Small Grain Variety Performance Tests at Hayden, Colorado 2005

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Summary

Each year small grain variety performance tests are conducted at Hayden, Colorado to identify varieties that are adapted for commercial production in northwest Colorado. Three small grain studies [winter wheat, spring wheat, and AGRO polyacrylamide (PAM)] were conducted at Hayden in 2005. Compared to other years, growing conditions during the 2005 cropping season were favorable for winter wheat production; however, growing conditions for spring wheat at Hayden were not favorable. Grain yield in the winter wheat variety performance test averaged 3430 lbs/acre (57.2 bu/acre). The highest yielding entry in the winter wheat test was CO00016 at 4117 lbs/acre (68.6 bu/acre) with six entries outyielding other varieties. Precipitation during July and August were low and yields in the spring wheat trial were also low, averaging 665 lbs/acre (11.1 bu/acre). Grain yields in the spring variety trial ranged from a high of 856 lbs/acre (14.2 bu/acre) for Lochsa to a low of 482 lbs/acre (8.0 bu/acre) for Snowcrest.

An AGRO by N rate study was conducted in winter wheat at Hayden during 2005 in a two-factor experiment. The two factors were: 1) PAM applied at rates of 0, 2, and 6 lbs/acre of AGRO and 2) nitrogen rates applied at 0, 10, 20, 30, and 40 lbs N/acre using ammonium nitrate. Nitrogen application had a significant negative effect on grain yield of winter wheat. The application of AGRO PAM did not increase grain yields. Based on data obtained from this study and other similar studies we have conducted over several years in the Hayden area, grain yields have not been consistently increased when polyacrylamide has been applied. We conclude that the application of polyacrylamide is not likely to be a profitable production practice for wheat growers in northwest Colorado.

Introduction

Small grain variety performance testing has been ongoing in northwest Colorado for many years (Pearson, et al., 2005; Pearson et al., 2004; Pearson, et al., 2003; Golus et al., 1997). Small grain variety performance tests are conducted in the Hayden, Colorado area to identify varieties that are adapted for commercial production in northwest Colorado.

Winter wheat and spring wheat variety performance tests were conducted at Hayden, CO in 2005. We also conducted an experiment to evaluate the application of AGRO PAM (also referred to as hydrogel) and nitrogen fertilizer application on grain yield of winter wheat grown under the dryland conditions of northwest Colorado.

Materials and Methods

Wheat Wheat Variety Performance Test

Nineteen winter wheat varieties and lines were evaluated during the 2005 growing season at the Mike Williams Farm near Hayden, Colorado. The experiment design was a randomized complete block with four replications. Plot size was 4-ft. wide by 40-ft. long with six seed rows per plot. The seeding rate was 56 lbs/acre and planting occurred on 8 Oct. 2004 (Fig. 1). No fertilizer or insecticides were applied to the winter wheat plots. Ally and 2,4-D herbicides were applied aerially for weed control. Harvest occurred on 18 Aug. 2005 using a Hege small plot combine (Fig. 2). Grain samples were cleaned in the laboratory using a small Clipper cleaner to remove plant tissue that remained in the grain sample following combining. Grain moistures and test weights were determined using a Seedburo GMA-128 seed analyzer. Grain yields were calculated at 12% moisture content. Protein concentration was determined by whole grain near infrared reflectance spectroscopy with a Foss NIRSystems 6500.

Spring Small Grain Variety Performance Tests

Nine spring wheat entries were evaluated during the 2005 growing season at the Mike Williams Farm near Hayden, Colorado. The location of the study area was at N 40° 28.65' W

107° 10.454' at an elevation of 6,508 feet. The experiment design was a randomized complete block with four replications. Plot size was 4-ft. wide by 40-ft. long with six seed rows per plot. Planting occurred on 18 Apr. 2005. Spring wheat was planted at 60 lbs seed/acre. No fertilizer, herbicides, or insecticides were applied to the spring wheat plots. Harvest occurred on 23 Aug 2005 using a Hege small plot combine. Grain samples were cleaned in the laboratory using a small Clipper cleaner to remove plant tissue that remained in the grain sample following combining. Grain moistures and test weights were determined using a Seedburo GMA-128 seed analyzer. Grain yields were calculated at 12% moisture content. Protein concentration was determined by whole grain near infrared reflectance spectroscopy with a Foss NIRSystems 6500.

AGRO PAM and Nitrogen Fertilizer Study

An AGRO PAM by N rate study was conducted on the Mike Williams Farm at Hayden, Colorado during 2005 in a two-factor experiment. The two factors were: 1) AGRO PAM applied at rates of 0, 2, and 6 lbs/acre of AGRO and 2) nitrogen fertilizer application rates at 0, 10, 20, 30, and 40 lbs N/acre applied using ammonium nitrate as the N source. A soil sample was obtained within the plot area prior to planting. Soil was sampled to a depth of 8 inches. Approximately 20 random soil cores were obtained across the plot area and bulked together. Once a subsample was air-dried it was sent to the Colorado State University Soil Testing Lab for analysis.

The winter wheat variety 'Hayden' was planted at 60 lbs of seed/acre. Treatments were applied by mixing the seed, AGRO, and nitrogen fertilizer in the same packet and the entire contents were applied through a cone planter during planting (Fig. 1). Agro (ALCOSORB AB3C) was provided by Ciba Specialty Chemicals Corp., Suffolk, VA. Planting occurred on 8 Oct 2004. Harvest occurred on 18 Aug 2005 with a Hege plot combine. Grain samples were cleaned in the laboratory using a small Clipper cleaner to remove plant tissue that remained in the grain sample following combining. Grain moistures and test weights were determined using a Seedburo GMA-128 seed analyzer. Grain yields were calculated at 12% moisture content.

Fig. 1. Planting winter wheat plots at Hayden, Colorado. Fred Judson is driving the tractor. A cone plant is attached to the tractor. 8 Oct. 2004. Photo by Calvin Pearson.

Results and Discussion

Summer 2005 in the Craig/Hayden area was more favorable for winter wheat production than in many years. The average maximum temperature for July 2005 at Hayden, Colorado was 88.4°F (Fig. 3). Precipitation at Hayden during the 2004-05 winter and spring growing season (September 2004 through August 2005, 12-month period) totaled 21.47 inches. The highest amount of precipitation occurred in June 2005 at 3.54 inches and the least amount of precipitation occurred in July 2005 at only 0.28 inches (Fig. 4).

Precipitation in the Craig/Hayden area varies considerably from month to month and year to year and is a critical factor affecting crop production. The monthly precipitation in 2005 illustrates the variability that occurs in the area (Fig. 4). If timely precipitation occurs, grain yields of small grains can be increased significantly. If precipitation does not occur in a timely fashion, grain yields of wheat can be low. Because precipitation is so variable during the growing season in the Craig/Hayden area wheat yields often vary considerably from year to year.

Winter Wheat Variety Performance Test

Grain moisture in the winter wheat variety performance test at Hayden averaged 11.3% (Table 1). Grain moisture content ranged from a high of 12.3% for Gary to a low of 10.6% for IDO575.

Grain yields of the winter wheat varieties averaged 3430 lbs/acre (57.2 bu/acre). Grain yields ranged from a high of 4117 lbs/acre (68.6

bu/acre) for CO00016 to a low of 2613 lbs/acre (43.6 bu/acre) for Hayden. CO00016, Hatcher, and CO00739 outyielded other entries.

Test weights averaged 56.2 lbs/bu. Test weights ranged from a high of 58.7 lbs/bu for IDO573 to a low of 50.7 lbs/bu for Gary.

There was no lodging in the winter wheat variety performance test in 2005 (Fig. 2).

Plant height averaged 34.0 inches. Plant height ranged from a high of 45.0 in. for IDO575 to a low of 29.4 in. for CO00016.

Protein concentration averaged 13.17% and ranged from a high of 15.17% for Hayden to a low of 11.86% for CO00796.

Spring Wheat Variety Performance Test

Grain moisture in the spring wheat variety performance test averaged 9.8% (Table 2). Grain yields averaged 665 lbs/acre (11.1 bu/acre). There were no significant differences among spring wheat varieties for grain moisture or grain yield.

Test weight averaged 60.0 lbs/bu. Test weight ranged from a high of 61.2 lbs/bu for Lolo to a low of 58.9 lbs/bu for Lochsa.

Plant height averaged 18.3 inches. Plant height ranged from a high of 20.9 in. for Forge to a low of 15.8 in. for Snowcrest.

There was no lodging in the spring wheat variety performance test in 2005.

Protein concentration averaged 11.61% and ranged from a high of 12.71% for Forge to a low of 9.95% for IDO593.

AGRO PAM and Nitrogen Fertilizer Study

A soil test performed by the CSU Soil Testing Laboratory showed the soil in the plot area, sampled at planting, had a pH of 7.3, a salinity of 0.5 mmhos/cm, 2.2% organic matter, 8.0 ppm NO_3-N, 5.6 ppm P, 443 ppm K, 0.7 ppm Zn, 11.2 ppm Fe, 12.1 ppm Mn, and 2.7 ppm Cu. The recommended fertilizer applicator from the CSU Soil Testing Lab was to apply 25 lbs/acre of nitrogen and 20 lbs/acre of P_2O_5 for a yield goal of 50 bu/acre.

The application of nitrogen and AGRO did not significantly affect (P=0.05) grain moisture or test weight. Grain moisture averaged across all varieties was 11.2%. Test weight averaged across all varieties was 55.8 lbs/bu.

The application of nitrogen in winter wheat at Hayden, Colorado in 2005 had a significant negative effect on grain yield (Fig. 5). As nitrogen rate increased from 0 lbs N/acre up to 60 lbs N/acre grain yield decreased by 233.3 lbs/acre (3.9 bu/acre). With each pound of nitrogen fertilizer applied grain yields decreased by 0.08 bu/acre. According to the soil test results, the soil was low in nitrate-nitrogen, yet winter wheat did not respond positively to the application of commercial fertilizer.

The application of AGRO PAM did not affect grain yield significantly (P=0.05; Fig. 6) and grain yields at the 2 and 6 lbs AGRO/acre remained flat compared to the check treatment of 0 lbs AGRO/acre.

Based on 2003 (Pearson et al., 2004) and 2004 findings (Pearson et al., 2005) with spring wheat and the findings with winter wheat in 2005, the application of AGRO PAM in dryland wheat in northwest Colorado does not appear to be a worthwhile production input.

Fig. 2. Winter wheat plots at Hayden, Colorado just prior to harvest, 18 Aug. 2005. Fred Judson is standing in the field. Photo by Calvin Pearson.

Acknowledgments

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References

Golus, H.M., C.H. Pearson, R.W. Hammon, J.S. Quick, and J.F. Shanahan. 1997. Wheat and barley variety performance tests, 1987-96, in northwest Colorado. Colorado State University, Agricultural Experiment Station and Dept. of Soil and Crop Sciences. Fort Collins, Colorado.

Pearson, C.H., S. Haley, J.J. Johnson, and C. Johnson. 2005. Small grain variety performance tests at Hayden, Colorado 2004. Available at www.colostate.edu/programs/wcrc/infopages/haydensmallgrain2004.pdf (accessed 29 Jan. 2006). Agricultural Experiment Station. Fort Collins, CO.

Pearson, C.H., S. Haley, J.J. Johnson, and C.L. Johnson. 2004. Small grain variety performance tests at Hayden, Colorado 2004. p. 23-28. *In* H.J. Larsen (ed.) Western Colorado Research Center 2003 research report. Technical Report TR04-05. Agricultural Exp. Stn. and Cooperative Ext., Colorado State Univ. Fort Collins, CO.

Pearson, Calvin H., Scott Haley, Jerry J. Johnson, and Cynthia Johnson. 2003. Small Grain Variety Performance Tests at Hayden, Colorado 2002. p. 51-55. *In*: Western Colorado Research Center 2002 Research Report. Colorado State University, Agricultural Experiment Station and Cooperative Extension, Technical Report TR03-7. Fort Collins, Colorado.

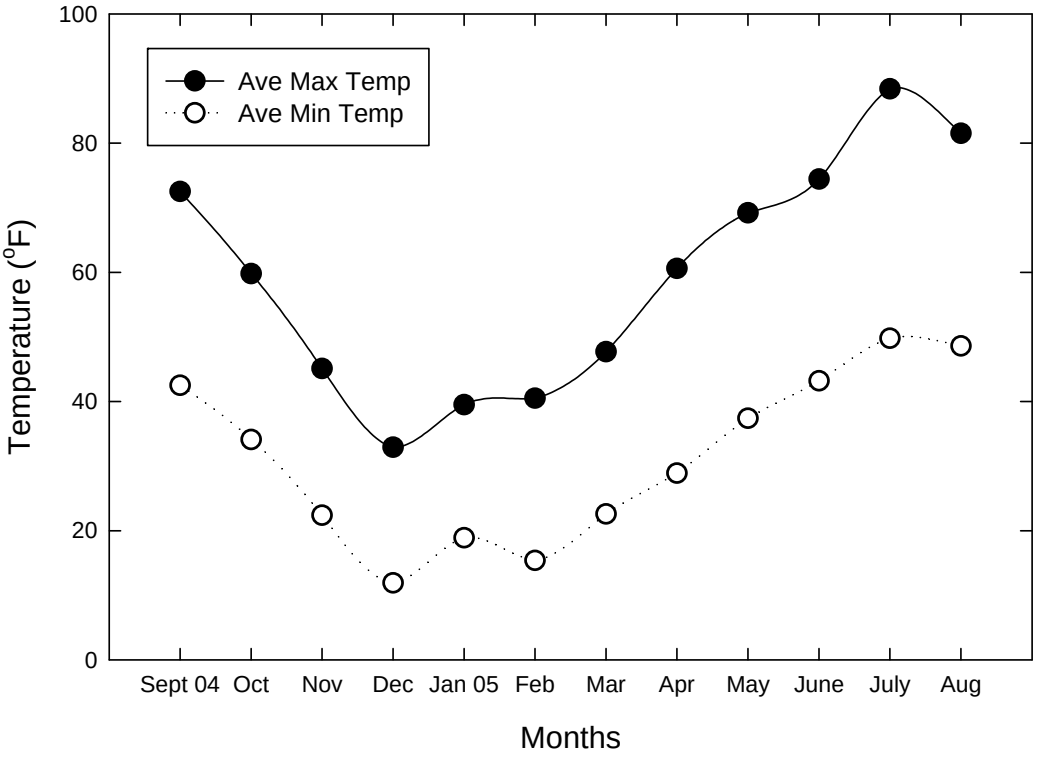

Fig. 3. Average maximum monthly and average minimum monthly temperatures for Sept 2004 through October 2005 at Hayden, Colorado.

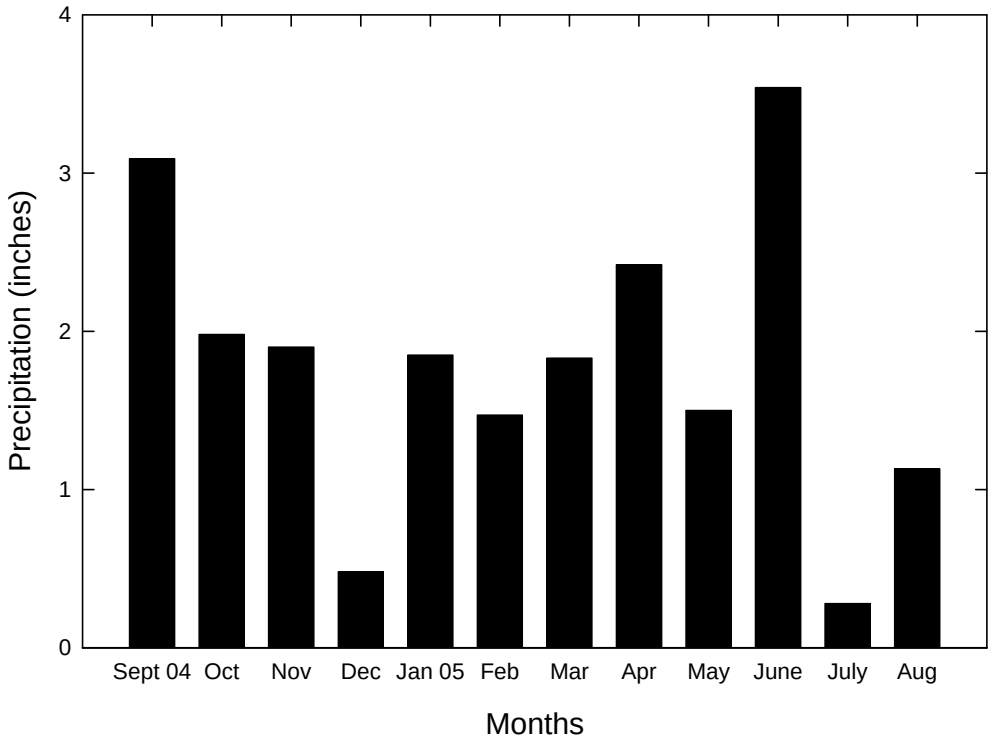

Fig. 4. Monthly precipitation for Sept. 2004 through October 2005 at Hayden, Colorado.

Table 1. Winter wheat variety performance at Hayden, Colorado in 2005. Farmer-Cooperator: Mike Williams.

Variety	Market class[1]	Grain moisture	Grain yield		Test weight	Plant height	Protein
		(%)	lbs/acre	bu/acre	lbs/bu	in.	(%)
CO00016	HRW	11.2	4117	68.6	56.7	29.4	13.96
Hatcher	HRW	11.1	3997	66.6	56.6	31.2	12.34
CO00739	HRW	11.5	3983	66.4	56.7	32.2	12.21
Lakin	HWW	12.0	3793	63.2	57.1	31.4	12.29
CO00554	HRW	11.2	3682	61.4	57.2	31.6	12.50
IDO573	HWW	11.0	3643	60.8	58.7	40.2	14.62
Above	HRW	10.8	3640	60.7	58.2	31.2	12.32
CO00796	HRW	11.5	3503	58.4	56.8	34.6	11.86
Ankor	HRW	11.9	3434	57.2	56.0	32.0	13.68
Deloris	HWW	11.3	3383	56.4	56.4	38.9	13.47
NuFrontier	HWW	11.4	3366	56.1	56.9	31.4	12.35
IDO575	HWW	10.6	3367	56.1	57.2	45.0	14.24
IDO604	HWW	11.2	3323	55.4	57.4	35.9	14.60
IDO571	HWW	11.5	3245	54.1	53.2	32.8	13.90
Avalanche	HWW	10.9	3215	53.6	58.5	30.1	12.15
Fairview	HRW	11.5	2967	49.5	53.6	33.3	12.97
Golden Spike	HWW	11.3	2958	49.3	54.3	33.5	12.30
Gary	HWW	12.3	2947	49.1	50.7	32.3	13.31
Hayden	HRW	11.0	2613	43.6	56.2	39.7	15.17
Ave.		11.3	3430	57.2	56.2	34.0	13.17
LSD (0.05)		0.4	275	4.6	1.4	1.4	
CV (%)		2.8	5.7	5.7	1.8	2.9	

[1] HRW = hard red winter wheat; HWW = hard white winter wheat.

Table 2. Spring wheat variety performance test at Hayden, Colorado 2005. Farmer-Cooperator: Mike Williams.

Variety	Market class[1]	Grain moisture	Grain yield		Test weight	Plant height	Protein
		(%)	lbs/acre	bu/acre	lbs/bu	inches	%
Lolo	HW	9.9	698	11.6	61.2	18.8	10.90
IDO377S	HW	10.4	814	13.6	59.6	20.2	11.66
Lochsa	HW	9.8	856	14.2	58.9	19.7	11.81
Snowcrest	HW	9.6	482	8.0	59.2	15.8	11.66
Jerome	HR	9.5	582	9.7	60.6	17.8	11.85
IDO593	HR	10.1	550	9.2	60.2	16.4	9.95
IDO578	HR	9.8	840	14.0	60.2	17.8	11.88
Forge	HR	9.4	636	10.6	60.9	20.9	12.71
Oxen	HR	9.8	531	8.8	59.7	17.6	12.10
Ave.		9.8	665	11.1	60.0	18.3	11.61
LSD (0.05)		NS	NS	NS	1.5	2.9	
CV(%)		4.4	31.5	31.5	1.7	11.0	

[1] HR = hard red wheat; HW = hard white wheat.

GPS Plot location – N40° 28.651', W107° 10.454'. Elevation – 6,508 feet.

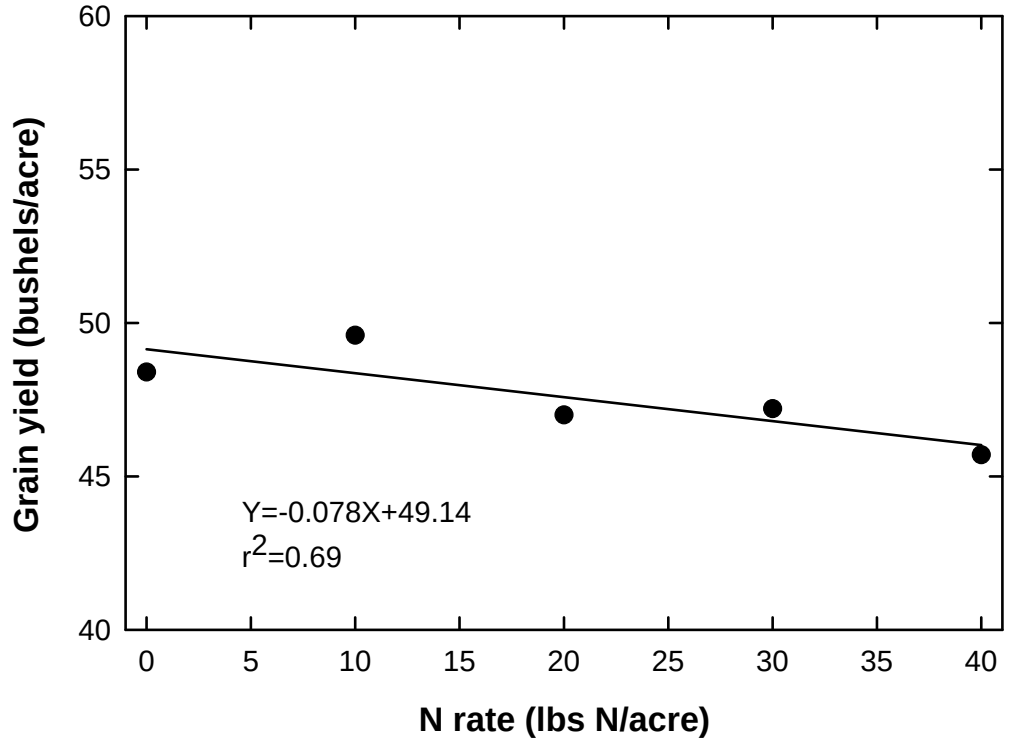

Fig. 5. The effect of nitrogen application on grain yield of winter wheat at Hayden, Colorado during 2005.

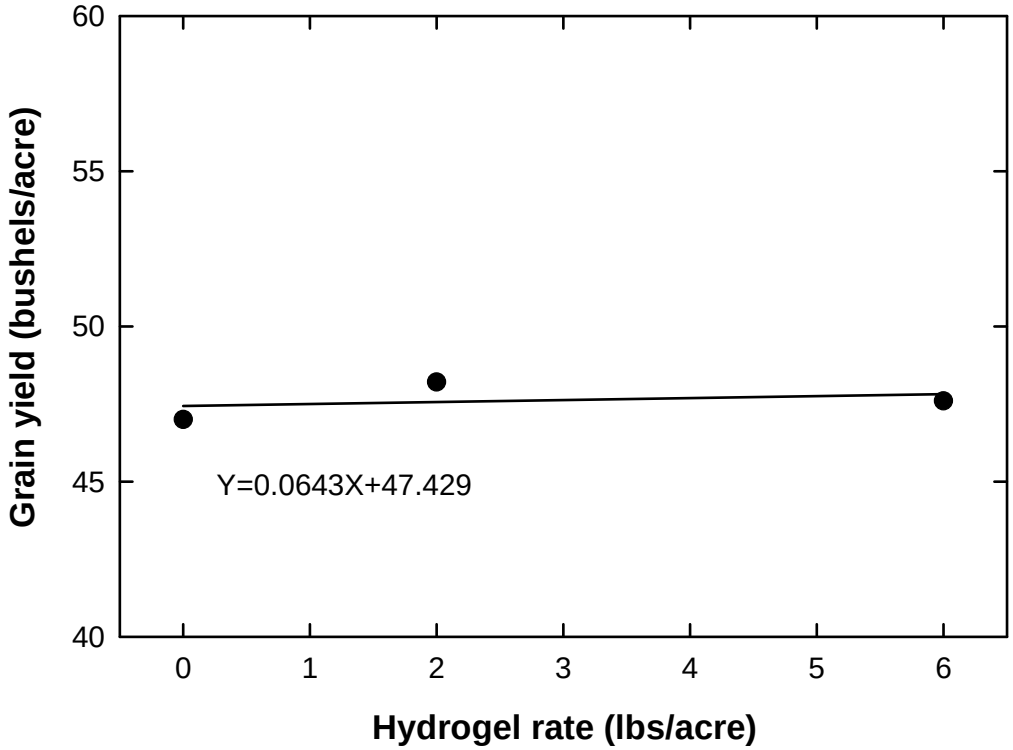

Fig. 6. The effect of applying AGRO PAM on grain yield of winter wheat at Hayden, Colorado during 2005.