COLORADO STATE REPORT

BREEDING AND SELECTION PROGRAM

The Colorado Potato Breeding and Selection Program intercrossed 109 parental clones in 2009 in two separate crossing blocks. The emphasis of the first crossing block was russet and specialty cultivar development. The second crossing block emphasized russet and specialty cultivar development and corky ringspot resistance. Seed from 399 combinations was obtained.

Approximately 55,960 seedling tubers representing 253 families were produced from 2007 and 2008 crosses for initial field selection in 2010. These seedlings represent crosses segregating primarily for russet, reds, specialty types, and resistance to late blight, PVY, and corky ringspot, and nematodes. Second through fourth size seedling tubers will be distributed to Idaho (USDA-ARS), Minnesota, North Dakota, Oregon, Texas, Wisconsin, and Alberta, Canada (Agriculture Canada).

Colorado grew 81,644 first-year seedlings representing 481 families in 2009, with 810 selected for subsequent planting, evaluation, and increase in future years. A portion of these seedlings were obtained from the USDA-ARS-Idaho, Agriculture Canada, Texas A&M University, and Oregon State University. Another 1,232 clones were in 12-hill, preliminary, and intermediate stages of selection. At harvest, 372 were saved for further increase and evaluation. Forty-eight advanced selections were saved and will be increased in 2010 pending further evaluation. Another 267 selections and cultivars were maintained for germplasm development, breeding, and other experimental purposes including seed increase/maintenance.

Field trials conducted in 2009 included: Preliminary Trial, Intermediate Yield Trial, Intermediate Specialty Yield Trial, Advanced Yield Trial, Southwestern Regional Russet Trial, Southwestern Regional Red Trial, Southwestern Specialty Trial, Western Regional Russet/Processing Trial, Western Regional Red Trial, Western Regional Specialty Trial, San Luis Valley Chipping Trial, and Western Regional Chipping Trial. All trials are grown under "low input" conditions, primarily for reduced nitrogen and fungicide.

A total of 212 samples are in the process of being evaluated for two or more of the following postharvest characteristics: blackspot susceptibility, storage weight loss, dormancy, enzymatic browning, specific gravity, french fry color, french fry texture, and chip color.

Advanced selections evaluated in the Southwest Regional Trials, Western Regional Trials, or by producers in 2009, included 10 russets (AC96052-1RU, AC99375-1RU, CO94035-15RU, CO95172-3RU, CO97087-2RU, CO98067-7RU, CO98368-2RU, CO99053-3RU, CO99053-4RU, and CO99100-1RU), five reds (CO98012-5R, CO99076-6R, CO99256-2R, CO00277-2R, and CO00291-5R), seven chippers (CO95051-7W, CO96141-4W, CO97043-14W, CO97065-7W, CO00188-4W, CO00197-3W, and CO00270-7W), and 17 specialties (AC97521-1R/Y, AC99329-7PW/Y, AC99330-1P/Y, ATC00293 -1W/Y, CO97222-1R/R, CO97226-2R/R, CO97227-2P/PW, CO97232-1R/Y, CO97232-2R/Y, CO97233-3R/Y, CO99045-1W/Y, CO00379-2R/Y, CO00405-1RF, CO00412-5W/Y, CO00415-1RF, CO01399-10P/Y, and VC1009-1W/Y).

Mesa Russet (CO94035-15RU) was named in 2009. Mesa Russet is a high yielding, dual-purpose russet. It has a medium maturity and a high percentage of US #1 tubers. It is resistant to second growth, blackspot bruise, shatter bruise, powdery scab (tuber and root galling) and verticillium wilt. Mesa Russet has also shown potential to fry after storage.
Since 1975, there have been 27 potato cultivars/clonal selections have been released by Colorado State University or in cooperation with other agencies (Table 1). Colorado State University releases accounted for 61% of the 56,000 acres planted to fall potatoes in Colorado in 2009. Colorado cultivars and clonal selections accounted for 45% of the 11,470 acres of Colorado certified seed accepted for certification in 2009. Advanced Colorado selections accounted for another 2% of the seed acreage. Four of the top 20 russet cultivars grown for seed in the U.S. [Canela Russet (#7), Rio Grande Russet (#8), and Russet Norkotah-S3 (#9), Russet Norkotah-S8 (#15)] were developed by the Colorado program. For the red category, Sangre-S11 ranked #7. For colored-fleshed specialties, Mountain Rose and Purple Majesty ranked #1 among red and purple-fleshed cultivars.

POTATO MANAGEMENT AND PHYSIOLOGY PROGRAM

Horticultural evaluations were conducted on 32 potato cultivars and advanced selections in 13 trials at 8 locations in the San Luis Valley of Colorado. Tests included 15 Russets, 5 Reds, 9 Specialty Potatoes, and 3 fingerlings. The trials assessed the influence of different cultural management practices on plant growth, development, tuber yield, tuber size distribution, and tuber quality of potato cultivars, in an effort to establish optimum management guidelines for each cultivar. Studies conducted in 2009 included the response of different potato cultivars to different nitrogen (N) application rates. Nitrogen rate treatments ranged from 0 (control) to 202 kg N/ha. The influence of in-row seed spacing on the performance of three Russet potatoes were evaluated. Potato cultivars were planted at 25, 30, 35, and 40 cm. In the in-season N application timing study, in-season N application started at 1, 2, or 3 weeks after tuber formation, which allowed N application to end early, mid term, or late in the growing season. The effect of pre-plant N application rate on the performance of a newly released potato cultivar Mesa Russet was evaluated. Pre-plant N application rate treatments included 68, 90, 112 kg N/ha, and a control. The remainder of the total N recommended for the cultivar was applied in three split applications during the crop growing season. The effect of potassium source and form of application on the performance of Russet Potato was evaluated. Treatments included liquid and dry formulations of potassium chloride, potassium sulfate, and a control, where no potassium was applied. Observations from the 2009 field studies and some of the data collected were presented at the potato growers meeting in Northeast Colorado; at the Southern Rocky Mountain Agricultural Conference in Monte Vista, Colorado; and at the Horticulture Department Seminar, Colorado State University. A field day was organized for potato growers and consultants at the San Luis Valley Research Center, Colorado, to allow stake holders to see how the potato crop performed under different management treatments, and to foster discussion with, and among growers. Some of the results from the 2009 studies were discussed with potato growers during the potato cultivar evaluation committee meeting, to help take decisions on advanced selections that need to be named, or need further research studies, or those that need to be discarded from research programs. Grower cooperators were given a tour of all the advanced selections planted in grower fields.
Findings from the potassium studies showed that the source and form of potassium fertilizer application can influence the performance of potatoes in the field. In the 2009 study, it was observed that potassium sulfate applied as a dry formulation increased total and marketable tuber

yield by 12 and 20%, respectively, compared to the application of potassium chloride as source of potassium fertilizer. It was observed that potatoes responded more positively to dry formulations of potassium sulfate in soils with high residual potassium, when compared to potassium chloride and liquid formulation of potassium sulfate. Dry formulation of potassium sulfate produced more bulky tubers compared to potassium chloride or liquid formulation of potassium sulfate. Tubers harvested from potassium sulfate plots recorded high tuber specific gravity of 1.09 to 1.099, compared to 1.095 for tubers harvested from potassium chloride plots. Potato growers have mostly been using potassium chloride as source of potassium fertilizer in their operations. Findings from this study will help growers to make better decisions on the potassium source and form to use in their fertilizer program to obtain high tuber yield and quality. Optimum total available (soil + water + applied) nitrogen (N) rate, and optimum available pre-plant (soil + applied) N rates were evaluated for the newly released Russet cultivar Mesa Russet. Optimum total available N rate for Mesa Russet was observed to be 162 kg N/ha. Optimum available pre-plant N rate was observed to range between 58 and 91 kg N/ha. The application of higher (112 kg N/ha) pre-plant N rates resulted in increased tuber external defects. For maximum tuber yield and quality, petiole N concentration from tuber initiation through tuber bulking should not fall below 10,000 kg/mg. The optimum range should be from 20,000 kg/mg at tuber initiation down to 10,000 kg/mg during tuber bulking. The use of recommended rates of N by growers have helped increase tuber specific gravity of Mesa Russet to 1.099. Application of the recommended pre-plant and total available N fertilizer rate for Mesa Russet has helped increase its agronomic N use efficiency, as well as reduced the nitrogen fertilizer input for the production of the cultivar. This has led to a significant increase in the profit margin of growers of the new cultivar. The application of optimal rates of N has reduced the potential of nitrate N leaching into surface and ground waters. The farm environment and the rural community who depend on well water are much safer. Potato markets are size specific. Therefore, tuber size distribution in a harvested crop is very important. Plant population studies can optimize in-row seed spacing for a specific tuber size range. Plant population studies conducted in 2009 showed that when Canela Russet is planted at 35 cm in-row spacing, and 85 cm row spacing, large tuber size production is increased by 14 and 22%, compared to in-row seed spacing of 30 and 25 cm, respectively. These findings have helped reduce the quantity of seed required to plant Canela Russet, and therefore, production cost for the cultivar has reduced, and grower profit margin has increased.

PATHOLOGY PROGRAM

The 2009 potato crop in Colorado was quite good overall with excellent yields of relatively large sized tubers. From a disease standpoint, the crop was affected by three major problems. First and most damaging was a high level of PVY in certain cultivars such as Russet Norkotah, reducing yields. Secondly, pink rot was an issue in some fields of Russet Norkotah due to the excessive precipitation in the late season. There were 6-800 acres that were abandoned because of too much disease. Third, much of the crop was harvested in the late season due to the moisture. This resulted in several fields with light to moderate frost damage. Most growers were able to dry the affected tubers during the early storage season and the impact from this condition was minimal. Finally, there have been certain lots with Fusarium dry rot due to the late maturity of specific cultivars like Canela Russet and the cold conditions during harvest. Shipments of the crop have been excellent and overall quality good, however, the lack of a good price has been detrimental to the growers profit margin.

POTATO SEED CERTIFICATION PROGRAM

Certified seed potato production in Colorado continues to be an important industry for the state. While the potential for quality seed production is great, the state is experiencing a slight decline in seed potato shipments and acreage entered.

Bulk shipments of the 2008 certified seed crop was just over 1 million cwt. This is the lowest shipment total since 1996. 60% of the seed loads were shipped out of the San Luis Valley, mostly out of state. 40% stayed in the valley. Shipments of the 2009 crop are expected to be slightly less than last year's crop.

13,326 acres were entered for the 2009 crop year. This is a decrease of 13% or 2,047 acres from 2008. Of those acres entered for 2009, 1,806 acres, or 13% were rejected for various disease tolerance violations. The primary disease causing seed lot rejections is Potato Virus Y (PVY). Total Russet Norkotah acreage decreased by 45% from 4,898 acres to 2,695 acres. This loss of 2,203 acres closely parallels the total acreage loss mentioned above. Approximately 1/3 of this Russet Norkotah acreage was rejected due to mosaic. Other cultivars showed increased levels of mosaic due to disease pressure in a valley where highly contaminated commercial lots are planted adjacent to certified seed lots.

Seed growers struggle to produce Russet Norkotah lots that pass inspection. We have seen a shift in Russet Norkotah production. The seed growers that used to buy G3 seed to increase one or two years no longer raise this cultivar. The growers that produce their own nuclear seed have increased greenhouse production, increasing the G1 acreage. They hope to maintain the quality and have a quantity of saleable product at a G3 level, after only three years exposure. Sometimes a seed lot will be rejected at the G3 level.

The Colorado potato industry has developed and does support a state seed law. This is expected to pass state legislature and will be fully enforced within two years. This calls to attention the disease pressure in the San Luis Valley, and directs growers to be more aware of the inoculum present and how it affects quality of certified seed. This is a positive move for the industry, but change comes hard. Several commercial growers have approached PCS about becoming certified seed growers. And the established certified growers are working to prepare for increased needs.