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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 generally not affected by a single tillage operation every 3 years in a WSF rotation. Grain yield varied greatly by year from 2014–2018. Wheat yields ranged across years from mid-20s to 80 bu/a at Tribune and less than 10 to near 60 bu/a at Garden City. Grain sorghum yields ranged from less than 50 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. However, at Tribune, when averaged across the 5-year period, a single tillage after wheat harvest reduced grain sorghum yields compared to a complete no-till system. This indicates that if a single tillage operation is needed to control troublesome weeds, that grain yields will generally not be significantly affected. Furthermore, if weed populations were high enough to cause yield reductions, then tillage might improve yields.

Keywords

no-tillage, herbicide resistant weeds, crop rotation

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Cover Page Footnote

This research was supported in part by the Ogallala Aquifer Program, a consortium between U.S. Department of Agriculture 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 generally not affected by a single tillage operation every 3 years in a WSF rotation. Grain yield varied greatly by year from 2014–2018. Wheat yields ranged across years from mid-20s to 80 bu/a at Tribune and less than 10 to near 60 bu/a at Garden City. Grain sorghum yields ranged from less than 50 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. However, at Tribune, when averaged across the 5-year period, a single tillage after wheat harvest reduced grain sorghum yields compared to a complete no-till system. This indicates that if a single tillage operation is needed to control troublesome weeds, that grain yields will generally 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 were 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 (Minimizer by Premier Tillage) 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 57–58 bu/a in 2018 compared with 41–43 bu/a for the 5-year average (Table 1). There were no significant yield differences among tillage treatments in any year or across years. Grain sorghum yields were very good in 2018 ranging from 115–130 bu/a (Table 2). Similar to wheat, there were no significant yield differences among tillage treatments in any year. However, averaged across years, NT produced greater yields than tillage post-wheat harvest.

At Garden City, wheat yields in 2018 were very low at 2–7 bu/a (Table 3). Between November 1, 2017, and April 1, 2018, 0.4 inches of precipitation was received, compared to the long-term period average of 3.46 inches. 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 2018 were good with all yields near 90 bu/a or greater (Table 4). 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 (with four tillage operations) 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 generally had little effect on wheat or grain sorghum yields from 2014–2018 at Garden City or Tribune, KS.

Acknowledgment

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

Reference

Schlegel, A.J., Y. Assefa, L.A. Haag, C.R. Thompson, and L.R. Stone. 2018. Long-term tillage on yield and water use of grain sorghum and winter wheat. *Agron. J.* 110:269-280.

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 2014–2018 near Tribune, KS

Tillage	Year					Average
	2014	2015	2016	2017	2018	
	----- bu/a -----					
No-tillage	28	24	75	30	57	43
June in fallow	22	22	81	25	58	42
July post-harvest	23	21	77	27	57	41
ANOVA (P > F)						
Treatment	0.427	0.599	0.174	0.477	0.857	0.444
Year	---	---	---	---	---	0.001
Year × treatment	---	---	---	---	---	0.409

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 2014–2018 near Tribune, KS

Tillage	Year					Average
	2014	2015	2016	2017	2018	
	----- bu/a -----					
No-tillage	77	133	129	147	130	123
June in fallow	84	114	129	145	123	119
July post-harvest	86	108	126	141	115	115
ANOVA (P > F)						
Treatment	0.573	0.104	0.280	0.567	0.065	0.046
Year	---	---	---	---	---	0.001
Year × treatment	---	---	---	---	---	0.096

ANOVA = analysis of variance.

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 2014–2018 near Garden City, KS

Tillage	Year					Average
	2014	2015	2016	2017	2018	
	----- bu/a -----					
No-tillage	8	34	55	20	4	24
June in fallow	6	35	60	19	3	25
July post-harvest	9	30	56	23	7	25
ANOVA (P > F)						
Treatment	0.601	0.363	0.369	0.420	0.199	0.764
Year	---	---	---	---	---	0.001
Year × treatment	---	---	---	---	---	0.265

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 2014–2018 near Garden City, KS

Tillage	Year					Average
	2014	2015	2016	2017	2018	
	----- bu/a -----					
No-tillage	58	63	116	51	98	77
June in fallow	57	62	121	46	88	75
July post-harvest	47	73	118	44	93	75
ANOVA (P>F)						
Treatment	0.110	0.464	0.642	0.579	0.572	0.714
Year	---	---	---	---	---	0.001
Year × treatment	---	---	---	---	---	0.393

ANOVA = analysis of variance.