Evaluation of Co-granulated Potassium and Boron on Potato Yield and Quality

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Background

Both potassium (K) and boron (B) are vital to potato tuber yield and storage characteristics. However, applying B evenly to crops is both challenging and important because B is required in small amounts and the window between deficiency and toxicity is narrow. A new fertilizer formulation has been developed to facilitate even B application by co-granulating it with potassium chloride (KCl; Mosaic Aspire; 0-0-48K-0.5B). In a three-year field study on a Hubbard loamy sand soil, we evaluated the effectiveness of Aspire as a K and B source for Russet Burbank potatoes.

Objective

The overall objective of this study was to evaluate the effectiveness of co-granulated K and B as a nutrient source for potatoes relative to muriate of potash (MOP) with and without granular B.

Methods

- 3-year study (2017 results pending)
- Russet Burbank potatoes grown in acidic, low-organic-matter Hubbard loamy sand soil.
- Six treatments
  1. Check with no K or B added
  2. 280 kg·ha^{-1} K as MOP at planting
  3. 280 kg·ha^{-1} K and 2.8 kg·ha^{-1} B as MOP with granulated 14.3% B (Granubor) at planting
  4. The same rates of K and B and as Aspire at planting
  5. 280 kg·ha^{-1} K as MOP split between planting and hilling
  6. 280 kg·ha^{-1} K and 2.8 kg·ha^{-1} B as Aspire split between planting and hilling

Measurements

- Petiole and tuber B and K
- Marketable yield (tubers above 85 g)
- Tuber size
- Tuber quality
- Statistical significance at α = 0.05

Table 1. Application rates of elements in fertilizer treatments.

Treatment #	K and B sources[1,2]	Application rates of K_2O and B ($kg \cdot ha^{-1}$)					
		Pre-planting		Emergence		Total applied	
		K_2O	B	K_2O	B	K_2O	B
1	None	0	0	0	0	0	0
2	MOP	280	0	0	0	280	0
3	MOP + B	280	2.8	0	0	280	2.8
4	Aspire	280	2.8	0	0	280	2.8
5	MOP split	140	0	140	0	280	0
6	Aspire split	140	1.4	140	1.4	280	2.8

[1]MOP: 0-0-60; Aspire: 0-58-0.5B; Granular B: 14.3% B

[2]All treatments received recommended rates of N, P, S, Zn, Mg based on soil test

Table 2. Initial soil characteristics in each year

Year	Primary macronutrients			Secondary macronutrients		
	NO_3-N (ppm)	Bray P (ppm)	NH_4OAc-K (ppm)	NH_4OAc-Ca (ppm)	NH_4OAc-Mg (ppm)	SO_4-S (ppm)
2015	2.33	17	58	555	123	2.0
2016	4.90	16	76	520	126	1.0

Year	Micronutrients					Other characteristics	
	Hot Water B (ppm)	DTPA-Cu (ppm)	DTPA-Fe (ppm)	DTPA-Mn (ppm)	DTPA-Zn (ppm)	Water pH	O.M. LOI (%)
2015	0.125	0.323	37.7	9.50	0.72	6.1	1.1
2016	0.090	0.317	21.7	5.61	0.43	6.1	1.0

Sample depth 60 cm for NO_3-N; all others 15 cm

Results

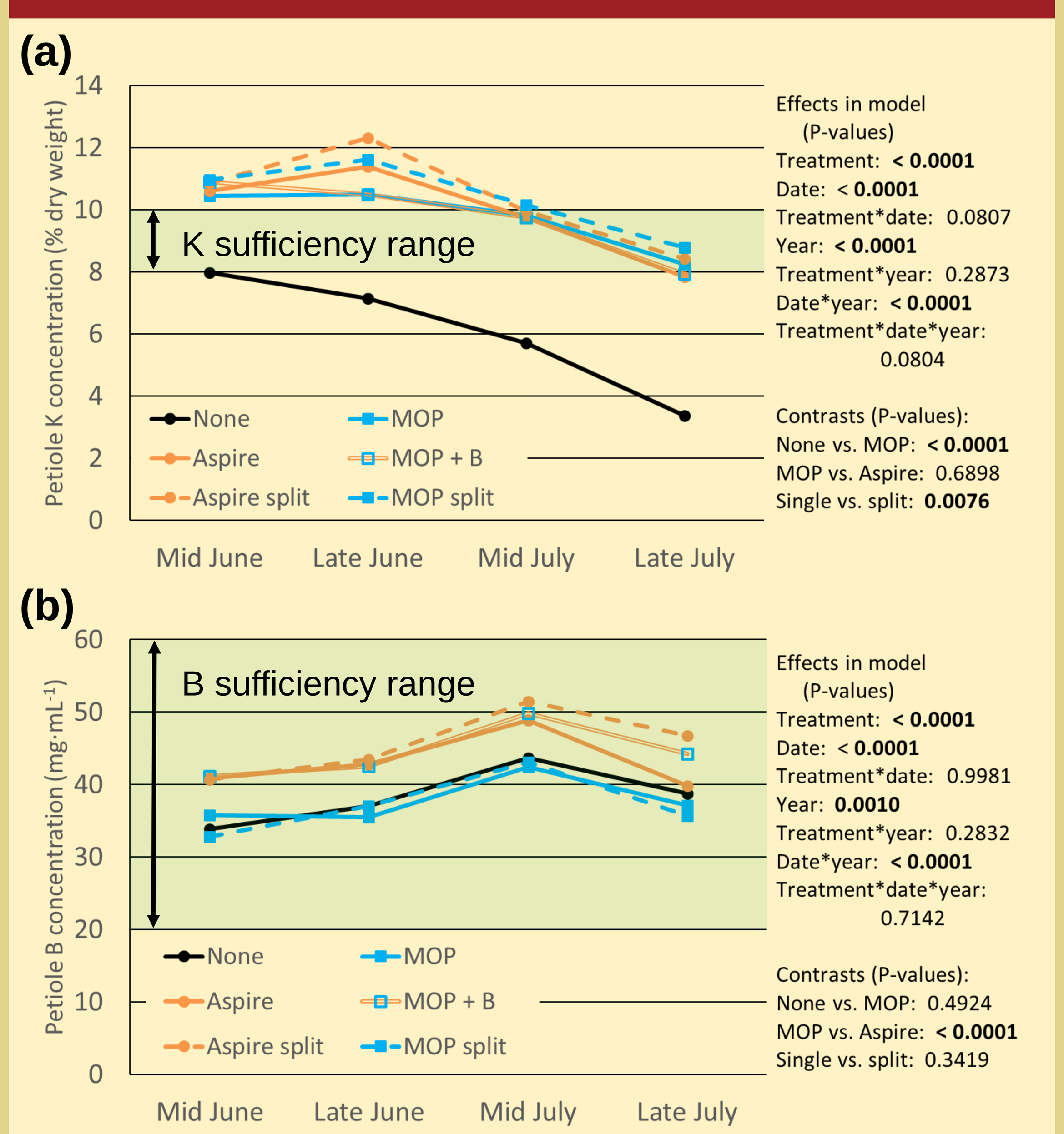

Figure 1. Petiole potassium (a) and boron (b) concentrations.

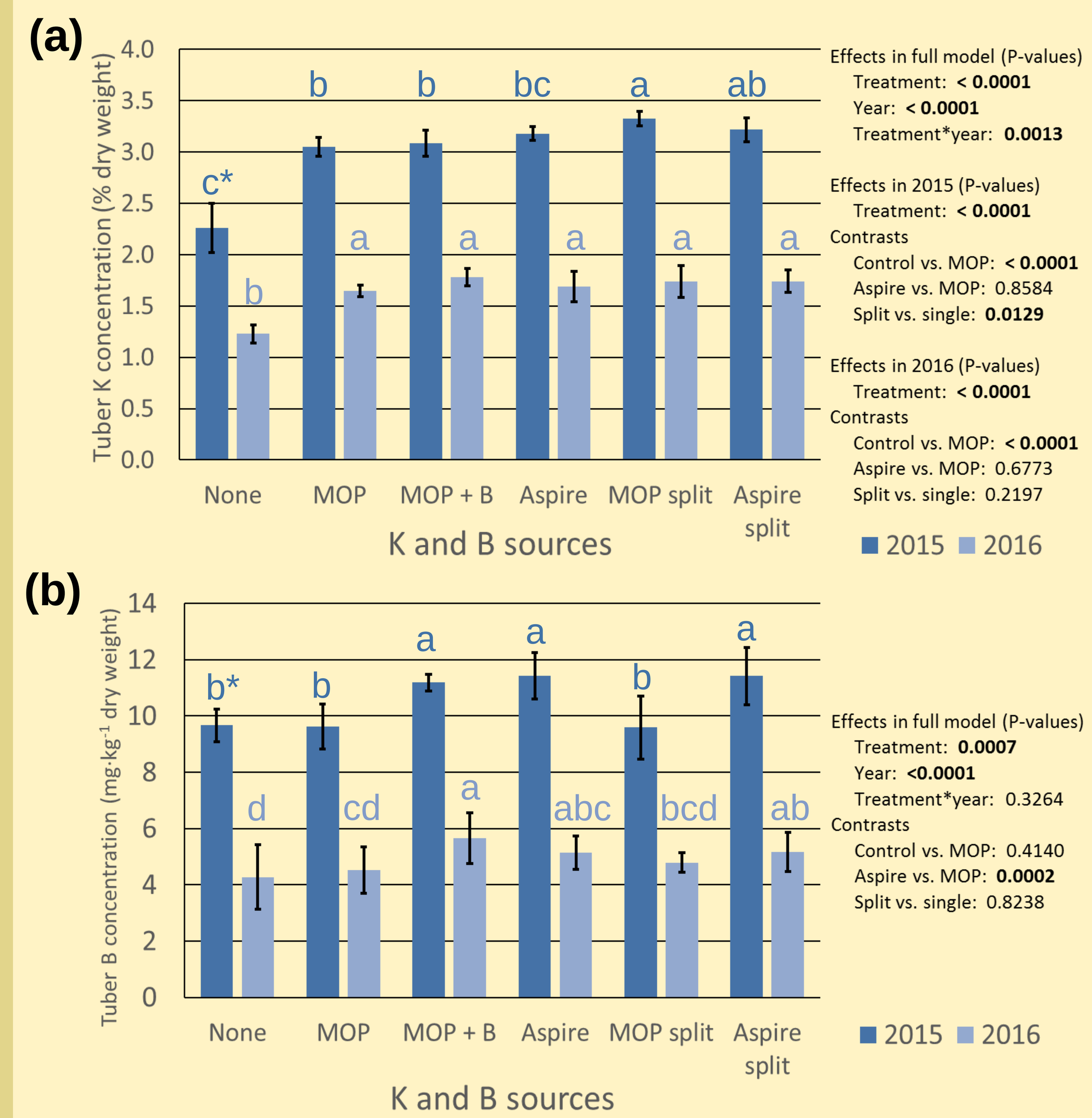

Figure 2. Tuber potassium (a) and boron (b) concentrations

* Columns within a year that have a letter in common are not different at α = 0.05.

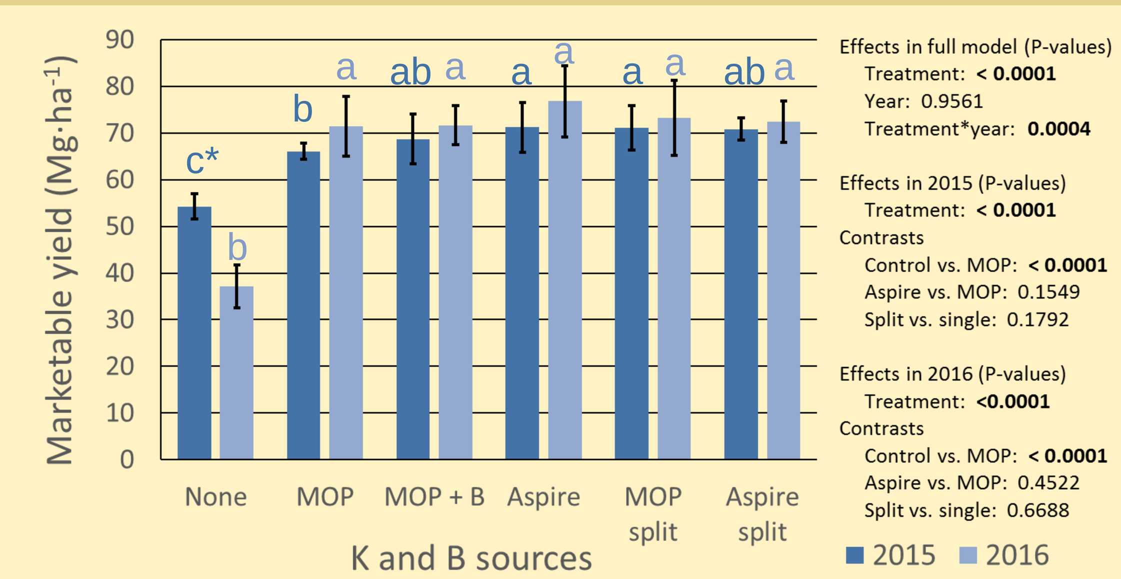

Figure 3. Marketable tuber yield

* Columns within a year that have a letter in common are not different at α = 0.05.

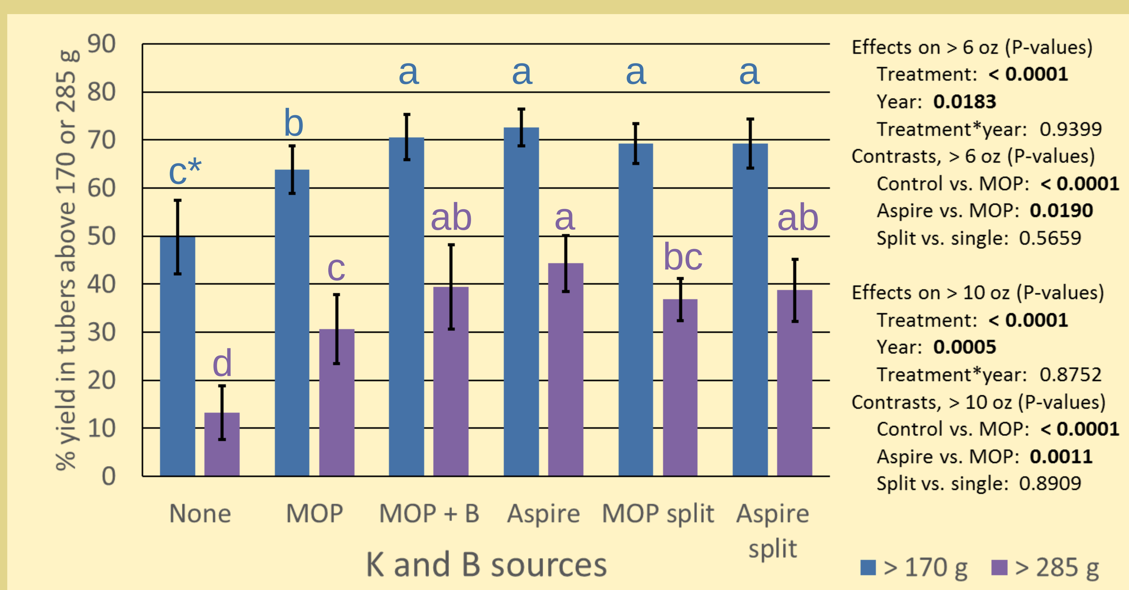

Figure 4. Tuber size

* Columns within a size class that have a letter in common are not different at α = 0.05.

Tuber quality

- Hollow heart and scab occurred in no more than 3% of the tubers in any treatment in any year.
- Tuber specific gravity was higher in the control than single or split MOP (P= 0.07).

Summary and Conclusions

- Based on petiole and tuber K concentrations (Fig. 1 & 2), the co-granulated potassium / boron formulation (Mosaic Aspire) provided K as effectively as MOP.
- Aspire also provided B as effectively as granular B.
- K fertilization increased tuber yield in both years (Fig. 3).
- In 2015, a single application of MOP produced smaller yields than split applications of MOP and single or split applications of Aspire.
- K fertilization increased tuber size relative to the zero-K control.
- When K application was not split, the addition of B as Granubor or Aspire increased tuber size compared to MOP without B.
- The treatments receiving split applications had less of their yield in tubers over 285 g than the treatment receiving a single application of Aspire.
- Overall, Aspire appears to be an effective source of K and B and to provide an efficient means of applying these nutrients.

Future Directions

In 2017, we removed the split-application treatments and added treatments evaluating other co-granulated nutrient formulations.

Acknowledgements

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