

MHPEC Sulphur Study Report 2019-2020

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Introduction: The Field Variability Study (FVS) has offered insight into the amount of soil sulphur typically seen in Manitoba potato grower fields. In a cursory examination of the data set, 40-60 lbs of sulphur appeared to be the beneficial amount of available soil sulphur, and compromised yields were observed outside of this range. Sulphur-associated decreases in total yield and 10-12 oz tubers often occurred in lighter-textured fields or areas of fields that had 0-5 lbs of sulphur at row closure, which is too low. **The goal of this study was to identify the exact range of lbs of soil sulphur needed by row closure to decrease yield variability and list potential products and rates needed to reduce yield variability.**

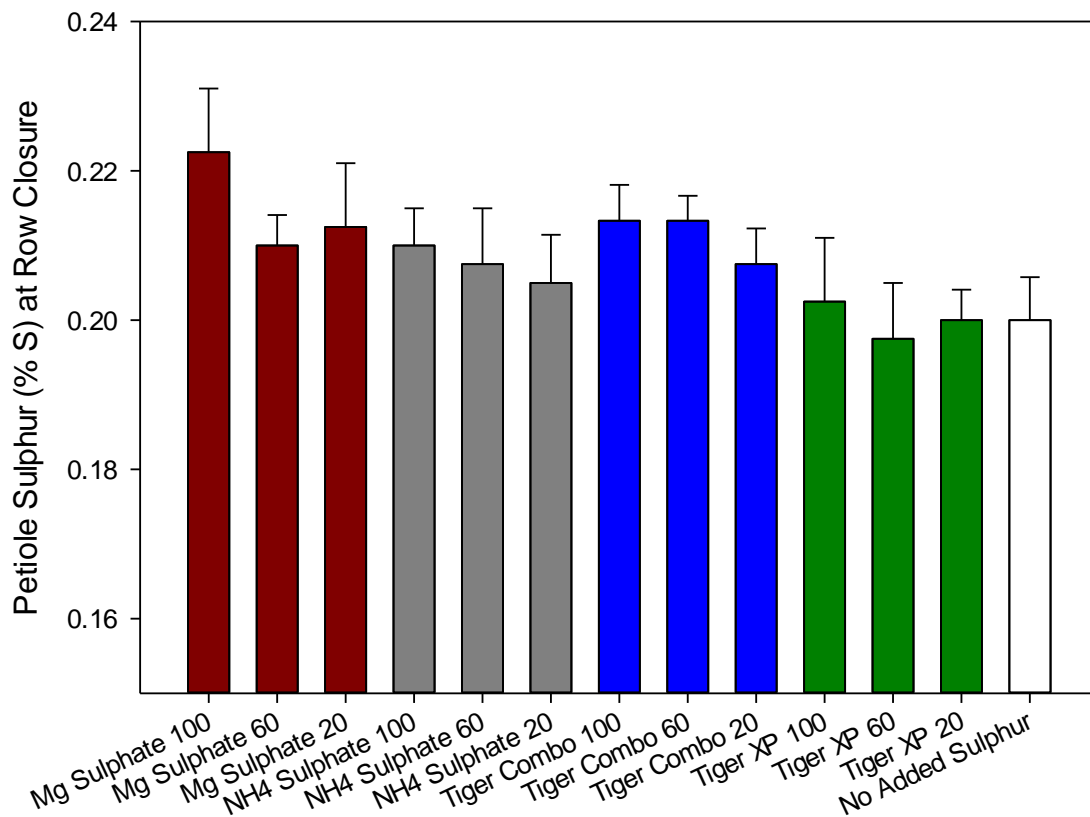
Core Results:

1. All fertilizers met or exceeded their target amount of soil sulphur at row closure with the exception of Tiger XP (See table 1 for rates applied, see figure 1 for detailed results).
2. The use of any of the four sulphur fertilizers tested improved soil sulphur availability at row closure, total yield, and the dollar value of that yield when fertilizer rates were not included in the analysis. See figure 2 for an example with total yield.
3. Recommendations on products and rates with a cost/benefit analysis will be forthcoming. Magnesium sulphate and Tiger Combo treatments appeared to offer the highest numerical yield, but the results were only nearly statistically significant. See figure 3 for an overview of the results.

Discussion: The growing seasons in 2019 and 2020 were so different, and the resulting yields were so different, that the data could not be combined across years for analysis. Combining any yield data from the same treatment across years would incur such extreme variability that no statistical test could identify any differences between fertilizer rate on yield.

The significant interaction effect of year makes it reasonable to compare simple effects (basic questions) such as: in both 2019 and 2020, did a particular sulphur fertilizer rate have an impact on total yield? The simple effects indicate all three rates of Tiger Combo and magnesium sulphate have significant impacts in both years on total yield, dollar value per cwt, and 10-12 oz yield. The problem is the simple effects analysis cannot go further to say which fertilizer improves total yield the most and what rate needs to be applied to achieve maximum benefit.

It is entirely possible that comparisons of fertilizer and rate within each year that trended towards significance, such as total yield ($P = 0.1164$), value ($P = 0.1303$), specific gravity ($P = 0.1499$), 10-12 oz yield ($P = 0.1163$), are actually important variables impacted by sulphur fertilizer but we lack the statistical power to identify them because we cannot combine years of study. It is possible that magnesium sulphate and Tiger Combo fertilizers have the most meaningful impact of the four fertilizers tested. The remedy for the lack of statistical power is another year of study with a balanced design and a year that allows the data from 2021 to be combined with either 2020 or 2019 data.



Sulphur Treatment Program + Goal Lbs of Sulfur Row Closure

Fig. 1 The effect of sulphur treatment program (x-axis) on the availability of soil sulphur (y-axis) at row closure. Bars indicate mean lbs of sulphur and the standard error is above each bar. Mg sulphate signifies magnesium sulphate, while NH4 sulphate stand for ammonium sulphate. All fertilizer rates for each treatment can be found in Table 1.

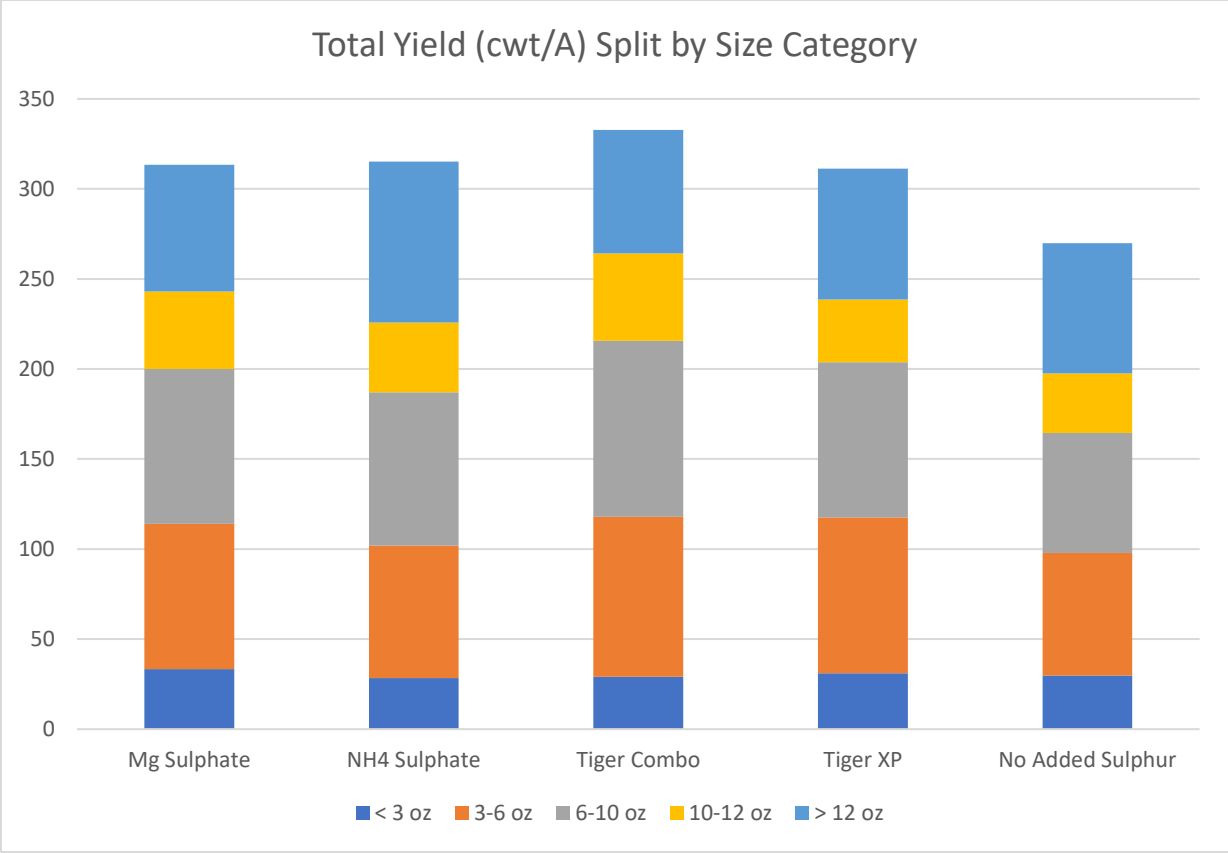


Fig. 2 The total yield by each fertilizer product consisted of the average of the twelve replicates of each fertilizer product (fertilizer not considered in this graphic) with each column separated by the tuber size profile. There was a significant effect ($P = 0.0164$) of fertilizer product use on total yield when the rates of each fertilizer were combined in the 2020 analysis. All fertilizers improved total yield when compared to the negative control. There were no significant total yield differences between the fertilizer products.

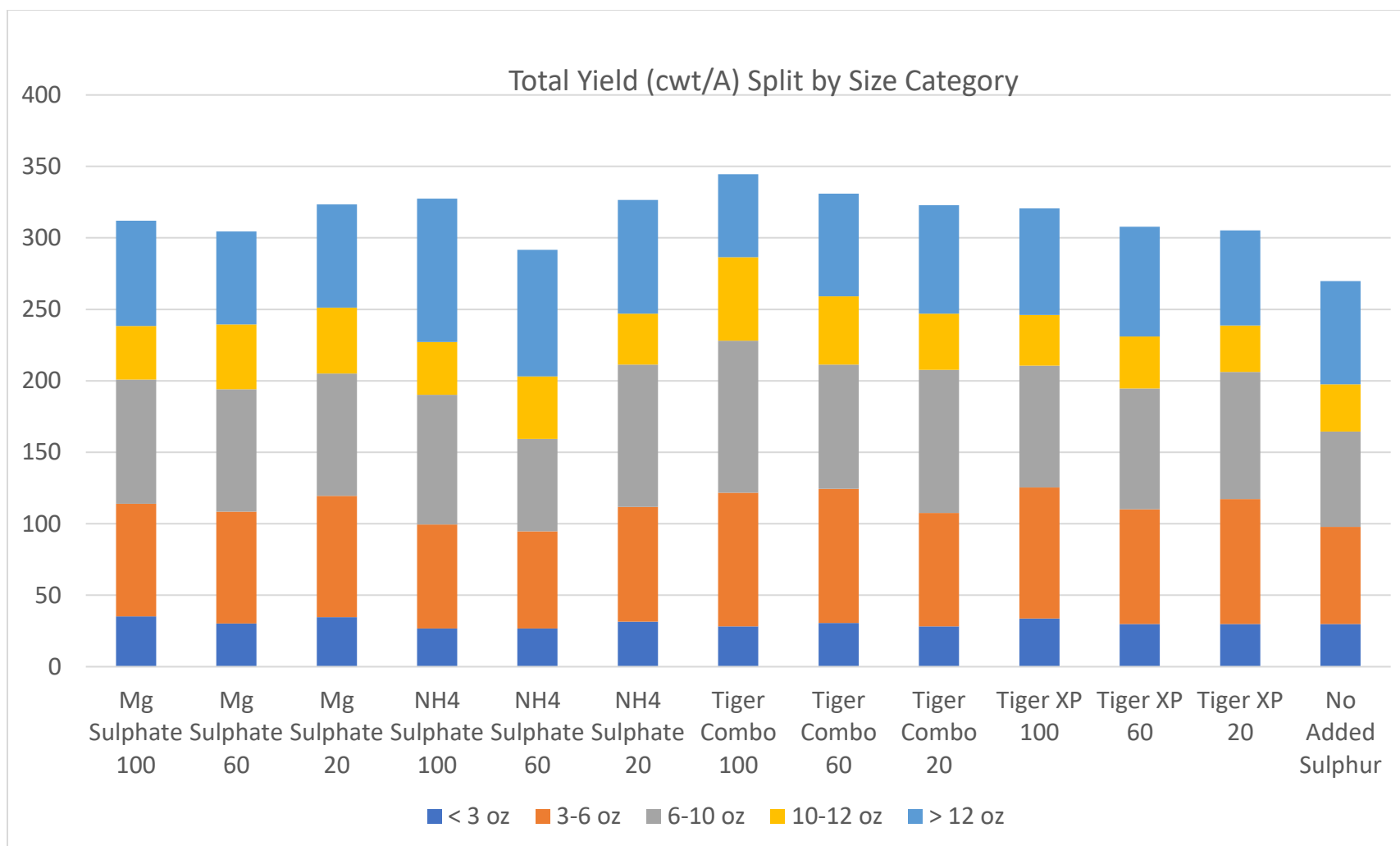


Fig. 3 The total yield consisting of the average of the four replicates of each fertilizer treatment with each column separated by the tuber size profile in 2020. The tuber size profile also consists of the average of the four replicates within a given treatment. There was no significant effect sulphur treatment and rate on total yield or any size category. Results from comparisons between fertilizer rates that trended towards significance were total yield ($P = 0.1164$), value ($P = 0.1303$), specific gravity ($P = 0.1499$), 10-12 oz yield ($P = 0.1163$).

Formulation (NPKS)	Fertilizer	Goal lbs by row closure	Lbs/A of product required to achieve goal	Lbs product applied preplant per replicate (4 plots)	Fertigation Fertilizer and Formulation	Sulphur Fertigation rate (lbs)
0-0-0-85	Tiger XP	20	24	1.2	None	None
0-0-0-85	Tiger XP	60	71	4	None	None
0-0-0-85	Tiger XP	100	118	6	None	None
12-0-0-50	Tiger Combo	20	40	2	None	None
12-0-0-50	Tiger Combo	60	120	6	None	None
12-0-0-50	Tiger Combo	100	200	10	None	None
0-0-0-16	Magnesium Sulphate	20	125	7	None	None
0-0-0-16	Magnesium Sulphate	60	375	19	None	None
0-0-0-16	Magnesium Sulphate	100	625	32	None	None
21-0-0-24	Ammonium Sulphate	20	68	4	Ammonium Thiosulphate 12-0-0-26	3
21-0-0-24	Ammonium Sulphate	60	188	10	Ammonium Thiosulphate 12-0-0-26	3
21-0-0-24	Ammonium Sulphate	100	313	16	Ammonium Thiosulphate 12-0-0-26	3
Negative Control (no additional sulphur)			0	0	None	None

Table 1. Sulphur fertilizer products employed in the study are listed by sulphur content to display the amount of each product necessary to achieve the goal lbs of sulphur available at row closure, as determined at a soil test conducted by Agvise, Inc. (Northwood, North Dakota). The fertigation rate assumes three lbs sulphur is in approximately one gallon of ammonium thiosulphate (ATS) per fertigation event. One fertigation event was required in 2019 and 2020, as determined by petiole testing from Agvise Inc. All plots received 115 lbs/acre (A) of mono-ammonium phosphate (MAP, 11-52-0-0), 42.24 lbs/A of Kmag blend (0-0-60-0), and 466.6 lbs/A of ESN (a polymer coated urea named Environmentally Smart Nitrogen, 44-0-0) from Redfern Farm Services, Brandon, Manitoba.