

**Proposals for 2012-2013**  
**Sastry Jayanty**  
**Potato Postharvest Physiology**  
**San Luis Valley Research Center, Department of Horticulture & LA**

**Funding Source: CCPGA Royalties**

**Title: Relationship between cooking time and starch content in Colorado cultivars**

**Most relevant funding source: CCPGA royalties**

**Collaborators: Dr. David Holm and Dr. Henry Thompson**

**Nature and scope, of proposed research:**

Certain combined characteristics of cellular structure and starch properties provide distinctions between varieties of potatoes and bear strong relation to their culinary qualities. Larger tissue cells and larger average starch granules are associated with mealiness. Smaller cells and starch granules characterize the less mealy and "waxy" varieties. Similarly, the same general relationships hold for the varietal characteristics of high vs. low solids and high vs. low starch contents. Within a variety, proportionately larger numbers of large starch granules are associated with tubers of high specific gravity, and smaller granules, with low specific gravity. There also is a distinct reduction in percent of small granules during storage of tubers.

Tubers of different cultivars containing the largest cells were rated highest in mealiness by the taste panel. Larger tissue cells and larger average starch granules are associated with mealiness. Smaller cells and starch granules characterize the less mealy and "waxy" varieties. Similarly, the same general relationships hold for the high vs. low solids and high vs. low starch contents. Larger numbers of large starch granules are associated with tubers of high specific gravity, and smaller granules, with low specific gravity. Small granules contain less amylose.

Differences in starch granule size are accompanied by differences in amylose and amylopectin. Small granules contain less amylose and gel at higher temperatures than do the larger starch granules. Amylose content likewise appears to be a varietal characteristic. These variations in amylose content reflect fundamental differences in the properties of the starch gels formed when different varieties of potatoes are cooked. Likewise, there are similar distinctions between the starches within different tissue zones of individual tubers. Cell size also varies characteristically within different tuber regions. Varietal differences in cell structure and in starch granule size and composition offer opportunities for genetic exploitation.

Potatoes cultivars with lower mealiness scores, amylose content, loosely packed cell arrangement, and with comparatively larger cells, showed lower hardness, cohesiveness, springiness, chewiness, gumminess and longer cooking time.

**Objectives:**

Finding correlation between cooking time and ratio between amylose and amylopectin in Colorado germplasm

**How the project will enhance the competitiveness of Colorado potato growers:**

This research will enhance the value of our industry by increasing grower returns and open new markets

**Extension-outreach plan for reporting project information to growers**

Results will be presented and reported to grower community and scientific community using following avenues

- Rocky Mountain Ag conference,
- Northern Colorado Potato Grower meeting
- Potato Association of America Annual meetings
- Field day,
- Open house,
- Tours,
- Annual Reports
- Spuditem or newsletter.
- And site visits to commercial storages

**Potential for results to leverage additional outside funding**

This is one of the important research area identified by Specialty Crop Research Initiative grant advisory panel which includes nutritionists, dieticians, potato trade organizations, Chefs and processing, fresh market, growers and related industry.

**Timeline and expected short term (1 yr) and longer term (3-5 yrs) outcomes**

Funds are requested for one year funding.

**Detailed annual budget**

<b>Requested funding for 2012-13:</b>	<b>\$25,000.00</b>
Research Associate (25%):	\$12,500.00
Equipment and laboratory supplies:	\$10,000.00
Chemicals Supplies and Services:	\$5,000.00

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**Funding Source: CCPGA Royalties**

**Title:** *Understanding factors involved in netting Loss from Russet Potatoes.*

**Requesting second year funding to verify first year results**

**Nature, scope, objectives of proposed research**

Russet potatoes sold on the fresh market have an established image in the minds of consumers as having a uniform oblong shape and uniform brown external color. During the current harvest season some San Luis Valley potato growers have experienced poor russet netting development or the development of russetting that is easily and unevenly removed during routine harvest and shipping operations. Poor development of the russet skin netting of potatoes can lead to appearance and quality problems resulting in potatoes that appear white with brown patches, or appear as lower quality white or yellow potatoes. This defect results in lower returns to growers, shippers, and retailers who may have loads rejected or be paid lower prices for the crop. Loss of russet netting can lead to quality problems from increased moisture loss and increased visual appearance of defects such as external bruises, small cracks, or minor harvest damage. Prolonged appearance and quality problems may create a negative reputation for Colorado grown russet potatoes compared to other growing areas.

Causes of russet netting loss are not well understood. Previous research has examined soil temperature, soil moisture, and soil chemistry issues such as acidity or salinity as potential causes for poor development of russetting. Colorado grown potatoes may be losing russet netting in response to other factors as well that may result from local growing practices. It is the goal of the project to understand local causes of netting loss and develop economically viable strategies to reduce the occurrence and severity of the problem.

**Last year results:**

We tested different rates of nitrogen application and different soil amendments last year in the field study. We are still evaluating samples in the storage on netting loss.

**Objectives of proposed research:**

1. To test effect of soil pH on netting loss in greenhouse experiments
2. To test effect of soil moisture on netting loss in greenhouse experiments

**Relationship of proposed research to overall problem for potato growers**

Through improvement in the appearance and quality of russet potatoes, growers and distributors of fresh market potatoes will be able to offer better quality to their customers and receive better prices for their crop. The improved appearance and quality of the potatoes can maintain or improve the reputation of Colorado grown potatoes as viewed by large retailers and consumers.

The overall goals of the project are to 1.) improve our understanding of factors related to poor development or loss of russet skin netting, and 2.) develop economically viable strategies to reduce the occurrence or severity of russet netting loss. The goals will be measured by evaluating whether there have been significant gains in the understanding of the problem and if potential solutions can be proven to reduce the losses caused by the defect. Success will also be determined by effective presentation of this information to the Colorado potato industry.

**Potential for results to leverage additional outside funding**

Preliminary results obtained with this grant money will greatly help in preparing proposals to get state and federal funding mainly national potato council –ARS grants.

**Extension-outreach plan for reporting project information to growers**

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- And site visits to commercial storages

**Detailed annual budget (personnel, materials and supplies, travel, equipment, services) and a budget justification.**

**Requested funding for 2011-12:   \$16, 000.00**

Research Associate (25%):	\$10,000.00
Temporary Labor:	\$4000.00
Equipment and greenhouse supplies:	\$1,000.00
Chemicals Supplies and Services:	\$500.00
Travel:	\$500.00

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**Funding Source: CCPGA Royalties**

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

**Nature, scope, objectives of proposed research**

Flavor is a critical trait in potatoes since it can determine the success or failure of new cultivars in the market place. However, potato breeders do not have the tools to focus on selection for superior flavor. Breeding progress for improved flavor requires both genetic diversity for the trait and an effective way to identify superior clones. The first requirement is not likely to be a problem because tremendous diversity is found in cultivated and wild relatives of potato. The second requirement is more problematic because flavor evaluation based on sensory panels is extremely time consuming and can be carried out on only a few samples at a time. Breeders must be able to associate specific components of flavor in potatoes with more objectively measurable traits (such as chemical compounds) and with the genes underlying those traits. This will facilitate the identification of clones with superior flavor in their breeding programs.

Components of flavor include taste, aroma, texture, and umami (a Japanese word meaning delicious). The major taste (nonvolatile) components in potato tubers are glycoalkaloids, sugars, amino acids, lipids, acids, and nucleotides (Maga, 1994). Glycoalkaloids can produce a bitter flavor (Sinden et al., 1976). Bryan et al (2008) reported that alpha copaene was a major aroma component in flavorful Phureja Group clones, but not in bland Tuberosum Group clones.

During last year 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 (Rio Grande Russet, Purple Majesty, CO95172-3RU and AC99329-7PW/Y) 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 AC99329-7PW/Y. Alpha copene which is dominant potato flavor compound is present in all cultivars tested except CO95172-3RU. Limonene and carene are major terpenes in the volatiles of CO95172-3RU.

This year one of our Master student working with Dr. Holm, Dr. Lavanya and Dr. Jayanty is screening carotenoid content in advance selections and diploid material. We will screen that material for flavor.

#### Research Objectives:

1. To evaluate a diverse array of potato germplasm for major volatile components (pyrazines, methoxypyrazines, methional, and alpha-copaene) identified as contributing to the “baked potato” flavor desired by consumers.
2. To relate volatile components to carotenoid content in advanced and diploid selections
3. To identify wild *Solanum* accessions with exceptional levels of major components of flavor.

#### How the project will enhance the competitiveness of Colorado potato growers:

The development of potato cultivars with enhanced flavor has the potential to increase consumer interest in fresh market potatoes and boost consumption.

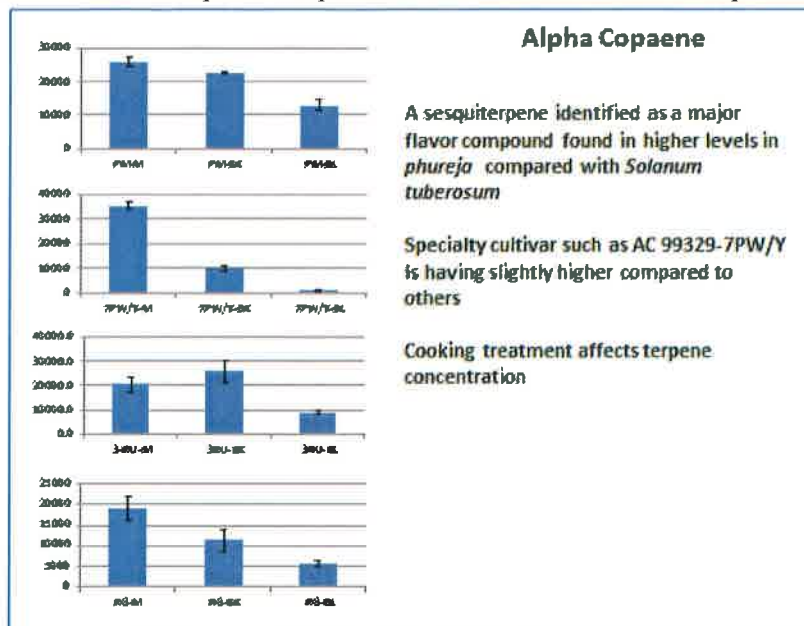
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#### Potential for results to leverage additional outside funding

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Research Associate (25%):	\$12,500.00
Temporary Labor:	\$2,500.00
Equipment and laboratory supplies:	\$5,000.00
Chemicals Supplies and Services:	\$5,000.00