Annual Report

2012-2013

Sastry S. Jayanty, Henry Castleberry, Elita Castleberry

Venu Perla, Diganta Kalita and Caroll Colter

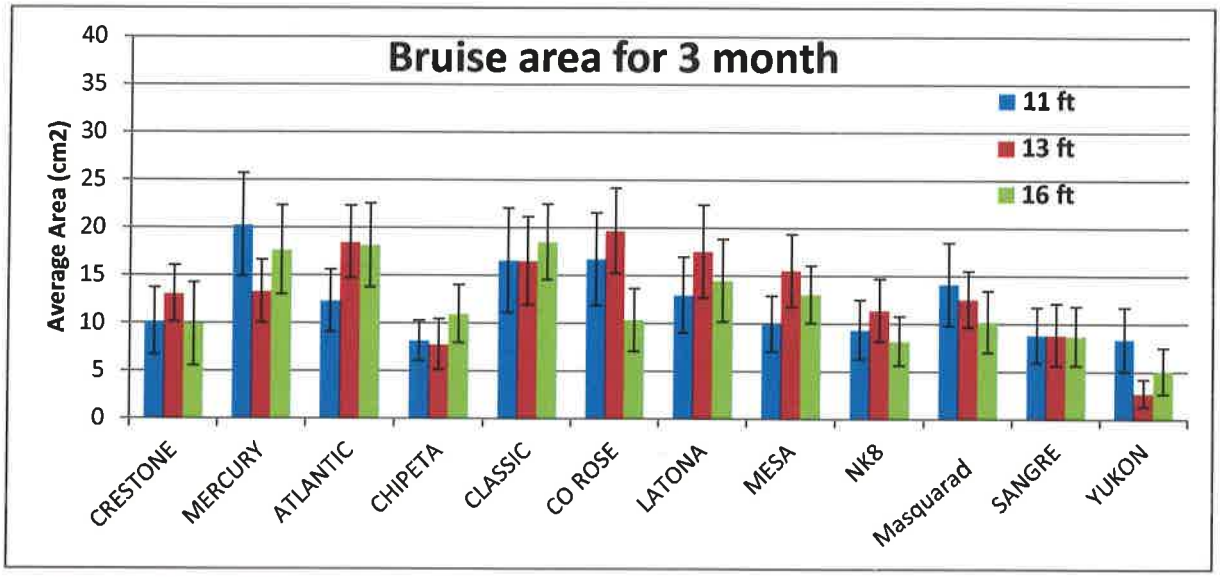
Department of Horticulture and Landscape Architecture
San Luis Valley Research Center
Colorado State University

0249 East County Road 9N
Center, CO-81125
www.ppb.colostate.edu

I. Effect of pile height on pressure bruise incidence

Our objective of this study was to come up with pile height recommendations for different cultivars grown in the San Luis Valley. We tested 11, 13 and 16 ft. pile heights on 12 cultivars harvested at the Research Center. We conducted this study using water tanks to put weight equivalent to the approximate pile height (11, 13 and 16 ft.) on potato samples placed in the cribs. We collected data after three and six months of storage . We did this study in a seed storage and no sprout inhibitor was applied.

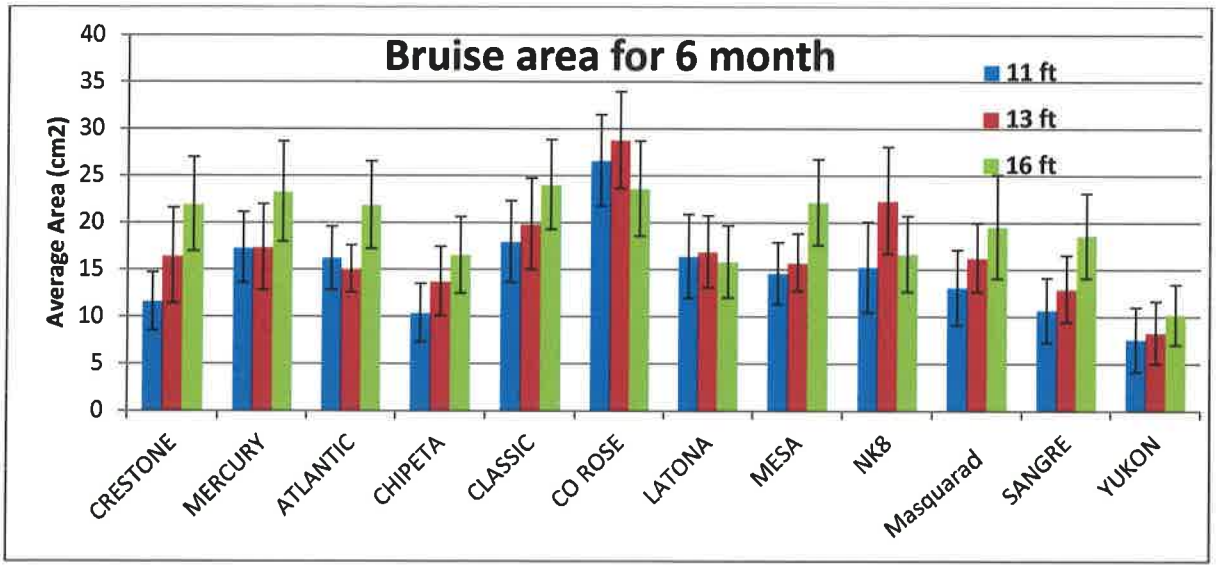
Data collected after three months of storage show the differences in the weight of the water tanks causing pile pressure does not significantly affect the bruise area. There is no significant difference between the different pile heights treatments in 12 cultivars at three months of storage duration. Yukon and Chepeta are having a less bruise area compared to rest of all russets and specialities. Among russet cultivars NK8 and Crestone Russet showed less bruise area.



At 11 ft. pile height there is no significant difference from the 3 to 6 month data in any of the varieties with the exception of Colorado Rose where there is an increased difference in the 3 and 6 month data. There is no significant difference from the 3 to 6 month data in any of the varieties with the exception of Chipeta, NK8, Yukon and Colorado Rose at 13 ft. pile height on pressure bruise. There is a difference in the 3 and 6 month data at 16 ft . pile height in Crestone, Mesa, Sangre, Mascarade, NK8, Yukon and Colorado Rose where the bruise area increases as time increases.

A trend can be seen in Crestone Russet , Chipeta, Mesa Russet, Mascarade and Yukon Gold with an increase in the pile height, bruise area also increases but not significantly. The other trend that can be seen is that at 16 ft. pile height there is an increase in the amount of bruise area.

This can be seen in Mercury Russet, Atlantic and Mesa Russet. Latona, NK8 and Colorado Rose show no increase in the bruise area regardless of pile height.

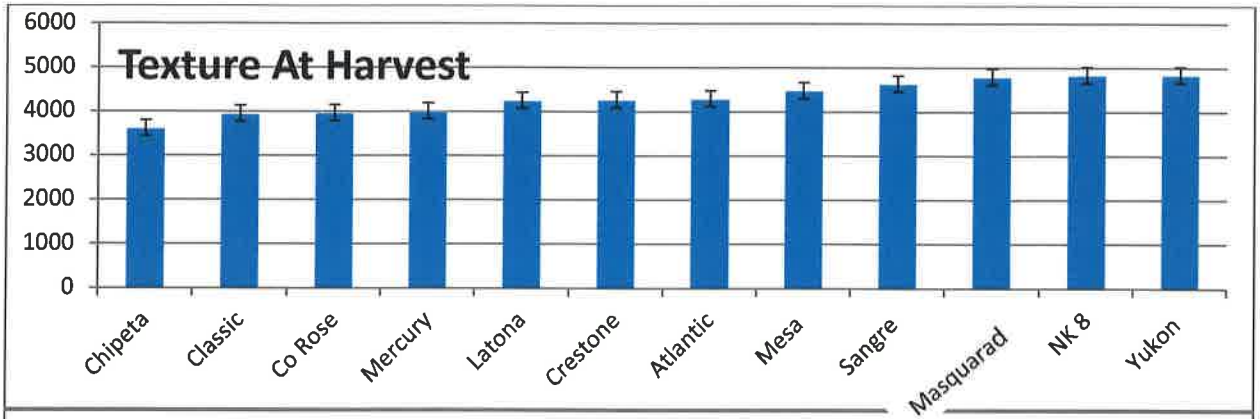


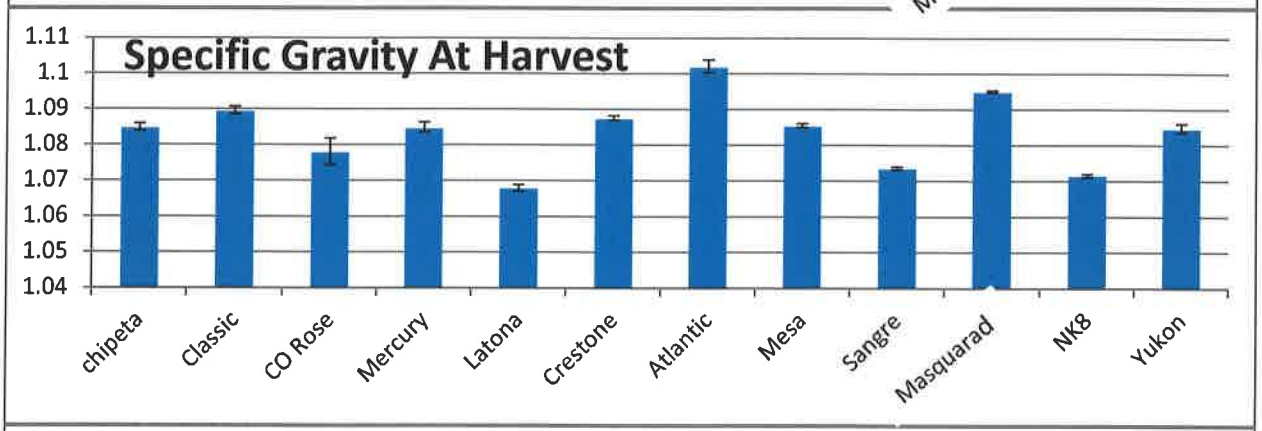
II. Relation of Texture on Pile Height and Pressure Bruise Incidence

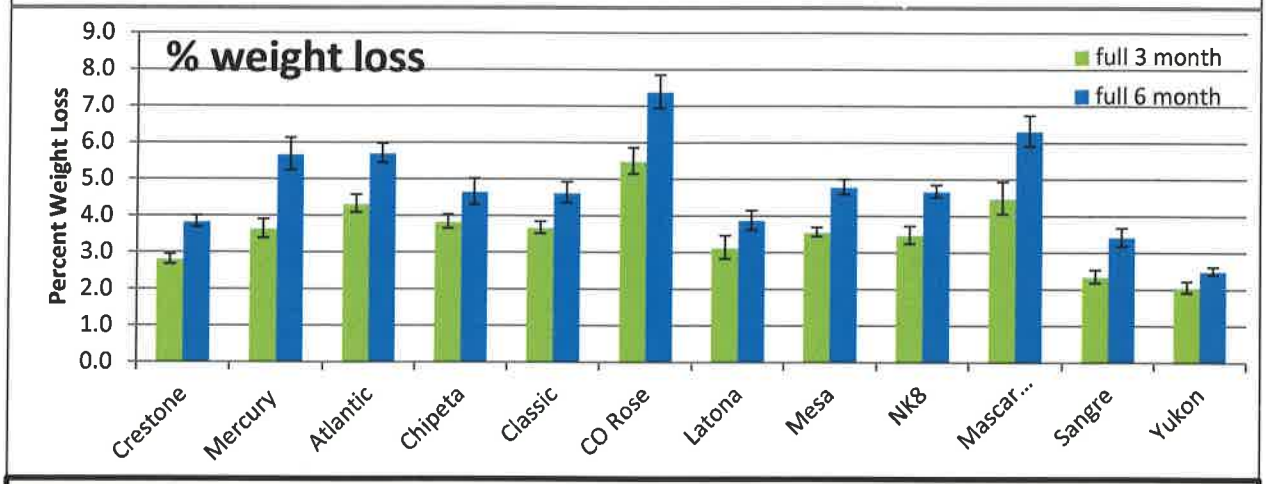
We analyzed the texture data at harvest and subsequent 3 and 6 months of storage. Among whites and other specialities Yukon Gold, Sangre lost the least amount of weight and with high peak load value even at 3 and 6 months of storage and resulting in less pressure bruise at different pile weights. Masquerade exhibited good peak load initially but due to considerable weight loss during storage did not perform well in the texture experiments at 3 and 6 months of storage.

Among russets NK8 and Mesa Russet is high in texture at harvest with a similar weight loss percentage and similar pressure bruise incidence area on tubers.

There is a statistical difference between 11 ft. and 16 ft. pile height in Crestone Russet pressure bruise incidence. There is no statistical difference among cultivars when we evaluated at 3 months storage time in terms of bruise area. There is more weight loss in Colorado Rose, Mascarade and Mercury Russet during 6 months of storage. It reflected by the increased bruise area more at 16 ft. pile high and less in lower pile heights.

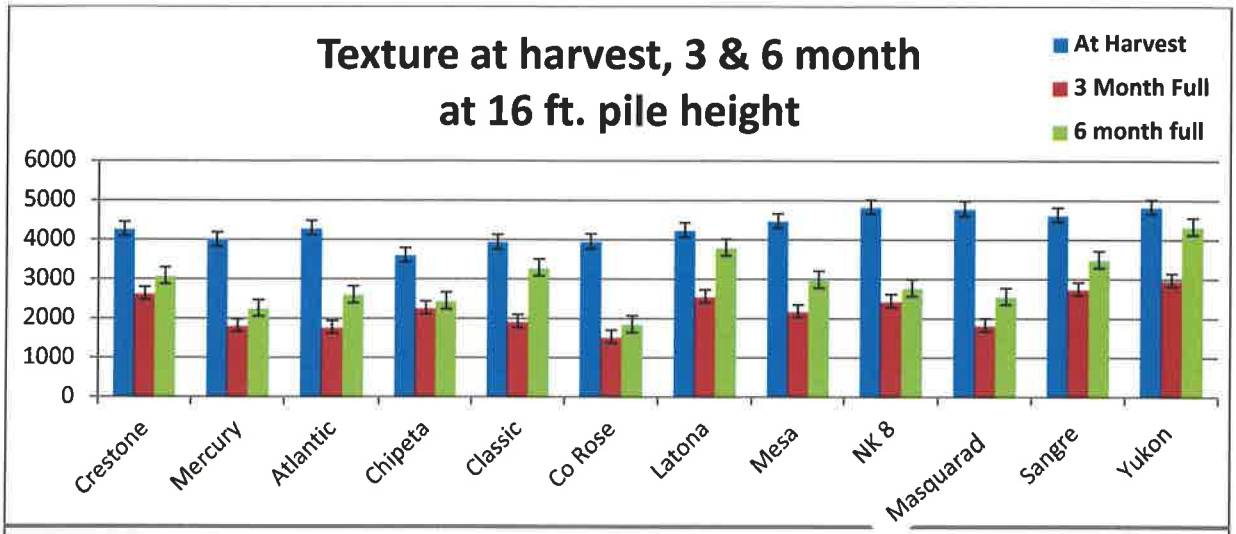


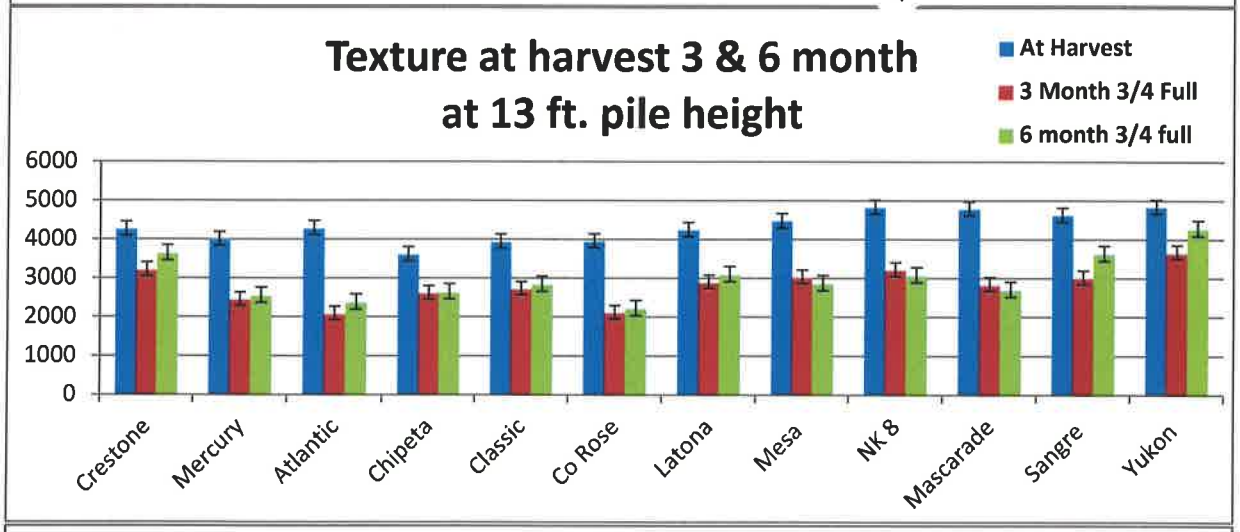


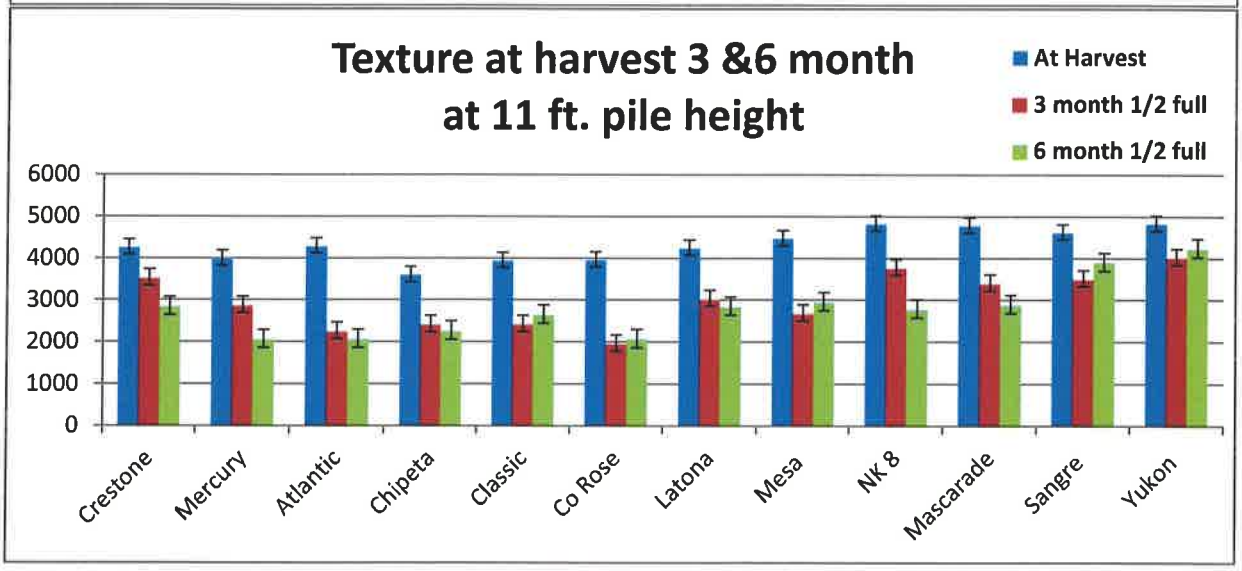


Conclusions and recommendations

1. **Texture analysis at harvest and weight loss in first one month will give very good indication on pressure bruise incidence**
2. **Cultivars that lost most weight in storage even they have good texture at harvest will have pressure bruise in long term storage**
3. **Crestone Russet showed sensitivity to pile height 16 ft. Pile height caused more pressure bruise than 11 ft. pile**


Texture at harvest, 3 & 6 month
at 16 ft. pile height
At Harvest
3 Month Full
6 month full
6000
5000
4000
3000
2000
1000
0
Crestone
Mercury
Atlantic
Chipeta
Classic
Co Rose
Latona
Mesa
NK 8
Masquarad
Sangre
Yukon


Texture at harvest 3 & 6 month
at 13 ft. pile height
At Harvest
3 Month 3/4 Full
6 month 3/4 full
6000
5000
4000
3000
2000
1000
0
Crestone
Mercury
Atlantic
Chipeta
Classic
Co Rose
Latona
Mesa
NK 8
Mascarade
Sangre
Yukon


Texture at harvest 3 &6 month
at 11 ft. pile height
At Harvest
3 month 1/2 full
6 month 1/2 full
6000
5000
4000
3000
2000
1000
0
Crestone
Mercury
Atlantic
Chipeta
Classic
Co Rose
Latona
Mesa
NK 8
Mascarade
Sangre
Yukon

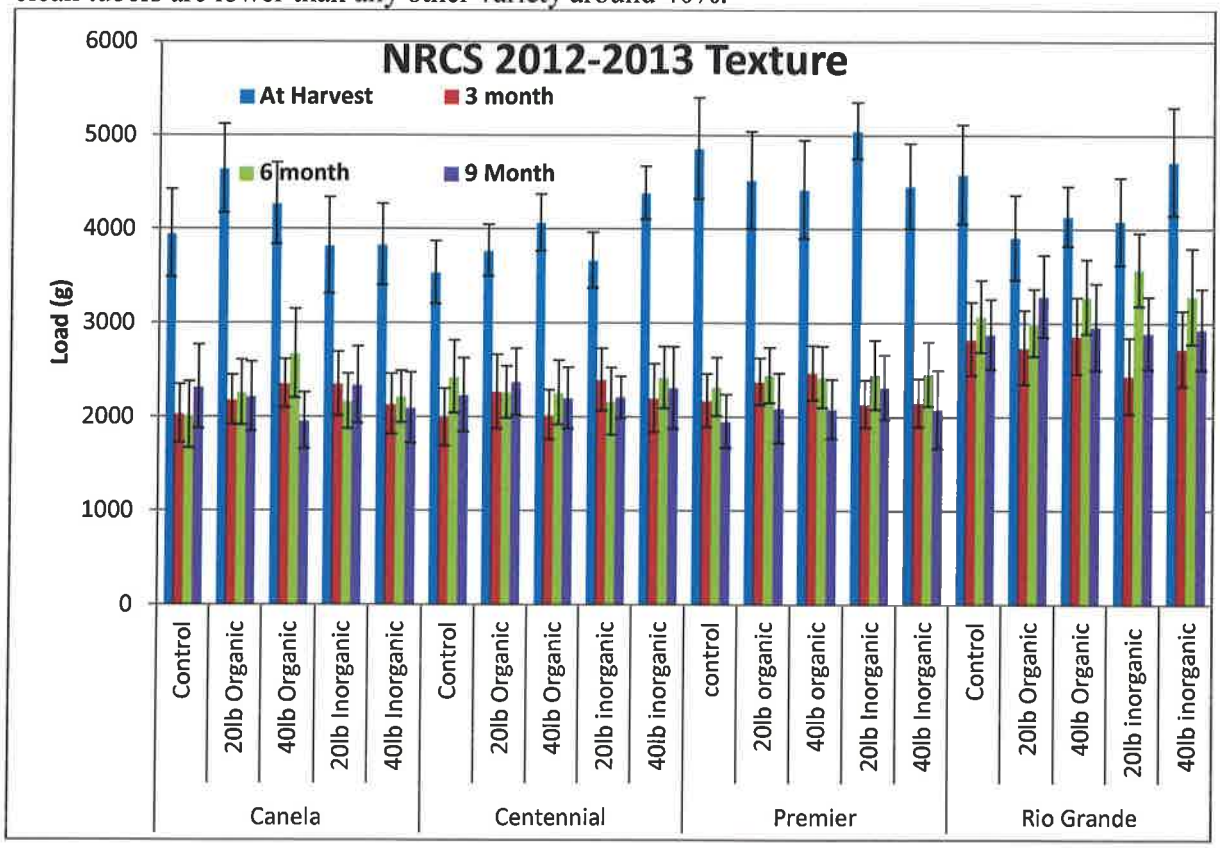
III. Storage quality on late nitrogen application

Introduction

Potato growers sometimes apply nitrogen (N) fertilizer late in the season (late tuber bulking) with the aim of increasing tuber size and yield. Late N fertilizer application has been reported to negatively impact tuber yield and tuber storage characteristics. This field study was conducted to evaluate the effect of N fertilizer source and late N application rate on tuber yield and quality of four russet potato cultivars. We used both inorganic (conventional) nitrogen and organic form such as blood meal.

Canela Russet (Canela)

There is no statistical difference with the late nitrogen application both organic and inorganic treatments. Texture was around 4000 g at harvest, and 2000g for 3, 6 and 9 months of storage. Bruise area 10 to 27 cm^2 with 20 lb inorg lowest and 40lb org highest for 3 months. 6 to 9 months about the same for all ranging from 25 to 30 cm^2. Bruise count is around 3 for lowest (Both inorg) and 5 for the highest (40lb org) for 3 mo. 6 and 9 mo are around 4. Weight loss was not significantly different depending on the treatment. It increased with time. There was more thumbnail than any other damage. Second most prolific damage was skinning. The percent of clean tubers are lower than any other variety around 40%.

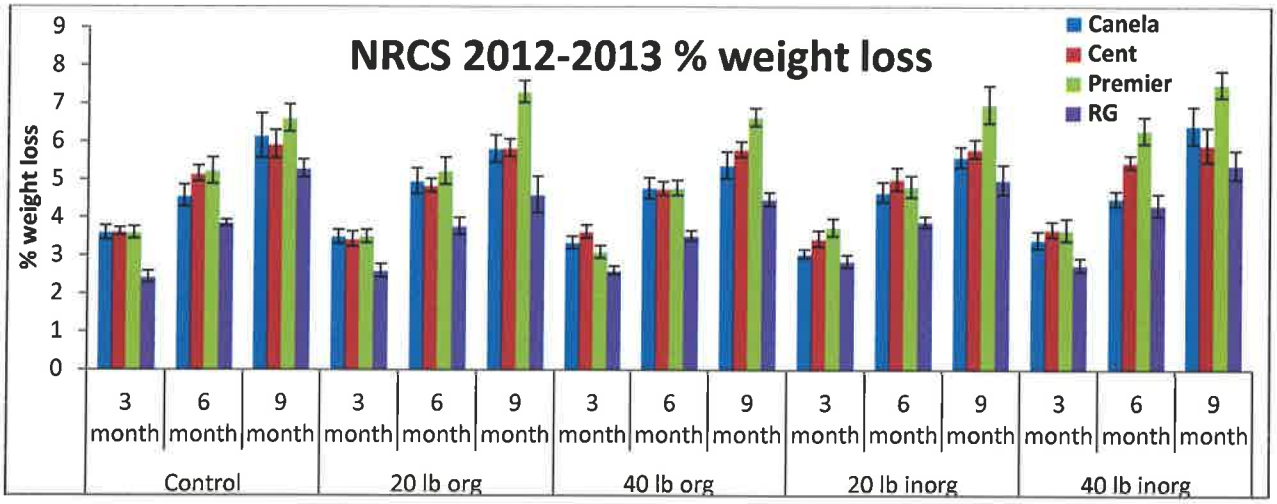


Centennial Russet (Cent)

Texture reading ranges from 3500g to 4250g at harvest, around 2000g for 3, 6 and 9 months of strage. Bruise area 5 to 9 cm^2 with 40 lb inorganic being the lowest and 40lb org highest for 3

mo. 6 to 9 months of strage about the same for all ranging from 17 to 26 cm^2. Bruise count is around 2 for 3 months where as for 6 and 9 months it ranges from 3.5 to 4.5. Weight loss was not significantly different depending on the treatment. It increased with time There was more thumbnail than any other damage. The percent of clean tubers are around 60%.

Premier Russet (Premier)
Texture readings range from 4500g to 5000g at harvest, around 2000g for 3, 6 and 9 Mo. Bruise area 9 to 13 cm^2 with 20 lb inorg being the lowest and 20lb org highest for 3 mo. 6 to 9 mo about the same for all ranging from 23 to 30 cm^2 with the exception of 6 mo 40lb inorg which was very high at 35 cm^2. Bruise count is around 3 for 3 mo. For 6 and 9 mo bruise count is around 4 with the exception of 6 month 40lb inorg. Specific gravity is 1.1 for all treatments and at all times with the exception of 40lb org at harvest which must have been an error in data collection. Weight loss was not significantly different depending on the treatment. It increased with time. The 9 mo was higher than all the other varieties. At 6 and 9 mo 40lb inorg lost more weight than other treatments. Damage indicates there was more thumbnail than any other damage. The percent of clean tubers are around 60%.



Rio Grande Russet (RG)
Peak load readings range from 4000g to 4500g at harvest and range from 3500g to 2500g for 3, 6 and 9 months of storage . The 3, 6 and 9 months of storage are higher than any other variety. Bruise area 7 to 15 cm^2 with 20 lb inorg and 40lb inorg being the lowest and 20lb org the highest for 3 mo. 6 to 9 mo they had a trend of 6 mo being lower than 9 mo. 6 mo ranged from 20 cm^2 to 26 cm^2 (control). 9mo ranges from 23 cm^2 (40lb org) to 34 cm^2 (control) . Count ranges from 2 to 3 for 3 mo. 6 and 9 mo are around 4 to 5. Weight loss was not significantly different depending on the treatment. It increased with time. Rio Grande had the lowest % weight loss of all varieties. Damage indicates there was more thumbnail than any other damage but it was around 15% which was the lowest for all varieties. The percent of clean tubers are around 60%.

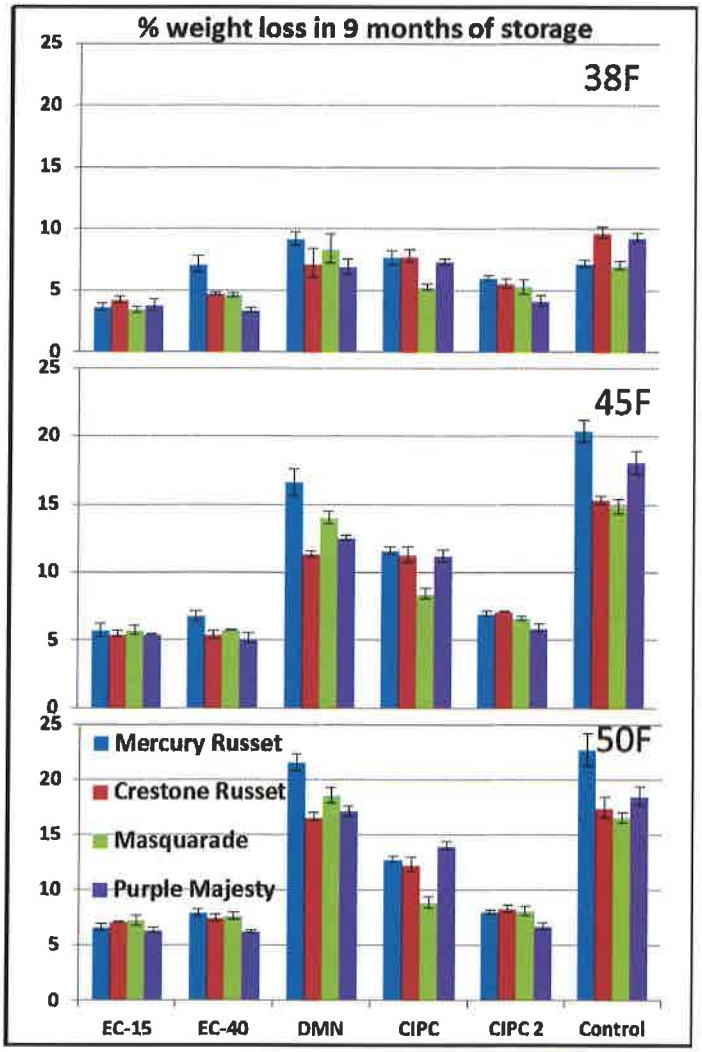
Conclusions and Recommendations

1. There is no difference in the organic and inorganic nitrogen applications late in the season.
2. Application of nitrogen late in the season in did not make any difference in terms of texture for Canela Russet, Premier Russet and Riogrande Russet. In Centennial Russet 40 lb convential application late in the season increased texture readings at harvest.
3. We are conducting 3rd year grower field tests final results will be available at the end of next storage season.

IV. Studying the efficacy of synthetic and organic sprout inhibitors on Colorado potato cultivars for long-term storage.

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.

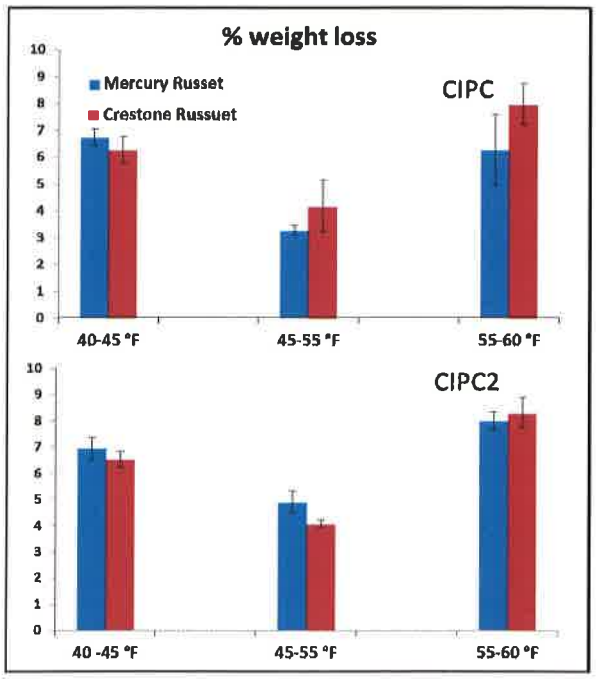
We selected four cultivars; two russets (CO99053-1RU (Crestone Russet), CO99100-1RU (Mercury Russet)) and two specialties (Purple Majesty, AC99329-7PW/Y (Masquerade)) to study sprout inhibition. These cultivars are either advanced selections or recently released cultivars with great potential in terms 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



Optimum temperature for CIPC and CIPC2 treatments

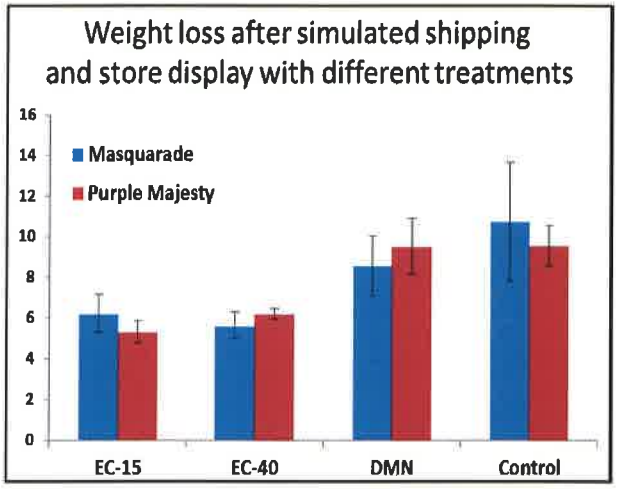
application of sprout inhibitors and

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 napthalic); 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 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.

- 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 the tuber pulp temperature is at 45 to 55°F had less weight loss and shrinkage.
- ❖ Organic sprout inhibitor Biox®-15 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 3 to 4 weeks
- ❖ Masquerade and Purple Majesty treated with Biox®-15 or 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.

V. Publications (2012-2013)

Extension publications

- **Sastry Jayanty**. (2012). Managing Tuber Maturity to Improve Skin Set. Spud Items Volume 64, No:11.
- **Sastry Jayanty**. (2012). Potato Storage Sanitation. Spud Items Volume 63, No:9.

Peer reviewed publications

- ❖ Diego Fajardo, **Sastry S. Jayanty** and Shelley Jansky (2013). Rapid high throughput amylose determination in freeze dried potato tuber samples. The Journal of Visualized Experiments (JoVE) (80), e50407, doi:10.3791/50407
- ❖ Venu Perla, **Sastry S. Jayanty***, David G. Holm and Robert D. Davidson, (2013). Relationship between tuber storage proteins and tuber powdery scab resistance in potato. American Journal of Potato Research. DOI: 10.1007/s12230-013-9343-y. Published online
- ❖ Diganta Kalita, David G. Holm and **Sastry S. Jayanty*** (2013). Role of polyphenols in acrylamide formation in the fried products of potato tubers with colored flesh. Food Research International. 54:753-759. Published online
- ❖ Diganta Kalita and **Sastry S. Jayanty*** (2013). Reduction of Acrylamide Formation by Vanadium Salt in Potato French Fries and Chips. Food Chemistry. 138: 644–649.
- ❖ Venu Perla and **Sastry S. Jayanty*** (2013). Biguanide related compounds in traditional antidiabetic functional plant foods. Food Chemistry. 138:1574–1580.