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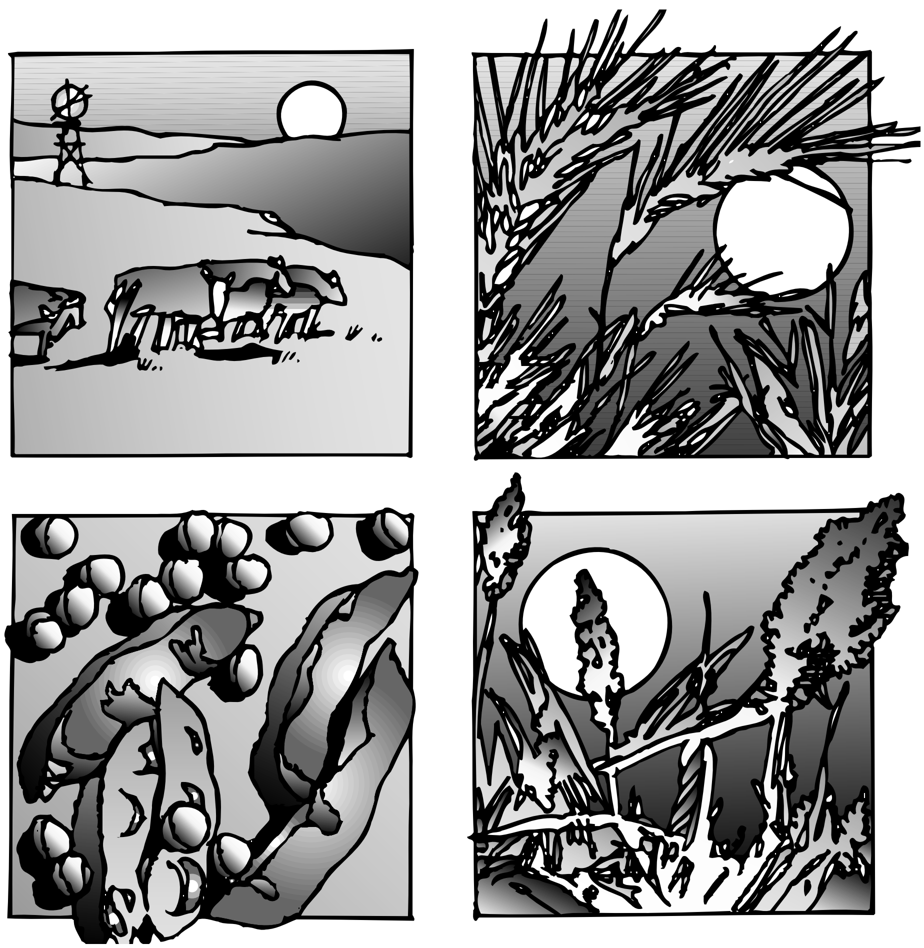
2001 AGRICULTURAL RESEARCH



Report of Progress 875

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

SOUTHEAST AGRICULTURAL RESEARCH CENTER

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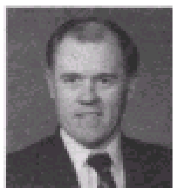

KEN KELLEY, Crops and Soils Agronomist, received a B.S. degree in Agricultural Education and a M.S. degree in Agronomy from Kansas State University. He has been a staff member since 1975. His research includes evaluation of crop rotation systems, wheat management practices, and herbicides.

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Contribution No. 01-379-S from the Kansas Agricultural Experiment Station.

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

A total of 120 steers grazed 'Red River' crabgrass pastures that were fertilized with additional nitrogen (N) or interseeded with lespedeza during the summers of 1998, 1999 and 2000. Wheat was also grazed in 1999 and 2000 prior to crabgrass emergence. Legume cover, forage dry matter production, grazing steer performance, and subsequent feedlot performance were measured. Available forage dry matter and grazing steer performance were similar between pastures of crabgrass fertilized with additional N and those interseeded with lespedeza. In 1999, finishing gain and ribeye area were higher (P<.05) for steers that grazed the pastures with lespedeza. In 2000, finishing gain and overall performance (grazing + finishing) were higher (P<.05) for steers that grazed pastures fertilized with additional N.

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, when fescue forage production declines and animal performance is reduced by the endophyte that typically is found in most fescue grown in this area. 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. 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.

Experimental Procedures

Pastures

Korean lespedeza was seeded on April 14 & 15, 1998 at 15 lb/a on five of 10 4-acre pastures that had been seeded with Red River crabgrass during the summer of 1997. An additional 2 lb/a of crabgrass seed was broadcast at this time on all 10 pastures. The ground had been worked previously and planted to wheat in the fall of 1997, after the crabgrass had set seed. The wheat was cut for hay in mid May of 1998. All pastures received 50 lb N/a on May 26, 1998 at the time of crabgrass emergence, and an additional 50 lb N/a was applied to the five pastures without lespedeza in early August. In 1998, all pastures were clipped on July 6 to a height of approximately 7 in. and mowed for hay on August 17 to control weeds.

'Jagger' hard red winter wheat was planted on October 15, 1998 and September 22, 1999 at a rate of 106 lb/a using a no-till drill. The wheat was planted for grazing in 1999 and 2000, respectively. Korean lespedeza was no-till seeded on April 7, 1999 at the rate of 19.5 lb/a, and March 15, 2000

[1]Southeast Area Extension Office.

at the rate of 18.3 lb/a on the same five pastures that had been seeded with lespedeza during 1998. An additional 2 lb/a of crabgrass seed was broadcast each year immediately prior to planting lespedeza. All pastures received 68-34-34 lb/a of N-P_2O_5-K_2O on November 19, 1998; 46 lb of N/a on March 26, 1999; 48.5 lb of N/a on May 28, 1999, 77-44-44 lb/a of N-P_2O_5-K_2O on October 12, 1999; and 56 lb of N/a on May 23, 2000. An additional 50 lb N/a was applied to pastures without lespedeza on July 16, 1999 and July 17, 2000.

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

In 1998, 40 mixed-breed steers with an initial weight of 702 lb were weighed on consecutive days, stratified by weight, and allotted randomly to the 10 pastures on June 23 to graze crabgrass. In 1999 and 2000, 50 mixed-breed steers with initial weights of 639 lb and 600 lb, respectively, were weighed on consecutive days, stratified by weight, and allotted randomly to the 10 pastures on March 30 (1999) and March 9 (2000) to graze out wheat and then graze crabgrass. In 1999, cattle grazed wheat from March 30 until May 26 (57 days) and then grazed crabgrass from May 26 until September 1 (98 days). In 2000, cattle grazed wheat from March 9 until May 9 (61 days) and then grazed crabgrass from May 9 until September 6 (120 days). 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. In 1998, all pastures were grazed continuously for 98 days at a stocking rate of one head/a until grazing was terminated and steers were weighed on September 28 and 29. In 1999, pastures were stocked initially with 1.2 head/a until August 17, when a steer closest to the pen average weight was removed from each pasture as available forage became limited because of below average rainfall. In 2000, a steer closest to the pen average weight was removed from each pasture at the end of the wheat phase. Pastures were then stocked at 1 head/a until grazing was terminated and steers were weighed on August 31 and September 1, 1999, and September 5 and 6, 2000. Pastures were mowed and harvested for hay on September 14 and 15 to remove residual forage after grazing was terminated in 2000.

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). Cattle that were grazed in 1998, 1999, and 2000 were fed for 142, 114, and 120 days, respectively. 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) for 1998 is presented in Figure 1. Available forage was similar between pastures that received additional N fertilizer and those that were interseeded with lespedeza. However, it decreased dramatically for both treatments after mid August, following mowing for hay coupled with below normal precipitation. Legume coverage averaged 4.7% in pastures interseeded with lespedeza and 1.3% in those that received additional N fertilization.

Available forage DM and lespedeza canopy coverage for 1999 are shown in Figure 2. Available forage DM was not significantly different ($P<.05$) between treatments overall or at any time during the growing season. Available forage DM from wheat decreased ($P<.05$) after

April 27 (Day 117) to a low of 660 lb/a on July 20 (Day 201), then increased somewhat by September 2.

Available forage DM and lespedeza canopy coverage for 2000 are shown in Figure 3. Available forage DM was not significantly different (P<.05) between treatments overall or at any time during the growing season. Available forage DM from wheat decreased (P<.05) after April 27 (Day 117) to a low of 1160 lb/a on June 6 (Day 158), then increased to its maximum on August 10.

Available forage DM appeared lower in much of 1999 compared to 1998 and 2000. Forage DM availability patterns also differed markedly in 1998 and 2000. In 1998, the maximum amount of forage occurred early in the season, whereas the maximum in 2000 occurred in August. These differences were likely due to a higher initial stocking rate and grazing wheat prior to crabgrass in 2000. In 1999, forage availability was relatively low throughout the season, which may be attributed, at least in part, to uneven rainfall distribution and thinner stands of crabgrass and lespedeza. Lespedeza canopy coverage peaked in 1999 on July 20 at 3.1% (Fig. 2) and in July, 2000 at 18% (P<.05)(Fig. 3).

Cattle Performance

Performance of steers that grazed crabgrass pastures either fertilized with additional N or interseeded with lespedeza are presented in Tables 1, 2, and 3 for 1998, 1999, and 2000, respectively. In 1998, grazing gains, subsequent feedlot performance, and overall performance were similar between pastures with lespedeza and those that received an extra application of N; grazing gains were 1.27 and 1.23 lb/head daily, respectively. Cattle should have been removed from pastures 2 weeks earlier in 1998 to achieve maximum gains. In 1999, grazing gains were similar between pastures with lespedeza and those that received an extra application of N. Gains during the wheat phase averaged 2.22 and 2.26 lb/head/day; during the crabgrass phase, 1.30 and 1.25 lb/head/day; and overall, gains averaged 1.64 and 1.62 lb/head/day for pastures interseeded with lespedeza and fertilized with additional N, respectively. Crabgrass gains in 1999 likely were limited by below-normal precipitation during the summer months. Steers that grazed pastures with lespedeza in 1999 gained more (P<.05) during the finishing phase and had larger (P<.05) ribeye area than those on pastures fertilized with additional N. Overall performance from the beginning of the grazing phase through the end of the finishing phase was similar (P>.05) between grazing treatments.

During all phases in 2000, grazing gains were again similar between pastures with lespedeza and those that received an extra application of N. Gains during the wheat phase for pastures with lespedeza averaged 3.09 and 3.18 lb/head/day for pastures fertilized with additional N. During the crabgrass phase, gains averaged 1.74 and 1.82 lb/head/day; and overall, gains averaged 2.19 and 2.28 lb/head/day for pastures interseeded with lespedeza and fertilized with additional N, respectively. Although grazing gains were similar, steers that grazed pastures that received an extra application of N in 2000 gained more (P<.05) during the finishing phase, which resulted in heavier (P<.05) final weights and higher (P<.05) overall gains from the beginning of the grazing phase through the end of the finishing phase than those pastures with lespedeza.

This study will be continued for at least one more year. Wheat will be planted in the fall and grazed out in the spring. Cattle will then graze crabgrass during the summer months. We are hopeful that the crabgrass will be able to reseed itself each year.

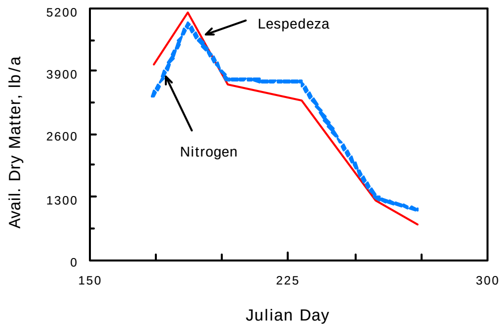

Figure 1. Available Forage in Crabgrass Pastures, 1998, Southeast Agricultural Research Center.

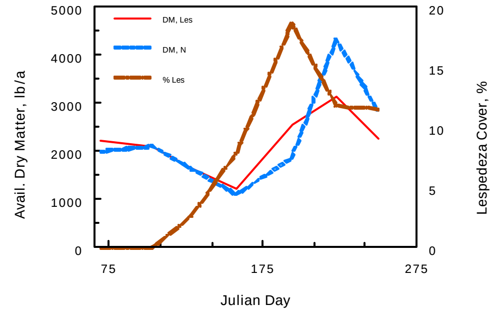

Figure 3. Available Forage and Lespedeza Canopy Cover in Crabgrass Pastures, 2000, Southeast Agricultural Research Center.

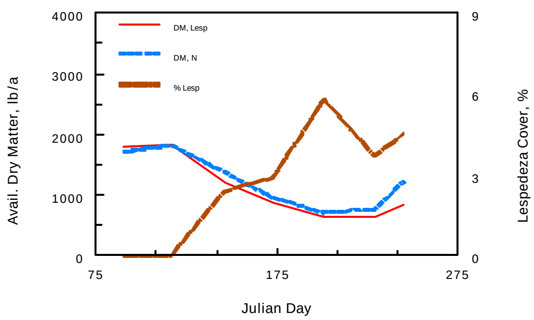

Figure 2. Available Forage and Lespedeza Canopy Cover in Crabgrass Pastures, 1999, Southeast Agricultural Research Center.

Table 1. Effects of Interseeding Lespedeza vs. Nitrogen Fertilization on Performance of Steers Grazing Crabgrass Pastures, Southeast Agricultural Research Center, 1998.

Item	Nitrogen Fertilization	Lespedeza
Grazing Phase (98 Days)		
No. of head	20	20
Initial wt., lb	702	702
Ending wt., lb	827	823
Gain, lb	124	121
Daily gain, lb	1.27	1.23
Gain/a	124	121
Finishing Phase (142 Days)		
Initial wt., lb	827	823
Final wt., lb	1253	1239
Gain, lb	426	416
Daily gain, lb	3.00	2.93
Daily DM intake, lb	26.3	26.9
Feed/gain	8.9	9.2
Hot carcass wt., lb	764	756
Backfat, in	.36	.34
Ribeye area, sq in	12.8	13.1
Yield grade	2.6	2.4
Marbling score	SM^{16}	SM^{43}
% Choice	65	75
Overall Performance (Grazing + Finishing Phase) (240 Days)		
Gain, lb	551	537
Daily gain, lb	2.30	2.24

Table 2. Effects of Interseeding Lespedeza vs. Nitrogen Fertilization on Performance of Steers Grazing Crabgrass Pastures, Southeast Agricultural Research Center, 1999.

Item	Nitrogen Fertilization	Lespedeza
Grazing Phase - Wheat		
No. of head	25	25
Initial wt., lb	639	639
Ending wt., lb	768	766
Gain, lb	129	127
Daily gain, lb	2.26	2.22
Gain/a	161	158
Grazing Phase - Crabgrass (98 Days)		
Initial wt., lb	772	766
Final wt., lb	895	893
Gain, lb	123	127
Daily gain, lb	1.25	1.30
Gain/a	142	145
Overall Grazing Performance (Wheat + Crabgrass) (155 Days)		
Gain, lb	252	254
Daily gain, lb	1.62	1.64
Gain/a	303	304
Finishing Phase (114 Days)		
Initial wt., lb	895	893
Final wt., lb	1350	1400
Gain, lb	456[a]	507[b]
Daily gain, lb	4.00[a]	4.45[b]
Daily DM intake, lb	29.7	33.3
Feed/gain	7.42	7.49
Hot carcass wt., lb	794	824
Backfat, in	.60	.54
Ribeye area, sq in	12.3[a]	13.2[b]
Yield grade	3.5	3.0
Marbling score	SM^{46}	SM^{93}
% Choice	67	92
Overall Performance (Grazing + Finishing Phase) (269 Days)		
Gain, lb	708	761
Daily gain, lb	2.64	2.83

[a,b]Means within a row with a different letter are significantly different (P<.05).

Table 3. Effects of Interseeding Lespedeza vs. Nitrogen Fertilization on Performance of Steers Grazing Crabgrass Pastures, Southeast Agricultural Research Center, 2000.

Item	Nitrogen Fertilization	Lespedeza
Grazing Phase - Wheat		
No. of head	25	25
Initial wt., lb	600	600
Ending wt., lb	794	789
Gain, lb	194	189
Daily gain, lb	3.18	3.09
Gain/a	242	236
Grazing Phase - Crabgrass (120 Days)		
No. of head	20	20
Initial wt., lb	794	789
Final wt., lb	1005	994
Gain, lb	211	205
Daily gain, lb	1.82	1.74
Gain/a	218	208
Hay production, lb of DM/a	605	605
Overall Grazing Performance (Wheat + Crabgrass) (181 Days)		
Gain, lb	412	397
Daily gain, lb	2.28	2.19
Gain/a	460	444
Finishing Phase (128 Days)		
Initial wt., lb	1005	994
Final wt., lb	1421[a]	1388[b]
Gain, lb	416[a]	394[b]
Daily gain, lb	3.25[a]	3.08[b]
Daily DM intake, lb	30.1	29.2
Feed/gain	9.25	9.53
Hot carcass wt., lb	835	830
Backfat, in	.58	.65
Ribeye area, sq in	13.6	13.5
Yield grade	3.2	3.4
Marbling score	MT^{15}	MT^{16}
% Choice	75[a]	100[b]
Overall Performance (Grazing + Finishing Phase) (309 Days)		
Gain, lb	821[a]	788[b]
Daily gain, lb	2.66[a]	2.55[b]

[a,b]Means within a row with a different letter are significantly different ($P<.05$).

SOUTHEAST AGRICULTURAL RESEARCH CENTER
KANSAS STATE UNIVERSITY

EFFECT OF GRAZING SYSTEM ON ENDOPHYTE-INFECTED AND ENDOPHYTE-FREE FESCUE-CLOVER PASTURES

Lyle W. Lomas, Joseph L. Moyer, Daniel W. Sweeney, Frank K. Brazle[1], Gary L.Kilgore[1], and Rodney Jones[2]

Summary

Thirty-two steers grazed tall fescue pastures interseeded with ladino clover to determine the effect of the presence of the fungal endophyte and grazing system (continuous or rotational stocked) on grazing and subsequent finishing performance of stocker steers. Steers grazing continuously stocked pastures had higher (P<.05) grazing, finishing, and overall gains than those that were rotated twice weekly. Cattle that grazed low endophyte pastures had higher (P<.05) grazing and overall gains, but similar (P>.05) finishing gains as those that grazed high endophyte pastures.

Introduction

Tall fescue is a well adapted pasture grass in the eastern US, but it has a reputation for poor performance by grazing livestock because of the presence of the fungal endophyte. Cattlemen utilizing high-endophyte tall fescue pasture either can tolerate depressed gains from their cattle or seek to improve grazing performance by destroying existing stands of fescue and replacing them with endophyte-free fescue or other forages or by interseeding legumes into existing pastures to reduce the adverse effects on animal performance.

Interseeding legumes into existing high-endophyte tall fescue pastures has proven to be an effective method to reduce the adverse effects on animal performance. An economic analysis from grazing research with stocker steers at the Southeast Agricultural Research Center showed that grazing endophyte-free fescue pasture was more profitable than using endopohyte-infected pasture with nitrogen fertilizer or clover in 2 of 3 years. However, on the average, grazing endophyte-infected fescue with clover was the most profitable pasture alternative, and endophyte-infected fescue with nitrogen fertilization was the least profitable. Endophyte-infected fescue interseeded with clover was the most profitable system in all 3 years when ownership was retained through slaughter.

Research at other locations has shown that intensive rotational grazing resulted in similar animal performance but greater gain per acre than continuous grazing. However, the results of many of these studies have been confounded by using a higher stocking rate on rotational grazed pasture than on continuous grazed pastures. The following study was conducted to compare legume persistence, forage production, and grazing and subsequent feedlot performance of stocker steers grazing endophyte-infected and endophyte-free fescue-

[1]Southeast Area Extension Office.

[2]KSU Department of Agricultural Economics.

clover pastures stocked continuously or rotationally at similar rates.

Experimental Procedures

Sixteen 5-acre pastures of 'Kentucky 31' tall fescue were used in a randomized complete block design experiment. Pastures were located at the Mound Valley Unit of the Kansas State University - Southeast Agricultural Research Center on a Parsons silt loam soil (fine, mixed, thermic, Mollic Albaqualf). One-half of the pastures were endophyte-free and the other half had more than 65% infection rate with the endophyte (*Neotyphodium coenophialum* Glen, Bacon, Price, and Hanlin). All pastures were fertilized in September, 1999 with 16-40-40 lb/a of $N\text{-}P_2O_5\text{-}K_2O$.

Sixty-four stocker steers with an initial weight of 594 lb were weighed on consecutive days, stratified by weight, and allotted randomly at 4 steers each to the sixteen 5-acre experimental pastures of 'Kentucky 31' tall fescue on April 25, 2000. Eight of the 16 pastures were endophyte-infected and eight were endophyte-free. All pastures had been previoiusly interseeded with 'Regal' ladino clover. All pastures were stocked with 4 steers. Four pastures of each type (endophyte-infected or endophyte-free) were selected at random and subdivided for rotational grazing. Cattle in the remaining pastures had access to the entire 5 acres at all times for continuous grazing. Cattle in rotationally grazed pastures initially had access to half the pasture for the first two weeks and the other half of the pasture during the third and fourth weeks of the study. Thereafter, pastures were subdivided into 8 paddocks for rotational grazing and steers were moved to a different paddock twice weekly. No protein or energy supplement was fed. 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. Two steers were removed from the study during the grazing phase for reasons unrelated to experimental treatment and replaced with "grazer" steers that were used to keep stocking rates equal on each pasture. Another steer was removed from the study at the end of the grazing phase for reasons unrelated to experimental treatment. Grazing was terminated and steers were weighed on September 11 and 12 (140 days).

Following the grazing period, cattle were moved to a finishing facility and fed a diet of 80% ground milo, 15% corn silage, and 5% supplement on a dry matter basis for 147 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.

Legume canopy coverage as well as available dry matter were monitored in all experimental pastures throughout the grazing phase using a calibrated falling disk meter.

Results and Discussion

Grazing and finishing performance are listed in Table 1. Cattle were pooled within grazing system and endophyte level since there were no grazing system x endophyte level interactions. Cattle that grazed continuously stocked pastures gained 25.2% more ($P<.05$) on pasture than those that were rotated twice weekly. Cattle that previously grazed continuously stocked pastures were also heavier ($P<.05$) at the end of the finishing phase, had higher ($P<.05$) finishing gains and higher ($P<.05$) overall gains, consumed more ($P<.05$) feed, and yielded heavier ($P<.05$) carcasses with more ($P<.05$) backfat and higher ($P<.05$) numerical yield grades than those that were previously rotated twice weekly during the grazing phase.

Cattle grazing low endophyte fescue gained 68.9% more (P<.05) than those that grazed high endophyte pastures during the grazing phase. There was no difference (P>.05) in finishing gains of steers that had previously grazed low or high endophyte pastures. Steers that grazed low endophyte pastures had higher (P<.05) overall gains, were heavier (P<.05) at slaughter, and yielded heavier (P<.05) carcasses than their counterparts that grazed high endophyte pastures. Steers that had previously grazed high endopohyte pastures required less (P<.05) feed per unit of gain and yielded carcasses with lower (P<.05) numerical yield grades and more (P<.05) marbling.

At least two more years of grazing are planned. An economic analysis will be performed using enterprise budgeting and whole-farm modeling after data have been collected.

Table 1. Effect of Grazing System on Endophyte-Infected and Endophyte-Free Fescue-Clover Pastures, Southeast Agricultural Research Center, 2000.

	Grazing System		Endophyte Level	
	Continuous	Rotational	Low	High
Grazing Phase (140 Days)				
No. of head	16	14	14	16
Initial wt., lb	594	593	593	594
Ending wt., lb	782[a]	743[b]	806[c]	720[d]
Gain, lb	188[a]	150[b]	213[c]	126[d]
Daily gain, lb	1.34[a]	1.07[b]	1.52[c]	.90[d]
Gain/a	150[a]	120[b]	185[c]	101[d]
Finishing Phase (147 Days)				
No. of head	16	13	14	15
Initial wt., lb	782	746	806[c]	722[d]
Ending wt., lb	1258[a]	1190[b]	1256[c]	1191[d]
Gain, lb	476[a]	443[b]	450	469
Daily gain, lb	3.23[a]	3.02[b]	3.06	3.19
Daily DM intake, lb	28.0[a]	26.1[b]	27.7	26.4
Feed/gain	8.67	8.68	9.05[c]	8.29[d]
Hot carcass wt., lb	761[a]	717[b]	761[c]	717[d]
Backfat, in	.46[a]	.40[b]	.45	.41
Ribeye area, sq in	12.9	12.7	12.9	12.7
Yield grade	2.8[a]	2.6[b]	2.8[c]	2.6[d]
Marbling score	SM[98]	SM[78]	SM[60c]	MT[16d]
% Choice	81	72	72	81
Overall Performance (Grazing + Finishing Phase) (287 Days)				
Gain, lb	664[a]	594[b]	663[c]	595[d]
Daily gain, lb	2.31[a]	2.07[b]	2.31[c]	2.07[d]

[a,b] Grazing system means with different superscripts are different (P<.05).
[c,d] Endophyte level means with different superscripts are different (P<.05).

EFFECTS OF LEGUME PERSISTENCE IN ENDOPHYTE-INFECTED TALL FESCUE PASTURES ON FORAGE PRODUCTION AND STEER PERFORMANCE

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

Summary

A total of 135 steers grazed high-endophyte tall fescue pastures in 1998, 1999, and 2000 that had been interseeded with either lespedeza, red clover, or ladino clover during 1995, 1996, and 1997. No additional legume was seeded after 1997 in order to evaluate legume persistence. Legume cover, forage dry matter production, and grazing steer performance were measured. In 1998, cattle grazing pastures interseeded with ladino clover gained significantly ($P<.05$) more than those grazing pastures interseeded with lespedeza or red clover. Gains from pastures interseeded with red clover or lespedeza were similar ($P>.05$). Steers that grazed pastures inteseeded with red clover gained more ($P<.05$) during the finishing phase than those that grazed pastures interseeded with ladino clover. Final weight at the end of the finishing phase, hot carcass weight, and overall daily gain were lower ($P<.05$) for steers that grazed pastures interseeded with lespedeza than for those interseeded with red clover or ladino clover. In 1999, grazing, finishing, and overall performance were similar among pastures previously interseeded with the three legumes. Steers that had previously grazed pastures interseeded with red clover had a lower ($P<.05$) percentage of choice carcasses than those that were interseeded with lespedeza or ladino clover. In 2000, grazing performance was similar among pastures previously interseeded with the three legumes. Presence of legumes was closely correlated with grazing steer performance.

Introduction

Interseeding legumes into high-endophyte 'Kentucky 31' tall fescue pastures has proven to be an effective means of minimizing the negative effect of the endophyte on performance of grazing beef cattle. White clover is the predominant legume seeded with tall fescue especially in the southeastern US; however, lespedeza and red clover are also used in specific areas. Legume persistence is extremely important in this production system, because legume seed is a major expenditure. This project was conducted to compare legume persistence, forage production, and grazing performance and subsequent feedlot performance of stocker steers grazing high-endophyte tall fescue pastures that had been interseeded previously with ladino clover, lespedeza, or red clover.

Experimental Procedures

Pastures

The experiment was conducted using a randomized complete block design with three replications. Nine experimental pastures (5-acres each) located at the Parsons Unit of the KSU Southeast Agricultural Research Center were randomly assigned a legume treatment. The pastures of established (>5 yr) Kentucky 31 tall

[1]Southeast Area Extension Office.

fescue had more than 65% infection rate with the endophyte (*Neotyphodium coenophialum* Glen, Bacon, Price, and Hanlin). Pastures were interseeded with either lespedeza ('Marion' in 1995 and Korean in 1996 and 1997), 'Regal' ladino clover, or 'Kenland' red clover using a no-till drill in each of the previous 3 years. No additional legume seed was planted in 1998 or 1999 in order to determine the persistence of legumes planted in previous years. All pastures were fertilized with 16-40-40 lb/a of $N\text{-}P_2O_5\text{-}K_2O$ in September of each year.

Available forage was determined at the initiation of grazing and during the season with a disk meter calibrated for tall fescue. Three exclosures (15-20 ft^2) were placed in each pasture; total production was estimated from three readings per exclosure, and available forage was determined from three readings near each cage. Legume canopy coverage was estimated from the percentage of the disk circumference that contacted a portion of the canopy.

Grazing Steers

In 1998, 1999, and 2000, 45 mixed-breed steers were weighed on consecutive days, stratified by weight, and allotted randomly to the nine pastures. Grazing was initiated on April 1, March 30, and April 4, in 1998, 1999, and 2000, respectively. Initial weights of steers utilized in 1998, 1999, and 2000 were 573, 565, and 553 lb, respectively. Cattle were treated for internal and external parasites prior to being turned out to pasture and later were vaccinated for protection from pinkeye. Steers were fed 2 lb of ground grain sorghum per head daily and had free access to commercial mineral blocks that contained 12% calcium, 12% phosphorus, and 12% salt. One steer was removed from one of the lespedeza pastures in 1998, one from one of the ladino clover pastures in 1999, and one from one of the red clover pastures in 2000 for reasons unrelated to experimental treatment. Pastures were grazed continuously at a stocking rate of 1 head/a. Grazing was terminated and steers were weighed on November 9 and 10 (223 days) and November 3 and 4 (218 days), and November 7 and 8 (218 days), in 1998, 1999, and 2000, respectively.

Following the grazing period, cattle were shipped to a finishing facility and fed a diet containing 80% ground milo, 15% corn silage, and 5% supplement on a dry matter basis. Steers were implanted with Synovex-S® on days 0 and 84 of the finishing period. Cattle that grazed in 1998 and 1999 were fed a finishing diet for 154 and 140 days, respectively, and slaughtered in a commercial facility. Carcass data were collected. Cattle that grazed these pastures during 2000 are currently completing the finishing phase of this study.

Results and Discussion

Pastures

Available forage dry matter for each legume treatment for 1998, 1999, and 2000 are shown in Figures 1, 2, and 3, respectively. Pastures interseeded with ladino clover or red clover had higher available forage dry matter than those interseeded with lespedeza during the early part of the study. Available forage dry matter production was similar among legume treatments during the latter part of the study. In 2000, available dry matter did not differ ($P>.10$) by previous legume treatment, so the average by date across treatment is shown in Figure 3.

Legume cover in 1998 for each previous legume treatment is shown in Figure 4. Legume cover was higher in pastures interseeded with ladino clover than in those seeded with red clover or lespedeza. Legume cover was similar in pastures interseeded with red clover or lespedeza. In 1999, there was no significant difference ($P>.05$, data not shown) in legume cover from previous seeding, although pastures seeded with ladino clover averaged more than 3% cover, whereas the average for red clover and lespedeza seedings were practically zero. In 2000, legume cover from previous seedings of ladino clover was 1.3% (data not shown), which was significantly (P<0.05) more than the zero legume cover from previous seedings of red clover and lespedeza.

Cattle Performance

Grazing and subsequent finishing performance of steers grazing high-endophyte fescue pastures interseeded with the various legumes in 1998 are presented in Table 1. Daily gains for pastures interseeded with ladino clover, red clover, and lespedeza were 1.24, 1.03, and .93 lb, respectively. Cattle grazing pastures interseeded with ladino clover gained significantly (P<.05) more than those grazing pastures interseeded with lespedeza or red clover. Gains of steers grazing pastures interseeded with red clover or lespedeza were similar (P>.05). Results for gains of grazing stocker cattle followed the same trends as legume cover.

Finishing gains were higher (P<.05) for steers that previously grazed red clover pastures than those that previously grazed pastures interseeded with ladino clover. Feed intake and feed/gain were similar between legume treatments. Cattle that grazed pastures interseeded with lespedeza had lower (P<.05) final live weight, hot carcass weight, and overall daily gain than those that grazed pastures interseeded with red clover or ladino clover. Overall gains between steers that grazed red clover or ladino clover were similar (P>.05).

Grazing and subsequent finishing performance of steers that grazed these pastures in 1999 are presented in Table 2. Legume treatment had no effect (P>.05) on grazing or finishing performance. However, the percent of steers that graded choice was lower (P<.05) from pastures interseeded with red clover than from those with lespedeza or ladino clover.

Grazing performance for 2000 is presented in Table 3. Legume treatment had no effect (P>.05) on grazing performance. Cattle that grazed these pastures during 2000 are currently completing the finishing phase of this study. This was the final year for this project. Final results will be summarized in next year's report.

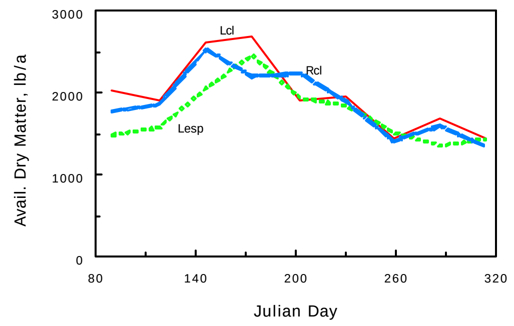

Figure 1. Available Forage in Tall Fescue Pastures, 1998, Southeast Agricultural Research Center.

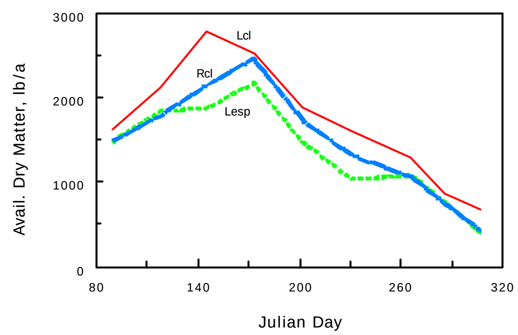

Figure 2. Available Forage in Tall Fescue Pastures, 1999, Southeast Agricultural Research Center.

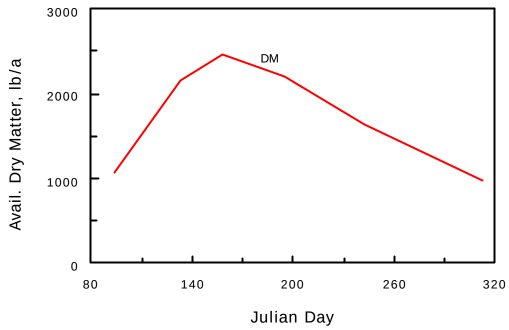

Figure 3. Available Forage in Tall Fescue Pastures, 2000, Southeast Agricultural Research Center.

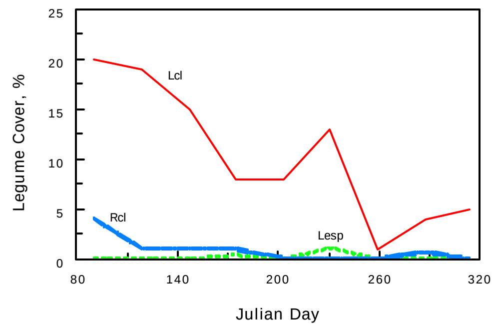

Figure 4. Legume Canopy Cover in Tall Fescue Pastures, 1998, Southeast Agricultural Research Center.

Table 1. Effects of Interseeding Legumes into Endophyte-Infected Fescue Pastures on Performance of Steers in 1998, Southeast Agricultural Research Center.

	Legume		
Item	Lespedeza	Red Clover	Ladino Clover
Grazing Phase (223 Days)			
No.of head	14	15	15
Initial wt., lb	572	574	573
Ending wt., lb	779[a]	803[a]	849[b]
Gain, lb	207[a]	230[a]	276[b]
Daily gain, lb	0.93[a]	1.03[a]	1.24[b]
Finishing Phase (154 Days)			
No. of head	14	15	15
Starting wt., lb	779[a]	803[a]	849[b]
Final wt., lb	1296[a]	1340[b]	1341[b]
Gain, lb	517[a,b]	537[a]	492[b]
Daily gain, lb	3.36[a,b]	3.49[a]	3.19[b]
Daily DM intake, lb	25.0	26.3	25.8
Feed/gain	7.45	7.58	8.07
Hot carcass wt., lb	790[a]	813[b]	817[b]
Dressing %	61.0	60.7	60.9
Backfat, in	.39	.38	.40
Ribeye area, sq in	16.0	15.5	15.3
Yield grade	1.8	2.0	2.1
Marbling score	SM^{10}	SM^{79}	SM^{62}
% Choice	62	80	67
Overall Daily Gain (377 Days)	1.92[a]	2.03[b]	2.04[b]

[a,b]Means within a row with a different letter are significantly different (P<.05).

Table 2. Effects of Interseeding Legumes into Endophyte-Infected Fescue Pastures on Performance of Grazing Steers, Southeast Agricultural Research Center, 1999.

	Legume		
Item	Lespedeza	Red Clover	Ladino Clover
Grazing Phase (218 Days)			
No. of head	15	15	14
Initial wt., lb	565	565	565
Ending wt., lb	775	784	779
Gain, lb	210	219	214
Daily gain, lb	.97	1.01	.98
Finishing Phase (140 Days)			
No. of head	15	15	14
Starting wt., lb	775	784	779
Final wt., lb	1322	1320	1344
Gain, lb	547	536	565
Daily gain, lb	3.90	3.82	4.03
Daily DM intake, lb	27.1	28.2	27.8
Feed/gain	6.94	7.38	6.9
Hot carcass wt., lb	790	800	808
Dressing %	59.7	60.6	60.1
Backfat, in	.51	.44	.45
Ribeye area, sq in	12.0	11.4	12.3
Yield grade	3.3	2.9	3.1
Marbling score	MT^{19}	SM^{70}	MT^{22}
% Choice	92[a]	73[b]	100[a]
Overall Daily Gain (358 Days)	2.12	2.11	2.18

[a,b]Means within a row with a different letter are significantly different (P<.05).

Table 3. Effects of Interseeding Legumes into Endophyte-Infected Fescue Pastures on Performance of Grazing Steers (218 Days), Southeast Agricultural Research Center, 2000.

	Legume		
Item	Lespedeza	Red Clover	Ladino Clover
No. of head	15	14	15
Initial wt., lb	552	554	552
Ending wt., lb	774	798	780
Gain, lb	223	245	229
Daily gain, lb	1.02	1.12	1.05

USE OF LEGUMES IN WHEAT-BERMUDAGRASS PASTURES

Joseph L. Moyer and Lyle W. Lomas

Summary

Use of hairy vetch in lieu of nitrogen (N) fertilizer for wheat in bermudagrass pastures tended to increase spring calf and cow gains with similar average forage availability compared to wheat-bermudagrass plus a N application during the wheat phase. Red clover in bermudagrass in lieu of one summer N application did not affect cow gains.

Introduction

Bermudagrass is a productive forage species when intensively managed. However, it has periods of dormancy and requires proper use to maintain forage quality, and also 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 two additional N applications of 50 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 (85 lb/a) was interseeded (no-till) into bermudagrass sod on September 15, 1999. The next day, 30 lb/a of hairy vetch and 4 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 "excellent." The four Nitrogen pastures were fertilized on February 7, 2000 with 45 lb/a of N as urea.

Cows and calves were weighed on consecutive days, and four pairs were assigned randomly by weight to each pasture on March 16. On April 4, legume pastures were broadcast with 12 lb/a of 'Kenland' medium red clover. All pastures were fertilized on May 22 with 60-50-30 lb/a of N-P_2O_5-K_2O.

The wheat grazing phase ended on May 10-11, when cows and calves were weighed and calves were weaned. Cows were returned to assigned pastures to continue grazing bermudagrass until August 17, when they were removed to begin calving. Nitrogen pastures received 50 lb/a of N as urea on July 12.

Available forage and legume canopy coverage were monitored throughout the grazing season with a calibrated disk meter. Pastures were mowed on September 8 to remove excess forage.

Results and Discussion

The stand of hairy vetch was excellent throughout the winter and spring. Gain during the wheat grazing period (57 days) tended to be greater (P<.10) for calves and cows in the Legume than in the Nitrogen pasture system (Table 1). Average available forage dry matter in the wheat grazing phase was similar (P=.15) for the Legume and the Nitrogen system, but there were differences (P<.05) at certain times during the growing season (data not shown). The legume canopy coverage was 95% for the Legume treatment, practically all hairy vetch.

Cow gains during the bermudagrass phase tended to be greater (Table 1, P>.05) for the Legume than the Nitrogen system. Average available forage was similar (P<.20) for the two systems. Average canopy coverage of red clover was not significantly greater (P>.20) for the Legumes than the Nitrogen system. After grazing was concluded, a similar (P>.20) amount of forage was removed as hay from the two systems. For the wheat and bermudagrass phases in the 2000 grazing season, total cattle gain tended to be higher (P<.10) in the Legumes than the Nitrogen treatment.

Table 1. Performance of Cow-Calf Pairs Grazing Bermudagrass Pastures Interseeded with Wheat and Fertilized with Nitrogen or Interseeded with Legumes, Southeast Agricultural Research Center, 2000.

	Management System	
Item	Nitrogen	Legumes
Wheat Phase		
No. of cow-calf pairs	16	16
No. of days	56	56
Stocking rate, cow-calf pairs/a	0.8	0.8
Calf initial wt., lb	425	424
Calf final wt., lb	582	608
Calf gain, lb	158[c]	184[d]
Calf daily gain, lb	2.82[c]	3.28[d]
Cow initial wt., lb	1229	1221
Cow final wt., lb	1329	1347
Cow gain, lb	100[c]	126[d]
Cow daily gain, lb	1.78[c]	2.25[d]
Cow + calf gain, lb/a	206[c]	248[d]
Legume cover, %	1[a]	95[b]
Average available DM, lb/a	1380	1640
Bermudagrass Phase		
No. of cows	16	16
No. of days	98	98
Stocking rate, cows/a	0.8	0.8
Cow initial wt., lb	1329	1347
Cow final wt., lb	1564	1609
Cow gain, lb	235[c]	262[d]
Cow daily gain, lb	2.40[c]	2.67[d]
Cow gain, lb/a	188[c]	210[d]
Legume cover, %	1	6
Average available DM, lb/a	4190	3600
Hay Removed, lb/a	1060	1030
Total cow + calf gain, lb/a	394[c]	457[d]

[a,b]Means within a row followed by a different letter are significantly different (P<.05).
[c,d]Means within a row followed by a different letter are significantly different (P<.10).

EFFECTS OF GRAIN SORGHUM PROCESSING ON SHEEP RESPONSE TO TALL FESCUE ENDOPHYTE

Joseph L. Moyer, Frank K. Brazle, and Lyle W. Lomas

Summary

In an 18-day trial, wethers were fed diets that contained 10% high- (HE) or low-endophyte (LE) fescue seed and grain sorghum that was either processed (steam-treated, low biological activity; LA) or unprocessed (raw, high activity; HA). Wethers fed LE-LA diets tended to gain more than those fed HE, had higher feed intake from days 13-18 than lambs fed HE-LA or LE-HA, lower respiration rate on day 7 and higher serum prolactin concentration than lambs fed the other diets. However, since there were differences in gain and intake responses between LE-LA and HE-LA compared to LE-HA and HE-HA, the raw sorghum grain may have had some ameliorative effect on the more toxic diet.

Introduction

Tall fescue is the predominant cool-season perennial grass in the United States, grown on about 35 million acres. However, most of the tall fescue in the US contains an endophytic fungus (*Neotyphodium coenophialum* Glen, Bacon, Price and Hanlin) that appears symbiotic with the plant but contains ergot alkaloids that are detrimental to many animals, including cattle, sheep, and horses.

Seeds of certain sorghum cultivars show relatively high levels of antifungal activity. Biological activity is destroyed by steam treatment of sorghum, and digestibility and other characteristics may also be altered. The objectives of this trial were to determine: 1) the effects of altering biological and other properties of sorghum grain on sheep response to fescue fungus, and 2) whether the breakdown of ergovaline was altered by such sorghum treatment.

Experimental Procedures

The trial was set up in a 2 x 2 factorial treatment arrangement with four animals per replication in a completely randomized design. Diets were formulated (Table 1) containing high-endophyte (HE) or low-endophyte (LE) tall fescue seed and a sorghum grain concentrate with high biological activity (HA) or low biological activity (steamed, LA). Results of analyses of diet constituents that differed among treatments are listed in Table 2. The HE tall fescue seed had about twice the concentration of ergovaline as the LE tall fescue seed. The HA sorghum had higher crude protein and available protein concentrations than did the LA (steam-treated) sorghum grain. Nutrient analyses of the treatment diets are shown in Table 3. The lower concentration of crude protein in the HE-LA and LE-LA treatments reflected the lower protein values found in the low-activity sorghum grain.

Wethers were obtained in early June and fed alfalfa hay and salt, free-choice, then preconditioned for three weeks with amounts increasing to 3.4 lb/head/day of the treatment diet (Table 1) containing endophyte-free tall fescue seed and ground, untreated sorghum grain. On July 17, wethers averaging 70 lb were sheared, vaccinated for enterotoxemia, weighed, and put in individual 4- x 7-ft stalls in a ventilated barn and maintained on the same uniform diet. Individual feed and water intake were measured during this period. The feeding of different treatment rations (Table 3) began on July 24 and continued for 18 days.

Semi-weekly measurements of respiration rate and rectal temperature were taken. On the last two days of the trial, feces were collected for ergovaline assay. At the conclusion of the trial, blood samples were taken for determination of serum prolactin concentration.

Wethers were fed together for 23 days with 3 lb/head/day of 79% ground, untreated sorghum grain, 12% soybean meal, 6% dried molasses, 1.5% ground limestone, and the rest salt and premix of Vitamin A, D, and E, plus free-choice high-quality clover hay, then weighed again.

Table 1. Composition of Diets Offered to Wethers.

Ingredient	Composition
	- - % - -
Ground sorghum grain	59.2
Soybean meal	9.5
Fescue seed	9.5
Ground alfalfa hay	14.2
Dried molasses	4.7
Limestone	1.2
Salt	0.5
Vitamin A, D, E premix	0.6
Soybean oil	0.6

Results and Discussion

Weights and gain of wethers offered different treatment diets are shown in Table 4. During the 18-day trial period, wethers tended (P>.10) to gain more on the LE-LA diet compared to diets that contained high-endophyte tall fescue seed. During the post-trial period, wethers that had previously consumed the HE-HA diet tended to gain more than wethers that had been fed the LE-HA diet.

Feed intake for three 6-day periods, overall intake for the 18-day trial, and feed efficiency are listed in Table 5. No difference in feed intake was found for the first two periods. However, during the final 6 days of the trial, wethers that were fed the HE-LA diet consumed significantly (P<.01) less than wethers consuming the LE-LA diet and wethers fed the LE-HA diet also consumed less (P<.05) then those fed the LE-LA diet. Wethers fed the HE-HA diet consumed an intermediate amount during the final period. Average daily intake for the total test period tended (P<.10) to be less for wethers on the HE-LA compared to the LE-LA diet. No difference (P>.10) among diets was found for feed efficiency of wethers.

Water intake for three 6-day periods of the 18-day trial and overall average daily intake are shown in Table 6. No difference in water intake was found among the treatment diets for the last two periods. However, during the first 6 days of the trial, wethers that were fed the HE-LA diet consumed significantly (P<.05) less than wethers consuming the HE-HA diet and wethers fed the LE-LA diet tended to consume less (P<.10) then those fed the HE-HA diet. Average daily intake for the total test period tended (P<.10) to be less for wethers on the HE-LA compared to the HE-HA diet.

Respiration rate of wethers at semi-weekly intervals during the 18-day trial is shown in Table 7. Differences in respiration rate were found among the treatment diets on the seventh and fourteenth days of the test. On day 7, respiration rate of wethers fed the LE-LA diet was significantly (P<.05) lower than the respiration rate of wethers fed the other diets, and the difference between respiration rates of wethers fed the HE-HA diet compared to the LE-LA diet was highly significant (P<.01). On day 14, respiration rate of wethers fed the HE-LA diet was lower (P<.05) compared to the respiration rate of wethers fed the HE-HA diet.

The semi-weekly body temperature of wethers during the 18-day trial is shown in Table 8. Differences in body temperature were found among the treatment diets only on the seventeenth day of the test. Body temperature of wethers fed the LE-HA diet were higher (P<.05) compared to the temperature of wethers fed the HE-LA diet. Wethers fed the LE-LA diet also tended (P<.10) to have a lower body temperature than wethers fed the HE-LA diet.

Blood serum prolactin and fecal ergovaline concentrations from collections near the end of the trial period are listed in Table 9. Serum prolactin concentration in wethers fed the LE-LA diet was higher (P<.05) than the prolactin concentration in wethers fed the other diets, and the difference between prolactin in wethers fed the HE-HA and HE-LA diets compared to the LE-LA diet was highly significant (P<.01). Serum prolactin concentration of wethers fed the LE-HA diet tended (P<.10) to be higher than prolactin in wethers fed the and HE-LA diets, and less than prolactin in wethers fed the LE-LA diet.

Fecal ergovaline concentration (Table 9) from wethers fed the HE-HA and HE-LA diets was significantly (P<.05) higher than fecal ergovaline from wethers fed the other diets, and the difference between concentrations from wethers fed the HE-HA diet compared to the LE-HA and LE-LA diets was highly significant (P<.01).

The wethers showed responses to the fescue endophytic fungus. Gain tended to be reduced and blood serum prolactin was reduced with diets containing high- compared to low-endophyte tall fescue seed. Altering the properties of the dietary sorghum grain with steam treatment modified sheep response to the fescue endophyte.

Feed intake values near the end of the test (third 6-day period) were similar for diets containing high- and low-endophyte seed when biologically active (raw) grain sorghum was used. However, intake levels in the third period of diets that included steamed grain sorghum were reduced when high-endophyte compared to low-endophyte seed was included. Water intake was differentially affected by treatment early in the study, but appeared transitory.

Respiration rates on day 14 of the trial (during the third period) were at their highest and were differentially affected by treatment. Wethers that consumed diets containing high-endophyte tall fescue seed had higher respiration rates with raw vs. steamed sorghum grain in the diet.

Body temperature of wethers was affected by treatment only near the end of the trial (day 17). Body temperature at that time tended to be lower with steamed compared to raw sorghum when the diet included low-endophyte fescue seed, but was not different when high-endophyte fescue seed was in the diet.

Serum prolactin concentration in wethers fed diets containing high-endophyte tall fescue seed were similarly low whether the sorghum was steamed or not. However, when low-endophyte tall fescue seed was in the diet, prolactin levels were higher with steamed sorghum.

Fecal ergovaline concentrations were at least 4-fold higher from diets containing high- compared to low-endophyte fescue seed. However, no difference was found between diets that contained steamed vs. raw sorghum grain with either high- or low-endophyte fescue seed.

Wethers that were fed LE-LA diets tended to gain more than those fed HE and had higher feed intake from days 13-18 than lambs fed HE-LA or LE-HA, indicating that steam treatment had a positive impact on feed utilization at low levels of endophyte toxin. This was also evidenced by the lower respiration rate on day 7 and higher serum prolactin concentration at the end of the study of lambs fed LE-LA diets compared to lambs on other diets.

Conversely, in the presence of high levels of endophyte toxin, feed intake, weight gain, and serum prolactin of wethers were reduced more when diets contained steam-treated compared to raw sorghums. This may indicate that, while steam-treated sorghum was a superior feed at low endophyte levels, biologically active sorghum could have played a role in ameliorating diets that contained the higher concentration of toxin.

Table 2. Analysis of constituents of different treatment diets: high-endophyte (HE) and low-endophyte (LE) tall fescue seed and high-activity (HA) and low-activity (LA, steam-treated) sorghum grain.

	Fescue seed		Sorghum grain	
Item	HE	LE	HA	LA
Dry matter, %	89.4	89.2	88.3	88.7
Crude protein, %	14.0	15.0	16.5	12.8
Available protein, %	9.6	10.5	11.8	8.4
Crude fiber, %	9.1	9.9	2.3	2.4
Ether extract, %	0.98	0.77	4.11	3.08
Ergovaline, ng/g	1875	950	- - -	- - -

Table 3. Nutrient analysis of different treatment diets: high-endophyte tall fescue seed with high-activity sorghum grain (HE-HA); high-endophyte tall fescue seed with low-activity sorghum grain (HE-LA); low-endophyte tall fescue seed with high-activity sorghum grain (LE-HA); and low-endophyte tall fescue seed with low-activity sorghum grain (LE-LA).

	Diet Treatment			
Item	HE - HA	HE - LA	LE - HA	LE - LA
Dry matter, %	88.7	88.6	88.6	88.3
Crude protein, %	19.3	17.0	19.2	16.4
Crude fiber, %	7.6	8.2	7.8	8.8
Ca, %	0.75	1.05	1.05	0.94
P, %	0.38	0.37	0.45	0.37
K, %	1.03	0.93	0.96	0.94

Table 4. Weights and gain of wethers offered different treatment diets: high-endophyte tall fescue seed with high-activity sorghum grain (HE-HA); high-endophyte tall fescue seed with low-activity sorghum grain (HE-LA); low-endophyte tall fescue seed with high-activity sorghum grain (LE-HA); and low-endophyte tall fescue seed with low-activity sorghum grain (LE-LA).

	Diet Treatment				
Item	HE- HA	HE- LA	LE- HA	LE- LA	SEM
	- - - - - - - - - - - - - - - - -	lb	- - - - - - - - - - - - - - - - - -		
Initial wt.	78.5	73.2	75.0	75.5	6.62
Test-end wt.	91.5	86.2	90.0	94.5	5.81
Test gain	13.0^{e}	13.0^{e}	15.0^{ef}	19.0^{f}	2.27
Final wt.	99.5	91.2	92.3	98.3	6.27
Post-test gain	8.0^{e}	5.0^{ef}	2.3^{f}	3.8^{ef}	1.85
Total gain	21.0	18.0	17.3	22.8	2.94

^{e,f}Means within a row with a different superscript differ (P<.10).

Table 5. Feed intake and efficiency of wethers offered different treatment diets: high-endophyte tall fescue seed with high-activity sorghum grain (HE-HA); high-endophyte tall fescue seed with low-activity sorghum grain (HE-LA); low-endophyte tall fescue seed with high-activity sorghum grain (LE-HA); and low-endophyte tall fescue seed with low-activity sorghum grain (LE-LA).

	Diet Treatment				
Item	HE- HA	HE- LA	LE- HA	LE- LA	SEM
	- kg -				
Total intake					
Days 1-6	10.8	9.3	10.4	10.5	0.77
Days 7-12	11.7	10.4	11.3	12.9	0.97
Days 13-18	10.2[ab,cd]	8.8[a, c]	9.0[ab,c]	12.0[b,d]	0.78
Average daily intake	1.82[ef]	1.58[e]	1.74[ef]	1.95[f]	0.125
Feed Efficiency	12.89	11.62	11.75	9.04	2.009

[a,b]Means within a row with a different superscript differ (P<.01).
[c,d]Means within a row with a different superscript differ (P<.05).
[e,f]Means within a row with a different superscript differ (P<.10).

Table 6. Water intake of wethers offered different treatment diets: high-endophyte tall fescue seed with high-activity sorghum grain (HE-HA); high-endophyte tall fescue seed with low-activity sorghum grain (HE-LA); low-endophyte tall fescue seed with high-activity sorghum grain (LE-HA); and low-endophyte tall fescue seed with low-activity sorghum grain (LE-LA).

	Diet Treatment				
Item	HE -HA	HE-LA	LE-HA	LE-LA	SEM
	- L -				
Total intake					
Days 1-6	31.1[c,e]	25.4[d,f]	27.2[cd,ef]	26.3[cd,f]	1.58
Days 7-12	32.7	26.9	29.8	30.7	3.13
Days 13-18	35.7	28.3	31.7	27.9	5.00
Average daily intake	5.5[e]	4.5[f]	4.9[ef]	4.7[ef]	0.48

[c,d]Means within a row with a different superscript differ (P<.05).
[e,f]Means within a row with a different superscript differ (P<.10).

Table 7. Respiration rate of wethers offered different treatment diets: high-endophyte tall fescue seed with high-activity sorghum grain (HE-HA); high-endophyte tall fescue seed with low-activity sorghum grain (HE-LA); low-endophyte tall fescue seed with high-activity sorghum grain (LE-HA); and low-endophyte tall fescue seed with low-activity sorghum grain (LE-LA).

	Diet Treatment				
Item	HE- HA	HE- LA	LE- HA	LE- LA	SEM
	- - - - - - - - - - - - - - - breaths/min - - - - - - - - - - - - - - - - -				
Day of test					
1	83	94	79	81	6.1
3	98	99	108	90	8.4
7	136[a,c]	120[ab,c]	125[ab,c]	90[b,d]	8.3
10	108	109	120	116	5.6
14	178[c]	141[d]	147[cd]	159[cd]	12.2
17	114	110	111	111	8.7

[a,b]Means within a row with a different superscript differ (P<.01).
[c,d]Means within a row with a different superscript differ (P<.05).

Table 8. **Body temperature of wethers offered different treatment diets: high-endophyte tall fescue seed with high-activity sorghum grain (HE-HA); high-endophyte tall fescue seed with low-activity sorghum grain (HE-LA); low-endophyte tall fescue seed with high-activity sorghum grain (LE-HA); and low-endophyte tall fescue seed with low-activity sorghum grain (LE-LA).**

	Diet Treatment				
Item	HE- HA	HE- LA	LE- HA	LE- LA	SEM
	- - - - - - - - - - - - - - - - - - - -	^{o}F	- - - - - - - - - - - - - - - - - - - -		
Day of test					
1	104.2	103.7	104.2	103.6	0.30
3	104.2	104.4	104.2	104.1	0.22
7	103.8	104.1	104.0	104.0	0.19
10	104.0	104.1	104.5	104.0	0.23
14	104.9	104.5	104.4	105.1	0.44
17	$104.6^{cd, ef}$	$104.3^{c, e}$	$105.0^{d, f}$	$104.4^{cd, e}$	0.20

^{c,d}Means within a row with a different superscript differ (P<.05).
^{e,f}Means within a row with a different superscript differ (P<.10).

Table 9. **Serum prolactin and fecal ergovaline concentrations from wethers offered different treatment diets: high-endophyte tall fescue seed with high-activity sorghum grain (HE-HA); high-endophyte tall fescue seed with low-activity sorghum grain (HE-LA); low-endophyte tall fescue seed with high-activity sorghum grain (LE-HA); and low-endophyte tall fescue seed with low-activity sorghum grain (LE-LA).**

Treatment Diet	Serum prolactin	Fecal ergovaline
	ng ml^{-1}	ng g^{-1}
HE- HA	$31^{a, c, f}$	$226^{a, c}$
HE- LA	$33^{a, c, f}$	$162^{ab, c}$
LE- HA	$57^{ab, c, g}$	$22^{b, d}$
LE- LA	$83^{b, d, h}$	$39^{b, d}$
SEM	7.6	35.0

^{a,b}Means within a column with a different superscript differ (P<.01).
^{c,d,}Means within a column with a different superscript differ (P<.05).
$^{f, g, h}$Means within a column with a different superscript differ (P<.10).

ALFALFA VARIETY PERFORMANCE IN SOUTHEASTERN KANSAS

Joseph L. Moyer

Summary

A 28-line test seeded in 1998 was cut four times in 2000. Yields ranged from 6.5 to 7.3 tons/a. For the year, '54H55', 'WL 326 GZ', and 'Cimarron 3i' yielded significantly (P<.05) more than 'Perry', 'WL 325 HQ', 'Gold Plus', and 'CW 5426'. Three-year total production was greater (P<.05) from Cimarron 3i, 'WL 324', 54H55, and WL 326 GZ than from WL 325 HQ and Gold Plus.

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 28-line test was seeded (15 lb/a) on April 14, 1998 at the Mound Valley Unit. The plot area was fertilized February 9, 2000 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 6. On July 26, plots were sprayed with 1.5 pt/a of Poast® with1% Activate®.

Moisture was adequate for the early summer. However, rainfall for July and August was substantially below normal, reducing fourth-cutting yields (see weather summary).

Results and Discussion

Yields of the first cutting in 2000 were significantly (P<.05) higher from 54H55 and Cimarron 3i than from eight other entries and the former yielded more than nine others (Table 1). Yields of the second cut were higher from 54H55 and WL 326 GZ than from seven other entries. In the third cut, seven entries had higher yield than Perry. In the fourth cut, 'ZC9750A' and 'Kanza' produced more (P<.05) forage than five other entries.

Total 2000 yield of 54H55 was higher (P<.05) than total yields of 11 other entries (Table 2). The three highest-yielding entries, 54H55, WL 326 GZ, and Cimarron 3i, produced more than four entries. Three-year total production was greater (P<.05) from Cimarron 3i, WL 324, 54H55, and WL 326 GZ than from WL 325 HQ and Gold Plus. The three top producers also had a higher three-year yield total than 'CW 75044'.

Table 1. Forage Yields (tons/a @ 12% moisture) of Four Cuttings in 2000 for the 1998 Alfalfa Variety Test, Mound Valley Unit, Southeast Agricultural Research Center.

Source	Entry	5/5	6/13	7/11	8/14
AgriPro Biosciences, Inc	ZC9750A	2.22abcdef[a]	1.97e	1.72ab	0.95a
AgriPro Biosciences, Inc.	ZC9751A	2.13abcdef	2.23abcd	1.75a	0.83abcde
AgriPro Biosciences, Inc.	ZC9651	2.10bcdef	2.19abcde	1.66ab	0.91abcd
AgriPro Biosciences, Inc.	AMERIGRAZE 401+Z	2.15abcdef	2.22abcd	1.66ab	0.85abcd
AgriPro Biosciences, Inc.	EMPEROR	2.21abcdef	2.30abc	1.74a	0.85abcd
AgriPro Biosciences, Inc.	ZC 9650	2.15abcdef	2.17abcde	1.68ab	0.84abcd
ALLIED - STAR	SENDERO	1.99f	2.23abcd	1.64ab	0.91abc
ALLIED - STAR	SPUR	2.03def	2.16abcde	1.60ab	0.87abcd
ALLIED - STAR	STAMINA	2.06cdef	2.24abcd	1.68ab	0.87abcd
CAL/WEST Seeds	CW 5426 Exp.	2.02def	2.08bcde	1.75a	0.76de
CAL/WEST Seeds	CW 6408 Exp.	2.03def	2.22abcd	1.68ab	0.81bcde
CAL/WEST Seeds	CW 74013 Exp.	2.12abcdef	2.32ab	1.59ab	0.83abcde
CAL/WEST Seeds	CW 74031 Exp.	2.12abcdef	2.11abcde	1.73ab	0.82abcde
CAL/WEST Seeds	CW 74034 Exp.	2.11abcdef	2.10abcde	1.71ab	0.91abcd
CAL/WEST Seeds	CW 75044 Exp.	2.03def	2.06cde	1.77a	0.90abcd
CAL/WEST Seeds	GOLD PLUS	2.00ef	2.20abcde	1.56ab	0.86abcd
DAIRYLAND	DS9612	2.19abcdef	2.24abcd	1.68ab	0.89abcd
DAIRYLAND - MBS	PROGRO	2.23abcde	2.29abc	1.61ab	0.89abcd
DEKALB Plant Genetics	DK 141	2.29abc	2.24abcd	1.62ab	0.83abcde
DEKALB Plant Genetics	DK142	2.13abcdef	2.12abcde	1.69ab	0.76e
GARST SEED	631	2.14abcdef	2.08bcde	1.68ab	0.85abcd
Germains	WL 324	2.18abcdef	2.20abcde	1.71ab	0.92ab
Germains	WL 325 HQ	2.07cdef	2.04de	1.60ab	0.87abcd
Germains	WL 326 GZ	2.22abcde	2.33a	1.79a	0.87abcd
Great Plains Research	CIMARRON 3i	2.31ab	2.31abc	1.76a	0.77cde
PIONEER	54H55	2.33a	2.34a	1.77a	0.88abcd
Public - Kansas AES	Kanza	2.19abcdef	2.04de	1.68ab	0.94a
Public - Nebraska AES	Perry	2.23abcd	2.07bcde	1.50b	0.70de
Average		2.14	2.18	1.68	0.85

[a]Means within a column followed by the same letter are not significantly (P<.05) different, according to Duncan's test.

Table 2. Forage Yields (tons/a @ 12% moisture) in 1998, 1999, and 2000, and 3-Year Total for the 1998 Alfalfa Variety Test, Mound Valley Unit, Southeast Agricultural Research Center.

Source	Entry	1998	1999	2000	3-Year Total
AgriPro Biosciences, Inc	ZC9750A	2.32	5.36	6.87	14.55
AgriPro Biosciences, Inc.	ZC9751A	2.42	5.58	6.94	14.93
AgriPro Biosciences, Inc.	ZC9651	2.36	5.42	6.85	14.62
AgriPro Biosciences, Inc.	AMERIGRAZE 401+Z	2.42	5.75	6.88	15.05
AgriPro Biosciences, Inc.	EMPEROR	2.50	5.45	7.10	15.05
AgriPro Biosciences, Inc.	ZC 9650	2.40	5.46	6.83	14.69
ALLIED - STAR	SENDERO	2.50	5.49	6.77	14.76
ALLIED - STAR	SPUR	2.26	5.36	6.66	14.28
ALLIED - STAR	STAMINA	2.26	5.74	6.84	14.84
CAL/WEST Seeds	CW 5426 Exp.	2.33	5.50	6.62	14.45
CAL/WEST Seeds	CW 6408 Exp.	2.33	5.37	6.74	14.44
CAL/WEST Seeds	CW 74013 Exp.	2.51	5.50	6.86	14.87
CAL/WEST Seeds	CW 74031 Exp.	2.41	5.44	6.78	14.63
CAL/WEST Seeds	CW 74034 Exp.	2.29	5.49	6.83	14.60
CAL/WEST Seeds	CW 75044 Exp.	2.28	5.26	6.75	14.29
CAL/WEST Seeds	GOLD PLUS	2.38	5.24	6.62	14.23
DAIRYLAND	DS9612	2.38	5.69	6.99	15.06
DAIRYLAND - MBS	PROGRO	2.50	5.49	7.02	15.01
DEKALB Plant Genetics	DK 141	2.57	5.44	6.98	14.99
DEKALB Plant Genetics	DK142	2.41	5.51	6.69	14.61
GARST SEED	631	2.52	5.58	6.74	14.84
Germains	WL 324	2.57	5.62	7.01	15.20
Germains	WL 325 HQ	2.32	4.98	6.60	13.90
Germains	WL 326 GZ	2.47	5.41	7.22	15.09
Great Plains Research	CIMARRON 3i	2.46	6.09	7.14	15.70
PIONEER	54H55	2.49	5.36	7.31	15.15
Public - Kansas AES	Kanza	2.50	5.30	6.85	14.65
Public - Nebraska AES	Perry	2.45	5.73	6.50	14.67
Average		2.41	5.49	6.85	14.75
LSD 0.05		0.19	0.39	0.42	0.68

EVALUATION OF TALL FESCUE CULTIVARS

Joseph L. Moyer

Summary

A test of tall fescue cultivars seeded in fall, 1999 was harvested for forage production in May, 2000. Production averaged 4.73 tons/a. ‘FA 102’ produced more forage than all other entries (5.69 tons/a). Entries from the southern US, ‘AU Triumph’, ‘Ga-5 NETF’, and ‘Jesup NETF’ headed earlier than other entries.

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 US 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 US 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. Plots were each 30 ft x 5 ft in four randomized complete blocks. Soil was a Parsons silt loam (Mollic albaqualf). Fertilizer to supply 60-50-60 lb/a of N-P_2O_5-K_2O was applied preplant. One hundred lb/a of N was added to all plots on February 9, 2000.

A 3-ft x 15-ft area was harvested from each plot to a 2-in height using a flail-type harvester. Samples were weighed on May 25, 2000, after all plots were headed. A forage subsample was collected and dried at 140 ^{0}F, this sample was used for moisture determination and forage was removed from the remainder of the plot at the same height. Summer and fall regrowth were inadequate to obtain reliable yield determination because of high temperatures and limited moisture.

Results and Discussion

Stands and vigor of tall fescue in all plots was considered “good”. Heading dates and forage yields from the cultivar test are shown in Table 1. Heading date varied among cultivars by 21 days, from Day 109 (April 18) for AU Triumph to Day 129-130 (May 8-9) for ‘Fuego’ and ‘Seine’. The entries developed in Alabama and

Georgia, AU Triumph, 'Ga-5 NETF', and 'Jesup NETF', headed earlier than all other entries. Fuego and Seine headed later than six of the other eight entries.

Forage yield in 2000 was higher for FA 102 than for all other cultivars (Table 1). 'Fuego' and 'Ky 31' HE produced more forage than five other entries, including Ky 31 EF.

Table 1. Forage Yield and Heading Date of Tall Fescue Cultivars in 2000, Mound Valley Unit, Southeast Agricultural Research Center.

Cultivar		Forage Yield	Heading Date[1]
		tons/a@12% moisture	Julian
FA 102 EF[2]		5.69	128
Jesup NETF[3]		4.47	124
Ga-5 NETF[3]		4.37	122
AU Triumph		4.39	109
Fuego LE[5]		5.16	130[4]
Seine EF		4.74	129
Select EF		4.67	126
Ky 31 EF		4.26	128
Ky 31 HE[5]		5.08	126
MV 99 EF		4.44	127
	Average	4.73	125
	LSD(.05)	0.46	2

[1]Julian day when 50% of tillers were headed.
[2]EF=Endophyte-free.
[3]Contains proprietary novel endophyte.
[4]Consisted of about 10% ryegrass tillers.
[5]LE= Low-endophyte seed (0-2% infected); HE=High-endophyte seed (80% infected).

EFFECTS OF NITROGEN RATE AND PLACEMENT ON EASTERN GAMAGRASS UNDER 1-CUT OR 2-CUT HARVEST SYSTEMS

Joseph L. Moyer and Daniel W. Sweeney

Summary

Yield was increased by 30% from the first 45 lb/a increment of nitrogen (N) application and 21% with the next 45 lb/a. Knifing N resulted in no increase in yield of the 1-cut system in 2000 but produced higher yields than broadcast application at the highest N rate of the 2-cut system. One-cut and 2-cut harvest systems responded similarly.

Introduction

Eastern gamagrass [*Tripsacum dactyloides* (L.) L.] is a warm-season, perennial grass native to the North American tallgrass prairie. It has relatively better forage yield potential and quality than most other warm-season native species. Eastern gamagrass thus may respond well to more intensive management practices, such as added nitrogen (N) and more harvests. This study was established to determine the response of eastern gamagrass to N fertilizer rates and placement under 1-cut or 2-cut harvest systems.

Experimental Procedures

Established (20-year-old) 'Pete' eastern gamagrass was fertilized with 54 lb P_2O_5/a and 61 lb K_2O/a in each of the past 9 years and burned each spring, except in 1996. In 2000, N (urea-ammonium nitrate, 28% N) treatments of 45 or 90 lb/a were applied on May 17 to 8 ft by 20 ft plots by broadcast or knife (4-inch) placement. Control plots received no N but were knifed. Nitrogen was not applied in the previous year so that residual responses could be tested.

Plots were cut with a flail-type harvester on 13 June and 21 August from the 2-cut system and on 11 July from the 1-cut system. Yields were determined from a 3- by 20-ft strip of each plot, and a subsample was taken for moisture determination.

Results and Discussion

Total yields in 2000 were increased (P<.05) by 30% with the first 45 lb/a increment of N and by an additional 21% with the next 45-lb/a increment (Table 1).

Nitrogen placement effects on yield resulted in an interaction (P<.05) between N rate and placement (Table 1). Compared to broadcast, knifing with no N or 45 lb/a of N did not affect yield. However, knifing N at the 90 lb/a rate increased yield by 23% compared to broadcast application at the same rate.

Table 1. Eastern Gamagrass Forage Yields in 2000 under Two Harvest Systems with Different Nitrogen Rates and Placements, Southeast Agricultural Research Center.

Harvest System	Nitrogen Rate	Nitrogen Placement	Forage Yield Cut 1	Cut 2	Total
	lb/a		- - - - - tons/a (12% moisture) - - - - -		
1-Cut	0		2.21	-	2.21
	45		3.24	-	3.24
	90		3.72	-	3.72
		LSD(.05)	0.55	-	0.55
2-Cut	0		1.53	0.97	2.50
	45		1.67	1.24	2.91
	90		2.10	1.62	3.72
		LSD(.05)	0.32[1]	0.30	0.51[1]
Overall	0				2.36
	45				3.08
	90				3.72
		LSD(.05)			0.36
	0	Broadcast			2.45
		Knife			2.27
	45	Broadcast			3.07
		Knife			3.08
	90	Broadcast			3.33
		Knife			4.10
		LSD(.05)			0.52
1-Cut					3.06
2-Cut					3.04
LSD(.05)					NS

[1]Interaction between Nitrogen Rate and Nitrogen Placement was significant ($P<.05$).

ACCELERATED AGING OF ENDOPHYTIC TALL FESCUE SEED

Joseph L. Moyer

Summary

Tall fescue seed infected with the endophytic fungus *Neotyphodium coenophialum* was aged at 104 ^{0}F for up to 9 days in an atmosphere of 0 or 80% relative humidity (RH). Effects on seed germination and live endophyte frequency in the laboratory and after field establishment were determined. Aging for up to 9 days with no humidity did not significantly (P>.05) reduce germination from the original 87%. Six and 9 days at 80% RH reduced germination by 11 and 54 percentage points, respectively. Endophyte infection rate in 1-yr-old stands was not significantly (P>.05) reduced by aging with no humidity from the 64% infection rate obtained from seed with no accelerated aging. However, infection rate from seed aged 6 and 9 days at 80% RH averaged 11%.

Introduction

Tall fescue is a cool-season grass used for forage on an estimated 30 to 35 million acres in the US. While it is agronomically superior to other cool-season grasses under a wide range of soil conditions and tolerates abusive grazing, animal performance on its forage is often inferior to that on other grasses. Many of the poor performance traits from using tall fescue seem to be associated with the presence of the endophytic fungus, *Neotyphodium coenophialum* (Morgan-Jones and Gams) Glenn, Bacon, and Hanlin. However, tolerance of the grass to stresses and heavy use is also partly attributable to its association with the same endophyte.

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 US and are represented in this test. Other cultivars are either fungus-free or contain a ubiquitous form of the endophyte.

The endophytic fungus appears to be transmitted solely as a seed-borne organism, and its elimination requires destruction of the host plant. Therefore, tall fescue pastures with a particular type of (or no) endophyte can only be obtained by planting seed with the desired type of infection. Further, establishment of a stand infected with any particular endophyte depends on its survival until the infected seedling is established. The level of endophyte infection obtained will thus be affected by the initial level of endophyte infection in the seed and the conditions to which it is subsequently exposed.

This experiment was conducted to examine the role of ambient humidity on the survival of tall fescue seed and its endophyte under conditions that accelerate aging (104 $_0$F).

Experimental Procedures

Fescue seed with a high endophyte frequency (>80%) was obtained in summer, 1999. Seedlots were placed in paper bags and sealed in a dessicator with drierite (0% RH), or suspended in a cheesecloth bag within a sealed container above a solution of saturated $(NH_4)_2SO_4$ (80% RH) and placed in a coldroom at 40 ^{0}F. Containers were removed from the coldroom at appropriate intervals and placed in a convection oven at 104 ^{0}F for 9, 6, or 3 days and removed at the same time. The "0-day" containers remained in the coldroom throughout the treatment period. Following treatment, the seed was immediately tested for germination, weighed for seeding in plots, and the remainder placed in a freezer (-10 ^{0}F). Field sampling and grow-out tests for endophyte frequency were performed in fall, 2000.

Germination was tested using 50 seeds and replicated three times. Seed were placed in petri dishes on moist blotter paper at 68 ^{o}F for 14 days.

Field plots were seeded on October 6, 1999 at the rate of 20 lb/a. A cone planter with 10-inch rows was used to seed 30 ft x 5 ft plots at the Mound Valley Unit, Southeast Agricultural Research Center. Plots were established in four randomized complete blocks. Soil was a Parsons silt loam (Mollic albaqualf). Fertilizer to supply 60-50-60 lb/a of N-P_2O_5-K_2O was applied preplant. One hundred lb/a of N was added to all plots on February 9, 2000. Forage was removed from the plots on May 25, 2000. Plots were sampled for cytological examination of tillers (described below) to determine endophyte frequency in September and October of 2000.

Grow-out testing for live endophyte frequency was performed by seeding two rows (replications) of each treated seedlot in flats of potting soil under artificial (10-hr/day) lights in a growth bench, periodically watered with nutrient solution. Temperature reached almost 90^o F during the day, 75^o F at night. At least 12 plants per row were selected for cytological examination of the leaf sheath by staining with a solution containing aniline blue, and frequencies were based on the number of endophyte-positive plants per number examined.

Results and Discussion

The effects of tall fescue seed treatment on germination and live endophyte frequency after 1 year in field plots and in the laboratory are shown in Table 1. Germination percentage was not affected by accelerated aging with no humidity for up to 9 days. However, aging at 80% RH reduced seed germination ($P<.05$) by Day 6. After 9 days of accelerated aging at 80% RH, germination was less than 40% of its original value.

Endophyte infection frequency in field plots one year after seeding are listed in Table 1. Infection rates were not reduced ($P>.05$) by accelerated aging in the absence of humidity. With 80 % RH, infection rate was reduced ($P<.05$) after 6 and 9 days at 104 ^{0}F. The fact that few plots seeded with the 80% RH treatment that was aged for 6 and 9 days attained zero infection may indicate that the few seedlings with viable endophyte had a higher survival rate than uninfected seedlings. This speculation is supported by the apparent higher numeric average infection rate for the 9-day than the 6-day accelerated aging and the fact that sampling was preceded by severe drought (see weather summary).

Endophyte infection frequency in seedlings of the laboratory grow-out was not reduced by accelerated aging in the absence of humidity (Table 1). At 80% RH, however, endophyte infection was reduced ($P<.05$) compared to no humidity at each corresponding time. Even when there was no acceleration of aging (0 time at 104 ^{0}F), endophyte infection was reduced by half in the 80% RH atmosphere compared to no humidity. That is, at 40 ^{0}F endophyte viability was cut in half after 9 days at 80% RH compared to the same temperature with no humidity.

The results of this experiment indicate the importance of relative humidity for tall fescue seed and particularly endophyte viability. Short-term exposure to high temperatures appeared to have little effect on endophyte or especially seedling viability when the ambient relative humidity was low. However, seed germination was reduced after 6 days of high temperature when the humidity was 80%. Viability of the tall fescue endophyte was more sensitive than seed to humidity. The same conditions that reduced seed germination practically eliminated the endophyte, and exposure to high humidity, even at a low temperature reduced its ability to infect seedlings.

Table 1. Germination and live endophyte frequency in field plots and in the laboratory after accelerated (104 ^{0}F) aging at 0 or 80% relative humidity for different times.

Treatment			Endophyte Frequency	
Days at 104 F	Relative Humidity	Germination	Field Plots	Lab Grow-out
		- - - - - - - - - - - - % - - - - - - - - - - - -		
0	0	88	64	46
	80	87	44	21
3	0	84	62	42
	80	85	44	12
6	0	89	50	42
	80	75	6	8
9	0	82	38	62
	80	32	17	0
LSD(.05)		7	19	24

EFFECT OF TIMING OF LIMITED-AMOUNT IRRIGATION AND N RATE ON SWEET CORN PLANTED ON TWO DATES

Daniel W. Sweeney and Charles W. Marr*

Summary

In 2000, irrigation increased the number of harvestable ears by 19% or more for sweet corn planted in mid-May. Total fresh weight was unaffected by irrigation for the April-planted sweet corn, but irrigation at the R1 growth stage produced more total weight of later-planted sweet corn than with no irrigation.

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. Literature is lacking on effects of irrigation management, nitrogen (N) rate, and planting date on the performance of sweet corn.

Experimental Procedures

The experiment was established on a Parsons silt loam in spring 1999 as a split-plot arrangement of a randomized complete block with three replications. The whole plots included four irrigation schemes: 1) no irrigation, 2) 2 in. at V12 (12-leaf stage), 3) 2 in. at R1 (silk stage), 4) 1 in. at both V12 and R1 and two planting dates (targets of late April and mid-May). The subplots consisted of three N rates of 40, 80, and 120 lb/a. Sweet corn was planted on April 26 and May 22, 2000. Sweet corn from the first planting date was picked on July 10 and 17 and that from the second planting date was picked on July 27 and August 3, 2000.

Results and Discussion

The total number of harvestable ears and the total fresh weight was influenced by an interaction between planting date and irrigation scheme (Table 1). In general, there were more harvestable ears from sweet corn planted at the second date than from the first. For sweet corn planted at the first date, splitting the irrigation amount between the V12 and R1 growth stages resulted in greater number of ears than irrigation applied at the R1 stage, but neither were significantly different than no irrigation. However, when planted at the later date, any irrigation scheme resulted in 19% or more harvestable ears than obtained with no irrigation. Total fresh weight of ears from sweet corn planted at the first date was not significantly affected by irrigation scheme. However, from the second date, total fresh weight of sweet corn ears was increased with irrigation, especially for that applied at the R1 growth stage. Although individual ear weight was not affected by an interaction of planting date and irrigation scheme, individual ear weight averaged about 13% greater

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from sweet corn planted at the second compared with the first date. Nitrogen rate had no effect on total ears, total fresh weight, or individual ear weight.

Table 1. Effects of Irrigation Scheme and Nitrogen Rate on Sweet Corn Planted at Two Dates, Southeast Agricultural Research Center, 2000.

Treatment		Total Ears	Total Fresh Weight	Individual Ear Weight
		no./acre	ton/a	g/ear
Planting Date	Irrigation Scheme			
Date 1	None	17700	5.05	259
	V12 (2")	17900	4.79	246
	R1 (2")	15400	4.05	241
	V12-R1 (1" each)	20000	5.00	226
Date 2	None	19400	5.57	258
	V12 (2")	23100	7.41	290
	R1 (2")	26400	8.32	285
	V12-R1 (1" each)	24800	7.07	262
LSD $_{(0.05)}$		3700	1.16	NS†
N Rate, lb/a				
40		20400	5.81	260
80		20900	5.76	249
120		20500	6.15	268
LSD $_{(0.05)}$		NS	NS	NS

†Main effect of planting date on individual ear weight was significant: D1=243 and D2=274 g/ear.

SOUTHEAST AGRICULTURAL RESEARCH CENTER
KANSAS STATE UNIVERSITY

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

Daniel W. Sweeney

Summary

In 2000, overall soybean yields were low with no difference between tillage systems or residual nitrogen (N) treatments.

Introduction

Many kinds of 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 systems as whole plots and N treatments as subplots. 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 2000, soybean yields were low because of drought conditions. Yields averaged 5.4 bu/a (data not shown). Soybean yields were unaffected by tillage or residual N treatments.

TIMING OF NITROGEN, PHOSPHORUS, AND POTASSIUM FERTILIZATION FOR WHEAT AND DOUBLE-CROPPED SOYBEAN IN REDUCED AND NO-TILL SYSTEMS

Daniel W. Sweeney

Summary

In 2000, fertilization more than doubled yields. Applying all the nitrogen (N) in the fall increased yields compared to all N applied in the spring. Yields of double-cropped soybeans were low and were unaffected by tillage and timing of N or P and K timing.

Introduction

Double-cropping soybean after wheat is practiced by many producers in southeastern Kansas. Typically, phosphorus (P) and potassium (K) fertilizers are applied in the fall prior to wheat planting, with no additional application prior to planting double-cropped soybean. Nitrogen (N) is applied either in the fall or spring or at both times. Moreover, as the acreage of conservation tillage increases either as reduced- or no-till, management of fertilizer nutrients becomes more crucial. Timing of N, P, and K fertilization may not only impact wheat production but also affect yields of the following double-cropped soybean. The objective of this study was to determine the effects of fall and late winter applications of N, P, and K for wheat followed by double-cropped soybean grown in reduced- and no-tillage systems.

Experimental Procedures

The experiment was established in 1997 as a split-plot design with three replications. Whole plots were tillage as either reduced- or no-till. The 3x3 factorial arrangement of the subplots included three N and three P-K fertilizations applied all in the fall, all in late winter, or split evenly between fall and late winter. For each treatment, total applied was 80 lb N/a, 70 lb P_2O_5/a, and 75 lb K_20/a. For reference, a check plot receiving no N, P, or K fertilization was included in each whole plot.

Results and Discussion

In 2000, wheat yield with no N, P, or K averaged less than 16 bu/a. Applying all the N in the fall produced average yields of 44.7 bu/a, which was greater than yield with all the N applied in the spring, with the 50-50% split N in fall and spring resulting in intermediate yields (Figure 1). Wheat yield was affected by an interaction between tillage and P-K timing in 2000. Wheat grown with no tillage and fertilized with all the P and K in the fall yielded less than when fertilized with P and K in the spring. In contrast, wheat grown with reduced tillage and fertilized with all the P and K in the fall tended to yield more than split P-K applications or 100% P and K spring-applied, even though the difference was not significant (Figure 2).

Double-crop soybean yield was low, averaging less than 7 bu/a. Tillage selection and timing of N or P and K fertilization did not significantly affect soybean yields in 2000.

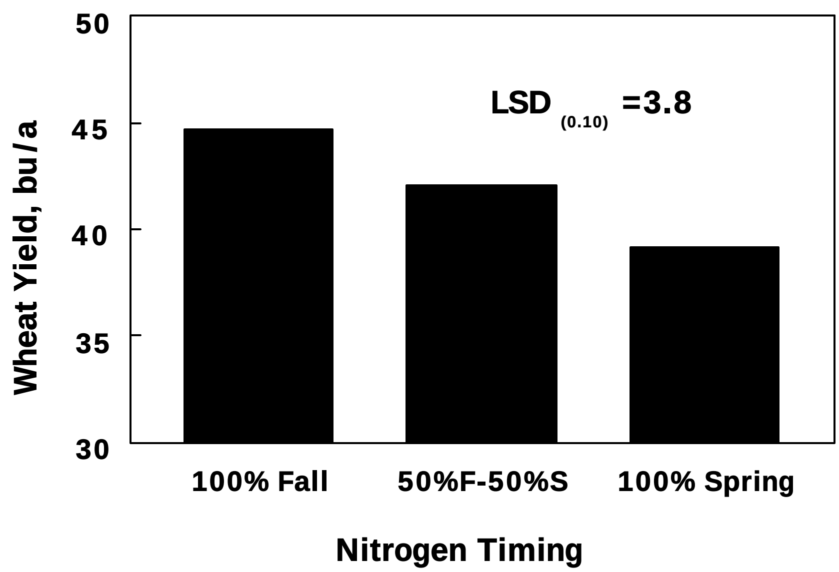

Figure 1. Effects of Nitrogen Fertilization Timing on Wheat Yield in a Continuous Wheat — Double-Cropped Soybean Rotation, Southeast Agricultural Research Center, 2000.

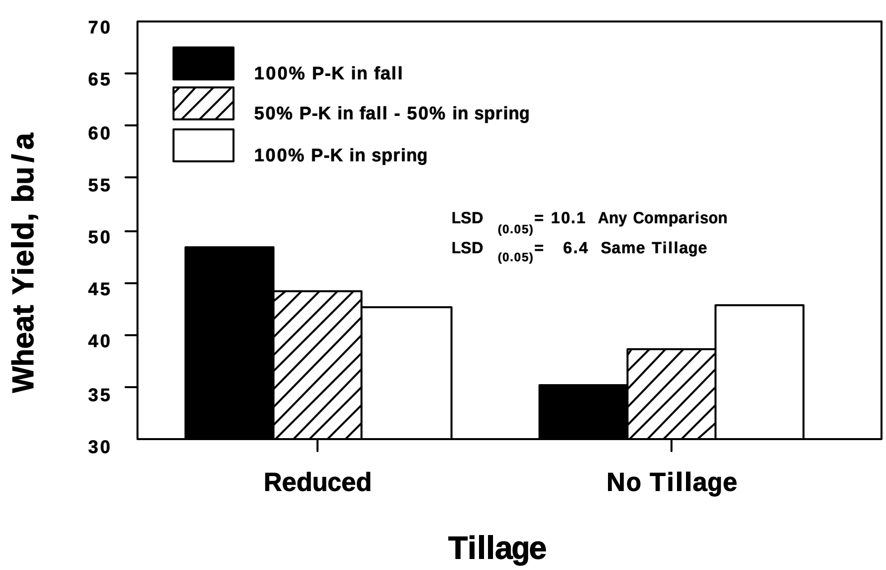

Figure 2. Effect of Tillage and Timing of P and K Fertization on Wheat Yield in a Continuous Wheat—Double-Cropped Soybean Rotation, Southeast Agricultural Research Center, 2000.

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

Daniel W. Sweeney

Summary

In 1999, overall soybean yields were low. Increasing soil phosphorus level increased yield by increasing the number of seeds per plant, but soil potassium level had no effect on soybean yield or yield components. In 2000, drought conditions resulted in low yields and produced unexplainable interactions between phosphorus and potassium fertility levels.

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 and May 30, 2000 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 yields of less than 14 bu/a (data not shown). Increasing soil 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.

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

Daniel W. Sweeney and Joseph L. Moyer

Summary

Clean seed yield of endophyte-free tall fescue was affected by N application to at least 100 lb N/a. Additional response to higher N rates and timing was variable for the two years. Forage aftermath was increased with increasing N rates up to 150 lb/a. Subsurface applications, especially knifing, often increased yield and crude protein, but appeared to produce more stem weight.

Introduction

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

Experimental Procedures

The experiment was established as a 2x3x5 factorial arrangement of a completely randomized block design with three replications. The two N timings were late fall (Dec. 2, 1998 and Dec. 6, 1999) and late winter (Feb. 24, 1999 and Mar. 1, 2000). The three placements for urea-ammonium nitrate solution were broadcast, spoke (approx. 3 in. deep), and knife (approx. 4 in. deep). The five N rates were 0, 50, 100, 150, and 200 lb/a. Each fall, all plots received broadcast applications of 50 lb P_2O_5/a and 50 lb K_2O/a. Seed harvest was on June 11, 1999 and June 8, 2000 and forage aftermath was harvested on June 14, 1999 and June 12, 2000.

Results and Discussion

In 1999, late fall application of N at rates up to 200 lb/a resulted in increased clean seed yield (Figure 1). With late winter application, yield increased with increasing rates to 100 lb N/a but decreased with higher N rates. This likely was associated with the number of panicles/m^2 (Figure 2). Caryopsis (individual seed) weight and the number of seeds/panicle were unaffected by N management in 1999. In 2000, seed yield was not significantly affected by N fertilization timing, but was affected by N rate (Figure 1). Similar to 1999, this yield response to N was reflected by an increase in the number of panicles/m^2 (Figure 2).

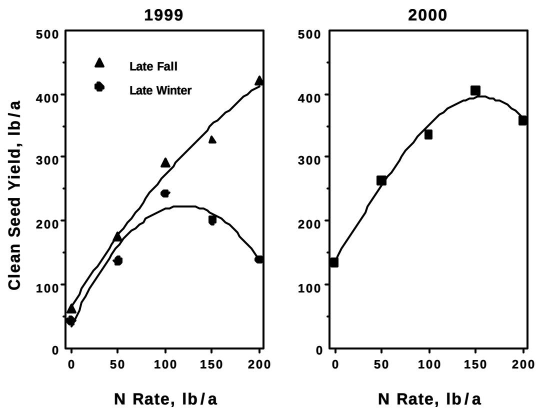

Figure 1. Effects of Nitrogen Timing and Rate on Clean Seed Yield of Endophyte-Free Tall Fescue in 1999 and 2000.

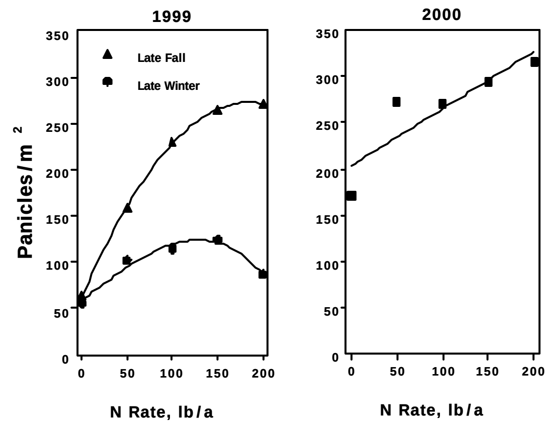

Figure 2. Effects of Nitrogen Timing and Rate on the Panicle Count of Endophyte-Free Tall Fescue in 1999 and 2000.

Yield of the forage aftermath left following seed harvest was increased by increasing N rates up to 150 lb/a but was not increased further by N applied at 200 lb/a in both years (Figure 3). Forage yield exceeded 3 tons/a at the higher N rates but was greater at the low N rates in 2000 than in 1999. Subsurface placement by either knife or spoke resulted in more than 0.5 tons/a additional aftermath forage than broadcast N applications in 1999 (Figure 4), with no effect due to timing of N fertilization (data not shown). However, in 2000 broadcast N applications in the late fall tended to produce less than spoke or knife applications (Figure 4), but the difference was not significant. Likely influenced by nearly an inch of rain the day after application, late winter broadcast N application resulted in nearly 0.5 tons/a more forage than with spoke, whereas knife resulted in intermediate yields.

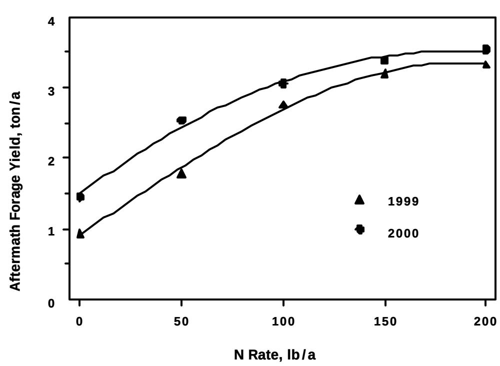

Figure 3. Effect of N Rate on Aftermath Tall Fescue Yield Following Seed Harvest in 1999 and 2000.

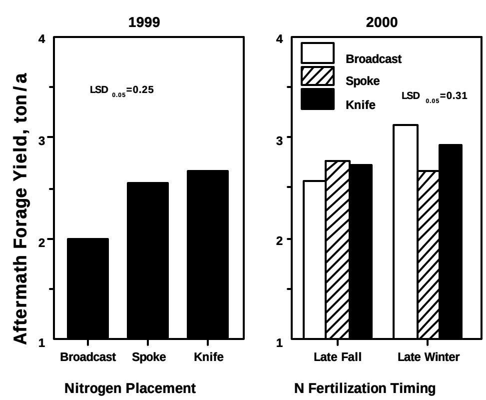

Figure 4. Effect of N Fertilizer Placement and Timing on Aftermath Tall Fescue Yield Following Seed Harvest in 1999 and 2000.

Averaged across both years, crude protein content was greatest with knife applications followed by spoke and broadcast (Figure 5). This effect occurred even though yield usually tended to follow the same trend (Figure 4). The crude protein content averaged low, less than 7% (Figure 5). Whether the N was applied in late fall or late winter, crude protein tended to decrease with initial increments of fertilizer N (Figure 5), likely in response to large increases in yield to N rate (Figure 4). However, when applied in late winter high N rates tended to increase crude protein more than when the N had been applied in the previous late fall (Figure 5). Although average crude protein was greater with knife applications, leaf to stem ratio tended to be lower with N applications applied in late winter (Figure 6). This suggests that even though yield and crude protein may often be greater with knife applications, other aspects of forage quality may be reduced.

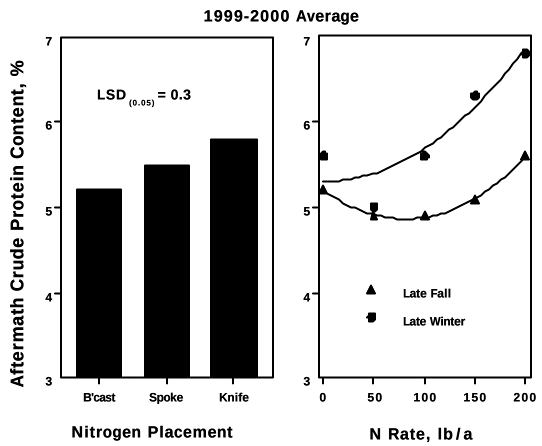

Figure 5. Effect of N Fertilizer Placement, Rate, and Timing on Crude Protein Content of Fescue Forage Following Seed Harvest.

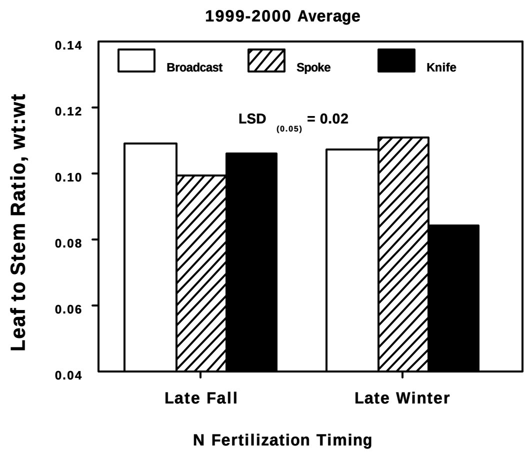

Figure 6. Effect of N Fertilizer Timing and Placement on Leaf to Stem Ratio (wt:wt basis) of Fescue Forage Following Seed Harvest.

SOUTHEAST AGRICULTURAL RESEARCH CENTER KANSAS STATE UNIVERSITY

INTEGRATED AGRICULTURAL MANAGEMENT SYSTEMS: NEOSHO RIVER BASIN SITE

Daniel W. Sweeney and Gary L. Kilgore*

Summary

In 2000, runoff volume and nitrate concentrations were greater from no-till than conventional tillage systems. Soluble phosphorus, atrazine, and metolachlor were greater from no-till than conventional tillage systems, especially with the low management option.

Introduction

The quality of our water resources is an important topic. Agricultural practices are perceived to impact surface water quality by being a non-point source of pollutants. Producers need to use voluntary practices such as Best Management Practices (BMPs) to protect and improve surface water quality in the state. Recent state-wide efforts in Kansas are designed to look at large, field-scale integrations of BMPs to determine their effects on losses of sediment, nutrients, and pesticides.

Experimental Procedures

The experiment was established on a Parsons silt loam in spring 1999 at the Greenbush Facility in Crawford County but was not fully implemented until 2000. The four treatments were: 1) Conventional tillage (spring chisel, disk, field cultivate, plant); Low management: nitrogen (N) and phosphorus (P) broadcast, with incorporation by tillage; and atrazine and metolachor herbicides applied preemerge, 2) Conventional tillage; High management: N and P knifed in, followed by tillage; metolachlor applied preemerge with atrazine applied postemerge, 3) No tillage; Low management: N and P broadcast; atrazine and metolachlor applied preemerge, and 4) No tillage; High management: N and P knifed in; metolachlor applied preemerge with atrazine applied postemerge. For grain sorghum, the total N rate was 120 lb/a and P was 40 lb P_2O_5/a. The background crop in 1999 was soybean. In 2000, grain sorghum was planted on May 24.

At the downslope end of each 1-acre plot, a soil berm was constructed to divert surface water flow through a weir. Each weir was instrumented with an ISCO® sampler that recorded flow amounts and collected runoff samples. Water samples were analyzed at the Soil Testing Laboratory for sediment, nutrients, and selected herbicides.

Results and Discussion

In 2000, during the time when the instruments were in the field (early June through early November), six events occurred where samples and flow were obtained from each treatment. This does not comprise all runoff events during the year because either

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equipment was removed from the field or malfunctioned. However, the events measured provided comparison data for the management systems tested.

Runoff volume (flow) from no-tillage systems averaged about 50 to 150% greater than from conventional tillage systems (Table 1). Nitrate concentrations were two- to three-fold greater from no-tillage system than conventions systems resulting in 10 to 20 times more nitrate lost during the six events from no-tillage than conventional systems. Ortho-P in solution was higher in the no-tillage system with low management in which the P was surface broadcast. Atrazine and metolachlor concentrations were greater in the no-tillage system with low management. Also, because of greater flow, the amount of atrazine and metolachlor in runoff from no-till for the six measured events was ten-fold greater than from conventional tillage systems. Because results may have been affected by the construction of ridge to divert runoff water to the collector, soil loss data collected in 2000 may not correctly represent treatment effects (data not shown). This will be corrected in 2001 by installation of an erosion mat across the water-diversion ridges.

Table 1. Flow Amount, Nutrients, and Herbicides in Runoff from Integrated Agricultural Management systems (IAMS): Water Quality Project - Neosho County Site, 2000.

Tillage	Mgmt.	Flow	NH_4-N	NO_3-N	ortho-P	Atrazine	Metolachlor
		Average for six runoff events					
		- ft^3-	--------- ppm ----------		----------------- ppb ---------------------		
Conv.	Low	324	1.00	1.38	188	3.9	3.6
	High	342	1.05	1.89	220	2.1	3.8
Notill	Low	536	0.39	4.77	734	10.0	12.7
	High	793	0.93	4.45	229	5.5	3.1
		Total for six runoff events					
		acre-in	------------------------------ g/acre ------------------------------------				
Conv.	Low	0.54	76.1	47	7.7	0.083	0.073
	High	0.57	61.7	76	12.4	0.096	0.117
Notill	Low	0.89	28.8	521	89.8	1.598	1.935
	High	1.31	82.0	1040	27.6	0.956	1.020

† Sediment and related data not reported here may have been affected by erosion of the ridge that was formed to divert water to the weir and collection device.

EFFECTS OF CROPPING SYSTEMS ON WINTER WHEAT YIELD*

Kenneth W. Kelley and Daniel W. Sweeney

Summary

In 2000, when 17 inches of rainfall occurred during May and June prior to wheat harvest, wheat yields following soybeans in a 3-yr cropping rotation were significantly higher in a continuous no-till system compared to conventional disk tillage. However, in a 2-yr crop rotation study, tillage methods had a smaller effect on wheat yields than in the 3-yr rotation. In addition, previous wheat - double-crop or wheat summer fallow treatments have had very little effect on wheat yields.

Introduction

Winter wheat is often rotated with other crops, such as soybeans, grain sorghum, and corn to diversify cropping systems in southeastern Kansas. Wheat typically is planted with reduced tillage or planted no-till into previous crop residues. This research investigates the combined effects of both crop rotation and tillage on yields of winter wheat in various cropping systems.

Experimental Procedures

3-Yr Crop Rotation

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 include: 1) plant all crops with conventional tillage (CT); 2) plant all crops with no-tillage (NT); and 3) alternate conventional and no-till systems. In the 2000 crop year, wheat followed soybean. Fertilizer N (120 lb N/a as urea-ammonium nitrate, UAN) and P (60 lb P_20_5/a as 10 - 34 - 0) were applied preplant at a depth of 4 to 6 in. with a coulter-knife applicator. Potassium (75 lb K_20/a) fertilizer was broadcast applied. In reduced tillage systems, disk tillage was performed after fertilizer application and prior to wheat planting. Wheat was planted with a no-till drill in 7.5 in. rows at a seeding rate of 90 lbs/a.

2-Yr Crop Rotation

In 1996, a 2-yr crop rotation study consisting of [corn / grain sorghum / soybean] - [wheat - double-crop soybean] was started at the Columbus Unit. Tillage treatments include: 1) plant all crops with conventional tillage and 2) plant all crops with no-tillage. Fertilizer N (120 lb N/a as urea-ammonium nitrate, UAN) and P (60 lb P_20_5/a as 10 - 34 - 0) were applied preplant at a depth of 4 to 6 in. with a coulter-knife applicator. Potassium fertilizer (75 lb K_20/a) was broadcast applied. In reduced tillage systems, disk tillage was performed after fertilizer application and prior to wheat planting. Wheat was planted with a no-till drill in 7.5 in. rows at a seeding rate of 90 lbs/a.

*This research was partially supported by the Kansas Soybean Commission.

2-Yr Wheat Double-Crop and Fallow System

In 1994, a 2-yr crop rotation was started at the Parsons Unit. In year one, six wheat cropping systems that included three crops (soybeans, grain sorghum, and sunflower) planted no-till after wheat harvest; two wheat summer-fallow treatments (disk tillage versus herbicide only); and one legume crop (white sweet clover) interseeded in wheat in early spring. In year two, three crops (corn, grain sorghum, and soybean) were planted with conventional tillage in each of the six previous wheat double-crop and fallow treatments. In the fall, wheat was planted with conventional disk tillage following corn, grain sorghum, and soybean harvests. Fertilizer N (UAN) was applied preplant with a coulter-knife applicator at 120 lb N/a, or no application was made. Phosphorus and K were broadcast applied and incorporated with tillage prior to planting of wheat in the fall.

Results and Discussion

3-Yr Crop Rotation - (Table 1)

Wheat yield was influenced significantly by tillage system. Yields were highest in the continuous no-till system both at the Columbus and Parsons Units. In 2000, nearly 17 inches of rainfall occurred in May and June prior to wheat harvest. Because of the excessive spring rainfall, soils may have become more water-saturated with disk tillage compared to no-till, resulting in greater stress during grain development. Test weights also were somewhat higher in the continuous no-till system compared with disk tillage treatments. However, previous crop rotation (corn and grain sorghum) before soybeans did not have any residual effect on wheat yields.

2-Yr Crop Rotation - (Table 2)

Previous crop (corn, grain sorghum, and soybean) influenced wheat yields more than tillage system (no-till versus disk tillage) in the 2-yr crop rotation at the Columbus Unit. Wheat yields were highest when planted no-till following soybeans (65 bu/a) and lowest when planted no-till following grain sorghum (55 bu/a). Results show that when fertilizer N is applied below crop residues, yield differences between cropping systems are often smaller compared to surface broadcast fertilizer applications. However, it is unclear why wheat yields were affected less by tillage in the 2-yr study than in the 3-yr study at the Columbus site in 2000.

2-Yr Wheat Double-Crop and Fallow System - (Table 3)

Wheat yields were influenced significantly by previous crop and fertilizer N in a 2-yr crop rotation at the Parsons Unit. With no fertilizer N, wheat yields were highest following soybean, intermediate following corn, and lowest following grain sorghum. However, with fertilizer N (120 lb/a), wheat yields were highest following corn and grain sorghum and lowest following soybean. It is unclear why wheat yields were lower following soybean in 2000.

Wheat yields were not significantly affected by the previous wheat double-crop and wheat summer fallow treatments. Even though the sweet clover legume treatment supplied significant amounts of residual N to the following corn and grain sorghum crops (data not shown), the residual benefit to second year wheat crop has been insignificant.

Table 1. Effects of Cropping System and Tillage on Winter Wheat Yield and Test Weight, Southeast Agricultural Research Center, Parsons and Columbus Units, 2000.

Previous Crop (before soybean)	Tillage	Parsons Unit Winter Wheat Yield	Parsons Unit Winter Wheat Test Wt.	Columbus Unit Winter Wheat Yield	Columbus Unit Winter Wheat Test Wt.
		bu/a	lbs/bu	bu/a	lbs/bu
Corn	NT	78.2	58.4	78.0	55.1
Corn	CT	64.9	56.4	61.1	54.7
Corn	Alt-CT	67.0	56.6	67.9	54.4
Corn	Alt-NT	66.2	57.5	71.2	53.8
Grain sorghum	NT	71.2	58.0	74.0	54.6
Grain sorghum	CT	68.5	56.9	58.7	53.4
Grain sorghum	Alt-CT	66.0	56.7	64.5	54.8
Grain sorghum	Alt-NT	66.7	56.9	65.5	54.7
LSD (0.05)		6.3	0.9	6.8	0.9
Means:					
Corn		69.1	57.2	69.5	54.5
Grain sorghum		68.1	57.1	65.7	54.4
LSD (0.05)		NS	NS	3.9	NS
NT		74.7	58.2	76.0	54.9
CT		66.7	56.6	59.9	54.0
Alt-CT		66.5	56.7	66.2	54.6
Alt-NT		66.4	57.2	68.3	54.2
LSD (0.05)		4.2	0.7	5.5	0.7

NT = no-tillage; CT = conventional tillage (disk).
Previous crop before wheat was soybean.
Previous crop before soybean was corn and grain sorghum.

Table 2. Effects of Previous Crop and Tillage on Winter Wheat Yield and Test Weight, Southeast Agricultural Research Center, Columbus Unit, 2000.

Previous Crop	Tillage	Winter Wheat Yield	Winter Wheat Test Weight
		bu/a	lbs/bu
Corn	NT	61.9	54.6
Corn	CT	61.6	54.6
Grain sorghum	NT	55.1	54.5
Grain sorghum	CT	59.8	54.7
Soybean	NT	65.0	55.1
Soybean	CT	63.1	54.8
LSD (0.05)		4.9	NS
Means:			
Corn		61.8	54.6
Grain sorghum		57.5	54.6
Soybean		64.0	55.0
LSD (0.05)		3.2	NS
NT		60.6	54.7
CT		61.5	54.7
LSD (0.05)		NS	NS

NT = no-tillage; CT = conventional tillage (disk).

Table 3. Effect of Previous Cropping Systems on Winter Wheat Yield, Southeast Agricultural Research Center, Parsons Unit, 2000.

Previous Wheat Cropping System	Wheat Yield Following: Corn		Grain Sorghum		Soybean		
	No N	120 N	No N	120 N	No N	120 N	Avg.
	---------------------------------- bu/a ----------------------------------						
WH-Grain sorghum	31.5	68.8	22.9	73.6	35.3	63.7	49.3
WH-Soybean	23.6	71.1	24.0	69.3	39.3	58.7	47.7
WH-Sunflower	36.9	70.7	22.0	68.9	38.8	66.3	50.6
WH-Chemical fallow	37.1	71.9	24.3	72.8	38.3	69.5	52.3
WH-Tillage fallow	36.8	71.3	21.9	72.0	38.7	66.4	51.2
WH-Sweet clover	35.5	69.1	25.3	74.1	39.1	64.4	51.2
Avg.	33.6	70.5	23.4	71.8	38.2	64.8	

LSD (0.05): Comparing previous crop (corn, grain sorghum, soybean) means for same or different N rate = 6.3
Comparison of previous double-cropping systems = NS

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EFFECTS OF CROPPING SEQUENCES ON SOYBEAN AND GRAIN SORGHUM YIELD

Kenneth W. Kelley

Summary

Cropping sequence had a significant effect on both soybean and grain sorghum yields. Yields declined significantly as the same crop was grown more frequently in the crop rotation. In the grain sorghum study, yield response to fertilizer N was small for first-year grain sorghum following 5 years of soybean and in the 2-yr rotation.

Introduction

Crop rotation is an important management tool. Research has shown that crops grown in rotation often yield 10 to 15 % higher than those in continuous cropping systems (monoculture). However, this "rotation effect" can be affected by environmental growing conditions. This research seeks to determine how soybean and grain sorghum yields were affected by various cropping sequences and yearly weather conditions.

Experimental Procedures

Beginning in 1992, various cropping sequences of soybean and grain sorghum have been compared at the Parsons Unit. Treatments include: 1) continuous soybeans and grain sorghum; 2) 2-year rotation of grain sorghum and soybean; and 3) 1, 2, 3, 4, and 5 years of one crop following 5 years of the other. Grain sorghum plots also are split to include two fertilizer nitrogen variables (60 and 120 lb N/a). Phosphorus and potassium fertilizers have been applied yearly to both crops. The site had been in native grass prior to establishing the various cropping sequences. Data from the initial 5-year period, when the rotation sequences were being established, are not shown.

Results and Discussion

Soybean yield responses for the various soybean and grain sorghum cropping sequences are shown in Table 1. Soybean yields were highest for first-year soybean following 5 years of grain sorghum, although not significantly different from soybean following grain sorghum in the 2-yr rotation. Yields declined as soybeans were grown more frequently in the crop rotation.

Grain sorghum yield responses are shown in Table 2. Similar to soybeans, grain sorghum yields were highest for first-year grain sorghum following 5 years of soybean. Grain sorghum yields declined as the crop was grown more frequently in the cropping sequence. Yield response to the lowest N rate (60 lb/a) was small for first-year grain sorghum and in the 2-yr crop rotation. As grain sorghum was grown more frequently, yield differences between N rates became larger. However, even at the highest N rate (120 lb/a), fifth-year grain sorghum yields were still significantly lower than for the first-year crop, indicating that yield differences could not be overcome by fertilizer N alone.

Table 1. Comparison of Soybean Yields in Various Cropping Sequences, Parsons Unit, Southeast Agricultural Research Center.

	Soybean Yield			
Soybean Sequence	1997	1998	1999	2000
	bu/a			
Continuous soybean	39.5	24.3	23.6	11.3
Fifth-year soybean	42.3	25.3	25.0	12.1
Fourth-year soybean	40.1	25.7	25.6	12.7
Third-year soybean	43.6	27.1	26.5	12.8
Second-year soybean	42.8	29.3	27.5	14.0
First-year soybean	40.9	30.4	29.5	14.1
Soybean - grain sorghum	42.5	30.0	27.4	13.7
LSD (0.05):	NS	1.3	1.2	0.8

Table 2. Comparison of Grain Sorghum Yields in Various Cropping Sequences, Parsons Unit, Southeast Agricultural Research Center.

	Grain Sorghum Yield					
	1997		1998		2000	
Grain Sorghum Sequence	60 N	120 N	60 N	120 N	60 N	120 N
	bu/a		bu/a		bu/a	
Continuous grain sorghum	115.7	133.3	74.1	82.2	44.6	59.5
Fifth-year grain sorghum	112.5	133.2	75.5	85.8	49.0	60.9
Fourth-year grain sorghum	109.4	130.1	76.9	86.5	55.3	61.9
Third-year grain sorghum	125.4	139.7	76.2	87.3	58.3	64.1
Second-year grain sorghum	119.6	132.2	79.7	91.8	64.7	67.6
First-year grain sorghum	142.5	147.9	95.0	102.5	70.4	72.4
Grain sorghum - soybean	144.3	148.3	98.1	103.8	65.5	67.8
Avg.	124.2	137.8	82.2	91.4	58.2	64.9
LSD (0.05): same crop seq.	5.0	5.0	4.6	4.6	2.4	2.4
LSD (0.05): different crop seq.	8.9	8.9	5.1	5.1	3.2	3.2

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 seeks to evaluate 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 has increased as soil acidity has decreased (data not shown).

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

Soil pH		Grain Yield			
		Grain Sorghum	Full-Season Soy	Double-Crop Soy	Wheat
0 - 4"	4 - 8"	(3-yr avg)	(2-yr avg)	(2-yr avg)	(2-yr avg)
		bu/a	bu/a	bu/a	bu/a
5.3	5.3	78.4	25.2	17.5	34.1
6.2	5.7	84.5	26.2	19.6	38.3
6.4	5.9	91.8	31.6	21.1	38.5
6.8	6.2	95.6	32.6	22.3	41.2
7.3	6.9	94.7	34.2	21.2	40.8
LSD (0.05)		4.2	2.4	2.8	3.5

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

Kenneth W. Kelley

Summary

In the low yielding environments of 1999 and 2000, full-season soybean yields were similar when grown in 7.5-, 15-, and 30-in. row spacing. Soybean yields also were not significantly affected by tillage method (no-till versus conventional). Glyphosate herbicide applications gave excellent weed control; thus, soybean yields were not significantly different among herbicide treatments, except for the control application 10 wks after planting.

Introduction

In recent years, improved equipment and herbicide technology has prompted more interest in planting soybean using conservation tillage practices. In addition, the acreage of soybeans planted in narrower row spacing in both conventional and reduced tillage systems appears to be increasing in southeastern Kansas. This research seeks to investigate the interactions of row spacing, tillage, and glyphosate herbicide application on full-season soybean following grain sorghum.

Experimental Procedures

Beginning in 1999, a 2-year rotation study involving soybeans and grain sorghum was established at the Columbus Unit. Main plot treatments consist of a factorial combination of conventional tillage (CT) and no-tillage (NT) with three different row spacings (7.5 -, 15-, and 30-in.). Subplot treatments 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.

Results and Discussion

Full-season soybean results for 1999 and 2000 are shown in Table 1. Yields were low in both years because of dry soil conditions and high air temperatures during the reproductive stages of grain development. Thus, yield differences between tillage methods and row spacings were small for the low-yielding environments of 1999 and 2000. In addition, except for the control treatment, soybean yields also were similar among glyphosate herbicide treatments. Weed population consisted primarily of crabgrass and common waterhemp species.

*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 Agricultural Research Center.

Row	Herbicide Treatment								2-yr
	PPI + 3 wks		3 wks		3 + 2 wks		10 wks		
Spacing	1999	2000	1999	2000	1999	2000	1999	2000	Avg.
	soybean yield (bu/a)								
No-Tillage									
7.5 in.	16.0	17.8	18.2	20.4	17.9	17.9	12.3	13.7	(16.8)
15 in.	16.9	16.8	17.6	15.7	17.4	16.8	11.1	13.5	(15.7)
30 in.	16.3	16.9	17.1	16.9	18.3	17.2	10.8	14.9	(16.1)
Avg.	(16.4)	(17.2)	(17.6)	(17.7)	(17.9)	(17.3)	(11.4)	(14.0)	(16.2)
Conventional Tillage									
7.5 in.	15.8	15.1	17.1	15.0	17.1	14.3	10.2	10.5	(14.4)
15 in.	17.2	15.8	18.0	16.4	18.9	15.8	13.4	14.3	(16.2)
30 in.	17.3	16.4	17.1	15.8	18.1	16.2	10.3	12.1	(15.4)
Avg.	(16.8)	(15.8)	(17.4)	(15.7)	(18.0)	(15.4)	(11.3)	(12.3)	(15.3)

LSD (0.05): Row spacing = NS; Tillage = NS; Herbicide (1999 = 0.7 bu; 2000 = 0.9 bu).

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 incorporated treatment was Prowl applied at 2.4 qt/a.

PERFORMANCE TEST OF DOUBLE-CROPPED SOYBEAN VARIETIES

James H. Long and Gary L. Kilgore*

Summary

Nineteen double-cropped soybean varieties were planted following winter wheat in Parsons, Kansas and evaluated for yield and other agronomic characteristics throughout the summer of 2000. Overall, grain yields were below average, however, variety differences were seen even under the dry growing conditions. Very early freezing temperatures cut the season short. Yields ranged from 2.0 bu/a to 14.1 bu/a. All varieties except 'Macon', a MG III were affected by the extreme cold weather conditions. Mid to late MG IV varieties had the highest yields, although all varieties had poor seed quality.

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 a threat of frost.

Experimental Procedures

Soybean varieties were planted into good moisture following winter wheat harvest at the Southeast Agricultural Research Center at Parsons. The soil is a Parsons silt loam. The wheat stubble was burned, then Squadron® herbicide was applied and the area was field cultivated prior to planting. Soybean then was planted on July 10, 2000 at 10 seed per ft of row. Harvest occurred November 22, 2000.

Results and Discussion

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

Yields ranged from 2.0 bu/a to 14.1 bu/a (Table 1). Several varieties yielded near 10 bu/a, and could be considered as top yielders in 2000, although great care should be taken in considering 2000 data due to the very early freeze. Consideration also should be given to plant height from data in 2000. Overall plant heights were very short, reflecting the very dry conditions, and this caused some harvest problems.

*Southeast Area Extension Office

Table 1. Yield of Variety Test for Double-Cropped Soybean at Columbus, Parsons, and Altamont, Kansas, 1994-2000.

Brand	Variety	Yield 2000	1999	1998	1997	1996	1995	1994
		-----	-----	-----	bu/a	-----	-----	-----
Agripro/Garst	484 RR/N	7.6	---	---	---	---	---	---
Agripro/Garst	569 RR/N	2.0	---	---	---	---	---	---
Golden Harv.	H-5447STS	10.2	20.2	---	---	---	---	---
Midland	XA491/N	6.4	---	---	---	---	---	---
Midland	9A480/N/RR	8.9	---	---	---	---	---	---
Midland	8530	7.8	22.5	---	---	---	---	---
NC+	4N 879RR	9.1	---	---	---	---	---	---
NC+	541/N/STS	10.0	---	---	---	---	---	---
Novartis	51T1	6.0	17.8	---	---	---	---	---
Novartis	S57-11	4.6	19.3	---	---	---	---	---
Pioneer	94B53	14.1	---	---	---	---	---	---
Pioneer	95B33	8.5	19.9	6.7	---	---	---	---
Pioneer	94B81	10.7	---	---	---	---	---	---
Triumph	TR481RR	9.3	---	---	---	---	---	---
Check Varieties								
LateIII/EarlyIV	Macon	6.5	---	---	---	---	---	---
Early MG IV	Flyer	---	13.0	2.8	40.1	10.1	14.9	17.0
Mid MG IV	KS4694	9.3	13.0	1.8	40.2	6.5	---	---
Early MG V	KS4997	10.3	21.1	---	---	---	---	---
Early MG V	Manokin	10.2	---	7.8	43.5	17.4	19.8	26.5
Early MG V	KS5292	8.5	15.5	2.7	39.5	13.3	13.8	25.4
LSD (0.05)		1.7	2.7	1.4	5.2	5.6	---	---
Averages		8.1	17.2	3.5	38.2	11.4	15.6	23.6

PERFORMANCE TEST OF COTTON VARIETIES

James H. Long, Gary Kilgore*, Scott Staggenborg, and Stewart Duncan*****

Summary

Twelve cotton varieties were planted in May, 2000 at Parsons, Kansas and evaluated for yield and other agronomic characteristics throughout the summer of 2000. Lint yields were excellent, and there were differences noted among varieties evaluated in southeastern Kansas. Yields ranged from 345 lb/a to 545 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 relatively new crop for southeastern Kansas. Acreage has expanded, however, and cotton is currently grown on approximately 40,000 acres throughout the state. The crop is somewhat drought tolerant, which appeals to Kansas growers. In fact, 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 southeastern Kansas are potential insect problems and the management decisions associated with cotton, such as having an early harvest before fall rains arrive.

Experimental Procedures

Twelve cotton varieties were grown following grain sorghum red clover. The soil is a Parsons silt loam located at the Parsons unit of the Southeast Agricultural Research Center. The soil was chiseled and disked twice. Cotoran® and Dual II Magnum® herbicides were applied, and the soil was field cultivated prior to planting. Cotton then was planted on May 19, 2000. Populations were thinned to 43,000 and 78,000 plants/acre. Plants emerged to form an excellent stand. Cotoran was applied postemergent to help control broadleaf weeds. Def 6 defoliant and Prep boll opener was applied on September 14, 2000 and Gramoxone® was applied on September 28 to control regrowth. Cotton lint was harvested on October 2 and 3, 2000. The cotton was ginned at Manhattan and lint quality was then determined by HVI (high volume instrumentation) testing.

Results and Discussion

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

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Yields ranged from 345 lb/a to 545 lb/a (Table 1). Several varieties yielded more than 500 lb/a for the 2000 growing season and should considered top yielders. Consideration should be given to quality factors and their effect on the price received for the crop.

Table 1. Yield and Quality of Cotton Varieties at Parsons, Kansas during 2000.

Company	Variety	Cotton Yield		2000 Quality Characteristics					
		Lint Yield	Turn out	Micronaire	Length	Uniformity	Strength	Color	Grade
		-lb/a-	-%-						
Fibermax	958	345	0.308	3.2	30.6	80.0	25.4	52	1
Novartis	2108SS	502	0.309	3.9	30.9	79.5	26.3	52	2
Novartis	2165C	431	0.307	3.0	30.1	78.2	26.0	52	2
Novartis	DG256	446	0.288	3.3	31.2	79.0	27.3	42	2
Deltapine	388	437	0.315	3.4	29.9	78.9	24.8	43	2
Paymaster	2379RR	502	0.299	3.7	29.1	80.0	29.0	52	2
Paymaster	2145RR	385	0.312	3.9	28.2	79.1	25.1	43	2
Paymaster	2156RR	545	0.301	3.7	28.5	79.1	23.9	62	2
Paymaster	280	457	0.273	3.3	32.6	79.5	29.3	52	2
Paymaster	2280BGRR	502	0.309	3.0	30.2	78.3	26.8	42	2
Stoneville	ST239	399	0.304	3.6	30.4	80.5	26.9	52	1
Stoneville	BXN16	416	0.297	3.6	29.3	80.0	25.0	52	3
LSD(0.05)		71	0.009	0.4	1.0	ns	2.3	---	---
Mean		447	0.302	3.5	30.1	79.3	26.3	---	---
C.V.		16	3.0	6.6	1.8	1.2	5.0	---	---

COMPARISON OF SOYBEANS GROWN ON SCN INFESTED AND UNINFESTED SOIL

James H. Long and Tim Todd*

Summary

Studies have been conducted since 1991 to determine the effect of cultural practices on the soybean cyst nematode (*Heterodera glycines*). Long-term studies have found that crop rotation, although reducing the number of cyst nematode in the soil, was of little help in preventing damage to a following crop of soybean. The extent of yield loss can be seen when grain yields and yield components are compared between an SCN infested and uninfested location. Susceptible soybeans grown in rotation yielded the same as a resistant variety at the uninfested location while grain yield in continuous and rotated susceptible soybeans was 30% less than the resistant variety.

Introduction

Soybean is a major grain crop in southeastern Kansas and has been grown on fields, sometimes continuously, for many years. In the past 10 years, these soybean production fields have been invaded by a major pest called the cyst nematode. Studies were begun in 1991 on farmer-owned fields and at the Southeast Agricultural Research Center - Columbus Field in the southeastern region and have provided excellent information on this very destructive pest and methods to help control its damage to this important commodity.

Experimental Procedures

A cultural practices study was begun on the Martin Farms and Columbus Field Station in 1991. Each study had exactly the same treatments at each location. Four cropping systems were begun at that time and included: 1) continuous susceptible 'Stafford' soybean; 2) a 3-year rotation that had grain sorghum followed by winter wheat then full-season Stafford; 3) a 4-year rotation that had grain sorghum followed by the resistant soybean variety 'Manokin', then grain sorghum again, and then the Stafford; and 4) the same rotation as three except that the full-season soybean was replaced by winter wheat followed by double-cropped Stafford or Manokin. Soybean grain yield, yield components, and cyst nematode numbers were recorded in each year.

Results and Discussion

Soybean yields at the Columbus location were the same for both susceptible and resistant varieties, while at Martin Farms SCN reduced yields by 30% across all rotations (Table 1). Stafford soybeans grown continuously did tend to yield less than soybeans grown in rotation and yielded the same as Manokin grown after wheat in a double-crop. There were no differences in yield components at the Columbus station. The resistant variety, Manokin, produced more pods than did the susceptible Stafford at Martin Farms.

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Manokin had many small pods at the top of the plants, which resulted in slightly smaller seed but more total grain. The resistant variety Manokin was the only component of the cropping rotation that reduced cyst nematode numbers during the season and preserved grain yields.

Table 1. Yield and Yield Components of Soybeans Grown on SCN Infested Soils Compared to Those Grown on Uninfested Soils from 1995-1998 at Martin Farms and Columbus Field Station.

	Grain Yield and Yield Components					
	Martin Farms - Infested			Columbus Field Station - Uninfested		
Cropping System	Bu/a	Pods/ft	Seeds/pod	Bu/a	Pods/ft	Seeds/pod
Full season:						
S-S-S	26.9bc	200b	2.1a	30.4ab	184bc	2.1ab
N-N-S	26.3bc	180bc	2.1a	34.4a	209ab	2.1ab
N-R-N-S	29.2b	182b	2.1a	32.9a	188b	2.1ab
N-S-N-R	38.1a	272a	1.8b	34.1a	223a	1.9bc
Double-cropped:						
N-R-N-S	21.6c	153c	2.1a	22.3c	154c	2.1a
N-S-N-R	29.7b	194b	2.0ab	26.8bc	184bc	1.9c

Means within a column followed by the same letter are not different according to Fisher's LSD (0.05).
S-S-S = continuous susceptible soybean
N-N-S = susceptible soybean following 2 years of nonhost
N-R-N-S = susceptible soybean following 2 years of a nonhost crop and one of a resistant variety
N-S-N-R = resistant variety following 2 years of a nonhost crop and one of a susceptible variety

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ANNUAL SUMMARY OF WEATHER DATA FOR PARSONS - 2000

Mary Knapp*

2000 Data

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg. Max	45.9	54.0	58.7	66.3	77.5	81.7	89.8	97.7	87.5	72.7	51.4	33.3	68.0
Avg. Min	24.5	30.1	37.5	42.5	57.0	62.3	69.0	69.9	56.5	51.2	30.5	14.5	45.5
Avg. Mean	35.2	42.0	48.1	54.4	67.3	72.0	79.4	83.8	72.0	62.0	41.0	23.9	56.8
Precip	0.63	1.95	5.25	0.9	7.26	9.78	3.52	0.00	2.87	5.21	1.36	0.87	39.64
Snow	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Heat DD*	924	666	523	319	54	13	0	0	65	167	727	1275	4730
Cool DD*	0	0	0	1	124	224	447	582	275	73	6	0	1730
Rain Days	6	3	14	6	8	15	9	0	6	11	6	4	88
Min < 10	2	1	0	0	0	0	0	0	0	0	0	9	12
Min < 32	24	21	5	1	0	0	0	0	0	4	22	31	108
Max > 90	0	0	0	0	2	1	16	27	15	2	0	0	63

NORMAL VALUES (1961-1990)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg. Max	40.5	46.6	57.1	68.2	76.8	85.2	91.7	90.1	81.5	71.3	56.8	44.5	67.5
Avg. Min	19.3	24.8	34.2	45.8	55.5	64.1	69.0	66.4	59.1	47.3	35.7	24.8	45.5
Avg. Mean	29.9	35.7	45.7	57.0	66.2	74.7	80.3	78.3	70.3	59.4	46.3	37.0	56.5
Precip	1.32	1.46	3.40	3.80	5.26	4.61	3.15	3.63	4.80	3.92	2.91	1.76	40.02
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	1088	820	598	261	88	0	0	0	31	220	561	939	4606
Cool DD	0	0	0	21	125	294	474	412	190	46	0	0	1562

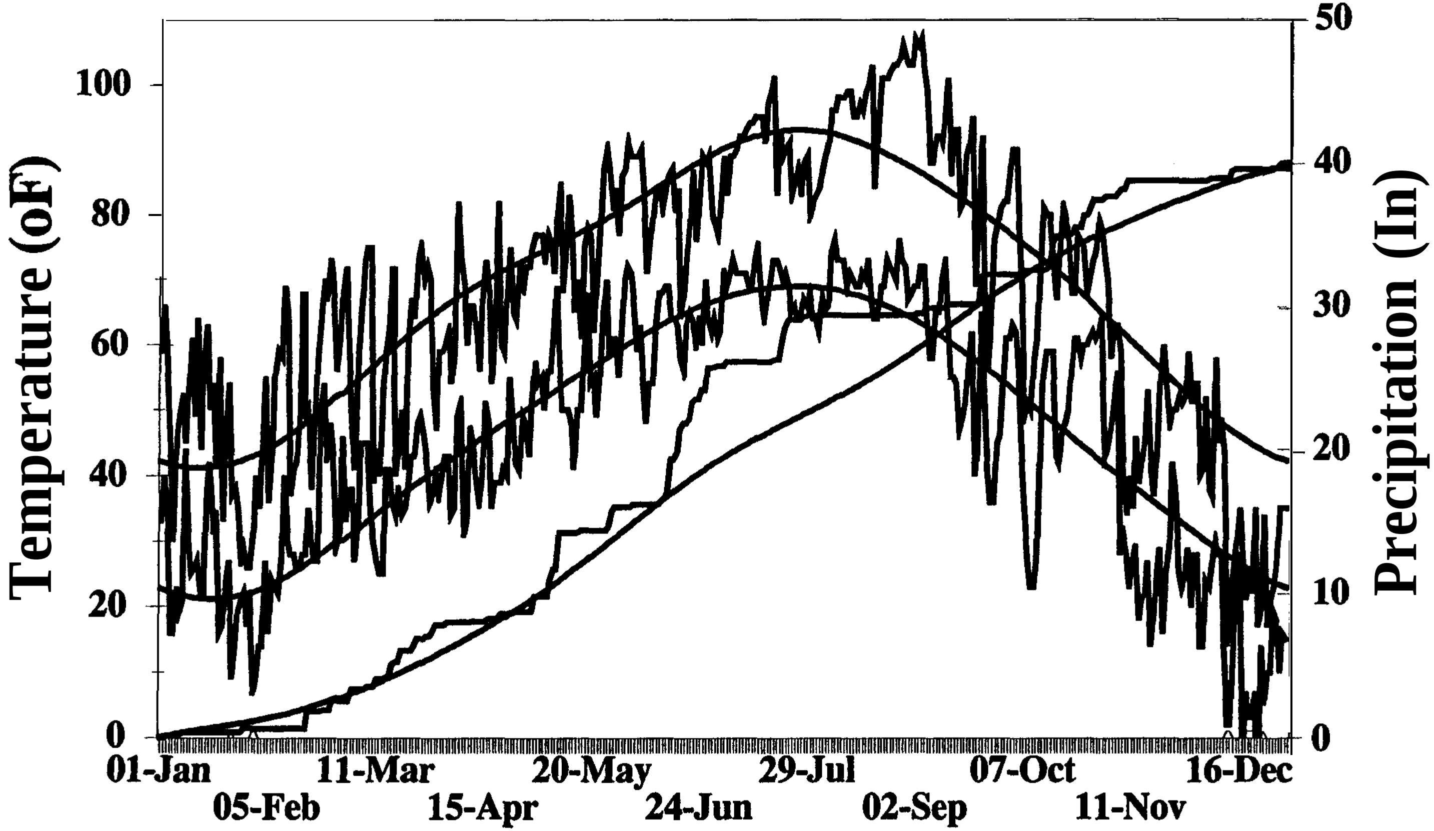
DEPARTURE FROM NORMAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg. Max	5.4	7.4	1.6	-1.9	0.7	-3.5	-1.9	7.6	6.0	1.4	-5.4	-11.2	0.5
Avg. Min	5.2	5.3	3.3	-3.3	1.5	-1.8	0.0	3.5	-2.6	3.9	-5.2	-10.3	-0.0
Avg. Mean	5.3	6.3	2.4	-2.6	1.1	-2.7	-0.9	5.5	1.7	2.6	-5.3	-13.1	0.0
Precip	-0.69	0.49	1.85	-2.86	2	5.17	0.37	-3.63	-1.93	1.29	-1.55	-0.89	-0.38
Snow	0.0	-3.0	-1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.0	0.0	-6.5
Heat DD	-164	-154	-76	58	-35	13	0	0	34	-54	166	336	124
Cool DD	0	0	0	-21	-2	-71	-28	170	85	27	6	0	168

* 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.

*Assistant Specialist, Weather Data Library, KSU.

Parsons Weather -- 2000



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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