

Western Canadian Rock Phosphate Incubation Study

Study by Elston Solberg (March, 2017)

Overview

Phosphate is a vital element for plant growth and the second most important plant nutrient after nitrogen. The base source for most phosphate fertilizers is rock phosphate. Direct application of rock phosphate has been demonstrated to be effective for providing plant available phosphorus in acidic soils but rock phosphate effectiveness is known to decline as soil pH increases because some acidity is required to convert the phosphate within rock phosphate to a water soluble plant available form of phosphate.

Sulphur is one of the 17 essential nutrients required for plant production and is becoming in commonly short supply in western Canadian soils. The application of elemental sulphur has been shown to improve plant available SO_4-S sulphur, although, it has been demonstrated that plant available sulphur can also be improved by blending sulphur with various types of compost material.

Rock phosphate is a certifiable organic crop input. Numerous research studies have indicated that phosphate availability in neutral to slight alkaline soils can be improved by blending rock phosphate with other organic soil amendments such as compost, sulphur and other elemental and bacterium blends.

Methods

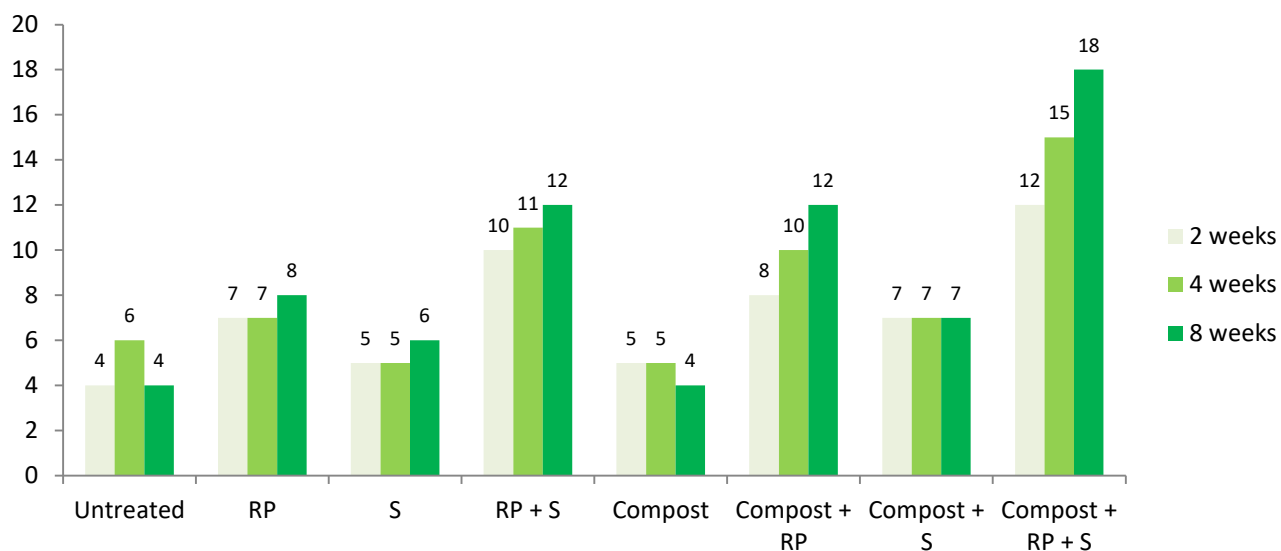
This study compares plant available phosphate and plant available sulphur using a check treatment and 7 other various combinations of rock phosphate, compost and elemental sulphur on a pH neutral (pH of 7.1), phosphate deficient (P of 4 ppm), western Canadian soil in a laboratory environment after a 2 week, 4 week and 8 week incubation period. Soil test sulphur was 3 ppm. Rock phosphate contained >20% P_2O_5 and was applied at 120 ppm, while sulphur (as elemental sulphur) was applied at 60 ppm. In blends, the ratio of components based on compost 25%, sulphur 7% and Rock Phosphate 68%. Conceptually, a 400lbs application will supply 54 lbs P_2O_5/ac and 24 lbs S/ac. Soil (300 g) was incubated at room temperature and 90% field capacity.

Results

Overall, phosphate availability was maximized with (from best to lowest):

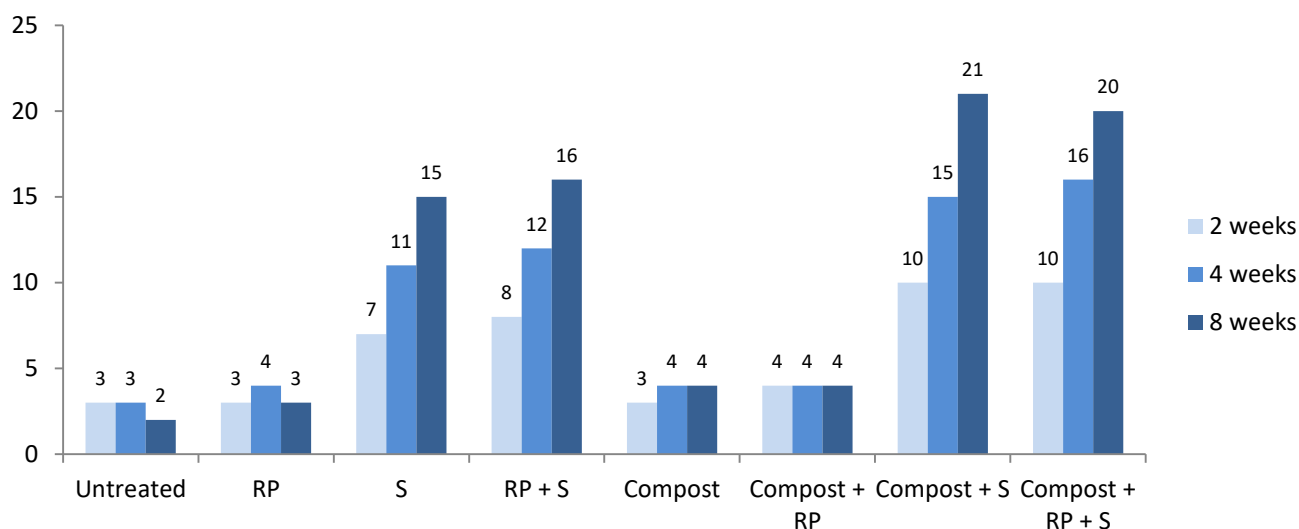
- elemental sulphur + compost + rock phosphate
- elemental sulphur + rock phosphate
- compost + rock phosphate
- rock phosphate
- compost + elemental sulphur
- elemental sulphur
- compost
- the check

Table 1. Soil analysis of phosphate (ppm) from treatments at 2, 4 and 8 weeks after application



The data (table 1) indicates that on a pH neutral, phosphate deficient western Canadian soil, that the rock phosphate application doubled phosphate availability after 8 weeks or by a factor of 1.2x to 2x (over the check and three time periods) and that the use of elemental sulphur and rock phosphate tripled phosphate availability after 8 weeks or by a factor of 1.8x to 3x. The addition of compost to the rock phosphate and sulphur further increased phosphate availability by 50% after 8 weeks or by factors of 1.7x to 4.5x.

Table 2. Soil analysis of sulphur (ppm) from treatments at 2, 4 and 8 weeks after application



According to table 2, plant available sulphur was maximized with the use of compost and elemental sulphur, elemental sulphur alone and the check. As expected rock phosphate appears to have zero to very limited impact on available sulphur while elemental sulphur had a high degree of influence on phosphate availability due to the acidic nature of sulphur.

Summary

The lower water solubility of rock phosphate versus commercial fertilizer can be beneficial because phosphate is available over a longer period of time and not prone to phosphate leeching (as is a concern with commercial fertilizers). On pH neutral and alkaline soils rock phosphate should be blended with other crop inputs such as elemental sulphur to maximize phosphate availability.

These rock phosphate blends may, in the right conditions, be as good as or better than commercial fertilizer in certain uses and soil matrices, in providing essential plant nutrients. A number of papers and researchers have suggested this, although this specific question was not addressed in this study.