Small Grain Variety Performance Tests at Hayden, Colorado 2004

Calvin H. Pearson[1], Scott Haley, Jerry J. Johnson, Cynthia Johnson[2]

Summary

Each year small grain variety performance tests are conducted in the Hayden, Colorado area to identify varieties that are adapted for commercial production in northwest Colorado. Three small grain experiments [winter wheat, spring wheat, and AGRO polyacrylamide (PAM)] were conducted at Hayden in 2004. Growing conditions during the 2004 growing season were more favorable for wheat production than in the past few years. The 2004 results provide information about the performance of wheat varieties under moderate, dryland stress conditions. Grain yield in the winter wheat variety performance test averaged 1902 lbs/acre (31.7 bu/acre). The highest yielding entry in the winter wheat test was Golden Spike at 2456 lbs/acre (41.0 bu/acre) with six entries outyielding other varieties. Grain yield in the spring wheat variety performance test averaged 1737 lbs/acre (28.9 bu/acre). Grain yield ranged from a high of 2391 lbs/acre (39.8 bu/acre) for Lolo to a low of 1227 lbs/acre (20.5 bu/acre) for SD 2746.

An AGRO by N rate study was conducted on spring wheat at Hayden during 2004 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 as the N source. Nitrogen application did not affect grain yield significantly, although there was a slight increase in grain yield as nitrogen application rate increased. The application of AGRO PAM did not affect grain yield significantly. As hydrogel rate increased from 0 to 6 lbs/acre grain yield actually decreased slightly from 12.2 bu/acre to 11.3 bu/acre. Based on data obtained from this study and other similar studies over several years in the Hayden area, grain yields have not been consistently increased when applying polyacrylamide and does not appear to be a profitable production practice for growers in northwest Colorado.

Introduction

Growers in northwest Colorado are limited to only a few crops to grow because of constraints created by dryland production conditions, a short growing season, limited precipitation, and isolation to markets for their crops. The principal cash crop grown in northwest Colorado is wheat. Alternative crops are of interest to growers in northwest Colorado. Alternative small grains, such as malting barley, triticale, and specialty wheats (i.e., hard white wheats) are of interest to growers because these crops are often sold into specialty markets which command a premium selling price.

New crop production inputs and practices are also of interest to growers in northwest Colorado if these inputs and practices are determined to be profitable and environmentally sound. Growers in this region of Colorado are supportive of agronomic research that provides them with science-based information. They can use this information to assist them in making crop production decisions.

During 2004, we conducted winter and spring small grain variety tests that included not only traditional small grains but also some of these specialty wheats. Small grain variety performance testing has been ongoing in northwest Colorado for many years (Golus et al., 1997). We also

[1] Contact information: Colorado State University Agricultural Experiment Station, Western Colorado Research Center – Fruita, 1910 L Road, Fruita, CO 81521. Ph. 970-858-3629; Fax 970-858-0461; email: calvin.pearson@colostate.edu

[2] Respectively: Professor/Research Agronomist, Western Colorado Research Center at Fruita; Associate Professor/Wheat Breeder, Fort Collins; Research Scientist/Extension Crop Specialist, Fort Collins; Research Associate, Crops Testing Program, Fort Collins.

conducted an experiment to evaluate the application of AGRO PAM (also referred to as hydrogel) and nitrogen fertilizer application on grain yield of spring wheat grown under the dryland conditions of northwest Colorado.

Materials and Methods

Wheat Wheat Variety Performance Test

Twenty-four winter wheat varieties and lines were evaluated during the 2004 growing season at the Duane and Darrell Hockett 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 26 Sept. 2003. Harvest occurred on 17 Aug. 2004 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 following combining. Grain moisture and test weight were determined with a Seedburo GMA-128 seed analyzer. Grain yields were calculated at 12% moisture content.

The disease, dwarf bunt, was readily apparent during grain harvest. To evaluate differences among varieties for dwarf bunt, harvested grain samples were rated for the relative amount of spores present in the sample. The rating scale was: 1 = no bunt, 2 = moderate bunt, and 3 = severe bunt. Protein concentration was determined by whole grain near infrared reflectance spectroscopy with a Foss NIRSystems 6500.

Spring Small Grain Variety Performance Tests

Ten spring wheat entries were evaluated during the 2004 growing season at the Dutch and 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. Planting occurred on 5 May 2004. Spring wheat was planted at 60 lbs seed/acre. No fertilizer, herbicides, or insecticides were applied to the spring wheat plots. Harvest occurred on 1 Sept. 2004 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 following combining. Grain moisture and test weight were determined with 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 Dutch and Mike Williams Farm at Hayden, Colorado during 2004 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 spring wheat variety 'Dirkwin' 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. Planting occurred on 5 May 2004. Harvest occurred on 1 Sept. 2004 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 following combining. Grain moisture and test weight were determined with a Seedburo GMA-128 seed analyzer. Grain yields were calculated at 12% moisture content.

Results and Discussion

The summer of 2004 in the Craig/Hayden area was more favorable for small grain production than in many other years. The average maximum temperature in July 2004 at Hayden, Colorado was 85.2° F (Fig. 1). Precipitation at Hayden during the 2004 growing season for the months of January through October totaled 14.62 inches. The highest amount of precipitation occurred during

September at 3.09 inches and the least amount of precipitation was received during March at only 0.54 inches (Fig. 2).

Precipitation in the Craig/Hayden area varies considerably from month to month and year to year and is a highly limiting factor for crop production. The monthly precipitation in 2004 illusrates the variability that often occurs in the area (Fig. 2). If timely precipitation occurs, grain yields of small grains can be increased significantly. If precipitation does not occur in a timely fashion then grain yields of wheat will be low. Because precipitation is so variable during the growing season in the Craig/Hayden area wheat yields variable considerably from year to year.

Winter Wheat Variety Performance Test

Grain moisture in the winter wheat variety performance test at Hayden averaged 8.6% (Table 1). Grain moisture content ranged from a high of 9.0% for CO00345, CO00347, CO00796, and Hatcher to a low of 8.0% for Arrowsmith and CO99W192.

Grain yields of the winter wheat varieties averaged 1902 lbs/acre (31.7 bu/acre). Grain yields ranged from a high of 2456 lbs/acre (41.0 bu/acre) for Golden Spike to a low of 1148 lbs/acre (19.2 bu/acre) for NuHills. Seven varieties outyielded other entries.

Test weights averaged 60.8 lbs/bu. Test weights ranged from a high of 62.4 lbs/bu for Hayden to a low of 59.8 lbs/bu for CO00347, CO00796, Hatcher, and CO99W192.

There was no lodging in the winter wheat variety performance test in 2004.

Six varieties (Golden Spike, Gary, Deloris, Hayden, IDO571, and Fairview) had no dwarf bunt in the harvested grain samples, indicating the incidence of bunt in these varieties was low (Table 1). The entry with the highest bunt rating at 3.0 was CO00796. Three entries (NuHorizon, CO99W192, and NuHills) had bunt ratings of 2.8.

Protein concentration averaged 8.08%. Overall, protein concentrations in this year's trial were considerably lower compared to those obtained in many other years. Protein concentration ranged from a high of 9.53% for NuHills to a low of 7.09% for Golden Spike.

Spring Wheat Variety Performance Test

Grain moisture in the spring wheat variety performance test averaged 10.3% (Table 2). Grain yields averaged 1737 lbs/acre (28.9 bu/acre). Grain yields ranged from a high of 2391 lbs/acre (39.8.0 bu/acre) for Lolo to a low of 1227 lbs/acre (20.5 bu/acre) for SD2746. Three varieties (Lolo, SD3827, and Jerome) were high yielding compared to other varieties.

Test weight averaged 61.8 lbs/bu. Test weight ranged from a high of 63.2 lbs/bu for SD3827 to a low of 60.0 lbs/bu for Walworth.

Plant height averaged 21.5 inches. Plant height ranged from a high of 23.2 in. for SD3827 to a low of 19.1 in. for Oxen.

There was no lodging in the spring wheat variety performance test in 2004. Protein concentration averaged 14.00% and ranged from a high of 15.11% for Briggs to a low of 11.92 for SD3827.

AGRO PAM and Nitrogen Fertilizer Study

A soil test performed by the CSU Soil Testing Laboratory showed the soil in the plot area, sampled on May 5, 2004, had a pH of 7.0, a salinity of 0.3 mmhos/cm, 2.2% organic matter, 2.0 ppm NO_3-N, 15.2 ppm P, 252 ppm K, 3.1 ppm Zn, 26.9 ppm Fe, 4.1 ppm Mn, and 5.0 ppm Cu.

The application of nitrogen and AGRO did not significantly affect ($P = 0.05$) grain moisture. Grain moisture averaged across all varieties was 10.2%. Test weight was significantly affected by nitrogen fertilization.

The application of nitrogen in spring wheat at Hayden, Colorado in 2004 did not increase grain yields significantly (Fig. 3). There was a trend to increase grain yields slightly as N rates increased. Grain yield was increased only by 0.04 bu/acre with each additional pound of applied N. The soil in the plot area was low in nitrate-nitrogen, and had a moderate organic matter content compared to many other soils in the area, but grain yields of spring wheat in these soils did not respond significantly to the application of nitrogen fertilizer.

The application of AGRO PAM did not affect

grain yield significantly ($p = 0.05$; Fig. 4). In fact, there was a trend for grain yield to decrease slightly as hydrogel rate increased. Grain yield decreased by 0.17 bu/acre with each additional pound of applied AGRO PAM.

Based on the 2003 (Pearson et al., 2004) and these 2004 findings with spring wheat at Hayden, Colorado, the application of AGRO PAM in dryland spring wheat in northwest Colorado does not appear to be a worthwhile production input. A similar study with AGRO and nitrogen fertilizer was initiated on winter wheat in fall 2004. Data for this study will be collected during the 2005 growing season.

Acknowledgments

Farmer-cooperators for the winter wheat variety were Duane and Darrell Hockett, and Dutch and Mike Williams for the spring wheat variety and AGRO tests. We thank these cooperators for their willingness to participate with us in conducting this research. We also thank C.J. Mucklow, CSU Cooperative Extension, for his support of our small grain research in northwest Colorado. Appreciation is also expressed to Lot Robinson, Fred Judson (Western Colorado Research Center staff), and Daniel Dawson (part-time hourly employee) who assisted with this research. Appreciation is also extended to the Colorado Wheat Administrative Committee for funding this research. Thanks to Ciba and Lloyd Garner for supplying the AGRO PAM.

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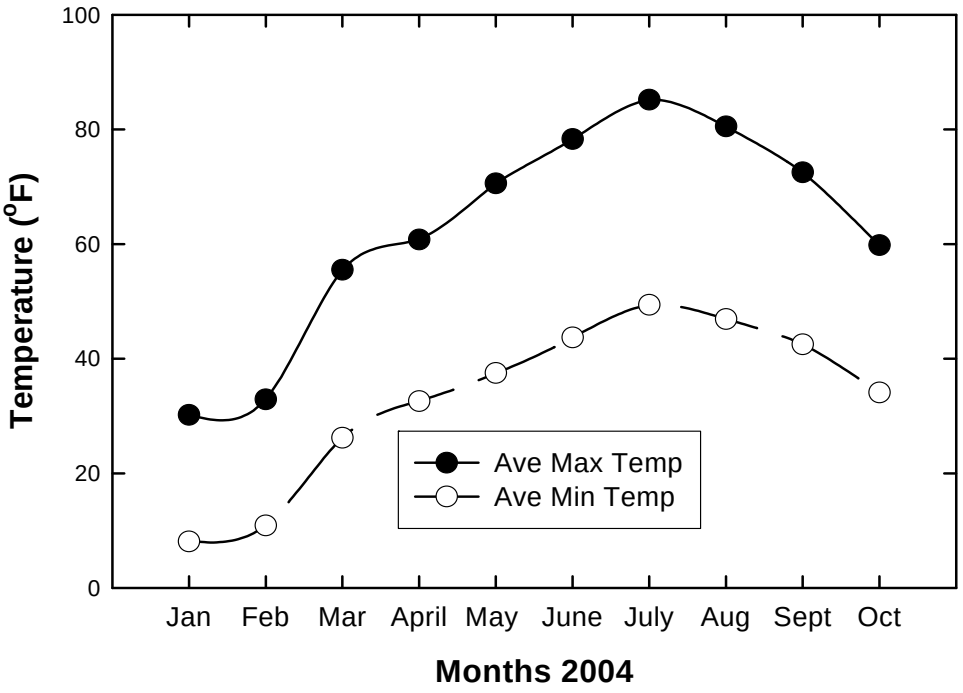

Fig. 1. Average maximum monthly and average minimum monthly temperatures for January through October 2004 at Hayden, Colorado.

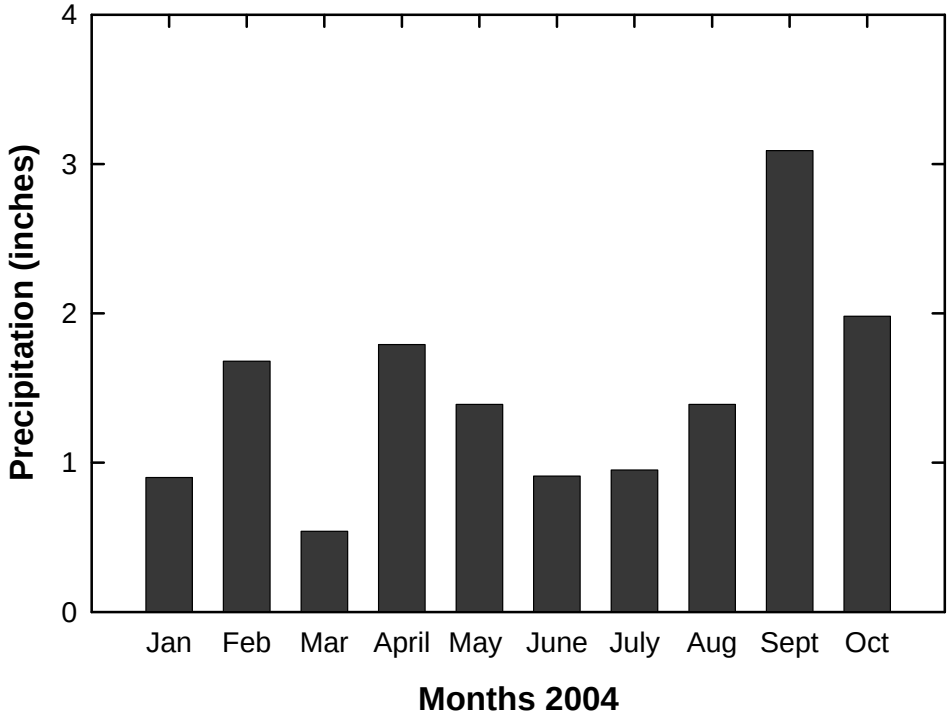

Fig. 2. Monthly precipitation for January through October 2004 at Hayden, Colorado.

Table 1. Winter wheat variety performance at Hayden, Colorado in 2004. Farmer-Cooperators: Duane and Darrell Hockett.

Variety	Market class[1]	Grain moisture	Grain yield		Test weight	Dwarf bunt incidence[2]	Protein
		(%)	lbs/acre	bu/acre	lbs/bu	1-3	%
Golden Spike	HWW	8.3	2456	41.0	60.3	1.0	7.09
Gary	HWW	8.6	2436	40.6	60.1	1.0	7.47
Deloris	HWW	8.8	2405	40.1	61.9	1.0	7.40
Hayden	HRW	8.7	2326	38.8	62.4	1.0	7.83
IDO571	HWW	8.9	2287	38.1	62.0	1.0	7.96
Ankor	HRW	8.7	2231	37.2	60.6	2.0	8.05
NuFrontier	HWW	8.4	2150	35.8	61.9	2.0	7.77
Fairview	HRW	8.8	2146	35.7	61.4	1.0	7.60
Lakin	HWW	8.4	2081	34.7	61.0	2.2	8.27
Hatcher (CO980607)	HRW	9.0	2027	33.8	59.8	2.2	8.37
Bond (CO00D007)	HRW	8.9	1909	31.8	59.9	2.2	7.94
CO00347	HRW	9.0	1878	31.3	59.8	2.2	7.72
CO00345	HRW	9.0	1870	31.2	59.9	2.5	7.74
Above	HRW	8.9	1864	31.0	60.8	1.5	8.15
CO00739	HRW	8.8	1846	30.8	60.5	2.5	7.56
Avalanche	HWW	8.3	1835	30.6	62.0	2.2	8.86
NuHorizon	HWW	8.4	1652	27.6	61.7	2.8	8.37
Antelope	HWW	8.5	1644	27.4	61.2	2.0	8.80
CO00796	HRW	9.0	1547	25.8	59.8	3.0	8.36
CO99W183	HWW	8.1	1545	25.8	60.6	2.2	8.65
Arrowsmith	HWW	8.0	1536	25.6	60.0	2.5	7.88
CO970547-7	HRW	8.7	1468	24.4	61.0	2.0	8.40
CO99W192	HWW	8.0	1358	22.6	59.8	2.8	8.27
NuHills	HWW	8.2	1148	19.2	60.9	2.8	9.53
Ave.		8.6	1902	31.7	60.8	2.0	8.08
LSD (0.05)		0.2	309	5.1	0.6		
CV (%)		1.8	11.5	11.5	0.73		

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

[2] Dwarf bunt incidence - 1= no bunt, 2 = moderate bunt, 3=severe bunt.

Table 2. Spring wheat variety performance test at Hayden, Colorado 2004. Farmer-Cooperators: Mike and Dutch Williams.

Barley variety	Market class[1]	Grain moisture	Grain yield		Test weight	Plant height	Protein
		(%)	lbs/acre	bu/acre	lbs/bu	inches	%
Lolo	HWS	10.5	2391	39.8	63.0	22.0	12.69
SD3827	HRS	10.3	1991	33.2	63.2	23.2	11.92
Jerome	HRS	10.2	1939	32.3	62.6	20.4	14.66
Forge	HRS	10.5	1781	29.7	62.7	21.2	14.33
Granger	HRS	10.3	1728	28.8	61.6	22.8	14.68
Walworth	HRS	10.5	1654	27.6	60.0	20.7	14.74
Briggs	HRS	10.0	1640	27.3	61.7	21.9	15.11
SD3623	HRS	10.1	1587	26.4	61.8	23.0	13.50
Oxen	HRS	10.3	1433	23.9	60.6	19.1	15.03
SD2746	HRS	10.5	1227	20.5	60.7	20.3	13.38
Ave.		10.3	1737	28.9	61.8	21.5	14.00
LSD (0.05)		NS	553.0	9.2	4.5	2.1	
CV(%)		4.7	22.0	22.0	1.0	6.9	

[1] HRS = hard red spring wheat; HWS = hard white spring wheat.

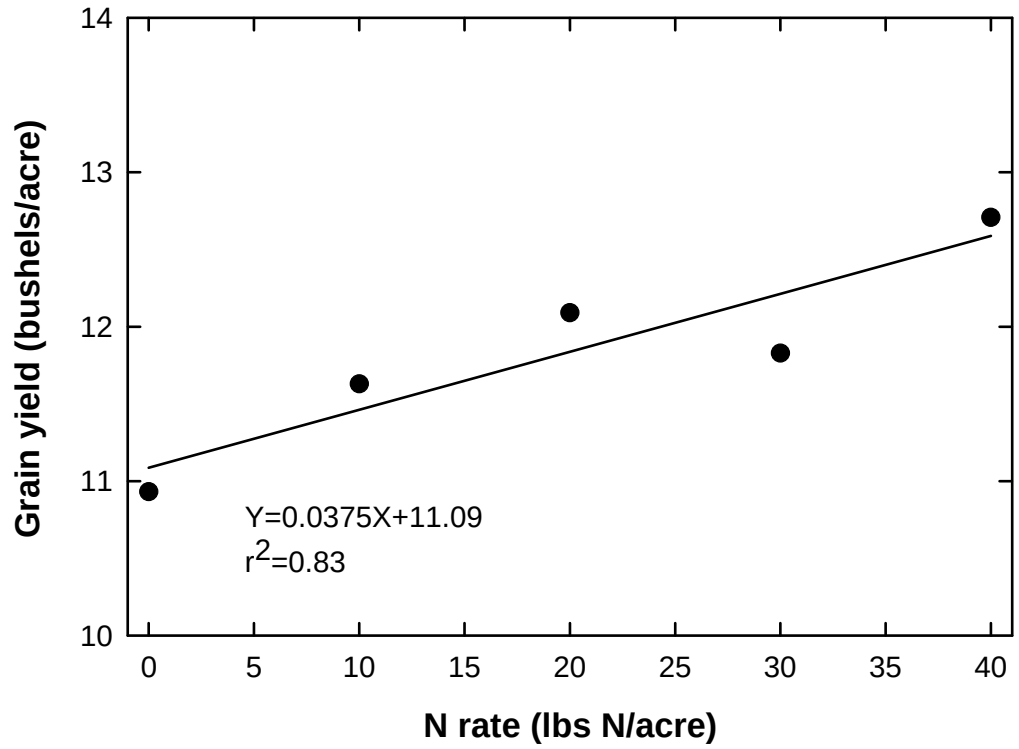

Fig. 3. The effect of nitrogen application on grain yield of spring wheat at Hayden, Colorado during 2004.

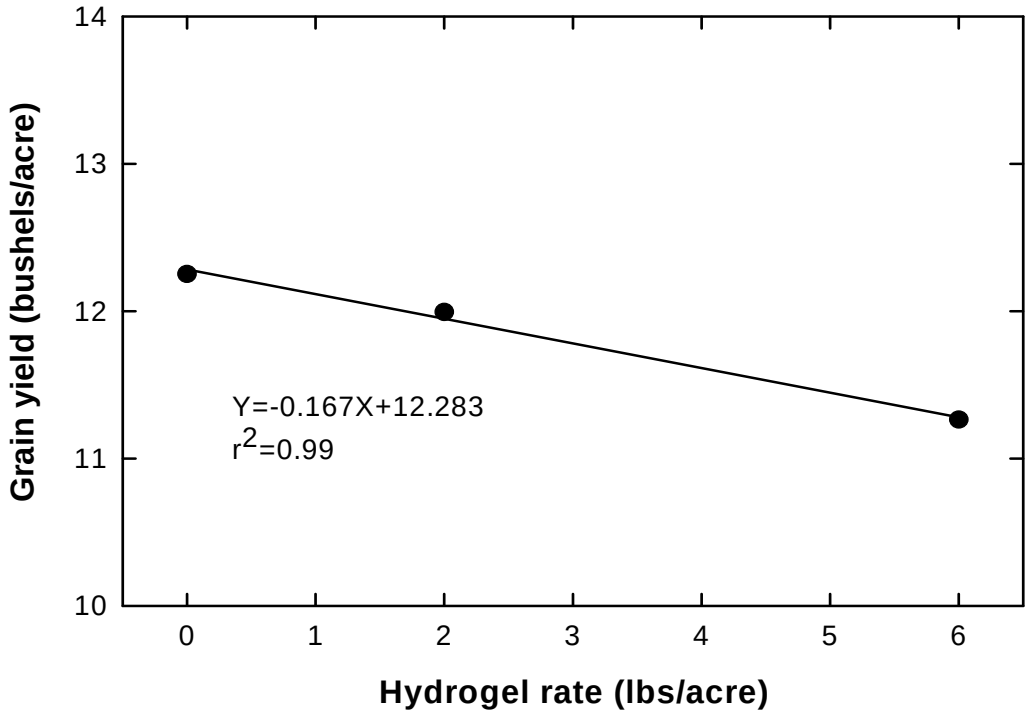

Fig. 4. The effect of applying AGRO PAM on grain yield of spring wheat at Hayden, Colorado during 2004.