EVALUATION OF MICRO-CARBON TECHNOLOGY-BASED P FERTILIZER, SUPER PHOS®, IN SPRING WHEAT

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ABSTRACT

Super Phos® (SP; 0-50-0) by Bio Huma Netics Inc. (Gilbert, AZ) is a Micro Carbon Technology™ – based phosphorus (P) fertilizer specifically formulated to resist "tie-up" with calcium (Ca) and magnesium (Mg) to remain water soluble and available to plant roots. The objective was to compare the efficiency and effectiveness of topdress and foliar application of SP, with traditional P fertilizers – ammonium polyphosphate (APP; 10-34-0), diammonium phosphate (DAP; 18-46-0), and triple super phosphate (TSP; 0-46-0) – for optimizing spring wheat grain yield and quality. SuperPhos® has performed very well in terms of spring wheat grain yield and grain protein content in this study. SuperPhos® applied at tillering as a foliar spray has also performed well in terms of grain yield, but lower grain protein value of just 12% indicated that a possible N loss via volatilization of urea applied at seeding have impacted the results. Results indicated that application of SP at seeding at the rate of 30 lb P_2O_5 ac^{-1} is a good option for P fertilization in dryland spring wheat cropping systems of Montana.

INTRODUCTION

Proper P nutrition is important for wheat root growth and tiller development (Roberts, 1998). Furthermore, P is an essential component of energy-carrying phosphate compounds (ATP & ADP), nucleic acids, essential coenzymes, and phospholipids (Raven et al., 1992). Phosphorus deficiency in wheat is expressed as slow-growing and late-maturing plants (Roberts, 1998). Phosphate is the only form of P that plants able to take up, yet only 1% of all P in most Montana agricultural soils is present in a phosphate form. Although typical Montana fields contain between 1 or 2 parts per million (ppm) to 20 or more ppm of P, its availability is directly affected by soil pH. In Montana's predominantly high pH calcareous soils, phosphate ions tend to react with Ca and Mg to form less soluble compounds (Jones and Jacobsen, 2002). The primary P fertilizer sources in Montana are APP, DAP, and TSP. The efficiency of conventional P fertilizers use by crops ranges between 10 and 30% in the year it is applied (Malhi et al., 2002). Super Phos® by Bio Huma Netics Inc. (Gilbert, AZ) is a Micro Carbon Technology™ – based P fertilizer specifically formulated to resist "tie-up" with Ca and Mg to remain water soluble and available to plant roots. This product has been proven to aid P uptake in cold, high pH and calcareous soils. Micro Carbon Technology® is based on refined leonardite - oxygen-rich form of coal comprised of decomposing plant matter and minerals – transformed into extremely small carbon and oxygen-rich organic molecules (www.bhn.us, 2014). The superior efficiency of Super Phos® applied to the soil or plant leaves is due to the very high specific surface and, thus, enhanced chemical activity of the organic matter produced by Micro Carbon Technology® (www.bhn.us, 2014). Super Phos® applied to the soil enhanced the efficiency of applied nutrients, counteract factors such as precipitation that may prevent nutrient uptake. Foliar application of Super Phos® is recommended to target the nutrients to the principal site of photosynthesis and to minimize the potential for loss of nutrients from the soil (Crawford, 2014).

METHODS

The objective was to compare the efficiency and effectiveness of topdress and foliar application of SP, with traditional P fertilizers – APP, DAP, and TSP – for optimizing spring wheat grain yield and quality. The experimental site was at Montana State University's Western Triangle Agricultural Research Center (WTARC), near Conrad, MT. The Choteau spring wheat variety was used. Eleven treatments were replicated four times. Nitrogen (N) was applied to SP at seeding to compensate for the N level in APP and DAP. Treatment 1 was established as a check plot unfertilized with P. For treatments 2 through 7, liquid APP and two granular P fertilizers - DAP, and TSP - were applied with the seed at planting. For Treatments 8 and 9, SP, diluted with water at a concentration of no greater than 5% (v/v) was applied at seeding by dribbling it over the top of the seed. Seed and P fertilizer were covered with approximately 1 inch of soil after application. For treatments 10 and 11, a foliar application of SP at tillering (Feekes 5) was done using an all-terrain-vehicle (ATV)-mounted stream-bar sprayer.

RESULTS AND DISCUSSION

This report summarizes the results from one growing season. SuperPhos® has performed very well in terms of spring wheat grain yield and grain protein content in this study. Grain yields were typical for dryland spring wheat in the Conrad region, ranging from 55 to 64 bu ac^{-1}, with grain protein content from 11.7 to 14.0% (Figures 1 and 2). The highest yields of 64 bu ac^{-1} and 63 bu ac^{-1} were obtained with SP applied at the rate of 30 lb P_2O_5 ac^{-1} as topdress at seeding and with SP applied as a foliar spray at tillering at 15 lb P_2O_5 ac^{-1}. Comparable grain yields of 62 bu ac^{-1} were obtained with SP and DAP applied at 10 lb P_2O_5 ac^{-1} as topdress as seeding. Furthermore, grain yield of 61 bu ac^{-1} with application of SP as a foliar spray at tillering at 15 lb P_2O_5 ac^{-1}. Application of SP at seeding at both 10 and 30 lb P_2O_5 ac^{-1} rate had resulted in high grain yields; tripling the rate from 10 to 30 had increased yield by 2 bu ac^{-1} (Figure 1). This confirmed that SP is much less corrosive and less likely to cause damage to the seeds, and suggests that SP could be applied with the seed at a higher rate compared to other P sources. Foliar application of SP at 15 P_2O_5 ac^{-1} rate at tillering akso produced significantly higher yields compared to untreated control. Results indicated that application of SP at seeding at the rate of 30 lb P_2O_5 ac^{-1} is a good option for P fertilization in dryland spring wheat cropping systems of Montana. SuperPhos® applied at tillering as a foliar spray has also performed well in terms of grain yield, but lower grain protein value of just 12% indicated that a possible N loss via volatilization of urea applied at seeding have impacted the results. SuperPhos® applied at tillering as a foliar spray has also performed well in terms of grain yield, but lower grain protein value of just 12% indicated that a possible deficiency in P early in the growing season may have impacted N uptake. Therefore, substantial amount of N was taken up to produce high grain yield, but not enough to maximize grain protein content.

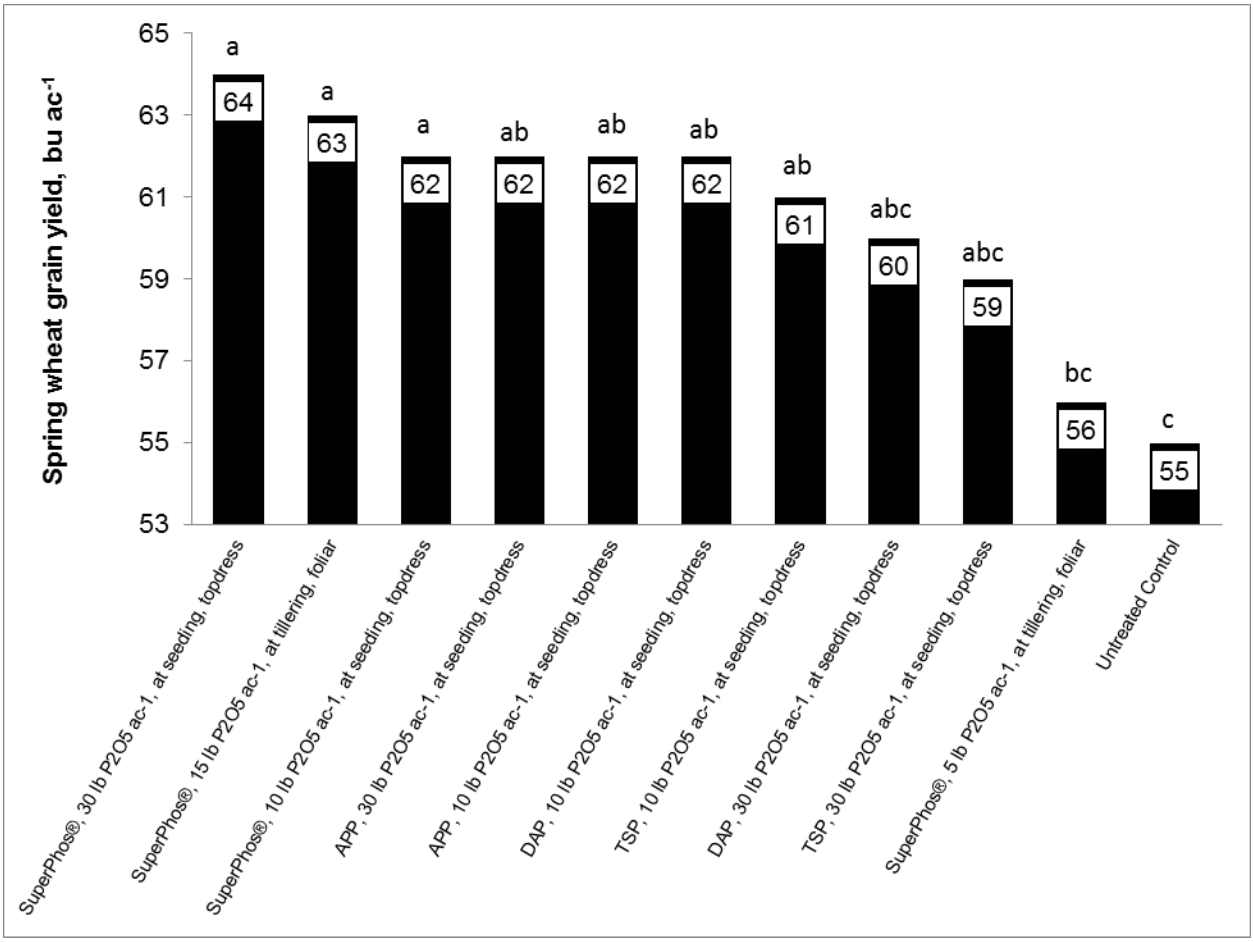

Figure 1. Spring wheat grain yield as a function of P fertilizer source, rate, time, and placement, Conrad, MT, 2013. Data points followed by the same letter are not significantly different at $p<0.05$.

SUMMARY

This report summarized data from one site-year. SuperPhos® has performed very well in terms of spring wheat grain yield and grain protein content in this study. Further studies aimed to pinpoint most appropriate application rate, time and method for optimization of wheat grain yield and quality are currently being carried out in Montana. Future studies will include thorough economical analysis comparing traditional P fertilizers to Micro Carbon Technology™ – based SP.

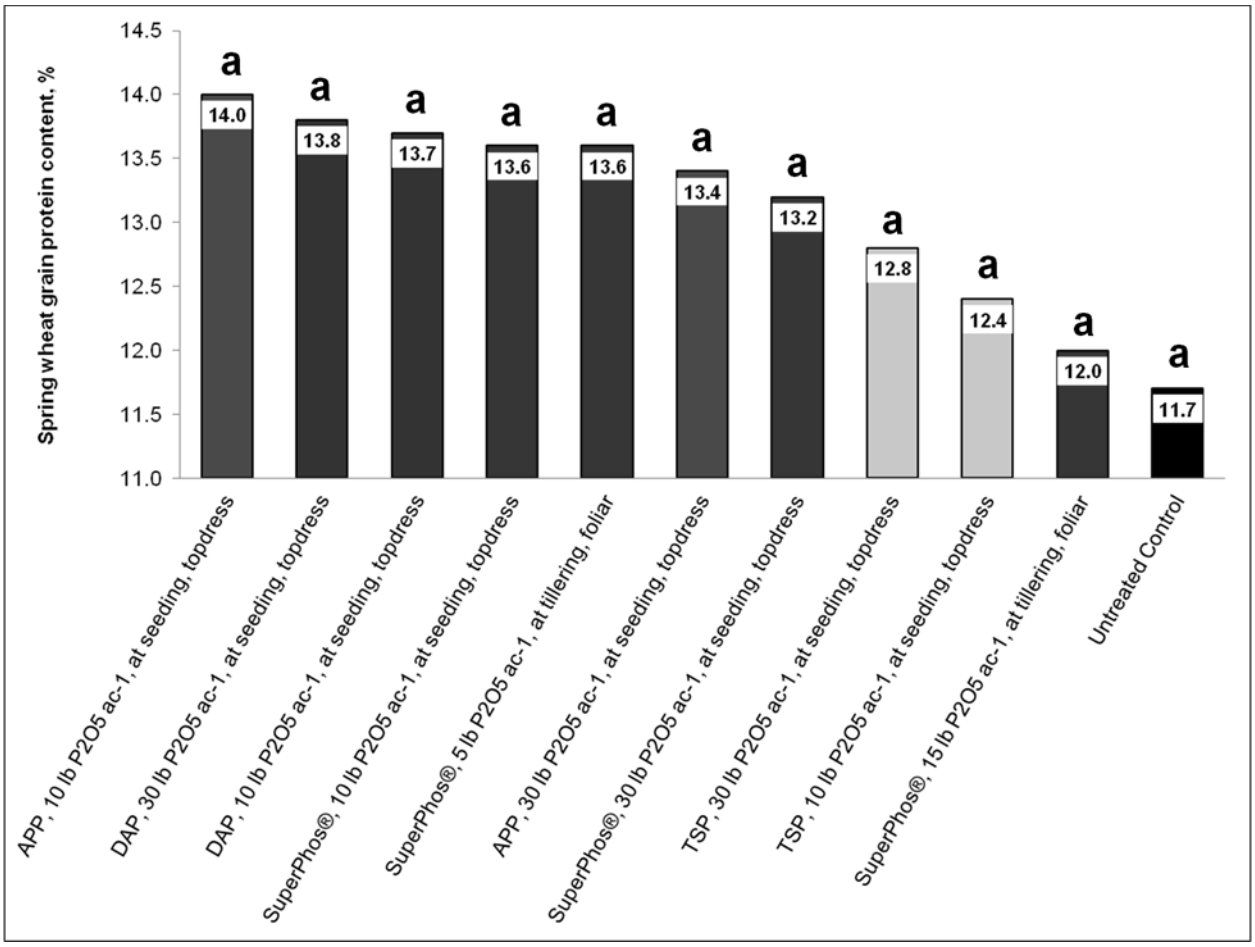

Figure 2. Spring wheat grain protein content as a function of P fertilizer source, rate, time, and placement, Conrad, MT, 2013. Data points followed by the same letter are not significantly different at $p<0.05$.

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