

# **SUMMARY REPORT OF 2012 RESEARCH STUDIES POTATO CULTURAL MANAGEMENT AND PHYSIOLOGY**

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## **Introduction**

Each potato cultivar has its own unique set of cultural management requirements to attain maximum tuber yield and quality. To attain sustainable yield and quality potential of any potato cultivar, optimum management guidelines for the cultivar need to be followed. The objective of the 2012 research studies was to establish cultivar specific management guidelines for the successful, sustainable, and economic production of new and existing potato cultivars, which optimize their genetic potential, while minimizing economic inputs and environmental degradation.

## **Outputs/Experiments Conducted**

In 2012, horticultural evaluations were conducted on 25 potato cultivars and advanced selections in 16 trials at 9 locations in the San Luis Valley of Colorado. Tests included 13 Russets, 10 yellow flesh specialty potatoes, and 2 Reds. The trials assessed the influence of different cultural management practices on plant growth, plant 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 2012 included the response of four potato cultivars to different nitrogen (N) application rates. Nitrogen rate treatments ranged from 0 (control) to 240 lb N/ac. The effect of N rate treatments on mid-season petiole nitrate nitrogen concentration was measured. The effect of extra late nitrogen fertilizer application on the performance of four Russet potato cultivars was evaluated. Late nitrogen fertilizer application treatments included 20 and 40 lb inorganic and organic N/ac, and a control where no extra late N was applied. The effect of soil amendments on potato tuber yield and quality was evaluated. The response of russet potato to the form and rate of potassium (K) fertilizer application was studied in 2012. The influence of ten preceding green manure cover crops on the performance of russet potato was evaluated. Seventeen advanced selections from the CSU potato breeding program were evaluated under six potato grower management conditions in order to determine their yield stability as well as the optimum management conditions suitable for each cultivar to attain its genetic potential. All data collected were subjected to statistical analysis to determine the management practice that resulted in maximum tuber yield and quality.

## **Outcomes/Results:**

### **Management Guidelines for CO99100-1RU:**

CO99100-1RU is an early Russet variety. Pre-cut seed to a size of 2.5 to 3.0 oz. and allow seed to suberize before planting.

To obtain maximum marketable size tubers, seed tubers should be planted at in-row spacing of 12 to 13 inches, with row spacing of 34 inches.

Available nitrogen (N) (residual soil N + irrigation water N + applied N) rate required for optimum tuber yield and quality should be between 140 to 150 lb N/A. This recommendation does not include nitrate nitrogen mineralization from previous crop stubble and from soil organic matter.

To gain early plant vigor, apply about 30% of the required seasonal N pre-plant or at planting. Apply the remaining N rate requirement in three equal split applications at approximately 7 to 10 days intervals during the growing season.

Begin in-season N application after tuber initiation. Finishing N application early in the season is recommended.

Optimum petiole nitrate concentration should range between 5,000 to 6,000 ppm at tuber initiation; 2,000 to 5,000 ppm at tuber bulking; and below 2,000 ppm at tuber maturity (fig 1).

Do not plan on vine kill. The vines of CO99100-1RU will die naturally when tubers are mature.

A total of 15 inches of irrigation water throughout the growing season is sufficient, while maintaining soil water content above 65 to 70%.

Tubers can be harvested between 90 to 100 days after planting.

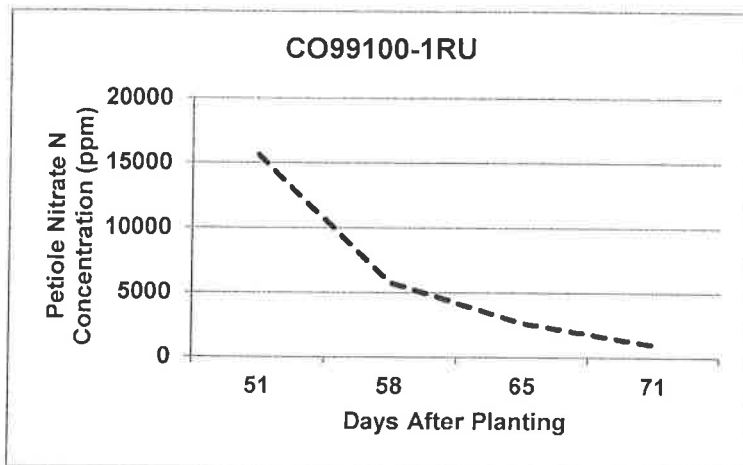


Fig. 1. Optimum petiole nitrate nitrogen levels for CO99100-1RU, 2012

### **Canela Russet:**

The demand by Canela Russet for N fertilizer in 2012 was high, probably due to the high heat units observed during the growing season, that culminated in high vegetative growth. Optimum tuber yield was observed when 180 lb N was applied per acre. Canela demand for N was comparable to that of Russet Norkotah-8 in 2012. Petiole nitrate nitrogen levels for optimum yield ranged from 20,400 ppm at 54 DAP to 22,350 ppm at 71 DAP. Fig. 2 shows how petiole nitrate nitrogen concentration in Canela compared to that of Russet Norkotah-8 in 2012, up to 71 DAP.

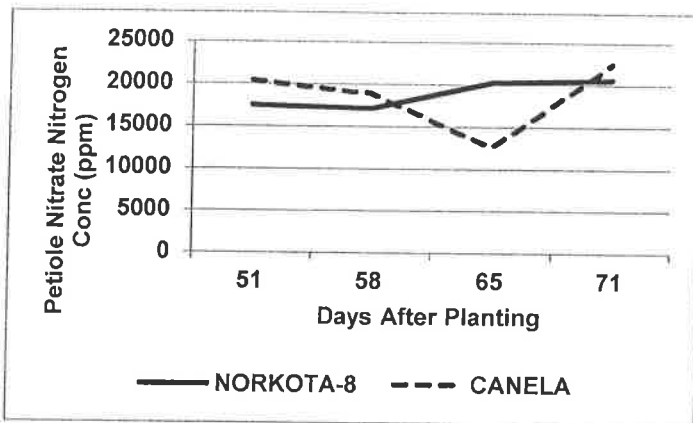


Fig 2. Optimum petiole nitrate nitrogen concentration levels for Russet Norkotah-8 and Canela Russet, 2012

**Masquerade (AC99329-7PW/Y):**

2012 seemed to be a year when the demand for nitrogen was higher than normal, due to the higher temperatures observed during the growing season, which caused high plant vegetative growth. Masquerade is known to be a heavy nitrogen feeder, and in 2012, optimum tuber yield was observed when nitrogen fertilizer was applied at 240 lb N/ac. Optimum petiole nitrate N levels ranged from 8,850 ppm at 54 DAP to 19,200 ppm at 71 DAP. Fig. 4 shows how petiole nitrate N concentration in Masquerade compared with that of Russet Norkotah-8 in 2012, up to 71 DAP.

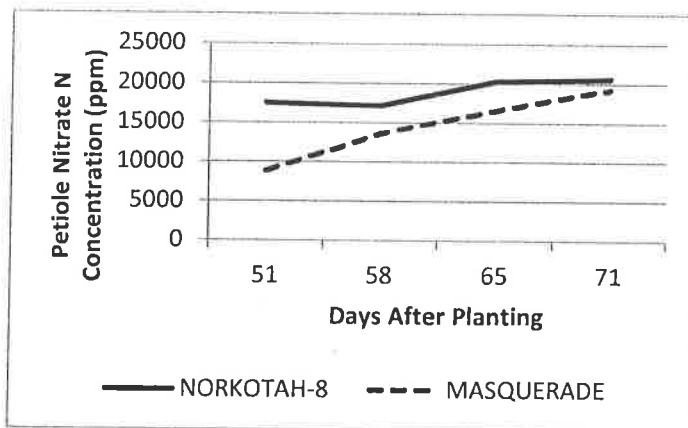


Fig 3 Optimum petiole nitrate nitrogen concentration levels for Russet Norkotah-8 and Masquerade, 2012

The petiole nitrate nitrogen concentrations observed for Canela Russet and Masquerade, in 2012, indicate that there was enough nitrogen in the soil at 71 days after planting (DAP), and plants were still accumulating nitrogen which had not been used for organ synthesis. Petiole nitrate nitrogen concentration was expected to start dropping in these cultivars after 71 DAP.

### **Potassium Fertilizer Use in Rio Grande Russet Potato Production:**

With a soil test of 264 ppm potassium (K) in the spring, optimum total and marketable (> 4 oz) tuber yield was observed with K application rate of 120 lb  $K_2O/ac$  for all three sources of K fertilizer studied. When compared among the K fertilizer sources (sulfate of potash, muriate of potash mixed with sulfur fertilizer, and muriate of potash with no sulfur fertilizer added), sulfate of potash was observed to produce higher total and marketable tuber yield. Also, the use of sulfate of potash increased tuber specific gravity, compared to the use of muriate of potash.

### **Late Application of Extra Nitrogen Fertilizer:**

Growers sometimes apply extra nitrogen fertilizer late in the growing season with the idea of increasing tuber size to desirable weights. The effect of the extra late N fertilizer application on tuber yield of four russet potatoes are reported below.

#### *Centennial Russet:*

In 2012, the application of extra 40 lb N/A of 32-0-0 in early August increased total tuber yield of Centennial Russet but did not influence marketable (> 4 oz) tuber yield.

#### *Rio Grande Russet:*

Total and marketable tuber yield of Rio Grande Russet was significantly increased with extra late application of 40 lb N/ac of 32-0-0.

#### *Canela Russet:*

Canela Russet did not respond to extra late application of organic or inorganic nitrogen fertilizer application during the growing season.

#### *Premier Russet:*

Premier Russet responded positively to extra late application of organic and inorganic nitrogen fertilizer. Total and marketable tuber yield increased significantly when 20 or 40 lb extra nitrogen fertilizer was applied late in the season.

Data from the 2012 studies indicate that the application of extra nitrogen fertilizer late in the growing season (first week of August) to increase tuber size is cultivar dependent.

### **Green Manure Cover Crops Preceding Rio Grande Russet:**

Preceding Rio Grande Russet with barley or Sudan Grass increased total and marketable tuber yield, in a 2-yr rotation. For premium size (>10 oz) tubers, yield increase was observed when Sudan Grass preceded Rio Grande Russet in a 2- or 3-yr rotation, compared to barley as a rotation crop.