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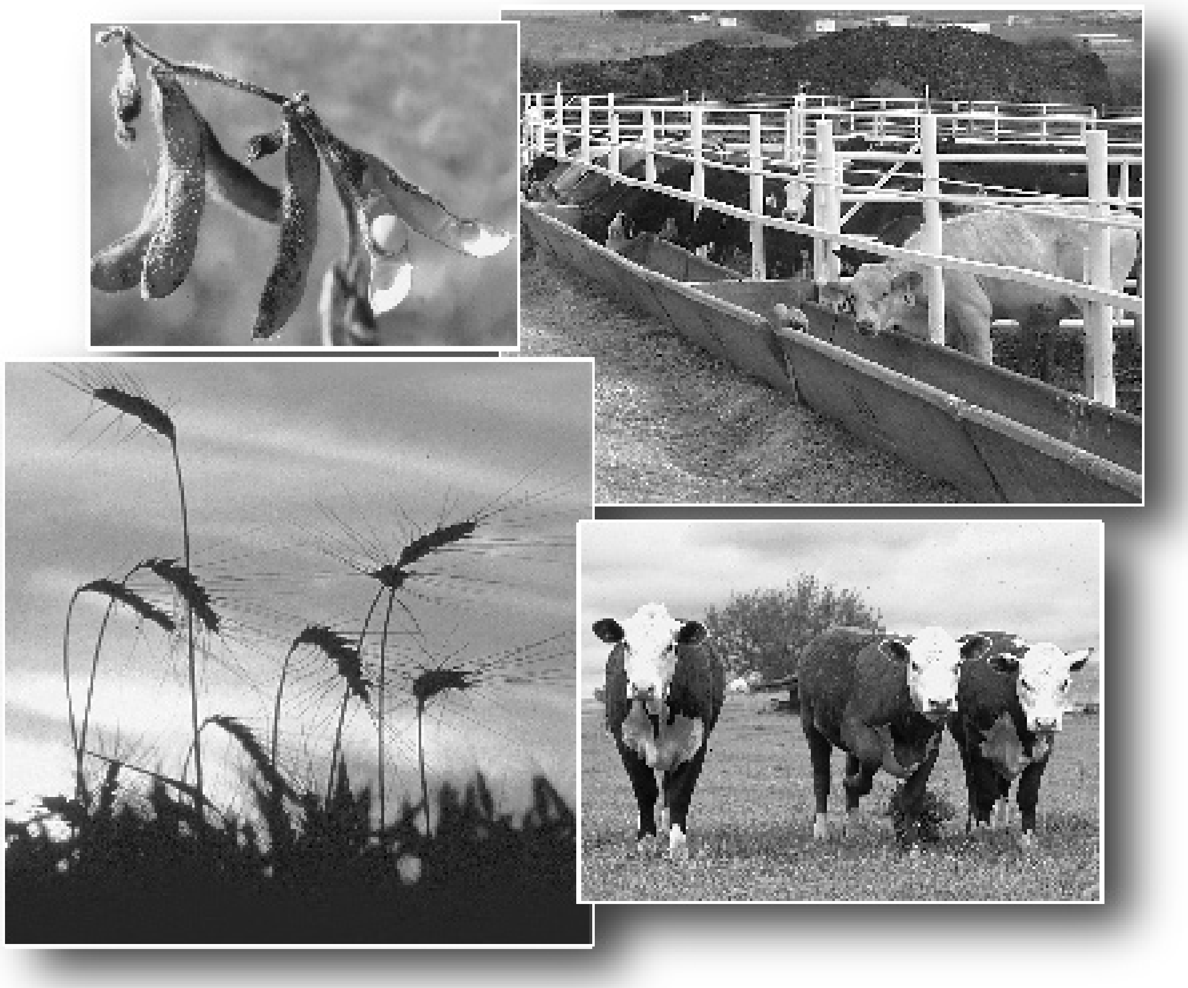

Southeast Agricultural Research Center

Report of Progress 979

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

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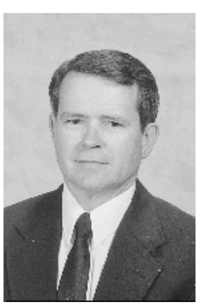

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Inside cover photos by Kelly Lynn Photography, Parsons, KS (used by permission), except Joe Moyer

TABLE OF CONTENTS

BEEF CATTLE RESEARCH

FORAGE CROPS RESEARCH

SOIL & WATER MANAGEMENT RESEARCH

CROPS & SOILS RESEARCH

CROP VARIETY DEVELOPMENT RESEARCH

OTHER

Contribution no. 07-222-S from the Kansas Agricultural Experiment Station

EVALUATION OF FORAGE PRODUCTION, STAND PERSISTENCE, AND GRAZING PERFORMANCE OF STEERS GRAZING TALL FESCUE CULTIVARS WITH THE NOVEL ENDOPHYTE

Lyle W. Lomas and Joseph L. Moyer

Summary

A total of 192 mixed black steers were used to evaluate the effect of tall fescue cultivar on grazing gains, forage production, and stand persistence in 2004, 2005, and 2006. Cultivars evaluated included high-endophyte Kentucky 31, low-endophyte Kentucky 31, ArkPlus, and MaxQ. Pastures with low-endophyte Kentucky 31, ArkPlus, or MaxQ produced higher ($P < 0.05$) steer grazing gains and more ($P < 0.05$) gain per acre than did high-endophyte Kentucky 31 during all three years. Steer live-weight gain and gain per acre were similar ($P > 0.05$) between pastures with low-endophyte Kentucky 31, ArkPlus, and MaxQ. There was no difference ($P > 0.05$) in available forage dry matter between varieties in 2004. However, in 2005, high-endophyte Kentucky 31 and MaxQ pastures had higher ($P < 0.05$) available-forage than low-endophyte Kentucky 31 and ArkPlus pastures. In 2006, high-endophyte Kentucky 31 pastures had more ($P < 0.05$) available-forage dry matter than pastures with the other varieties. Stand density did not differ ($P > 0.05$) between varieties. However, stand density of all varieties declined after the summer of 2006.

Introduction

Tall fescue, the most widely adapted cool-season perennial grass in the United States, is grown on approximately 66 million acres. Although tall fescue is well-adapted in the eastern half of the country between the temperate North and mild South, the presence of a fungal endophyte results in poor performance by grazing livestock, especially during the summer.

Until recently, producers with high-endophyte tall fescue pastures had two primary options to improve grazing-livestock performance. One option was to destroy existing stands and replace them with endophyte-free fescue or other forages. Although it supports greater grazing-animal performance than endophyte-infected fescue does, endophyte-free fescue has proven to be less persistent under grazing and more susceptible to stand loss from drought stress. In situations where high-endophyte tall fescue must be grown, the other option was for producers to adopt management strategies to reduce the negative effects of the endophyte on grazing animals, such as incorporation of legumes into existing pastures. Addition of legumes can improve nutritive quality of fescue pastures, increase gains of grazing livestock, and reduce N fertilizer rates.

During the past few years, new cultivars of tall fescue have been developed that have a so-called novel endophyte that provides vigor to the fescue plant, but does not have the traditional negative effect on performance of grazing livestock. The objective of this study was to evaluate grazing and subsequent finishing performance of stocker steers, forage availability, and stand persistence of two of these new cultivars and to compare them with high- and low-endophyte Kentucky 31 tall fescue.

Experimental Procedures

Sixty-four crossbred steers were weighed on two consecutive days and allotted to 16 five-acre pastures of high-endophyte Kentucky 31, low-endophyte Kentucky 31, ArkPlus, or MaxQ tall fescue (four replications/cultivar) on March 16, 2004 (513 lb), March 24, 2005 (501 lb), and March 29, 2006 (568 lb). All pastures were seeded in the fall of 2002 and had been harvested for hay in 2003. All pastures were fertilized on January 15, 2004, with 80 lb of N per acre and P_2O_5 and K_2O as required by soil test, on February 2, 2005, and January 19, 2006, with 80 lb of N, on September 3, 2004, September 13, 2005, and September 11, 2006, with 40-40-30 lb of N-P_2O_5-K_2O per acre.

Cattle were treated for internal and external parasites before being turned out to pasture and later were vaccinated for protection from pinkeye. Steers had free access to commercial mineral blocks that contained 12% calcium, 12% phosphorus, and 12% salt.

Cattle were weighed every 28 days, and forage availability was measured approximately every 28 days with a disk meter calibrated for tall fescue. In 2006, two steers were removed from the study for reasons unrelated to experimental treatment. Pastures were grazed continuously until November 30, 2004 (257 days), December 6, 2005 (257 days), and August 15, 2006 (139 days), when steers were weighed on two consecutive days and grazing was terminated.

After the grazing period, cattle were moved to a finishing facility, implanted with Synovex S®, and fed a diet of 80% ground milo, 15% corn silage, and 5% supplement (dry-matter basis). Cattle grazed in 2006 were re-implanted with Synovex S® on day 84 of the finishing period. Cattle that were grazed during 2004 and 2005 were fed a finishing diet for 112 days. Steers grazed during 2006 on low-endophyte Kentucky 31, ArkPlus or MaxQ were fed a finishing diet for 142 days, while steers that grazed high-endophyte Kentucky 31 were fed a finishing diet for 168 days. All steers were slaughtered in a commercial facility and carcass data were collected.

Results and Discussion

Grazing performance is presented by cultivar in Table 1, Table 2, and Table 3 for 2004, 2005, and 2006, respectively. Steers that grazed pastures of low-endophyte Kentucky 31, MaxQ, or ArkPlus gained significantly more ($P < 0.05$) and produced more ($P < 0.05$) gain/acre than those that grazed high-endophyte Kentucky 31 pastures during each of the three years. Gains of cattle that grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ were similar ($P > 0.05$) in 2004, 2005, and 2006. Steer daily gains over three years from pastures with high-endophyte Kentucky 31, low-endophyte Kentucky 31, ArkPlus, and MaxQ were 0.94, 1.17, and 0.78; 1.54, 1.60,and 1.78; 1.55, 1.53, and 1.68; and 1.47, 1.65, and 1.87 lb per head daily, during 2004, 2005, and 2006, respectively. Gains per acre over three years from pastures with high-endophyte Kentucky 31, low-endophyte Kentucky 31, ArkPlus, and MaxQ were 194, 241, and 87; 317, 329, and 198; 319, 314, and 186; and 302, 340, and 208 lb per acre during 2004, 2005, and 2006, respectively. Drought stress reduced the length of the grazing season in 2006, which resulted in lower steer gain and gain/acre than measured in the previous two years.

Finishing performance, carcass characteristics, and overall performance (grazing + finishing) for steers grazed in 2004, 2005, and 2006 are presented in Table 1, Table 2, and Table 3, respectively. In 2004, steers that had previously grazed high-endophyte Kentucky 31 had lower ($P < 0.05$) final finishing weights and lower ($P < 0.05$) hot carcass weights than those that grazed low-endophyte Kentucky 31 or ArkPlus. Final live weights and hot carcass weights were similar ($P > 0.05$) for steers that grazed high-endophyte Kentucky 31 or MaxQ. However, steers that grazed high-endophyte Kentucky 31 or ArkPlus had higher ($P < 0.05$) finishing daily gains than those that had grazed low-endophyte Kentucky 31 or MaxQ.

In 2005 and 2006, steers that had previously grazed high-endophyte Kentucky 31 had lower ($P < 0.05$) final finishing weights than those that grazed low-endophyte Kentucky 31 or MaxQ. Cattle that grazed high-endophyte Kentucky 31 pastures in 2006 had lower ($P < 0.05$) final finishing weights than steers that grazed the other three varieties, even though they were fed 26 days longer. Final live weight was similar ($P > 0.05$) for steers that had grazed high-endophyte Kentucky 31 or ArkPlus in 2005 and 2006. In 2005, steers that grazed high-endophyte Kentucky 31 had lower ($P < 0.05$) hot carcass weights than those that grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ. Final live weight and hot carcass weight were similar ($P > 0.05$) for steers that grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ in 2005 and 2006. Finishing daily gains were similar ($P > 0.05$) between steers that grazed the four fescue cultivars during both 2005 and 2006.

In 2004, cattle that grazed high-endophyte Kentucky 31 required less ($P < 0.05$) feed per lb of gain than those that had grazed low-endophyte Kentucky 31 or MaxQ and had similar ($P > 0.05$) feed conversion to steers that had grazed ArkPlus. Steers that grazed low endophyte Kentucky 31 had similar ($P > 0.05$) feed efficiency to those that grazed ArkPlus or MaxQ. Steers that grazed ArkPlus required less ($P < 0.05$) feed per lb of gain than those that grazed MaxQ. Feed conversion was similar between treatments in 2005. However, in 2006, steers that grazed high-endophyte Kentucky 31 had lower ($P < 0.05$) DM intakes and required less ($P < 0.05$) feed per pound of gain than those that had grazed MaxQ. The lower DM intake was likely related to the lighter weight of the high-endophyte Kentucky 31 steers. Feed conversion was similar ($P > 0.05$) among steers that had grazed high-endophyte Kentucky 31, low-endophyte Kentucky 31, or ArkPlus. Steers that had grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ had similar ($P > 0.05$) feed efficiency.

In 2004, steers that grazed ArkPlus had greater ($P < 0.05$) external fat thickness than those that grazed high-endophyte Kentucky 31, low-endophyte Kentucky 31, or MaxQ and a higher ($P < 0.05$) numerical yield grade than those that grazed MaxQ. There were no significant differences ($P > 0.05$) between treatments in the percentage of cattle grading choice or higher. In 2005, steers that had grazed high-endophyte Kentucky 31 had a lower ($P < 0.05$) dressing percentage than those that grazed MaxQ and a smaller ($P < 0.05$) ribeye area than those that had grazed low-endophyte Kentucky 31 or ArkPlus. The smaller ribeye area was likely due to the lower ($P < 0.05$) hot carcass weight of the high-endophyte Kentucky 31 cattle. However, steers that had grazed high-endophyte Kentucky 31 yielded a higher ($P < 0.05$) percentage of choice carcasses than those that had grazed ArkPlus. In 2006, steers that grazed low-endophyte Kentucky 31 had larger ($P < 0.05$) ribeye areas than those that grazed MaxQ. Steers that grazed MaxQ yielded a higher ($P < 0.05$) percentage of choice carcasses than those that grazed high-endophyte Kentucky 31, low endophyte Kentucky 31, or ArkPlus.

In 2004, cattle that grazed high-endophyte Kentucky 31 had lower ($P < 0.05$) overall gains (grazing + finishing) than those that grazed low-endophyte Kentucky 31 or ArkPlus and similar ($P > 0.05$) overall gains as those that grazed MaxQ. Overall gains of steers that grazed low-endophyte Kentucky 31 or ArkPlus were similar ($P > 0.05$). In 2005, cattle that had grazed high-endophyte Kentucky 31 had lower ($P < 0.05$) overall gains than those that grazed low-endophyte Kentucky 31 or MaxQ and similar ($P > 0.05$) overall gains as those that grazed ArkPlus. Overall gains of steers that grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ were similar ($P > 0.05$). In 2006, cattle that grazed high-endophyte Kentucky 31 had lower ($P < 0.05$) overall daily gains than those that grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ. Overall daily gains of steers that grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ were similar (P > 0.05).

Available forage and stand density of each cultivar are presented in Table 4. Although there was no difference between cultivars for average available forage for the entire grazing season in 2004, available forage between cultivars did differ on three measurement dates toward the latter part of the grazing season. On August 30, low-endophyte Kentucky 31 pastures had less (P < 0.05) available forage than did pastures with high-endophyte Kentucky 31, ArkPlus, or MaxQ. On September 29, low-endophyte Kentucky 31 pastures had less (P < 0.05) available forage than did MaxQ pastures. On December 1, high-endophyte Kentucky 31 pastures had more (P < 0.05) available forage than low-endophyte Kentucky 31 or ArkPlus pastures.

In 2005, high-endophyte Kentucky 31 pastures had higher (P < 0.05) average available forage than the other three varieties, MaxQ pastures had higher (P < 0.05) available forage than low-endophyte Kentucky 31 or ArkPlus, while average available forage for low-endophyte Kentucky 31 and ArkPlus pastures were similar (P > 0.05). High-endophyte Kentucky 31 pastures had more (P < 0.05) available forage than the other three varieties on March 24 and September 8. On August 11, high-endophyte Kentucky 31 and MaxQ pastures had more (P < 0.05) available forage than low-endophyte Kentucky 31 and ArkPlus pastures. On November 2, MaxQ pastures had more (P < 0.05) available forage than low-endophyte Kentucky 31 pastures. On December 6, high-endophyte Kentucky 31 and low-endophyte Kentucky 31 pastures had more (P < 0.05) available forage than ArkPlus and MaxQ pastures.

In 2006, high-endophyte Kentucky 31 pastures had higher (P < 0.05) average available forage than the other three varieties. Average available forage for low-endophyte Kentucky 31, ArkPlus, and MaxQ were similar (P > 0.05).

In general, pastures with less available-forage dry matter produced higher steer gains than those with greater available-forage dry matter. This may indicate that lower available dry matter was the result of greater forage intake by grazing steers, which in turn resulted in higher gains and/or less vigor of the fescue cultivar. Stand density was similar among cultivars at both the beginning and end of each grazing season. Stand density of all varieties gradually increased each year to a high in 2005 and then dramatically decreased in 2006 due to drought stress.

Cattle grazing ArkPlus or MaxQ tall fescue, new varieties with the novel endophyte, appear to have similar gains as cattle grazing low-endophyte Kentucky 31, and significantly higher gains than cattle grazing high-endophyte Kentucky 31 tall fescue. Persistence of these varieties under grazing will continue to be monitored. This study will be continued for at least two more years or until fescue stands deteriorate.

Table 1. Effect of Cultivar on Grazing and Subsequent Performance of Steers Grazing Tall Fescue Pastures, Southeast Agricultural Research Center, 2004.

	Tall Fescue Cultivar			
Item	High-Endophyte Kentucky 31	Low-Endophyte Kentucky 31	ArkPlus	MaxQ
Grazing Phase (257 days)				
No. of head	16	16	16	16
Initial wt., lb	513	513	513	512
Ending wt., lb	756[a]	908[b]	911[b]	890[b]
Gain, lb	243[a]	396[b]	399[b]	377[b]
Daily gain, lb	0.94[a]	1.54[b]	1.55[b]	1.47[b]
Gain/acre, lb	194[a]	317[b]	319[b]	302[b]
Finishing Phase (112 days)				
Beginning wt., lb	756[a]	908[b]	911[b]	890[b]
Ending wt., lb	1252[a]	1341[b,c]	1388[b]	1285[a,c]
Gain, lb	497[a]	433[b,c]	477[a,c]	395[b]
Daily gain, lb	4.44[a]	3.86[b]	4.26[a]	3.53[b]
Daily DM intake, lb	27.2	28.1	28.6	27.1
Feed/gain	6.14[a]	7.36[b,c]	6.73[a,c]	7.68[b]
Hot carcass wt., lb	731[a]	786[b,c]	801[b]	754[a,c]
Dressing %	58	59	58	59
Backfat, in	0.38[a]	0.38[a]	0.49[b]	0.34[a]
Ribeye area, in^2	12.0	11.9	12.1	12.2
Yield grade	2.8[a,b]	3.1[a,b]	3.3[a]	2.7[b]
Marbling score	SM^{50}	SM^{63}	SM^{86}	SM^{24}
% Choice	69	75	94	69
Overall Performance (Grazing + Finishing) (369 days)				
Gain, lb	740[a]	828[b,c]	876[b]	772[a,c]
Daily gain, lb	2.00[a]	2.25[b,c]	2.37[b]	2.09[a,c]

[a,b] Means within a row with the same letter are not significantly different ($P < 0.05$).

Table 2. Effect of Cultivar on Grazing and Subsequent Performance of Steers Grazing Tall Fescue Pastures, Southeast Agricultural Research Center, 2005.

Item	Tall Fescue Cultivar High-Endophyte Kentucky 31	Low-Endophyte Kentucky 31	ArkPlus	MaxQ
Grazing Phase (257 days)				
No. of head	16	16	16	16
Initial wt., lb	501	501	501	501
Ending wt., lb	802[a]	912[b]	893[b]	926[b]
Gain, lb	302[a]	412[b]	392[b]	425[b]
Daily gain, lb	1.17[a]	1.60[b]	1.53[b]	1.65[b]
Gain/acre, lb	241[a]	329[b]	314[b]	340[b]
Finishing Phase (112 days)				
Beginning wt., lb	802[a]	912[b]	893[b]	926[b]
Ending wt., lb	1298[a]	1392[b]	1365[a,b]	1395[b]
Gain, lb	496	479	472	470
Daily gain, lb	4.43	4.28	4.21	4.19
Daily DM intake, lb	29.6	29.2	29.0	30.1
Feed/gain	6.69	6.83	6.93	7.19
Hot carcass wt., lb	760[a]	821[b]	811[b]	833[b]
Dressing %	58.5[a]	59.0[a,b]	59.5[a,b]	59.7[b]
Backfat, in	0.44	0.44	0.49	0.48
Ribeye area, in^2	11.0[a]	11.8[b]	11.8[b]	11.6[a,b]
Yield grade	3.4	3.4	3.5	3.4
Marbling score	SM^{65}	SM^{62}	SM^{04}	SM^{58}
% Choice	94[a]	81[a,b]	56[b]	75[a,b]
Overall Performance (Grazing + Finishing) (369 days)				
Gain, lb	797[a]	891[b]	864[a,b]	895[b]
Daily gain, lb	2.16[a]	2.41[b]	2.34[a,b]	2.42[b]

[a,b] Means within a row with the same letter are not significantly different ($P < 0.05$).

Table 3. Effect of Cultivar on Grazing and Subsequent Performance of Steers Grazing Tall Fescue Pastures, Southeast Agricultural Research Center, 2006.

Item	Tall Fescue Cultivar			
	High-Endophyte Kentucky 31	Low-Endophyte Kentucky 31	ArkPlus	MaxQ
<u>Grazing Phase (139 days)</u>				
No. of head	14	16	16	16
Initial wt., lb	568	568	568	568
Ending wt., lb	676[a]	816[b]	801[b]	829[b]
Gain, lb	109[a]	248[b]	233[b]	260[b]
Daily gain, lb	0.78[a]	1.78[b]	1.68[b]	1.87[b]
Gain/acre, lb	87[a]	198[b]	186[b]	208[b]
<u>Finishing Phase</u>				
No. of days	168	142	142	142
Beginning wt., lb	676[a]	816[b]	801[b]	829[b]
Ending wt., lb	1299[a]	1364[b]	1343[a,b]	1367[b]
Gain, lb	623[a]	547[b]	541[b]	539[b]
Daily gain, lb	3.71	3.85	3.81	3.79
Daily DM intake, lb	24.7[a]	26.4[a,b]	26.0[a,b]	27.7[b]
Feed/gain	6.69[a]	6.85[a,b]	6.80[a,b]	7.31[b]
Hot carcass wt., lb	793	827	815	826
Dressing %	61	61	61	60
Backfat, in	0.54	0.49	0.50	0.51
Ribeye area, in^2	12.6[a,b]	13.5[a]	12.7[a,b]	12.5[b]
Yield grade	3.2	3.0	3.3	3.4
Marbling score	SM^{30}	SM^{28}	SM^{06}	SM^{40}
% Choice	50[a]	69[a]	56[a]	94[b]
<u>Overall Performance (Grazing + Finishing)</u>				
No. of days	307	281	281	281
Gain, lb	797[a]	891[b]	864[a,b]	895[b]
Daily gain, lb	2.38[a]	2.83[b]	2.76[b]	2.84[b]

[a,b] Means within a row with the same letter are not significantly different ($P < 0.05$).

Table 4. Effect of Cultivar on Available Forage and Stand Density of Tall Fescue Pastures, Southeast Agricultural Research Center, 2004, 2005, and 2006.

	Tall Fescue Cultivar			
Date	High Endophyte Kentucky 31	Low Endophyte Kentucky 31	ArkPlus	MaxQ
Available Forage	- - - - - - - - lb of dry matter/acre - - - - - - - -			
3/17/04	2611	2367	2276	2585
4/14/04	2890	2569	2576	2822
5/11/04	4652	4331	4258	4730
6/15/04	3816	3276	3632	3607
7/7/04	3179	3026	3252	3068
8/4/04	3038	2912	2975	3094
8/30/04	2610[a]	2392[b]	2630[a]	2824[a]
9/29/04	2192[a,b]	1879[b]	2056[a,b]	2246[a]
10/27/04	2042	1872	1764	2034
12/1/04	1653[a]	1366[b]	1342[b]	1488[a,b]
2004 Season Average	2868	2599	2676	2850
3/24/05	1883[a]	1394[b]	1404[b]	1498[b]
4/20/05	2760	2526	2516	2913
5/18/05	3431	3099	3331	3389
7/14/05	2972	2811	2749	2670
8/11/05	2401[a]	2080[b]	2148[b]	2472[a]
9/8/05	2558[a]	2262[b]	2331[b]	2309[b]
10/5/05	2301	2029	2142	1996
11/2/05	1451[a,b]	1354[b]	1568[a,b]	1791[a]
12/6/05	1950[a]	1643[a]	1096[b]	1270[b]
2005 Season Average	2412[a]	2133[c]	2132[c]	2257[b]
3/29/06	797[a]	706[a,b]	525[a,b]	490[b]
4/27/06	2062	1939	1061	1070
5/24/06	2062[a]	760[b]	1304[a,b]	1383[a,b]
6/19/06	2094[a]	1504[b]	1206[b]	1316[b]
7/17/06	1780	1154	866	1946
8/15/06	1745[a]	1019[b]	950[b]	846[b]
2006 Season Average	1756[a]	1180[b]	985[b]	1175 [b]
Stand Density	- - - - - - - - tillers/ft^2 - - - - - - - -			
3/17/04	66	62	70	70
12/1/04	78	85	74	75
12/12/05	130	135	118	134
12/14/06	53	43	47	37

[a,b,c] Means within a row with the same letter are not significantly different ($P < 0.05$).

SUPPLEMENTATION OF GRAZING STOCKER CATTLE WITH DISTILLER'S GRAINS[1]

Lyle W. Lomas and Joseph L. Moyer

Summary

A total of 72 steers grazing smooth bromegrass pastures in 2005 and 2006 and 32 steers grazing bermudagrass pastures in 2006 were used to evaluate the effects of supplementation with dried distiller's grains (DDG), at 0.5 or 1.0% of bodyweight on available forage, grazing gains, subsequent finishing gains, and carcass characteristics. Supplementation treatment of steers grazing smooth bromegrass had no effect (P > 0.05) on forage availability. Supplementation with DDG resulted in significantly higher (P < 0.05) grazing gains and gain/acre than feeding no supplement. Supplementation with 1.0% DDG resulted in higher (P<0.05) grazing gains and gain/acre than supplementation with 0.5% DDG in 2005, but gains were similar (P>0.05) for cattle fed the two supplementation rates in 2006. Supplementation during the grazing phase had no effect (P>0.05) on finishing gains. However, in 2005, steers that were supplemented during the grazing phase had higher (P<0.05) slaughter weights and overall gains than those that received no DDG while grazing. In 2006, steers supplemented with 0.5% DDG while grazing had higher (P<.0.05) slaughter weights and overall gains than those that received no DDG while grazing. Steers supplemented with 1.0% DDG while grazing had similar (P>0.05) slaughter weights and overall gains to those that received no DDG while grazing. Supplementation of steers grazing bermudagrass with DDG had no effect (P > 0.05) on grazing or finishing performance.

Introduction

Distiller's grains are a by-product of the ethanol industry. Ethanol production from feed grains is a rapidly growing industry that is making a major contribution to the American agricultural economy. Total ethanol production in the United States has nearly quadrupled in the past 10 years and is expected to increase even more in the future. Kansas currently has eight dry mill ethanol plants in operation, with a capacity of producing more than 215 million gallons of ethanol annually and additional potential plants are in various stages of planning. Current ethanol production in Kansas creates a market for more than 76 million bushels of corn and sorghum and yields approximately 684 thousand tons of dried distiller's grains annually. The availability of this co-product will likely increase and the cost decrease even more with the growth of the ethanol industry and efficient, cost-effective uses of this feedstuff need to be identified. Conversely, the value of distiller's grains as a supplement for grazing cattle also needs to be determined.

More than 80% of distiller's grains are currently being fed to ruminants, but they are also being used in swine and poultry diets. Distiller's grains are commonly included in diets of dairy and finishing cattle at 20-30% of diet dry matter. A limiting factor in feeding large amounts of distiller's grains is the environmental impact of excess nitrogen and phosphorus. A South Dakota study revealed that protein was in excess of

[1]Distiller's grains were provided by East Kansas Agri Energy, Garnett, KS.

requirements when distiller's grains were included at 30% of the diet dry matter in cows producing either 53 or 66 lb of milk/day. Care must also be taken in balancing diets containing distiller's grains to avoid overfeeding of phosphorus and sulfur.

Forage-based livestock production is a vital component of the Kansas economy. Kansas has nearly 18 million acres of pasture land and ranks 6th in the United States in the number of beef cows, with more than 1.5 million head. Cash receipts from cattle production in Kansas exceeded $5.6 billion in 2003. Forages account for 80% of the feed units consumed by beef cattle and, therefore, represent an extremely important resource to the industry. Increasing the proportion of feed that is harvested directly by grazing cattle and balancing their diets with low-cost supplements such as distillers grains could improve the sustainability and profitability of the beef cattle industry in Kansas and also create additional demand for corn and sorghum co-products.

Productivity of forage-livestock systems is limited by seasonality of forage growth. The energy and content of cool–season grasses can decline as much as 30% and 60%, respectively, from the vegetative stage to maturity. Livestock growth rates and reproductive performance generally decline in response to these changes in seasonal forage availability and quality unless their diets are supplemented with additional nutrients. Depending on price, use of supplemental feeds may be a cost-effective risk management strategy if the amounts and/or nutritional quality of forages are inadequate. Because of the expansion of the grain processing industries, co-products like distillers grains or gluten feed may be purchased at a price that is competitive with corn on a net energy basis and, with further growth of the industry, will likely be less expensive in the future. Because the co-products generally have high concentrations of protein and phosphorus, their composition complements those of mature forages that are typically deficient in these nutrients.

Experimental Procedures

Thirty-six steers of predominately Angus breeding were weighed on two consecutive days, stratified by weight, and randomly allotted to nine 5-acre smooth bromegrass pastures on April 5, 2005 (437 lb) and April 11, 2006 (484 lb). Three pastures of steers were randomly assigned to one of three supplementation treatments (three replicates per treatment) and were grazed for 196 days and 161 days in 2005 and 2006, respectively. Supplementation treatments were 0, 0.5% or 1.0% of bodyweight of corn DDG per head daily. Pastures were assigned to the same treatment during both years. Pastures were fertilized with 100-40-40 lb/a of N-P_2O_5-K_2O_5 on March 5, 2005, and March 6, 2006. Pastures were stocked with 0.8 steers/acre and grazed continuously until October 18, 2005 (196 days), and September 19, 2006 (161 days), when steers were weighed on two consecutive days and grazing was terminated.

Forty mixed black yearling steers (749 lb) were weighed on two consecutive days, stratified by weight, and randomly allotted to eight 5-acre 'Hardie' bermdagrass pastures on June 1, 2006. Supplementation treatments were 0, 0.5% or 1.0% of bodyweight of corn distillers dried grain per head daily. There were two replicates of the 0 level and three each of the 0.5 and 1.0% levels. Pastures were fertilized with 100-30-30 lb/a of N-P_2O_5-K_2O_5 on June 1, 2006, and 100 lb/a of N on July 7, 2006. Pastures were stocked with one steer per acre and grazed continuously until September 6, 2006 (89 days), when steers were weighed on two consecutive days and grazing was terminated.

Cattle in each pasture were group-fed DDG in meal form on a daily basis and pasture was the experimental unit. No implants or feed additives were used during the grazing phase. Weight gain was the primary measurement. Cattle were weighed every 28 days and quantity of distillers grain fed adjusted at that time. Cattle were treated for internal and external parasites before being turned out to pasture and later were vaccinated for protection from pinkeye. Cattle had free access to commercial mineral blocks that contained 12%

calcium, 12% phosphorous, and 12% salt.

Forage availability was measured approximately every 28 days with a disk meter calibrated for the respective forage being grazed. In 2005, one steer was removed from the study for reasons unrelated to experimental treatment.

After the grazing period, cattle were shipped to a finishing facility, implanted with Synovex S®, and fed a diet of 80% ground milo, 15% corn silage, and 5% supplement (dry-matter basis). Cattle that grazed smooth bromegrass pastures in 2005 and 2006 were fed a finishing diet for 126 days during both years. Cattle that grazed bermudagrass pastures in 2006 were fed a finishing diet for 85 days. Cattle were slaughtered in a commercial facility at the end of the finishing period and carcass data were collected.

Results and Discussion

Available forage during the grazing phase is presented by date and supplementation level for the smooth bromegrass pastures in Table 1. Supplementation with DDG had no effect ($P > 0.05$) on the quantity of forage available for grazing in either year. However, the quantity of available forage did vary ($P < 0.05$) by sampling date. In 2005, available forage was the lowest on April 6 (1,159 lb/acre), increased with each successive sampling date to a high of 10,271 lb per acre on June 28, and then gradually declined as the grazing season progressed. In 2006, available forage was lowest on April 14 (2,102 lb/acre), increased with each successive sampling date to a high of 5,526 on June 6, and then gradually declined as the grazing season progressed. Average available forage was approximately 2,400 lb/acre less in 2006 than in 2005, reflecting the lower level of precipitation in 2006.

Grazing and subsequent finishing performance of steers supplemented with DDG while grazing smooth bromegrass in 2005 and 2006 are presented in Table 2 and Table 3, respectively. In 2005, steers supplemented with 0.5 or 1.0% DDG during the grazing phase had 37% or 54% higher ($P < 0.05$) weight gain, daily gain, and steer gain per acre, respectively, than those that received no supplement. Steers supplemented with 0.5% or 1.0% DDG had 112 or 165 lb higher ($P < 0.05$) total weight gain, 0.57 or 0.84 lb higher ($P < 0.05$) daily gain, and 89 or 132 lb higher ($P < 0.05$) gain per acre, respectively, than those that received no supplementation. Supplementation of grazing steers with 1.0% DDG resulted in 13% higher ($P < 0.05$) weight gain (53 lb), daily gain (0.27 lb), and gain per acre (43 lb), than those supplemented with 0.5% DDG. Steers supplemented with DDG at 0.5 or 1.0% body weight per head daily consumed a total of 650 or 1,308 lb of DDG, respectively, during the 196 day grazing period. Average consumption of DDG was 3.3 or 6.7 lb per head daily for steers supplemented with 0.5 or 1.0% DDG per head daily, respectively. In 2005, steers supplemented with 0.5 or 1.0% DDG per head daily required 5.8 or 7.9 lb of DDG for each additional pound of bodyweight gain during the grazing phase.

In 2006, steers supplemented with 0.5 or 1.0% DDG while grazing smooth bromegrass had 31% or 35% higher ($P < 0.05$) weight gain, daily gain, and steer gain per acre, respectively, than those that received no supplement. Steers supplemented with 0.5% or 1.0% DDG had 82 or 91 lb higher ($P < 0.05$) total weight gain, 0.51 or 0.56 lb higher ($P < 0.05$) daily gain, and 66 or 73 lb higher ($P < 0.05$) gain per acre, respectively, than those that received no supplementation. Supplementation of grazing steers with 0.5 or 1.0% DDG resulted in similar ($P > 0.05$) grazing performance. Steers supplemented with DDG at 0.5 or 1.0% body weight per head daily consumed a total of 539 or 1,062 lb of DDG, respectively, during the 161 day grazing period. Average consumption of DDG was 3.3 or 6.6 lb per head daily for steers supplemented with 0.5 or 1.0% DDG per head daily, respectively. In 2006, steers supplemented with 0.5 or 1.0% DDG per head daily required 6.6 or 11.7 lb of DDG for each additional lb of bodyweight gain during the grazing phase.

Supplementation with DDG during the

grazing phase had no effect ($P > 0.05$) on subsequent finishing gain in either year. Steers that were supplemented during the grazing phase in 2005 were heavier ($P < 0.05$) at the end of the grazing phase, heavier ($P < 0.05$) at the end of the finishing phase, and had higher ($P < 0.05$) hot carcass weights than those that received no supplement while grazing. In 2006, steers that received 0.5% DDG during the grazing phase maintained their weight advantage and were heavier ($P < 0.05$) at the end of the finishing phase and had higher ($P < 0.05$) carcass weight than the unsupplemented control. Final slaughter weight of steers supplemented with 1.0% DDG was similar ($P > 0.05$) to that of steers supplemented with 0 or 0.5% DDG. Supplementation during the grazing phase had no effect ($P > 0.05$) on feed intake in either year. However, steers that received no supplement while grazing in 2005 required less ($P < 0.05$) feed per lb of gain than those that were supplemented with distillers grains at 1.0% of their bodyweight. Supplementation during the grazing phase had no effect ($P > 0.05$) on dressing percent, fat thickness, ribeye area, yield grade, marbling score, or percentage of cattle that graded choice.

In 2005, overall gain (grazing + finishing) was higher ($P < 0.05$) for cattle that were supplemented with DDG during the grazing phase. Steers that were supplemented with 0.5 or 1.0% DDG had 89 or 148 lb higher ($P < 0.05$) overall gain and 0.28 or 0.46 lb higher ($P < 0.05$) daily gain, respectively, than those that received no supplement while grazing. Overall gains were similar ($P > 0.05$) between steers supplemented with 0.5 or 1.0% DDG. In 2006, overall gain for steers supplemented with 0.5% during the grazing phase was higher ($P < 0.05$) than for those that received no supplement. Overall gain of steers supplemented with 1.0% DDG was similar ($P < 0.05$) to that of steers supplemented with 0 or 0.5% DDG. Steers that were supplemented with 0.5% DDG had 93 lb higher ($P < 0.05$) overall gain and 0.32 lb higher ($P < 0.05$) daily gain than those that received no supplement while grazing.

Grazing and finishing performance of steers supplemented with DDG while grazing bermudagrass pastures are presented in Table 4. Supplementation with DDG during the grazing phase had no effect ($P > 0.05$) on the available forage, grazing, finishing, or overall performance. The unsupplemented cattle gained more than anticipated during the grazing phase (2.25 lb per head daily), which resulted in supplementation not being beneficial. The only difference noted in the bermudagrass study was that steers not supplemented during the grazing phase had less ($P < 0.05$) external fat at slaughter than steers supplemented with DDG.

Under the conditions of this study, it appears that supplementation of stocker cattle grazing smooth bromegrass pasture with DDG at 0.5% of their bodyweight would provide the most efficient conversion of supplement into additional bodyweight gain and likely produce the greatest return on dollars invested in supplement. There was no apparent benefit of supplementing yearling cattle grazing bermudagrass pasture with DDG in the study conducted in 2006. This study will be continued for at least one more year.

Table 1. Effect of Supplementation with Distiller's Dried Grains on Available Smooth Bromegrass Forage, Southeast Agricultural Research Center, 2005 and 2006.

	Level of Distiller's Grains (%BW/hd/day)			
	0	0.5	1.0	
Date				Average
	- - - - - - - - - - - lb of dry matter/acre - - - - - - - - - - -			
4/6/05	1602	1595	1480	1559[a]
5/3/05	4205	4040	4098	4114[b]
6/2/05	4241	4470	4470	4394[b]
6/28/05	9954	10107	10753	10271[c]
7/26/05	9680	9522	10349	9851[c]
8/23/05	7285	7378	7229	7297[d]
9/22/05	6844	6872	6983	6900[d,e]
10/17/05	6189	6315	6231	6245[e]
2005 Season Average	6250	6287	6449	6329
4/14/06	2015	2192	2100	2102[a]
5/11/06	4996	4847	5065	4969[b]
6/6/06	5468	5657	5454	5526[c]
7/5/06	4197	4578	4160	4312[d]
8/1/06	3982	3894	3693	3856[e]
8/29/06	3567	4025	3519	3704[e]
9/20/06	2923	2585	3364	2960[f]
2006 Season Average	3878	3908	3968	3918

[a,b,c,d,e,f] Means within a column within the same year with the same letter are not significantly different ($P < 0.05$).

Table 2. Effect of Supplementing Steers Grazing Smooth Bromegrass Pastures with Distiller's Dried Grains on Grazing and Subsequent Finishing Performance, Southeast Agricultural Research Center, 2005.

	Level of Distiller's Grains (%BW/hd/day)		
Item	0	0.5	1.0
Grazing Phase (196 days)			
No. of head	11	12	12
Initial wt., lb	435	438	437
Final wt., lb	739[a]	853[b]	907[c]
Gain, lb	304[a]	416[b]	469[c]
Daily gain, lb	1.55[a]	2.12[b]	2.39[c]
Gain/acre, lb	243[a]	332[b]	375[c]
Total DDG consumption, lb/head	0	650	1308
Average DDG consumption, lb/head/day	0	3.3	6.7
DDG, lb/additional gain, lb	-	5.8	7.9
Finishing Phase (126 days)			
Beginning wt., lb	739[a]	853[b]	907[c]
Ending wt., lb	1225[a]	1317[b]	1375[b]
Gain, lb	486	464	468
Daily gain, lb	3.85	3.68	3.72
Daily DM intake, lb	26.1	26.6	28.0
Feed/gain	6.78[a]	7.23[a,b]	7.52[b]
Hot carcass wt., lb	747[a]	805[b]	848[c]
Dressing %	61	61	62
Backfat, in	0.52	0.62	0.68
Ribeye area, in^2	13.2	13.4	13.5
Yield grade	2.8	3.2	3.5
Marbling score	SM^{38}	SM^{35}	SM^{69}
% Choice	83	83	83
Overall Performance (Grazing + Finishing) (322 days)			
Gain, lb	790[a]	879[b]	938[b]
Daily gain, lb	2.45[a]	2.73[b]	2.91[b]

[a,b,c]Means within a row with the same superscript are not significantly different ($P < 0.05$).

Table 3. Effect of Supplementing Steers Grazing Smooth Bromegrass Pastures with Distiller's Dried Grains on Grazing and Subsequent Finishing Performance, Southeast Agricultural Research Center, 2006.

Item	Level of Distiller's Grains (%BW/hd/day) 0	0.5	1.0
Grazing Phase (161 days)			
No. of head	12	12	12
Initial wt., lb	484	484	484
Final wt., lb	746[a]	828[b]	837[b]
Gain, lb	262[a]	344[b]	353[b]
Daily gain, lb	1.63[a]	2.14[b]	2.19[b]
Gain/acre, lb	209[a]	275[b]	282[b]
Total DDG consumption, lb/head	0	539	1062
Average DDG consumption, lb/head/day	0	3.3	6.6
DDG, lb/additional gain, lb	-	6.6	11.7
Finishing Phase (126 days)			
Beginning wt., lb	746[a]	828[b]	837[b]
Ending wt., lb	1215[a]	1308[b]	1277[a,b]
Gain, lb	469	480	440
Daily gain, lb	3.72	3.81	3.50
Daily DM intake, lb	26.2	27.2	27.7
Feed/gain	7.09	7.14	7.93
Hot carcass wt., lb	730[a]	791[b]	771[a,b]
Dressing %	60	61	60
Backfat, in	0.51	0.52	0.52
Ribeye area, in^2	12.0	12.3	12.6
Yield grade	3.1	3.3	3.1
Marbling score	SM^{33}	SM^{36}	SM^{69}
% Choice	58	50	58
Overall Performance (Grazing + Finishing) (287 days)			
Gain, lb	731[a]	824[b]	793[a,b]
Daily gain, lb	2.55[a]	2.87[b]	2.76[a,b]

[a,b,c] Means within a row with the same superscript are not significantly different ($P < 0.05$).

Table 4. Effect of Supplementing Steers Grazing Bermudagrass Pastures with Distiller's Dried Grains on Grazing and Subsequent Finishing Performance, Southeast Agricultural Research Center, 2006.

Item	Level of Distiller's Grains (%BW/hd/day) 0	0.5	1.0
Grazing Phase (89 days)			
No. of head	10	15	15
Initial wt., lb	749	749	749
Final wt., lb	950	954	988
Gain, lb	200	205	239
Daily gain, lb	2.25	2.30	2.68
Gain/acre, lb	200	205	239
Total DDG consumption, lb/head	0	382	756
Average DDG consumption, lb/head/day	0	4.3	8.5
DDG, lb/additional gain, lb	-	76.4	19.4
Finishing Phase (85 days)			
Beginning wt., lb	950	954	988
Ending wt., lb	1283	1282	1290
Gain, lb	333	328	302
Daily gain, lb	3.92	3.86	3.55
Daily DM intake, lb	25.5	25.1	25.2
Feed/gain	6.52	6.53	7.15
Hot carcass wt., lb	756	775	786
Dressing %	59	60	61
Backfat, in	0.34^{a}	0.46^{b}	0.45^{b}
Ribeye area, in^2	11.8	12.6	12.2
Yield grade	2.8	3.0	3.1
Marbling score	SL^{99}	SM^{26}	SM^{61}
% Choice	50	47	53
Overall Performance (Grazing + Finishing) (174 days)			
Gain, lb	533	533	541
Daily gain, lb	3.06	3.06	3.11
Available Forage Dry Matter, lb/acre			
--Date--			
6/14/06	2659	2516	2478
7/7/06	2250	3486	1130
8/4/06	3761	3034	4327
9/5/06	2777	2190	3377
Season Average	2862	2806	2828

[a,b,c] Means within a row with the same superscript are not significantly different ($P < 0.05$).

EVALUATION OF VARIOUS MANAGEMENT ALTERNATIVES FOR NO-TILL SEEDING OF WINTER CEREALS INTO BERMUDAGRASS SOD

Lyle W. Lomas and Joseph L. Moyer

Summary

Thirty-two dry pregnant cows (1,224 lb) were used to compare grazing performance between wheat and a mixture of wheat and rye that was no-till seeded into bermudagrass sod and subsequent performance from grazing bermudagrass in 2005. In 2006, 36 stocker steers (648 lb) were used to evaluate the effect of burning bermudagrass residue prior to no-till planting wheat on grazing gains and gain/acre. Cows grazing wheat had higher ($P < 0.05$) gains than those grazing a mixture of wheat and rye during the winter cereal phase. However, gains during the bermudagrass phase and overall were similar ($P > 0.05$) between cows grazing pastures that were planted with wheat or a mixture of wheat and rye. Burning bermudagrass residue before planting wheat resulted in similar ($P > 0.05$) gains, but higher ($P < 0.05$) stocking rates and gain/a than the unburned control.

Introduction

Bermudagrass is a productive forage species when intensively managed. However, it has periods of dormancy that limit its use during much of the year. No-till seeding of winter cereals into bermudagrass sod can be an effective way to extend the grazing season and increase beef production from bermudagrass acres. Winter cereals can produce a large quantity of high quality forage which result in some of the highest gains attainable by grazing cattle in early spring. Seeding winter cereals into bermudagrass sod helps control and/or utilize winter annual weeds and alleviates problems with mud that are frequently encountered when wheat is planted on tilled soil in areas of high rainfall. However, no-till seeding of wheat in bermudagrass sod usually results in poorer stands and less fall cereal growth compared to wheat planted alone in tilled soil. Removal of residue by burning could improve early-season forage production by eliminating the apparent inhibition of nutrients and moisture by bermudagrass residue. The purpose of this study was to compare wheat and a wheat-rye mixture and to evaluate the effects of fall burning before no-till planting wheat in bermudagrass sod for their effects on forage production and grazing cattle performance.

Experimental Procedures

Eight 5-acre ‘Hardie’ bermudagrass pastures were randomly assigned to be no-till seeded with either ‘Jagger’wheat (89 lb/a) or a mixture of ‘Jagger’ wheat (50 lb/a) and ‘Oklon’ rye (50 lb/a) on September 20, 2004, in a completely randomized design with four replications. All pastures were fertilized with 50 lb/a of N on March 8, 2005, 100-40-30 lb/a of N-P_2O_5-K_2O on May 19, 2005, and 50 lb/a of N on July 5, 2005.

Thirty-two pregnant fall-calving cows of predominately Angus breeding with an average initial weight of 1,224 lb were weighed on consecutive days, stratified by weight, and allotted randomly to these pastures on March 30, 2005, and grazed winter cereals until May 24 (55 days). Cows remained on the same respective pastures and grazed bermudagrass until August 17, 2005 (85 days). Cows were weighed on two consecutive days at the end of the winter cereal and bermudagrass phases.

Eight 5-acre ‘Hardie’ bermudagrass pastures were randomly assigned to burned or unburned control treatments in a completely randomized design with four replications and were no-till seeded with ‘Jagger’ wheat (89 lb/a). Wheat was seeded in the four unburned control pastures on September 26-27, 2005, and in the burned pastures on November 8, 2005. Two pastures were burned on November 4, 2005, and the other two were burned on November 7, 2005. On January 19, 2006, all pastures received 50 lb/a of N.

Twenty-four mixed black steers (648 lb) were weighed on consecutive days, stratified by weight, and allotted randomly to these pastures on March 29, 2006. Additional cattle were added and removed from pastures as needed using the “put and take” method in order to match cattle numbers with available forage. Cattle were weighed on two consecutive days and removed from pasture on June 2, 2006 (65 days).

During both years, cattle were weighed and forage availability measured approximately every 28 days with a disk meter calibrated for the forage being grazed. Cattle were treated for internal and external parasites before being turned out to pasture and later were vaccinated for protection from pinkeye. Cattle had free access to commercial mineral blocks that contained 12% calcium, 12% phosphorus, and 12% salt.

Results and Discussion

Performance of cows that grazed wheat or a mixture of wheat and rye are presented in Table 1. Pastures seeded with wheat produced higher ($P < 0.05$) cattle gains and more ($P < 0.05$) gain/acre than pastures seeded with a mixture of wheat and rye despite having lower ($P < 0.05$) available forage. This may have been due, at least in part, to the rye maturing earlier than the wheat and cattle being reluctant to consume the mature rye forage. However, subsequent gains and gain/acre during the bermudagrass phase and overall (winter cereal + bermudagrass) were similar ($P > 0.05$) between pastures that were seeded with wheat or a mixture of wheat + rye.

The effect of burning bermudagrass residue before planting wheat on performance of grazing steers is presented in Table 2. Gains were similar ($P > 0.05$) between burned and control pastures. Average available forage was higher ($P < 0.05$) for the unburned control pastures primarily due to the presence of dead bermudagrass residue from the prior year. However, burned pastures produced more useable wheat forage which allowed for a higher ($P < 0.05$) stocking rate and more ($P < 0.05$) gain/acre.

Based on the results of this study, there was no advantage to no-till planting a blend of wheat and rye compared to seeding wheat alone in bermudagrass sod. However, in years with a greater amount of winter and spring moisture, a mixture of wheat and rye might be more advantageous. Burning bermudagrass residue before planting wheat supported a higher ($P < 0.05$) stocking rate and produced more ($P < 0.05$) gain/acre than the unburned control.

Table 1. Comparison of Wheat and a Wheat-Rye Mixture No-Till Seeded into Bermudagrass Sod on Performance of Grazing Cows, Southeast Agricultural Research Center, 2005.

Item	Wheat	Wheat + Rye
Winter Cereal Phase (55 days)		
No. of head	16	16
Beginning wt., lb	1224	1224
Ending wt., lb	1458[a]	1421[b]
Gain, lb	234[a]	197[b]
Daily gain, lb	4.25[a]	3.58[b]
Gain/acre, lb	187[a]	157[b]
Bermudagrass Phase (85 days)		
Beginning wt., lb	1458[a]	1421[b]
Ending wt., lb	1629	1599
Gain, lb	178	171
Daily gain, lb	2.01	2.09
Gain/acre, lb	137	142
Overall Performance (140 days)		
Gain, lb	405	375
Daily gain, lb	2.89	2.68
Gain/acre, lb	324	300
Available Forage Dry Matter, lb/acre		
--Date--		
3/30/05	1923	2349
4/27/05	1826[a]	2557[b]
5/25/05	1752	2066
6/22/05	2836	3035
7/19/05	3440	3626
8/16/05	3374[a]	4153[b]
Season Average	2525[a]	2964[b]

[a,b]Means within a row with the same letter are not significantly different ($P < 0.05$).

Table 2. Effect of Burning on Performance of Steers Grazing Wheat Pasture that was No-Till Seeded into Bermudagrass Sod, Southeast Agricultural Research Center, 2006 (65 days).

Item	Control	Burned
No. of head	12	24
Beginning wt., lb	648	648
Ending wt., lb	781	798
Gain, lb	133	151
Daily gain, lb	2.05	2.32
Gain/acre, lb	80[a]	184[b]
Average stocking rate, head/acre	0.6[a]	1.2[b]
Available Forage Dry Matter, lb/acre		
--Date--		
3/31/06	3200[a]	787[b]
4/27/06	2373	1738
5/24/06	2545	1665
Season Average	2706[a]	1396[b]

[a,b]Means within a row with the same letter are not significantly different (P < 0.05).

SOUTHEAST AGRICULTURAL RESEARCH CENTER
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ALFALFA VARIETY PERFORMANCE IN SOUTHEASTERN KANSAS

Joseph L. Moyer

Summary

A 13-line alfalfa test seeded in 2005 was cut three times in 2006. Yields were greater ($P < 0.05$) from 'FSG505' than from 'Integrity', 'AA108E', and 'FSG408DP'. Two-year production was greater from FSG505 than from Integrity, AA108E, and '6420'.

Introduction

Alfalfa can be an important feed and cash crop on some soils in southeastern Kansas. The worth of a particular variety is determined by many factors, including its pest resistance, adaptability, longevity under specific conditions, and productivity.

Experimental Procedures

A 13-line alfalfa test was seeded (15 lb/a) on April 14, 2005, at the Mound Valley Unit (Parsons silt loam). Plots were fertilized with 20-50-200 lb/a of N-P_2O_5-K_2O on March 28. Harvests were taken on May 15, June 14, and July 18. No treatment for insects or disease was necessary.

Results and Discussion

Conditions were very dry throughout the 2006 growing season (see Weather Summary), resulting in only three cuttings. Yields of the first cutting in 2006 were significantly ($P < 0.05$) greater for 'Perry' and FSG505 than for 'Kanza', AA108E, WL 357HQ, and FSG408DP (Table 1). Second-cut yields were greater for FSG505 than for AA108E and Integrity. Third-cut yields were greater from WL 357HQ and FSG505 than for AA108E and Integrity. Total 2006 yields were greater from FSG505 than from Integrity, AA108E, and 6420 (Table 1). Two-year total yields were greater for FSG505 than for Integrity, AA108E, and 6420.

Statewide alfalfa performance test results can be found at http://www.ksu.edu/kscpt/.

Table 1. Total and 2006 Forage Yields (tons/a @ 12% moisture) for the 2005 Alfalfa Variety Test, Mound Valley Unit, Southeast Agricultural Research Center.

Source	Entry	5/15	6/14	7/18	2006 Total	2-Yr Total
AgriPro Biosciences, Inc	AA112E	$2.19^{a,b,c}$	$1.15^{a,b}$	$0.49^{a,b,c}$	$3.82^{a,b}$	$8.56^{a,b}$
AgriPro Biosciences, Inc	AA108E	2.00^{c}	0.83^{b}	0.37^{c}	3.20^{b}	7.55^{b}
AgriPro Biosciences, Inc	Integrity	$2.08^{b,c}$	0.83^{b}	0.38^{c}	3.28^{b}	7.37^{b}
Allied	FSG505	$2.34^{a,b}$	1.34^{a}	$0.56^{a,b}$	4.25^{a}	9.68^{a}
Allied	FSG408DP	2.06^{c}	$0.99^{a,b}$	$0.47^{a,b,c}$	3.52^{b}	$8.18^{a,b}$
Cal/West	CW 15030	$2.20^{a,b,c}$	$1.16^{a,b}$	$0.48^{a,b,c}$	$3.84^{a,b}$	$8.38^{a,b}$
Cimarron USA	Cimarron VL400	$2.15^{a,b,c}$	$1.06^{a,b}$	$0.40^{a,b,c}$	$3.62^{a,b}$	$8.44^{a,b}$
Garst Seed	6420	$2.11^{a,b,c}$	$1.04^{a,b}$	$0.48^{a,b,c}$	$3.64^{a,b}$	8.00^{b}
Garst Seed	6530	$2.13^{a,b,c}$	$1.15^{a,b}$	$0.39^{b,c}$	$3.68^{a,b}$	$8.48^{a,b}$
Johnston Seed Co.	Good as Gold II	$2.24^{a,b,c}$	$1.09^{a,b}$	$0.50^{a,b,c}$	$3.82^{a,b}$	$8.62^{a,b}$
W-L Research	WL 357 HQ	2.04^{c}	$1.01^{a,b}$	0.57^{a}	$3.61^{a,b}$	$8.62^{a,b}$
Kansas AES & USDA	Kanza	1.98^{c}	$1.09^{a,b}$	$0.50^{a,b,c}$	$3.57^{a,b}$	$8.44^{a,b}$
Nebraska AES & USDA	Perry	2.36^{a}	$1.00^{a,b}$	$41^{a,b,c}$	$3.78^{a,b}$	$8.68^{a,b}$
Average		2.14	1.06	0.46	3.66	8.38

^{a,b,c} Means within a column followed by the same letter are not significantly ($P < 0.05$) different, according to Duncan's test.

Table 2. Four-year Forage Yields (2001-2004), and 2006 Stand Ratings in the 2001 Alfalfa Variety Test, Mound Valley Unit, Southeast Agricultural Research Center.

Source	Entry	4-Yr Total Yield	2006 Stand Rating
		- tons/a @ 12%	- - - 0 to 5[1] - - -
AgriPro Biosciences, Inc	Dagger + EV	19.39[ab,c]	3.3[b,c,d]
Allied	350	18.39[b,c]	3.3[b,c,d]
Allied	400SCL	18.75[b,ce]	3.7[a,b,,c,d]
Croplan Genetics	5-Star	19.38[a,b,c]	3.3[b,c,d]
Croplan Genetics	Rebound 4.2	18.95[b,c]	4.3[a,b]
Dairyland	HybriForce-400	19.80[a,b]	4.0[a,b,,c]
Garst Seed	6420	20.56[a]	4.7[a]
Midwest Seed	Pawnee	18.55[b,c]	3.0[c,d]
Pioneer	54V54	19.08[a,b,c]	3.7[a,b,,c,d]
W-L Research	WL 327	19.81[a,b]	3.7[a,b,,c,d]
W-L Research	WL 342	19.39[a,b,c]	3.3[b,,c,d]
Kansas AES & USDA	Kanza	18.18[c]	2.7[,d]
Nebraska AES & USDA	Perry	19.11[a,b,c]	3.0[c,d]
Average		19.18	3.5

[a,b,c,d] Means within a column followed by the same letter are not significantly ($P < 0.05$) different, according to Duncan's test.

EVALUATION OF TALL FESCUE CULTIVARS

Joseph L. Moyer

Summary

Spring 2006 yields of the 2003 trial were higher for 'KY 31' HE and 'FTF-24' than for any of 14 other entries. 'Enhance' and 'FA 2860' had lower yield than any of 10 other entries. Three-year production for FTF-24 was greater than for any of 10 other cultivars.

Introduction

Tall fescue (*Festuca arundinacea* Schreb.) is the most widely grown forage grass in southeastern Kansas. The abundance of this cool-season perennial grass is due largely to its vigor and tolerance to the extremes in climate and soils of the region. Tolerance of the grass to stresses and heavy use is partly attributable to its association with a fungal endophyte, *Neotyphodium coenophialum* (Morgan-Jones and Gams) Glenn, Bacon, and Hanlin, but most ubiquitous endophytes are also responsible for the production of substances toxic to some herbivores, including cattle, sheep, and horses.

Recent research efforts have identified endophytes that purportedly lack toxins but augment plant vigor. Such endophytes have been inserted into tall fescue cultivars adapted to the United States and are represented in this test. Other cultivars are either fungus-free or contain a ubiquitous form of the endophyte. Such combinations need to be tested in this western fringe of the United States' tall fescue belt.

Heading date indicates relative maturity of the cultivars. Because reproductive growth is largely stem production, early heading should generally indicate an earlier decline in forage quality.

Experimental Procedures

All trials were seeded at the Mound Valley Unit, Southeast Agricultural Research Center, with a cone planter in 10-inch rows on Parsons silt loam soil (Mollic albaqualf). Plots were 30 ft x 5 ft, arranged in four randomized complete blocks. The tests were seeded with 19 lb/a of pure, live seed on September 17, 2003.

Fertilizer to supply 140-50-60 lb/a of N-P_2O_5-K_2O was applied to all plots on March 28, 2006. Harvest was performed for a strip 3-ft wide and 15-20 ft long from each plot, cut once to a 3-in. height with a flail-type harvester after all plots were headed (May 16). Practically no regrowth occurred because of dry conditions. A forage subsample was collected and dried at 140° F for moisture determination, and forage was removed from the rest of the plot at the same height.

Results and Discussion

Spring 2006 forage yield of entries in the 2003 trial was greater ($P < 0.05$) for Ky 31 HE than for 15 of the other entries. It and FTF-24 had greater yield than any of 14 other entries. Enhance and FA2860 had lower yield than any of 10 higher-producing entries.

Total 3-year production for 2004-2006 for FTF-24 was greater than for any of 10 other cultivars. Select had lower yield than that of FTF-24, FTF-25, or FA 117.

Table 1. Forage Yield of Tall Fescue Cultivars Seeded in 2003, Mound Valley Unit, Southeast Agricultural Research Center, 2006.

Cultivar	Forage Yield 2006[1]	2005	2004	3-Year Total
	------ ----- tons/a@12% moisture --------------			
FTF-24	1.36	4.63	5.11	11.10
FTF-25	1.25	4.61	4.80	10.67
AU Triumph	1.30	4.20	4.15	9.64
Stockman	1.24	4.28	4.85	10.37
Tuscany II	1.22	4.41	4.57	10.20
Montendre	1.15	4.20	4.13	9.48
ArkPlus [2]	1.30	4.13	4.83	10.26
Jesup MaxQ [2]	1.14	4.18	4.80	10.12
Select	1.18	3.72	4.34	9.24
Enhance	1.02	4.10	4.19	9.31
FA 111	1.16	3.84	4.37	9.36
FA 117	1.29	4.39	4.94	10.62
FA 120	1.24	4.29	4.48	10.02
FA 121	1.22	4.43	4.85	10.50
FA 2845	1.16	3.92	4.30	9.38
FA 2846	1.08	3.94	4.44	9.46
FA 2847	1.18	4.36	4.75	10.28
FA 2848	1.17	4.32	4.46	9.94
FA 2849	1.11	3.94	4.46	9.51
FA 2850	1.18	4.28	4.65	10.10
FA 2860	1.05	4.05	4.61	9.71
FA 2861	1.16	4.08	4.91	10.14
Ky 31 HE [3]	1.38	4.10	4.62	10.10
Ky 31 LE [3]	1.09	4.04	4.40	9.52
Average	1.19	4.18	4.58	9.96
LSD (0.05)	0.14	0.47	0.82	1.09

[1]One cutting obtained in 2006, on May 16.
[2]Contains proprietary novel endophyte.
[3]LE = Low-endophyte seed (0-2% infected); HE = High-endophyte seed (80% infected).

FORAGE PRODUCTION OF SEEDED BERMUDAGRASS CULTIVARS

Joseph L. Moyer and Charles M. Taliaferro[1]

Summary

In plots seeded in 2002, forage yields in 2006 and for the five-year total were higher for 'Cheyenne' than for any of the other entries. In plots planted in 2005, yield in 2006 was higher for 'KF 111' than for seven of the other 13 entries.

Introduction

Bermudagrass can be a high-producing, warm-season perennial forage for eastern Kansas when not affected by winterkill. Producers in southeastern Kansas have profited from the use of more winter-hardy varieties that produced more than common bermudas. Seeded types may offer cost savings or other advantages in marginal areas. Further developments in bermudagrass breeding should be monitored to speed adoption of improved, cold-hardy types.

Experimental Procedures

2002 Seeding

Five bermudagrass entries were seeded at 8 lb/a of pure, live seed for hulled seed or 5 lb/a of hulless seed at the Mound Valley Unit of the Southeast Agricultural Research Center on May 7. In 2006, plots were fertilized on May 6 with 125-50-60 lb/a of N-P_2O_5-K_2O, and on June 26 with 50 lb/a of N as ammonium nitrate.

Plots were cut June 14; then drought curtailed midsummer regrowth. Subsamples were collected from the 20 x 3 ft strips taken for yield to determine moisture content of forage.

2005 Planting

Seeded entries were planted at the rates used in the 2002 planting on June 21, but 'Midland 99' plugs were planted two weeks later. Fertilization was performed the same as the 2002 seeding. Plots were harvested as the earlier plots, on June 21 and August 4.

Results and Discussion

2002 Seeding

Spring greenup on April 11 was greater for 'Wrangler' than for any of the other cultivars and less for 'Cherokee' than for any except Cheyenne (Table 1). Forage production by June 21 was greater ($P < 0.05$) for 'Johnston's Gold' than for Cherokee. Differences among the other cultivars were not significant. Total 5-year production was higher for Cheyenne than for all other cultivars (Table 1).

2005 Planting

Spring greenup on April 11 was greater for Wrangler than for any other cultivar, and for 'Rialta' than for the other 12 entries (Table 2). First-cut yields of Wrangler and Rialta were also greater than for the other cultivars.

The second-cut yield of KF 111 was greater

[1]Southeast Agricultural Research Center, and Emeritus Professor, Plant and Soil Sciences Department, Oklahoma State University, Stillwater, respectively.

than that of the other eight cultivars. Midland 99 yield was greater than yield of Wrangler, Rialta, and Cherokee (Table 2). Total yield in the drought year of 2006 was higher for KF 111 and Midland 99 than for six other cultivars. Two-year production of KF 111 was higher than that of seven of the other cultivars (Table 2).

Table 1. Spring Greenup Rating and Forage Yield in 2006 and for Five Years of Bermudagrass Seeded in 2002, Mound Valley Unit, Southeast Agricultural Research Center.

		Greenup[1]	Forage Yield	
Entry		4/11	6/21/2006	5-Yr Total
			- tons per acre @ 12% moisture -	
Cherokee		1.0	0.95	14.58
Guymon		1.8	1.18	14.69
Wrangler		3.8	1.34	14.18
Johnston's Gold		2.5	1.41	14.54
Cheyenne		1.0	1.37	18.91
	Average	1.9	1.25	15.38
	LSD 0.05	0.8	0.41	1.54

[1]Spring greenup rating 0 to 5, where 0 = no green showing and 5 = total canopy green on April 11.

Table 2. Spring Greenup Rating and Forage Yield in 2006 and for Two Years of Bermudagrass Seeded in 2005, Mound Valley Unit, Southeast Agricultural Research Center.

		Green-	Forage Yield			
		up[1]	2006			2-Yr
Source	Entry	4/11	6/21	8/4	Total	Total
			- tons per acre @ 12% moisture -			
K-F Seeds	KF 888	0.3	1.88	1.65	3.53	5.31
K-F Seeds	KF 194	0.0	2.37	1.61	3.98	6.40
K-F Seeds	KF 111	0.3	2.66	2.22	4.88	6.88
K-F Seeds	KF 222	0.4	1.94	1.67	3.61	5.75
K-F Seeds	SG 19	0.6	2.62	1.58	4.20	6.12
Genetic Seed & Chemical	Sungrazer	0.3	2.40	1.83	4.23	6.28
Genetic Seed & Chemical	Sungrazer I	0.0	1.88	1.99	3.86	5.96
Genetic Seed & Chemical	Sungrazer Plus	0.0	1.68	1.88	3.56	6.34
Nixa Hardware & Seed	Cherokee	0.1	1.67	1.40	3.07	4.48
Genetic Seed & Chemical	Jackpot	0.3	2.36	1.84	4.20	6.32
Oklahoma State University	Wrangler	4.7	3.76	1.06	4.82	6.37
Oklahoma State University	Midland 99[2]	0.8	2.86	2.00	4.86	4.86
Johnston Seed	Riata	3.5	3.50	1.09	4.59	5.58
DLF International Seeds	CIS-CD 4	1.2	2.24	1.72	3.96	4.66
	Average	0.9	2.42	1.68	4.10	5.81
	LSD 0.05	0.7	0.53	0.43	0.77	0.79

[1]Spring greenup rating 0 to 5, where 0 = no green showing and 5 = total canopy green on April 11.
[2] Sprigged cultivar.

PERFORMANCE OF WARM-SEASON PERENNIAL FORAGE GRASSES

Joseph L. Moyer and Kenneth W. Kelley

Summary

Twelve warm-season perennial grasses seeded in spring 2001 were harvested for forage production on July 13, 2006. After application of 60 lb/a of nitrogen, production averaged 2.28 tons/a. 'Kaw' big bluestem produced 3.2 tons/a of forage, which was more ($P < 0.05$) than seven other entries.

Introduction

Warm-season perennial grasses can fill a production void left in forage systems by cool-season grasses. Reseeding improved varieties of certain native species, such as big bluestem and indiangrass, could help fill that summer production "gap." Other warm-season grasses, such as sand bluestem (*Andropogon hallii* Hack.), are used in other areas, and may have potential for certain sites in southeastern Kansas.

Experimental Procedures

Warm-season grass plots (30 ft x 5 ft) were seeded with a cone planter in 10-inch rows on May 10, 2001, at the Columbus Unit, Southeast Agricultural Research Center. Fifty lb/a of diammonium phosphate (18-46-0) were applied with the seed material to facilitate movement through the planter. Big bluestem and sand bluestem entries were seeded at 10 lb/a pure, live seed (PLS). Indiangrasses were seeded at 8 lb PLS/a. Entries were obtained from the USDA-NRCS Plant Materials Center in Manhattan; the USDA-ARS Southern Plains Research Station, Woodward, Oklahoma; and the USDA-ARS Forage Research Unit, Lincoln, Nebraska. Plots were sprayed with 2,4-D to control weeds in 2001. In 2002, plots were burned in spring and clipped in summer. Plots were burned each spring from 2003 to 2006. Fifty lb/a of nitrogen as urea were applied to all plots on April 5, 2006, as well as in 2005. A 20 ft x 3 ft area was harvested in 2003, 2004, and 2005, and on July 13, 2006, with a Carter flail harvester at a height of 2 to 3 inches. The remainder of the area was clipped to the same height.

Results and Discussion

Forage yields from the warm-season cultivar test after nitrogen fertilization are shown in Table 1. Stands had improved since 2004, and yields averaged 3.20 tons/a. Kaw big bluestem and 'Kaw C3 Syn 2', an experimental synthetic from Kaw yielded more ($P < 0.05$) forage than three of the indiangrass entries, two sand bluestems, and two other big bluestem entries. 'Osage' indiangrass yielded more than the other indiangass entries, a big bluestem experimental, and two sand bluestems.

Table 1. Forage Yields of Warm-season Grass Cultivars, Columbus Unit, Southeast Agricultural Research Center, 2005.

Species	Cultivar	Forage Yield	
		2006	4-Year Total
		- tons/a @ 12% moisture -	
Big bluestem	Kaw	3.20	8.84
	Pawnee C3 Syn. 2	2.55	7.70
	Kaw C3 Syn. 2	3.23	8.73
	TS Intermediate	3.06	7.84
	TS Early	2.27	4.99[1]
Sand bluestem	WW (Woodward)	2.99	7.74
	AB Medium	2.26	6.03
	CD Tall	2.20	6.72
Indiangrass	Oto C3 Syn. 2	2.32	6.74
	Holt x Oto Late C3 Syn. 2	2.29	7.18
	NE 54 C2	2.40	8.04
	Osage	3.05	8.75
LSD (0.05)		0.61	1.52

[1]Poor stand; some of the forage composed of weedy species.

GROWING ANNUAL CROPS FOR SUMMER FORAGE

Joseph L. Moyer and Kenneth J. Moore[1]

Summary

Forage yields of millet and sudangrass at the vegetative stage were higher ($P < 0.05$) than those of other species, followed by corn, then oat. Yield at the reproductive stage was highest for corn, followed by millet. Regrowth after cutting at the vegetative stage was greater for sudangrass than for crabgrass, with millet intermediate, and nil for the other species. Sudangrass and crabgrass produced a similar amount of forage after cutting at the reproductive stage, followed by millet. Total forage production from vegetative harvests was greater for sudangrass and millet than for other species, whereas corn produced the most total forage from harvests at the reproductive stage, followed by millet and sudangrass.

Introduction

Pastures in eastern Kansas consist mainly of cool-season grasses that produce mostly in the spring and early summer, but nutritional needs of stockers and cow-calf pairs generally increase throughout the season. Typical management undergrazes early growth of cool-season pastures for use when production declines and demand increases. The problem with this approach is that as ungrazed forage matures, its quality declines. A complementary system that uses annuals for summer grazing would provide high-quality forage when quality of cool-season grasses is lowest. To design such a system, basic information relating to growth and development of annual species in each area is needed. The objective of this research is to evaluate the adaptability, yield, and quality of summer annual forages at specific sites on a regional basis for use in complementary forage systems.

Experimental Procedures

Oat, Italian ryegrass, berseem clover, corn, and forage rape were planted in blocks with four replications at designated rates when soil temperature reached about 50^0F on March 29, 2006. Sudangrass, pearl millet, soybean, and crabgrass were planted after soil temperature reached ca. 59^0F on May 17. Fertilizer (100-50-60 lb/a of N-P_2O_5-K_2O) was applied preplant. Separate portions of the plots were harvested initially at one of two growth stages: mid-vegetative and early reproductive (Table 1). Regrowth was harvested from previously harvested strips if sufficient forage was produced. Subsamples were used for moisture determination, then ground for analysis.

[1]Southeast Agricultural Research Center and Department of Agronomy, Iowa State University, Ames, respectively.

Table 1. Harvest dates for crops at vegetative and reproductive stages.

Species	Vegetative	Reproductive
Oat	5/26	6/9
Ryegrass	6/2	6/14
Clover	6/2	6/14
Forage rape	6/2	6/21
Sudangrass	6/30, 7/31, 10/5	7/5, 8/29
Millet	6/30, 7/31	7/17, 10/5
Soybean	6/30	8/4
Corn	6/26	7/17
Crabgrass	6/30, 7/17, 8/29	7/5, 7/31, 10/5

Results and Discussion

When cut at the mid-vegetative stage, before reproductive growth had begun, pearl millet and sudangrass produced more ($P < 0.05$) forage than the other species (Table 2). Corn and oat produced more forage than four of the other species, according to Duncan's test.

At the reproductive stage (tassel emergence), corn produced more forage ($P < 0.05$) than any other species. Millet and sudangrass produced more at heading than all other species except for oat, which, in turn yielded more than crabgrass, berseem clover, and rape. Soybean produced more forage than crabgrass, but drought limited production of all species at that stage.

Regrowth, when it occurred, was severely limited by drought. Similar harvestable amounts of regrowth were produced after the previous vegetative cutting by sudangrass and millet, with less ($P < 0.05$) produced by crabgrass than sudangrass. After cutting at the reproductive stage, more regrowth was produced by sudangrass and crabgrass than by millet (Table 2).

Total forage production from cutting at the vegetative stage was greater ($P < 0.05$) for sudangrass and millet than for all other species (Table 2). In turn, crabgrass produced more total forage at that stage than all other species except for corn. Total yield of corn was greater than yield of the remaining species, except for oat.

When cutting at the reproductive stage, total forage production was greatest for corn ($P < 0.05$, Table 2). Millet and sudangrass each produced more than all remaining species. Conversely, total production of berseem clover, ryegrass, and rape were less than production of all other species except soybean when cut at the reproductive stage.

Table 2. Yield of Forage in Summer 2006 from Nine Annual Species, Mound Valley Unit, Southeast Agricultural Research Center.

Species	Cultivar	Cut at Vegetative Stage			Cut at Reproductive Stage		
		First Growth	Re-growth	Total	First Growth	Re-growth	Total
		- - - - - - - - - tons/a @ 12% moisture - - - - - - - - -					
Oat	Striker	1.66	- -	1.66	2.98	- -	2.98
Ryegrass	Feast II	1.08	- -	1.08	2.06	- -	2.06
Berseem	Joe Burton	0.94	- -	0.94	2.01	- -	2.01
Forage rape	Bonar	0.69	- -	0.69	2.17	- -	2.17
Sudangrass	Trudan 8	2.77	2.29	5.06	3.57	1.97	5.54
Pearl millet	Tifleaf III	2.90	2.00	4.90	4.85	0.77	5.62
Soybean	Derry	0.83	- -	0.83	2.65	- -	2.65
Corn	Garst 8315IT	2.04	- -	2.04	6.97	- -	6.97
Crabgrass	Red River	1.25	1.39	2.64	1.49	1.78	3.27
	Average	1.57	1.89	2.21	3.19	1.51	3.70
	LSD (0.05)	0.54	0.87	0.66	0.70	0.28	0.65

NITROGEN MANAGEMENT FOR CRABGRASS HAY PRODUCTION

Joseph L. Moyer and Daniel W. Sweeney

Summary

Fertilization of crabgrass with 50 lb/a of N resulted in less P < 0.05) forage in the first cutting and in total 2006 yield than fertilization with 100 or more lb/a. Split application resulted in less forage than a single application only in the first cutting. There were no yield differences in the second cutting, nor between sources of N.

Introduction

Warm-season grass is needed to fill a production void left in forage systems by cool-season grasses. Crabgrass could fill this niche by providing high quality forage in summer. Although an annual species, it is a warm-season grass that has the capacity to reseed itself. Nitrogen is needed by crabgrass for optimum production, but little is known about its needs or responses to different nitrogen management alternatives.

Experimental Procedures

The plot area at the Mound Valley Unit, Southeast Agricultural Research Center was fertilized with 0-60-60 lb/a of N-P_2O_5-K_2O on May 18, 2005. It was seeded with 5 lb of pure, live seed/a of 'Red River' crabgrass [*Digitaria ciliaris* (Retz.) Koel.] shortly thereafter using a Brillion seeder. Another 3 lb/a PLS of seed was broadcast in spring, 2006, another 0-60-60 lb/a of N-P_2O_5-K_2O was applied on April 5, 2006, and the plot area was rotary-hoed.

Nitrogen (N) treatments were rates, sources, and timing arranged in a 4x2x2 factorial, plus a check in four replications. Rates were 50, 100, 150, and 200 lb of N/a per year, sources were urea and ammonium nitrate, and timing was either all in a single application at the beginning of the growing season or split, with half applied initially and half after the first harvest.

Nitrogen was applied for the initial spring applications on June 8, 2005, and April 12, 2006. Growth was delayed in 2005, so only one harvest was obtained, on September 1. No second (split) application was made. In 2006, plots were harvested on June 26, 2006, and the split application was made the same day. The second cutting was made on September 18. Harvest was with a Carter flail cutter at a height of 2 to 3 inches. The remainder of the area was clipped at each harvest to the same height. A forage subsample was taken from each plot for moisture determination and forage analysis.

Results and Discussion

Forage yields in 2005 averaged 2.85 tons/a, with no difference due to treatments (data not shown). Yield for the first harvest in 2006 and total yield were significantly ($P < 0.05$) affected by N rate (Table 1). Treatment with 50 lb N/a of N yielded significantly less forage in both the first harvest and total yield than treatment with the higher N rates, which did not differ from one another.

Yields from the two sources of fertilizer N did not differ (data not shown). Time of fertilizer N application affected yield only for the first harvest (Table 1). The single application timing resulted in more forage than split application, probably because the split treatments had only received half their total amount of N prior to the first harvest, whereas the single application treatments received the full amount.

Table 1. Forage Yields of Crabgrass in Response to Nitrogen Management, Mound Valley Unit, Southeast Agricultural Research Center, 2006.

Nitrogen	Nitrogen	Forage Yield		
Rate	Timing	Cut 1	Cut 2	Total
lb/a		- - - - - - tons/a @ 12% moisture - - - - -		
50		1.12	1.02	2.14
100		1.65	1.08	2.73
150		1.73	1.16	2.89
200		1.86	0.88	2.74
LSD (0.05)		0.26	NS	0.24
Check		0.90	0.89	1.80
	Single	1.71	0.97	2.68
	Split	1.45	1.12	2.57
	LSD (0.05)	0.14	NS	NS

SOUTHEAST AGRICULTURAL RESEARCH CENTER
KANSAS STATE UNIVERSITY

NITROGEN MANAGEMENT FOR SEED AND RESIDUAL FORAGE PRODUCTION OF ENDOPHYTE-FREE AND ENDOPHYTE-INFECTED TALL FESCUE

Daniel W. Sweeney and Joseph L. Moyer

Summary

Dry conditions in 2006 resulted in overall low seed yields. N rates up to 100 lb/a produced about twice as much seed as with no fertilizer N. Forage aftermath yield was increased with increasing N rates up to 200 lb/a. Endophyte infection had no effect on yields of clean seed or aftermath forage.

Introduction

Nitrogen fertilization is important for fescue and other cool-season grasses, but management of nitrogen (N) for seed production is less defined. Endophyte-free tall fescue may need better management than infected stands. Nitrogen fertilization has been shown to affect forage yields, but data are lacking regarding the yield and quality of the aftermath remaining after seed harvest. The objective of this study was to determine the effects of timing and rate of N applied to endophyte-free and endophyte-infected tall fescue for seed and aftermath forage production.

Experimental Procedures

The experiment was established as a split-plot arrangement of a completely randomized block design with three replications. Whole plots were endophyte-free and endophyte-infected tall fescue. The subplots were a 3 × 5 factorial arrangement of fertilizer N timing and N rate. The three N timings were 100% in late fall (Dec. 1, 2003; Dec. 17, 2004; and Dec. 13, 2005), 100% in late winter (Feb. 26, 2004; Mar. 7, 2005; and Feb. 28, 2006), and 50% of N in late fall and 50% in late winter. The five N rates were 0, 50, 100, 150, and 200 lb/a. In all treatments, N fertilizer was broadcast applied as urea ammonium-nitrate (UAN) solution. Each fall, all plots received broadcast applications of 40 lb P_2O_5/a and 70 lb K_2O/a. Seed harvest was on June 7, 2004; June 15, 2005; and June 16, 2006 and forage aftermath was harvested on June 14, 2004; June 20, 2005; and June 20, 2006.

Results and Discussion

In 2006, dry conditions reduced seed yield to less than 40 lb/a. Although yields were low, clean seed production was increased with N rates up to 100 lb/a (Figure 1). However, this trend was more apparent in the split late-fall and late-winter application than when all N was applied in the fall or in the spring (interaction data not shown). Aftermath forage yields were increased by N rates up to 200 lb/a, but the increased response diminished at N rates greater than 100 lb/a (Figure 1). Endophyte infection had no effect on yield of clean seed or aftermath forage.

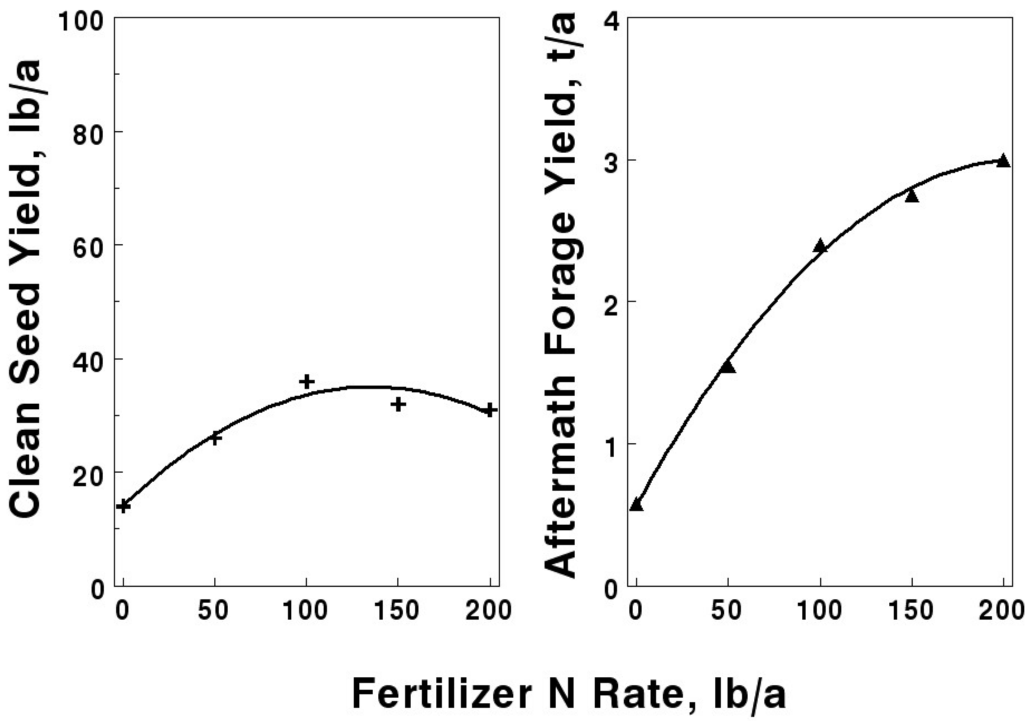

Figure 1. **Effects of Nitrogen Fertilizer Rate on Clean-seed Yield and on Aftermath-forage Yield during 2006, Southeast Agricultural Research Center.**

SOUTHEAST AGRICULTURAL RESEARCH CENTER
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TILLAGE AND NITROGEN PLACEMENT EFFECTS ON YIELDS IN A SHORT-SEASON CORN-WHEAT-DOUBLECROP SOYBEAN ROTATION

Daniel W. Sweeney and Kenneth W. Kelley

Summary

In 2006, adding N increased wheat yields, but placement or tillage did not. Double-crop soybean yields were greater following poor wheat in the controls, but were unaffected by tillage or residual N placement.

Introduction

Many rotational systems are employed in southeastern Kansas. This experiment was designed to determine the long-term effect of selected tillage and nitrogen (N) fertilizer placement options on the yields of short-season corn, wheat, and double-crop soybean in rotation.

Experimental Procedures

A split-plot design with four replications was initiated in 1983, with tillage system as the whole plot and N treatment as the subplot. After 22 years, the rotation was changed in 2005 to begin a short-season corn-wheat-doublecrop soybean sequence. The three tillage systems were conventional, reduced, and no tillage and were continued in the same areas as during the previous 22 years. The conventional system consisted of chiseling, disking, and field cultivation. Chiseling occurred in the fall preceeding corn or wheat crops. The reduced-tillage system consisted of disking and field cultivation prior to planting. Glyphosate (Roundup®) was applied to the no-till areas. The four N treatments for the crop were: no N (control), broadcast urea-ammonium nitrate (UAN - 28% N) solution, dribble UAN solution, and knife UAN solution at 4 inches deep. The N rate for the corn crop grown in odd years was 125 lb/a. The N rate of 120 lb/a for wheat was split as 60 lb/a applied preplant as broadcast, dribble, or knifed UAN. All plots, except for the controls, were top-dressed in the spring with broadcast UAN at 60 lb N/a.

Results and Discussion

In 2006, adding fertilizer N, in general, nearly doubled wheat yields, compared with yields in the no-N controls (Figure 1). There were no differences in yield, however, due to placement method in any of the tillage systems. In contrast, double-cropped soybean yields were greater following wheat in the controls where yields had been low (Figure 2). Tillage did not affect either wheat or following double-crop soybean yields.

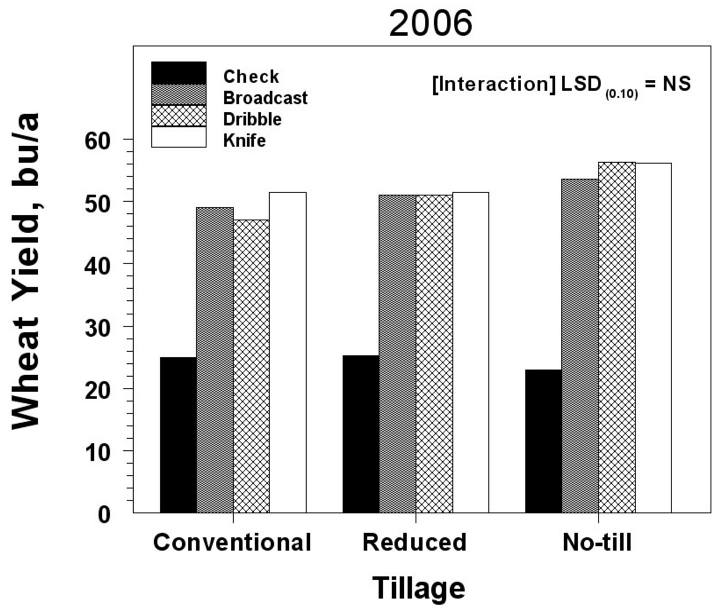

Figure 1. **Effect of Tillage and N Placement on Wheat Yield in 2006, Southeast Agricultural Research Center.**

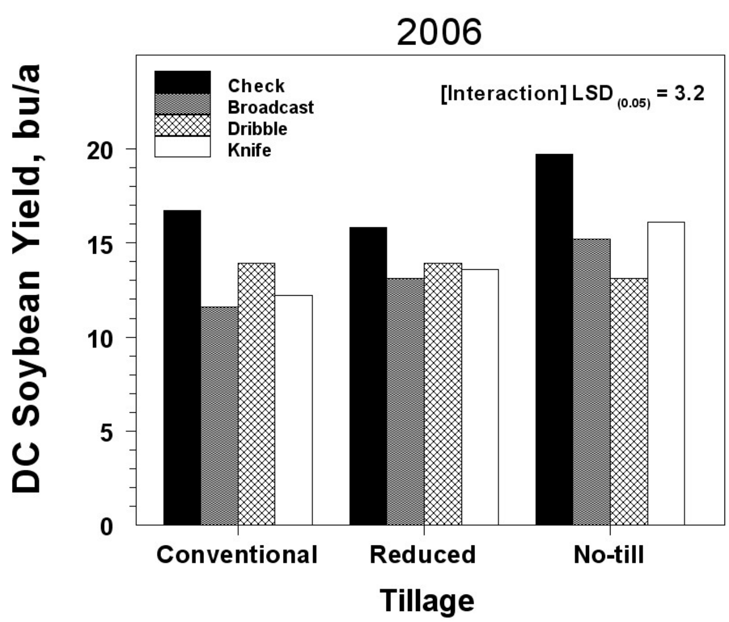

Figure 2. **Effects of Tillage and Residual N Placement on Soybean Yield Planted as a Double-crop after Wheat in 2006, Southeast Agricultural Research Center.**

SURFACE RUNOFF NUTRIENT LOSSES FROM CROPLAND RECEIVING FERTILIZER AND TURKEY LITTER

Daniel W. Sweeney and Gary M. Pierzynski

Summary

Phosphorus losses were greater when turkey litter was applied based on crop N needs. Applying turkey litter based on crop P needs reduced P losses, especially when incorporated. Nitrogen losses appeared to be a bit more variable, but values seemed low. Incorporation by conventional tillage generally resulted in greater sediment loss, but these losses were small on this soil typical of southeastern Kansas.

Introduction

Surface runoff losses of nutrients and sediment are significant threats to surface water quality. Little information is available on relative losses of nutrients from animal wastes as compared to commercial fertilizers, especially in southeastern Kansas. Current nutrient management guidelines in Kansas require P-based applications of animal wastes, rather than N-based applications, when the risk of offsite P movement is high; yet the water quality benefits from this strategy are not known. The objectives of this study were: i) to compare surface runoff losses of nutrients and sediment from fertilizer and turkey litter manure nutrient sources and ii) to determine the influence of tillage on nutrient and sediment losses in surface runoff from the use of fertilizer and turkey litter.

Experimental Procedures

The experiment was initiated in 2005 near Girard on the Greenbush Educational facility's grounds. The soil was a Parsons silt loam overlying a claypan B horizon. There were five treatments replicated twice. The treatments were:

1) control – no fertilizer or turkey litter applied,
2) fertilizer – only commercial fertilizer to supply N and P with no turkey litter,
3) turkey litter (N based) – turkey litter applications to supply all N (that also provides excess P),
4) turkey litter (P based) – turkey litter applications to supply all P with supplemental fertilizer N, and
5) turkey litter (P based) – same as treatment 4 but with incorporation of litter and fertilizer.

Treatments 1 through 4 were planted with no tillage, but treatment 5 was planted after chisel and disk incorporation of the litter and fertilizer. Plot size was one acre. ISCO samplers were used to determine runoff volume and to sample runoff water. Water samples were analyzed for NH_4-N, NO_3-N, ortho-P, bio-available P, total N, total P, and total suspended solids (TSS) by standard methods.

Runoff was measured and samples obtained for six events in 2005: 3 June, 9 June, 10-12 June (weekend), 30 June, 4 July, and 19 July. The first three events were before turkey litter and fertilizer application and the last three events were after applications. Rainfall amounts were: 0.96 in. (3 June), 1.48 in. (9 June), 2.29 in. (10-12 June), 1.52 in. (30 June), 1.22 in. (4 July) (estimated from regional data because of instrument malfunction), 1.42 in. (19 July). In 2006, there were also three runoff events prior to new application of turkey litter and fertilizer: 4 May (1.54 in. rainfall), 6 May (0.68 in. rainfall), and 9 May (1.39 in. rainfall).

Results and Discussion

With one exception, average runoff volume and concentrations, as well as total volume and loadings were unaffected by treatment assignment prior to mid-June in 2005. Because turkey litter and fertilizer had not yet been applied in 2005, the single difference in total N must be a small residual from previous farming operations on those plots. Most concentrations and loadings were small in 2005 prior to turkey litter and fertilizer applications (Table 1).

The first runoff event after application may be expected to produce the most losses of nutrients. Ortho-P, bio-available P, total N, and total P concentrations of the first event were significantly affected by treatments. In general, the various P concentrations were highest in the N-based treatment, followed by the no-till fertilizer and P-based treatments (Table 2). However, when the P-based treatment was incorporated, values were similar to those in the control. P loadings were not affected by treatment in the first event after application. Unless incorporated, NH_4-N loadings were greater from fertilizer and turkey litter treatments than from the control. TSS was greater from the P-based turkey litter treatment that received conventional tillage, but the value was small (less than 0.1 ton/a).

For the three runoff events in 2005 after turkey litter and fertilizer application, average concentrations were affected by treatment, except for TSS. Ammonium-N concentration was greater in the P-based no-till treatment than when incorporated (Table 3). Nitrate-N concentration was greatest in runoff from the fertilized and P-based turkey litter treatments. Phosphorus concentrations were generally greatest in runoff from the N-based turkey litter treatment, followed by the no-till and fertilizer P-based treatments. Incorporation of turkey litter significantly reduced the various P concentrations in runoff compared with runoff from the no-till, P-based treatment, and these values were similar to those from the control. Phosphorus loadings, however, were greater from the N-based turkey litter treatment with no differences in loadings from the other treatments. So, P loadings were small prior to treatment applications and tended to be increased by the N-based treatment in the first event, but this was only significant when considering the total of the three events after application in 2005 (Figure 1).

In 2006, runoff events prior to turkey litter and fertilizer applications should give an indication of residual effects of the treatments on runoff volume, nutrient concentrations, and nutrient loadings. Several average concentrations, average flow, total loadings, and total flow were significantly affected by the treatments. As in the previous year, P concentrations and loadings were greater in runoff from the N-based turkey litter treatment (Table 4). It is unclear why average and total flow was greater from the no-till N-based and P-based treatments than from the no-till control and fertilized treatments.

Overall, this field study demonstrates the excessive P losses that can occur if a producer applies turkey litter based on crop N needs. Applying turkey litter based on crop P needs reduced P losses, especially when incorporated. Nitrogen losses appeared to be a bit more variable, but values seemed low. Incorporation by conventional tillage generally resulted in greater sediment loss, but these losses were small on this soil typical of southeastern Kansas.

Table 1. Average Concentrations and Total Loadings of Selected Chemical Parameters in Runoff Water of the Three Events in 2005 Prior to Application of Turkey Litter and Fertilizer.

	Concentrations							
Amendment	NH_4-N	NO_3-N	Ortho-P	Bio-Avail P	Total N	Total P	TSS	Avg. Flow
	-------- ppm --------		- ppb -	---------- ppm ----------			- mg/L -	- ft^3/ac -
Control	0.3	1.8	750	0.78	3.9	0.84	295	3570
Fertilizer	0.3	0.7	760	0.85	3.6	0.93	61	1730
Litter – N based	0.1	0.8	470	0.51	2.4	0.40	17	4980
Litter – P based	4.8	0.1	920	0.77	16.5	1.78	165	4170
Litter – P based – CT	1.0	0.6	540	0.58	3.5	0.55	166	3130
LSD (0.10)	NS	NS	NS	NS	NS	NS	NS	NS

	Loadings							
Amendment	NH_4-N	NO_3-N	Ortho-P	Bio-Avail P	Total N	Total P	TSS	Total Flow
	-- lb/a --							- ft^3/ac -
Control	0.09	0.07	0.11	0.11	0.59	0.09	14	7150
Fertilizer	0.05	0.14	0.22	0.24	0.93	0.25	19	5200
Litter – N based	0.13	0.49	0.39	0.42	2.12	0.32	13	14930
Litter – P based	0.62	0.06	0.31	0.26	3.83	0.44	73	9150
Litter – P based – CT	0.31	0.32	0.26	0.27	1.67	0.24	78	9390
LSD (0.10)	NS	NS	NS	NS	1.94	NS	NS	NS

NS = nonsignificant

Table 2. Average Concentrations and Total Loadings of Selected Chemical Parameters in Runoff Water of the First Single Event in 2005 After Application of Turkey Litter and Fertilizer.

	Concentrations							
Amendment	NH_4-N	NO_3-N	Ortho-P	Bio-Avail P	Total N	Total P	TSS	Flow
	-------- ppm --------		- ppb -	---------- ppm ----------			- mg/L -	- ft^3/ac -
Control	0.9	1.9	1030	1.9	10.1	1.2	560	1220
Fertilizer	19.5	11.5	5070	5.2	38.8	6.0	530	1090
Litter – N based	11.5	0.0	15170	15.5	48.5	17.1	640	2050
Litter – P based	20.9	7.0	4570	3.6	46.4	4.9	580	2210
Litter – P based – CT	0.4	3.2	520	0.8	8.4	1.5	1640	1260
LSD (0.10)	NS	NS	2520	2.4	26.0	3.1	NS	NS

	Loadings						
Amendment	NH_4-N	NO_3-N	Ortho-P	Bio-Avail P	Total N	Total P	TSS
	-- lb/a --						
Control	0.07	0.17	0.06	0.06	0.97	0.07	54
Fertilizer	1.62	0.96	0.42	0.45	3.24	0.50	64
Litter – N based	1.47	0.00	1.97	1.99	5.95	2.21	84
Litter – P based	2.62	1.29	0.63	0.53	6.32	0.67	58
Litter – P based – CT	0.04	0.29	0.05	0.06	0.77	0.14	132
LSD (0.10)	1.80	NS	NS	NS	NS	NS	36

NS = nonsignificant

Table 3. Average Concentrations and Total Loadings of Selected Chemical Parameters in Runoff Water of the First Three Events in 2005 After Application of Turkey Litter and Fertilizer.

Amendment	NH_4-N	NO_3-N	Ortho-P	Bio-Avail P	Total N	Total P	TSS	Avg. Flow
	Concentrations							
	-------- ppm --------		- ppb -	---------- ppm ----------			- mg/L -	- ft^3/ac -
Control	0.61	2.03	610	0.66	8.9	0.85	520	960
Fertilizer	5.82	10.01	1780	2.38	22.5	2.83	350	870
Litter – N based	5.42	2.43	7230	7.43	29.1	8.13	550	1480
Litter – P based	9.17	7.24	2250	1.98	25.9	2.72	520	1630
Litter – P based – CT	0.47	3.21	410	0.51	9.7	0.93	1490	1400
LSD (0.10)	5.38	3.37	1720	1.01	8.2	0.99	NS	NS

Amendment	NH_4-N	NO_3-N	Ortho-P	Bio-Avail P	Total N	Total P	TSS	Total Flow
	Loadings							
	---------- lb/a ----------							- ft^3/ac -
Control	0.13	0.36	0.09	0.10	1.60	0.12	93	2890
Fertilizer	1.18	1.45	0.37	0.43	3.46	0.48	34	2610
Litter – N based	1.83	0.52	2.50	2.55	8.76	2.77	150	4450
Litter – P based	3.13	2.53	0.80	0.71	8.82	0.92	117	4880
Litter – P based – CT	0.09	0.79	0.10	0.12	2.20	0.21	326	4200
LSD (0.10)	1.54	NS	1.36	1.35	NS	1.41	134	NS

NS = nonsignificant

Table 4. Average Concentrations and Total Loadings of Selected Chemical Parameters in Runoff Water of the Three Events in 2006 Prior to Application of Turkey Litter and Fertilizer.

	Concentrations							
Amendment	NH_4-N	NO_3-N	Ortho-P	Bio-Avail P	Total N	Total P	TSS	Avg. Flow
	-------- ppm --------		- ppb -	---------- ppm ----------			- mg/L -	- ft^3/ac -
Control	0.9	0.2	420	0.58	3.0	0.67	302	920
Fertilizer	1.0	0.2	730	0.79	3.0	0.83	42	840
Litter – N based	0.7	0.3	2380	2.12	3.9	2.14	92	2230
Litter – P based	0.6	0.1	600	0.77	2.5	0.74	24	2660
Litter – P based – CT	0.6	0.4	400	0.56	3.0	0.63	246	1870
LSD (0.10)	NS	NS	1000	0.81	NS	0.69	151	1020

	Loadings							
Amendment	NH_4-N	NO_3-N	Ortho-P	Bio-Avail P	Total N	Total P	TSS	Total Flow
	--- lb/a ---							- ft^3/ac -
Control	0.22	0.03	0.12	0.16	0.64	0.18	59	2750
Fertilizer	0.16	0.03	0.10	0.13	0.42	0.11	4	2510
Litter – N based	0.24	0.10	0.88	0.83	1.37	0.81	29	6690
Litter – P based	0.26	0.06	0.28	0.34	1.15	0.34	11	7970
Litter – P based – CT	0.14	0.08	0.10	0.14	0.79	0.15	60	5600
LSD (0.10)	NS	NS	0.38	0.23	NS	0.22	NS	3060

NS = nonsignificant

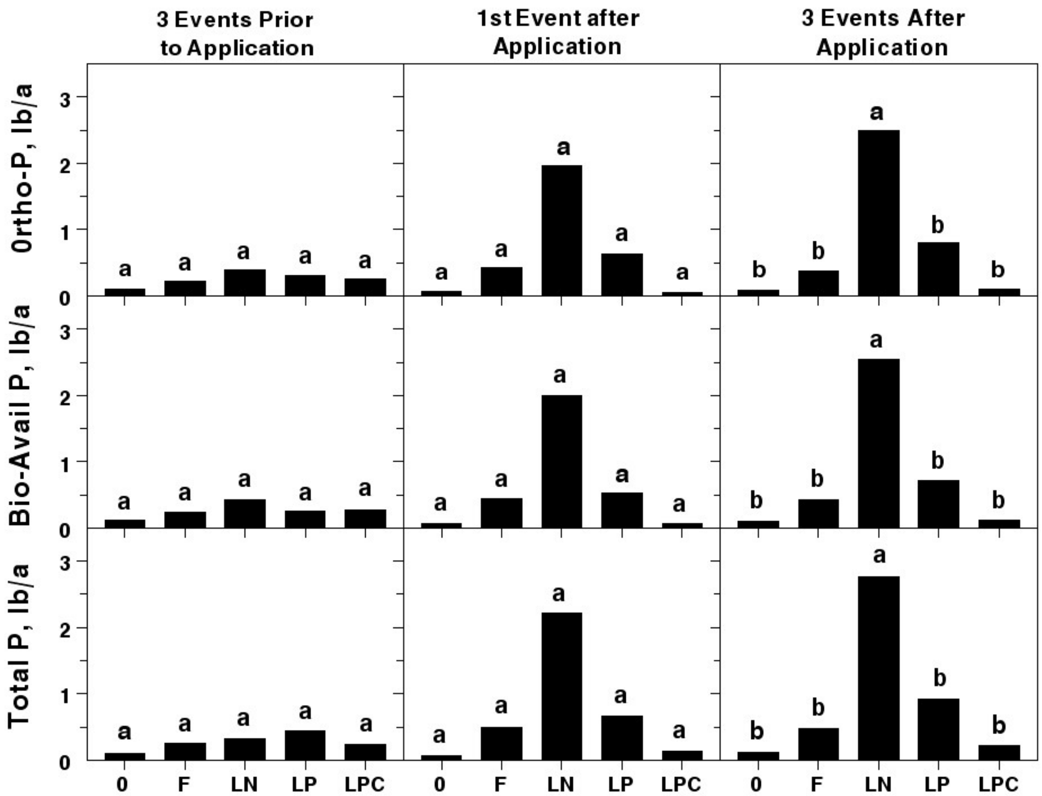

Figure 1. Effect of Treatments on Ortho-P, Bio-available P, and Total P Loadings in 2005. Treatment abbreviations are: 0 – no turkey litter or fertilizer, F – fertilizer N and P, LN – N-based turkey litter application, LP – P-based turkey litter application with supplemental fertilizer N, and LPC – same as LP but incorporated by chisel and disk conventional tillage. (Treatments 0, F, LN, and LP are with no tillage.) Within a grid, treatments with the same letter are not significantly different at p=0.10.

EFFECT OF N AND P STARTERS ON SHORT-SEASON CORN GROWN IN CONSERVATION TILLAGE SYSTEMS

Daniel W. Sweeney and David B. Mengel

Summary

Yields were low in 2006, averaging less than 80 bu/a. Applying N and P increased yields by about 15 bu/a more than with no fertilizer, but there were no differences between starter treatments or tillage systems. In contrast to yield, dry matter production was greater with reduced tillage throughout the season, but the difference became less as the plant aged. Early in the season, increasing P rate in the starter resulted in significantly greater dry matter production, but this response declined rapidly by reproductive growth.

Introduction

Corn acreage has been on the rise in southeastern Kansas in recent years because of the introduction of short-season cultivars which enable producers to plant in the upland, claypan soils typical of the area. Short-season hybrids reach reproductive stages earlier than full-season hybrids and thus may partially avoid mid-summer droughts that are often severe on these claypan soils with limited plant-available moisture storage. However, soil fertility and other management options have not been well defined for short-season corn production in southeastern Kansas. Optimum corn production results from use of proper management options that include soil fertility and tillage selections. Reducing tillage has the potential to reduce losses to the environment, but maintaining proper plant nutrition is critical for crop production. Starters have been used to improve early plant growth in no- or reduced-tillage systems, and this often translates to additional yield. However, data are limited regarding the effect of starter fertilization on yield of short-season corn grown on the claypan soils found in areas of the eastern Great Plains. The objective of this study was to determine the effect of N and P rates in starter fertilizers on short-season corn planted with reduced or no tillage.

Experimental Procedures

The experiment was conducted in 2006 at the Southeast Agricultural Research Center of Kansas State University at Parsons. The soil was a Parsons silt loam with a claypan subsoil. Selected background soil chemical analyses in the 0- to 6-inch depth were 6.5 pH (1:1 soil:water), 5 ppm P (Bray-1), 65 ppm K (1 M $NH_4C_2H_3O_2$ extract), 5.3 ppm NH_4-N, 6.4 ppm NO_3-N, and 2.8% organic matter. The experimental design was a split-plot arrangement of a randomized complete block with three replications. The whole plots were tillage system (reduced and no-till) and subplots were starter N-P combinations. Nine of the subplots were starter fertilizer combinations where N rates were 20, 40, and 60 lb/a and P rates were 0, 25, and 50 lb P_2O_5/acre. In addition, there were two reference subplot treatments: a no starter treatment (all N and P applied preplant) and a no N or P control. All plots except the no N-P control were balanced to receive a total of 120 lb N/a and 50 lb P_2O_5/acre. The N and P fertilizer sources were 28-0-0 and 10-34-0 fluids. All plots received 60 lb K_2O/acre as solid KCl broadcast preplant. Pioneer 35P80 Roundup-Ready® corn was planted at 25,000 seeds/a on April 3, 2006. Starter solutions were applied 2 x 2 with the planter. Grain was harvested for yield on August 14, 2006.

Results and Discussion

Rainfall was sporadic, especially during reproductive growth. This resulted in low overall yields averaging less than 80 bu/a, with no differences due to starter or starter rates (data not shown). All starter treatments averaged 79.8 bu/a compared with 77.2 bu/a when all the fertilizer was applied broadcast before planting. The control treatment receiving no N or P fertilizer yielded 62.2 bu/a. The response of corn to N and P fertilizer appeared to be related to increased number of kernels per ear, but starter N and P rates did not affect yield components. Additionally, there were no differences in yield or yield components between tillage systems nor were there any significant interactions between tillage and starter fertilizer treatments.

In contrast to yield, dry matter production was affected by tillage at all four growth stages and by P starter early in the season. However, dry matter accumulation during the growing season was not affected by interactions of tillage with N or P starter fertilizer. At V6, reduced tillage resulted in more than twice as much growth as with no-tillage (Table 1). Reduced tillage resulted in significantly greater dry matter production throughout the season, but the difference became less as the plant aged. Early in the season, increasing P rate in the starter resulted in significantly greater dry matter production. However, this response declined rapidly and was not significantly different by the time the corn plant entered reproductive growth.

Table 1. Effect of Conservation Tillage Systems and Starter P Rates on Dry Matter Accumulation at the V6, V12, R1, and R4 Growth Stages During the 2006 Season.

	Dry Weight			
Treatments	V6	V12	R1	R4
	-------------------------------- lb/a	----------------------------		
Tillage				
Reduced	230	3470	5840	9400
No-till	100	2160	4060	7120
LSD (0.05)	30	380	900	1570
Starter P_2O_5 rate, lb/a				
0	140	2700	4940	8380
25	170	2810	4910	7990
50	190	2940	5000	8420
LSD (0.05)	20	180†	NS	NS
All N-P Broadcast	130	2400	4750	7370
Control (No N or P)	70	1760	3810	7420

†Significant at the 0.10 level of probability.

EFFECTS OF CROPPING SYSTEMS ON WINTER WHEAT AND DOUBLE-CROP SOYBEAN YIELD[1]

Kenneth W. Kelley and Daniel W. Sweeney

Summary

Over a 10-year period, wheat yields averaged 54 bu/a following either corn or soybeans and 52 bu/a following grain sorghum when liquid N and P fertilizer were knifed below crop residues before planting. But wheat yields were affected very little by tillage method (no-till or disk). The crop previous to wheat also significantly influenced double-crop soybean yields in all years. Soybean yields averaged 32 bu/a when corn or grain sorghum preceded wheat and 27 bu/a when soybeans preceded wheat.

Introduction

Winter wheat is often rotated with other crops, such as soybean, grain sorghum, and corn, to diversify cropping systems in southeastern Kansas. Wheat typically is planted with reduced tillage, although the acreage of wheat planted with no-till has increased significantly in recent years. In extreme southeastern Kansas, double-crop soybean traditionally is planted after wheat harvest. Like wheat, more double-crop acreage is being planted with conservation-tillage methods. This research investigates the combined effects of both crop rotation and tillage on yields of winter wheat and double-crop soybean in a two-year crop rotation.

Experimental Procedures

In 1996, a two-year crop rotation study consisting of corn, grain sorghum, or soybean in rotation with wheat and double-crop soybean was started at the Columbus Unit on two adjacent sites. Tillage treatments were to plant all crops with conventional tillage and to plant all crops with no tillage. Fertilizer N (120 lb/a N as liquid 28 % N) and P (68 lb/a P_20_5 as liquid 10-34-0) were applied preplant at a depth of 4 to 6 in. with a coulter-knife applicator. Potassium fertilizer (120 lb/a K_20) was broadcast applied. In conventional tillage systems for wheat, disk tillage was performed before fertilizer application and planting. Wheat was planted with a no-till drill in 7.5-in. rows at a seeding rate of 90 to 120 lb/a, depending on date of planting. In the no-till system, weeds that emerged before planting were controlled with a preplant application of glyphosate. In early spring, wheat was sprayed with a postemergence herbicide when needed to control broadleaf weeds.

Double-crop soybean (MG IV) was planted in late June or early July after wheat harvest. Row spacing for double-crop soybean differed over years. During the first three years of the study, soybean was planted in 30-inch rows; in the last six years, row spacing has been 7.5-inches.

[1]This research was partially funded by the Kansas Soybean Commission.

Tillage method for double-crop soybean also has differed over years. From 1997 to 2002, two tillage methods were evaluated (no-till and disk tillage). Since 2003, all double-crop plots have been planted no-till. Weeds were effectively controlled with herbicides.

Results and Discussion

Wheat Results (Table 1)

In this two-year rotation, the previous crop (corn, grain sorghum, or soybean) has had a smaller effect on wheat yield compared with previous fertilizer research trials, mainly because fertilizer N and P were knifed below crop residues in all rotations and tillage systems before planting. In addition, the rate of N applied (120 lb/a) has been high enough for the yields produced. For the 10-year period, wheat yields averaged 54 bu/a following either soybean or corn and 52 bu/a following grain sorghum.

Wheat yields also were affected very little by tillage method. When wheat was planted during the optimum planting window of October, grain yields were relatively good, regardless of tillage system. Results indicate that wheat planted no-till into previous summer crop residues will yield similarly to wheat planted with reduced-tillage methods, provided that good management practices are used, such as sub-surface placement of fertilizer N and P.

Double-crop Soybean Results (Table 1)

Crops previous to wheat significantly influenced double-crop soybean yields in nearly all years. Soybean yields were greatest when corn and grain sorghum preceded wheat and were least when soybean preceded wheat. Nutrient analyses of double-crop soybean plants have shown very little difference in nutrient uptake between previous crops (data not shown). More research is needed to determine why the observed yield response occurs.

In the initial years of the study, double-crop soybean yields were similar between reduced and no-till methods. In the last few years, however, double-crop soybean yields have been significantly greater when planted no-till. There initially was concern that soybean root growth would be reduced in no-till systems, but recent data suggest that double-crop soybean planted no-till is better able to withstand drought stress conditions. Additional research is planned to further evaluate the effects of conservation management practices on soil quality characteristics, such as quantities of soil carbon and organic matter.

Table 1. Effects of Previous Crop and Tillage on Wheat and Double-crop Soybean Yield, Columbus Unit, Southeast Agricultural Research Center, 1997 - 2006.

Previous Crop to Wheat	Tillage	Average Grain Yield: Wheat	Average Grain Yield: Double-crop Soybean
		---------- bu/a ----------	
Corn	NT	53.4	32.8
Corn	RT	53.7	30.9
Grain sorghum	NT	51.1	33.1
Grain sorghum	RT	52.3	31.1
Soybean	NT	54.8	27.9
Soybean	RT	52.8	25.4
Means:			
Corn		53.5	31.9
Grain sorghum		51.7	32.1
Soybean		53.8	26.7
LSD (0.05)		1.5	1.8
No-till		53.1	31.3
Reduced tillage		52.9	29.2
LSD (0.05)		NS	1.6

Since 2003, all double-crop soybean has been planted with no-till (NT).
Reduced tillage (RT) consisted of disking before wheat planting.

EFFECT OF SOIL pH ON CROP YIELD

Kenneth W. Kelley

Summary

Grain yields of grain sorghum, soybean, and wheat increased as soil acidity decreased with lime application. Yields were greatest, however, when pH was near the neutral range of 7.0.

Introduction

In southeastern Kansas, nearly all topsoils are naturally acidic (pH less than 7.0). Agricultural limestone is applied to correct soil acidity and to improve nutrient availability. But applying too much lime can result in alkaline soil conditions (pH greater than 7.0), which also reduces nutrient availability and increases persistence of some herbicides. This research evaluated crop yield responses to different levels of soil pH.

Experimental Procedures

Beginning in 1989, five soil pH levels, ranging from 5.5 to 7.5, were established on a native grass site at the Parsons Unit in a three-year crop rotation consisting of (wheat-double-cropped soybean)-grain sorghum-soybean. Crops are grown with conventional tillage.

Results and Discussion

Grain yield responses for the various soil pH treatments over several years are shown in Table 1. Yields of all crops increased as soil acidity decreased. Yields generally were greatest, however, when soil pH was near the neutral range of 7.0. Plant nutrient availability (nitrogen and phosphorus) also increased as soil acidity decreased (data not shown).

Table 1. Effects of Soil pH on Crop Yields, Parsons Unit, Southeast Ag Research Center.

	Grain Yield			
	Grain Sorghum	Full-season Soybean	Double-crop Soybean	Wheat
Soil pH[1]	(5-yr avg)	(4-yr avg)	(4-yr avg)	(4-yr avg)
(0 - 6 inch)	---------- bu/a ----------			
5.3	82.3	28.2	18.9	43.0
5.6	87.8	30.3	21.8	44.0
6.3	92.8	33.6	23.3	45.1
6.8	95.7	34.2	25.0	46.6
7.2	95.3	35.0	24.0	45.8
LSD (0.05)	4.0	1.9	1.3	2.3

[1] Average pH from 2001 to 2005.

EFFECTS OF TILLAGE ON FULL-SEASON SOYBEAN YIELD

Kenneth W. Kelley and Daniel W. Sweeney

Summary

Full-season soybean yields have differed over time according to tillage method at two different sites. In general, when drier-than-normal conditions occur, soybean yields have been greater when soybean was planted no-till following corn or grain sorghum; when summer rainfall is above normal, however, tillage has had less effect on full-season soybean yield.

Introduction

In southeastern Kansas, full-season soybean often is rotated with other crops, such as corn and grain sorghum, to diversify cropping systems. Soybean previously has been planted with conventional tillage (chisel-disk-field cultivate) following corn or grain sorghum, but improved equipment technology has made no-till planting more feasible. Thus, this research evaluates the long-term effects of tillage method on full-season soybean yield.

Experimental Procedures

From 1995 through 2002, a three-year crop rotation was evaluated at both the Columbus and Parsons Units. The rotation consisted of [corn or grain sorghum]-soybean-[wheat and double-crop soybean], and tillage effects on full-season soybean yields were evaluated every three years. Tillage treatments were: 1) plant all crops with conventional tillage (CT); 2) plant all crops with no tillage (NT); and 3) alternate CT and NT systems. Beginning in 2003, the three-year rotation was changed to a two-year rotation, which consisted of soybeans following grain sorghum. Tillage effects on soybean yield were evaluated each year at both the Columbus and Parsons Units.

Results and Discussion

Effects of tillage method on full-season soybean yields are shown in Table 1. At the Columbus Unit, soybean yields were greater with CT than with NT during the first two cropping cycles. In recent years, however, soybean yields with continuous NT have been equal to or greater than with CT. But soybean yields for NT following CT have been significantly lower than those for continuous NT or continuous CT. At the Parsons Unit, tillage system had no significant effect on soybean yields in 1996, 1999, and 2004. In 2006, drought conditions prevented any meaningful yield data.

Results suggest that the effects of tillage on soybean yields have changed over time. Additional research is needed to evaluate long-term effects of no-till and continuous tillage on soybean yield and on changes in soil properties, such as soil carbon and nitrogen.

Table 1. Effects of Tillage Systems on Full-season Soybean Yield, Southeast Agricultural Research Center, 1996 - 2006.

Tillage System[1]	1996[2]	1999[2]	2002[2]	2003	2004	2005	2006[3]	avg.
	Full-season Soybean Yield							
	---------------------------------- bu/a ----------------------------------							
	Columbus Unit							
NT only	48.4	18.1	27.0	35.7	46.1	30.8	35.8	34.6
NT following CT	46.0	14.2	26.0	29.3	38.4	23.7	29.8	29.6
CT only	53.9	20.3	23.4	35.8	43.2	29.3	27.9	33.4
CT following NT	54.4	20.0	26.5	36.9	40.3	25.9	28.3	33.2
LSD (0.05)	4.9	1.3	1.4	2.0	3.7	1.7	2.3	2.5
	Parsons Unit							
NT only	45.3	15.8	32.4	34.9	42.4	30.8	---	33.6
NT following CT	43.7	14.9	32.1	33.5	42.2	27.1	---	32.2
CT only	45.2	15.5	27.9	30.8	45.1	29.4	---	32.3
CT following NT	45.8	16.0	29.6	35.1	43.8	29.4	---	33.3
LSD (0.05)	NS	NS	3.9	2.8	NS	1.9		NS

[1] NT = no tillage; CT = conventional tillage (disk-chisel-disk-field cultivate).
[2] Effects of previous crop (corn and grain sorghum) on soybean yield were non-significant (NS) for the first phase of the study from 1996 through 2002; thus, yields were averaged over both previous crops.
From 2003 to 2006, previous crop before soybean was grain sorghum.
[3] Drought conditions in 2006 prevented any meaningful yield data at the Parsons Unit.

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EFFECTS OF PHOSPHORUS AND POTASSIUM FERTILIZER RATE AND TIME OF APPLICATION IN A WHEAT DOUBLE-CROPPING SYSTEM

Kenneth W. Kelley

Summary

Grain yields of grain sorghum, wheat, and double-crop soybean were not significantly affected by fertilizer P and K rates or time of application in the first cropping cycle where initial soil test values were in the medium range.

Introduction

Timing of fertilizer phosphorus (P) and potassium (K), as well as rate of application, are important management decisions in crop production. In southeastern Kansas, producers often plant wheat following the harvest of a feed-grain crop, such as grain sorghum or corn, and then plant double-crop soybean after wheat, giving three crops in two years. In these multi-cropping systems, producers typically apply fertilizer P and K to the feed-grain and wheat crops only. Because of increasing fertilizer cost, this research seeks to determine the direct and residual effects of P and K fertilizer, as well as rates of application, on grain yields in a double-cropping system.

Experimental Procedures

The study was established in 2004 at the Columbus Unit. Crop rotation consists of grain sorghum / [wheat - double-crop soybean], giving three crops in a two-year period. Both grain sorghum and wheat are planted with conventional tillage, and double-cropped soybean are planted no-till. Different rates of fertilizer P and K are applied preplant to the grain sorghum crop only or to both the grain sorghum and wheat crops. Fertilizer is incorporated with tillage. The initial soil test values before study establishment were 23 ppm Bray-1 P and 160 ppm exchangeable K for the 0- to 6-in. soil depth.

Results and Discussion

Effects of the various fertilizer P and K treatments on grain sorghum, wheat, and double-crop soybean yields are shown in Table 1. For the initial cropping phase of this study, grain yields were not significantly affected by any of the fertilizer P and K treatments. The non-significant yield response to fertilizer P and K for the first year of the study was not unexpected because initial soil tests indicated that soil values of P and K were sufficient for the expected yield goals. Initial results confirm that current KSU soil test recommendations are an accurate management tool for making fertilizer recommendations.

The amount of nutrient removal in harvested grain for 100 bu/a grain sorghum, 50 bu/a wheat, and 25 bu/a double-crop soybean is 87 lb/a P_2O_5 and 72 lb/a K_2O. Thus, this study will continue for several cropping cycles to monitor the residual effects of fertilizer P and K treatments on grain yields and soil nutrient concentrations of P and K. Additional treatments, such as starter fertilizer effects, likely will be imposed in the study as soil test values change with time.

With fertilizer costs increasing, it is important that producers take soil tests at periodic intervals to monitor soil concentrations of P and K, which likely will result in greater fertilizer use efficiency and higher net returns.

Table 1. Effects of Phosphorus and Potassium Fertilizer Rate and Time of Application on Grain Yield in a Double-cropping System, Southeast Agricultural Research Center, Columbus Unit, 2006.

Fertilizer Rate Applied to						Grain Yield		
Grain Sorghum			Wheat			Grain Sorghum	Wheat	DC Soybean
N	P_2O_5	K_2O	N	P_2O_5	K_2O			
---------- lb/a ----------						---------- bu/a ----------		
120	0	0	120	0	0	53.0	50.1	25.1
120	40	40	120	40	40	52.2	52.5	24.0
120	80	80	120	0	0	51.8	49.0	24.7
120	60	60	120	60	60	50.8	50.6	24.1
120	120	120	120	0	0	50.9	52.5	26.0
120	80	80	120	80	80	55.4	50.8	24.5
LSD (0.05)						NS	NS	NS

Initial soil test values before study establishment were 23 ppm Bray-1 P and 160 ppm exchangeable K for the 0- to 6-inch soil depth.

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EFFECTS OF FERTILIZER NITROGEN RATE AND TIME OF APPLICATION ON CORN AND GRAIN SORGHUM YIELD

Kenneth W. Kelley

Summary

In 2006, corn and grain sorghum yields were affected very little by timing of fertilizer N. Corn yield was affected more by fertilizer N rate than grain sorghum yield under the drought conditions of 2006.

Introduction

Because of recent increases in fertilizer nitrogen (N) prices, producers are looking for ways to reduce production costs for feed-grain crops, such as corn and grain sorghum. One method that has gained renewed interest is applying some of the fertilizer N requirement after the crop has emerged, referred to as "side-dressing." Some research has shown that a subsurface application of banded N after the crop has emerged results in more efficient N use and often increases net return. In southeastern Kansas, excessive spring rainfall also increases the potential for greater N loss where fertilizer N is applied preplant.

Experimental Procedures

Studies were established at the Columbus Unit in 2005 to evaluate the effects of time and rate of fertilizer N application for both grain sorghum and corn. Fertilizer N (28 % liquid N) treatments consisted of different N rates applied either preplant or side-dressed. Preplant fertilizer N was subsurface applied in mid-March on 15-inch centers at a depth of 4 to 6 inches. Side-dress N also was subsurface applied between 30-inch rows at a depth of 4 to 6 inches when crop was approximately 12 inches tall. All plots received 30 lb/a N preplant as 18 - 46 - 0. The previous crop before grain sorghum was full-season soybean.

Results and Discussion

In 2006, drought conditions resulted in low grain yields and low responses to fertilizer N timing effects. This study will be continued for several more years to evaluate N treatment effects over various rainfall conditions.

Table 1. Effects of Fertilizer N Rate and Time of Application on Corn and Grain Sorghum Yield, Columbus Unit, 2006.

Rate of Fertilizer N Applied[1]		Grain yield[2]	
Preplant	Side-dress	Corn	Grain sorghum
------------ lb/a ------------		bu/a	bu/a
30	0	81.8	69.8
60	0	94.6	70.7
90	0	103.9	72.3
120	0	106.7	70.3
150	0	105.4	68.2
30	30	92.4	73.2
30	60	99.4	73.4
30	90	106.2	68.8
30	120	112.4	65.6
LSD (0.05)		10.6	NS

[1] 30 lb/a N was applied preplant as 18-46-0 to all treatments. Liquid 28 % N was the fertilizer source for the additional N applied either preplant or side-dressed.

[2] Previous crop was double-crop soybean.

PERFORMANCE TEST OF DOUBLE-CROPPED SOYBEAN VARIETIES

James H. Long and Gary L. Kilgore[1]

Summary

Fourteen double-cropped soybean varieties were planted following winter wheat at the Columbus unit and evaluated for yield and other agronomic characteristics throughout the summer of 2006. Overall, grain yields were very poor, with a normal frost occurring, and few differences were seen. Yields ranged from 0 bu/a to 8.3 bu/a. Grain yields were again related to maturity, as the top varieties were those that matured early. High variability in yield and height due to excessive drought and heat means that this 2006 test should be used with caution as even the best grain yields were less than 10 bu/a. Varieties with few or no pods also were very late in maturity and were still green at first frost.

Introduction

Double-cropped soybean is an opportunistic crop grown after winter wheat across a wide area of southeastern Kansas. Because this crop is vulnerable to weather-related stress, such as drought and early frosts, it is important that the varieties not only have good yield potential under these conditions, but also have the plant structure to allow them to set pods high enough to be harvested. They also should mature late enough to benefit from late summer rains yet before threat of frost.

Experimental Procedures

Soybean varieties were planted into good moisture following winter wheat harvest at the Southeast Agricultural Research Center at Parsons. The soil is a Parsons silt loam. The wheat stubble was disked under, the soil was field cultivated and soybean were then planted with John Deere 7000 planter units. Glyphosate-tolerant varieties were used. Soybean were planted on June 21, 2006, at 10 seed per foot of row. When appropriate, 22 ounces of Roundup Weathermax® +.25 oz Classic® were sprayed after planting. Harvest occurred November 8, 2006.

Results and Discussion

Soils were moist after rains in mid June, and and plant stands were excellent. Excellent growing conditions prevailed very early, but very severe drought occurred from mid June until harvest. Rains never came and some varieties never set pods. Even best varieties set very few pods in 2006. Yields ranged from 0 bu/a to 8.3 bu/a (Table 1). Several varieties yielded more than 5 bu/a, but little can drawn from 2006 as the severe drought caused high variability in the test during 2006. Use results with caution. Overall plant heights were very short, reflecting the hot, dry conditions (Table 1). Soybean plants in lowest yielding varieties did not set pods and were essentially in a vegetative state when frost hit. In some cases,

[1]Southeast Area Extension Office.

plants were still blooming or had just finished blooming when frost occurred. These immature plants had green leaves, stems, and some very small flat pods that hung on until killed by the freezing temperatures.

Table 1. Yields from 2003-2006 for a Variety Test of Double-Cropped Soybean at Columbus and Parsons.

Source	Variety		Maturity	Height	Grain Yield			
					2003	2004	2005	2006
			Julian day[1]	-in-	bu/a			
Agventure	AV 54G4NRRSTS		294	20.0	--	--	--	0.0
Agventure	AV 49G9NRRSTS		290	19.8	--	--	--	5.2
Midland	MG9A545NRS		294	20.5	--	28.7	23.5	2.3
Midland	MG4806NRS		290	19.0	--	--	--	6.5
Monsanto	Asgrow AG5605		293	20.0	--	--	29.5	3.5
Mycogen	5B482NRR		287	15.8	--	--	--	5.0
Mycogen	5N501RR		289	20.8	--	--	--	4.3
Pioneer	94M30		294	21.8	--	--	--	0.0
Pioneer	95M50		293	21.7	--	--	23.5	1.0
Public	KS3406NRR	(MG III)	288	23.5	--	--	--	5.0
Public	KS4602NRR	(MG IV)	289	17.8	--	--	--	5.6
Public	KS5306NRR	(MG V)	292	23.5	--	--	27.4	2.0
Public	KS5502NRR	(MG V)	293	19.5	--	--	--	0.0
Public	K032811		285	20.0	--	--	--	8.3
Average			291	19.8	26.6	28.9	23.0	3.5
LSD (0.05)			2	3.5	4.4	4.0	5.3	3.9

[1]Julian Day number 270 = September 27; 280 = October 7; and 290 = October 17.

SOUTHEAST AGRICULTURAL RESEARCH CENTER KANSAS STATE UNIVERSITY

PERFORMANCE TEST OF RIVER-BOTTOM SOYBEAN VARIETIES

James H. Long and Gary L. Kilgore [1]

Summary

Fourteen soybean varieties typically grown on deep river-bottom soils were planted at Erie, Kansas, and evaluated for yield and other agronomic characteristics throughout the summer of 2006. Plants matured normally in October although the year ended hot and dry. Grain yields were average for this environment and variety differences were seen with this very productive soil. Yields ranged from 31.7 to 44.2 bu/a. and the test averaged over 39 bu/a. The shorter-season Maturity Group (MG) III and IV varieties yield as well as, or better than, MG V varieties when grown on these deep soils. Most soybean plants were average in height this year (34 to 44 inches), yet there was little lodging.

Introduction

Full-season soybean is grown on the highly productive river-bottom soils of southeastern Kansas. Because this crop is not as vulnerable to weather-related stress, such as drought, it is important that the varieties have good yield potential and minimal lodging. In addition, the crop should be harvested before fall rains make clayey soils impassable or heavier precipitation causes flooding.

Experimental Procedures

Fourteen soybean varieties were grown after corn in 2005. The farmer/cooperator was Joe Harris. The soil is a Lanton deep silt loam that sits on the Neosho River flood plain approximately 1,750 feet from the river channel. The soil was chiseled, disked, and field cultivated before planting. Dual II® Magnum herbicide was applied pre-emergent at the rate of 1 pint/a + .6 oz/a First Rate®. Soybean was planted on June 12, 2006, at 10 seeds/ft of row. Plants emerged to form an excellent stand. All varieties were glyphosate tolerant, and 22 oz/a of Roundup Weathermax® + .25 oz Classic® herbicide was applied postemergent, 33 days after planting. The soybean was harvested on November 8, 2006.

Results and Discussion

Warmer-than-normal conditions persisted late in the summer, with below average rainfall all summer, yet the deep soils with stored water kept the soybean growing. Plant growth was normal and the test was harvested in November after a killing frost.

Yields ranged from 31.7 bu/a to 44.2 bu/a (Table 1). Many varieties yielded more than 40 bu/a for the 2006 growing season. Consideration should be given to plant height and its effect on lodging on these productive soils, as plants can grow nearly 4 feet tall. Overall plant height in

[1]Southeast Area Extension Office.

2006 ranged from 34.5 to 44.0 in.

Lodging was not a problem during the 2006 growing season.

Table 1. Yields from 2003 through 2006 for a Variety Test of River-Bottom Soybean at Erie, Kansas.

Source	Variety	Maturity	Height	Grain Yield			
				2003	2004	2005	2006
		Julian day[1]	-in-	---------------bu/a--------------			
Midland	MG4806NRS	288	41.8	--	--	--	44.2
Midland	MG4367NR	283	40.5	--	--	--	41.8
Monsanto	Asgrow 4903 RR	288	42.3	--	--	--	44.1
Monsanto	Dekalb 46-51 RR	287	44.0	--	--	--	43.0
Mycogen	5N501 RR	285	39.8	--	--	--	41.0
Mycogen	5B482N RR	286	40.3	--	--	--	40.7
Pioneer	93M96	285	35.5	--	--	--	41.5
Pioneer	94M30	290	38.8	--	--	35.5	38.4
Pioneer	94B73	285	38.8	38.7	50.7	30.8	39.9
Public	KS3406NRR (MGIII chk)	284	28.5	--	--	31.5	41.0
Public	K032811	282	41.8	--	--	--	41.5
Public	KS4602RR (Mid IV chk)	288	34.5	--	--	36.2	34.3
Public	KS5306NRR (E V chk)	292	42.3	--	--	36.6	31.7
Public	K5502NRR (Mid V chk)		293	37.3	--	--	3 4 . 9 32.5
Average		--	39.5	38.5	44.5	35.5	39.6
LSD (0.05)		2	3.1	2.5	3.9	5.8	3.1

[1]Julian Day number 270 = September 27; 280 = October 7; and 290 = October 17.

SOUTHEAST AGRICULTURAL RESEARCH CENTER KANSAS STATE UNIVERSITY

PERFORMANCE TEST OF COTTON VARIETIES

James H. Long, Gary Kilgore , Scott Staggenborg, Chris Pachta, and Stewart Duncan[1]

Summary

Thirty-four cotton varieties were planted at Parsons, Kansas, and were evaluated for yield and other agronomic characteristics throughout the summer of 2006. Lint yields were much below average at 393 lb/a, and large variety differences were seen. Yields ranged from 277 lb/a to 490 lb/a of lint. Quality is reported on the individual varieties. Quality should be strongly considered because it will affect the final price of the crop.

Introduction

Cotton is a new crop for southeastern Kansas but is already grown on nearly 150,000 acres in the state. The crop is somewhat drought tolerant. Many of the varieties tested are grown on the high plains of Texas and in Oklahoma. Some factors that may influence the amount of cotton grown in this region are potential insect problems, local ginning capacity, with management decisions associated with cotton, such as having an early harvest before fall rains arrive.

Experimental Procedures

Thirty-four cotton varieties were grown following grain soybean in 2005. The soil at the Parsons unit of the Southeast Agricultural Research Center is a Parsons silt loam. The soil was disked and field cultivated just before planting. Cotton was planted on June 9, 2006. Dual II Magnum®, Staple®, Cotoran®, and Warrior® herbicides and insecticide were applied pre-emergent to help control weeds and thrips. Fertilizer composed of 53 lb/a N, 60lb/a P_2O5, and 100 lb/a K_2O was applied to the soil for the cotton. Plants emerged to form an adequate stand. The target population was 68,000 plants/acre. Cotton was sprayed with Gramoxone Extra® on October 5 and 9 to kill the plants and lint was harvested on November 1, 2006. The cotton was ginned at Manhattan, and lint quality was then determined by HVI (high volume instrumentation) testing.

Results and Discussion

The summer of 2006 started and ended hotter and drier than normal. There was very little substantial rain from planting until harvest. The lack of rainfall severely reduced lint yield but allowed for a timely harvest. Although cotton lint yields in 2006 were less than 70% of the

[1]Southeast Agricultural Research Center, Southeast Area Extension Office, State Extension Agronomy, State Extension Agronomy, and Northeast Area Extension Office, respectively.

three-year average they were much greater than soybean yields for the Parsons area. Fibermax FM 960BR, with 490 lb/a had the greatest lint yield in 2006 (Table 1). DP&L DP 444 BG/RR had the greatest two-year and three-year average lint yield at 632 and 742 lb/a, respectively. Ten varieties had similar yields in 2006, each making more than 415 lbs of lint. These should be considered top yielders. Quality characteristics indicate differences between varieties that may affect the price at the gin (Table 2). Turnout was high again in 2006 due to a burr extractor on the production cotton stripper used for harvest.

Table 1. Average Lint Yield (lb/a) of Cotton Varieties from 2004-2006 at the Parsons Unit of the Southeast Agricultural Research Center.

Source	Variety	2006	2005	2004	2yr Avg	3yr Avg
		Lint Yield, lb/a				
AFD	506582 F	446	--	--	--	--
All-Tex	45009 RF	388	--	--	--	--
All-Tex	45039 B2/RF	428	--	--	--	--
All-Tex	Summit B2/RF	508	--	--	--	--
Americot	AMX 1504 B2RF	531	--	--	--	--
Americot	AMX 1532 B2RF	523	--	--	--	--
Americot	AMX 821 R	413	--	--	--	--
Croplan Genetics	CG 3020B2RF	514	738	--	626	--
Croplan Genetics	CG 4020B2RF	495	721	--	608	--
Croplan Genetics	CG 3520B2RF	439	723	--	581	--
DP&L	2145 RR	416	659	733	538	603
DP&L	DP 110 RF	383	--	--	--	--
DP&L	DP 117 B2RF	441	701	--	571	--
DP&L	DP 434 RR	469	801	525	635	599
DP&L	DP 444 BG/RR	449	885	961	667	765
DP&L	DP 2280 BGRR	384	--	689	--	--
DP&L	DPLX 04V282DF	514	--	--	--	--
DP&L	PM 2140 B2RF	398	567	--	483	--
DP&L	DPLX 04V294DF	457	--	--	--	--
DP&L	DPLX 07H835DF	373	--	--	--	--
Dynagro	DG 2100 B2RF	417	--	--	--	--
Fibermax	FM 9058F	511	--	--	--	--
Fibermax	FM 9063B2F	490	--	--	--	--
Fibermax	FM 960BR	542	--	728	--	--
Fibermax	FM 989B2R	429	--	--	--	--
Phytogen	PHY 125 RF	409	--	--	--	--
Phytogen	PHY 310 R	471	--	--	--	--
Phytogen	PHY 370 WR	486	--	--	--	--
Phytogen	PHY 485 WRF	501	--	--	--	--
Stoneville	NG 1553R	311	683	536	497	510
Stoneville	NG2448R	452	--	710	--	--
Stoneville	NG3273B2RF	468	--	--	--	--
Stoneville	ST 4554B2RF	462	687	--	574	--
Stoneville	NG 3550RF	426	738	--	582	--
	Average	451	705	594	578	584
	CV (%)	11	11	11	11	11
	LSD (0.05)	69	76	76	73	74

Table 2. Lint Quality Characteristics of Cotton Varieties from 2006 at the Parsons Unit of the Southeast Agricultural Research Center.

Source	Variety	% Lint	Mic	Length in	Unif. %	Strength g/tex	Color Grade
AFD	5065B2F	0.4	5.2	1.06	80	27.9	52 2
All-Tex	45009 RF	0.3	4.6	1.06	81	30.5	52 1
All-Tex	45039 B2/RF	0.4	5.1	1	81	26.6	52 1
All-Tex	Summit B2/RF	0.4	4.7	1.01	80	25.8	52 2
Americot	AMX 1504 B2RF	0.4	5.1	0.99	81	26.7	52 1
Americot	AMX 1532 B2RF	0.4	4.6	1.11	81	27.4	52 1
Americot	AMX 821 R	0.4	5.1	1	80	26.2	53 1
Croplan Genetics	CG 3020B2RF	0.4	4.9	1.04	81	26.2	52 1
Croplan Genetics	CG 3520B2RF	0.38	4.7	1.09	80	26.9	52 2
Croplan Genetics	CG 4020B2RF	0.4	4.4	1.07	79	26.7	53 1
DP&L	2145 RR	0.4	6	0.9	80	26.5	52 2
DP&L	2280 BGRR	0.4	5.8	0.97	80	27.2	53 2
DP&L	DP 110 RF	0.4	5.5	1.05	80	31.3	53 1
DP&L	DP 117 B2RF	0.4	6.1	0.97	80	27.9	52 2
DP&L	DP 434 RR	0.4	5	1.05	81	27.1	53 2
DP&L	DP 444 BG/RR	0.4	5.2	1.01	80.1	27.8	53 2
DP&L	DPLX 04V282DF	0.4	5.6	0.98	80	25.4	53 1
DP&L	DPLX 04V294DF	0.4	5.3	0.97	81	25.3	52 2
DP&L	DPLX 07H835DF	0.4	5.1	1.03	80	26.7	52 1
DP&L	PM 2140 B2RF	0.4	5.1	1.03	79	28.4	62 1
Dyna Gro	DG 2100 B2RF	0.4	4.9	1.02	79	25.1	52 1
Fibermax	FM 9058F	0.4	4.6	1.1	81	28.3	52 2
Fibermax	FM 9063B2F	0.4	4.5	1.12	82	31.2	52 1
Fibermax	FM 960BR	0.4	4.4	1.06	80	32	53 1
Fibermax	FM 989B2R	0.4	5.2	1.06	80	30.1	52 1
PhytoGen	PHY 125 RF	0.4	4.7	1.05	82	29.7	52 2
PhytoGen	PHY 310 R	0.4	5.5	1	80	27.5	42 2
PhytoGen	PHY 370 WR	0.4	5	1.04	80	29.4	53 1
PhytoGen	PHY 485 WRF	0.4	5.2	1.07	80	28.5	63 1
Stoneville	NG 1553R	0.4	5.1	0.99	80	27.5	52 1
Stoneville	NG 2448R	0.4	5.6	0.97	80	29.1	52 1
Stoneville	NG 3273B2RF	0.4	4.5	1.06	80	26.1	52 1
Stoneville	NG 3550RF	0.4	5.1	1.08	81	29.4	53 2
Stoneville	ST 4554B2RF	0.4	4.6	1.1	80	31.1	53 1
	Average	0.4	5	1.03	80	27.9	--
	CV (%)	5	8	3	1	5	--
	LSD (0.05)	0	0.8	0.07	2	2.7	--

SOUTHEAST AGRICULTURAL RESEARCH CENTER
KANSAS STATE UNIVERSITY

ANNUAL SUMMARY OF WEATHER DATA FOR PARSONS, KANSAS - 2006

Mary Knapp[1]

2006 DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg. Max	55.3	48.8	59.9	75.3	77.4	87.2	93.4	95.4	80.9	70.4	59.9	46.7	70.9
Avg. Min	28.6	21.6	34.5	48.0	56.8	62.2	68.8	70.9	52.1	45.3	36.2	26.7	46.0
Avg. Mean	41.9	35.2	47.2	61.7	67.1	74.7	81.1	83.1	66.5	57.8	48.1	36.7	58.4
Precip	0.69	0	2.14	4.6	3.86	2.62	4.8	3.85	0.64	1.88	1.36	2.92	29.31
Snow	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	14.0	17.0
Heat DD*	715	835	552	175	99	0	0	0	55	281	508	878	4096
Cool DD*	0	0	0	76	163	290	500	563	101	59	0	0	1750
Rain Days	4	0	10	7	9	5	5	6	3	9	8	5	71
Min < 10	0	3	0	0	0	0	0	0	0	0	0	5	8
Min < 32	22	21	12	1	0	0	0	0	0	3	12	17	88
Max > 90	0	0	0	3	0	4	21	23	1	3	0	0	55

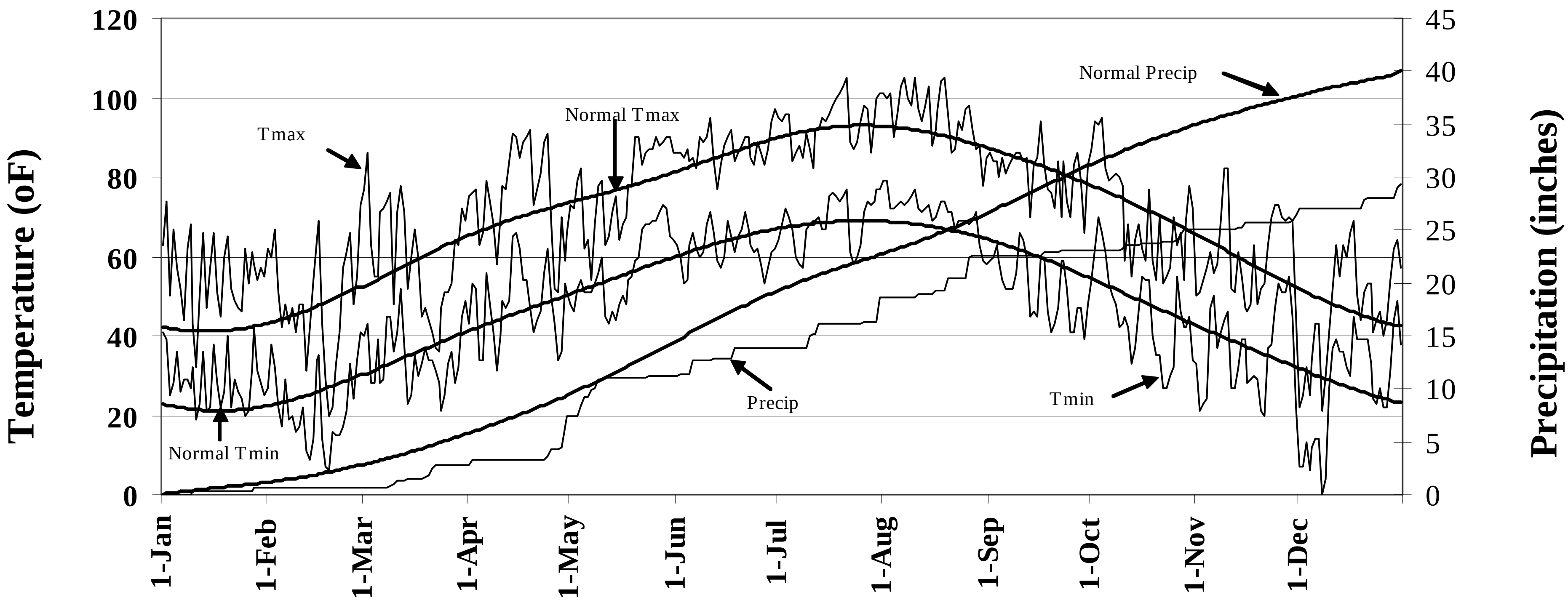
NORMAL VALUES (1971-2000)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg. Max	40.2	47.2	57.2	67.1	76.0	85.0	91.1	90.0	81.0	70.5	55.5	44.4	67.1
Avg. Min	20.2	25.6	34.8	44.1	54.4	63.4	68.3	66.0	58.0	46.3	34.9	24.8	45.1
Avg. Mean	30.2	36.4	46.0	55.6	65.2	74.2	79.7	78.0	69.5	58.4	45.2	34.6	56.1
Precip	1.37	1.78	3.37	3.82	5.39	4.82	3.83	3.42	4.93	4.04	3.29	2.03	42.09
Snow	2.0	3.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	0.0	8.5
Heat DD	1079	800	590	295	95	6	0	3	51	229	594	942	4684
Cool DD	0	0	0	13	101	283	456	406	187	24	0	0	1470

DEPARTURE FROM NORMAL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg. Max	15.1	1.6	2.7	8.2	1.4	2.2	2.3	5.4	-0.1	-0.1	4.4	2.3	3.8
Avg. Min	8.4	-4.0	-0.3	3.9	2.4	-1.2	0.5	4.9	-5.9	-1.0	1.3	1.9	0.9
Avg. Mean	11.7	-1.2	1.2	6.1	1.9	0.5	1.4	5.1	-3.0	-0.6	2.9	2.1	2.3
Precip	-0.68	-1.78	-1.23	0.73	-1.53	-2.2	0.97	0.43	-4.29	-2.16	-1.93	0.89	-12.78
Snow	1.0	-3.0	-1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2	14.0	8.5
Heat DD	-364	35	-39	-120	4	-6	0	-3	4	52	-86	-65	-588
Cool DD	0	0	0	63	62	7	44	157	-87	35	0	0	280

* Daily values were computed from mean temperatures. Each degree that a day's mean is below (or above) 65 F is counted for one heating (or cooling) degree day.

[1]Assistant Specialist, Weather Data Library, Kansas State University.

Weather Summary for Parsons -- 2006



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