K-STATE Research and Extension

2018 SWREC Agricultural Research

Wheat Stubble Height on Subsequent Corn and Grain Sorghum Crops

A. Schlegel and L. Haag

Summary

A field study initiated in 2006 at the Southwest Research-Extension Center near Tribune, KS, was designed to evaluate the effects of three wheat stubble heights on subsequent grain yields of corn and grain sorghum. Corn and sorghum yields in 2017 were greater than the long-term average. When averaged from 2007 through 2017, corn grain yields were 9 bu/a greater when planted into either high or strip-cut stubble than into low-cut stubble. Average grain sorghum yields were 5 bu/a (but not significantly) greater in high-cut stubble than low-cut stubble. Similarly, water use efficiency was greater for high or strip-cut stubble for corn and high-cut stubble for grain sorghum than for low-cut stubble. 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.

Experimental Procedures

This study was conducted at the Southwest Research-Extension Center dryland station near Tribune, KS. From 2007 through 2017, 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. For 2017, these heights were 20, 10, and 30 in. (cut after 2016 wheat harvest). In 2017, corn and grain sorghum were seeded at rates of 15,000 seeds/a and 45,000 seeds/a, respectively. Nitrogen was applied to all plots at a rate of 80 lb/a. Starter fertil-

izer (10-34-0 nitrogen–phosphorus–potassium (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 ft in 1-ft increments at seeding and harvest to determine water use and water use efficiency.

Results and Discussion

The 2017 growing season was above normal for precipitation with more than 4 inches received in April, May, and July. This produced above average yields for both corn and sorghum (Tables 1–4). With the good growing conditions, stubble height had little effect on corn yield or other parameters. When averaged across 2007 to 2017, corn yields were 9 bu/a greater in high or strip-cut than low-cut wheat stubble (Table 2). Biomass production and water use efficiency were also greater with the taller stubble.

Grain sorghum yields in 2017 were not affected by stubble height (Table 3). When averaged across years from 2007 through 2017, the highest yields were obtained in the high-cut stubble but were not significantly greater than the other stubble heights (Table 4). None of the other measured parameters for grain sorghum were affected by wheat stubble height except for greater water use efficiency in high-cut vs. low-cut stubble.

Table 1. Corn yield, biomass, and yield components as affected by stubble height, Tribune, KS, 2017

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	129	14.0	17.6	16620	10505	13.31b	494	452
High	133	14.5	17.4	15751	9451	13.81ab	498	456
Strip	136	14.3	17.7	17526	11105	14.06a	490	456
$LSD_{0.05}$	8	0.9	0.9	2053	2050	0.54	33	33
ANOVA (P > F)								
Stubble height	0.242	0.411	0.644	0.207	0.239	0.033	0.094	0.957

[1] Water use efficiency (lb of grain/inch of water use).
LSD = least significant difference.
ANOVA = analysis of variance.

Table 2. Corn yield, biomass, and yield components as affected by stubble height, Tribune, KS, 2007–2017

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	81b	13.9	13.8	9830b	6001	10.81	518	300b
High	90a	14.0	14.2	10713a	6445	11.11	508	336a
Strip	90a	14.0	14.2	10873a	6591	11.04	539	336a
$LSD_{0.05}$	5	0.4	0.6	626	551	0.28	78	19
ANOVA (P > F)								
Year	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Stubble height	0.001	0.966	0.334	0.002	0.092	0.087	0.731	0.001
Year × stubble height	0.986	0.995	0.978	0.337	0.102	0.830	0.944	0.953

[1] Water use efficiency (lb of grain/inch of water use).
LSD = least significant difference.
ANOVA = analysis of variance.

Table 3. Sorghum yield and yield components as affected by stubble height, Tribune, KS, 2017

Stubble height	Yield	Head population	Biomass	Residue	1,000-seed weight	Kernels	WUE[1]
	bu/a	10^3/a	---------- lb/a ----------		oz	no./head	lb/in
Low	157	79.6	14325b	6613	0.98	1822	548
High	158	81.0	15040a	7321	0.97	1795	571
Strip	156	79.6	14439ab	6807	0.98	1784	559
$LSD_{0.05}$	9	6.2	636	874	0.04	64	46
ANOVA (P > F)							
Stubble height	0.888	0.836	0.066	0.225	0.765	0.496	0.557

[1] Water use efficiency (lb of grain/inch of water use).
LSD = least significant difference.
ANOVA = analysis of variance.

Table 4. Sorghum yield, biomass, and yield components as affected by stubble height, Tribune, KS, 2007–2017

Stubble height	Yield	Head population	Biomass[2]	Residue[2]	1,000-seed weight	Kernels	WUE[1]
	bu/a	10^3/a	---------- lb/a ----------		oz	no./head	lb/in.
Low	102	55.2	11015	6056	0.89	1911	395b
High	107	56.9	11615	6419	0.90	1971	423a
Strip	103	56.2	11197	6135	0.88	1895	408ab
$LSD_{0.05}$	5	2.3	540	485	0.02	110	19
ANOVA (P > F)							
Year	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Stubble height	0.063	0.355	0.082	0.300	0.145	0.358	0.020
Year × stubble height	0.996	0.902	0.998	0.993	0.679	0.020	0.954

[1] Water use efficiency (lb of grain/inch of water use).
[2] 2015 values not included in average - no samples collected.
LSD = least significant difference.
ANOVA = analysis of variance.