Kansas Agricultural Experiment Station Research Reports

Volume 6
Issue 9 *Kansas Fertilizer Research*

Article 13

2020

Response to Mixing Wheat Seed with Fertilizer in the Drill at Planting

C. Weber
Kansas State University, cmweber@ksu.edu

D. A. Ruiz Diaz
Kansas State University, ruizdiaz@ksu.edu

Recommended Citation

Weber, C. and Ruiz Diaz, D. A. (2020) "Response to Mixing Wheat Seed with Fertilizer in the Drill at Planting," *Kansas Agricultural Experiment Station Research Reports*: Vol. 6: Iss. 9. https://doi.org/10.4148/2378-5977.7981

Response to Mixing Wheat Seed with Fertilizer in the Drill at Planting

Abstract

Mixing dry phosphorus (P) fertilizer with winter wheat seed is common in Kansas to provide a starter fertilizer benefit to the crop. This study was designed to evaluate the effects of dry P sources, rates, and times fertilizer mixed with wheat seed, effects on early growth and overall productivity and yield of the crop. Two winter wheat studies were conducted in the 2018–2019 wheat growing season at Manhattan (site 1) and Topeka (site 2) Kansas. The previous crop for site 1 was soybean and corn at site 2. The winter wheat was no-till drilled at 70 lb/a and mixed with either diammonium phosphate (DAP) (18-46-0) or Micro-Essentials SZ "MESZ" (12-40-0-10S-1Zn) rates of 30, 60, and 120 lb P_2O5/a. Mixing times in which wheat seed was in contact with the fertilizer were 0, 12, 28, and 40 days. The winter wheat was drilled in October and November and top-dressed with 100 lb N/a using UAN 28% at green-up in the spring. The overall trends observed in these preliminary results suggest that either P fertilizer source can be stored for a prolonged period of time with no negative impact, and producers can avoid the economic expenses of replacing the seed-fertilizer blend.

Keywords

wheat, phosphorus, fertilizer, seed, planting

Response to Mixing Wheat Seed with Fertilizer in the Drill at Planting

C. Weber and D.A. Ruiz Diaz

Summary

Mixing dry phosphorus (P) fertilizer with winter wheat seed is common in Kansas to provide a starter fertilizer benefit to the crop. This study was designed to evaluate the effects of dry P sources, rates, and times fertilizer mixed with wheat seed, effects on early growth and overall productivity and yield of the crop. Two winter wheat studies were conducted in the 2018–2019 wheat growing season at Manhattan (site 1) and Topeka (site 2) Kansas. The previous crop for site 1 was soybean and corn at site 2. The winter wheat was no-till drilled at 70 lb/a and mixed with either diammonium phosphate (DAP) (18-46-0) or Micro-Essentials SZ "MESZ" (12-40-0-10S-1Zn) rates of 30, 60, and 120 lb P_2O_5/a. Mixing times in which wheat seed was in contact with the fertilizer were 0, 12, 28, and 40 days. The winter wheat was drilled in October and November and top-dressed with 100 lb N/a using UAN 28% at green-up in the spring. The overall trends observed in these preliminary results suggest that either P fertilizer source can be stored for a prolonged period of time with no negative impact, and producers can avoid the economic expenses of replacing the seed-fertilizer blend.

Introduction

In general, winter wheat is one of the most responsive crops to P fertilizers in Kansas, making starter P fertilizer common across the state (Ruiz Diaz and Weber, 2019). Some producers lack fertilizer setups on their drills and commonly blend dry P fertilizers with wheat seed and then drill both together in the same hopper to get a starter fertilizer effect. However, little research has been done to address concerns with potential injury to wheat seed when mixed with different phosphorus fertilizer rates and timings. Thus, increases in nitrogen fertilizer rates (salt) in the seed furrow commonly cause issues with seed germination and the fall stand of wheat. This could ultimately decrease fall stands of the crop, which leads to a greater need for fall/spring tillering to recover this reduction in fall stand. In addition, the following questions arise "How long can dry fertilizer sit with the wheat seed?" and "Will it cause the same damage as a high starter fertilizer rate in-furrow?" This report provides a summary of results from an ongoing study evaluating the effect of fertilizer rates and fertilizer time exposure to wheat seed, and effects on wheat grain yield.

Procedures

The study was conducted at two locations during the 2018–2019 wheat growing season at Manhattan (site 1) and Topeka (site 2) in northeast Kansas near Kansas State

University (Table 1). The previous crop for site 1 was soybean and site 2 was corn. The winter wheat variety Everest was mixed with DAP (18-46-0) and Micro-Essentials SZ - MESZ (12-40-0-10S-1Zn) fertilizers. The blend of seed and fertilizer was stored in open plastic buckets for 0, 12, 28, and 40 days before drilling. Rates included 0, 30, 60, and 120 lb P_2O_5/a with 70 lb wheat seed/a (a complete combination of P rates and times for two P fertilizer sources). No nitrogen (N) was applied in the fall except for the N present in DAP and MESZ fertilizers. At green-up, 100 lb N/a was applied to all plots to ensure N was not a limiting factor. Normalized difference vegetation index (NDVI) measurements were taken at jointing (Feekes 6) stage with a Holland RapidSCAN CS-45 active sensor ran 35–40 inches above the crop canopy. Averages of NDVI readings were then recorded for each treatment. Biomass samples were collected at jointing (Feekes 6) and were taken from 2.5 feet of row times two rows in the backside of the plots. Additional biomass samples were taken at soft dough (Feekes 11.2) in the same manner as the jointing biomass samples. Grain harvest was completed with a plot combine, and subsamples were taken from each treatment. All biomass samples and grain were analyzed for P concentrations using the salicylic-sulfuric acid digestion method (Miller and Keeney, 1982). All statistical analyses were completed using SAS Studio (version 9.4; SAS, Institute, Inc, Cary, NC). Analysis of variance (ANOVA) using the GLIMMIX procedure was conducted.

Results

Early Growth

Increases were observed in NDVI when increasing rates of P_2O_5 were mixed with the seed with both DAP and MESZ fertilizer sources (Figure 1A). However, no significant differences were observed when DAP was mixed while increasing time intervals. When MESZ was mixed, the NDVI values at jointing were lower for the longer time interval of 40 days (Figure 1B). Also, significant increases were observed in total P uptake at jointing when using increased rates of both P fertilizer sources (Figure 1B). However, there were no significant effects of time mixed and total P uptake at jointing with either P fertilizer sources (Figure 1D).

Grain Yield and Phosphorus Removal

Preliminary results of this study showed that as rates of both P fertilizer sources were increased, significant increases were observed in the total amount of P removed in wheat grain (Figure 2A). However, when looking at the duration of the source mixed with seed, no significant results were found for DAP, but a slight decrease was observed in P removal for the longest MESZ mixing time of 40 days (Figure 2B). In addition, the yield was significantly increased as rate of both P fertilizer sources increased (Figure 3B). Also, the time DAP was mixed with seed had no significant effect on grain yield, while the longest mixing time using MESZ resulted in a small decrease in wheat grain yield (Figure 4B).

Based on these preliminary results, P rates in-furrow were the primary driver for increasing NDVI at jointing, P uptake at jointing, grain yield, and P removal with the grain. This response was significant up to the highest P rate for both fertilizer sources and likely due to the combination of low soil test and late planting date for the wheat (due to unfavorable weather conditions). The time DAP was mixed with wheat seed

had no effect on any of the measurements taken which indicates producers have flexibility regarding the time elapsed between mixing the seed and fertilizer, and planting. In this study, the storage conditions were in a dry environment to prevent fertilizer from absorbing water; it is possible that conditions of high relative humidity might affect the physical characteristics of the seed-fertilizer blend. The overall trends observed in these preliminary results suggest that either P fertilizer source can be stored for a prolonged period of time with no negative impact, and producers can avoid the economic expenses of replacing the seed-fertilizer blend.

References

Bremner, J.M., and Mulvaney, C.S. 1982. Total nitrogen and total phosphorus on soil and plant tissue are analyzed by the salicylic-sulfuric acid digestion. Salicylic acid thiosulfate modification of the Kjeldhal method to include nitrate and nitrite. p. 621. *In* Miller, R.H. Miller, and Keeney, D.R., (eds.) Methods of Soil Analysis. Part 2. Am. Soc. Agron., Inc., Madison, WI.

Gieseking, J.E., Snider, H.J., and Getz, C.A. 1935. Destruction of organic matter in plant material by the use of nitric and perchloric acids. Ind. and Eng. Chem., Anal. Ed., V.7, p185-186.

Ruiz Diaz, D. and Weber, C. 2019. In-furrow starter fertilizers for wheat. Issue 763. Kansas State Univ. Ext., Manhattan.

Table 1. Sites and soils type information for wheat experimental studies from 2019

Location	County	Soil type	Soil texture	Planting date	0–6 inch samples		
					pH	P	OM
						ppm	%
1	Riley	Smolan	Silt Loam	11/19/2019	5.75	17	3.2
2	Shawnee	Eudora	Silt Loam	10/19/2019	6.99	18	1.6

P = phosphorus. OM = organic matter.

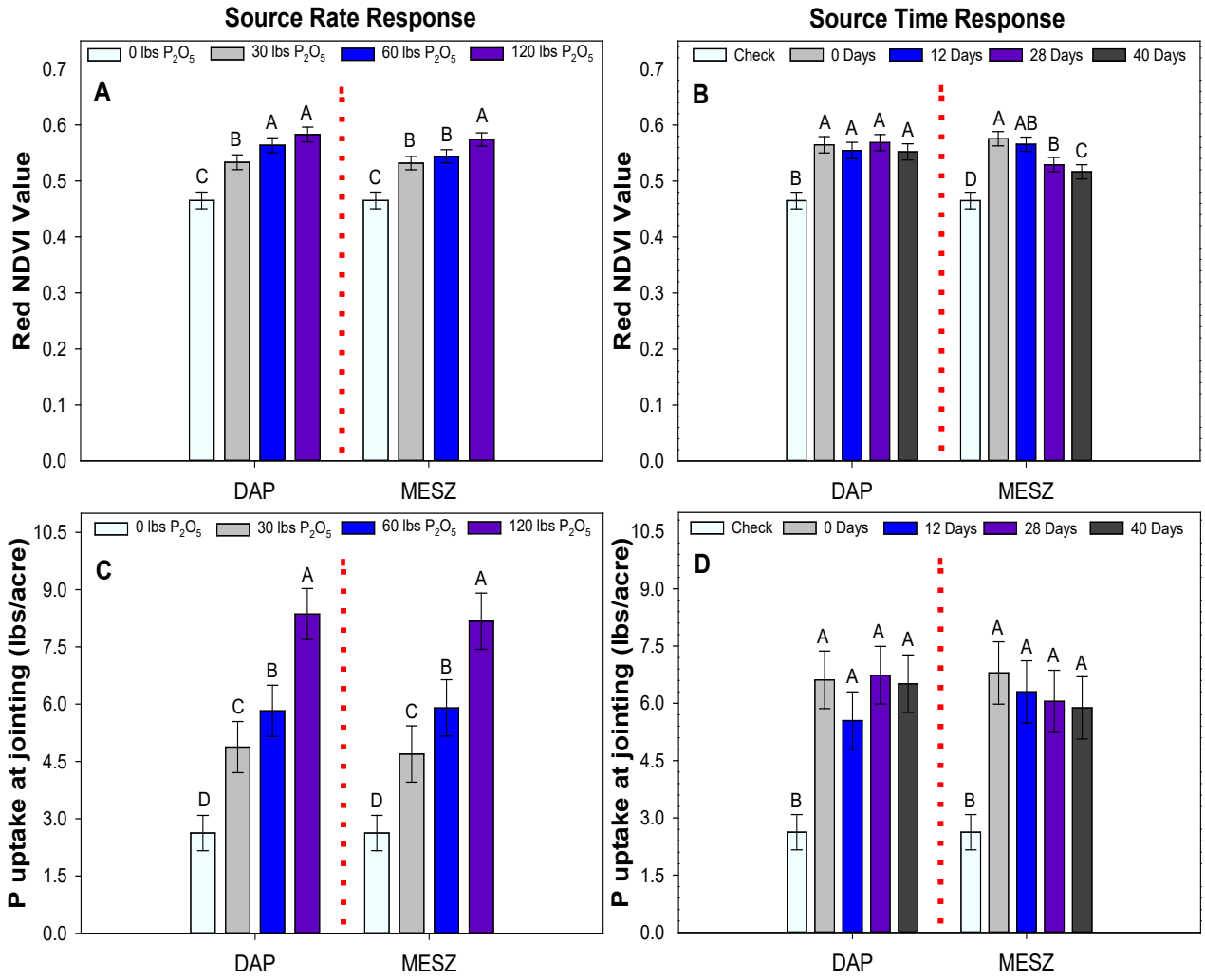

Figure 1. Normalized difference vegetation index (NDVI) measurements taken at the jointing (Feekes 6) stage with comparison made between fertilizer source rates mixed with seed (A), and comparison made between fertilizer mixing duration with seed (B). Phosphorus (P) uptake, lb/a, at the jointing (Feekes 6) stage with comparison made between fertilizer source rates mixed with seed (C), and comparison made between fertilizers mixing duration with seed (D). DAP = diammonium phosphate. MESZ = Micro essentials fertilizer.

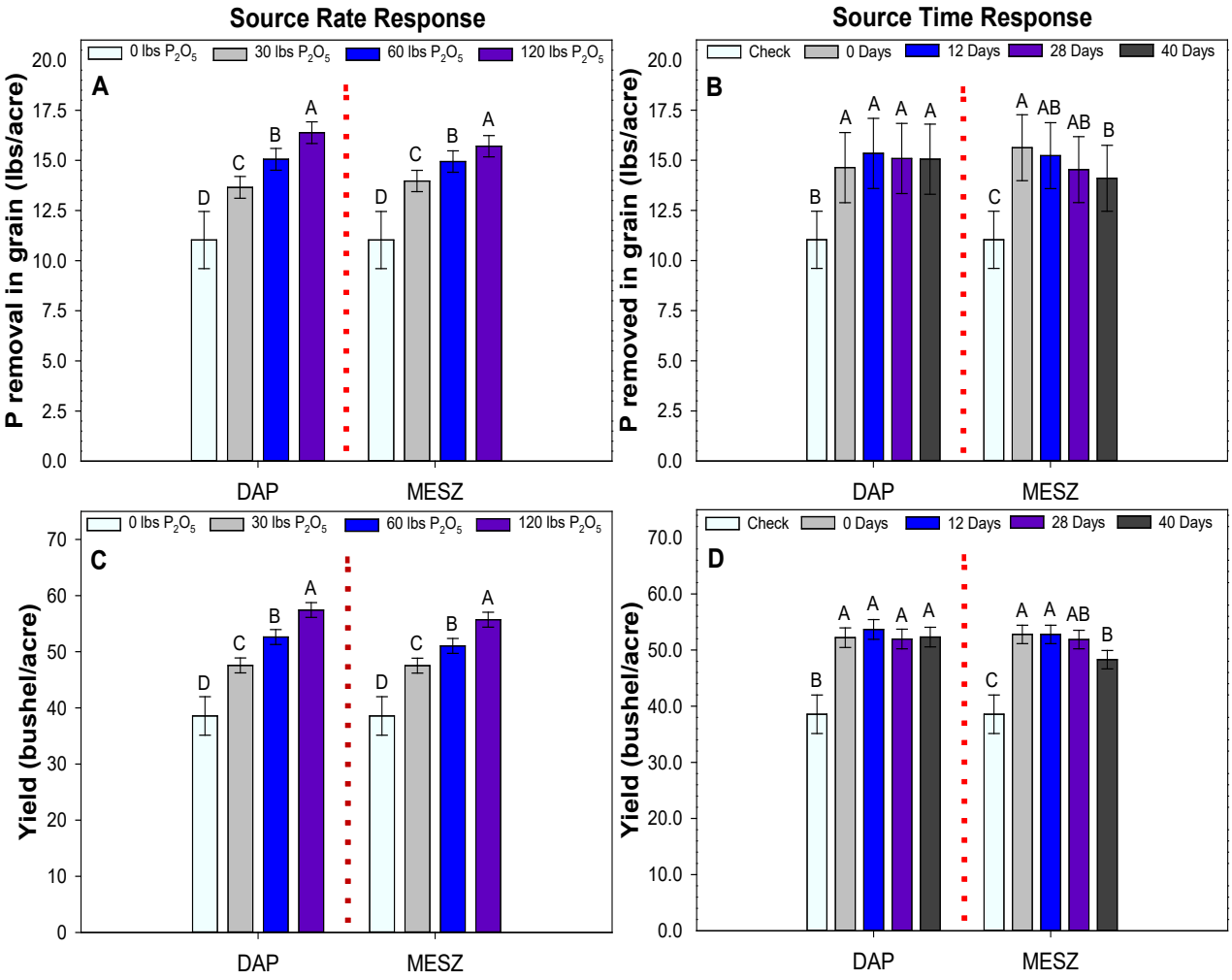

Figure 2. Phosphorus (P) removed in grain lb/a at grain harvest with comparison made between fertilizer source rates mixed with seed (A) and comparison made between fertilizer mixing duration with seed (B). Grain yield in bu/a with comparison made between fertilizer source rates mixed with seed (C), and comparison made between fertilizers mixing duration with seed (D). DAP = diammonium phosphate. MESZ = Micro essentials fertilizer.