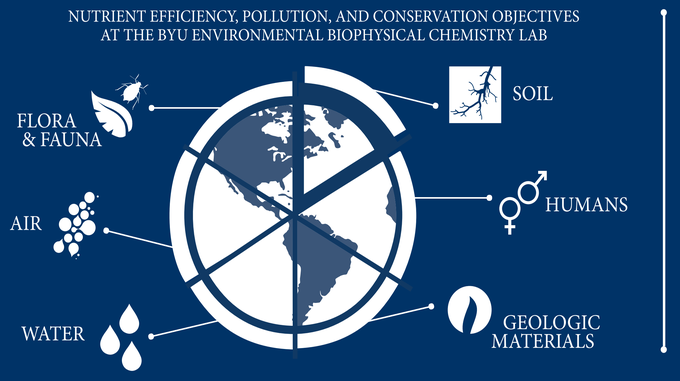

The Mode of Action for a Citrate Soluble Phosphorus Fertilizer Product

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STUDY OBJECTIVES

- INCREASE POTATO PRODUCTION AND FARM SUSTAINABILITY
- CONSERVE PHOSPHORUS ORE
- MINIMIZE POTENTIAL FOR PHOSPHORUS ENRICHMENT IN SURFACE WATER

ABSTRACT

A proposed mode of action to enhance phosphorus (P) efficiency is the use of citrate soluble [CS; 5-28-0-10(Mg)] fertilizer. The P remains in the granule until it comes into close proximity to roots which exude acids that solubilize the P for plant uptake, minimizing opportunity for precipitation. University research in OR and MN showed positive results for this fertilizer in potatoes. We and others verified the solubility claims in lab trials. The P in the fertilizer remained 353% more soluble than monoammonium phosphate (MAP; 11-52-0), which had dissolved in water. In this study, various blends of MAP and CS were evaluated on potato (*Solanum tuberosum* L.) with various P rates and N balanced. In 2013 and 2014, the average US No. 1 tuber yields increased by 3.1 Mg ha^{-1} for CS blends, primarily due to an increase in large tubers. Overall yields were not impacted and there were no significant impacts on any other tuber quality factor, including internal and external defects, and specific gravity. No differences were measured in 2015 on soils with relatively high soil test P concentrations. The CS fertilizer appears to be a good source and can be used at a lower rate.

INTRO

- P is poorly soluble in soil
- Relatively high P requirements for potato
- Growers often apply high levels of P
- Concerns over residual soil P getting into surface water and waste of ore
- Strategy to meet P needs is to use a fertilizer that won't dissolve in water, but will solubilize in the presence of acidic root exudates

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METHODS

- Russet Burbank potato--Idaho
  - 2 locations in 2013
  - 3 locations in 2014
  - 10 locations in 2015
- Calcareous sandy loam soils, pH 8
- Olsen Bicarbonate soil test P=12-66 ppm
- Fertilizer broadcast, incorporated treatments:
  - Control (no P fertilizer)
  - Various blends of MAP and citrate soluble fertilizer (CS; Crystal Green®, Ostara Nutrient Recovery Technologies, Inc., Vancouver, BC) applied at 50, 75, and 100% rates
  - MAP alone

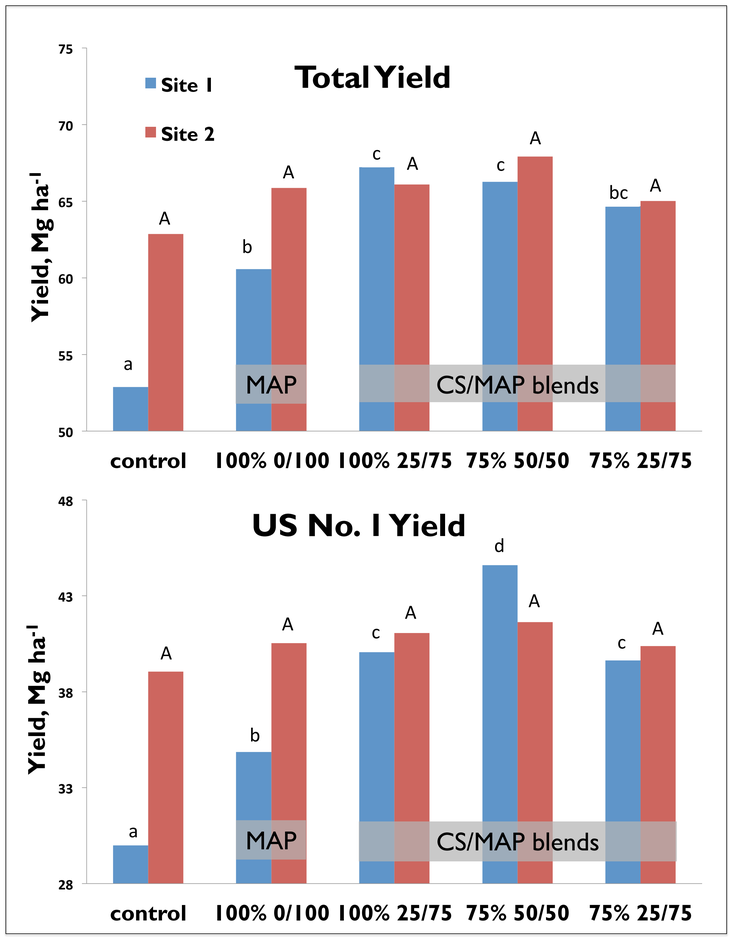

Fig. 1 Total yield and US No. 1 yield for potatoes in 2014 sites 1 & 2. Rates at 100% = full rate (112 kg ha^{-1}) or 75% (84 kg ha^{-1}) with ratios of 0/100, 25/75, 50/50, or 25/75 CS/MAP, respectively. Data bars with letters at top with the same letter(s) are not statistically different.

RESULTS

- **2013** (data not shown)
  - Reduced rate (75%) of CS/MAP blends (with ½ or ¼ P supplied as CS) had US No. 1 yields equivalent to the full rate of MAP, whereas the reduced rate (75%) of MAP alone did not.
  - There were no other significant differences in other yield and grade categories
- **2014 site 1** (Fig. 1)
  - Full and reduced rates of CS performed better than a full rate of MAP alone
- **2014 site 2** (Fig. 1)
  - No significant differences
- **2014 site 3** (Fig. 2)
  - Blends with ½ of P supplied by CS resulted in greater yields for US No. 1 with the full rate, for marketable with the reduced (75%) rate, and for total yield with both the full and reduced rates
- **2015** (data not shown)
  - Minimal differences were observed in these relatively higher soil test P trials

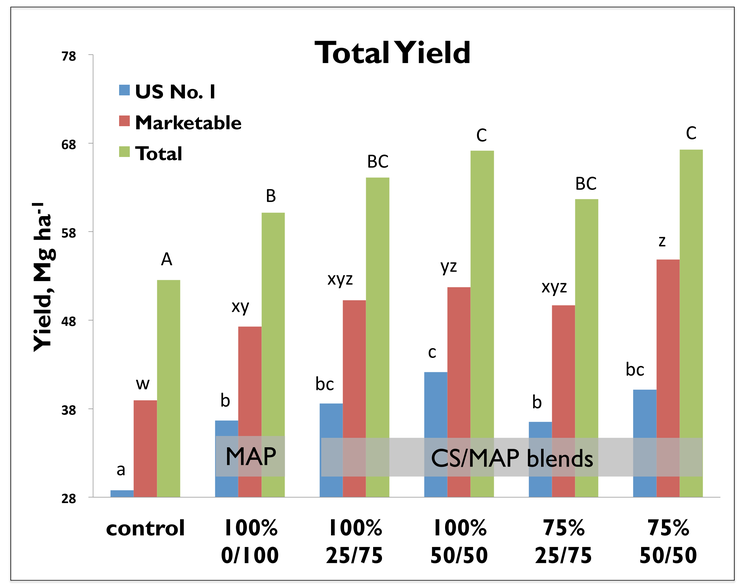

Fig. 2 Total Yield for potatoes in 2014 site 3. Rates at 100% = full rate (112 kg ha^{-1}) or 75% (84 kg ha^{-1}) with ratios of 0/100, 25/75, 50/50, or 25/75 CS/MAP, respectively. Data bars with letters at top with the same letter(s) are not statistically different.

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