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Large-Scale Dryland Cropping Systems

Abstract

A large-scale dryland cropping systems research and demonstration project at the Southwest Research-Extension Center near Tribune, Kansas, evaluated two summer crops (corn and grain sorghum) along with winter wheat in crop rotations varying in length from 1 to 4 years. The rotations were continuous grain sorghum, wheat-fallow, wheat-corn-fallow, wheat-sorghum-fallow, wheat-corn-sorghum-fallow, and wheatsorghum- corn-fallow. The objective of the study is to identify cropping systems that enhance and stabilize production in rain-fed locations to optimize economic crop production. Averaged across the past 7 years, wheat yields ranged from 22 to 25 bu/a and were not affected by length of rotation. Corn and grain sorghum yields (7-year average) were about twice as great when following wheat than when following corn or grain sorghum. Grain sorghum yields were almost twice as great as those of corn in similar rotations.

Keywords

cropping systems, tillage systems, soil fertility, irrigation, fallow replacement, forage rotations, corn, wheat, sorghum, no-till

Cover Page Footnote

This research project received support from the Ogallala Aquifer Initiative.

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Summary

A large-scale dryland cropping systems research and demonstration project at the Southwest Research-Extension Center near Tribune, Kansas, evaluated two summer crops (corn and grain sorghum) along with winter wheat in crop rotations varying in length from 1 to 4 years. The rotations were continuous grain sorghum, wheat-fallow, wheat-corn-fallow, wheat-sorghum-fallow, wheat-corn-sorghum-fallow, and wheat-sorghum-corn-fallow. The objective of the study is to identify cropping systems that enhance and stabilize production in rain-fed locations to optimize economic crop production. Averaged across the past 7 years, wheat yields ranged from 22 to 25 bu/a and were not affected by length of rotation. Corn and grain sorghum yields (7-year average) were about twice as great when following wheat than when following corn or grain sorghum. Grain sorghum yields were almost twice as great as those of corn in similar rotations.

Introduction

The purpose of this project is to research and demonstrate several multicrop rotations that are feasible for the region, along with alternative systems that are more intensive than 2- or 3-year rotations. The objectives are to (1) enhance and stabilize production of rain-fed cropping systems through the use of multiple crops and rotations, using best management practices to optimize precipitation capture and utilization for economic crop production, and (2) enhance adoption of alternative rain-fed cropping systems that provide optimal profitability.

Procedures

The crop rotations are 2-year (wheat-fallow [WF]), 3-year (wheat-grain sorghum-fallow [WSF] and wheat-corn-fallow [WCF]), and 4-year rotations (wheat-corn-sorghum-fallow [WCSF] and wheat-sorghum-corn-fallow [WSCF]), and continuous sorghum (SS). All rotations are grown using no-till practices except for WF, which is grown using reduced-tillage. All phases of each rotation are present each year. Plot size is a minimum of 100 × 450 ft. In most instances, grain yields were determined by harvesting the center 60 ft (by entire length) of each plot with a commercial combine and determining grain weight in a weigh-wagon or combine yield monitor.

Results and Discussion

Grain yields of wheat were above average in 2014, while grain sorghum yields were about average, and corn yields were below average (Table 1). Precipitation during late June through the rest of the summer increased grain sorghum yields more than corn

yields. Wheat yields were greater in the 4-year rotations and WSF than for WCF or WF. Corn yields were less than 30 bu/a for all rotations. Grain sorghum yields were quite variable but tended be higher for sorghum following wheat than following corn or sorghum.

Wheat yields averaged across the past 6 years (2008–2014) ranged from 22 to 25 bu/a and were not affected by length of rotation (Table 2). Corn yields following wheat averaged about twice as much as following sorghum. Similarly, sorghum yields following wheat were about twice as much as following corn or sorghum. Grain sorghum yields were almost twice as great as corn yields when compared in similar rotations.

Acknowledgements

This research project received support from the Ogallala Aquifer Initiative.

Table 1. Grain yield response to crop rotation in large-scale cropping systems study, Tribune, Kansas, 2014

Crop rotation	Wheat	Corn	Sorghum
	---------- bu/a ----------		
Wheat-fallow[1]	16b[2]		
Wheat-corn-fallow	17b	27	
Wheat-sorghum-fallow	27a		59
Wheat-corn-sorghum-fallow	33a	16	32
Wheat-sorghum-corn-fallow	31a	5	53
Sorghum-sorghum			18
$LSD_{0.05}$	9	ns	ns

[1] Wheat-fallow rotation is reduced-till; all other rotations are no-till.
[2] Means within a column with the same letter are not statistically different at P=0.05.

Table 2. Grain yield response to crop rotation in large-scale cropping systems study, Tribune, Kansas, 2008–2014

Crop rotation	Wheat	Corn	Sorghum
	---------- bu/a ----------		
Wheat-fallow[1]	23		
Wheat-corn-fallow	23	36a[2]	
Wheat-sorghum-fallow	25		65a
Wheat-corn-sorghum-fallow	22	35a	33b
Wheat-sorghum-corn-fallow	23	18b	62a
Sorghum-sorghum			30b
$LSD_{0.05}$	ns	5	8

[1] Wheat-fallow rotation is reduced-till; all other rotations are no-till.
[2] Means within a column with the same letter are not statistically different at P=0.05.