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Occasional Tillage in a Wheat-Sorghum-Fallow Rotation

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Occasional Tillage in a Wheat-Sorghum-Fallow Rotation

Abstract

Beginning in 2012, research was conducted in Garden City and Tribune, KS, to determine the effect of a single tillage operation every 3 years on grain yields in a wheat-sorghum-fallow (WSF) rotation. Grain yields of wheat and grain sorghum were not affected by a single tillage operation every 3 years in a WSF rotation. Grain yield varied greatly by year from 2014 to 2017. Wheat yields ranged across years from mid-20s to 80 bu/a at Tribune and about 10 (hail damage) to near 60 bu/a at Garden City. Grain sorghum yields ranged from less than 60 to greater than 140 bu/a, depending upon year and location. In no year or location, were grain yields significantly affected by a single tillage operation. This indicates that if a single tillage operation is needed to control troublesome weeds, that grain yields will not be significantly affected. Furthermore, if weed populations were high enough to cause yield reductions, then tillage might improve yields.

Keywords

wheat-sorghum-fallow rotation, occasional tillage in rotations, tillage, southwest Kansas

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Cover Page Footnote

This research was supported in part by the Ogallala Aquifer Program, a consortium between USDA Agricultural Research Service, Kansas State University, Texas AgriLife Research, Texas AgriLife Extension Service, Texas Tech University, and West Texas A&M University.

Occasional Tillage in a Wheat-Sorghum-Fallow Rotation

A. Schlegel and J. Holman

Summary

Beginning in 2012, research was conducted in Garden City and Tribune, KS, to determine the effect of a single tillage operation every 3 years on grain yields in a wheat-sorghum-fallow (WSF) rotation. Grain yields of wheat and grain sorghum were not affected by a single tillage operation every 3 years in a WSF rotation. Grain yield varied greatly by year from 2014 to 2017. Wheat yields ranged across years from mid-20s to 80 bu/a at Tribune and about 10 (hail damage) to near 60 bu/a at Garden City. Grain sorghum yields ranged from less than 60 to greater than 140 bu/a, depending upon year and location. In no year or location, were grain yields significantly affected by a single tillage operation. This indicates that if a single tillage operation is needed to control troublesome weeds, that grain yields will not be significantly affected. Furthermore, if weed populations were high enough to cause yield reductions, then tillage might improve yields.

Introduction

Previous research has shown lower dryland wheat and grain sorghum yields with reduced tillage compared with no-tillage in a wheat-sorghum-fallow (WSF) rotation. The reduced tillage systems generally used four or more tillage operations in the 3-yr rotation. With increased incidence of herbicide resistant weeds, the use of a complete no-tillage system may not be economical and tillage may be needed for effective control. The objective of the research project is to determine the effect of a single tillage operation every 3 years on grain yields in a WSF rotation.

Procedures

Research on occasional tillage intensities in a predominantly no-tillage WSF rotation at the Kansas State University Southwest Research-Extension Center research stations at Garden City and Tribune was initiated in 2012. The three tillage treatment intensities in this study are a single tillage in May or June during fallow, a single tillage after wheat harvest, and a complete no-tillage system. A sweep plow was used for all tillage operations. When needed, herbicides were used to control weeds during fallow for all treatments. All treatments used herbicides for in-crop weed control. All other cultural practices (variety/hybrid, seeding rate, fertilization, etc.) were the same for all treatments.

Results and Discussion

Weeds were effectively controlled in all treatments and there were no visual differences in weed population across treatments.

At Tribune, wheat yields were 27 to 30 bu/a in 2017 compared with 75 to 80 bu/a in 2016 (Table 1). Yields were reduced by wheat streak mosaic in 2017. There were no significant yield differences among tillage treatments in any year or across years. Grain sorghum yields were greater in 2017 than in any previous years ranging from 141 to 147 bu/a (Table 2). Similar to wheat, there were no significant yield differences among tillage treatments in any year or averaged across years.

At Garden City, wheat yields in 2017 were 19–23 bu/a (Table 3), and wheat yields were reduced in the fall of 2016 by wheat streak mosaic and dry conditions. Wheat yields in 2014 were severely reduced by hail. There were no significant yield differences among tillage treatments in any year or averaged across years. Grain sorghum yields in 2017 were less than half the yield of 2016 (Table 4), due to dry conditions late in the growing season. Similar to wheat, there were no significant yield differences among tillage treatments in any year or averaged across years.

In other research (Schlegel et al., 2018), reduced tillage systems produced lower yields than a complete no-tillage system in a WSF rotation. However, in this study, a single tillage operation in a 3-yr WSF rotation did not affect wheat or grain sorghum yields from 2014 to 2017 at Garden City or Tribune, KS.

Acknowledgment

This research was supported in part by the Ogallala Aquifer Program, a consortium between USDA Agricultural Research Service, Kansas State University, Texas AgriLife Research, Texas AgriLife Extension Service, Texas Tech University, and West Texas A&M University.

Table 1. Grain yield response of dryland wheat to a single tillage operation (sweep plow) in a 3 year wheat-sorghum-fallow rotation grown from 2014 to 2017 near Tribune, KS

Tillage	Year				Average
	2014	2015	2016	2017	
	----- bu/a -----				
No-tillage	28	24	75	30	39
June in fallow	26	25	80	27	39
July post-harvest	24	23	75	29	38
<u>ANOVA (P > F)</u>					
No-tillage vs. tillage	0.381	0.983	0.350	0.162	0.657
June vs. July	0.551	0.555	0.053	0.588	0.221
Year	---	---	---	---	0.001
Year × tillage	---	---	---	---	0.419

ANOVA = analysis of variance.

Table 2. Grain yield response of dryland grain sorghum to a single tillage operation (sweep plow) in a 3-year wheat-sorghum-fallow rotation grown from 2014 to 2017 near Tribune, KS

Tillage	Year				Average ^b
	2014 ^a	2015 ^a	2016 ^a	2017 ^b	
	----- bu/a -----				
No-tillage	77	133	129	147	122
June in fallow	84	124	131	145	118
July post-harvest	79	118	129	141	115
<u>ANOVA (P > F)</u>					
No-tillage vs. tillage	0.445	0.095	0.852	0.338	0.126
June vs. July	0.395	0.404	0.617	0.386	0.479
Year	---	---	---	---	0.001
Year × tillage	---	---	---	---	0.093

ANOVA = analysis of variance.

Note: Due to treatment change on August 31, 2016 (does not effect no-tillage):

^a June in fallow and July post-harvest yields are two plots averaged together per block.^b June in fallow and July post-harvest yields are one plot per block.

Table 3. Grain yield response of dryland wheat to a single tillage operation (sweep plow) in a 3-year wheat-sorghum-fallow rotation grown from 2014 to 2017 near Garden City, KS

Tillage	Year				Average
	2014	2015	2016	2017	
	----- bu/a -----				
No-tillage	8	34	55	20	29
June in fallow	8	37	58	19	30
July post-harvest	10	33	56	23	30
<u>ANOVA (P > F)</u>					
No-tillage vs. tillage	0.767	0.686	0.460	0.604	0.642
June vs. July	0.222	0.101	0.200	0.239	0.715
Year	---	---	---	---	0.001
Year × tillage	---	---	---	---	0.287

ANOVA = analysis of variance.

Table 4. Grain yield response of dryland grain sorghum to a single tillage operation (sweep plow) in a 3-year wheat-sorghum-fallow rotation grown from 2014 to 2017 near Garden City, KS

Tillage	Year				Average
	2014	2015	2016	2017	
	----- bu/a -----				
No-tillage	58	63	116	51	72
June in fallow	57	64	123	46	71
July post-harvest	53	71	121	44	70
<u>ANOVA (P>F)</u>					
No-tillage vs. tillage	0.602	0.478	0.115	0.345	0.720
June vs. July	0.485	0.204	0.362	0.713	0.735
Year	---	---	---	---	0.001
Year × tillage	---	---	---	---	0.255

ANOVA = analysis of variance.