

## **AIM Research Trial Report: Reduced Nitrogen on Seed Potatoes**

Working Group: Seed and Tuber Quality Improvement

Crop Year: 2023

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### **Project Rationale:**

Since the start of the AIM program, the Seed Working Group has been investigating ways to optimize the size profile of seed potatoes to necessitate less cutting of seed. Reduced seed cutting with larger average seed piece size has generally been associated with improved emergence, less seed wastage, and improved yields. This group has conducted research on a number of best management practices associated with reducing average tuber size and increasing the number of tubers per plant, including use of gibberellic acid, tighter seed spacing, manipulation of physiological age, and use of ethylene gas in storage. There has also been some work done around reducing the amount of nitrogen applied at planting for seed potatoes. In these past studies, there has been no reduction in yield with the reduction of nitrogen; in fact, we have seen some small increases in yield and tuber number at lower rates of nitrogen. Therefore, it was requested to continue this work in 2023 but with some of the newer varieties being contracted by Cavendish Farms instead of just with legacy varieties such as Russet Burbank and Shepody.

### **Project Overview:**

Three (3) fields were set up with reduced nitrogen trials in 2023 across two farms. At a farm in West Prince (WP), we set up two trials on seed fields. Varieties evaluated were Targhee Russet and Mountain Gem. For both varieties, the standard nitrogen rate was 100 lbs N per acre, applied in-furrow at planting. The treatment rate was 70 lbs N per acre, applied in-furrow, a 30% reduction in applied nitrogen. This fertilizer was specially blended for the trial, ensuring that the P, K, and other nutrients were the same between treatment and control, with nitrogen as the only nutrient reduced. The Mountain Gem field was in corn in 2022, so we don't anticipate that there would have been a nitrogen credit from the preceding crop. The Targhee Russet field was in alfalfa/timothy hay in 2022, so there definitely would be a nitrogen credit to the crop from the previous crop, but the exact nature of this credit was not quantified.

Planting date was May 20<sup>th</sup> for Targhee Russet and May 23<sup>rd</sup> for Mountain Gem. Top-kill date was September 1<sup>st</sup> for the Mountain Gem and September 7<sup>th</sup> for the Targhee Russet. Samples were harvested on September 26<sup>th</sup>, 2023. In these two fields, fields were split between low N and standard N rates, with the splits flagged and recorded.

At another field in East Prince (EP) we set up two trials on an irrigated seed field. The variety evaluated was Mountain Gem. The standard nitrogen rate was 150 lbs/ac N, applied in-furrow at planting. The treatment rate was 113 lbs/ac N applied in-furrow. In this trial, the total fertilizer blend was reduced by 25%, so P, K and other nutrients were also reduced by 25%; however, given the relatively strength of this field, it was not felt that this reduction would have a negative impact on yield or quality. Brown mustard was grown in this field in 2022 and harvested for seed, so there would be a limited nitrogen credit coming from the previous crop. Planting date was May 30<sup>th</sup>, 2023 and top-killing date was August 29<sup>th</sup>, 2023. Top-kill dates were relatively early, as the grower was concerned about the presence of green-peach aphids

and Mountain Gem susceptibility to PVY transmission. Harvest samples were dug on September 27th, 2023. For this trial, the low N treatment consisted of 12 rows (2 planter passes) in the middle of the field, with the conventional N control filling the remainder of the field.

At harvest, six 10 foot samples were dug from each of the low N treatment and control in the same part of the field to reduce the effect of natural in-field variability. Hand-dug potato yield samples were graded by Steve Watts of Genesis Crop Systems. Seed was divided into four size categories (< 4 oz, 4- 7 oz, 7-10 oz, and > 10 oz.). The total number of tubers per plot was also recorded. To calculate the cwt per acre from the lbs in 10 feet of row, we used the multiplication factor of 13.

### Potato Yield and Quality:

#### West Prince – Targhee Russet

Treatment	Tubers/ Strip	< 4 oz lbs/10 ft	4-7 oz lbs/10 ft	7- 10 oz lbs/10 ft	> 10 oz lbs/10 ft	Total	1-7 oz seed (cwt/ac)	Total Yield (cwt/ac)
100 lbs/ac N	66.2	4.8	10.5	3.3	0.8	19.5	198.9	252.8
70 lbs/ac N	58.3	3.3	10.6	3.9	0.6	18.5	180.7	240.7
Difference	-7.9	-1.5	-0.1	0.6	-0.2	-1	-18.2	-12.1
p-value	0.08	<b>0.01</b>	0.92	0.34	0.67	0.27	0.35	0.27

#### West Prince – Mountain Gem

Treatment	Tubers/ Strip	< 4 oz lbs/10 ft	4-7 oz lbs/10 ft	7- 10 oz lbs/10 ft	> 10 oz lbs/10 ft	Total	1-7 oz seed (cwt/ac)	Total Yield (cwt/ac)
100 lbs/ac N	71.2	4.9	11.9	3.2	0.9	21.1	218.4	274.1
70 lbs/ac N	67.2	3.6	12.4	4.3	0.3	20.7	208	269.1
Difference	-4	<b>-1.3</b>	0.5	1.1	-0.6	-0.4	-10.4	-5
p-value	0.45	<b>0.07</b>	0.62	0.14	0.35	0.75	0.56	0.75

#### East Prince – Mountain Gem

Treatment	Tubers/ Strip	< 4 oz lbs/10 ft	4-7 oz lbs/10 ft	7- 10 oz lbs/10 ft	> 10 oz lbs/10 ft	Total	1-7 oz seed (cwt/ac)	Total Yield (cwt/ac)
150 lbs/ac N	49.3	2.5	5.7	5.5	5.2	18.9	106.6	245.7
113 lbs/ac N	56.3	2.5	8.2	6.4	3	19.9	139.1	259.6
Difference	<b>7.0</b>	0.0	<b>2.5</b>	0.9	-2.2	<b>1.0</b>	32.5	<b>13.9</b>
p-value	<b>0.02</b>	0.89	<b>0.06</b>	0.41	0.12	<b>0.10</b>	0.14	<b>0.10</b>

**Nitrates Results (expressed in ppm):**

<b>WP - Targhee Russet</b>		<b>WP - Mountain Gem</b>		<b>EP - Mountain Gem</b>	
100 lbs/ac N	4.5	100 lbs/ac N	4.5	150 lbs/ac N	15.1
70 lbs/ac N	3.9	70 lbs/ac N	2.9	113 lbs/ac N	10.2
Difference	-0.6	Difference	-1.6	Difference	<b>-4.9</b>
p-value	0.82	p-value	0.44	p-value	<b>0.01</b>

**Key Findings:**

- At the two West Prince sites, there was no significant difference in total yield or tuber number between the two nitrogen rates. While there was a slightly negative numerical trend for the lower nitrogen rate on both varieties, these results are not statistically significant. The only significant difference (at 90% confidence interval) was that the weight of tubers under four ounces was lower in the 70 lbs/ac N treatment for both varieties.
- Because there was no difference in yield between the treatments, and there was also no difference in the amount of residual nitrates after harvest, that leads us to conclude that the optimum nitrogen rate is likely somewhere in the 70 to 100 lbs/acre range. Based on our observed results, we would not recommend that the producer make a significant change in their standard nitrogen fertility program. 100 lbs/acre of nitrogen is already a lower rate than many seed growers employ in PEI. The grower may want to continue assessing this rate, depending on variety and other nitrogen credits from previous crop and manure application, in future years.
- In the East Prince field, there was a statistically higher total yield and number of tubers per sample in favour of the low nitrogen treatment compared to the grower standard rate of 150 lbs/acre. The reduced N treatment had a higher number of tubers per cwt, primarily in the 4-7 ounce size category. As a result, the percentage of the seed lot that will need to be cut more than once has been decreased while the total yield has increased, which was the objective of the trial.
- Further supporting the potential to decrease the applied nitrogen rate is the fact that there was statistically higher residual nitrate (50% more) after harvest in the 150 lbs/acre standard practice than in the 113 lbs/acre treatment. This indicates that the 150 lbs/acre supplied more nitrogen than was needed by the crop, and the 113 lbs/acre rate resulted in less residual N that will be susceptible to nitrate leaching or off-gassing as nitrous oxide.

Thank you to the two farms participating in this trial this year. We would also like to thank Dan Ulrick for his assistance in sample harvest and Steve Watts for grading our samples for these trials.