

Wheat Stubble Height on Subsequent Corn and Grain Sorghum Crops

A. Schlegel

Summary

A field study initiated in 2006 was designed to evaluate the effects of three wheat stubble heights on subsequent grain yields of corn and grain sorghum. Corn yields in 2014 were similar to the long-term average, while sorghum yields were greater than the long-term average. Taller cut stubble in 2014 increased biomass production of corn and yield for grain sorghum. When averaged across 2007 through 2014, corn grain yields were 9 bu/a greater when planted into either tall or strip-cut stubble than into low-cut stubble. Average grain sorghum yields were not significantly affected by wheat stubble height. Water use efficiency was greater for taller cut stubble for both corn and grain sorghum. Harvesting wheat shorter than necessary causes a yield penalty for the subsequent row crops, especially dryland corn.

Introduction

Seeding of summer row crops throughout the west-central Great Plains often occurs following wheat in a 3-year rotation (wheat-summer crop-fallow). Wheat residue provides numerous benefits, including evaporation suppression, delayed weed growth, improved capture of winter snowfall, and soil erosion reductions. Stubble height affects wind velocity profile, surface radiation interception, and surface temperatures, all of which affect evaporation suppression and winter snow catch. Taller wheat stubble is also beneficial to pheasants in postharvest and overwinter fallow periods. Using stripper headers increases harvest capacity and provides taller wheat stubble than previously attainable with conventional small-grains platforms. Increasing wheat cutting heights or using a stripper header should further improve the effectiveness of standing wheat stubble. The purpose of this study is to evaluate the effect of wheat stubble height on subsequent summer row crop yields.

Procedures

This study was conducted at the Southwest Research-Extension Center dryland station near Tribune, Kansas. From 2007 through 2014, corn and grain sorghum were planted into standing wheat stubble of three heights. Optimal (high) cutter-bar height is the height necessary to maximize both grain harvested and standing stubble remaining (typically around two-thirds of total plant height), the short cut treatment was half of optimal cutter-bar height, and the third treatment was stubble remaining after stripper header harvest. In 2014, these heights were 6, 11, and 17 inches, which were less than

the average heights from 2007–2014. In 2014, corn and grain sorghum were seeded at rates of 15,000 seeds/a and 40,000 seeds/a, respectively. Nitrogen was applied to all plots at a rate of 80 lb/a. Starter fertilizer (10-34-0 N-P-K) was surface dribbled off-row at a rate of 7 gal/a. Plots were 40 × 60 ft, with treatments arranged in a randomized complete block design with six replications. Two rows from the center of each plot were harvested with a plot combine for yield and yield component analysis. Soil water measurements were obtained with neutron attenuation to a depth of 6 feet in 1-foot increments at seeding and harvest to determine water use and water use efficiency.

Results and Discussion

The 2014 growing season had below-normal precipitation from February through May, which negatively affected profile soil water and corn establishment. Corn plant populations were about 5,000 plants/acre less than the long-term average (Tables 1 and 2). However, slightly above-normal precipitation from June through September allowed corn yields to be similar to the long-term average. Stubble height did not affect grain yield or any other yield component, but the taller stubble produced more biomass and residue. On average, corn yields were 9 bu/a greater when planted into high- or strip-cut stubble. Biomass production and water use efficiency were also greater with the taller stubble.

Grain sorghum yields were about 60% greater than corn yields in 2014 and were greater in taller-cut stubble (Table 3). When averaged across years from 2007–2014, the highest yields were obtained in the high-cut stubble but were not significantly greater than the other stubble heights. None of the other measured parameters for grain sorghum was affected by stubble height except for greater water use efficiency in high-cut stubble.

Table 1. Corn yield and yield components as affected by stubble height, Tribune, Kansas, 2014.

Stubble height	Yield	Plant population	Ear population	Biomass	Residue	1,000-seed weight	Kernels	WUE ¹
	bu/a	----- 10 ³ /a -----		----- lb/a -----		oz.	no./ear	lb/in.
Low	66	7.4	7.7	5700	2500	10.8	1088	280
High	68	8.5	9.0	8700	5500	11.0	680	288
Strip	67	8.0	8.5	8600	5500	10.9	930	277
LSD _{0.05}	17	3.5	3.3	1900	1800	0.8	790	68
ANOVA (P > F)								
Stubble height	0.954	0.802	0.702	0.009	0.006	0.894	0.532	0.935

¹ Water use efficiency (lb of grain/in. of water use).**Table 2. Corn yield and yield components as affected by stubble height, Tribune, Kansas, 2007–2014.**

Stubble height	Yield	Plant population	Ear population	Biomass	Residue	1,000-seed weight	Kernels	WUE ¹
	bu/a	----- 10 ³ /a -----		----- lb/a -----		oz	no./head	lb/in.
Low	68	13.7	13.3	8510	5280	10.3	504	265
High	77	13.7	13.8	9830	6160	10.5	483	304
Strip	77	13.8	13.8	9780	6120	10.4	524	304
LSD _{0.05}	5	0.6	0.7	610	570	0.3	105	20
ANOVA (P > F)								
Year	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Stubble height	0.001	0.995	0.242	0.001	0.003	0.321	0.745	0.001
Year × stubble height	0.581	0.987	0.943	0.240	0.103	0.738	0.890	0.654

¹ Water use efficiency (lb of grain/in. of water use).

Table 3. Sorghum yield and yield components as affected by stubble height, Tribune, Kansas, 2014.

Stubble height	Yield bu/a	Head	Biomass	Residue	1,000-seed	Kernels No./head	WUE ¹ lb/in.
		population 10 ³ /a			weight oz		
Low	105	57	9400	4200	0.88	1890	434
High	113	58	10700	5200	0.89	1950	458
Strip	113	59	10200	4700	0.90	1920	462
LSD _{0.05}	5	3	1600	1500	0.03	94	30
ANOVA (P > F)							
Stubble height	0.010	0.519	0.223	0.391	0.345	0.346	0.125

¹ Water use efficiency (lb of grain/in. of water use).**Table 4. Sorghum yield and yield components as affected by stubble height, Tribune, Kansas, 2007–2014.**

Stubble height	Yield bu/a	Head	Biomass	Residue	1,000-seed	Kernels no./head	WUE ¹ lb/in.
		population 10 ³ /a			weight oz		
Low	89	50	10500	6100	0.86	1960	353
High	94	52	11000	6400	0.87	2010	381
Strip	91	51	10500	6100	0.85	1920	371
LSD _{0.05}	5	3	700	600	0.02	170	25
ANOVA (P > F)							
Year	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Stubble height	0.080	0.333	0.156	0.412	0.192	0.516	0.048
Year × stubble height	0.965	0.502	0.994	0.984	0.547	0.038	0.872

¹ Water use efficiency (lb of grain/in. of water use).