Soil Amendment Evaluation on Hard Red Spring Wheat, 2012

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Abstract

This research project was established to evaluate combinations of sources for plant nutrients, organic matter and minor element minerals on hard red spring wheat grown in a commercial field near Madras, Oregon. Treatments included a commercial fertilizer blend, urea, dairy manure, beet lime and basalt rock dust. Average yield across treatments was 135.1 bu/acre. All treatments produced statistically similar yields, but were significantly higher than the check.

Introduction

Central Oregon soils are formed from volcanic ash and tend to be sandy, coarse, and low in organic matter. Currently, the standard inputs for crop production include commercial fertilizer for nutrition and agricultural beet lime for adjusting soil ph. Some alternate soil amendments were evaluated in this trial in response to local interest. The amendments were dairy manure, beet lime, and ground basalt powder. Dairy manure is a source of potassium, phosphorus, and sulfur but is low in available nitrogen. Beet lime is a by-product of the beet sugar purification process, with the calcium carbonate absorbing the impurities from the beet juice sludge. The impurities are not known to be harmful when used as a soil amendment, but they do lower the lime score of beet lime compared to agricultural lime. The rock dust used was a finely ground basalt powder from a local rock quarry.

The benefit of these alternate amendments and their interaction with commercial fertilizer in local soils is not well understood. The trial objective was to compare combinations of soil inputs and determine responses to yield and protein in hard red spring wheat.

Materials and Methods

A field trial was conducted in a commercial field of hard red spring wheat north of Madras. Plots located within a commercial wheat field were 12 ft by 30 ft, replicated four times in a randomized complete block design. Treatments included commercial fertilizer, urea, dairy manure, beet lime, and basalt rock dust. All treatments except the commercial fertilizer blend were applied on April 5, 2012 and tilled into the soil profile at 6 inches prior to planting. The commercial fertilizer blend was applied on April 20, 2012, to match the application timing that the grower used on the remainder of the field. The field was irrigated using wheel lines and additional units of nitrogen at 20 gal/acre of UAN 32 were applied via chemigation on May 14, May 28, and June 14.

One hundred flag leaves were sampled on June 11, 2012 and sent to AgriSource Laboratories for total nitrogen percent analysis (Table 1). Heights were taken prior to harvest. Harvested area was approximately 20 ft by 4.5 ft (exact lengths were taken for each plot). A Wintersteiger plot combine was used to harvest plots on August 21, 2012 and weighed. Samples were analyzed for

test weight and protein content by Horse Heaven Grain, Roosevelt, WA. Four soil samples were taken from each plot, combined and analyzed by AgSource Laboratories in Umatilla, OR.

Treatments included:

1. Commercial fertilizer (245-26-60-36 lb/acre)
2. Urea (245 lb/N) + manure (3 ton/acre)
3. Commercial fertilizer (245-26-60-36 lb/acre) + manure (2 ton/acre)
4. Commercial fertilizer (245-26-60-36 lb/acre) + manure (2 ton/acre) + beet lime (2 ton/acre)
5. Commercial fertilizer (245-26-60-36 lb/acre) + manure (1.4 ton/ac+ rock dust (0.6 ton/acre)
6. Commercial fertilizer (245-26-60-36 lb/acre) + rock dust (0.6 ton/acre)
7. Check

Results and Discussion

Soil samples taken prior to amendment application on April 5, 2012 are presented in Table 1. Petiole samples showed no significant difference between treatments when analyzed at flag leaf stage but were significantly higher than the unfertilized check (Table 2). Plant heights were statistically similar. With one exception, seed yields were similar across treatments but significantly different from the untreated (Table 3). Protein content was similar across treatments and significantly higher than the check. Test weights were similar across treated and untreated plots. Results from soil samples following harvest showed significantly higher levels of calcium and sulfur for the treatment that included the commercial blend, compost and lime (Table 4).

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Table 1. Soil test results taken on April 5, 2012 on field prior to treatment application.
[1]NO3 = nitrate, NH4 = ammonia, Ca = calcium, Fe = iron, Mg = magnesium, S = sulfur.

Soil depth	pH	NO_3[1]	NH_4	Ca	Fe	Mg	S
(in)		-----(lb/acre)-----		----------(ppm)----------			
0-6	6.0	32	17	8.0	61	3.7	8.6

Table 2. Total nitrogen analysis of petioles on June 11, 2012 and plant height for hard red spring wheat located north of Madras and harvested August 21, 2012.

Treatment	Total Nitrogen	Height
	(%)	(in)
Commercial fertilizer (245-26-60-36) + manure (2 ton/acre) + beet lime (2 ton/acre)	4.3 a	31.3 ab
Commercial fertilizer (245-26-60-36) + manure (2 ton/acre)	4.3 a	32.5 a
Commercial fertilizer (245-26-60-36) + manure (1.4 ton/ac+ rock dust (0.6 ton/acre)	4.4 a	32.5 a
Commercial fertilizer (245-26-60-36)	4.3 a	31.6 ab
Urea (245 lb/N) + manure (3 ton/acre)	4.2 a	31.6 ab
Check	3.7 b	28.3 b
LSD	*0.3*	*3.9*

Table 3. Yield, protein, and test weight from hard red spring wheat located north of Madras harvested August 21, 2012.

Treatment	Yield	Protein	Test Weight
	(bu/ac)	(%)	(lbs/bu)
Commercial fertilizer (245-26-60-36) + manure (2 ton/acre) + beet lime (2 ton/acre)	148.5 a	13.3 a	61.1
Commercial fertilizer (245-26-60-36) + manure (2 ton/acre)	145.7 a	13.6 a	62.0
Commercial fertilizer (245-26-60-36) + manure (1.4 ton/acre+ rock dust (0.6 ton/ac)	142.7 a	13.4 a	61.8
Commercial fertilizer (245-26-60-36)	142.4 a	13.6 a	62.4
Urea (245 lb/N) + manure (3 ton/acre)	137.3 a	13.2 a	62.3
Check	105.8 b	11.9 b	62.9
Average	135.1	13.2	62.1
LSD	*15.0*	*0.7*	*NS*

Table 4. Soil pH, calcium, iron, magnesium, and sulfur content in parts per million (ppm) for soil samples taken on August 22, 2012.

Treatment	pH	P	K	Ca	Fe	Mg	S
				(ppm)			
Commercial fertilizer (245-26-60-36)	6.1 cd	34 ab	217	7.7 b	74 a	3.4 b	8.1 b
Urea (245 lb/N) + manure (3 ton/acre)	6.1 cd	35 ab	213	8.2 b	73 ab	3.4 b	8.0 b
Commercial fertilizer (245-26-60-36) + manure (2 ton/acre)	6.2 bc	40 a	210	8.2 b	68 ab	3.5 b	7.9 b
Commercial fertilizer (245-26-60-36) + manure (2 ton/acre) + beet lime (2 ton/acre)	6.8 a	37 ab	202	11.1 a	63 b	3.5 a	18.0 a
Commercial fertilizer (245-26-60-36) + manure (1.4 ton/acre) + rock dust (0.6 ton/acre)	6.0 d	27 c	199	7.6 b	70 ab	3.5 b	7.9 b
Check	6.3 b	34 ab	197	8.1 b	63 b	3.7 a	7.8 b
LSD	*0.2*	*7.1*	*50*	*0.8*	*10.8*	*0.2*	*2.8*