Spring Wheat Response to Phosphorus from Distillers Grains

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Introduction: Condensed distillers solubles (CDS) and wet distillers grains (WDG), which are co-products from ethanol production, have been shown to contribute phosphorus (P) and nitrogen to wheat and corn in previous trials conducted at the NDSU Carrington Research Extension Center. The cost of acquisition and transportation of CDS and WDGs, and the means to apply on farmlands have made it impractical for most farmers in the state to consider distillers grains (DGs) as a viable fertilizer alternative. However, a few farmers, mostly at close proximity to ethanol plants, who have acquired DGs at a relatively low cost want more evidence to substantiate recent reports of yield gain from application of DGs.

Materials and Methods: This trial was conducted on a loam soil with low soil available soil test P at 4 ppm (8 lbs/ac). Soil N was 47 lbs/ac. Treatments included three P sources: commercial inorganic fertilizer as triple super phosphate (TSP), CDS, and WDG. These were applied at 20 and 40 lbs/ac plus a check (0 lbs P). At 20 lbs P, CDS was applied at 270 gal/ac, and WDG at 3.3 T/ac. Fertilizer treatments were applied on the May 2, and incorporated the following day, before seeding wheat (variety Prosper). Sulfur at 10 lbs was applied to the Check and TSP plots as well as N as urea, for a total of 150 lbs N including soil N. at 80 lbs P, the N applied with WDG was greater than 150 lbs/ac. Crop vigor was evaluated on June 14, using a handheld sensor (GreenSeeker). The sensor produces an index called NDVI (Normalized Difference Vegetation Index) which gives higher index values for more vigorous or healthier crops. Yields were recorded following harvest on August 7.

Results and discussions

Phosphorus application resulted in significantly higher NDVI values at higher rates, implying enhanced crop vigor, compared to the check. A contrast of the average NDVI values for the TSP treatment versus either CDS or WDG showed that TSP treatments were significantly more vigorous (Figure 1). This was likely due to greater availability of the 80 lbs N as urea (same amount as the check) applied to TSP treated plots compared to 47 and 16 lbs N applied with CDS treatments respectively, at 40 lbs and 80 lbs P, and the 40 lbs N added with WDG at 40 lbs P, respectively. It is likely that N as well as P supplied by CDS and WDG was slowly made available to the crop as a slow release fertilizer.

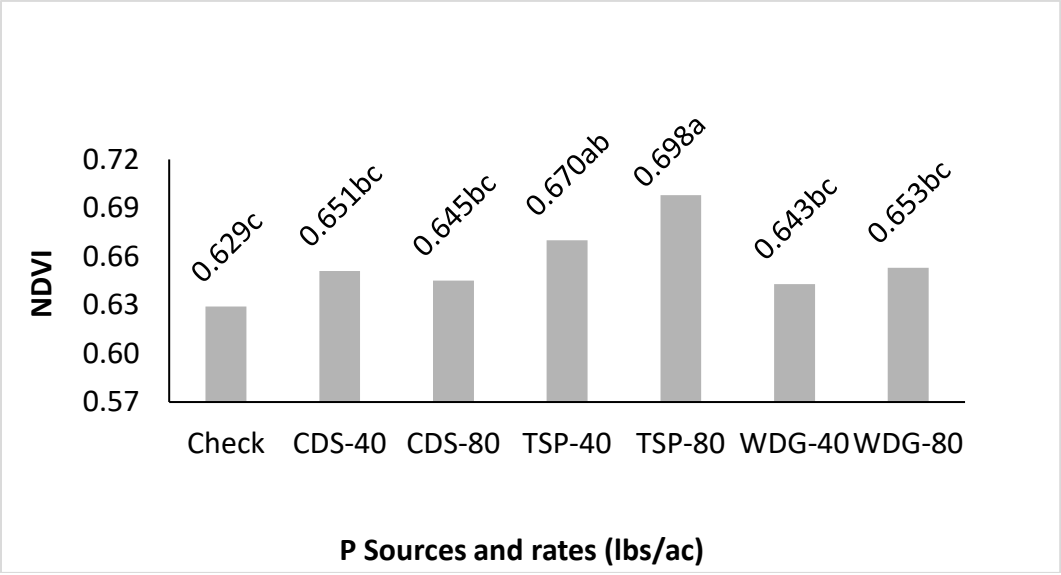

Figure 1. Effect of P sources (Condensed distillers grains, triple super phosphate, and wet distillers grains) and P rates on wheat vigor (Normalized Difference Vegetation Index).

Grain yields increased significantly due to P application rates, increasing from 42 bushels at the check to 52 bushels at 40 lbs P, and to 57 bushels at 80 lbs P, averaged across P sources. Yields were significantly greater for each P level for each source compared to the check (Figure 2). Since P had a significant effect on grain yields, and while yield differences between P sources were not significant, it is evident that distillers grains supplied P to the wheat crop. Grain protein content was greater for WDG (14.73) compared to either TSP (14.23) or CDS (14.28), probably due to higher amount of N applied with WDG.

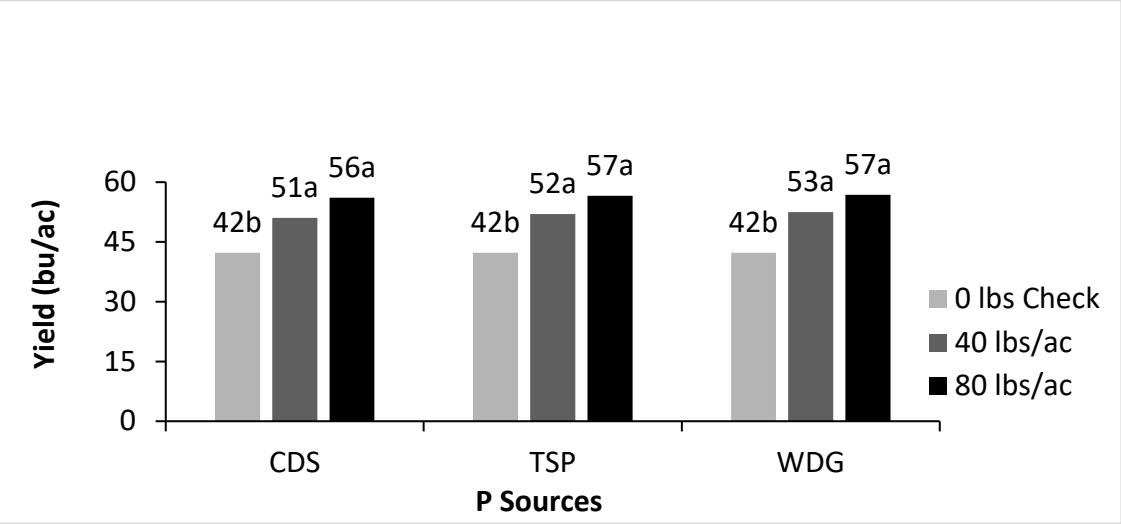

Figure 2. Yield response of wheat to P supplied from condensed distillers grains (CDS), wet distillers grains (WDG), and triple super phosphate (TSP), at three P rates.

Conclusion: Condensed distillers solubles and wet distillers grains, if applied to the soil before planting, can supply the required P to sustain high yields of corn and wheat.