

# NITROGEN FERTILIZER MANAGEMENT FOR NEW POTATO VARIETIES

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Every potato variety exhibits unique characteristics and consequently present specific management challenges. These varietal differences can impact every aspect of production, from seed preparation to storage conditions. This paper will discuss results from a series of studies designed to develop guidelines for optimizing nitrogen use efficiency and yield for six new potato varieties.

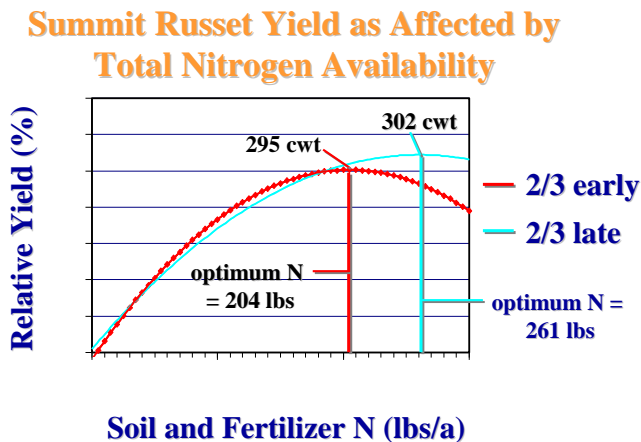
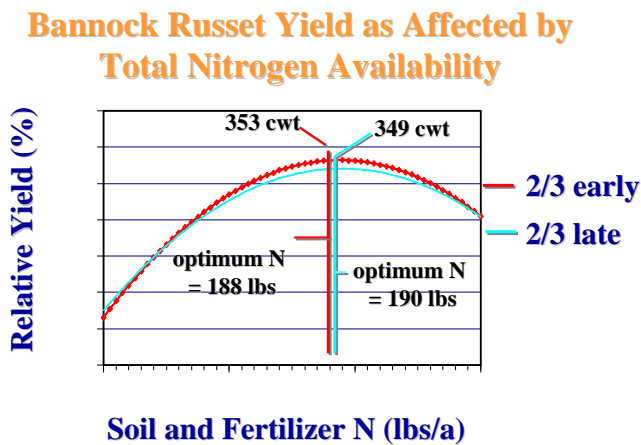


Figure 1. Nitrogen rate and timing responses for Bannock Russet and Summit Russet at Aberdeen, Idaho.

Experiments designed to determine optimum N rates and application timings for seven potato varieties were carried out at Aberdeen from 1999 through 2001 and Parma in 2001 and 2002. At Aberdeen, N as  $\text{NH}_4\text{NO}_3$  (34-0-0) was applied to four varieties (Russet Burbank, Gem Russet, Bannock Russet and Summit Russet) at 4 rates (0, 90, 180, or 270 lb N/A) using two seasonal application patterns. Nitrogen was applied either 2/3 pre-plant plus 1/3 in-season (early treatment), or 1/3 pre-plant plus 2/3 in-season (late treatment). At Parma, N was applied to three varieties (Alturas, Ranger Russet and A8893-1) at five rates (0, 100, 200, 300, or 400 lb N/A), using the same early or late season application patterns used at Aberdeen. All preseason applications were broadcast applied and mechanically incorporated into the soil. All in-season N was hand-applied at 1 to 2 week intervals during tuber bulking and incorporated with 1/2 to 1 inch of sprinkler irrigation water.

Each variety in the Aberdeen study showed a unique response to N rate and timing as illustrated in Figure 1. Bannock Russet reached maximum yield at around 190 lb/A N with no response to the timing of application. By comparison, Summit Russet showed a large difference in N timing response, especially with respect to the amount of N needed to achieve maximum yield. Only 204 lb N/A was needed when most of the N was applied pre-plant, but 261 lb N/A was needed when most N was applied during tuber bulking.

These N management studies allowed for determination of optimum N rates for these seven varieties, as well as optimum N timings (Tables 1 and 2).

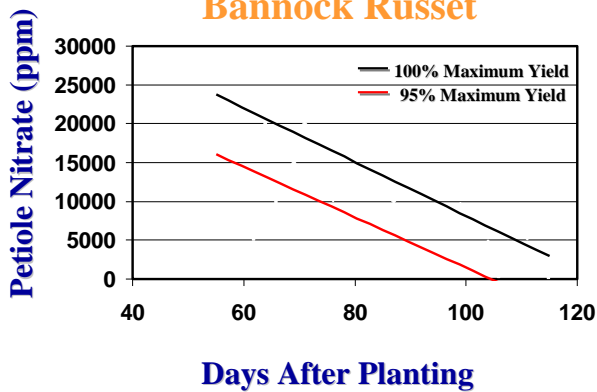
Table 1. N rate, including soil residual N, to achieve maximum yield for seven potato varieties, with either 2/3 (early) or 1/3 (late) of the N applied pre-plant.

Variety	Early Application	Late Application
<u>At Aberdeen</u>		
Bannock Russet	188	190
Gem Russet	235	229
Russet Burbank	215	248
Summit Russet	204	261
<u>At Parma</u>		
Alturas	244	233
Ranger Russet	261	282
A8893-1	289	243

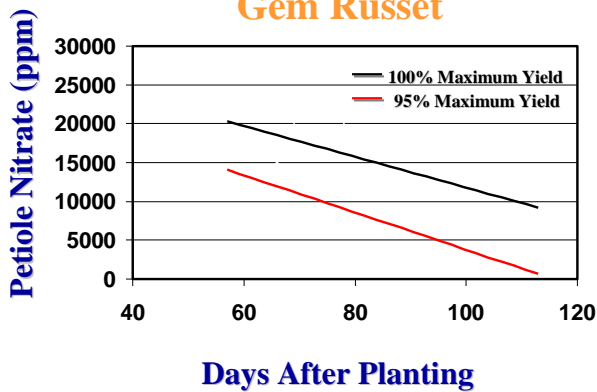
Table 2. Maximum yields of seven potato varieties with optimal amounts of either early (2/3 preplant) or late (1/3 preplant) applied N.

Variety	Early Application	Late Application
<u>At Aberdeen</u>		
Bannock Russet	349	353
Gem Russet	347	341
Russet Burbank	336	328
Summit Russet	295	302
<u>At Parma</u>		
Alturas	564	570
Ranger Russet	476	473
A8893-1	453	466

### Petiole NO<sub>3</sub>-N Sufficiency Range – Bannock Russet



### Petiole NO<sub>3</sub>-N Sufficiency Range – Gem Russet



### Petiole NO<sub>3</sub>-N Sufficiency Range – Summit Russet

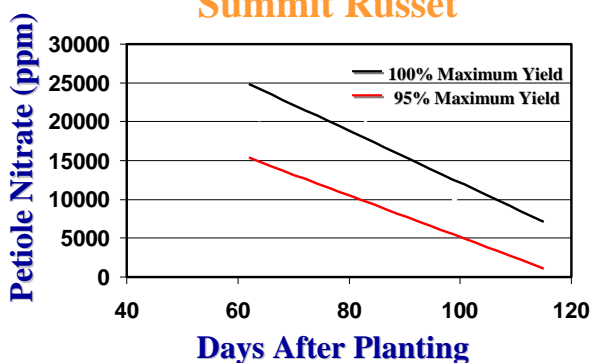


Figure 2. Petiole nitrate-N sufficiency curves for Bannock Russet, Gem Russet, and Summit Russet.

It should be noted that these studies were conducted on silt loam soils with relatively low leaching potential. Comparing varieties at the same sites, Bannock Russet at Aberdeen and Alturas at Parma used distinctly less N to achieve maximum yields. Summit Russet used considerably less N to achieve maximum yields when most N was applied early than when most N was applied late.

Petiole nitrate-N sufficiency curves were constructed from data obtained from the Aberdeen studies. As with N rates, the sufficiency curves were unique to each variety (Figure 2). The curve for Bannock Russet started out near 20,000 ppm, a level common to many varieties. However, the curve declined very rapidly and was below 5,000 ppm by early senescence.

The sufficiency range for Gem Russet was very similar to that commonly used for Russet Burbank. It started out just below 20,000 ppm and slowly declined through the season to a point near 8,000 ppm at senescence.

The sufficiency curve for Summit Russet was somewhat unique. Although the general trend was somewhere between that for Gem Russet and Bannock Russet, it tended to have a very wide range early in the season. The acceptable

range became more restricted as the season progressed. This suggests that there is considerable latitude in petiole nitrate-N levels for Summit early in the season, without much impact on yield. This information can be used to help customize N management for each of these six new varieties.

Ranger Russet and Russet Norkotah are the second and third most commonly used varieties in Idaho. Fertilizer recommendations are available for both. Research conducted in Idaho and other western states have provided the following management tips:

For **Ranger Russet**:

- Use from similar amounts down to 80% of N recommended for Russet Burbank
- Apply 1/4 to 1/3 N preplant
- Design N management to maintain green vines until vine-kill
- Sufficiency ranges for petiole nitrate-N
  - Prior to tuber set: 18,000 - 20,000 ppm
  - Tuberization: 17,000 - 19,000 ppm
  - Early bulking: 16,000 - 19,000 ppm
  - Late bulking: 14,000 – 17,000 ppm
  - Maturation: 11,000 - 13,000 ppm
- Ensure adequate K availability

For **Russet Norkotah** (standard):

- Use from similar amount to 20% more N than for Russet Burbank
- Apply 60 to 70% of total N preplant
- Apply 70 - 80% of total N by the end of first flower
- Avoid N deficiency situations, especially those caused by overwatering
- Sufficiency ranges for petiole nitrate-N
  - Prior to tuber set: 20,000 - 24,000 ppm
  - Tuberization: 18,000 – 20,000 ppm
  - Early bulking: 16,000 – 18,000 ppm
  - Late bulking: 14,000 – 16,000 ppm
  - Maturation: 8,000 - 10,000 ppm

For **Russet Norkotah** (intermediate lines, CO#8, TXNS298, TXNS112, TXNS296, TXNS 223, etc.):

- Use from similar amounts to 20% less N than recommended for Russet Burbank
- Apply 60 to 70% of total N preplant
- Apply 70 - 80% of total N by the end of first flower
- Avoid N deficiency situations, especially those caused by overwatering
- Sufficiency ranges for petiole nitrate-N
  - Prior to tuber set: 20,000 - 24,000 ppm
  - Tuberization: 18,000 – 20,000 ppm
  - Early bulking: 16,000 – 18,000 ppm
  - Late bulking: 14,000 – 16,000 ppm
  - Maturation: 8,000 - 10,000 ppm

For **Russet Norkotah** (CO#3):

- Use from N rates 10 to 20% less than recommended for Russet Burbank
- Apply 50 to 60% of total N preplant
- Apply seasonal applications through mid-bulking
- Sufficiency ranges for petiole nitrate-N
  - Prior to tuber set: 20,000 - 24,000 ppm
  - Tuberization: 18,000 – 20,000 ppm
  - Early bulking: 16,000 – 18,000 ppm
  - Late bulking: 14,000 – 16,000 ppm
  - Maturation: 8,000 - 10,000 ppm