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Contribution No. 03-322-S from the Kansas Agricultural Experiment Station.

SOUTHEAST AGRICULTURAL RESEARCH CENTER
KANSAS STATE UNIVERSITY

INTERSEEDING LESPEDEZA INTO CRABGRASS PASTURE VERSUS ADDITIONAL NITROGEN FERTILIZATION ON FORAGE PRODUCTION AND CATTLE PERFORMANCE

Lyle W. Lomas, Joseph L. Moyer, Frank K. Brazle[1] and Gary L. Kilgore[1]

Summary

Fifty steers grazed wheat-'Red River' crabgrass pastures fertilized with additional nitrogen (N) or interseeded with lespedeza in a double-crop grazing system during 2002. These pastures had been grazed in a wheat-crabgrass double-crop grazing system and broadcast with 2 lb/a of crabgrass during each of the four previous years. In 2002, no additional crabgrass seed was planted in order to determine whether crabgrass would voluntarily reseed itself sufficiently to sustain the system. Legume cover, forage dry matter production, grazing steer performance, and subsequent feedlot performance were measured. Forage availability, grazing, finishing, and overall performance were similar (P>0.05) between steers that grazed pastures fertilized with additional N and those interseeded with lespedeza.

Introduction

Cattlemen in southeastern Kansas, eastern Oklahoma, and western Arkansas need high quality forages to complement grazing of tall fescue. Complementary forages are especially needed during the summer months, which is when fescue forage production declines and animal performance is reduced by the endophyte that typically is found in most fescue grown in this region. Crabgrass could fill this niche by providing high-quality forage for summer grazing. A high level of nitrogen (N) fertilization is required for crabgrass. Adding a legume could reduce the amount of N fertilizer required, enhance the utilization of crabgrass, and extend grazing of high-quality forage in late summer. Since crabgrass is an annual, it must reseed itself sufficiently on a volunteer basis to provide grazing the following year if it is to be a viable forage in southeastern Kansas. The purpose of this study was to evaluate the effect of interseeding lespedeza into crabgrass pastures on forage availability, grazing stocker steer performance and subsequent feedlot performance, and to determine if crabgrass can reseed itself on a volunteer basis to sufficiently sustain the system.

Experimental Procedures

Pastures

Korean lespedeza was no-till seeded on March 1, 2002 at the rate of 18.5 lb/a on five of 10 4-acre pastures that had previously been interseeded with lespedeza during each of the past four years. All pastures had originally been seeded with Red River crabgrass during the summer of 1997 and no-till seeded with 'Jagger' wheat at 121 lb/a on September 25, 2001. All pastures were broadcast with 2 lb/a of crabgrass seed during the spring and grazed for the past 4 years in a wheat-crabgrass double-crop system. No additional crabgrass was seeded in 2002 in order to determine if it could voluntarily reseed itself in a manner sufficient to sustain the system. All pastures were fertilized with 60-55-40 lb/a of N-P_2O_5-K_2O on November 13, 2001; 46 lb of N/a on February 14, 2002; and 48 lb of N/a on May 15, 2002 at the time of crabgrass emergence. An additional 48 lb of N/a was applied to the five pastures without lespedeza

[1]Southeast Area Extension Office.

on July 1, 2002.

Available forage was determined at the initiation of grazing and during the season with a disk meter calibrated for crabgrass and for wheat. One exclosure (15-20 ft^2) was placed in each pasture. Total production was estimated from three readings per exclosure and available forage was determined from three readings near each cage. Lespedeza canopy coverage was estimated from the percentage of the disk circumference that contacted a portion of the canopy.

Cattle

Fifty yearling steers of predominately Angus breeding with an initial weight of 665 lb were weighed on consecutive days, stratified by weight, and allotted randomly to the 10 pastures on March 7, 2002 to graze out wheat and then graze crabgrass. Cattle grazed wheat until May 7 (61 days) and then grazed crabgrass until September 4 (120 days). Pastures were stocked initially with 1.2 head/a until the end of the wheat phase (May 7), when a steer closest to the pen average weight was removed from each pasture. Pastures were then stocked at 1 head/a until grazing was terminated and steers were weighed on September 3 and 4, 2002.

Cattle were treated for internal and external parasites prior to 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.

Following the grazing period, cattle were shipped to a finishing facility and fed a diet of 80% ground milo, 15% corn silage, and 5% supplement (dry matter basis) for 120 days. Steers were implanted with Synovex S® on days 0 and 84 of the finishing period. Cattle were slaughtered in a commercial facility at the end of the finishing period and carcass data collected.

Results and Discussion

Pastures

Available forage dry matter (DM) is presented in Figure 1. Available forage was similar between pastures that received additional N fertilizer and those that were interseeded with lespedeza. Available forage in both treatments in 2002 appeared to be lower than in 2000 and 2001. This may have been due at least in part to less precipitation during the grazing phase in 2002 and a stocking rate closely matching available forage. Lespedeza canopy coverage peaked at 13% on June 24.

Cattle Performance

Performance of steers that grazed crabgrass pastures either fertilized with additional N or interseeded with lespedeza are shown in Table 1. There were no differences (P>0.05) in performance of cattle that grazed pastures fertilized with additional N and those interseeded with lespedeza during the grazing phase, finishing phase, or overall. Gains during the wheat phase averaged 3.05 and 2.94 lb/head/day; during the crabgrass phase, 1.72 and 1.58 lb/head/day; and overall, grazing gains averaged 2.17 and 2.03 lb/head/day for pastures fertilized with additional N and interseeded with lespedeza, respectively. Gain per acre averaged 233 and 224 lb during the wheat phase, 207 and 189 lb during the crabgrass phase, and 440 and 413 lb overall for pastures fertilized with additional N and interseeded with lespedeza, respectively. Crabgrass gains were likely limited by forage availability due to below-normal precipitation during the summer months.

Finishing gains averaged 3.67 and 3.62 lb/head/day and overall gains (grazing + finishing) averaged 2.75 and 2.64 lb/head/day for steers that had previously grazed pastures fertilized with additional N and interseeded with lespedeza, respectively. Two steers that had previously grazed lespedeza were removed from the study during the finishing phase for reasons unrelated to experimental treatment. Previous grazing treatment had no effect (P>0.05) on finishing performance or carcass characteristics.

Grazing and finishing performance were similar (P>0.05) between steers that grazed pastures fertilized with additional N and those interseeded with lespedeza. Cattle performance and gain per acre were similar to those measured during the previous three years when crabgrass was seeded each year.

This study will be continued for at least two more grazing seasons with no additional crabgrass seed being sown in order to determine if the crabgrass will reseed itself in a manner sufficient to sustain the system.

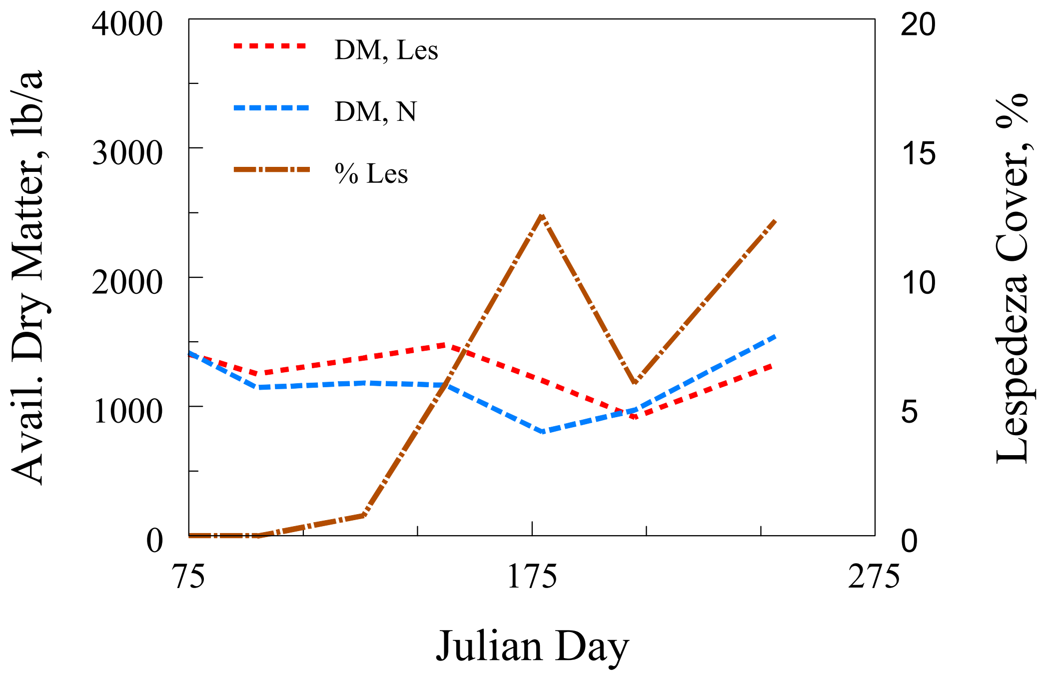

Figure 1. Available Forage and Lespedeza Canopy Cover in Wheat and Crabgrass Pastures, 2002, Southeast Agricultural Research Center.

Table 1. Effect of Interseeding Legumes vs. Nitrogen Fertilization on Performance of Steers Grazing Crabgrass Pastures, Southeast Agricultural Research Center, 2002.

Item	Nitrogen	Lespedeza
Grazing Phase - Wheat (61 days)		
No. of head	15	20
Initial wt., lb	665	665
Ending wt., lb	851	844
Gain, lb	186	179
Daily gain, lb	3.05	2.94
Gain/a, lb	233	224
Grazing Phase - Crabgrass (120 days)		
No. of head	12	16
Initial wt., lb	849	842
Ending wt., lb	1056	1031
Gain, lb	207	189
Daily gain, lb	1.72	1.58
Gain/a, lb	207	189
Overall Grazing Performance (Wheat + Crabgrass) (181 days)		
Gain, lb	393	368
Daily gain, lb	2.17	2.03
Gain/a, lb	440	413
Finishing Phase (118 days)		
No. of head	12	14
Initial wt., lb	1056	1030
Ending wt., lb	1490	1456
Gain, lb	434	427
Daily gain, lb	3.67	3.62
Daily DM intake, lb	28.5	27.6
Feed/gain	7.76	7.63
Hot carcass wt., lb	895	871
Dressing %	60.1	59.8
Backfat, in	.60	.56
Ribeye area, in^2	12.4	12.8
Yield grade	3.7	3.5
Marbling score	SM^{45}	SM^{34}
% Choice	92	86
Overall Performance (Grazing + Finishing Phase) (299 days)		
Gain, lb	825	791
Daily gain, lb	2.75	2.64

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

EFFECT OF GRAIN SORGHUM SUPPLEMENTATION OF STEERS AND HEIFERS GRAZING SMOOTH BROMEGRASS PASTURES ON GRAZING AND SUBSEQUENT FINISHING PERFORMANCE

Lyle W. Lomas and Joseph L. Moyer

Summary

Twenty-four steer calves and 12 heifer calves were used to evaluate the effect on grazing and subsequent finishing performance from grain sorghum supplementation while grazing smooth bromegrass. Cattle supplemented with 4 lb of grain sorghum per head daily had higher ($P<0.05$) grazing gain than those that received no supplement, while 2 lb of supplement per head daily resulted in no significant ($P>0.05$) improvement in grazing gain over no supplementation. Forage availability was not affected ($P>0.05$) by supplementation. Supplementation during the grazing phase had no effect ($P>0.05$) on finishing or overall performance.

Introduction

Supplementation of grazing stocker cattle is an effective way to increase gains of cattle on pasture. Whether or not to provide supplement to grazing cattle may depend on several factors including pasture conditions, supplement cost, anticipated selling price, cattle weight, and expected selling date. While supplementation will improve grazing gains in most cases, the effect of supplementation on available forage during the grazing phase and on subsequent finishing performance and carcass characteristics are not clearly documented. The purpose of this study was to evaluate the effect of grain sorghum supplementation on forage availability, grazing performance, and subsequent finishing performance.

Experimental Procedures

Twenty-four steer calves (552 lb) and twelve heifer calves (472 lb) of predominately Angus breeding were weighed on consecutive days, stratified by weight within sex, and allotted randomly to nine 5-acre smooth bromegrass pastures on April 25, 2002. Two pastures of steers and one pasture of heifers were randomly assigned to one of three supplementation treatments and grazed for 188 days. Supplementation treatments were 0, 2, or 4 lb of ground grain sorghum/head daily. Cattle were weighed, forage samples collected, and forage availability measured approximately every 28 days with a disk meter calibrated for smooth bromegrass. Grazing was terminated and cattle were weighed on October 29 and 30, 2002.

Cattle were treated for internal and external parasites prior to 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.

Following the grazing period, cattle were shipped to a finishing facility and fed a diet of 80% ground milo, 15% corn silage, and 5% supplement (dry matter basis) for 120 days. Steers were implanted with Synovex S® and heifers with Ralgro® on days 0 and 84 of the finishing period. Cattle were slaughtered in a commercial facility at the end of the finishing period and carcass data collected.

Results

Available forage during the grazing phase is presented in Table 1. There were no significant ($P>0.05$) differences in pasture forage as a result of supplementation treatment or gender on any of the evaluation dates. Forage availability peaked on May 29 and was lowest on October 29.

Cattle performance is presented in Table 2. Cattle fed 4 lb of grain sorghum per head daily gained 0.3 lb more ($P<0.05$) per day and produced 45 lb more ($P<0.05$) grazing gain per acre than those that received no supplement. Supplementation with 2 lb of grain sorghum per head daily resulted in no significant ($P<0.05$) improvement in grazing performance over the unsupplemented control.

Level of supplementation during the grazing phase had no effect ($P>0.05$) on finishing gain or overall gain. Cattle supplemented with 4 lb of milo per head daily during the grazing phase were heavier at the end of the finishing phase than those supplemented with 0 or 2 lb per head daily, although this difference was not significant ($P>0.05$). Cattle that received no supplement during the grazing phase apparently made some compensatory gain in the feedlot. Cattle supplemented with 4 lb of milo per head daily during the grazing phase had higher ($P<0.05$) marbling scores than those that received 0 or 2 lb of supplement. Marbling score was lower ($P<0.05$) for cattle supplemented with 2 lb of supplement than for those supplemented with 0 or 4 lb per head daily.

Although the steers were heavier ($P<0.05$) than the heifers at both the beginning and ending of the grazing phase, grazing gains of steers and heifers were similar ($P<0.05$). During the finishing phase, steers had higher ($P<0.05$) gains, consumed more ($P<0.05$) feed, had lower ($P<0.05$) feed/gain, heavier ($P<0.05$) carcasses, and higher ($P<0.05$) overall gains than heifers. Heifers had a higher ($P<0.05$) dressing percent and higher ($P<0.05$) marbling scores than steers.

In summary, supplementation with 4 lb of milo/head/day improved ($P<0.05$) performance during the grazing phase, but had no effect ($P>0.05$) on finishing or overall performance. Supplementation with 2 lb of grain sorghum per head daily resulted in similar ($P>0.05$) performance as feeding no supplement. Based on these data, a producer that was going to background cattle and sell them at the end of the grazing period might want to consider supplementation with 4 lb of grain sorghum per head daily. If the producer planned to retain ownership of the cattle through slaughter, there would be little or no advantage to supplementation during the backgrounding phase.

Table 1. Effect of Grain Sorghum Supplementation on Forage Availability for Steers and Heifers Grazing Smooth Bromegrass Pastures, Southeast Agricultural Research Center, 2002.

	Forage Availability (lb/acre)				
	Grain Sorghum (lb/head/day)			Sex	
Date	0	2	4	Steers	Heifers
April 25	3109	3546	3309	3451	3191
May 29	4234	4266	4251	4625	3876
June 27	2936	2798	2963	2907	2891
July 24	2292	2307	2460	2311	2395
August 27	1830	1699	1762	1658	1870
September 26	1502	1497	1614	1565	1510
October 29	1145	1055	987	1013	1112
Average	2436	2452	2478	2504	2406

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

Table 2. Effect of Grain Sorghum Supplementation of Steers and Heifers Grazing Smooth Bromegrass Pastures on Grazing and Subsequent Finishing Performance, Southeast Agricultural Research Center, 2002.

Item	Grain Sorghum (lb/head/day)			Sex	
	0	2	4	Steers	Heifers
Grazing Phase (188 days)					
No. of head	12	12	12	24	12
Initial wt., lb	512	512	512	552[a]	472[b]
Ending wt., lb	822[c]	844	879[d]	897[a]	800[b]
Gain, lb	310[c]	332	366[d]	345	328
Daily gain, lb	1.65[c]	1.77	1.95[d]	1.83	1.74
Gain/acre, lb	248[c]	266	293[d]	276	262
Finishing Phase (112 days)					
Initial wt., lb	822[c]	844	879[d]	897[a]	800[b]
Ending wt., lb	1214	1217	1254	1320[a]	1136[b]
Gain, lb	392	373	375	424[a]	336[b]
Daily gain, lb	3.50	3.33	3.35	3.78[a]	3.00[b]
Daily DM intake, lb	25.8	25.6	25.2	26.9[a]	24.2[b]
Feed/gain	7.46	7.76	7.57	7.12[a]	8.07[b]
Hot carcass wt., lb	720	746	749	780[a]	696[b]
Dressing %	59.4	61.4	59.8	59.0[a]	61.3[b]
Backfat, in	.39	.47	.45	.41	.46
Ribeye area, in^2	12.1	11.9	12.4	12.3	11.9
Yield grade	2.7	3.1	3.0	2.9	2.9
Marbling score	SM[51c]	SM[28d]	SM[74e]	SM[28a]	SM[74b]
% Choice	94	69	94	71	100
Overall Performance (Grazing + Finishing) (300 days)					
Gain, lb	702	705	741	768[a]	664[b]
Daily gain, lb	2.34	2.35	2.47	2.56[a]	2.21[b]

[a,b] Gender means within a row with the same letter are not significantly different (P<0.05).
[c,d,e] Supplementation level means within a row with the same letter are not significantly different (P<0.05).

USE OF LEGUMES IN WHEAT-BERMUDAGRASS PASTURES

Joseph L. Moyer and Lyle W. Lomas

Summary

Use of spring hairy vetch and summer red clover in wheat-bermudagrass pastures increased summer cow gains with similar average forage availability compared to wheat-bermudagrass plus a summer nitrogen (N) application.

Introduction

Bermudagrass is a productive forage species when intensively managed. However, it has periods of dormancy and requires proper use to maintain forage quality. It also requires adequate nitrogen (N) fertilizer to optimize forage yield and quality. Interseeding wheat or other small grains can lengthen the grazing season but this requires additional N fertilization. Legumes in the bermudagrass sward could improve forage quality and reduce fertilizer usage. However, legumes are difficult to establish and maintain with the competitive grass. Red clover has shown promise of summer survival in bermudagrass sod and may be productive enough to substitute for midsummer N fertilization. Hairy vetch is a vigorous winter annual legume that has survived most winters in southeastern Kansas. This study was designed to compare cow-calf and dry cow performance on a wheat-bermudagrass pasture system that included a winter and a summer legume with a single 60 lb/a N application (Legumes) versus wheat-bermudagrass with an additional N application of 50 lb/a (total N applied, 160 lb/a) and no legumes (Nitrogen).

Experimental Procedures

Eight 5-acre ‘Hardie’ bermudagrass pastures located at the Mound Valley Unit of the KSU - Southeast Agricultural Research Center (Parsons silt loam soil) were assigned to Legume or Nitrogen treatments in a completely randomized design with four replications.

‘Jagger’ wheat (89 lb/a) was interseeded (no-till) into bermudagrass sod on September 11, 2001. The next day, 26 lb/a of hairy vetch and 2 lb/a of arrowleaf clover were interseeded into the four pastures assigned to the legume treatment. Stands of wheat and hairy vetch were assessed as “Fair to Good” in the fall. Pastures that received no legumes (Nitrogen) were fertilized with 50 lb/acre of N as urea on January 14, 2002.

On March 27, legume pastures were broadcast with 12 lb/a of ‘Kenland’ medium red clover. Because of poor wheat production, calves were weaned and cows were weighed on consecutive days and assigned randomly by weight to each pasture on April 23. All pastures were fertilized on May 31 with 60-50-30 lb/a of N-P_2O_5-K_2O and clipped on June 3. Nitrogen pastures received 50 lb/a of N as urea on July 18. Cows grazed bermudagrass until August 13, when they were removed to begin calving.

Available forage and legume canopy coverage were monitored throughout the grazing season with a calibrated disk meter. Pastures were mowed on August 21 to remove excess forage.

Results and Discussion

The stand of hairy vetch was fair to good during the winter and spring in the Legume treatment, providing an average legume canopy coverage of 19%. Cows gained an average of 129 lb during the wheat grazing period (29 days), similar for the two systems. Available forage dry matter in the wheat grazing phase was also similar, averaging 2240 lb dry matter/a.

Cow gains during the bermudagrass phase were higher for the Legume than the Nitrogen system (Table 1, P<0.05). Average available forage was similar (P>0.10) for the two systems. Average canopy coverage of red clover tended to be greater (P<0.20) for the Legume than the Nitrogen system, ranging from a high of 5% recorded on June 18 down to 2% at the end of grazing. Overall gains for the season and gain per acre were higher for the Legume than the Nitrogen system (Table 1, P<0.05). Hay production was similar (P>0.10) for the systems, averaging 4780 lb/a.

Table 1. Performance of Cows Grazing Bermudagrass Pastures Interseeded with Wheat and Fertilized with Nitrogen or Interseeded with Legumes, Southeast Agricultural Research Center, 2002.

	Management System	
Item	Nitrogen	Legumes
Bermudagrass Phase		
No. of cows	16	16
No. of days	83	83
Stocking rate, cows/a	0.8	0.8
Cow initial wt., lb	1442	1452
Cow final wt., lb	1538	1582
Cow gain, lb	96[a]	130[b]
Cow daily gain, lb	1.16[a]	1.57[b]
Cow gain, lb/a	77[a]	104[b]
Legume cover, %	1	6
Average available DM, lb/a	2820	2800
Overall Grazing Performance		
No. of days	112	112
Cow gain, lb	220[a]	264[b]
Cow daily gain, lb	1.96[a]	2.36[b]
Cow gain, lb/a	176[a]	211[b]

[a,b] Means within a row followed by a different letter are significantly different at P<0.05.

ALFALFA VARIETY PERFORMANCE IN SOUTHEASTERN KANSAS

Joseph L. Moyer

Summary

A 13-line test seeded in 2001 was cut four times in 2002. Yields ranged from 7.53 to 6.49 tons/a. For the year, 'HybriForce', '6420', and 'Dagger+EV' yielded significantly ($P<0.05$) more than 'Kanza' and 'Rebound 4'. Two-year total production was greater ($P<0.05$) from HybriForce, 6420, and Dagger+EV, than from Kanza, and Rebound 4.

Introduction

Alfalfa can be an important feed and/or 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 test was seeded (15 lb/a) on May 9, 2001 at the Mound Valley Unit (Parsons silt loam) after preplant fertilization with 20-50-200 lb/a of N-P_2O_5-K_2O. Plots were treated for weed control with 1 pt/a of Poast® on June 19 and 2 qt/a of Butyrac® on July 2, and for webworm infestation on August 9 with malathion. Plots were harvested on July 13 and August 21, 2001.

In 2002, plots were fertilized on February 22 with 20-50-200 lb/a of N-P_2O_5-K_2O. Alfalfa weevils were controlled by spraying 1.5 pt/a of Lorsban® on April 17. Plots were sprayed on July 5 with 1.5 pt/a of Poast® to control grass. The first three harvests were taken on May 7, June 18, and July 17. Blister beetles invaded and ate many leaflets in early August, but plots regrew by the fourth harvest on August 22. Moisture was inadequate for regrowth until late fall (see weather summary).

Results and Discussion

Yields in 2001 (Table 1) were significantly ($P<0.05$) higher from Dagger+EV, HybriForce, and 'Pawnee' than from Rebound 4 and Kanza. Yields of the first cutting in 2002 were significantly ($P<0.05$) higher from HybriForce and 'WL 342' than from Pawnee and Kanza (Table 1). Yields of the second cut did not differ, but third-cut yield was higher from 6420 than from 'Perry'. Webworms defoliated much of the growth in early August. However, regrowth averaging 0.7 tons per acre was cut August 22, with no difference among varieties. Drought prevented regrowth until October, and amounts were insufficient for harvest.

For 2002, HybriForce, 6420 and Dagger+EV yielded significantly ($P<0.05$) more than five other entries (Table 1). Total 2-year yield of HybriForce and 6420 were higher ($P<0.05$) than total yields of six other entries. HybriForce, 6420, and Dagger+EV had greater 2-year production than Kanza and Rebound 4. Statewide alfalfa performance test results can be found at http://www.ksu.edu/kscpt/.

Table 1. Forage Yields (tons/a @ 12% moisture) for Four Cuttings in 2002, and Totals for 2001-2002 for the 2001 Alfalfa Variety Test, Mound Valley Unit, Southeast Agricultural Research Center.

		2002						
Source	Entry	5/7	6/18	7/17	8/22	Total	2001	2-Yr Total
AgriPro Biosciences, Inc	Dagger + EV	1.92[b,c]	2.13[a]	1.04[a,b]	0.76[a]	5.86[a,b]	1.44[a]	7.30[a,b]
Allied	350	1.80[b,c,d]	1.91[a]	1.02[a,b]	0.69[a]	5.44[b]	1.30[a,b,c]	6.75[b,c]
Allied	400SCL	1.92[b,c]	2.04[a]	1.04[a,b]	0.65[a]	5.64[a,b]	1.16[b,c]	6.73[b,c]
Croplan Genetics	5-Star	1.81[b,c,d]	1.98[a]	1.09[a]	0.70[a]	5.58[a,b]	1.36[a,b,c]	6.94[a,b,c]
Croplan Genetics	Rebound 4.2	1.77[b,c,d]	1.95[a]	1.07[a]	0.63[a]	5.43[b]	1.14[c]	6.57[c]
Dairyland	HybriForce-400	2.22[a]	2.08[a]	1.05[a,b]	0.77[a]	6.13[a]	1.40[a,b]	7.53[a]
Garst Seed	6420	1.99[a,b,c]	2.16[a]	1.15[a]	0.81[a]	6.11[a]	1.39[a,b,c]	7.51[a]
Midwest Seed	Pawnee	1.73[c,d]	1.95[a]	1.00[a,b]	0.66[a]	5.37[b]	1.40[a,b]	6.74[b,c]
Pioneer	54V54	1.80[b,c,d]	2.03[a]	0.97[a,b]	0.71[a]	5.51[a,b]	1.34[a,b,c]	6.85[a,b,c]
W-L Research	WL 327	1.98[a,b,c]	1.93[a]	1.06[a,b]	0.78[a]	5.75[a,b]	1.26[a,b,c]	7.05[a,b,c]
W-L Research	WL 342	2.02[a,b]	2.04[a]	1.04[a,b]	0.70[a]	5.80[a,b]	1.25[a,b,c]	7.04[a,b,c]
Kansas AES & USDA	Kanza	1.58[d]	1.91[a]	1.09[a]	0.74[a]	5.33[b]	1.15[c]	6.49[c]
Nebraska AES & USDA	Perry	1.88[b,c]	2.03[a]	0.81[b]	0.62[a]	5.35[b]	1.29[a,b,c]	6.65[b,c]
Average		1.88	2.01	1.03	0.71	5.64	1.31	6.94

[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

Ten tall fescue cultivars seeded in fall, 1999 were harvested in May, 2002. 'Seine' produced more forage than 'AU Triumph' and 'FA 102'. Seven entries produced more total forage than FA 102 in 2001 and 2002, although FA 102 was the top producer in 2000.

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 U.S. 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.

Experimental Procedures

A 10-line test was seeded with a cone planter in 10-inch rows using 19 lb/a of pure, live seed on September 9, 1999 at the Mound Valley Unit, Southeast Agricultural Research Center. Each plot was 30 ft x 5 ft and plots were arranged in four randomized complete blocks. Soil was a Parsons silt loam (Mollic albaqualf). Fertilizer to supply 150-50-60 lb/a of N-P_2O_5-K_2O was applied to all plots on February 21, 2002. A 3-ft x 20-ft area was harvested from each plot to a 2-in. height using a flail-type harvester and weighed on May 23, 2002, after all plots were headed. A forage subsample was collected and dried at 140 ^{0}F for moisture determination and forage was removed from the remainder of the plot at the same height. Fall regrowth was insufficient for harvest because of late-summer drought.

Results and Discussion

Heading date was significantly ($P<0.05$) later for Seine and 'Fuego' than for the other entries in 2002 (Table 1). AU Triumph was earlier than all other entries, followed by 'Ga-5'.

Forage yield in 2002 was higher ($P<0.05$) for Seine than for AU Triumph and FA 102 (Table 1). Eight of the nine other entries produced more forage than AU Triumph in 2002, and seven entries produced more forage than it and FA 102.

Although FA 102 was the top producer in 2000, its total production in 2001 and 2002 was significantly ($P<0.05$) less than eight of the other entries (Table 1). Seven entries had more total production than FA 102 and AU Triumph.

Table 1. Forage Yield and Heading Date of Tall Fescue Cultivars in 2002 that were Seeded in 1999, Mound Valley Unit, Southeast Agricultural Research Center.

Cultivar		Heading Date	Forage Yield	
			5/23	2-YR Total[5]
		Julian Day	- - - - tons/a@12% moisture - - - -	
FA 102 EF[1]		127	2.62	6.27
Jesup NETF[2]		128	2.92	7.13
Ga-5 NETF[2]		126	2.77	6.77
AU Triumph		123	2.42	6.41
Fuego LE[3]		131	2.91	7.02
Seine EF		131	3.02	7.00
Select EF		129	2.73	7.00
Ky 31 EF		129	2.81	7.22
Ky 31 HE[3]		128	2.87	7.17
MV 99 EF		129	2.98	7.09
	Average	128[4]	2.81	6.91
	LSD(0.05)	0.7	0.32	0.47

[1] EF=Endophyte-free.
[2] Contains proprietary novel endophyte.
[3] LE= Low-endophyte seed (0-2% infected); HE=High-endophyte seed (80% infected).
[4] May 8, 2002.
[5] Includes spring and fall cuttings in 2001.

EVALUATION OF ANNUAL LESPEDEZA CULTIVARS

Joseph L. Moyer and Gary L. Kilgore

Summary

Four annual lespedezas were harvested for forage and seed production. Forage yield averaged 3.3 tons/a, with no significant (P>0.10) difference among cultivars. Seed yield averaged only 152 lb/a because of the dry fall, with a tendency (P=0.07) for common Korean to produce more than 'Kobe'.

Introduction

The annual lespedezas comprise the only group of legumes grown primarily for forage in the U.S. that is truly warm-season in adaptation. The two primary species are Korean lespedeza (*Lespedeza stipulacea* Maxim.) and striate lespedeza (*L. striata* Hook. and Arn.). The annual lespedezas are used for seeding in small grain rotations as well as a supplement to cool- and warm-season perennial grass pastures. Low yield relative to other forage species has resulted in a decline of importance over the past several decades, but recent releases may have improved forage yield and/or quality.

Experimental Procedures

A four-line test was seeded with a cone planter in 10-in. rows using 20 lb/a of pure, live seed on April 17, 2002 at the Mound Valley Unit, Southeast Agricultural Research Center. All of the entries besides common Korean were of the striate type. Each plot was 30 ft x 10 ft and plots were arranged in four randomized complete blocks. Soil was a Parsons silt loam (Mollic albaqualf). Fertilizer to supply 20-50-200 lb/a of N-P_2O_5-K_2O was applied to all plots prior to planting. Plots were treated with 1 lb/acre a.i. of 2,4-DB on June 7, and 0.2 lb/a a.i of sethoxydim with surfactant on July 5.

A 3-ft x 20-ft area was harvested from each plot to a 2-in. height using a flail-type harvester, and weighed on August 20, 2002 after all plots had begun to bloom. Stands were visually evaluated at that time. A forage subsample was collected and dried at 140 ^{0}F for moisture determination. The remainder of the plot was left for seed production. On October 24, a 3.5-ft x 20-ft area was clipped from each plot with a sickle mower, and plant material was dried and seed was threshed with a plot combine.

Results and Discussion

Forage yield of the four entries averaged 3.3 tons/a with no significant (P>0.10) difference among cultivars (Table 1). Stands varied among cultivars, perhaps partly affected by hard rains of April 27-28. In fact, forage yield and stand rating were correlated (r=0.51, P<0.05). However, there was apparently enough compensation on the part of cultivars to preclude significant differences in forage yield.

Seed yield averaged only 152 lb/a because of dry conditions during late summer and early fall (Table 1). Seed production tended (P=0.07) to be greater for Korean than for 'Kobe', but yields were similar for all other comparisons.

Table 1. Forage and Seed Yield, and Stand Rating of Annual Lespedeza Cultivars in 2002, Mound Valley Unit, Southeast Agricultural Research Center.

Cultivar	Forage Yield[1]	Seed Yield	Stand Rating
	- tons/acre -	- lb/acre -	-0 to 5-
Common Korean	3.82[a,2]	223[a,2]	4.5[a,3]
Legend	3.19[a]	153[a,b]	3.2[b]
Kobe	3.35[a]	116[b]	3.4[b]
Marion	2.85[a]	129[a,b]	2.6[b]
Average	3.09	152	3.4

1 12% moisture basis.

2 Means within a column followed by the same letter are not significantly ($P<0.10$) different, according to multiple t-tests.

3 Means within a column followed by the same letter are not significantly ($P<0.05$) different, according to multiple t-tests.

FORAGE PRODUCTION OF BERMUDAGRASS CULTIVARS IN EASTERN KANSAS

Joseph L. Moyer, Keith Janssen[1], Kenneth W. Kelley, and Charles M. Taliaferro[2]

Summary

Plot coverage in Ottawa in 2002 was poorer for 'Midland' and 'Ozark' than other entries, and was being re-established for 'CD 90160'. Yields were higher ($P<0.05$) for the two experimental lines, 'LCB84x19-16' and 'LCB84x16-66', than for the other entries. Coverage for sprigged plots at Columbus in 2002 was slightly less for 'Wrangler' than for LCB84x19-16). Total yields for 2002 were higher for 'Midland 99', Ozark, and LCB84x19-16 than for four of the other five entries. Two-year total yields were also higher for Ozark and Midland 99 than for all other entries, except for LCB84x19-16. Seeded plot yields of Wrangler and 'Guymon' were similar but yield of CD 90160 was less ($P<0.05$) and contained more weedy forage. Total 2-year production was similar for the three 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. Further developments in bermudagrass breeding should be monitored to speed adoption of improved, cold-hardy types.

Experimental Procedures

Plots were sprigged at 1-ft intervals with plants in peat pots on April 27, 2000 at the East Central Experiment Field, Ottawa, and on April 28 at the Columbus Unit of the Southeast Agricultural Research Center, except for entry CD 90160, seeded at 8 lb/a of pure, live seed. At the same time, another set of plots at Columbus was seeded with seed-producing cultivars that were also included in the sprigged trial. All plots were 10 x 20 ft each, arranged in four randomized complete blocks. Sprigged plots were subsequently sprayed with 1.4 lb/a of S-metolachlor. Plot coverage by bermudagrass was assessed in August 2000 and in May 2001 at both locations, in July 2001 and 2002 at Ottawa, and August 2002 in Columbus. One lb/a of 2,4-D was applied to the Columbus plots in April 2002. Application of 60 lb/a of N was made at Ottawa and 90-60-60 lb/a of N-P_2O_5-K_2O at Columbus in April 2002. In early July, 60 lb/a of N was applied at each location. Strips (20 x 3 ft) were cut on July 3, 2002 at Ottawa and June 28 and August 8 at Columbus. Subsamples were collected for determination of moisture.

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Five bermudagrass entries were seeded at the Mound Valley Unit of the Southeast Agricultural Research Center on May 7 at 8 lb/acre of pure, live seed for hulled seed or 5 lb/acre of hulless seed. After 5.5 inches of rain on May 8-9 caused some washing of plots, they were harrowed lightly and reseeded on May 22. Plots were sprayed with 2,4-D on June 7, assessed for maturity and coverage and cut on July 22 and again on September 5.

Results and Discussion

Plot coverage in Ottawa during the dry summer of 2000 was most complete by Midland 99, the new cultivar from Oklahoma State University, and Guymon, a seed-producing type from the same source (Table 1). Poorest coverage was shown by Greenfield and Ozark.

By spring 2001 in Ottawa, Guymon had good stands remaining whereas CD 90160, an experimental seeded type, and Midland were winterkilled (Table 1). In midsummer, Guymon and Wrangler, both seed-producing types, had excellent stands, and Greenfield had recovered to a large extent. Stands of Midland, Ozark, and experimental LCB84x16-66 were only fair by early July, and nonexistent for CD90160.

Total 2001 forage production was higher ($P<0.05$, Table 1) for LCB84x19-16, Midland 99, Ozark, and LCB 84x16-66 than for Midland, Greenfield, Guymon, and Wrangler. One entry, CD 90160, did not live to produce forage in 2001.

The spring and early summer of 2002 were favorable for growth at both Ottawa and Columbus. However, regrowth was curtailed at Ottawa because of drought, which continued until near fall dormancy. Plot coverage in Ottawa by July 2002 was poorer for Midland and Ozark than other entries (Table 1), and plots of CD 90160 were in the process of re-establishment. None of the plots had very good coverage, partly because of moisture shortages during parts of the previous 2 growing seasons.

Forage yields for 2002 at Ottawa were higher ($P<0.05$) for the two experimental lines, LCB84x19-16 and LCB84x16-66, than for the other entries (Table 1). Midland produced less forage than all other cultivars that were harvested. Yield totals for the 2 years were higher for LCB84x19-16 than for all other cultivars, except for LCB84x16-66. Midland was lower yielding than all other cultivars, and Greenfield, Wrangler, and Guymon produced less than Midland 99 and Ozark.

In Columbus, plot coverage of the sprigged plots after the summer of 2000 was most complete for Guymon and Wrangler (Table 1). The least coverage was made by LCB84x19-16, which was significantly less than Guymon. The seeded cultivar, CD 90160, had the best coverage in the first summer (Table 2).

By spring 2001 in Columbus, sprigged plots of Greenfield had better stands remaining than six of the other eight cultivars. Conversely, CD 90160 was winterkilled and LCB84x16-66 had poor stands (Table 2).

Forage yields of the first cutting in Columbus were higher ($P<0.05$) for Ozark than four other cultivars (Table 2). Entry LCB84x16-66 yielded less than the other cultivars except for CD 90160, which winterkilled, and Midland. Second-cut yields were higher for Ozark and Midland 99 than for the other entries.

Total forage yields in sprigged plots in 2001 were higher ($P<0.05$) for Ozark than for all other cultivars except Midland 99. In turn, Midland 99 produced more total forage than five of the other cultivars. Entry LCB84x16-

66 yielded less than the other cultivars except for CD 90160, which winterkilled, and Midland.

Coverage for sprigged plots at Columbus in 2002 was slightly less for Wrangler than for LCB84x19-16 (Table 2). First-cut 2002 forage yields at Columbus were higher ($P<0.05$) for Ozark and LCB84x19-16 than for Guymon and Wrangler. Second-cut yields and total yields for 2002 were higher for Midland 99, Ozark, and LCB84x19-16 than for four of the other five entries. Two-year total yields were also higher for Ozark and Midland 99 than for other entries, except for LCB84x19-16 (Table 2).

Plot coverage of seeded plots at Columbus was less in 2000 for Guymon and Wrangler than for CD 90160 (Table 3). However, by 2002, Guymon had better coverage than CD 90160. Forage yields of seeded plots at Columbus were similar in 2001 (Table 3), although most forage in plots of CD 90160 consisted of weedy grasses. Total 2001 forage produced by the other two cultivars averaged a little more than 3.5 tons/a.

In 2002, first-cut and total (not shown) yields of Wrangler and Guymon were similar but yield of CD 90160 was less ($P<0.05$) and contained more weedy forage. Second-cut 2002 and total 2-year production were similar for the three entries.

The newly seeded plots at Mound Valley were covered fairly well by July 22, 2002 (Table 4). 'Cheyenne' had significantly ($P<0.05$) better coverage than 'Johnston's Gold'. Plant maturity, as indicated by seedhead density, was less advanced by July 22 for 'Cherokee' and Cheyenne than for the other three cultivars.

Forage production by July 22, 2002 was greater ($P<0.05$, Table 4) for Cheyenne than for the other cultivars. Cherokee had greater production than Guymon in the first cutting. There was no significant ($P>0.10$) difference among cultivars for second-cut yields; However, total 2002 production was greater for Cheyenne than for the other cultivars (Table 4).

Table 1. Plot Cover and Forage Yield of Bermudagrass Sprigged in 2000, Ottawa Experiment Field, Department of Agronomy.

Entry	Plot Cover†				Forage Yield		
	Aug 2000	May 2001	July 2001	July 2002‡	2001	2002	2-Year Total
					- tons/a @ 12% moisture -		
CD 90160*	2.8	- -	- -	- -	- -	- -	- -
Greenfield	1.8	1.2	4.2	2	3.64	3.46	7.10
Guymon	3.5	3.0	4.9	2	4.00	3.50	7.51
LCB 84x16-66	2.2	1.0	2.2	2	5.49	4.53	10.02
LCB 84x19-16	3.0	2.0	4.0	2	6.27	5.08	11.35
Midland	2.2	0.1	1.6	1	3.47	1.87	5.34
Midland 99	4.2	1.2	3.9	2	6.15	2.97	9.12
Wrangler	2.0	2.0	4.8	2	4.04	3.34	7.39
Ozark	1.8	1.0	2.2	1	5.68	3.60	9.29
Average	2.6	1.5	3.5	2.44	4.84	3.55	8.39
LSD 0.05	0.7	0.7	0.9	0.66	0.99	0.89	1.53

* Plot being re-established from sprigs.
† Ratings from 0 to 5, where 5=100% coverage.
‡ Ratings from 0 to 3, where 3=Excellent coverage.

Table 2. Plot Cover and Forage Yield of Bermudagrass Sprigged in 2000, Columbus Unit, Southeast Agricultural Research Center.

Entry	Plot Cover[†]			Forage Yield			
	Aug 2000	May 2001	Aug 2002	2001	6/28 2002	8/14 2002	2-Year Total
				- tons per acre @ 12% moisture -			
CD 90160[*]	4.2	1.0	3.5[‡]	- -	- -	- -	- -
Greenfield	2.8	3.8	4.5	4.69	4.27	2.76	11.72
Guymon	3.8	3.5	4.8	4.92	3.37	2.41	10.70
LCB 84x16-66	2.5	2.0	4.8	3.75	4.83	3.15	11.73
LCB 84x19-16	2.2	2.8	5.0	4.87	5.28	3.47	13.62
Midland	2.5	2.2	4.5	4.12	4.19	2.92	11.24
Midland 99	2.8	2.8	4.8	5.84	4.96	3.82	14.62
Wrangler	3.2	3.5	4.0	5.34	3.80	2.04	11.18
Ozark	2.5	3.0	4.5	6.45	5.28	3.76	15.49
Average	2.9	2.7	4.5	5.00	4.50	3.04	12.54
LSD 0.05	1.3	0.7	0.9	1.04	1.05	0.43	1.73

[*] Plot established from seed.
[†] Ratings from 0 to 5, where 5=100% coverage.
[‡] Contained other grasses.

Table 3. Plot Coverage and Forage Yield of Bermudagrass Seeded in 2000, Columbus Unit, Southeast Agricultural Research Center.

Entry	Plot Cover*			Forage Yield			
	Aug 2000	May 2001	Aug 2002	2001	6/28 2002	8/14 2002	2-Year Total
				- tons per acre @ 12% moisture -			
CD 90160	5.0†	1.0	3.5†	3.51†	2.45†	2.33†	8.28†
Guymon	3.5	3.0	4.5	3.62	3.34	2.33	9.28
Wrangler	3.5	3.0	3.8	3.38	3.35	2.02	8.75
Average	4.0	2.3	3.9	3.50	3.04	2.23	8.77
LSD 0.05	1.0	0.1	1.0	NS	0.49	NS	NS

* Ratings from 0 to 5, where 5=100% coverage.
† Contained other grasses.

Table 4. Plot Coverage and Forage Yield of Bermudagrass Seeded in 2002, Mound Valley Unit, Southeast Agricultural Research Center.

Entry	July 22		2002 Forage Yield		
	Cover†	Maturity‡	July 22	Sept. 5	Total
			- tons per acre @ 12% moisture -		
Cherokee	2.2	1.8	2.30	2.47	4.76
Guymon	1.8	4.2	1.80	3.20	5.00
Wrangler	1.5	5.0	2.11	2.36	4.46
Johnston's Gold	0.8	4.5	2.04	3.16	5.20
Cheyenne	3.0	2.8	3.00	3.00	6.00
Average	1.8	3.6	2.25	2.84	5.09
LSD 0.05	1.2	0.9	0.41	NS	0.71

† Ratings from 0 to 5, where 5=100% coverage.
‡ Ratings from 0 to 5, where 5=Full bloom.

EFFECT OF POPULATION, PLANTING DATE, AND TIMING OF LIMITED-AMOUNT IRRIGATION ON SWEET CORN

Daniel W. Sweeney and M.B. Kirkham[1]

Summary

In 2002, irrigation increased the number of harvestable ears, total fresh weight, and individual ear weight. Early planting increased total ears, fresh weight and individual ear weight. Increasing plant population to 30,000 plants/a reduced individual ear weight.

Introduction

Field corn responds to irrigation, and timing of water deficits can affect yield components. Sweet corn is considered as a possible value-added, alternative crop for producers. Even though large irrigation sources, such as aquifers, are lacking in southeastern Kansas, supplemental irrigation could be supplied from the substantial number of small lakes and ponds in the area. Information is lacking on effects of irrigation management, plant population, and planting date on the performance of sweet corn.

Experimental Procedures

The experiment was established on a Parsons silt loam in spring 2002 as a split-plot arrangement of a randomized complete block with three replications. The whole plots included four irrigation schemes: 1) no irrigation, 2) 1.5 in. at VT (tassel), 3) 1.5 in. at R2 (blister), 4) 1.5 in. at both VT and R2; and two planting dates (targets of late April and mid-May). The subplots were three plant populations of 15,000; 22,500; and 30,000 plants/a. Sweet corn was planted on April 23 and May 22, 2002. Sweet corn from the first planting date was picked on July 15 and 19 and that from the second planting date was picked on July 30 and Aug. 5, 2002.

Results and Discussion

The total number of ears, total fresh weight, and individual ear weight were less from the late-planted sweet corn than from sweet corn planted in late April (Table 1). Limited irrigation resulted in as much as 50% more ears and 70% greater fresh weight than without irrigation. Irrigation at VT (tassel) resulted in more ears than R2, whereas individual ear weight was greater from R2 irrigations. Increasing plant population did not result in a significant increase in harvested ears. However, there was a reduction in individual ear weight from the 30,000 plants/a population that also resulted in lower total fresh weight compared with less dense populations.

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[1]Department of Agronomy, KSU.

Table 1. Effects of Planting Date, Irrigation Scheme, and Plant Population on Sweet Corn, Southeast Agricultural Research Center 2002.

Treatment	Total Ears	Total Fresh Weight	Individual Ear Weight
	no./a	ton/a	g/ear
Planting Date			
Date 1	19400	4.82	227
Date 2	15300	3.63	215
LSD $_{(0.05)}$	1500	0.43	9
Irrigation Scheme			
None	13800	3.12	204
VT (1.5 in.)	18400	4.37	217
R2 (1.5 in.)	16200	4.14	231
VT-R2 (1.5 in. at each)	20900	5.28	231
LSD $_{(0.05)}$	2200	0.61	13
Population, plants/a			
15000	16500	4.49	246
22500	17400	4.25	220
30000	18100	3.95	197
LSD $_{(0.05)}$	NS	0.37	10
Interactions	NS	NS	NS

TILLAGE AND NITROGEN FERTILIZATION EFFECTS ON YIELDS IN A GRAIN SORGHUM - SOYBEAN ROTATION

Daniel W. Sweeney

Summary

In 2002, soybean yields were unaffected by tillage or residual nitrogen (N) treatments. Analysis across all years from 1984 to 2002 showed similar results.

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) fertilization options on the yields of grain sorghum and 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. The three tillage systems were conventional, reduced, and no tillage. The conventional system consisted of chiseling, disking, and field cultivation. The reduced-tillage system consisted of disking and field cultivation. Glyphosate (Roundup) was applied each year at 1.5 qt/a to the no-till areas. The four N treatments for the odd-year grain sorghum crops from 1983 to 1999 were: a) no N (check), b) anhydrous ammonia knifed to a depth of 6 in., c) broadcast urea-ammonium nitrate (UAN - 28% N) solution, and d) broadcast solid urea. The N rate was 125 lb/a. Harvests were collected from each subplot for both grain sorghum (odd years) and soybean (even years) crops. Effects of residual N were addressed for soybean, even though N fertilization was applied only to grain sorghum.

Results and Discussion

In 2002, soybean yields averaged 18.6 bu/a (data not shown). Yields were unaffected by tillage or residual N treatments. Analyzed across all soybean years (even-numbered years) from 1984 to 2002, yield averaged 22.2 bu/a and was unaffected by tillage or N residual (data not shown).

EFFECTS OF RESIDUAL SOIL PHOSPHORUS AND POTASSIUM FOR GLYPHOSATE-TOLERANT SOYBEAN PLANTED NO-TILL

Daniel W. Sweeney

Summary

In 2002, increasing antecedent soil K test levels produced greater soybean yield, whereas different soil P test levels did not increase yield.

Introduction

The response of soybean to phosphorus (P) and potassium (K) fertilization can be sporadic and producers often omit these fertilizers. As a result, soil test values can decline. Acreage planted with no tillage may increase because of new management options such as glyphosate-tolerant soybean cultivars. However, data are lacking regarding the importance of soil P and K levels on yield of glyphosate-tolerant soybean grown with no tillage.

Experimental Procedures

The experiment was established on a Parsons silt loam in spring 1999. Since 1983, fertilizer applications have been maintained to develop a range of soil P and K levels. The experimental design is a factorial arrangement of a randomized complete block with three replications. The three residual soil P levels averaged 5, 11, and 28 ppm, and the three soil K levels averaged 52, 85, and 157 ppm at the conclusion of the previous experiment. Roundup Ready® soybean was planted on May 26, 1999, May 30, 2000, and June 18, 2001 at approximately 140,000 seed/a with no tillage.

Results and Discussion

In 1999, wet conditions during the early part of the growing season followed by dry conditions resulted in low overall soybean yields of less than 14 bu/a (data not shown). Increasing soil P test level from 5 ppm to over 10 ppm increased yield about 20%. This was primarily because of an increased number of seeds per plant. Soil P levels did not affect population or seed weight. Soil test K levels had no effect on yield or yield components. In 2000, drought conditions resulted in lower average yields (<12 bu/a) than in 1999. As a result, yield or yield components were either not affected or were influenced by an unexplainable interaction between P and K fertility levels (data not shown).

Similar to 2001 (data not shown), environmental conditions in 2002 were somewhat more favorable than 1999 and 2000, resulting in soybean yields greater than 20 bu/a (Table 1). Greater soil P levels tended to slightly increase yield, but the difference was not significant. However, increased number of pods/plant with increased soil test P may suggest a potential for increased yield under better growing conditions. Greater soil K levels increased glyphosate-tolerant soybean yield by as much as 21% compared to plots that have never received K fertilizer. This yield increase may have been related to non-significant changes in seed weight, pods/plant, and seeds/pod as soil K level increased.

Table 1. Effect of Antecedent Soil P and K Test Levels on Glyphosate-tolerant Soybean Yield and Yield Components, Southeast Agricultural Research Center, 2002.

Initial Soil Test Level	Yield	Population	Seed Weight	Pods/plant	Seeds/pod
	bu/a	plants/a	mg		
P (ppm)					
5	22.6	123 000	121	21	1.6
11	25.1	110 000	117	28	1.6
28	25.3	112 000	117	28	1.7
LSD $_{(0.05)}$	NS	NS	NS	3	NS
K (ppm)					
52	21.9	114 000	115	25	1.5
85	24.5	113 000	123	24	1.6
157	26.6	118 000	117	28	1.7
LSD $_{(0.05)}$	3.6	NS	NS	NS	NS
PxK Interaction	NS	NS	NS	NS	NS

EFFECT OF PLANTING DATE ON GRAIN SORGHUM YIELD AND OTHER AGRONOMIC TRAITS

Kenneth W. Kelley

Summary

From 2000 to 2002, grain sorghum yielded significantly more when planted in late April compared to mid-May or early June. High air temperatures during flowering and grain-filling severely reduced yield potential of later planting dates.

Introduction

In southeastern Kansas, grain sorghum is often planted from late April through June, depending upon weather conditions and cropping management. In recent years, more producers have opted for an earlier planting date so that flowering occurs before the hottest and driest period of late July and early August. In addition, early-planted grain sorghum matures in late August or early September when weather is typically favorable for harvesting. However, when soil conditions are too wet in late April or early May, producers may delay planting until early June so that grain sorghum will flower in late August and early September when air temperatures often are somewhat cooler. This research evaluated various grain sorghum hybrids of different maturity at three different planting dates for effects on grain yield and other agronomic traits.

Experimental Procedures

Beginning in 2000, various grain sorghum hybrids of different maturity were planted with conventional tillage (chisel - disk - field cultivate) at three different planting dates (April, May, and June) in 30-in. row spacing at a seeding rate of 45,000 seeds/a. Fertilizer was applied preplant at a rate of 120 lb N/a, 60 lb P_20_5/a, and 75 lb K_20/a. Herbicides were applied preemergent for weed control. Plots were machine harvested at different times, depending on grain sorghum maturity and yields were adjusted to 12.5 % moisture.

Results and Discussion

Grain sorghum results for the 3-yr period from 2000 to 2002 are shown in Tables 1, 2, and 3. Grain sorghum yields were higher from the late April planting and lowest from the June planting. Early-planted grain sorghum generally flowered before mid-July, regardless of hybrid maturity. In all 3 years, June-planted grain sorghum yielded significantly less than April-planted because high air temperatures during August and early September were unfavorable for grain development. In addition, some hybrids were affected more by high air temperatures during flowering than others. Plant height decreased with delayed planting date.

Results confirm that April-planted grain sorghum often flowers before the onset of hot and dry conditions in mid-summer; thus, for the current weather patterns experienced in southeastern Kansas, yield potential is greater for the April planting date. However, seedling injury may be greater with the April planting because of cool soil temperatures and herbicide stress.

Table 1. Effect of Planting Date on Grain Sorghum Yield, Test Weight, Height, and Maturity, Southeast Ag Research Center, Columbus Unit, 2000.

		Yield			Test Weight			Height			Heading Date		
Brand	Hybrid	April	May	June	April	May	June	April	May	June	April	May	June
		---------- bu/a ----------			---------- lbs/bu ----------			---------- in.----------					
Asgrow	459	123.0	103.4	62.5	60.6	59.2	57.0	51	54	52	7/13	7/27	8/13
Cargill	737	133.1	106.9	59.7	59.3	57.8	54.3	46	49	43	7/13	7/27	8/13
Cargill	770Y	131.4	105.6	61.7	57.6	55.1	50.7	49	52	46	7/14	7/31	8/15
DeKalb	54	125.5	102.3	57.4	58.8	57.2	51.2	61	61	53	7/15	8/3	8/16
DeLange	133	115.7	83.4	62.3	59.3	56.9	53.9	50	50	47	7/15	8/1	8/15
Garst	5515	95.9	99.8	48.9	58.4	57.2	53.7	49	51	50	7/11	7/26	8/12
Hoegemeyer	6712	112.0	102.7	58.3	60.3	57.9	54.9	50	50	41	7/13	7/27	8/13
Mycogen	1506	128.5	110.9	73.0	58.8	56.2	53.8	58	62	55	7/14	8/3	8/15
NC+	371	103.6	95.9	57.1	59.9	57.5	55.5	48	50	42	7/13	7/27	8/13
NK	KS585	107.7	100.1	47.3	61.3	60.6	58.1	47	47	42	7/8	7/23	8/10
Pioneer	8500	117.0	101.5	59.2	61.3	59.6	57.0	50	53	46	7/11	7/26	8/12
Pioneer	84G62	132.3	110.6	63.0	60.4	59.0	55.2	49	55	48	7/14	7/31	8/15
Avg.		118.8	101.1	59.2	59.7	57.8	54.6	53	51	47	7/13	7/29	8/14

LSD (0.05) for yield: date of planting means = 9.2 ; between hybrids & same planting date = 9.6; between hybrids and different date of planting or same hybrid and different date of planting = 11.8
Planting dates: April 27, May 23 and June 8.

Table 2. Effect of Planting Date on Grain Sorghum Yield, Test Weight, Height, and Maturity, Southeast Ag Research Center, Columbus Unit, 2001.

		Yield			Test Weight			Height			Heading Date		
Brand	Hybrid	April	May	June	April	May	June	April	May	June	April	May	June
		---------- bu/a ----------			---------- lbs/bu ----------			---------- in.----------					
Agripro	5522Y	90.4	58.4	31.7	58.1	56.6	53.4	54	42	35	7/5	7/21	8/12
Agripro	5624	89.2	62.0	27.4	57.7	56.5	49.9	45	41	36	6/30	7/21	8/13
Asgrow	549	102.0	65.8	32.2	59.6	57.7	52.4	54	45	39	7/4	7/23	8/15
Cargill	737	86.3	66.8	42.2	57.7	57.1	53.6	44	39	35	7/5	7/23	8/12
Cargill	775Y	81.0	59.7	33.4	58.1	57.1	52.5	48	39	36	7/6	7/22	8/13
DeKalb	40Y	90.3	64.9	20.0	59.1	57.9	49.1	48	42	37	7/6	7/23	8/18
DeKalb	54	106.6	63.6	8.5	59.5	57.2	45.0	56	46	42	7/6	7/25	8/25
Hoegemeyer	6055	95.4	69.7	52.8	58.4	56.8	55.6	48	43	35	7/3	7/20	8/8
Mycogen	1506	108.1	71.2	34.1	59.3	58.4	51.2	55	48	42	7/4	7/23	8/19
NC+	371	85.9	65.5	29.7	58.6	57.5	52.0	50	41	35	7/4	7/21	8/13
NC+	7B47	103.8	66.4	32.8	58.7	57.1	52.6	49	40	34	7/4	7/23	8/13
NK	KS585	104.9	76.2	54.6	60.4	59.5	56.8	53	42	35	6/28	7/18	8/7
Pioneer	84G62	109.6	78.5	39.2	58.9	57.4	54.7	50	45	38	7/6	7/23	8/15
Pioneer	8500	103.0	68.8	34.4	59.5	57.9	52.2	52	43	36	7/3	7/21	8/9
Triumph	461	95.6	57.7	35.5	57.9	56.7	52.9	53	43	38	7/6	7/26	8/17
Avg.		96.8	66.3	33.9	58.8	57.4	52.2	50	43	37	7/4	7/22	8/14

LSD (0.05) for yield: date of planting means = 18.5; between hybrids & same planting date = 9.2; between hybrids and different date of planting or same hybrid and different date of planting = 17.5
Planting dates: April 26, May 17, and June 11.

Table 3. Effect of Planting Date on Grain Sorghum Yield, Test Weight, Height, and Maturity, Southeast Ag Research Center, Parsons Unit, 2002.

		Yield			Test Weight			Height			Heading Date		
Brand	Hybrid	April	May	June	April	May	June	April	May	June	April	May	June
		---------- bu/a ----------			---------- lbs/bu ----------			---------- in.----------					
Asgrow	459	79.1	69.4	67.1	59.6	59.1	57.4	44	40	42	7/15	7/25	8/9
DeKalb	40Y	76.1	76.0	58.7	60.3	59.7	58.1	40	38	39	7/14	7/22	8/7
DeKalb	54	86.8	94.8	28.6	59.4	60.1	53.7	46	39	41	7/17	7/28	8/15
DeLange	123Y	69.2	63.7	30.0	59.0	58.7	55.3	39	34	37	7/17	7/25	8/10
Garst	5382	71.9	86.4	67.8	59.8	59.7	57.5	41	36	37	7/17	7/25	8/10
Garst	5522Y	84.9	75.4	76.6	59.4	58.3	58.8	45	38	39	7/13	7/21	8/5
Hoegemeyer	6055	80.9	80.2	77.6	58.2	58.5	58.5	43	36	38	7/11	7/19	8/2
Midland	4758Y	86.1	76.5	62.0	59.8	59.5	57.5	45	40	40	7/13	7/25	8/9
Mycogen	1506	89.1	82.4	65.3	59.4	59.4	58.0	48	41	40	7/16	7/26	8/11
Mycogen	775Y	86.2	77.6	72.2	59.3	58.7	58.8	42	34	38	7/12	7/20	8/5
NC+	7B47	85.7	87.1	78.3	58.9	58.7	58.8	40	36	39	7/13	7/22	8/6
NC+	7W51	86.2	80.0	80.0	59.3	58.3	58.2	43	37	39	7/16	7/24	8/8
NK	KS585	82.2	81.2	80.5	59.5	60.3	60.2	41	36	37	7/8	7/16	8/1
Pioneer	84G62	91.2	94.2	83.8	60.0	59.4	58.2	44	40	39	7/16	7/24	8/8
Pioneer	84Y00	89.6	91.5	83.8	59.1	58.5	57.3	46	42	42	7/17	7/25	8/6
Pioneer	8500	94.0	78.8	84.2	59.5	59.4	59.5	45	39	39	7/10	7/19	8/3
Triumph	481	77.7	87.0	40.6	60.2	59.7	54.7	45	37	42	7/19	7/27	8/12
Avg.		83.3	81.3	66.9	59.4	59.2	57.6	43	38	39	7/14	7/23	8/7

LSD (0.05) for yield: date of planting means = 3.6; between hybrids & same planting date = 5.7; between hybrids and different date of planting or same hybrid and different date of planting = 6.3. Planting dates: April 23, May 23 and June 11.

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

Kenneth W. Kelley and Daniel W. Sweeney

Summary

Wheat yields were similar with different previous crops (corn, grain sorghum, and soybean) when fertilizer N and P were knifed below crop residues. Wheat yields also were affected very little by tillage method (no-till vs. disk). Previous crop before wheat significantly influenced double-crop soybean yields in nearly all years. Soybean yields were highest when corn and grain sorghum preceded wheat and lowest when soybean 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 no-tillage has increased significantly in recent years. In extreme southeastern Kansas, double-crop soybean traditionally is planted following 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 2-yr crop rotation.

Experimental Procedures

In 1996, a 2-yr crop rotation study consisting of [corn / grain sorghum / soybean] - [wheat - double-crop soybean] was started at the Columbus Unit on two adjacent sites. Tillage treatments were: 1) plant all crops with conventional tillage and 2) plant all crops with no-tillage. Fertilizer N (120 lb N/a as liquid 28 % N) and P (68 lb P_20_5/a 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 K_20/a) was broadcast applied. In conventional tillage systems, disk tillage was performed prior to 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 prior to planting were controlled with a preplant application of glyphosate (1 pt/a). In early spring, wheat was sprayed with a postemerge herbicide to control broadleaf weeds when needed.

Following wheat harvest, double-crop soybean (MG IV) was planted using reduced tillage (disk twice) or no-till methods. During the first 3 years of the study, double-crop soybean was planted in 30-in. rows, whereas, in the last 3 three years, row spacing has been 7.5-in. Weeds were effectively controlled with herbicides.

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

Results and Discussion

Wheat Results (Table 1)

In this 2-yr rotation, previous crop (corn, grain sorghum, and soybean) has had a smaller effect on wheat yield compared to previous fertilizer research trials, mainly because fertilizer N and P is knifed below crop residues in all rotations and tillage systems prior to planting. In addition, the rate of N applied (120 lb/a) has been high enough for the yields produced. Thus, wheat yield differences between previous crops were small for the 5-yr period.

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 high, regardless of tillage system. Results indicate wheat planted no-till into previous summer crop residues will yield similar to wheat planted with reduced tillage methods, provided that good management practices, such as sub-surface placement of fertilizer N and P, are utilized.

Double-crop Soybean Results (Table 2)

Previous crop before wheat significantly influenced double-crop soybean yields in nearly all years. Soybean yields were highest when corn and grain sorghum preceded wheat and lowest when soybean preceded wheat. Nutrient analyses of double-crop soybean plants have shown very little difference in nutrient uptake between previous crops. 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. However, in the last few years, which have been drier than normal during the growing season, double-crop soybean yields have been significantly higher when planted no-till. Initially, there was concern that soybean root growth would be reduced in no-till systems, but recent data suggest that no-till planted double-crop soybean are better able to withstand drought stress conditions. Additional research is planned to further evaluate the effects of conservation management practices on soil quality, such as soil carbon and organic matter levels.

Table 1. Effects of Previous Crop and Tillage on Winter Wheat Yield, Southeast Agricultural Research Center, Columbus Unit, 1997 - 2002.

Previous Crop before Wheat	Tillage	Winter Wheat Yield 1997	1998	1999	2000	2001	2002†
		--------------------------------		bu/a		--------------------------------	
Corn	No-till	36.7	57.2	40.1	61.9	70.8	40.2
Corn	Disk	39.1	61.8	40.5	61.6	65.9	42.1
Grain sorghum	No-till	34.1	59.1	40.0	55.1	70.8	33.3
Grain sorghum	Disk	37.5	61.2	44.6	59.8	68.2	37.2
Soybean	No-till	36.4	61.6	37.5	65.0	73.7	45.2
Soybean	Disk	36.0	63.1	43.4	63.1	72.3	41.3
Means:							
Corn		37.9	59.5	40.3	61.8	68.4	41.2
Grain sorghum		35.8	60.1	42.3	57.5	69.5	35.2
Soybean		36.2	62.3	40.5	64.0	73.0	43.3
LSD (0.05)		NS	2.4	NS	3.2	NS	2.2
No-till		35.7	59.3	39.2	60.6	71.7	39.6
Disk		37.5	62.0	42.8	61.5	68.8	40.2
LSD (0.05)		NS	2.0	NS	NS	NS	NS
Planting date		12/12	10/22	11/25	10/25	10/25	10/23

† Hail damage in 2002.

Table 2. Effects of Previous Crop and Tillage on Double-Crop Soybean Yield, Southeast Agricultural Research Center, Columbus Unit, 1997 - 2002.

Previous Crop before Wheat	Tillage	Double-crop Soybean Yield 1997	1998	1999	2000†	2001	2002
		---------- bu/a ----------					
Corn	No-till	38.5	31.8	27.7	9.4	36.9	32.9
Corn	Disk	39.3	31.2	24.5	10.0	30.4	29.8
Grain sorghum	No-till	39.4	30.9	28.4	11.5	36.8	33.4
Grain sorghum	Disk	40.3	32.2	26.0	9.8	32.2	30.3
Soybean	No-till	33.2	26.2	26.9	9.7	31.7	28.2
Soybean	Disk	32.8	26.3	20.8	8.6	25.8	25.6
Means:							
Corn		38.9	31.5	26.1	9.7	33.7	31.3
Grain sorghum		39.9	31.6	27.2	10.7	34.5	31.8
Soybean		33.0	26.3	23.9	9.1	28.7	26.9
LSD (0.05)		2.3	3.0	2.4	1.3	2.6	1.7
No-till		37.0	29.6	27.7	10.2	35.1	31.5
Disk		37.5	29.9	23.8	9.4	29.5	28.5
LSD (0.05)		NS	NS	1.9	NS	2.2	1.4

† 2000 yields were influenced by summer drought and early freeze damage.

EFFECTS OF PREVIOUS CROP AND TILLAGE ON FULL-SEASON SOYBEAN YIELD[1]

Kenneth W. Kelley and Daniel W. Sweeney

Summary

Full-season soybean yields were similar following corn and grain sorghum in a 3-yr crop rotation study. Tillage systems significantly influenced full-season soybean yield over time.

Introduction

In southeastern Kansas, approximately 1.6 million acres are devoted to crop production, which consists primarily of soybean, grain sorghum, corn, and wheat. The acreage of double-cropped soybean planted no-till has increased significantly in recent years; however, only a limited acreage of spring crops are planted no-till. Tillage may be necessary to incorporate no-till double-cropped wheat and soybean residues before planting a spring crop, such as corn and grain sorghum, in order to reduce nitrogen immobilization and to increase soil temperature for faster seed emergence and early seedling growth benefits. For full-season soybean following corn or grain sorghum, tillage may or may not be beneficial. This research seeks to investigate the combined effects of crop rotation and tillage on full-season soybean yield.

Experimental Procedures

In 1995, a 3-yr crop rotation study consisting of [corn / grain sorghum] - soybean - [wheat - double-crop soybean] was started at the Parsons and Columbus Units. Tillage treatments were:
1) plant all crops with conventional tillage (CT);
2) plant all crops with no-tillage (NT); and
3) alternate conventional and no-till systems.
Three cropping cycles have been completed following the 2002 soybean crop.

Results and Discussion

In the 3-yr crop rotation study (Table 1), full-season soybean yield has been similar following corn and grain sorghum at both the Columbus and Parsons Units. Tillage systems significantly influenced soybean yield. At the Columbus Unit in 1996 and 1999, soybean yields were higher with conventional tillage compared to no-tillage, whereas in 2002, soybean yields were lowest with conventional tillage. At the Parsons Unit in 1996 and 1999, tillage systems had no significant affect on soybean yields. However, in 2002, soybean yields were lowest with conventional tillage, which was similar to the Columbus results in 2002.

Results suggest that soybean yields at both locations have been affected by tillage systems over time. However, additional research is needed to evaluate long-term tillage effects on soybean yield. Beginning in 2003, a 2-yr crop rotation will be employed to evaluate effects of tillage on soybean yield each year.

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

Table 1. Effects of Previous Crop and Tillage on Full-Season Soybean Yield, Southeast Agricultural Research Center, 1996 - 2002.

		Full-Season Soybean Yield					
		Columbus			Parsons		
Previous Crop	Tillage	1996	1999	2002	1996	1999	2002
		bu/a					
Corn	NT only	48.5	17.9	26.7	45.6	15.6	32.5
Corn	CT only	54.8	20.4	23.2	46.7	15.4	28.5
Corn	Alt. CT-NT	54.2	20.0	26.2	45.6	15.9	29.2
Corn	Alt. NT-CT	45.6	14.5	25.4	42.7	14.5	31.4
Grain sorghum	NT only	48.3	18.3	27.3	45.1	16.0	32.4
Grain sorghum	CT only	52.9	20.1	23.6	43.7	15.5	27.3
Grain sorghum	Alt. CT-NT	54.5	20.1	26.8	45.9	16.2	30.0
Grain sorghum	Alt. NT-CT	46.4	13.9	26.5	44.6	15.2	32.7
		3.8	1.2	1.6	NS	NS	2.3
Means:							
Corn		50.8	18.2	25.4	45.2	15.4	30.4
Grain sorghum		50.5	18.1	26.1	44.8	15.7	30.6
LSD (0.05):		NS	NS	NS	NS	NS	NS
NT only		48.4	18.1	27.0	45.3	15.8	32.4
CT only		53.9	20.3	23.4	45.2	15.5	27.9
Alt. CT-NT		54.4	20.0	26.5	45.8	16.0	29.6
Alt. NT-CT		46.0	14.2	26.0	43.7	14.9	32.1
LSD (0.05):		4.9	1.3	1.4	NS	NS	3.9

NT = no-tillage; CT = conventional tillage (chisel - disk - field cultivate).
Alt. CT-NT or NT-CT = alternate tillage systems each year.

EFFECTS OF TILLAGE, ROW SPACING, AND HERBICIDE ON FULL-SEASON SOYBEAN FOLLOWING GRAIN SORGHUM[1]

Kenneth W. Kelley

Summary

Soybean yield differences between tillage systems, row spacing, and herbicide treatments were small in 2002. Weed competition was light; however, soybean yields in 30-in. rows were affected more by weed competition compared to narrower row spacings.

Introduction

In recent years, improved equipment and herbicide technology has prompted more interest in the no-till planting of glyphosate-resistant soybean in narrow rows. However, for optimum yield potential, adequate weed control is important. This research seeks to investigate the interactions of tillage, row spacing, and glyphosate herbicide application on full-season soybean following grain sorghum.

Experimental Procedures

Beginning in 1999, a 2-year rotation study involving soybean and grain sorghum was established at the Columbus Unit on two adjacent sites. Main plot treatments consist of a factorial combination of conventional (CT) and no-tillage (NT) with three different row spacings (7.5-, 15-, and 30-in.). Subplot treatments for soybean consist of four glyphosate herbicide applications: 1) full rate at 3 wks after planting, 2) full rate at 3 wks and reduced rate at 5 wks after planting; 3) preplant residual herbicide (Prowl) + glyphosate at 3 wks after planting, and 4) control (glyphosate at 10 wks). Conventional tillage treatments consisted of disk, chisel, disk, and field cultivate before planting. Soybean planting population was targeted at 225,000 seeds/a for 7.5-in. rows, 175,000 seeds/a for 15-in. rows, and 125,000 seeds/a for 30-in. rows.

In addition, tillage and row spacing effects are evaluated each year on grain sorghum. Fertilizer (120 lb N/a and 70 lb P_20_5/a) is applied below the soil surface with a coulter-knife application. Potassium (100 lb K_20/a) is surface-applied.

Results and Discussion

Full-season soybean results for 2002 are shown in Table 1. Yield differences between tillage systems, row spacing, and herbicide treatments were small in 2002. Weed competition was light; however, soybean yields in 30-in. rows were affected more by weed competition compared to narrower row spacings.

Grain sorghum yield results from 2000 to 2002 are shown in Table 2. On average, grain yields have been similar among tillage systems. Yields have been somewhat higher with narrower row spacing. This study will be continued for at least one more cropping cycle.

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

Table 1. Effects of Tillage, Row Spacing, and Herbicide on Full-Season Soybean Yield Following Grain Sorghum, Columbus Unit, Southeast Research Center, 2002.

Row Spacing	Tillage Method†	Herbicide Treatment: PP+ 3 wks	3 wks	3 + 2 wks	10 wks	Avg.
		Soybean Yield (bu/a)				
7.5-in.	CT	23.8	23.7	24.4	24.2	24.0
15-in.	CT	25.0	25.0	25.4	25.8	25.3
30-in.	CT	23.0	23.3	25.1	21.3	23.2
7.5-in.	NT	28.4	26.9	25.9	25.3	26.6
15-in.	NT	24.2	24.0	24.1	24.1	24.1
30-in.	NT	24.5	23.4	24.4	20.8	23.3
Means:						
Row	7.5-in.	25.3				
spacing	15-in.	24.7				
	30-in.	23.2				
	LSD (0.05)	NS				
Tillage	CT	24.2				
	NT	24.7				
	LSD (0.05)	NS				
Herbicide	PP+ 3 wks	24.8				
	3 wks	24.4				
	3 + 2 wks	24.9				
	10 wks	23.6				
	LSD (0.05)	NS				

† CT = conventional tillage (disk - chisel - disk - field cultivate); NT = no-tillage.
Herbicide treatments consisted of postemergent applications of glyphosate. Full rate (1 qt/a) at 3 wks after planting and reduced rate (1 pt/a) at 5 wks after planting. Control treatment (10 wks after planting) consisted of 1.5 qt/a of glyphosate. Preplant (PP) treatment consisted of Prowl applied at 2.4 qt/a.

Table 2. Effects of Tillage and Row Spacing on Grain Sorghum Yield, Columbus Unit, Southeast Agricultural Research Center, 2000 - 2002.

Row	Tillage	Grain Sorghum Yield			
Spacing	Method†	2000	2001	2002	3-yr Avg.
		bu/a			
7.5-in.	CT	95.4	104.1	95.0	98.2
15-in.	CT	106.2	106.0	102.2	104.8
30-in.	CT	80.1	101.7	87.0	89.6
7.5-in.	NT	85.3	111.1	100.6	99.0
15-in.	NT	90.4	96.1	100.4	95.6
30-in.	NT	76.4	102.2	99.1	92.6
LSD (0.05)		7.9	NS	10.2	
Means:					
Row spacing	7.5-in.	90.4	107.6	97.8	98.6
	15-in.	98.4	101.1	101.3	100.3
	30-in.	78.2	101.9	93.1	91.1
	LSD (0.05)	5.6	NS	NS	
Tillage	CT	93.9	103.9	94.7	97.5
	NT	84.0	103.1	100.0	95.7
	LSD (0.05)	7.2	NS	NS	

† CT = conventional tillage (disk - chisel - disk - field cultivate); NT = no-tillage.

EFFECT OF SOIL pH ON CROP YIELD

Kenneth W. Kelley

Summary

Grain yields of grain sorghum, soybean, and wheat increased as soil acidity decreased. However, yields were highest 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. However, 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 varying 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 3-yr 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. However, yields generally were highest when soil pH was near the neutral range of 7.0. Plant nutrient availability (nitrogen and phosphorus) also increased as soil acidity has decreased (data not shown).

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

	Grain Yield			
Soil pH	Grain Sorghum (3-yr avg)	Full-Season Soy (3-yr avg)	Double-Crop Soy (3-yr avg)	Wheat (3-yr avg)
(0 - 6 in.)	bu/a	bu/a	bu/a	bu/a
4.9	78.4	26.5	17.6	45.4
5.3	84.5	28.7	20.3	46.1
6.1	91.8	32.8	22.0	47.3
6.5	95.6	33.4	23.3	49.1
7.0	94.7	34.3	22.3	48.2
LSD (0.05)	4.2	2.3	1.1	2.7

HERBICIDE RESEARCH

Kenneth W. Kelley

Summary

Herbicide performance evaluations with corn, grain sorghum, soybean, cotton, and bermudagrass were conducted in 2002. Complete results of the various herbicide research studies are available from the author.

Introduction

Chemical weed control is an important management tool for row crop production. In recent years, new technology has provided several different methods to control weeds, especially for crops like soybeans and corn. Herbicide research trials are conducted annually to evaluate new and commonly used herbicide products for effects on weed control and grain yield.

Experimental Procedures

In 2002, corn, grain sorghum, and soybean herbicide trails were conducted at the Columbus Unit. Cotton herbicide research, soybean herbicide burn-down treatments for no-till planting, and herbicide applications for no-till double-crop soybean were evaluated at the Parsons Unit. Herbicide evaluations for established bermudagrass were conducted at the Mound Valley Unit. All trials were replicated three times. Herbicide treatments were applied with a tractor-mounted compressed air sprayer or hand-applied with a CO_2 applicator. Weed control ratings were made during the summer. Grain yields were determined for soybean and grain sorghum plots.

Results and Discussion

Complete results of the various herbicide studies conducted in 2002 can be obtained by contacting the author (kkelley@oznet.ksu.edu).

PERFORMANCE TEST OF DOUBLE-CROPPED SOYBEAN VARIETIES

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

Summary

Eighteen double-cropped soybean varieties were planted no-till following winter wheat at the Parsons unit and evaluated for yield and other agronomic characteristics throughout the summer of 2002. Overall, grain yields were below average, however, variety differences were seen even under the dry growing conditions. Yields ranged from 15.3 bu/a to 22.3 bu/a. Maturity group V varieties had the highest yields.

Introduction

Double-cropped soybean is an opportunistic crop grown after winter wheat over a wide area of southeast 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 high yield potential under these conditions but also the plant structure to allow them to set pods high enough to be harvested. They also should mature before threat of frost.

Experimental Procedures

Soybean varieties were planted no-till 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 bush-hogged and soybeans were then planted without tillage with a John Deere 7000 planter. Round-up Ready ® varieties were used. Soybean was planted on June 20, 2002 at 10 seed per ft of row. Harvest occurred October 22, 2002.

Results and Discussion

Soils were moist after rains throughout May, June and early July and plant stands were excellent. Excellent growing conditions prevailed early however, drought occurred in late July and August.

Yields ranged from 15.3 bu/a to 22.3 bu/a (Table 1). Several varieties yielded more than 20 bu/a, and could be considered as top yielders in 2002. Consideration also should be given to plant height from data in 2002. Overall plant heights were good, reflecting the moist early conditions.

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[1]Southeast Area Extension Office.

Table 1. Yields for a Variety Test of Double-Cropped Soybean at Parsons, Kansas, 2002.

Brand	Variety	Grain Yield	Height	Maturity
		-------bu/a---------	-in-	days from 9/1
Croplan	RC5252RR	20.9	29.8	41
Croplan	RC4848RR	18.1	28.3	25
Dekalb	DKB45-51RR	17.1	27.0	22
Delange	AG4677NRR	16.7	29.0	25
Delange	AG4902RR	17.3	26.8	26
Delange	AG5012NRR	22.1	32.0	33
DynaGro	DG3481NRR	17.6	27.3	22
Midland	9A462NRRS	16.5	29.8	25
Midland	9A483NRR	16.9	27.8	27
Midland	9A523NRR	22.3	32.5	35
NK	X249RR	21.8	34.3	35
NK	X257RR	20.1	31.5	40
Pioneer	94B74RR	18.8	30.5	21
Pioneer	95B32RR	21.3	22.5	37
Pioneer	95B42RR	22.0	35.0	37
Stine	S4882-4RR	18.2	26.8	23
Stine	S5302-4RR	20.2	29.5	38
Triumph	TR4462RR	15.3	25.0	21
LSD (0.05)		4.4	2.8	3.2

PERFORMANCE TEST OF RIVER-BOTTOM SOYBEAN VARIETIES

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

Summary

Twelve 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 2002. Grain yields were good and variety differences were seen with the very productive soils. Yields ranged from 35.7 bu/a to 42.0 bu/a. The shorter-season Maturity Group (MG) IV varieties yielded as well or better than the MG V varieties. The soybeans were not tall, and only four varieties lodged significantly.

Introduction

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

Experimental Procedures

Twelve soybean varieties were grown following corn in 2001. The farmer/cooperator was Joe Harris. The soil is a Lanton deep silt loam that sits on the Neosho flood plain approximately 1750 feet from the river channel. The soil was chiseled and disked, Dual II herbicide was applied at the rate of 3 pints /a, and the soil was field cultivated prior to planting. Soybean was planted on June 10, 2002 at 10 seeds/ft of row. Plants emerged to form an excellent stand.

Since all varieties were Round-up Ready ®, Roundup herbicide was applied postemergent on July 10 and August 2. The soybeans were harvested on November 2, 2002.

Results and Discussion

Warm and moist conditions persisted until mid July, then it became hot and dry. Soybean grew well throughout the season due to the deep moisture.

Yields ranged from 35.7 bu/a to 42.0 bu/a (Table 1). Several varieties yielded more than 40 bu/a for the 2002 growing season. Consideration should be given to plant height and its effect on lodging as well as plant maturity. Overall plant height ranged from 29.5 to 36.3 in. With respect to plant maturity, the indeterminate, early to mid MG IV varieties yielded as well or better than the determinate growth habit, MG V varieties.

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[1]Southeast Area Extension Office.

Table 1. Yields for a Variety Test of River-Bottom Soybean at Erie, Kansas, 2002.

Brand	Variety	Grain Yield	Height	Maturity
		-------bu/a---------	-in-	days from 9/1
AG	AG5603RR	40.8	32.8	45
AG	AG5501RR	37.9	35.8	40
Croplan	RC3939RR	37.6	31.0	19
Croplan	RC444RR	41.5	35.8	25
DynaGro	DG3481NRR	42.0	34.0	28
Midland	9A411NRRS	37.4	32.0	26
Midland	9A442NRR	40.3	35.0	25
Pioneer	93B85RR	39.0	33.3	20
Pioneer	94B13RR	35.7	33.0	23
Pioneer	94B54RR	36.2	36.3	26
Stine	S4442-4RR	41.5	29.5	25
Triumph	TR4462RR	41.1	35.8	26
LSD (0.05)		2.5	2.3	2.5

PERFORMANCE TEST OF COTTON VARIETIES

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

Summary

Ten cotton varieties were planted at Parsons, Kansas, and evaluated for yield and other agronomic characteristics throughout the summer of 2002. Lint yields were very good and variety differences were seen. Yields ranged from 436 lb/a to 778 lb/a of lint. Quality is reported on the individual varieties. Quality should be strongly considered as it will affect the final price of the crop.

Introduction

Cotton is a new crop for southeastern Kansas but is already grown on nearly 50,000 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 and the management decisions associated with cotton, such as having an early harvest before fall rains arrive.

Experimental Procedures

Ten cotton varieties were grown following wheat in 2001. The soil located at the Parsons unit of the Southeast Agricultural Research Center is a Parsons silt loam. The soil was disked twice. Treflan® herbicide was applied, and then the soil was field cultivated prior to planting. Cotton was planted on May 31, 2002. Populations were thinned to 43,000 and 87,000 plants/acre. Plants emerged to form an excellent stand. Cotoran® and Staple® was applied postemergent to help control broadleaf weeds. Gramoxone® was applied on September 25 as a conditioner then again on October 1 to open the bolls and to control the regrowth. Cotton lint was harvested on October 7 and 8, 2002. The cotton was ginned at Manhattan and lint quality was then determined by HVI (high volume instrumentation) testing.

Results and Discussion

Normally moist conditions persisted until July, then it became hot and dry. Cotton grew well throughout the season even with the lack of moisture in July and August.

Yields ranged from 436 lb/a to 778 lb/a (Table 1). Several varieties yielded more than 700 lb/a for the 2002 growing season and should considered top yielders. There are now three years of data for cotton lint yields (Table 2). Several varieties have nearly equal yields over that period.

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[1]Southeast Area, Northeast Area, and South Central Area Extension Agronomists, respectively.

Quality characteristics indicate differences between varieties that may affect the price at the gin and these should be considered, especially if the qualities are much lower than average. Turnout was high again this year due, in part, to a burr extractor on the cotton stripper.

Table 1. Yield and Quality of Cotton Varieties at Parsons, Kansas, 2002.

		Cotton Yield		2002 Quality Characteristics					
Company	Variety	Lint Yield	Turn out	Micronaire	Length	Uniformity	Strength	Color	Grade
		lb/a	%		in	%	g/tex		
DP&L	2145RR	778	0.33	5.2	1.01	81.2	30.9	52	1
DP&L	2167RR	621	0.34	5.0	1.00	82.2	29.3	42	1
DP&L	2156RR	707	0.34	5.0	0.99	81.3	29.0	42	1
DP&L	2266RR	572	0.31	4.6	1.05	82.2	30.9	42	2
DP&L	2280BGRR	615	0.31	4.7	1.06	82.0	31.6	42	1
DP&L	2326RR	436	0.31	5.3	1.04	83.3	32.1	53	1
Fibermax	5013	619	0.30	4.8	1.04	83.2	31.1	42	2
NK	2108SS	511	0.33	4.7	1.05	81.9	29.5	42	2
Stoneville	ST2454R	521	0.31	4.9	1.04	82.5	30.5	42	2
Stoneville	ST457	600	0.34	4.8	1.11	84.1	32.9	43	1
LSD(0.05)		125	0.01	0.5	0.03	1.8	2.2	–	–
Mean		598	0.32	4.9	1.04	81.2	30.8	–	–
C.V.		18	3.0	5.0	1.0	1.0	3.0	–	–

Table 2. Period of Years Yield of Cotton Varieties at Parsons, Kansas, 2000-2002.

		Cotton Lint Yield				
Company	Variety	2002	2001	2000	2-Yr	3-Yr
		lb/a				
DP&L	2145RR	778	888	385	833	683
DP&L	2167RR	621	842	–	731	–
DP&L	2156RR	707	863	508	785	692
DP&L	2266RR	572	942	–	757	–
DP&L	2280BGRR	615	887	545	751	682
DP&L	2326RR	436	436	–	–	–
Fibermax	5013	619	957	–	788	–
NK	2108SS	511	970	502	741	661
Stoneville	ST2454R	521	876	–	699	–
Stoneville	ST457	600	–	–	–	–
Average Yield		598	893	477	744	624
LSD(0.05)		125	95	71	–	–
C.V.		18	9	16	–	–

DATE OF PLANTING EFFECTS ON DIFFERENT MATURITIES OF SOYBEAN

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

Summary

Five varieties of soybean, from maturity (MG) II through V were planted on six dates from May 1 to July 15 at Parsons, Kansas and evaluated for yield and other agronomic characteristics throughout the summer of 2002. Overall, grain yields were below average; however, large planting date and variety differences were seen even under the dry growing conditions. Yields ranged from 14.3 bu/a to 31.0 bu/a. Maturity group IV and V varieties had the highest yields. See the Results and Discussion for a recap of yields across years.

Introduction

Much data is available on performance of individual varieties of soybean through variety testing programs. However, information was needed to compare new production practices such as expanded (both early and late) dates of planting and widely varying maturity of varieties. In addition, in southeast Kansas soybean production systems should try to avoid typical mid-summer drought. Information on the combination of planting date and variety maturity that would have plants blooming and setting/filling pods either before or after this time would prove valuable. The crop also should mature before threat of frost.

Experimental Procedures

Five soybean varieties, from MG II through V, were planted into good moisture at the Southeast Agricultural Research Center at Parsons. The soil is a Parsons silt loam. The varieties were IA2021 an early MG II; Macon, a late MG III; KS4694, an early MG IV; KS4997, a late MG IV; and KS5292, an early MG V. Each variety was planted on the six dates, + or - five days, of May 1, May 15, June 1, June 15, July 1, and July 15 . Seed were planted in 7.5in. rows at 150,000 seed/a. Harvest occurred as needed.

Results and Discussion

In year 2002, late MG IV to MG V varieties were best, although MG III and early MG IV varieties worked well planted June 1 (Table 1). Across years MG II soybean planted early yielded as well as MG late IV and V soybean planted early. Overall, the late MG IV and MG V varieties planted from June 1 to July 1 were highest yielders (Table 1). Yields ranged from 14.3 bu/a to 31.0 bu/a in 2002 (Table 1) and 11.5 bu/a to 27.9 bu/a from 1999 until 2002 (Table 2). The year 2000 was not included as grain yields were less than 5 bu/a.

[1]Southeast Area Extension Office.

Table 1. Effect of Date of Planting on Soybean at Parsons, Kansas, 2002.

Variety	Date of Planting					
	May1	May15	June 1	June 15	July 1	July15
	-------------------------------------bu/a--					
IA2021	19.3	14.3	19.0	19.5	16.4	15.5
Macon	20.7	19.7	25.3	26.9	19.3	19.5
KS4694	19.7	18.9	28.5	24.2	18.8	19.1
KS4997	25.8	23.4	27.7	23.8	29.0	31.6
KS5292	24.4	20.3	26.1	29.1	30.0	29.9
LSD (0.05)	Date X Variety - 3.7					

Table 2. Effect of Date of Planting on Soybean at Parsons, Kansas, 1999, 2001-2002.

Variety	Date of Planting					
	May1	May15	June 1	June 15	July 1	July15
	-------------------------------------bu/a--					
IA2021	20.8	17.1	18.5	19.4	13.7	10.3
Macon	17.2	14.1	22.6	19.2	20.7	18.8
KS4694	16.5	17.0	24.0	20.6	21.0	18.2
KS4997	20.6	21.9	24.0	24.5	28.1	23.6
KS5292	19.2	19.3	25.0	23.7	27.40	24.0
LSD (0.05)	Date X Variety - 2.8					

ANNUAL SUMMARY OF WEATHER DATA FOR PARSONS - 2002

Mary Knapp[1]

2002

DATA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg. Max	39.6	49.4	53.4	68.8	72.5	85.8	91.5	91.2	85.5	64.2	55.5	45.9	66.9
Avg. Min	23.4	26.0	28.6	47.0	52.6	65.1	69.1	68.4	59.8	44.5	31.0	25.2	45.1
Avg. Mean	31.5	37.7	41.0	57.9	62.5	75.4	80.3	79.8	72.6	54.4	43.3	35.6	56.0
Precip	2.39	0.16	0.50	3.9	10.87	3.22	2.76	3.22	3.62	1.36	0.50	1.36	33.90
Snow	2.5	0.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8	13.3
Heat DD*	1038	764	745	255	127	6	0	0	16	376	653	913	4890
Cool DD*	0	0	0	42	50	319	474	459	245	46	0	0	1633
Rain Days	5	2	3	9	13	9	6	5	4	8	3	6	73
Min < 10	4	2	3	0	0	0	0	0	0	0	1	4	14
Min < 32	26	25	18	3	0	0	0	0	0	4	18	24	118
Max > 90	0	0	0	0	0	7	19	22	12	0	0	0	60

NORMAL VALUES (1971-2000)

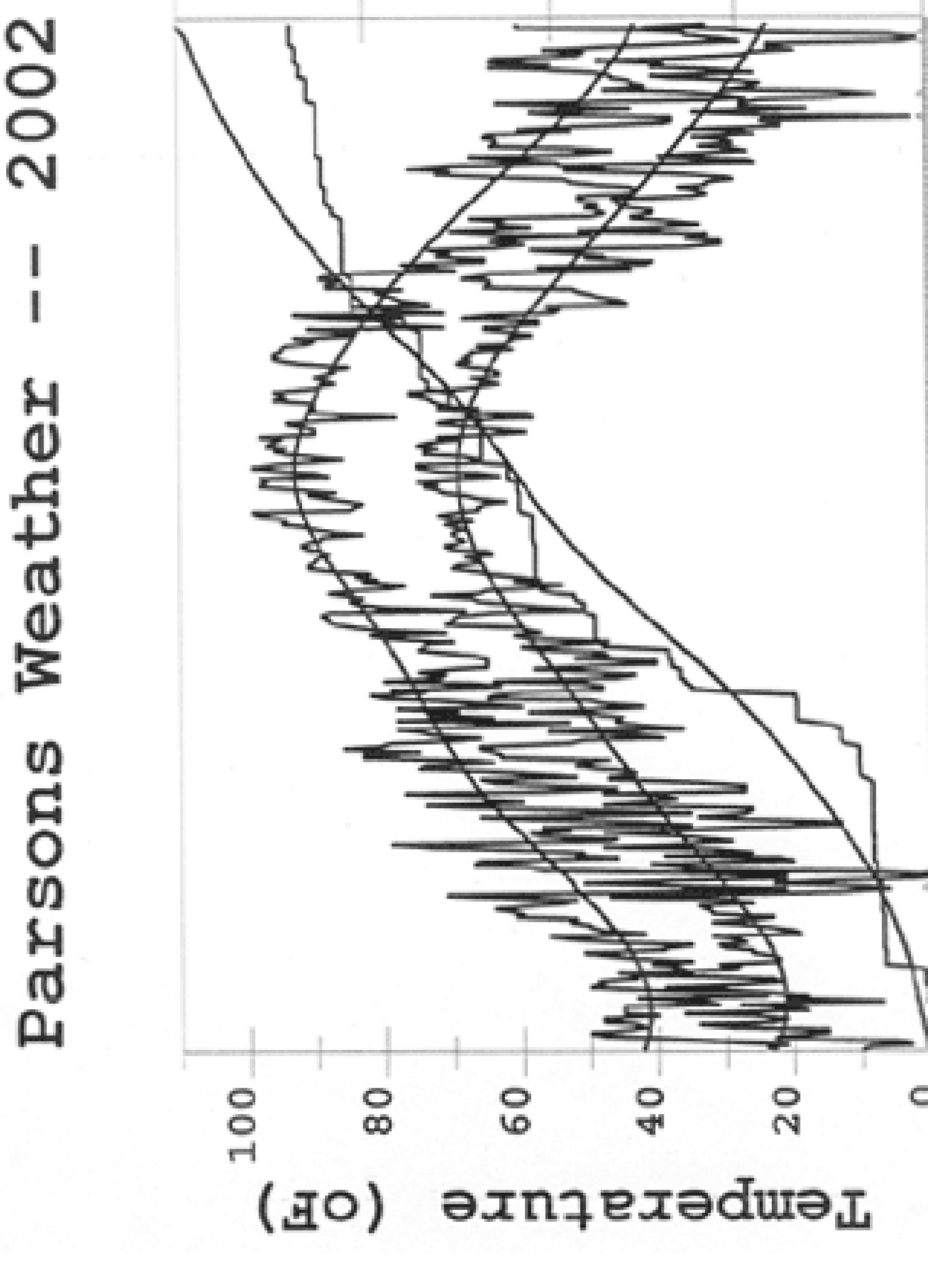
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg. Max	40.2	47.2	57.2	67.1	76.0	85.0	91.1	90.0	81.0	70.5	55.5	44.4	67.1
Avg. Min	20.2	25.6	34.8	44.1	54.4	63.4	68.3	66.0	58.0	46.3	34.9	24.8	45.1
Avg. Mean	30.2	36.4	46.0	55.6	65.2	74.2	79.7	78.0	69.5	58.4	45.2	34.6	56.1
Precip	1.37	1.78	3.37	3.82	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	0.0	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	-0.6	2.2	-3.8	1.7	-3.5	0.8	0.4	1.2	4.5	-6.3	0.0	1.5	-0.2
Avg. Min	3.2	0.4	-6.2	2.9	-1.8	1.7	0.8	2.4	1.8	-1.8	-3.9	0.4	-0.0
Avg. Mean	1.3	1.3	-5.0	2.3	-2.7	1.2	0.6	1.8	3.1	-4.0	-2.0	1.0	-0.1
Precip	1.02	-1.62	-2.87	0.12	5.48	-1.6	-1.07	-0.2	-1.31	-2.68	-2.79	-0.67	-8.19
Snow	0.5	-2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.0	8.8	4.8
Heat DD	-41	-36	155	-41	32	-1	0	-3	-35	147	59	-30	206
Cool DD	0	0	0	29	-51	36	18	53	58	22	0	0	163

* 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, KSU.


Parsons Weather -- 2002
Temperature (oF)
Precipitation (In)
0
20
40
60
80
100
0
10
20
30
40
01-Jan
22-Feb
15-Apr
06-Jun
28-Jul
18-Sep
09-Nov
31-Dec

SCIENTIFIC NAMES OF CROPS LISTED IN THIS PUBLICATION

Common Name	Scientific Name (*Genus species*)
Alfalfa	*Medicago sativa* L.
Bermudagrass	*Cynodon dactylon* (L.) Pers.
Corn	*Zea mays* L.
Cotton	*Gossypium hirsutum* L.
Crabgrass	*Digitaria sanguinalis* (L.) Scop.
Eastern gamagrass	*Tripsacum dactyloides* (L.) L.
Grain sorghum	*Sorghum bicolor* (L.) Moench
Hairy vetch	*Vicia villosa* Roth
Korean lespedeza	*Lespedeza stipulacea* Maxim.
Ladino clover	*Trifolium repens* L.
Red clover	*Trifolium pratense* L.
Soybean	*Glycine max* (L.) Merr.
Sunflower	*Helianthus annuus* L.
Tall fescue	*Festuca arundinacea* Schreb.
Wheat	*Triticum aestivum* L.
White clover	*Trifolium repens* L.

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BASF Wyandotte Corp., Parsippany, NJ
Bayer Corp., Kansas City, MO
Cash Grain, Weir, KS
Coffeyville Feed & Farm Supply, Coffeyville, KS
Cutting Edge Agri Products, Lowry City, MO
DeLange Seed Co., Girard, KS
Dow Agro Sciences, Indianapolis, IN
Roger Draeger, Weir, KS
DuPont Agricultural Products, Wilmington, DE
Farmers Coop, Columbus, KS
Fluid Fertilizer Foundation, Manhattan, KS
FMC Corp., Philadelphia, PA
Ft. Dodge Animal Health, Overland Park, KS
General Mills, Great Falls, MT
Goertzen Seed Co., Haven, KS
Joe Harris, St. Paul, KS
Harvest Brands, Inc., Pittsburg, KS
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Martin Farms, Columbus, KS
Merial Limited, Rathaway, NJ
McCune Farmers Coop, McCune, KS
Monsanto Agricultural Products, St. Louis, MO
National Crop Insurance Services, Overland Park, KS
Nixa Hardware & Seed Co, Nixa, MO
Novartis Crop Protection, Greensboro, NC
Novartis Seeds, Inc., Minneapolis, MN
Parsons Livestock Market, Parsons, KS
Pennington Seed, Inc., Madison, GA
Phillips Seed Co, Abilene, KS
Pioneer Hi-Bred International, Johnston, IA
Polansky Seed, Belleville, KS
Producers Coop, Girard, KS
R & F Farm Supply, Erie, KS
Schering-Plough Animal Health, Union, NJ
Tri-States Agriservices, Carl Junction, MO
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Wilma Shaffer, Columbus, KS
Syngenta Crop Protection, Greensboro, NC
Syngenta Seed Co, Ames, IA
Emmet & Virginia Terril, Catoosa, OK
Urbana Laboratories, St. Joseph, MO
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RESEARCH CENTER PERSONNEL

Lyle Lomas . . . . Research Center Head & Animal Scientist

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- Larry Buffington . . . . Custodial Specialist
- Connie Clingan . . . . Office Assistant
- Larry Ellis . . . . Agricultural Technician
- TaLana Erikson . . . . Animal Science Technician II
- Terry Green . . . . Animal Science Technician II
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- Kelly Kusel . . . . Research Technologist
- Joyce Erikson . . . . Agricultural Technician

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- Michael Dean . . . . Plant Science Technician II
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Joseph Moyer . . . . Forage Agronomist

- Mike Cramer . . . . Plant Science Technician II
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- Bobby Myers . . . . Plant Science Technician II
- David Kerley . . . . Agricultural Technician

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