Majesty lost the least weight with EC-40 and CIPC2 and had no sprouting in either temperature. Purple Majesty had minimum sprouting at 50°F with CIPC2 and CIPC; and lost the least amount of weight with CIPC2.
- DMN is not an effective sprout inhibitor even at 38°F storage temperature.

2. Nutritional and Health Attributes (Sastry Jayanty and David Holm)

One of the goals for this element of the project is to determine FDA requirements for the nutritional claims we are hoping to use and the steps in the approval process. Specific testing has been done to analyze the nutritional attributes of the four selected varieties. This testing is ongoing and needs to verify the necessary FDA requirements. Dr. Jayanty presented the some of the results of his experimental testing to the Potato Association of America on August 15th, 2011 in Wilmington, North Carolina.

During the course of the project nutritional and health attributes of the four selected cultivars and advanced selections were characterized. This information was generated based on the tests that include estimation of resistant starch levels, antioxidant activities, nutritional composition analysis and flavor. The idea is to present the consumer with improved dietary health attributes of these cultivars for brand identification and to increase sales and profitability. This matches the information needed by the consumers based on survey data gathered during the project. As consumers develop a better awareness of health attributes, it is to be expected that they would start to use this information in developing buying choices for potatoes.

Table 3

Resistant starch

Potatoes are rich in carbohydrates and are also a good source of minerals and vitamins. However, recent evidence linking the glycemic index (GI) of foods to risk for a number of chronic diseases and the general perception that potatoes have a high GI, have raised concerns about the health benefits of potatoes. Starch rich foods, such as potatoes, when consumed are metabolized to the monosaccharide glucose, which then enters into

Blood stream causing a temporary rise in blood glucose levels.

This “glycemic response” is measured as the GI. Resistant starch (RS), which as a low GI and alpha amylase inhibitors (AAI) are believed to reduce a food’s GI. Leaves and tubers were harvested from different cultivars grown in Colorado and advanced selections being developed at the SLVRC for estimation of AAI and RS. The data indicate that there is significant variability in potato selections and cultivars for both RS and AAI (Table 3)

Cultivars	Total starch (g/100 g potato material)	RS (g/100g total starch)		NRS (g/100g total starch)
		RS – Raw	RS-Baked	
Dark Purple Flesh	63.37	12.06	4.76	95.45
Purple Majesty	70.46	13.43	3.24	96.86
Yukon Gold	60.10	34.64	2.32	97.73
Rio Grande Russet	59.84	23.71	9.70	91.16
Rio Colorado	63.32	17.98	3.73	96.40
Mountain Rose	62.16	12.15	6.71	93.72
Lenape	63.90	14.52	6.14	94.22
CO94035-15RU	68.49	20.27	5.33	94.94
CO95051-7W	71.81	32.86	5.72	94.59
AC96052-1RU	66.37	14.62	10.38	90.60
CO97226-2R/R	60.48	9.81	8.77	91.93
CO97232-1R/Y	66.00	23.78	5.49	94.80
AC97521-1R/Y	61.02	23.76	7.07	93.39

Antioxidant levels and effect of cooking on them in different cultivars

Potato tubers, which are one of the richest sources of antioxidants, are always cooked before human consumption. The objective of this study was to understand the effects of various domestic cooking methods, i.e., boiling, microwaving and baking on total phenolics, flavonoids, flavonols, lutein, anthocyanins and antioxidant activities in 5 cultivars and 9 advanced selections with different skin and flesh colors after 6 months of storage. The three cooking methods reduced the levels of these compounds and the percentage of DPPH (2,2-Diphenyl-1-picrylhydrazyl) radical scavenging activity in all the cultivars and selections. Boiling minimized these losses. Red fleshed tubers contained more flavonoids, whereas purple tubers contained more flavonols. Despite severe loss of these compounds due to cooking, both the flesh types retained larger amounts of all these compounds due to higher initial levels. Decline in the radical scavenging activity is directly related to loss of these compounds due to cooking treatments in all white and colored flesh tubers. Red and purple fleshed tubers exhibited greater radical scavenging activity than yellow and white fleshed tubers after

Nutritional value	Cooking method		
	Boiled	Microwaved	Baked
Total phenols	↓	↓↓	↓↓
Total flavonoids	↓	↓↓	↓↓
Total flavonols	↓	↓↓	↓↓↓
Lutein	↓	↓↓	↓↓
Pelargonidin	↓	↓↓	↓↓
Delphinidin	↓	↓↓	↓↓
Malvidin	↓	↓↓	↓↓
Antioxidant activity	↓	↓↓	↓↓↓

each of the cooking treatments. Table 4 has the summary of nutritional values of potato cultivars and advanced selections affected by cooking methods. The number of inverted arrows indicate the degree of loss of nutritional value.

Selenium levels in Colorado cultivars

Selenium (Se) is an essential trace element in the human body. Development and survival of animals and humans will be at risk without Se. Higher levels of Se in blood plasma have been correlated with reducing many cancers. Potato plants are being supplemented with selenium (Se) in several countries to enrich tubers with Se for obvious health benefits. Se is not an essential nutrient and interferes with metabolism of essential nutrient sulfur (S) in the plants. The objective of the present investigation was to find out the activities of Se-independent glutathione peroxidase (Se-Ind-GPx), Se-dependent glutathione peroxidase (Se-Dep-GPx), and thioredoxinreductase (TRxR) enzymes in stored potato tubers grown on non-Se-enriched field; and their relationship with tuber Se and S levels. Our results indicate that these enzyme activities and the nutrient levels in the tubers were significantly influenced by genotype. Tubers of Rio Grande Russet, Crestone Russet, and Purple Majesty can supply more than the recommended dietary allowance (RDA) of Se to adult humans.

Furthermore, Se-Dep-GPx activities were influenced by Se levels in the tubers.

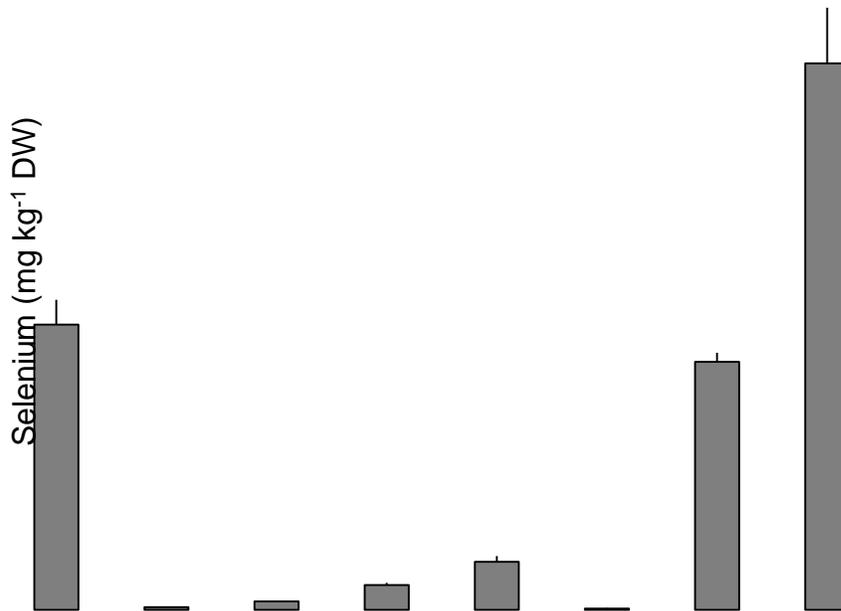


Figure 1

Volatile compound analysis in Colorado potato cultivars and advanced selections using solid phase micro extraction technique

We tested three cooking methods, (i.e., boiling, microwaving and baking) on six month old stored tubers. Six to eight randomly selected tubers from each potato cultivar or advanced selection of Rio Grande Russet, Purple Majesty, Crestone Russet and Masquerade were tested using Solid Phase Micro Extraction (SPME) and Gas Chromatograph and Mass Spectrometry (GCMS). We quantified 10 different flavor volatiles in three different cooking methods. Our results indicate cultivars differ in volatile profiles and cooking treatment affects volatile

concentrations. Different cooking methods affect volatile compounds in a different way. Furfural which brings sweet and nutty flavor completely disappeared in the baking process. Pungent, Sweet and Fruity flavor compound, 3methyl butanal is higher in Purple Majesty and Masquerade. Alpha coapene which is a dominant potato flavor compound is present in all cultivars tested except Crestone Russet. Limonene and carene are major terpenes in the volatiles of Crestone Russet.

Highlights

- After baking Rio Grande Russet retained a considerable amount of resistant starch
- Polyphenols and pigments in potato were reduced by boiling, microwaving and baking.
- Antioxidant activity of the tubers was decreased by cooking methods.
- Red and purple tubers retained higher antioxidant levels after cooking methods.
- Loss of polyphenols and pigments were low in boiling and severe in baking.
- Selenium is very important dietary supplement
- Tubers of Rio Grande Russet, Crestone Russet, and Purple Majesty can supply more than the recommended dietary allowance (RDA) of Se to adult humans
- Out of 4 cultivars and advanced selections tested, Purple Majesty and Masquerade exhibited more flavor compounds when analyzed using GC-MS after steaming, microwaving and baking.

Publications:

Venu Perla, David G. Holm and Sastry S. Jayanty* (2012). Effects of cooking methods on polyphenols, pigments and antioxidant activity in potato tubers. LWT- Food Science and Technology 45:161-171.

Venu Perla and Sastry S. Jayanty* (2012). Biguanide related compounds in traditional antidiabetic functional plant foods. Food Chemistry

Venu Perla, David G. Holm and Sastry S. Jayanty* (2012). Selenium and sulfur content and activity of associated enzymes in selected potato germplasm. 2012. American Journal of Potato Research. 89:111-120.

New Variety Identification and Development (David Holm)

The overall goal of this project as stated in the title is in keeping with the mission statement of Colorado Potato Breeding and Selection Program (Program), i.e. to develop cultivars that will help assure that the Colorado potato industry remains productive, competitive, and sustainable and to develop cultivars that provide the consumer with improved nutrition and quality.

Therefore it is appropriate that four selections from the Program were used for this project. They were individually identified because of characteristics (nutritional, taste, dietary, and appearance) that would make them good subjects for a branding study.

The process of developing a new cultivar takes 14+ years. Years 1 and 2 are the potato breeding phase of the development process. Parents are selected with desired characteristics and crossed to produce true (botanical) potato seed (TPS). Seedling tubers are then produced from the true seed in year 2. Subsequent years (3+) represent the selection phase of the development process. Each year represents another cycle of field selection. As each cycle is completed, fewer and fewer clones remain and the amount of seed per selection is increased. Throughout the evaluation process selections are tested for characteristics of importance. Some of these characteristics are associated with consumer acceptance and recognition in the marketplace.

Each year the Program identifies selections that merit advanced testing associated with characteristics that are amenable to branding. These new cultivars are identified which have improved nutritional aspects and quality that lend themselves well to differentiation and branding. For this project, eighty-five advanced selections were planted in 2012 and will be increased in 2013 pending results of ongoing evaluations. Advanced selections evaluated in the Southwest Regional Trials, Western Regional Trials, or by Colorado producers in 2012, included 11 russets (AC99375-1RU, AC00395-2RU, CO99053-3RU, CO99100-1RU, CO03187-1RU, CO03202-1RU, CO03276-4RU, CO03276-5RU, CO04211-4RU, CO04220-7RU, and CO04233-1RU), 5 reds (CO99076-6R, CO99256-2R, CO00277-2R, CO00291-5R, and CO04159-1R), 11 chippers (AC00206-2W, AC01151-5W, AC03433-1W, AC03452-2W, CO00188-4W, CO00197-3W, CO00270-7W, CO02024-9W, CO02033-1W, CO02321-4W, and CO03243-3W), and 17 specialties (AC99329-7PW/Y, AC99330-1P/Y, AC03534-2R/Y, ATC00293-1W/Y, CO97222-1R/R, CO97226-2R/R, CO97232-2R/Y, CO00412-5W/Y, CO01399-10P/Y, CO04021-2R/Y, CO04029-5W/Y, CO04013-1W/Y, CO04063-4R/R, CO04067-8R/Y, CO04099-3W/Y, CO04099-4W/Y, and CO04188-4R/Y).

Publications:

Madiwale, Gaurav P., Reddivari, Lavanya, Holm, David G., and Vanamala, Jairam. 2011. Storage elevates phenolic content and antioxidant activity but suppresses antiproliferative and pro-apoptotic properties of colored-flesh potatoes against human colon cancer cell lines. *J. Agric. Food Chem.* 59:8155-8166.

Madiwale, Gaurav P., Reddivari, Lavanya, Stone, Martha, Holm, David G., and Vanamala, Jairam. 2012. Combined effects of storage and processing on the bioactive compounds and pro-apoptotic properties of color-fleshed potatoes in human colon cancer cells. *J. Agric. Food Chem.*

3. Marketing and consumer research program (Jennifer Keeling-Bond)

The table below summarizes the consumer and marketing research element of the project:

Consumer and Marketing Research	Timeline	Status
Assessing consumer knowledge of potato nutrition	2009-2010	Completed- important consumer knowledge identified
“Brand” creation	2010-2011	Completed- specific labels designed and tested for varieties
Sensory analysis report	2010-2011	Completed- Consumer taste preferences identified
Analyze research data for information gaps	2011-2012	Ongoing- Further analysis of the data
Marketing strategy development	2012	Beginning in 2012

The marketing research under the direction of Dr. Jennifer Bond focused on assessing consumer knowledge of potato nutrition and health characteristics possessed by potatoes. The primary methods for this involved sensory analysis, label creation, secondary data review, and development of choice set survey and consumer experiment protocols. Three Colorado State University faculty members and one graduate student are assisting with this project.

Sensory analysis

Testing was conducted in mid-July of 2009. Statistical analysis of the in-home and trained panels was completed in 2010 and a draft of the keys findings has been completed.

Label creation

Sample labels were created by Alysce Christian and submitted to the marketing team for feedback. This feedback was instrumental in creating the final label design. The labels are appropriate for use on both poly-bags and clam-shell type packaging. Application of label claims will now be determined through analysis of the collected consumer data. Data gathered in pre- and post-revelation on nutrition information testing determined that consumers were willing to pay more after being exposed to the nutrition information. This information will be valuable in determining label information.

Sample Label



Secondary Data Review

A review has been completed of national consumption trends and a published report has been completed. Further analysis of this data was conducted in early 2011 along with the consumer experiment research to determine which health attributes have the greatest value to consumers. The data revealed that consumers were “Least Knowledgeable” about resistant starch content (44%) followed by antioxidant levels (31%). Discovering baseline consumer nutrition levels are important in developing marketing strategy moving forward.

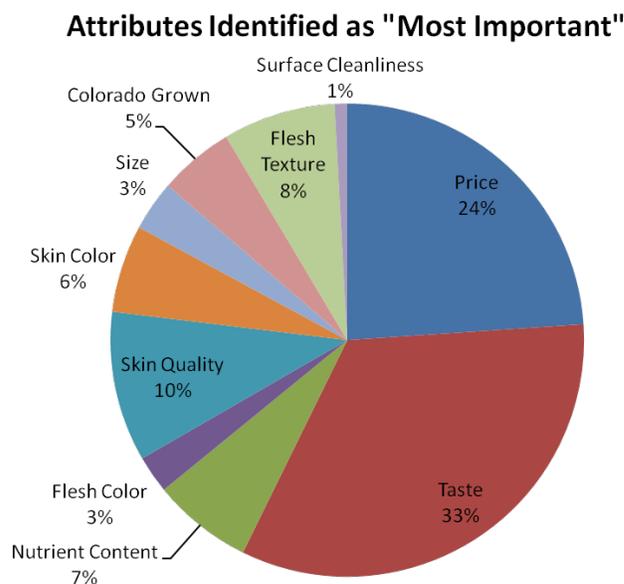
Choice Set Survey and Consumer Experiments

After developing experimental protocols the actual experiments were conducted in October and November 2009, and June of 2011. The actual experiments consisted of a consumer demand survey and analysis of willingness to pay for various combinations of label claims and product attributes. This was followed up with practice auctions, and actual potato auctions. Following the auctions sensory evaluation using the four potato varieties was conducted on both baked and microwave potatoes. Each experiment took between 1.5-2 hours and six actual experiments were conducted with over 140 volunteer subjects. Key consumer preferences have been identified through this research. The graph below illustrates consumers “most important” potato attribute preference.

Key points developed from the consumer surveys include:

- Taste is the most important attribute by a factor of 2.5 – 5 over price and other physical attributes that affect mouth feel and enjoyment
- Nutrient content, source, and convenience are ranked last
- Significant heterogeneity – positive correlations between nutrient content and source

- Consumers are most knowledgeable about preparation methods and price, but least knowledgeable about nutrition information
- Consumers self-report most knowledge about preparation (by a factor of 2-7) over price
- Report very little knowledge regarding nutritional information, caloric content, and source
- Negative correlations between knowledge about price and vitamin and mineral content
- There is a negative relationship between knowledge about nutrition and knowledge about price
- Consumers view Taste and related attributes (skin quality, flesh texture, and color), along with price, as most important when purchasing fresh potatoes,
- Consumers in our study did view nutrition, source, or convenience as very important
- Bottom line: Taste and related attributes dominate others in importance, and very little is known about potato nutrition qualities



Additional marketing efforts around Colorado (Robert Davidson)

The cultivars used in this project were distributed to several private growers in Colorado over the past three years for use as garden seed and for sale in commercial operations. Overall satisfaction for the cultivars has been high with several producers indicating a strong demand, particularly for the Purple Majesty and the Masquerade. One operation, Jumping Good Goat Dairy, Ms. Dawn Jump, has utilized these cultivars in 1-2 acre plots for the past two years under organic production. She has been quite successful in marketing these potatoes from both the field, at harvest, and from the store during the year. Other locations utilizing these potatoes have included producers in Hesperus, Pagosa Springs, Gunnison, Dove Creek, Fort Collins, and Teller county. Additionally, this project was extended to include three producers as part of a Specialty Crops mini-grant from CSU for two years. Again, the project was aimed at introducing these cultivars and others to the general farmer's markets in the state, especially utilizing organic production techniques.

These four cultivars were also served during the week long Annual Potato Association of America meetings held in Denver, CO in August, 2012. Over 200 potato research scientists from North America and parts of the rest of the world attended. Each cultivar was served in a

different format (baked, mashed, boiled, etc.) and for different meals, but overall opinions of the taste, texture, etc. were rated extremely high by all participants at the conference.

Publications:

Masters' students Danny Iverson and Eric Larson worked closely on this project and will be including many of the results in their thesis.

Sections of this project and the sensory analysis were presented at the Potato Association of America poster session at the Potato Expo in Las Vegas in January, 2013. Over 1500 growers and industry representatives attended the Potato Expo and over 550 growers viewed this poster presentation.

The findings were communicated to the three hundred fifty Colorado potato producers during the annual Southern Rocky Mt. Ag Conference held in Monte Vista, CO in February, 2012.

Research Abstracts were submitted to the Western Agricultural Economics Association for inclusion in the summer meeting schedule but were not accepted.



Beneficiaries

The groups that will benefit from this project include all potato producers in Colorado and their buyers, private growers and gardeners in Colorado, and the base level North American consumer. There are an estimated 165 potato growers in Colorado and most work with a major warehouse to market commercial potatoes. This information will be developed and sent to the growers to help increase their knowledge base regarding potential branding of potatoes. It is of note that each of the cultivars selected has been widely accepted into the marketplace and there is a real momentum developing to brand the various cultivars and include their attributes. The Colorado Certified Potato Growers' Association developed an exclusive release with Albert Bartlett Company in Scotland for Purple Majesty potato. This cultivar is currently branded and

sold as “Purple Majesty” in the U.K. and has received wide acceptance and a good knowledge base from the consumers on its great health attributes and flavor!

Another portion of this project which will be key to moving ahead with branding efforts in Colorado concerns the consumer survey's which were conducted. It is clear that consumers have a fairly well evolved sense of the various attributes potatoes bring to the table, but there is also a need to continue education, especially where various health attributes are concerned.

Lessons learned

There were two key objectives for the project which were instrumental in its success and acceptance by the industry. The first was to increase the planted acreage of the four project varieties with the intention of having adequate supply to use for continuing the necessary agronomic studies, for consumer marketing studies and testing, and on a limited basis test commercial marketing. This objective was met without difficulty as the needed seed and commercial testing quantities of the four varieties were produced and are currently in storage.

The second key objective involved testing the consumer message track that is being developed. The idea was to refine the consumer message so that consumer knowledge of potato nutrition and health attributes is being clearly received and understood. The consumer studies conducted have shown that a consumer's willingness to pay for different potato varieties is influenced by the consumer's initial sensory experience with a variety, their pre-existing knowledge of potato nutritional properties, a variety of demographic variables, and the consumer's exposure to additional nutritional information prior to purchase and consumption. For example it was discovered that consumers were willing to bid higher prices for the four varieties with a health attribute after receiving nutrition education and tasting the varieties. They were unwilling to do this with the control variety of Russet Burbank after the same procedure. This knowledge will help us move closer to achieving the goal of branding cultivars in Colorado.

Finally, this project showed that there is a continuing spectrum of activities which will need to take place to successfully implement “branding” of potato cultivars. Because Jennifer Keeling-Bond left CSU employment mid-year of the final year of the project some of the work needed in this portion of the project was left uncompleted. Colorado State University was unable to identify someone to fill Dr. Bond's role in the project. This precluded having the full consumer evaluations of the four cultivars completed and will require that this phase of the project be done by early 2013. Additionally, the bag labels for each cultivar were not completed and will require some additional work to have these prior to the evaluations. Finally, there is additional work needed to have the FDA accept and validate the nutritional guidelines as established in this project so that they are available for marketing and branding of the cultivars. It is unfortunate that this was the case because clearly there is recognition by potato producers that consumers are interested in “branded” potato products. Three different potato growers have applied for exclusive control over some of the varieties involved in this project including Masquerade and CO97226-2R/R. This grower interest is driven by what is perceived as great consumer interest and potential for “branding” these varieties.

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Project Title: Irrigation Efficiency of Three Water Delivery Systems on Diverse Market Classes of Dry Edible Beans in Colorado Final Report

Project Summary

Pinto bean is a major market class, accounting for more than 90 percent of dry bean production in Colorado. However light red kidney, great northern, Anasazi and black beans are also produced to a limited extent. The focus on production of the pinto market class is based on a long tradition of pinto production in Colorado and the climate in the High Plains well suited for harvesting traditional semi-vine prostrate type pinto varieties. However, due to market competition from the northern High Plains region and Canada, commodity prices for pinto beans have lagged behind light red kidney and black beans in recent years. To allow Colorado to maintain their stature as an important region for dry bean production and to maintain the economic viability of the crop, other market classes such as light red kidney and black beans that currently have higher market value must be considered. During most of the 2008-09 market, light red kidney beans traded in the \$48 to 55/cwt. range while pinto beans traded in the \$28 to 38/cwt. range. However, the price structure has changed dramatically in 2011 due to climatic conditions in the ND-MN region that reduced the supply of pinto beans and created a shortage of pinto and black beans. Pinto and blacks are trading today at \$45/cwt. according the USDA-CO Dept. of Ag Market News. Nevertheless, Colorado producers need to be vigilant and consider long term diversification of bean production to provide new market opportunities for dry beans.

Colorado is facing declining water supplies due to increased competition with municipal and industrial users, withdrawals from aquifers at non-sustainable rates, and greater limitations on water diversions to satisfy longstanding legal compacts with neighboring states, and environmental concerns to maintain adequate habitats for wildlife. Statewide studies in Colorado project a 20% loss in irrigated acreage in the highly productive areas of the Front Range over the next 25 years (Colorado Water Conservation Board, 2004). Producers need information to more efficiently use limited water resources and make changes to allow crop production to maintain its economic viability.

Based on our results from 2010 and a preliminary view of data from 2011, we anticipate that furrow and drip irrigation methods will be more efficient than sprinkler. The two levels of application, 100 and 55% of recommended levels, differed for yield with the highest economic return at 100% for all market classes. The final results from both years of the research will provide dry bean producers and the dry bean industry with specific information regarding the economic viability of different market classes of the dry bean crop. Because market prices were near an all-time high in 2011, the data will show that dry edible beans will provide a favorable economic return compared to corn or wheat. The data will also show the most efficient method of deliver of irrigation water, so that water resources can be preserved for the survival of agriculture in Colorado. This project did not built on a previously funded project with the SCBGP or SCBGP-FB

Project Approach

We conducted a two-year experiment to evaluate three diverse market classes of dry edible beans, pinto, light red kidney and black, using furrow, sprinkler and drip irrigation methods under two irrigation schedule regimes in 2010 and 2011. The research was conducted at the USDA/ARS Limited Irrigation Research Farm in Greeley, CO. We hired a graduate student, Lucas Pesek, to work on the project while he worked toward a MS degree at Colorado State University. We also employed one full time college student during the summer months during both years. The field plots in 2010 and 2011 were planted in early June 4 and the irrigation

delivery systems were installed by the end of June. Neutron probe tubes were installed to monitor soil moisture content and a model to apply irrigation water to dry beans has been developed and calibrated to predict soil moisture needs of the bean crop. The project team, Drs. Gerald Buchleiter, Howard Schwartz, Allan Andales, and I met regularly to discuss the research project and personnel needs throughout the past two years.

Unfortunately, the field plots that had light red kidney beans in 2010 were destroyed by root pathogens and stand loss due to poor seedling emergence; consequently we planted yellow beans in place of light red kidney beans in 2011. Excellent field plots for pinto and black beans were harvested for yield, yield components and harvest index in both years and for yellow beans in 2011. Data collected in 2010 showed significant differences among irrigation systems for yield and irrigation level. Crop yield was strongly associated with water applied, where the relationships between yield and water applied appeared linear. Drip and furrow irrigation systems had higher yield per unit of water applied than sprinkler irrigation. Field days for growers and processors were conducted in 2010 with approximately 30 people in attendance and in 2012 with approximately 20 people in attendance. We also presented information regarding this project to the Rocky Mountain Bean Dealers Conference in Denver in March, 2011 as invited speakers. The topic of the presentation was the incorporation of upright bean varieties and best management practices to enhance profitability of the dry bean crop. More than 100 people were in attendance for that presentation.

Since field plots for the second year of the project were harvested in late September 2011, we have completed yield analysis, seed weight, pod number, seed number per pod, and biomass. This information is critical to allow bean producers to utilize irrigation water and determine the optimum economic return among the different bean market types. We anticipated that a Colorado Agricultural Experiment Station Bulletin would have been written and published by March 1, 2012 but we will now proceed to write the CAES bulletin for publication in early 2013. Project partners included the USDA/ARS Water Unit Project, Fort Collins CO and the Colorado Dry Bean Administrative Committee. The USDA provided all land, water and some critical labor resources to this project at no cost and the CDBAC provided a 25% match to funding for the project. These resources allowed us to generate a large data set that would not have been possible without their assistance.

Goals and Outcomes Achieved

The project has completed data analysis and is preparing a CAES Experiment Station Bulletin for publication in early 2013. The results from the research demonstrated that pinto and black bean had comparable and high yield under 100% ET (Tables 1 and 5), drip irrigation produced higher yield at both 100% and 55% ET than sprinkler or furrow irrigation (Table 2, and 6), and irrigation efficiency for seed yield was the same for 100% and 55% irrigation rates. Therefore, lower rates of irrigation did not improve water use efficiency (Tables 3 and 4).

Based on these results, it can be concluded that bean producers can improve water use efficiency with drip irrigation, however reducing applied irrigation water does not improve water use efficiency, and black and pinto beans did not differ for yield under each of the irrigation methods. We do not anticipate problems with publication of one CSU Experiment Station Bulletin March 2013. These results will allow dry bean producers in the region to maximize the use of scarce water resources.

Beneficiaries

The primary beneficiaries to this project are the growers and processors of dry edible beans in Colorado. To date, grower participating in field days will enhance economic return on investment opportunities and preserve limited irrigation water. Our Field day program demonstrated the three methods of irrigation delivery at two levels of application. We also demonstrated drip irrigation technology as well as novel market classes to the Front Range region. Adaptation of better methods to preserve irrigation water and enhance economic return to the grower will benefit all citizens of Colorado. Improved efficiency of irrigation and higher economic return will allow Colorado growers to remain competitive with the northern High Plains producers that have lower input expenses. Final publications will provide growers specific information to allow them to make decisions to improve production practices, preserve resources, and increase economic return. The research will also provide baseline data to design future research projects that can focus on improving irrigation delivery systems and market classes that have highest economic return to the grower.

Approximately 30 people were in attendance in 2010 and about 22 in 2011 for field days at the Limited Irrigation Research Center, near Greeley CO. Approximately 100 attended the 2011 Rocky Mountain Bean Dealers Convention in January 2011 where the research was introduced. In addition, lessons learned from this project were shared through the Colorado Bean News publication, which is distributed to nearly 2000 bean producers, dealers and other industry representatives in Colorado and the surrounding states. The Colorado Bean News is available online at <http://www.csuag.com/cbn/>.

The growers benefited by viewing 3 irrigation systems, at two irrigation levels on diverse market classes of dry beans. The final peer reviewed publication will provide data to show that yield can be increased by using drip irrigation, however, reducing water application reduced yield in the same proportion as water application. This information will allow growers to make informed decisions about water management and choice of market class for dry bean production.

Lessons Learned

The field research was completed with very few complications or problems outside of the inability to grow commercial light red kidney beans in Greeley Colorado. By substituting yellow beans in 2011 for light red kidney beans, we were able to obtain one year of data on a large seeded Andean dry bean market class. A concern to us at the outset of the project was that we knew that we could not complete data analysis and publication at the end of the project completion date (December 31, 2012). We knew this would be the case, because harvest, threshing, weighing and data analysis for a project this large cannot be completed in such a short time period after harvest. At this time, all data is analyzed.

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