

AIM Research Trial Report: Effect of Growth Regulators on Emergence & Marketable Yield
Working Group: Seed Management
Crop Year: 2021
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Project Rationale:

Some of the newer processing varieties that have been evaluated and now have contracted volume on Prince Edward Island can be slower to emerge than some of our conventional varieties. In the already comparatively short PEI growing season, this has the potential to limit yield and quality in some years. In recent years, there have been a number of studies done to investigate the use of growth regulators like gibberellic acid (GA) on accelerated emergence. The AIM Seed Management Working Group was interested to investigate whether the use of gibberellic acid as well as a new commercial product called Stimulate would lead to an improvement in emergence as well as having an impact on yield and quality of the potato crop. Dave Main, Research Biologist with AAFC Charlottetown and member of the Seed Working Group, agreed to set up and administer this trial at AAFC Harrington Farm in the 2021 growing season.

Project Overview:

Seed was obtained for two processing varieties of interest in Prince Edward Island: Dakota Russet and Payette Russet. Seed was cut and treated 15 days prior to planting.

For the Dakota variety, four treatments were undertaken: control treatment (no GA applied), 100% of label rate for GA (13.3 ppm), 150% of label rate (20 ppm), and 100% of label rate for Stimulate (30 ml/cwt).

For the Payette variety, four treatments were undertaken: control treatment (no GA applied), 100% of label rate for GA (13.3 ppm), 50% of label rate (6.7 ppm), and 100% of label rate for Stimulate (30 ml/cwt).

Stimulate Yield Enhancer (from Stoller) contains gibberellic acid along with auxin (IAA & IBA) and cytokinin. It is applied as a seed treatment, as is gibberellic acid alone.

GA was sprayed on the cut seed pieces at a rate of 0.56 ml per pound of seed.

Seed was planted in 25 foot rows, replicated four times in a randomized complete block design. The planting date was May 25th. Emergence was monitored over multiple dates, beginning on June 8th and finishing on June 28th. Stem counts were completed on September 8th. The same in-row seed spacing (12 inches) was used for all varieties and treatment. The same fertility and crop protection program was used for all varieties and treatments. All plants were topkilled on September 24th and 27th and harvest was done on October 19th. Potatoes were graded into five categories: less than 1 7/8th inch diameter (smalls), between 1 7/8th inch diameter and 10 ounce weight, greater than 10 ounce weight (10 oz), off-type (rough, knobs, other defects) and sunburn (greening).

Results:

Table 1: Emergence and Stem Count Results – Dakota Russet

Treatment	Emergence Jun 15 plants/row*	Emergence Jun 17 plants/row*	Emergence Jun 22 plants/row*	Total Plants in 4 plots	Total Stems/row	Stems per Plant
0% GA	8.0	17.5	26.8	100	49.50 a	1.98 a
100% GA	11.5	22.3	26.8	100	54.50 ab	2.18 ab
150% GA	12.5	21.8	26.8	100	63.50 c	2.54 c
Stimulate	7	15.0	26.5	100	55.00 b	2.20 b

* includes 2 guard plants in each row

Table 2: Emergence and Stem Count Results – Payette Russet

Treatment	Emergence Jun 17 plants/row*	Emergence Jun 18 plants/row*	Emergence Jun 25 plants/row*	Total Plants in 4 plots	Total Stems/row	Stems per Plant
0% GA	3.0	6.25	26.25	100	108.5 ab	4.34 ab
100% GA	11.3	15.3	26.8	99	115.0 b	4.64 c
50% GA	10.0	13.0	27.0	100	114.5 b	4.58 bc
Stimulate	3.0	5.5	26.5	100	106.0 a	4.24 a

* includes 2 guard plants in each row



Row on left side (351) is Payette with zero GA applied. Row in the middle (352) is Payette with 100% label rate of GA applied. Row on the right is a guard row.

Regarding plant emergence, the treatments with GA appeared to provide some advantage in emergence for both varieties. At 21 days after planting in Dakota Russet, the 100% GA treatment showed 43% emergence compared with 30% emergence for the 0% GA treatment. The 150% GA treatment did not show much additional improvement in emergence versus the 100% treatment. For Payette Russet, emergence for all treatments progressed more slowly than for Dakota. At 23 days after planting, both of the GA treatments showed 37-42% emergence, compared with only 11% for the control treatment and the Stimulate treatment. A similar trend was observed on June 18th. By June 25th, all treatments were at or close to full emergence. For neither variety did the Stimulate treatment appear to provide any difference in emergence compared to the control treatment.

For Dakota Russet, there were significant differences observed in stems per plant between treatments, with the 150% GA treatment having the largest increase (28% increase from 0% GA control treatment). There was no difference between the 100% GA and Stimulate treatments, but the Stimulate treatment was also significantly higher than the control.

For Payette, there was no difference between the Stimulate and 0% GA treatments. The 50% GA treatment was significantly higher than the Stimulate treatment, while the 100% GA was significantly higher than the Stimulate and 0% GA treatments.

Table 3: Yield and quality for Dakota Russet

Treatment	Total Yield cwt/ac	Smalls cwt/ac	Smalls %	> 10 oz cwt/ac	> 10 oz %	Specific Gravity	Tuber Number	M. Yield cwt/ac
0% GA	396.6 a	89.8 a	22.6	21.4 a	5.4	1.079	283 a	306.2 a
100% GA	407.5 a	123.7 b	30.4	12.6 a	3.1	1.082	321 a	282.5 a
150% GA	408.0 a	124.5 b	30.5	15.5 a	3.8	1.082	325 a	281.8 a
Stimulate	400.2 a	106.5 ab	26.6	9.2 a	2.3	1.079	312 a	293.3 a

Table 4: Yield and quality for Payette Russet

Treatment	Total Yield cwt/ac	Smalls cwt/ac	Smalls %	> 10 oz cwt/ac	> 10 oz %	Specific Gravity	Tuber Number	M. Yield cwt/ac
0% GA	441.7 a	45.0 a	12.0	35.1 a	7.9	1.093	277 a	394.0 a
100% GA	465.0 a	65.7 b	17.4	38.4 a	8.3	1.093	310 b	395.7 a
50% GA	440.9 a	59.4 b	16.4	20.8 a	4.7	1.093	314 b	379.3 a
Stimulate	453.7 a	48.8 a	12.8	40.2 a	8.9	1.091	286 ab	401.4 a

For both Dakota and Payette Russets, there was no significant differences in Total Yield or Marketable Yield between the treatments. For both varieties, there was a significant increase ($p < 0.05$) in the yield of small tubers for both GA treatments compared with the 0% GA and Stimulate treatments. There also appears to be a trend for the GA treatments to have more tubers per plot than the 0% GA control. This difference in tuber number was statistically significant for Payette but not for Dakota. Therefore, it appears that use of GA may have increased the total number of tubers, but this did not lead to an increase in marketable yield. No difference in the yield of tubers greater than 10 ounces or specific gravity were detected for either variety.

Summary:

Key findings from this trial were:

- For Dakota Russets, 150% of label rate of GA significantly increased the number of stems per plant when compared with the other treatments. However, this did not result in an increase in marketable yield.
- For Payette Russets, 100% of the label rate of GA significant increase the number of stems per plant when compared to the control and Stimulate treatments. Again, this did not result in an increase in marketable yield.
- Use of gibberellic acid had a similar trend over both varieties, increasing the number of tubers per plot, but with these additional tubers being primarily in the unmarketable small category (less than 1 7/8th inch diameter).
- The use of the Stimulate product was not associated with any significant differences in yield or quality.
- Use of GA may continue to add value for seed producers or fresh market/chip producers trying to decrease average tuber size and increase tuber number. For French fry processing, it does not appear to add any value on these two varieties.

Thank you to Dave Main with AAFC Charlottetown for agreeing to host this trial and for all of the hard work from AAFC staff to manage and complete this research in 2021.