

Wheat and Barley Response to Pre-plant Phosphorus at Safford Agricultural Center, 2001-02

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Abstract

This two year study is a follow-up to a study started in 1999, looking at phosphorus applications at planting on wheat and barley. Treatments applied were 0, 100, 200 and 400 pounds of 16-20-0 planted through the grain drill with the seed. Phosphorus applied at planting improved yields in most replicates, but because of the cost of the fertilizer, the higher yields were not always the most economically profitable.

Introduction

Pre-plant (or at planting) phosphorus is normally applied to winter crops in the high desert soils in southeastern Arizona. The University of Arizona has phosphorus fertilizer recommendations for small grains grown in Arizona based on the bicarbonate soluble P extractions from soils. These guidelines were tested recently in a study by Ottman, et.al. (1) in an effort to encourage growers to test their soils to see if the cost of the phosphorus was justified. This study was established to find the efficacy of pre-plant phosphorus applications in the Safford Valley, particularly at our location.

Materials and Methods

A phosphorus study on hard red wheat was planted in December of 2000 and a follow-up study on wheat and barley was planted on the Safford Agricultural Center in December of 2001. Seed was planted with an International 12 foot grain drill with a fertilizer attachment over four 3-foot beds. The crop history follows:

Crop History - 2001:

Elevation: 2954 feet above sea level

Soil type: Pima clay loam variant

Planting date: 21 December 2000

Seeding rate: 150 pounds per acre

Herbicide: None

Fertilizer: 16-20-0 at planting per treatment outlined, 200 lbs/ac urea was side-dressed on 3-1-01

Insecticides: None

Irrigation: Furrow, watered up plus 8 irrigations for a total of ca. 36 acre inches

Rainfall during the growing season: 3 inches

Plot size: 12 feet by 45 feet

Replicates: Four

Harvest dates: Wheat - 6-21-00 Heat units (40 to 81EF) from planting to maturity (6-6) = 3276

Crop History - 2002:

Elevation: 2954 feet above sea level
Soil type: Pima clay loam variant
Planting date: 19 December 2001 Seeding rate: 150 pounds per acre
Herbicide: 2,4-D on 4-8-02 to control broad-leafed weeds
Fertilizer: 16-20-0 at planting per treatment outlined, 200 lbs/ac urea was side-dressed on 2-5-02 and 4-9-02
Insecticides: None
Irrigation: Furrow, watered up plus 9 irrigations for a total of ca. 40 acre inches
Rainfall during the growing season: 3.14 inches
Plot size: 12 feet by 45 feet
Replicates: Four
Harvest dates: Barley - 13 June, Wheat - 15 July Heat units (40 to 81EF) from planting to maturity (6-6) = 3260

Plots were harvested with a Gleaner Combine with a 13 foot header. Individual plots were weighed using electronic weigh scales and samples were taken to determine moisture, bushel weight and percent protein.

Phosphorous treatments applied at planting:

Trt #	Treatment	P ₂ O ₅ Applied	Cost of Phosphorous Fertilizer
1	Untreated check	0 lbs/ac P ₂ O ₅	\$0.00/acre
2	100 lbs/ac 16-20-0 applied	20 lbs/ac P ₂ O ₅	\$12.75/acre
3	200 lbs/ac 16-20-0 applied	40 lbs/ac P ₂ O ₅	\$25.50/acre
4	400 lbs/ac 16-20-0 applied	80 lbs/ac P ₂ O ₅	\$51/acre

Results and Discussion

Tables 1 and 2 show the effects of the phosphorous treatments on Yecora Rojo variety of hard red wheat in this two-year study. Both years showed increases where phosphorus was applied compared to the untreated check. Bushel weight of the untreated check was a bit lower than the phosphorus treated plots in both years, but not different enough to cause concern. Differences in percent moisture of the grain and plant heights also didn't seem to be relevant. Percent grain protein was not measured in 2001, but the differences seen in 2002 might justify further research. Table 3 shows a summary of yields, crop values and average value after subtracting phosphorus fertilizer costs. This table indicates that the maximum economic yield is achieved by applying 100 pounds per acre of 16-20-0 (ammonium phosphate). This is the same result shown in the previous study (2).

A barley study was not planted in 2001. Information from the 2002 study is contained in Table 4. No significant differences were seen between the variables measured. The experimental variability in yields between replicates as indicated by the coefficient of variability (CV(%)) was higher than desirable in the study. Never-the-less, an economic analysis was performed and shown in Table 5. The result was an indication that 200 pounds per acre of 16-20-0 produced the highest economic yield. This varies from the results found in the previous study, which indicated the untreated check produced the highest economic yield.

The recommendation apparent from this research on salty soils in the Safford valley is that soil be tested for available phosphorus prior to planting, and that phosphorus be applied to the crop according to Ottman's recommendations. Then, that a test strip be placed in individual fields with 50 pounds per acre of P₂O₅ more and less than the recommendation, to fine tune the best rate for that particular field.

References

1. Ottman, M.J., S.H. Husman and B.R. Tickes. 1997. Barley and Durum response to phosphorus at Buckeye, Maricopa and Yuma, 1997. Forage and Grain, A College of Agriculture Report, The University of Arizona, Tucson, AZ. Series P-110, pp. 125-129.
2. Clark, L.J. and E.W. Carpenter. 2000. Wheat and barley response to pre-plant phosphorous at Safford Agricultural Center, 2000. Forage and Grain, A College of Agriculture Report, The University of Arizona, Tucson, AZ. Series P-124, pp. 91-95.

Table 1. Yield and other economic and agronomic variables in phosphorus study on wheat at the Safford Agricultural Center, 2001.

Treatment	Yield per acre @10%M	Bushel Weight	Percent Moisture	Percent Protein	Plant Height (inches)
Untreated check	2312.0 b ¹	62.3 b	7.0 ab	--	--
100 lbs/ac 16-20 @ planting	2555.9 a	63.0 a	7.3 a	--	--
200 lbs/ac 16-20 @ planting	2414.2 ab	62.8 ab	6.9 b	--	--
400 lbs/ac 16-20 @ planting	2635.3 a	62.6 ab	7.0 b	--	--
Average	2479.4	62.7	7.0	--	--
LSD(05)	224.2	0.68	0.27	--	--
CV (%)	8.7	1.0	3.7	--	--

1. Values within columns followed by the same letter are not significantly different at the 95% level of confidence using Duncan's Multiple Range Test.

Table 2. Yield and other economic and agronomic variables in phosphorus study on wheat at the Safford Agricultural Center, 2002.

Treatment	Yield per acre @10%M	Bushel Weight	Percent Moisture	Percent Protein	Plant Height (inches)
Untreated check	3297.5 a ¹	61.50 a	10.18 a	16.82	24.2 ab
100 lbs/ac 16-20 @ planting	3527.8 a	61.75 a	9.85 a	15.47	24.1 ab
200 lbs/ac 16-20 @ planting	3522.4 a	62.00 a	10.10 a	15.53	24.6 a
400 lbs/ac 16-20 @ planting	3526.1 a	61.75 a	9.95 a	15.28	23.6 b
Average	3468.5	61.75	10.02	15.8	24.16
LSD(05)	291.99	0.75	0.58	--	0.93
CV (%)	5.26	0.76	3.63	--	2.40

1. Values within columns followed by the same letter are not significantly different at the 95% level of confidence using Duncan's Multiple Range Test.

Table 3. Yield and economic summaries for phosphorous study on wheat at the Safford Agricultural Center, 2001 and 2002.

Treatment	2001 Yield per acre @10%M	2001 Crop Value (\$/ac ²)	2002 Yield per acre @10%M	2002 Crop Value (\$/ac ¹)	Average Value per acre (\$/ac)	Cost of Fertilizer per acre	Value less Fertilizer cost
Untreated check	2312.0	\$87.86	3297.5	\$158.28	\$246.14	\$0.00	\$246.14
100 lbs/ac 16-20	2555.9	\$97.12	3527.8	\$169.33	\$266.46	\$12.75	\$253.71
200 lbs/ac 16-20	2414.2	\$91.74	3522.4	\$169.08	\$260.81	\$25.50	\$235.31
400 lbs/ac 16-20	2635.3	\$100.14	3526.1	\$169.25	\$269.39	\$51	\$218.39

1. Increase over the check is the increased value of the crop calculated at 4.8 cents/lb less the phosphorous fertilizer costs (\$255/ton).

2. Increase over the check is the increased value of the crop calculated at 3.8 cents/lb less the phosphorous fertilizer costs (\$255/ton).

Table 4. Yield and other economic and agronomic variables in phosphorus study on barley at the Safford Agricultural Center, 2002

Treatment	Yield per acre @ 10% M	Bushel Weight	% Moisture	Plant Height
Untreated check	3497.1 a ¹	49.25 a	8.75 a	23.75 a
100 lbs/ac 16-20 @planting	3843.2 a	49.50 a	8.95 a	23.38 a
200 lbs/ac 16-20 @planting	4327.9 a	49.25 a	10.12 a	23.88 a
400 lbs/ac 16-20 @planting	3261.9 a	49.25 a	9.72 a	23.12 a
Average	3732.6	49.31	9.39	23.53
LSD(05)	1190.9	1.31	1.64	1.76
CV (%)	19.9	1.66	10.90	4.67

1. Values within columns followed by the same letter are not significantly different at the 95% level of confidence using Duncan's Multiple Range Test.

Table 5. Yield and economic summaries for phosphorous study on barley at the Safford Agricultural Center, 2002.

Treatment	2002 Yield per acre @ 10% M	2002 Crop Value (\$/ac ¹)	Cost of Fertilizer per acre	Value less Fertilizer cost
Untreated check	3497.1	\$167.86	\$0.00	\$167.86
100 lbs/ac 16-20 @ planting	3843.2	\$184.47	\$12.75	\$171.72
200 lbs/ac 16-20 @ planting	4327.9	\$207.74	\$25.50	\$182.24
400 lbs/ac 16-20 @ planting	3261.9	\$156.57	\$51	\$105.57

1. Increase over the check is the increased value of the crop calculated at 4.8 cents/lb, less the phosphorous fertilizer costs (\$255/ton).