Using Gypsum to Reduce Tuber Rot and Increase Potato Yields on Sandy Loam Soils.

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Poster Information

Eastern Shore AREC Soil Fertility Program

ABSTRACT

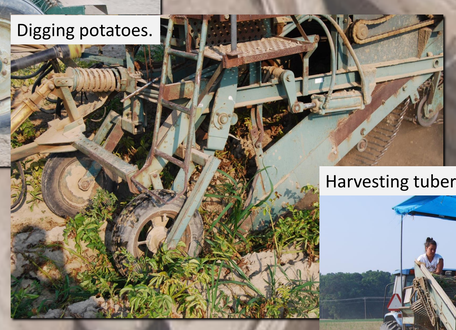
Calcium (Ca) and sulfur (S) may significantly impact white potato (*Solanum tuberosum*) tuber quality and yield in the Mid-Atlantic. A field trial was initiated on a Bojac sandy loam using 'Superior' white potatoes in summer 2010. Gypsum was applied at 1120, 2240, 3360, and 4480 kg ha^{-1}, giving effective S application rates of 188, 376, 564, and 753 kg S ha^{-1} and Ca application rates of 252, 504, 756, and 1008 kg Ca ha^{-1}. Sulfur rates comparable to the gypsum application were also applied using elemental sulfur along with separate treatments of 0, 28, 56, and 112 kg S ha^{-1}. Soft rot (*Erwinia carotovora* ss. *carotovora*) and Pythium leak (*Pythium* sp.) occurred naturally in this trial causing tuber rots in the field. Potato tubers were harvested using a mechanized potato harvester and graded for marketability. Gypsum applications reduced tuber rot in 2010 and 2011 and increased total marketable yield. Sulfur applications alone did not impact total yield, but S applications via gypsum did reduce tuber rot in 2011. Little tuber rot incidence occurred in 2012 and treatments had no significant impact on rot or yield. Overall, gypsum applications may be beneficial in years with high tuber rot incidence to reduce rot and increase marketable yield for potatoes grown in Mid-Atlantic sandy loam soils.

INTRODUCTION

Eastern Shore of Virginia soils are naturally deficient in S and S depositions have decreased due to reductions in acid rain; possibly warranting additions of S fertilizer. Similarly, sandy loam soils often test low for Ca and soil test values continue to decrease as lime use is reduced due to proper fertility management, a desired low pH for potato production, and reductions in acid rain. Studies indicated that use of S and Ca containing products, such as gypsum, can provide adequate fertility for raising soil test concentrations. Adequate supplies of S and Ca from gypsum may increase yield, reduce tuber rot, and increase tuber quality for white potato production in the Mid-Atlantic.

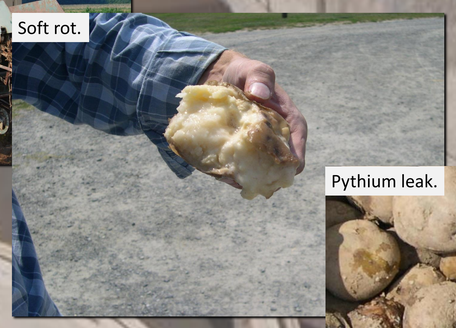
Planting with fertilizer attachment on planter.

Digging potatoes.



Harvesting tubers.

Soft rot.



Pythium leak.

OBJECTIVES

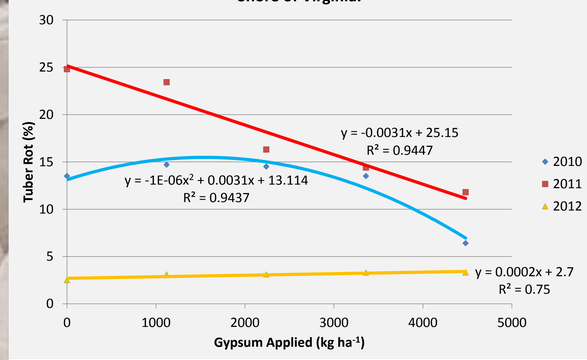
- To determine if calcium and/or sulfur fertilization will decrease tuber rot for white potato production on sandy loam soils.
- To find appropriate calcium and/or sulfur rates to produce maximum marketable tuber yield on sandy loam soils.

MATERIALS AND METHODS

- Study was initiated in 2010 at the Virginia Tech Eastern Shore Agricultural Research and Extension Center in Painter, Virginia, USA.
- Bojac sandy loam (Coarse-loamy, mixed, semiactive, thermic Typic Hapludult).
- Naturally occurring tuber rot inoculum for *Erwinia carotovora* ss. *carotovora* and *Pythium* sp.
- Gypsum ($CaSO_4$; 22.5% Ca and 16.8% S) applied at the following rates:
  - 1120 kg ha^{-1}
  - 2240 kg ha^{-1}
  - 3360 kg ha^{-1}
  - 4480 kg ha^{-1}
- Effective calcium application rates via gypsum:
  - 252 kg Ca ha^{-1}
  - 504 kg Ca ha^{-1}
  - 756 kg Ca ha^{-1}
  - 1008 kg Ca ha^{-1}
- Effective sulfur application rates via gypsum:
  - 188 kg S ha^{-1}
  - 376 kg S ha^{-1}
  - 564 kg S ha^{-1}
  - 753 kg S ha^{-1}
- Sulfur application rates via elemental sulfur:
  - 28 kg S ha^{-1}
  - 56 kg S ha^{-1}
  - 112 kg S ha^{-1}
  - Plus 4 gypsum equivalent rates previously mentioned.
- A 0-Ca + 0-S control was included.
- Potatoes were harvested mechanically and graded according to rot, marketability, and size.
- All other production practices were followed as outlined by *Commercial Vegetable Production Recommendations – Virginia*.
- The study included four replications and was arranged as a randomized complete block design.
- Regression analysis for fertilizer rates and ANOVA for sources was conducted at alpha = 0.10.

RESULTS AND DISCUSSION

Fig. 1. Percentage rot of total yield due to gypsum application for white potatoes grown on sandy loam soils on the Eastern Shore of Virginia.



Tuber Rot:

- Addition of gypsum significantly reduced tuber rot as a percentage of tuber yield in both 2010 and 2011 growing seasons (Figure 1).
- Higher rates (>2240 kg ha^{-1}) of gypsum may be necessary as indicated by a negative linear and negative quadratic response.
- Little tuber rot was experienced in 2012.
- Elemental S rates did not significantly impact tuber rot in any year.

Total Marketable Yield:

- Additions of gypsum significantly increased total marketable yield in a quadratic relationship in 2010 and linearly in 2011 (Figure 2), but not in 2012.
- Higher rates of gypsum (>4480 kg ha^{-1}) may be necessary as indicated by a positive quadratic relationship in 2010 and a positive linear correlation in 2011.
- Sulfur fertilization using elemental S did not strongly correlate to yield (Figure 3).

Fig. 2. Total marketable yield due to gypsum application for white potatoes grown on sandy loam soils on the Eastern Shore of Virginia.

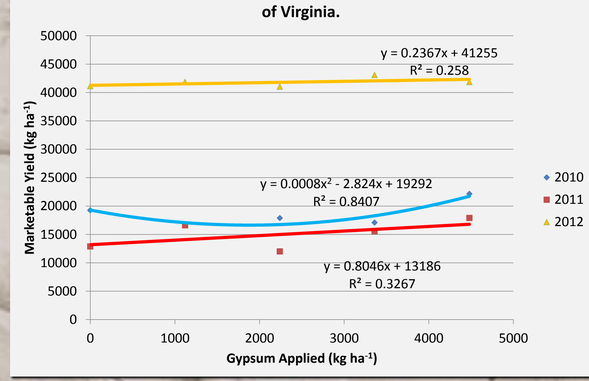
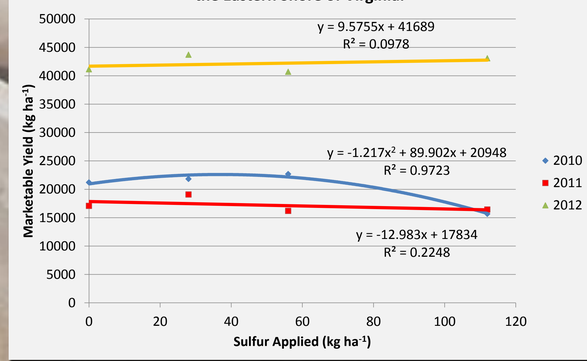


Fig. 3. Total marketable yield due to elemental sulfur fertilization for white potatoes grown on sandy loam soils on the Eastern Shore of Virginia.



Comparing sulfur sources (Gypsum vs. elemental sulfur):

Tuber Rot:

- In 2010, no effect was significant.
- In 2011, a source main effect indicated higher tuber rot incidence with elemental S than gypsum (22.3 vs. 16.4%, respectively); averaged across S rates.
- In 2012, no effect was significant.

Total Marketable Yield:

- In 2010, yield was not impacted.
- In 2011, yields generally indicated that gypsum provided higher yields than elemental sulfur.
- In 2012, yield was not impacted.

CONCLUSIONS

- Calcium additions via gypsum applications can significantly reduce tuber rot and increase total marketable yields in white potato production in years with significant rot incidence.
- Even though soil S concentrations are generally low on the Eastern Shore of Virginia, S additions did not significantly increase yield or reduce incidence of tuber rot.

THANK YOU!

- This project was funded through check-off funds from the Virginia Irish Potato Board.