AIM Research Trial Report: **Effect of Dramatically Reduced Fertility on Yield & Quality**
Working Group: Science & Technology
Crop Year: 2021
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Project Rationale:

For many years, there has been significant work done in Prince Edward Island to determine the fertility needs for a profitable potato crop. So many variables go into figuring out the right rate, including variety, soil fertility, use of irrigation, and nutrient sources. Particularly as fertilizer prices are increasing rapidly, there is an impetus to ensure that we are only supplying the fertility needed for the crop without compromising the overall fertility of the soil or losing nutrients to the environment through leaching or off-gassing.

Sometimes it is difficult to assess how much fertility a potato crop truly needs, and impact on a crop can only be judged through substantial increases or decreases in fertility. In this project, we investigate the effect on a processing potato crop due to an unplanned yet significant reduction in fertilizer.

Project Overview:

At the summer 2021 meeting of the Science and Technology Working Group, group member Jason Webster indicated that their farm (MWM Farms) had experienced a planting issue in one field of Mountain Gem Russets. For part of this field, one of the fertilizer applicators on the potato planter was plugged, resulting in one out of six (6) rows having no fertilizer applied at planting. This presenting an opportunity to compare the yield and quality of rows that received only pre-plant fertilizer application compared with the grower standard practice (GSP) for fertility.

The pre-plant fertilizer application consisted of 475 lbs/acre of 10.8-0-28-4.5 Mg, resulting in application of 51 lbs/ac of N, 134 lbs/ac of K, and 21 lbs/ac of Mg. All rows received this pre-plant application.

The in-planter fertilizer application consisted of 1000 lbs/acre of 15-18-10-2.5 Mg-0.1 B. This resulted in application of 150 lbs/ac of N, 180 lbs/ac of P, 100 lbs/ac of K, 25 lbs/ac of Mg and 1 lb/ac of B. One out of six rows did not receive this planter blend. Total fertilizer rates are summarized below:

	N	**P**	**K**	**Mg**
Control (GSP)	201	180	234	46
Reduced Fertility	51	0	134	21

The field of question was located in Middleton, PEI. Average fertility from soil tests for this field were:

		ppm							
OM %	pH	P_2O_5	K_2O	Mg	Ca	S	Zn	B	CEC
3.2	6.2	361	178	79	800	14	2.8	0.2	9.9

It was quite easy to identify the rows with the reduced fertilizer application, as they were lighter green in colour and had taller and more erect stems than the control rows. Affected rows were flagged and

marked with GPS for harvest in the fall. At harvest, four 10 foot strips were harvested from each of the control (GSP) and reduced fertility treatments, with each strip having the same number of plants. Seed spacing was 12 inches.

In this photo, you can pick out the rows that had reduced fertility, as they appear a lighter shade of green as well as more upright, erect stems (photo by Ryan Barrett).

Results:

Table 3: Yield and quality for Mountain Gem Russets

Treatment	Total Yield cwt/ac	Smalls %	> 10 oz %	Hollow Heart %	Specific Gravity	M. Yield cwt/ac	Payout $/acre
Control (GSP)	347.6	3.5	46.2	14.2	1.083 a	297.6	$3835
Reduced Fertility	322.2	5.1	28.2	2.5	1.094 b	288.2	$3858
Difference	-25.4	+1.6	-18.0	-11.7	+0.011	-9.4	+$23

Despite a 150 lbs/acre difference in applied nitrogen and 180 lbs/acre difference in applied phosphorus, there was no statistical difference in total or marketable yield or crop value between the two treatments. Where there were differences was for some size and quality variables.

The incidence of hollow heart was significantly higher ($p < 0.10$) in the GSP treatment (14.2%) than in the reduced fertility treatment (2.5%). As excess nitrogen has been shown in previous studies to be potential causal factor in the occurrence of hollow heart, this is not a big surprise. In addition, specific gravity was significantly higher ($p < 0.05$) for the reduced fertility treatment, resulting in a higher contract bonus value for gravity. The reduced fertility treatment had a showed a trend toward a lower

percentage of tubers greater than 10 oz. than the GSP rows, but this was not statistically significant. These differences in size and quality led to the difference in crop value as shown, despite the lack of difference in marketable yield.

As this trial was "accidental" in nature, we are not able to look at what response a more intermediate fertilizer rate would have been. 200 lbs/ac N and 180 lbs/ac P would be considered a high fertility rate for the Mountain Gem variety, as it has so far shown to have a higher yield potential and more resistance to potato early dying (PED) than standard varieties such as Russet Burbank. While excess P is not normally associated with reductions in yield, excess N can result in delayed maturity, suppressed specific gravity, and reduced yield in a number of previous studies. From this trial, we can simply show that it appears that fertility did not appear to be overly limiting on marketable yield and crop value in this field when compared with the grower's standard fertility rate. From this, there appears to be significant room for additional work to identify the optimum required fertilizer rate for some of the newer contracted varieties in PEI, including Mountain Gem. The amount of fertilizer not applied to the reduced fertility treatment rows had a value of $275 per acre in 2021.

Summary:

Key findings from this trial were:

- There was no difference in total or marketable yield between grower standard practice (control) and a reduced fertility treatment.
- The reduced fertility treatment had lower percentage of 10 oz or greater tubers, a reduction in hollow heart incidence, and an increase in specific gravity.
- There is an indication that for the Mountain Gem variety, there may be the potential to reduce fertility rates while not reducing yield and quality.

Thank you to the team at MWM Farms for bringing this "accidental" trial to my attention and to working with us to ensure that data was collected. Thank you also to Morgan McNeil for her assistance in data collection and analysis and to Cavendish Farms Central Grading for helping us to grade these samples.