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2002 Agricultural Research

Southeast Agricultural Research Center

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Kansas State University Agricultural Experiment Station and Cooperative Extension Service

LYLE LOMAS, Research Center Head and Animal Scientist, received B.S. and M.S. degrees in Animal Husbandry from the University of Missouri and a Ph.D. in Animal Husbandry from Michigan State University. He provides leadership for research, is responsible for administration, and directs beef cattle research at the Research Center. Lyle joined the staff in 1979 as Animal Scientist and became Head in 1986. His research interests are beef cattle nutrition and forage utilization by grazing beef cattle.

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.

JIM LONG, Crop Variety Development Agronomist, received a B.S. degree from Missouri Southern State College and M.S. and Ph.D. degrees in Agronomy from the University of Arkansas. He joined the staff in 1990 and directs variety performance testing of grains, works with plant breeders in development and evaluation of new wheat and soybean cultivars, and conducts soybean production research.

JOE MOYER, Forage Agronomist, received B.S., M.S., and Ph.D. degrees in Agronomy from Kansas State University. He has been a staff member since 1978. His research evaluates cultivars and management practices with forage grasses and legumes and forage utilization by beef cattle.

DAN SWEENEY, Soil and Water Management Agronomist, received a B.S. degree in Chemistry from Kentucky Wesleyan College, a M.S. degree in Agronomy from Purdue University, and a Ph.D. in Soil Science from the University of Florida. He joined the staff in 1983. His research focuses on soil fertility, tillage and compaction, and irrigation.

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Contribution No. 02-380-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 160 steers grazed 'Red River' crabgrass pastures that were fertilized with additional nitrogen (N) or interseeded with lespedeza during the summers of 1998, 1999, 2000, and 2001. Wheat was also grazed in 1999, 2000, and 2001 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 2001, wheat grazing gain, overall grazing performance, 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, which is when fescue forage production declines and animal performance is reduced by the endophyte that typically is found in most fescue grown in this region. Crabgrass could fill this niche by providing high-quality forage for summer grazing. A high level of nitrogen (N) fertilization is required for crabgrass. Adding a legume could reduce the amount of N fertilizer required, enhance the utilization of crabgrass, and extend grazing of high-quality forage in late summer. 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, September 22, 1999, and September 28, 2000 at a rate of 106 lb/a using a no-till drill. The wheat was planted for grazing in

[1]Southeast Area Extension Office.

1999, 2000, and 2001, respectively. Korean lespedeza was no-till seeded on April 7, 1999 at the rate of 19.5 lb/a; March 15, 2000 at the rate of 18.3 lb/a; and March 27, 2001 at the rate of 15 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; 56 lb of N/a on May 23, 2000; 71-41-41 lb/a on November 17, 2000; and 51 lb of N/a on May 17, 2001. 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, 2000, and 2001, 50 mixed-breed steers with initial weights of 639 lb, 600 lb, and 554 lb, respectively, were weighed on consecutive days, stratified by weight, and allotted randomly to the 10 pastures on March 30 (1999), March 9 (2000), and March 22 (2001) 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). In 2001, cattle grazed wheat from March 22 until May 17 (56 days) and then grazed crabgrass from May 17 until September 6 (112 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 and 2001, 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 l head/a until grazing was terminated and steers were weighed on August 31 and September 1, 1999; September 5 and 6, 2000; and September 5 and 6, 2001. Pastures were mowed and harvested for hay on September 14, 2000, May 15, 2001, and September 10, 2001 to remove residual forage after grazing.

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, 2000, and 2001 were fed for 142, 114, 128, and 119 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, DM 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. Three pastures were eliminated from the analysis because they contained significant amounts of volunteer ladino clover.

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 DM increased to its maximum on August 10.

Available forage DM and lespedeza canopy coverage for 2001 are shown in Figure 4. Available forage DM was not significantly different (P<.05) between treatments overall or at any time during the growing season. Available forage DM decreased (P<.05) after April 19 (Day 109) to a low of 1160 lb/a on June 14 (Day 165), then increased through August 10.

Available forage DM appeared lower in much of 1999 compared to the other three years. Forage DM availability patterns also differed markedly in 1998, when the maximum amount of forage occurred early in the season, whereas the maximum in 2000 and 2001 occurred late in the season. These differences were likely due to a higher initial stocking rate and grazing wheat prior to crabgrass in 2000 and 2001. 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), in July, 2000 at 18% (P<.05; Fig. 3), but was similar (P>.10) for July through September, 2001, peaking at 19% (Fig. 4).

Cattle Performance

Performance of steers that grazed crabgrass pastures either fertilized with additional N or interseeded with lespedeza are shown in Table 1. 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 1.23 and 1.27 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.

In 2001, steers that grazed pastures fertilized with additional nitrogen had higher (P<.05) wheat grazing gains and overall grazing gains (wheat + crabgrass) than those that grazed pastures interseeded with lespedeza. Gains during the wheat phase for pastures with lespedeza averaged

2.56 and 3.11 lb/head/day for pastures fertilized with additional N. During the crabgrass phase, gains averaged 1.72 and 1.99 lb/head/day; and overall, gains averaged 2.00 and 2.36 lb/head/day for pastures interseeded with lespedeza and fertilized with additional N, respectively.

Finishing gains, overall performance, and fat thickness were greater (P<.05) for steers that grazed pastures fertilized with additional nitrogen than those that grazed pastures interseeded with lespedeza.

This study will be continued for at least three more grazing seasons with no additional crabgrass seed being sown in order to determine if the crabgrass will re-seed itself.

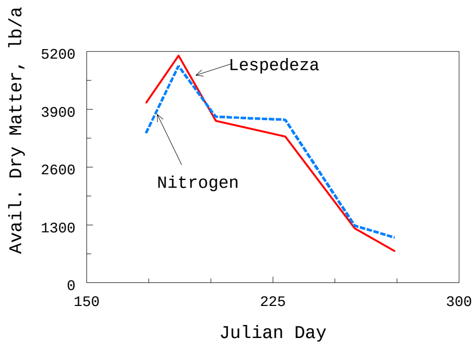

Figure 1. Available Forage in Crabgrass Pastures, 1998, Southeast Agricultural Research Center.

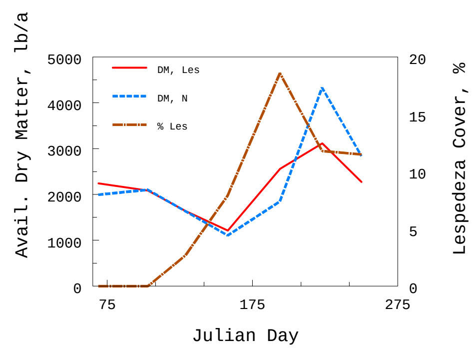

Figure 3. Available Forage and Lespedeza Canopy Cover in Wheat and Crabgrass Pastures, 2000, Southeast Agricultural Research Center.

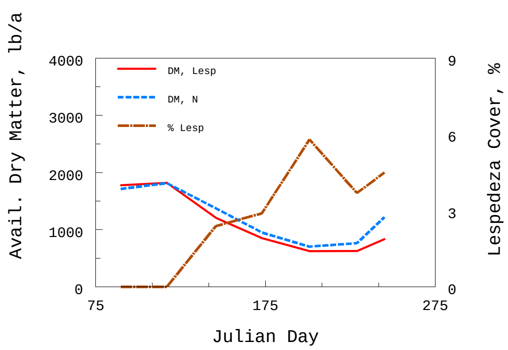

Figure 2. Available Forage and Lespedeza Canopy Cover in Wheat and Crabgrass Pastures, 1999, Southeast Agricultural Research Center.

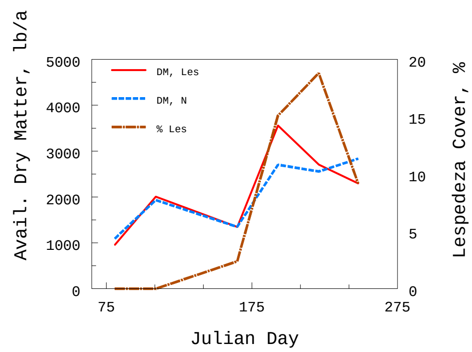

Figure 4. Available Forage and Lespedeza Canopy Cover in Wheat and Crabgrass Pastures, 2001, Southeast Agricultural Research Center.

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

	1998		1999		2000		2001	
Item	Nitrogen	Lespedeza	Nitrogen	Lespedeza	Nitrogen	Lespedeza	Nitrogen	Lespedeza
Grazing Phase - Wheat								
No. of days	-	-	57	57	61	61	56	56
No. of head	-	-	15	20	15	20	15	20
Initial wt., lb	-	-	639	639	600	600	554	554
Ending wt., lb	-	-	768	766	794	789	727	697
Gain, lb	-	-	129	127	194	189	174	144
Daily gain, lb	-	-	2.26	2.22	3.18	3.09	3.11[a]	2.56[b]
Gain/a, lb	-	-	161	158	242	236	218	180
Hay production, lb of DM/a	-	-	-	-	-	-	1563	1660
Grazing Phase - Crabgrass								
No. of days	98	98	98	98	120	120	112	112
No. of head	12	16	12[c]	16[c]	12	16	12	16
Initial wt., lb	702	702	772	766	786	785	729[a]	697[b]
Ending wt., lb	827	823	895	893	1005	994	952[a]	889[b]
Gain, lb	124	121	122	128	218	208	223	192
Daily gain, lb	1.27	1.23	1.25	1.30	1.82	1.74	1.99	1.72
Gain/a, lb	124	121	142	145	218	208	223	192
Hay production, lb of DM/a	-	-	-	-	605	605	666	838
Overall Grazing Performance (Wheat + Crabgrass)								
No. of days	-	-	155	155	181	181	168	168
Gain, lb	-	-	251	254	412	397	397[a]	336[b]
Daily gain, lb	-	-	1.62	1.64	2.28	2.19	2.36[a]	2.00[b]
Gain/a, lb	-	-	303	304	460	444	440	372
Finishing Phase								
No. of days	142	142	114	114	128	128	119	119
No. of head	12	16	12	16	12	16	12	16
Starting wt., lb	827	823	895	893	1005	994	952[a]	889[b]
Final wt., lb	1253	1239	1350	1400	1421	1388	1428[a]	1323[b]
Gain, lb	426	416	456[a]	507[b]	416	394	476[a]	434[b]
Daily gain, lb	3.00	2.93	4.00[a]	4.45[b]	3.25	3.08	4.00[a]	3.65[b]
Daily DM intake, lb	26.3	26.9	29.7	33.3	30.1	29.2	27.4	25.1[b]
Feed/gain	8.77	9.18	7.42	7.49	9.25	9.53	6.85	6.88
Hot carcass wt., lb	764	756	794	824	835	830	845[a]	784[b]
Dressing %	61.0	61.0	58.8	58.8	58.8	59.8	59.2	59.2
Backfat, in	.36	.34	.60	.54	.58	.65	.56[a]	.42[b]
Ribeye area, in^2	12.8	13.1	12.3[a]	13.2[b]	13.6	13.5	13.5	13.1
Yield grade	2.6	2.4	3.5	3.0	3.2	3.4	3.2	2.7
Marbling score	SM^{16}	SM^{43}	SM^{46}	SM^{93}	MT^{15}	MT^{16}	MT^{30}	MT^{26}
% Choice	65	75	67	92	75	100	100	94
Overall Performance (Grazing + Finishing Phase)								
No. of days	-	-	269	269	309	309	287	287
Gain, lb	-	-	708	761	821	788	874[a]	768[b]
Daily gain, lb	-	-	2.64	2.83	2.65	2.55	3.05[a]	2.68[b]

[a,b]Means within a row within the same year with the same letter are not significantly different ($P<.05$).
[c]Pastures were stocked with 1.2 steers per acre for 83 days and then 1 steer per acre for the final 15 days.

EFFECT 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 pasture in 1998, 1999, and 2000 that had been previously interseeded with either lespedeza, red clover, or ladino clover during 1995, 1996, and 1997. Legume cover, forage dry matter production, grazing steer performance, and subsequent feedlot performance were measured. Pastures interseeded with ladino clover produced higher stocker gains in 1998 and more available forage and legume cover in all 3 years than those interseeded with lespedeza or red clover. Legume treatment had little effect on subsequent finishing performance. Results of this study indicate that lespedeza and red clover should be seeded every year and ladino clover at least every 2 years in endophyte-infected tall fescue pasture in order to provide sufficient legume to improve performance of grazing cattle.

Introduction

Cattlemen with high-endophyte tall fescue pastures can either tolerate low gains from their cattle, seek to improve animal performance by destroying existing stands of fescue and replacing them with endophyte-free fescue or other forages, or interseed legumes into existing pastures to reduce the adverse effects on animal performance. Previous research at the Southeast Agricultural Research Center has shown that performance of stocker steers grazing high-endophyte tall fescue improved significantly when 'Regal' ladino clover was broadcast on the pastures in late winter, and that interseeding ladino clover into existing stands of high-endopyte tall fescue produced higher grazing gains than interseeding lespedeza or red clover. This study was conducted to compare legume persistence, forage production, grazing performance, and subsequent feedlot performance of stocker steers grazing high-endophyte tall fescue pastures that had been previously interseeded with ladino clover, lespedeza, or red clover.

Experimental Procedures

Pastures

Nine 5-acre pastures were selected at the Parsons Unit of the Kansas State University - Southeast Agricultural Research Center. Soils are Parsons silt loam (fine, mixed thermic Mollic Albaqualf). Pastures were allotted in a randomized complete block design with three replications. The pastures of established (>5-yr) ‘Kentucky 31' tall fescue had more than 65% infection rate with the endophyte (*Neotyphodium coenophialum* Glen, Bacon, Price and Hanlin formerly *Acremonium coenophialum*). Pastures were fertilized in September 1998, 1999, and 2000 with 16-40-40 lb/a of N-P_2O_5-K_2O. Pastures were treated in early spring of 1994 with 3 tons/a of ag lime (62% ECC). Three

[1]Southeast Area Extension Office.

legumes were seeded in late February 1995 with a no-till drill. Three pastures each received 4 lb/a of Regal ladino clover, 12 lb/a of 'Kenland' red clover, or 15 lb/a of 'Marion' striate lespedeza. Pastures were seeded again in mid-March of 1996 and early March of 1997 with the same respective legumes that were planted in 1995, except that Korean rather than Marion lespedeza was planted. Seeding rates in 1996 were 6 lb/a of Regal ladino clover , 13 lb/a of Kenland red clover, or 17 lb/a of Korean lespedeza. Seeding rates in 1997 were 4 lb/a of Regal ladino clover, 12 lb/a of Kenland red clover, or 14 lb/a of Korean lespedeza.

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), 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 grazed during 1998, 1999, and 2000 were fed a finishing diet for 154, 140, and 111 days, respectively, and slaughtered in a commercial facility. Carcass data were collected.

Results and Discussion

Pastures

Available forage dry matter of the pastures for 1998, 1999, and 2000 is presented in Figures 1, 2, and 3, respectively. Available forage dry matter was higher in pastures that had been interseeded with ladino clover than in those with lespedeza in all 3 years, and higher than those with red clover in 1999 and 2000.

Legume canopy coverage for 1998, 1999, and 2000 is presented in Figures 4, 5, and 6, respectively. Greater legume coverage was maintained in each of the 3 years in pastures that were previously interseeded with ladino clover than in those with red clover or lespedeza. However, legume coverage declined each year with an average of only 1.3% remaining in ladino clover pastures in 2000.

Cattle Performance

Grazing and subsequent finishing performance of steers grazing fescue pastures in 1998, 1999, and 2000 that had been previously interseeded with the various legumes are presented in Table 1. Results are listed by year for each legume treatment, since there was a significant ($P<.05$) treatment x year interaction. In 1998, steers grazing pastures interseeded with ladino clover gained 33.3% more (P<.05) and 20.4% more (P<.05) than those grazing pastures interseeded with lespedeza and red clover, respectively. Gains of steers grazing pastures interseeded with lespedeza or red clover were similar (P>.05). In 1999 and 2000, grazing gains among legume treatments were similar (P>.05).

Legume treatment during the grazing phase had no effect on subsequent finishing performance or carcass parameters, except steers that grazed pastures interseeded with red clover in 1998 gained 9.1% more (P<.05) than those that grazed pastures interseeded with ladino clover. This may have been compensatory gain, as cattle that grazed pastures interseeded with ladino clover gained more (P<.05) than those grazing pastures interseeded with red clover during the grazing phase. Finishing performance of steers that had previously grazed pastures interseeded with lespedeza or red clover were similar (P>.05). Overall gains from the beginning of the grazing phase through the end of the finishing phase were similar among legume treatments during each of the 3 years.

Table 1. Effects of Interseeding Legumes into Endophyte-Infected Fescue Pastures on Performance of Steers.

	1998			1999			2000		
	Legume			Legume			Legume		
Item	Lespedeza	Red Clover	Ladino Clover	Lespedeza	Red Clover	Ladino Clover	Lespedeza	Red Clover	Ladino Clover
Grazing Phase									
No. of days	223	223	223	218	218	218	218	218	218
No. of head	14	15	15	15	15	14	15	14	15
Initial wt., lb	572	574	573	565	565	565	552	549	552
Ending wt., lb	779^{a}	803^{a}	849^{b}	775	784	779	774	792	780
Gain, lb	207^{a}	230^{a}	276^{b}	210	219	214	223	243	229
Daily gain, lb	0.93^{a}	1.03^{a}	1.24^{b}	0.97	1.01	0.98	1.02	1.12	1.05
Finishing Phase									
No. of days	154	154	154	140	140	140	111	111	111
No. of head	14	15	15	15	15	14	15	14	15
Starting wt., lb	779^{a}	803^{a}	849^{b}	775	784	779	774	792	780
Final wt., lb	1296	1340	1341	1322	1320	1344	1216	1221	1204
Gain, lb	$517^{a,b}$	537^{a}	492^{b}	547	535	565	441	429	424
Daily gain, lb	3.36	3.48	3.19	3.90	3.82	4.03	3.98	3.86	3.82
Daily DM intake, lb	25.0	26.3	25.8	27.1	28.2	27.8	27.7	27.4	28.8
Feed/gain	7.4	7.6	8.1	6.9	7.4	6.9	7.0	7.1	7.6
Hot carcass wt., lb	790	813	817	790	800	808	706	720	696
Dressing %	61.0	60.7	60.9	59.7	60.6	60.1	58.1	58.9	57.8
Backfat, in	.39	.38	.40	.51	.44	.45	.41	.42	.43
Ribeye area, in^2	16.0	15.5	15.3	12.0	12.2	12.3	11.6	11.4	11.7
Yield grade	1.8	2.0	2.1	3.3	3.1	3.1	3.0	3.1	2.9
Marbling score	SM^{10}	SM^{79}	SM^{62}	MT^{19}	SM^{70}	MT^{22}	SM^{01}	SM^{10}	SL^{95}
% Choice	62	80	67	92	73	100	40	42	47
Overall Performance (Grazing + Finishing Phase)									
No. of days	377	377	377	358	358	358	329	329	329
Gain, lb	724	767	768	757	755	779	664	672	652
Daily gain, lb	1.92	2.03	2.04	2.12	2.11	2.18	2.02	2.04	1.98

[a,b]Means within a row within the same year with the same letter are not significantly different (P<.05).

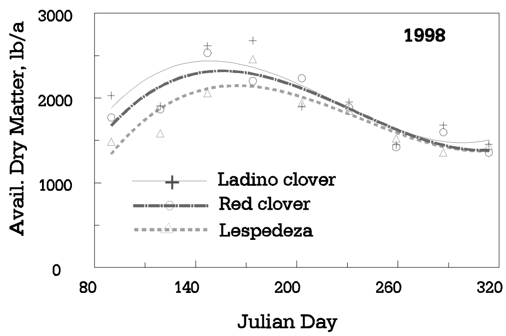

Figure 1. **Available Forage in Tall Fescue Pastures Previously Interseeded with Legumes 1998, Southeast Agricultural Research Center.**

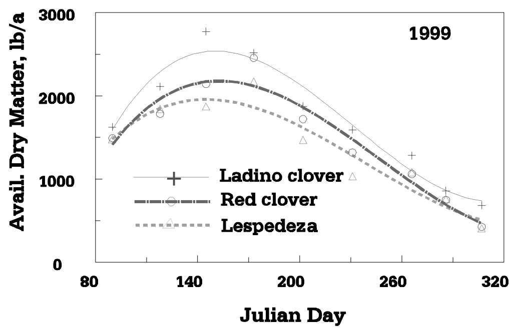

Figure 2. **Available Forage in Tall Fescue Pastures Previously Interseeded with Legumes, 1999, Southeast Agricultural Research Center.**

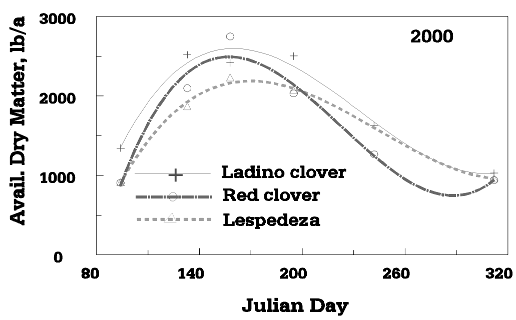

Figure 3. **Available Forage in Tall Fescue Pastures Previously Interseeded with Legumes, 2000, Southeast Agricultural Research Center.**

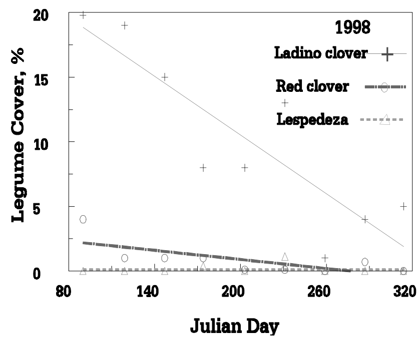

Figure 4. **Legume Canopy Cover in Tall Fescue Pastures Previously Interseeded with Legumes SE Agricultural Research Center.**

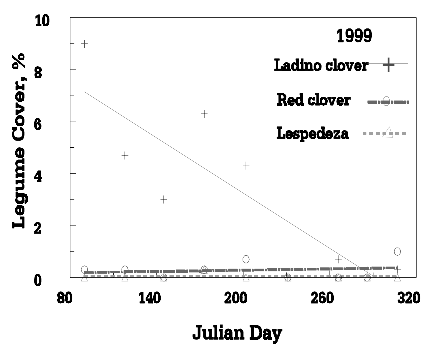

Figure 5. **Legume Canopy Cover in Tall Fescue Pastures Previously Interseeded with Legumes SE Agricultural Research Center.**

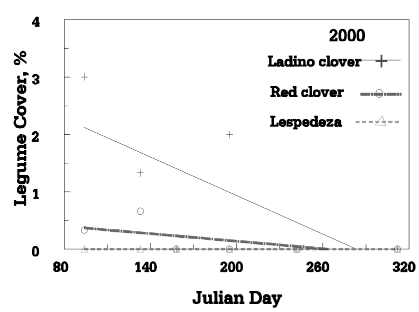

Figure 6. **Legume Canopy Cover in Tall Fescue Pastures Previously Interseeded with Legumes SE Agricultural Research Center.**

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

A total of 92 steers steers grazed tall fescue pastures in 2000 and 2001 that had been previously interseeded with ladino clover to determine effects of the presence of the fungal endophyte and grazing system (continuous or rotational stocked) on grazing and subsequent finishing performance of stocker steers. In both years, steers that grazed continuously stocked pastures had higher (P<.05) grazing and overall gains than those that were rotationally grazed. 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 United States, 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. Interseeding legumes into existing high-endophyte tall fescue pastures has proven effective in reducing 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 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-P_2O_5-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 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. 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.

After the 2000 grazing season, only 7 of the original 16 pastures had sufficient stands of fescue for grazing in 2001. Of these, 2 were low endophyte continuously grazed pastures, 3 were high endophyte continuously grazed pastures, and 2 were high endophyte rotationally grazed pastures. Pastures grazed in 2001 maintained the same treatment they had in 2000. Twenty-eight steers (627 lb) were grazed from April 10, 2001 to August 28, 2001 (140 days). No protein or energy supplement was fed. Cattle in rotationally grazed pastures were moved to a different paddock daily for the first 56 days and every 2 days for the remainder of the grazing period.

Cattle were managed the same otherwise in both years. 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 in 2000 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 in 2002 for reasons unrelated to experimental treatment. Grazing was terminated and steers were weighed on September 11 and 12, 2000 (140 days) and August 27 and 28 (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 in 2000 and 128 days in 2001. 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 and 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 for steers grazed in 2000 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 grazed continuously stocked pastures were heavier (P<.05) at the end of the finishing phase, and had higher (P<.05) finishing gains and higher (P<.05) overall gains. These cattle also 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 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 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 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.

Grazing and finishing performance for steers grazed in 2001 are listed in Table 2. Cattle that grazed continuously stocked pastures gained 135% more (P<.05) on pasture, were 126 lb heavier (P<.05) at the end of the grazing phase, 104 lb heavier (P<.05), at the end of the finishing phase, gained 102 lb more (P<.05) overall (grazing + finishing), and yielded 72 lb heavier (P<.05) carcasses with a higher (P<.05) numerical yield grade and a greater (P<.05) percentage of Choice carcasses than those that were rotationally grazed. Finishing gains, feed intake, and feed conversion were similar (P>.05) between grazing systems.

Cattle that grazed low endophyte pastures gained 42% more (P=.08) during the grazing phase, were 91 lb heaver (P<.05) at the end of the finishing phase, gained 90 lb more (P<.05) overall (grazing + finishing), yielded carcasses that were 59 lb heavier (P<.05) with more (P<.05) external fat and higher (P<.05) numerical yield grades than those that grazed high endophyte pastures. Endophyte level had no effect (P>.05) on finishing gains, feed intake, or feed conversion.

2001 was the final year for this study. An economic analysis will be performed using enterprise budgeting and whole-farm modeling.

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	32	30	30	32
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	32	29	30	31
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]
Dressing %	60.5	60.3	60.6	60.2
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).

Table 2. Effect of Grazing System on Endophyte-Infected and Endophyte-Free Fescue-Clover Pastures, Southeast Agricultural Research Center, 2001.

	Grazing System		Endophyte Level	
	Continuous	Rotational	Low	High
Grazing Phase (140 Days)				
No. of head	20	8	8	20
Initial wt., lb	628	627	628	627
Ending wt., lb	846[a]	720[b]	859	790
Gain, lb	219[a]	93[b]	232	163
Daily gain, lb	1.56[a]	0.66[b]	1.66	1.17
Gain/a	175[a]	74[b]	185	131
Finishing Phase (128 Days)				
No. of head	20	8	8	20
Initial wt., lb	846[a]	720[b]	859	790
Ending wt., lb	1342[a]	1238[b]	1377[c]	1286[d]
Gain, lb	519	495	517	496
Daily gain, lb	4.05	3.87	4.04	3.87
Daily DM intake, lb	26.4	26.4	26.5	26.3
Feed/gain	6.84	6.54	6.83	6.57
Hot carcass wt., lb	803[a]	731[b]	825[c]	766[d]
Dressing %	59.9	59.1	59.9	59.5
Backfat, in	.47	.44	.54[c]	.43[d]
Ribeye area, sq in	13.2	12.8	13.3	13.0
Yield grade	2.9[a]	2.6[b]	3.1[c]	2.7[d]
Marbling score	SM[60]	SL[90]	SM[92]	SM[20]
% Choice	85[a]	42[b]	88	67
Overall Performance (Grazing + Finishing Phase) (268 Days)				
Gain, lb	714[a]	612[b]	749[c]	659[d]
Daily gain, lb	2.66[a]	2.28[b]	2.79[c]	2.46[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).

EFFECT OF SUPPLEMENTATION AND SUPPLEMENTATION METHOD ON PERFORMANCE OF STEERS GRAZING SMOOTH BROMEGRASS PASTURES[1]

Lyle W. Lomas and Joseph L. Moyer

Summary

Thirty-six steers were used to evaluate the effect of protein supplementation and supplementation method during the grazing phase on grazing and subsequent finishing performance of steers grazing smooth bromegrass pastures. Neither protein supplementation nor supplementation method had no effect (P>>05) on grazing or subsequent feedlot performance.

Introduction

Supplementation is an effective means of improving gains of grazing stocker cattle, especially when forage quality is marginal. Supplements may either be hand-fed or fed free-choice. Considerations in selecting method of supplementation may include supplement cost, labor required to feed the supplement, and improvement in gain of cattle consuming the supplement. Several cooked molasses supplements have appeared on the market during the past decade. The hardness of these products is used to limit free-choice consumption. This study was conducted to determine the effect of protein supplementation and supplementation method on performance of steers grazing smooth bromegrass pastures.

Experimental Procedures

Thirty-six Angus steers with an initial weight of 688 lb were weighed on April 23 and 24, 2001, stratified by weight, and randomly assigned to on of nine 5-acre smooth bromegrass pastures. Steers in each pasture were then randomly assigned to one of three supplementation treatments: 1) unsupplemented control; 2) hand-fed 3 lb per head daily of a 20% all natural protein supplement ; or 3) free-choice access to a cooked molasses 30% protein supplement with 7% crude protein equivalent from NPN (All-In-One Supplement manufactured by Postive Feed, Sealy, TX). Cattle were vaccinated for protection from pinkeye and treated for internal and external parasites prior to being turned out to pasture. Steers had free access to commercial mineral blocks that contained 12% calcium, 12% phosphorus, and 12% salt. Free-choice supplement consumption was measured weekly. Every 28 days cattle were weighed, available forage dry matter availability was determined by the falling disk method, and a fecal sample was taken from a steer in each pasture for subsequent nitrogen analysis. Cattle were grazed for 140 days, weighed off pasture on September 10 and 11, 2001. 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

[1]All-In-One Supplement and partial financial support for this study was provided by Postive Feed Inc., Sealy, TX.

a dry matter basis for 114 days. Steers were implanted with Synovex S® on days 0 and 84 of the finishing period. Cattle were slaughtered in a commercial facility at the end of the finishing period, and carcass data collected.

Results

Results of the grazing phase of this study are reported in Table 1. Grazing gains were not different (P>.05) between supplementation treatments. Apparently the pasture met the protein requirements of these steers without supplemental protein. An improvement in gain was obtained on these same pastures with energy supplementation in previous years. However, steers grazed in previous studies were lighter and would have had a higher protein requirement. A response to supplementation in the latter part of the present study was expected but was not measured as forage maturity increased and availability decreased.

Steers that were offered the free-choice supplement consumed less (P<.05) mineral than the unsupplemented control. This was likely due the fact that the cooked molasses product was fortified with minerals. Mineral consumption between the hand-fed and free-choice supplemented cattle was similar (P>.05).

Average available forage dry matter was higher (P<.05) in pastures grazed by hand-fed steers than in those grazed by unsupplemented controls. The higher amount of forage available on pastures grazed by hand-fed steers may be due in part to steers consuming less forage as a result of being fed grain on a daily basis. Forage availability was similar between pastures grazed by hand-fed and free-choice supplemented steers. All pastures had sufficient available dry matter on all dates to support acceptable rates of gain.

Fecal nitrogen did not different among treatment groups on any of the sampling dates. This may lend further support to the contention that the pasture probably met the protein requirements of the grazing steers without additional supplementation.

Feed costs were similar between the hand-fed and free-choice supplemented steers. However, labor costs were higher for those that were hand-fed daily and total supplementation costs were higher for the hand-fed steers than for those that were supplemented free-choice.

Supplementation during the grazing phase had no effect on finishing performance, overall performance (grazing + finishing), or carcass parameters.

Table 1. Effect of Supplementation and Supplementation Method on Performance of Steers Grazing Smooth Bromegrass Pastures, Southeast Agricultural Research Center, 2001.

Item	Unsupplemented Control	Hand-Fed Supplement[a]	Free-Choice Supplement[b]
Grazing Phase (140 Days)			
No. of head	12	12	12
Initial wt., lb	688	688	688
Final wt., lb	941	964	949
Gain, lb	253	276	261
Daily gain, lb	1.81	1.97	1.86
Supplement Consumption, lb/head/day	0	3.0	0.72
Mineral Block Consumption, oz/hd/day	2.67[c]	1.99[c,d]	1.14[d]
Average Available Forage, lb of DM/acre	2109[c]	2641[d]	2286[c,d]
Average Fecal Nitrogen, %	2.40	2.30	2.55
Supplementation cost, $/hd/day			
Feed cost	0	0.20	0.22
Labor + transportation cost	0	0.15	0.01
Total cost	0	0.35	0.23
Finishing Phase (114 Days)			
No. of head	12	12	12
Initial wt., lb	941	964	949
Final wt., lb	1384	1425	1387
Gain, lb	443	460	438
Daily gain, lb	3.88	4.04	3.85
Daily DM intake, lb	25.9	26.3	26.7
Feed/gain	6.74	6.51	6.93
Hot carcass wt., lb	818	852	834
Dressing %	59.1	59.8	60.1
Backfat, in	.56	.48	.55
Ribeye area, sq in	13.2	13.6	13.6
Yield grade	3.0	2.9	3.1
Marbling score	SM[81]	SM[18]	MT[24]
% Choice	83	75	100
Overall Performance (Grazing + Finishing Phase) (254 Days)			
Gain, lb	696	737	699
Daily gain, lb	2.74	2.90	2.75

[a]20% all natural protein pellet.
[b]All-In-One Supplement manufactured by Postive Feed, Inc., Sealy, TX.
[c,d]Means within a row with the same letter are not significantly different (P<.05).

USE OF LEGUMES IN WHEAT-BERMUDAGRASS PASTURES

Joseph L. Moyer and Lyle W. Lomas

Summary

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

Introduction

Bermudagrass is a productive forage species when intensively managed. However, it has periods of dormancy and requires proper use to maintain forage quality. It also requires adequate nitrogen (N) fertilizer to optimize forage yield and quality. Interseeding wheat or other small grains can lengthen the grazing season but this requires additional N fertilization. Legumes in the bermudagrass sward could improve forage quality and reduce fertilizer usage. However, legumes are difficult to establish and maintain with the competitive grass. Red clover has shown promise of summer survival in bermudagrass sod and may be productive enough to substitute for midsummer N fertilization. Hairy vetch is a vigorous winter annual legume that has survived most winters in southeastern Kansas. This study was designed to compare cow-calf and dry cow performance on a wheat-bermudagrass pasture system that included a winter and a summer legume with a single 60 lb/a N application (Legumes) versus wheat-bermudagrass with an additional N application of 50 lb/a (total N applied, 110 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 (95 lb/a) was interseeded (no-till) into bermudagrass sod on September 26, 2000. The next day, 19 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 "Fair to Good" in the fall.

On March 21, legume pastures were broadcast with 12 lb/a of 'Kenland' medium red clover. Cows and calves were weighed on consecutive days, and four pairs were assigned randomly by weight to each pasture on April 17. Calves were weighed off and weaned on May 22. All pastures were clipped on May 23 and fertilized on May 25 with 60-50-30 lb/a of N-P_2O_5-K_2O.

Cows were returned to assigned pastures to continue grazing the bermudagrass phase until August 21, when they were removed to begin calving. Nitrogen pastures received 50 lb/a of N as urea on July 18.

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 fair during the winter and spring in the Legume treatment, providing an average legume canopy coverage of 16%. Cows gained an average of 144 lb during the wheat grazing period (35 days) and calves gained 113 lb. Average available forage dry matter in the wheat grazing phase was 1400 lb dry matter/a.

Cow gains during the bermudagrass phase were higher for the Legume than the Nitrogen system (Table 1, P<.05). Average available forage was similar (P>.10) for the two systems. Average canopy coverage of red clover tended to be greater (P<.10) for the Legume than the Nitrogen system, ranging from 1% to a high of 4% recorded on July 11.

Table 1. Performance of Cows Grazing Bermudagrass Pastures Interseeded with Wheat and Fertilized with Nitrogen or Interseeded with Legumes, Southeast Agricultural Research Center, 2001.

	Management System	
Item	Nitrogen	Legumes
Bermudagrass Phase		
No. of cows	16	16
No. of days	88	88
Stocking rate, cows/a	0.8	0.8
Cow initial wt., lb	1317	1335
Cow final wt., lb	1492	1556
Cow gain, lb	175[b]	221[a]
Cow daily gain, lb	1.99[b]	2.51[a]
Cow gain, lb/a	140[b]	177[a]
Legume cover, %	0[d]	2[c]
Average available DM, lb/a	2770	2830

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

ALFALFA VARIETY PERFORMANCE IN SOUTHEASTERN KANSAS

Joseph L. Moyer

Summary

A 28-line test seeded in 1998 was cut three times in 2001. Yields ranged from 4.1 to 4.9 tons/a. For the year, 'ZC9751A' yielded significantly (P<.05) more than 'Cimarron 3i' and five other cultivars. Four-year total production was greater (P<.05) from 'WL 324', ZC9751A, '54H55', 'DS9612', and Cimarron 3i, than from 'WL 325 HQ', 'Gold Plus', and 'Spur'.

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 (Parsons silt loam). The plot area was fertilized March 9, 2001 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 12. Plots were sprayed on July 26 with 1.5 pt/a of Poast® with1% Activate®. Webworms invaded in early August, and remaining foliage was clipped August 9.

Moisture was adequate for the early summer. However, rainfall for July and August was substantially below normal, inhibiting regrowth after the August clipping (see weather summary).

Results and Discussion

Yields of the first cutting in 2001 were significantly (P<.05) higher from 'CW 6408' and 'DK 142' than from Cimarron 3i and 'Sendero' (Table 1). Yields of the second cut were higher from ZC9751A than from nine other entries. In the third cut, three entries had higher yield than 'Perry' and DK 142. Total 2001 yield of ZC9751A was higher (P<.05) than total yields of six other entries (Table 1).

Four-year total production was greater (P<.05) from WL 324, ZC9751A, 54H55, DS 9612, and Cimarron 3i, than from WL 325 HQ, Gold Plus, and Spur (Table 2). The eight top producers had a higher four-year yield total than WL 325 HQ. Statewide alfalfa performance test results can be found at:

http://www.oznet.ksu.edu/kscpt.

Table 1. Forage Yields (tons/a @ 12% moisture) of Three Cuttings and the Total in 2001 for the 1998 Alfalfa Variety Test, Mound Valley Unit, Southeast Agricultural Research Center.

Source	Entry	5/9	6/18	7/13	Total
AgriPro Biosciences, Inc	ZC9750A	1.44ab[a]	2.05bc	1.08ab	4.58ab
AgriPro Biosciences, Inc.	ZC9751A	1.48ab	2.37a	1.05abcd	4.90a
AgriPro Biosciences, Inc.	ZC9651	1.53ab	2.10abc	1.06abcd	4.69ab
AgriPro Biosciences, Inc.	AMERIGRAZE 401+Z	1.44ab	2.26ab	0.96abcd	4.66ab
AgriPro Biosciences, Inc.	EMPEROR	1.49ab	2.08bc	0.96abcd	4.53ab
AgriPro Biosciences, Inc.	ZC 9650	1.38ab	2.08bc	1.06abcd	4.52ab
ALLIED - STAR	SENDERO	1.31b	2.12abc	0.96abcd	4.39bc
ALLIED - STAR	SPUR	1.46ab	2.04bc	0.96abcd	4.46b
ALLIED - STAR	STAMINA	1.38ab	2.19abc	0.97abcd	4.54ab
CAL/WEST Seeds	CW 5426 Exp.	1.47ab	2.20ab	0.98abcd	4.66ab
CAL/WEST Seeds	CW 6408 Exp.	1.58a	1.92c	0.96abcd	4.46b
CAL/WEST Seeds	CW 74013 Exp.	1.43ab	2.15abc	1.04abcd	4.62ab
CAL/WEST Seeds	CW 74031 Exp.	1.53ab	2.15abc	1.00abcd	4.69ab
CAL/WEST Seeds	CW 74034 Exp.	1.42ab	2.18abc	1.09a	4.68ab
CAL/WEST Seeds	CW 75044 Exp.	1.42ab	2.11abc	1.06abc	4.60ab
CAL/WEST Seeds	GOLD PLUS	1.42ab	2.04bc	1.00abcd	4.46b
DAIRYLAND	DS9612	1.42ab	2.25ab	1.06abc	4.74ab
DAIRYLAND - MBS	PROGRO	1.48ab	2.22ab	1.03abcd	4.73ab
DEKALB Plant Genetics	DK 141	1.50ab	2.16abc	0.92cd	4.58ab
DEKALB Plant Genetics	DK142	1.56a	2.10bc	0.91d	4.58ab
GARST SEED	631	1.44ab	2.08bc	0.96abcd	4.48b
Germains	WL 324	1.46ab	2.21ab	1.00abcd	4.68ab
Germains	WL 325 HQ	1.44ab	2.16abc	0.96abcd	4.56ab
Germains	WL 326 GZ	1.49ab	2.20ab	0.94bcd	4.62ab
Great Plains Research	CIMARRON 3i	0.96c	2.16abc	0.97abcd	4.10c
PIONEER	54H55	1.46ab	2.17abc	1.04abcd	4.67ab
Public - Kansas AES	Kanza	1.48ab	2.08bc	1.100a	4.67ab
Public - Nebraska AES	Perry	1.56ab	2.16abc	0.91d	4.63ab
Average		1.45	2.14	1.00	4.59

[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 4-Year Total for the 1998 Alfalfa Variety Test, Mound Valley Unit, Southeast Agricultural Research Center.

Source	Entry	1998	1999	2000	4-Year Total
AgriPro Biosciences, Inc	ZC9750A	2.32	5.36	6.87	19.12
AgriPro Biosciences, Inc.	ZC9751A	2.42	5.58	6.94	19.84
AgriPro Biosciences, Inc.	ZC9651	2.36	5.42	6.85	19.32
AgriPro Biosciences, Inc.	AMERIGRAZE 401+Z	2.42	5.75	6.88	19.70
AgriPro Biosciences, Inc.	EMPEROR	2.50	5.45	7.10	19.58
AgriPro Biosciences, Inc.	ZC 9650	2.40	5.46	6.83	19.20
ALLIED - STAR	SENDERO	2.50	5.49	6.77	19.16
ALLIED - STAR	SPUR	2.26	5.36	6.66	18.74
ALLIED - STAR	STAMINA	2.26	5.74	6.84	19.38
CAL/WEST Seeds	CW 5426 Exp.	2.33	5.50	6.62	19.10
CAL/WEST Seeds	CW 6408 Exp.	2.33	5.37	6.74	18.89
CAL/WEST Seeds	CW 74013 Exp.	2.51	5.50	6.86	19.50
CAL/WEST Seeds	CW 74031 Exp.	2.41	5.44	6.78	19.31
CAL/WEST Seeds	CW 74034 Exp.	2.29	5.49	6.83	19.28
CAL/WEST Seeds	CW 75044 Exp.	2.28	5.26	6.75	18.89
CAL/WEST Seeds	GOLD PLUS	2.38	5.24	6.62	18.70
DAIRYLAND	DS9612	2.38	5.69	6.99	19.80
DAIRYLAND - MBS	PROGRO	2.50	5.49	7.02	19.74
DEKALB Plant Genetics	DK 141	2.57	5.44	6.98	19.58
DEKALB Plant Genetics	DK142	2.41	5.51	6.69	19.18
GARST SEED	631	2.52	5.58	6.74	19.32
Germains	WL 324	2.57	5.62	7.01	19.86
Germains	WL 325 HQ	2.32	4.98	6.60	18.46
Germains	WL 326 GZ	2.47	5.41	7.22	19.72
Great Plains Research	CIMARRON 3i	2.46	6.09	7.14	19.79
PIONEER	54H55	2.49	5.36	7.31	19.82
Public - Kansas AES	Kanza	2.50	5.30	6.85	19.32
Public - Nebraska AES	Perry	2.45	5.73	6.50	19.30
Average		2.41	5.49	6.85	19.34
LSD 0.05		0.19	0.39	0.42	0.82

EVALUATION OF TALL FESCUE CULTIVARS

Joseph L. Moyer

Summary

Ten tall fescue cultivars seeded in fall, 1999 were harvested in May and September, 2001. 'Ky 31' EF produced more total forage than 7 other entries. 'FA 102', the highest yielding entry in 2000, yielded less than all other entries in 2001.

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 United States' tall fescue belt.

Experimental Procedures

A 10-line test was seeded with a cone planter in 10-inch rows using 19 lb/a of pure, live seed on September 9, 1999 at the Mound Valley Unit, Southeast Agricultural Research Center. Each plot was 30 ft x 5 ft and plots were arranged in four randomized complete blocks. Soil was a Parsons silt loam (Mollic albaqualf). Fertilizer to supply 150-50-60 lb/a of N-P_2O_5-K_2O was applied to all plots on March 9, 2001.

A 3-ft x 20-ft area was harvested from each plot to a 2-in. height using a flail-type harvester, and weighed on May 22, 2001, after all plots were headed. A forage subsample was collected and dried at 140 ^{0}F for moisture determination and forage was removed from the remainder of the plot at the same height. Fall regrowth was cut using the same procedure on September 19.

Results and Discussion

Forage yield of Cut 1 in 2001 was higher (P<.05) for Ky 31 EF, 'Jesup' NETF, and 'Select' EF than for FA 102 EF and 'AU Triumph' (Table 1). Second-cut forage yield was similar for all entries, averaging 1.02 tons/a.

Total forage production for 2001 was greater (P<.05) for Ky 31 EF, 'Ky 31' HE, and Select EF than for four other entries (Table 1). Total yield of FA 102 EF was less than the yield of any other entry. AU Triumph and 'Seine' EF produced less total forage than five other entries.

Table 1. Forage Yield of Tall Fescue Cultivars in 2001, Mound Valley Unit, Southeast Agricultural Research Center.

Cultivar	Forage Yield 5/22	9/19	Total
	- - - - - - - - - - tons/a@12% moisture	- - - - - - - - - -	
FA 102 EF[1]	2.73	0.92	3.65
Jesup NETF[2]	3.29	0.92	4.21
Ga-5 NETF[2]	3.02	0.97	4.00
AU Triumph	2.88	1.10	3.98
Fuego LE[3]	2.99	1.13	4.12
Seine EF	3.00	0.98	3.98
Select EF	3.27	1.00	4.26
Ky 31 EF	3.31	1.10	4.42
Ky 31 HE[3]	3.17	1.13	4.30
MV 99 EF	3.19	0.92	4.11
Average	3.09	1.02	4.10
LSD(.05)	0.34	NS	0.19

[1]EF=Endophyte-free.
[2]Contains proprietary novel endophyte.
[3]LE= Low-endophyte seed (0-2% infected); HE=High-endophyte seed (80% infected).

PERFORMANCE OF WARM-SEASON, PERENNIAL, FORAGE GRASSES

Joseph L. Moyer and Kenneth W. Kelley

Summary

Eight warm-season, perennial grasses seeded in spring, 1996 was harvested for forage production on July 3, 2001. Production averaged 3.56 tons/a. Big bluestem and switchgrass entries produced more (P<.05) forage than other species. Three years of nitrogen (N) fertilization resulted in higher average yields of 'Kanlow' switchgrass and 'Kaw' big bluestem than five other entries. Eastern gamagrass entries were developing satisfactory stands 5 years after seeding.

Introduction

Warm-season, perennial grasses can fill a production void in forage systems left by cool-season grasses. Reseeding improved varieties of certain native species, such as big bluestem, switchgrass, and indiangrass, could help fill that summer production "gap." Certain introduced, warm-season grasses, such as the so-called Old World bluestems (*Bothriochloa* species), have as much forage potential as big bluestem and are easier to establish, but may lack some quality characteristics.

Experimental Procedures

Warm-season grass plots (30 ft x 5 ft) were seeded with a cone planter in 10-inch rows on May 22, 1996 at the Parsons Unit, Southeast Agricultural Research Center. Fifty lb/a of diammonium phosphate (18-46-0) were applied with the seed material to facilitate movement through the planter. Big bluestem entries were seeded at 10 lb pure, live seed (PLS)/a. Indiangrass and switchgrasses were seeded at 8 lb and 5 lb PLS/a, respectively. 'Pete' eastern gamagrass was seeded with 10 lb material/a. The previous entries were obtained from the USDA-NRCS Plant Materials Center in Manhattan. The two Woodward (WW) entries, 'WW Ironmaster' and 'WW 2745', were obtained from Dr. Chet Dewald, USDA Southern Plains Station, and seeded at 5 lb material/a. The plot area was clipped to control weeds in 1996 and burned in April of 1997, 1998, and 1999. Plots were fertilized with 60 lb N/a in 1997, 1998, and 2000 but not in 1999. A 20 ft x 3 ft area was harvested in early July each year with a Carter flail harvester at a height of 2-3 inches, and the remainder of the area was clipped to the same height.

Results and Discussion

Forage yields from the warm-season cultivar test are shown in Table 1. Stands were generally good except for eastern gamagrass entries. The forage harvested from plots seeded with eastern gamagrass thus contained some forage from weedy grass species. Forage production in 2001 averaged 3.56 tons/a (Table 1). Kaw and 'PI-483446' big bluestems, and Kanlow and 'Blackwell' switchgrasses produced more than WW Ironmaster Old World bluestem, 'Osage' indiangrass, and the eastern gamagrass entries, which lacked full stands.

Average forage yields for the three years when N was applied (1997, 1998, and 2001) are shown in Table 1. Kanlow switchgrass produced more forage than all other entries except for Kaw big bluestem. The entries of eastern gamagrass yielded less than all other entries, partly because stands were poor in 1997 and 1998.

Table 1. Forage Yields of Warm-Season Grass Cultivars, Parsons Unit, Southeast Agricultural Research Center.

		Forage Yield	
Cultivar	Species	2001	3-Year Average
		tons/a@12% moisture	
Kaw	Big bluestem	4.28	3.98
PI-483446	Big bluestem	4.26	3.67
Pete[1]	Eastern gamagrass	3.14	2.61
WW 2745[1]	Eastern gamagrass	2.94	2.64
Osage	Indiangrass	2.87	3.39
WW Ironmaster	Old World bluestem	2.76	3.46
Blackwell	Switchgrass	4.02	3.53
Kanlow	Switchgrass	4.18	4.36
LSD(.05)		0.47	0.46

[1]Fair-poor stand; some of the forage composed of weedy species.

FORAGE PRODUCTION OF BERMUDAGRASS CULTIVARS IN EASTERN KANSAS

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

Summary

Total 2001 production in Ottawa was higher from experimental line LCB84x19-16, 'Midland 99', 'Ozarka', and LCB84x16-66 than for 'Midland', 'Greenfield', 'Guymon', and 'Wrangler'. One entry, 'CD 90160', did not survive the winter of 2000-2001. In Columbus, total 2001 forage yields in sprigged plots were higher ($P<.05$) for Ozarka than for all other cultivars except Midland 99, which yielded more than five other cultivars. Yields of entries in seeded plots were similar (3.5 tons/a, $P>.10$).

Introduction

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

Experimental Procedures

Plots were sprigged at 1-ft intervals with plants in peat pots on April 27, 2000 at the East Central Experiment Field, Ottawa, and on April 28 at the Columbus Unit of the Southeast Agricultural Research Center, except for entry CD 90160, which was seeded at 8 lb/acre of pure, live seed. At the same time, another set of plots at Columbus was seeded with seed-producing cultivars that were also included in the sprigged trial. All plots were 10 x 20 ft each, arranged in four randomized complete blocks. Sprigged plots were subsequently sprayed with 1.4 lb/a of S-metolachlor. Plot coverage by bermudagrass was assessed in August 2000 and in May 2001 at both locations, and July 2001 at Ottawa. One lb/a of 2,4-D was applied to the Columbus plots in April. Application of 60 lb/a of N was made at Ottawa and 120-70-90 lb/a of N-P_2O_5-K_2O at Columbus in April 2001. In early July, 60 lb/a of N was applied at each location. Strips (20 x 3 ft) were cut on July 10, August 15, and November 14, 2001 at Ottawa and June 27 and August 14 at Columbus. Subsamples were collected for determination of moisture.

Results and Discussion

Conditions in the winter of 2000-2001 were difficult for bermudagrass because the previous summer was dry and enabled little growth, and winter was more severe than usual. The spring of 2001 was also unusual in that April was drier and warmer than average, and midsummer was also drier than average. In late summer, Ottawa began to receive some moisture that enabled growth for a late-fall cutting after dormancy but Columbus remained dry until mid-September.

[1]Department of Agronomy, Oklahoma State University, Stillwater.

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

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

Forage yields of the first cutting in Ottawa were higher (P<.05) for the experimental line, LCB 84x19-16, Guymon, and Midland 99 than for five of the other six entries (Table 1). Midland yielded less than six other entries. Second-cut yields were higher for Midland 99 and Ozarka than for the other entries. The three seed-producing types and Greenfield produced less than four other entries.

At the fall dormancy harvest in Ottawa, the experimental LCB84x16-66 yielded more forage and Guymon less than all other entries (P<.05, Table 1). Total 2001 forage production was higher for LCB84x19-16, Midland 99, Ozarka, and LCB 84x16-66 than for Midland, Greenfield, Guymon, and Wrangler. One entry, CD 90160, did not live to produce forage in 2001.

In Columbus, plot coverage of the sprigged plots after the summer of 2000 was most complete for Guymon and Wrangler (Table 1). Poorest coverage was made by LCB84x19-16, which was significantly less than Guymon. The seeded cultivar, CD 90160, had the best coverage in both sets of plots (Tables 2 and 3). The other entries in the seeded plot, Guymon and Wrangler, had less coverage than CD 90160 (Table 3).

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

Forage yields of the first cutting in Columbus were higher (P<.05) for Ozarka than four other cultivars (Table 2). Entry LCB84x16-66 yielded less than the other cultivars except for CD 90160, which winterkilled, and Midland. Second-cut yields were higher for Ozarka and Midland 99 than for the other entries.

Total forage yields in sprigged plots in 2001were higher (P<.05) for Ozarka than for all other cultivars except Midland 99. In turn, Midland 99 produced more total forage than five of the other cultivars. Entry LCB84x16-66 yielded less than the other cultivars except for CD 90160, which winterkilled, and Midland.

Forage yields of seeded plots were similar in 2001, although most forage in plots of CD 90160 consisted of weedy grasses (Table 3). Average total forage produced by the other two cultivars averaged a little more than 3.5 tons/a.

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

	Plot Cover[†]			2001 Forage Yield			
Entry	Aug 2000	May 2001	July 2001	July 10	Aug 15	Nov 14	Total
				- tons per acre @ 12% moisture -			
CD 90160[*]	2.8	- -	- -	- -	- -	- -	- -
Greenfield	1.8	1.2	4.2	2.22	0.50	0.92	3.64
Guymon	3.5	3.0	4.9	3.01	0.44	0.56	4.00
LCB 84x16-66	2.2	1.0	2.2	2.04	1.06	2.40	5.49
LCB 84x19-16	3.0	2.0	4.0	3.14	1.10	2.02	6.27
Midland	2.2	0.1	1.6	1.37	0.71	1.40	3.47
Midland 99	4.2	1.2	3.9	2.90	1.75	1.51	6.15
Wrangler	2.0	2.0	4.8	2.87	0.30	0.88	4.04
Ozarka	1.8	1.0	2.2	2.00	1.71	1.98	5.68
Average	2.6	1.5	3.5	2.44	0.94	1.46	4.84
LSD 0.05	0.7	0.7	0.9	0.66	0.34	0.32	0.99

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

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

	Plot Cover†		2001 Forage Yield		
Entry	Aug 2000	May 2001	June 27	Aug 14	Total
			- tons per acre @ 12% moisture -		
CD 90160*	4.2	1.0	- -	- -	- -
Greenfield	2.8	3.8	3.14	1.55	4.69
Guymon	3.8	3.5	3.30	1.62	4.92
LCB 84x16-66	2.5	2.0	1.98	1.76	3.75
LCB 84x19-16	2.2	2.8	2.58	2.29	4.87
Midland	2.5	2.2	2.17	1.96	4.12
Midland 99	2.8	2.8	3.10	2.73	5.84
Wrangler	3.2	3.5	3.34	2.00	5.34
74 x 12-6	2.5	3.0	3.70	2.74	6.45
Average	2.9	2.7	2.91	2.08	5.00
LSD 0.05	1.3	0.7	0.94	0.39	1.04

* Plot established from seed.
† Ratings from 0 to 5, where 5=100% coverage.

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

	Plot Cover*		2001 Forage Yield		
Entry	Aug 2000	May 2001	June 27	Aug 14	Total
			- tons per acre @ 12% moisture -		
CD 90160	5.0†	1.0	2.04†	1.47†	3.51†
Guymon	3.5	3.0	2.21	1.41	3.62
Wrangler	3.5	3.0	1.88	1.50	3.38
Average	4.0	2.3	2.04	1.46	3.50
LSD 0.05	1.0	0.1	NS	NS	NS

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

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

In the year of application (2000), forage yield was increased by 30% from the first 45 lb/a increment of N application and by another 21% with the next 45 lb. In 2001, yield increased 26% with the residual of 90 lb/a of N applied in 2000 compared to no N, but was not increased by 45 lb/a of N applied in 2000. Knife N application in 2000 at the 90 lb/a rate resulted in 23% higher yields compared to broadcast application at the same rate, and residual effects of the 2000 knife placement yielded 17% more than broadcast in 2001.

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 may thus respond well to more intensive management practices, such as added 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 (22-year-old) 'Pete' eastern gamagrass was fertilized with 54 lb P_2O_5/a and 61 lb K_2O/a each year from 1992 to 2000, and burned each spring except 1996. In 2000, nitrogen (urea-ammonium nitrate, 28% N) treatments of 0, 45, or 90 lb/a were applied on May 17 to 8 ft x 20 ft plots by broadcast or knife (4-inch) placement. Nitrogen was not applied in 2001 so that residual responses could be tested.

Plots were cut with a flail-type harvester in late June and mid August from the 2-cut system, and July 10 from the 1-cut system. Yields were determined from a 3 ft x 20 ft strip of each plot, with a subsample taken for moisture determination.

Results and Discussion

Yields in 2000 increased ($P<.05$) by 30% with the first 45 lb/a increment of N, and increased an additional 21% with the next 45-lb increment (Fig. 1). The residual from application of 90 lb/a of N in 2000 compared to no N resulted in 26% greater ($P<.05$) forage yield in 2001. Also in 2001, there was a 26% higher yield for residual of the 90-lb N rate compared to 45 lb/a of N applied in 2000 for the 2-cut system, but not for the 1-cut system or overall (data not shown).

Knifing N in 2000 resulted in significant ($P<.05$) yield interactions in 2000 between N rate and N placement factors. In 2000, total yield increased ($P<.05$) with each increment of added N, and knife placement increased yield more than broadcast at the 90 lb/a N rate (Fig. 2). In 2001, yield was increased ($P<.05$) by residual effects of 2000 knife placement of N similarly at all N rates.

The two harvest systems resulted in similar total yields in both years. However, in 2001, there was an interaction between harvest system and the residual from N application treatments. That is, the 1-cut harvest system responded to the first 45 lb/a of N applied in 2000 with increased ($P<.05$) yield whereas the 2-cut system did not (data not shown).

Results for this year of treatment (2000) and the subsequent year of residual effects (2001) are consistent with earlier results from this study site (see Agricultural Research Reports SRP 733 (1995), pp. 41-43; SRP 809 (1998), pp. 19-21; and SRP 853 (2000), pp. 25-26). In summarizing this and previous data, nitrogen increased yield by 30-60% with the first 45 lb/a increment of N and by an additional 14-45% with the next 45-lb increment. Knife application of 90 lb N/a often increased yield compared to broadcast application at the same rate, particularly in the 2-cut harvest system. The 1-cut harvest system yielded more than the 2-cut system half of the time; otherwise the systems were similar. Residual responses of N placement and especially N rate were obtained the year after treatment on all three occasions, and residual effects were found up to 3 years after treatment.

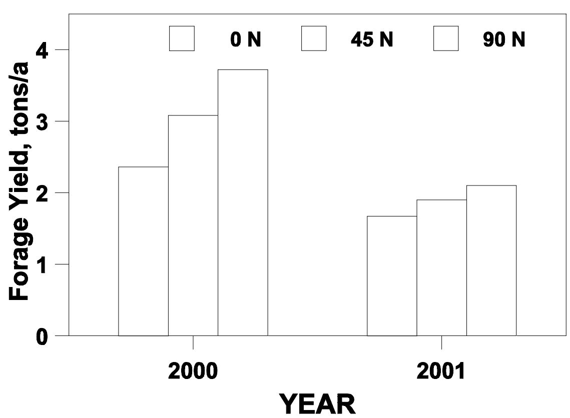

Figure 1. Eastern gamagrass forage yields (12% moisture) for 2000 and 2001 from different N application rates in 2000, Southeast Agricultural Research Center.

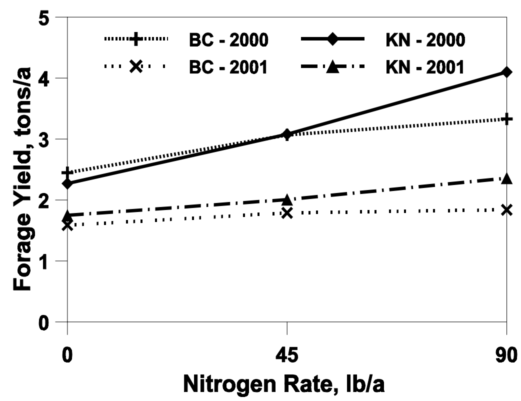

Figure 2. Eastern gamagrass forage yields (12% moisture) for 2000 and 2001 from different N application methods and rates in 2000, Southeast Agricultural Research Center.

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

Daniel W. Sweeney and Charles W. Marr[1]

Summary

In 2001, irrigation did not increase the number of harvestable ears, but did increase individual ear weight. Early planting increased total fresh weight and individual ear weight. Nitrogen applied at 120 lb/a increased number of ears and total fresh weight.

Introduction

Field corn responds to irrigation and timing of water deficits can affect yield components. Sweet corn is considered as a possible value-added, alternative crop for producers. Even though large irrigation sources, such as aquifers, are lacking in southeastern Kansas, supplemental irrigation could be supplied from the substantial number of small lakes and ponds in the area. 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 were three N rates – 40, 80, and 120 lb/a. Sweet corn was planted on April 25 and May 15, 2001. Sweet corn from the first planting date was picked on July 6 and 11 and that from the second planting date was picked on July 24 and 30, 2001.

Results and Discussion

Although the total number of ears was unaffected by planting date, the total fresh weight and individual ear weight were greater for sweet corn planted in late April than that planted in mid May (Table 1). Irrigation did not increase the total number of ears in 2001 perhaps because of approximately 50% greater than normal rainfall during June. However, individual ear weights were significantly greater with irrigations at V12 or R1 compared to no irrigation. Nitrogen fertilization at 120 lb/a resulted in greater than 10% more ears and more total fresh weight. However, individual ear weight was not affected by N fertilization rate.

[1] Department of Horticulture, Forestry and Recreation Resources, KSU.

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

Treatment	Total Ears	Total Fresh Weight	Individual Ear Weight
	no./a	ton/a	g/ear
Planting Date			
Date 1	19900	5.52	252
Date 2	19300	4.77	225
LSD $_{(0.05)}$	NS	0.53	10
Irrigation Scheme			
None	19300	4.81	224
V12 (2")	20000	5.41	246
R1 (2")	18800	5.08	246
V12-R1 (1" at each)	20400	5.30	236
LSD $_{(0.05)}$	NS	NS	14
N Rate, lb/a			
40	18400	4.80	239
80	18900	5.05	238
120	21100	5.59	237
LSD $_{(0.05)}$	1500	0.38	NS

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

Daniel W. Sweeney

Summary

In 2001, grain sorghum yields were unaffected by tillage. Yields were increased by approximately 50% by nitrogen fertilization, although there were no differences among N sources.

Introduction

Many rotational systems are employed in southeastern Kansas. This experiment was designed to determine the long-term effect of selected tillage and nitrogen (N) fertilization options on the yields of grain sorghum and soybean in rotation.

Experimental Procedures

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

Results and Discussion

In 2001, grain sorghum yields averaged near 70 bu/a (data not shown). Yields were unaffected by tillage. Applying N in any form increased grain sorghum yields by 25-30 bu/a, but there were no differences among N sources.

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

Daniel W. Sweeney

Summary

In 2001, antecedent soil K test levels had a greater effect on yield and yield components than soil P test 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, May 30, 2000, and June 18, 2001 at approximately 140,000 seed/a with no tillage.

Results and Discussion

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

In 2001, environmental conditions were somewhat more favorable than 1999 and 2000, resulting in soybean yields greater than 20 bu/a (Table 1). Although greater soil P levels appeared to slightly increase yield, the difference was not significant. However, increased number of pods/plant with increased soil test P may suggest a potential for increased yield under better growing conditions. Soil K level increased glyphosate-tolerant soybean yield by as much as 37% compared to plots that have never received K fertilizer. This yield increase appeared to be related to increases in seed weight, pods/plant, and seeds/pod as soil K level increased.

Table 1. Effect of Antecedent Soil P and K Test Levels on Glyphosate-tolerant Soybean Yield and Yield Components, Southeast Agricultural Research Center, 2001.

Initial Soil Test Level	Yield	Population	Seed Weight	Pods/plant	Seeds/pod
	bu/a	plants/a	mg		
P (ppm)	22.5	98 000	133	21	1.8
5	25.4	100 000	130	28	1.7
11	24.2	96 000	125	30	1.8
28	NS	NS	NS	4	NS
LSD $_{(0.05)}$					
K (ppm)					
52	20.1	99 000	119	22	1.6
85	24.4	96 000	132	29	1.8
157	27.6	98 000	137	28	1.9
LSD $_{(0.05)}$	3.5	NS	9	4	0.2
PxK Interaction	NS	NS	NS	NS	NS

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 greater with late fall application than with late winter application at the 150 lb/a N rate. Forage aftermath was increased with increasing N rates up to 150 lb/a and subsurface knife applications, but was unaffected by N timing.

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, Dec. 6, 1999, and Dec. 4, 2000) and late winter (Feb. 24, 1999, Mar. 1, 2000, and Mar. 6, 2001). 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, June 8, 2000, and June 11, 2001 and forage aftermath was harvested on June 14, 1999, June 12, 2000, and June 14, 2001.

Results and Discussion

In 2001, late fall application of N at rates up to 150 lb/a resulted in increased clean seed yield (Figure 1). With late winter application, clean seed yield increased with increasing rates to 100 lb N/a but did not appear to benefit from higher N rates. This likely was associated with the number of panicles/m^2.

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 (Figure 2). Subsurface placement by knifing resulted in more than 0.2 tons/a additional aftermath forage than broadcast surface or spoke subsurface N applications in 2001, with no effect due to timing of N fertilization (data not shown).

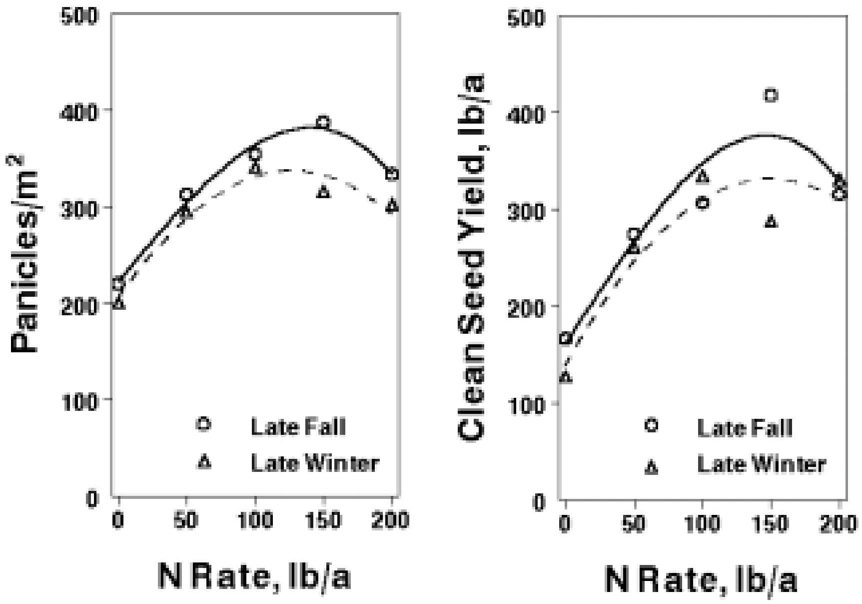

Figure 1. Effects of Nitrogen Timing and Rate on Clean Seed Yield and Panicle Count of Endophyte-Free Tall Fescue in 2001, Southeast Agricultural Research Center.

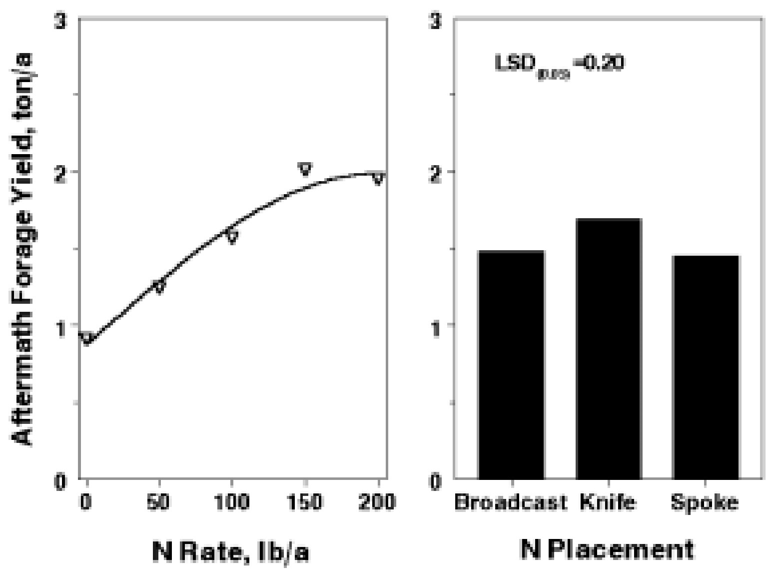

Figure 2. Effects of Nitrogen Rate and Placement on Forage Aftermath following Seed Harvest of Endophyte-Free Tall Fescue in 2001, Southeast Agricultural Research Center.

INTEGRATED AGRICULTURAL MANAGEMENT SYSTEMS: NEOSHO RIVER BASIN SITE[1]

Daniel W. Sweeney and Gary L. Kilgore[2]

Summary

In 2001, results were variable. Until additional data are obtained, results should be viewed with caution.

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. Grain sorghum was planted in 2000 and 2001.

At the downslope end of each 1-acre plot, a soil berm was constructed to divert surface water flow through a weir. In March 2001, soil berms were planted with fescue grass and covered with erosion matting material to minimize the potential for affecting sediment values from runoff samples. 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 2001, during the time when the instruments were in the field (early April through

[1]This research has been partially funded by the Kansas Fertilizer Research Fund and the Kansas Corn, Sorghum, Soybean, and Wheat Commissions.

[2]KSU Southeast Area Extension Office, Chanute.

early November), nine events occurred after the herbicide and fertilizer applications were applied in which samples and flow measurements were obtained from at least one replication of each treatment. Until additional data have been obtained, average results reported in Table 1 should be viewed with caution.

Table 1. Flow Amount, Nutrients, Herbicides, and Total Suspended Solids in Runoff from Integrated Agricultural Management Systems (IAMS): Water Quality Project - Neosho County Site, 2001.

Tillage	Mgmt.	Flow	NH_4-N	NO_3-N	Total-N	Total-P	Ortho-P	Atrazine	Metola-chlor	TSS
		Average for nine runoff events								
		- ft^3-	------------------ ppm ------------------				--------------- ppb -----------------			mg/L
Conv.	Low	1490	0.35	1.42	3.43	0.61	353	14.4	9.0	383
	High	1987	0.38	1.60	3.53	0.96	747	15.3	11.5	259
Notill	Low	997	0.71	2.35	4.46	1.05	860	83.3	20.0	170
	High	2968	0.38	2.58	4.73	0.95	646	15.5	21.1	355
		Total for nine runoff events								
		acre-in	----------------------------------- g/acre ---							lb/a
Conv.	Low	3.69	79.0	585	1463	291	163	3.80	3.10	545
	High	4.93	109.3	815	1760	504	375	5.38	4.33	348
Notill	Low	2.47	73.9	626	1030	247	204	8.78	7.26	108
	High	7.09	184.7	2205	3836	706	413	3.67	7.22	793

EVALUATION OF STARTER AND POP-UP FERTILIZERS ON GRAIN SORGHUM PLANTED NO-TILL[1]

Daniel W. Sweeney

Summary

In 2000 and 2001, starter and pop-up fertilizers had little effect on grain sorghum growth, yield, or yield components.

Introduction

Starter and pop-up fertilizers have the potential to improve early growth of grain sorghum, thus increasing yield. The objective of these experiments was to determine the effect of starter and pop-up fertilizers on the production and growth of grain sorghum planted no-till in southeastern Kansas.

Experimental Procedures

Two experiments were established at the Mound Valley Field of the Kansas State University Southeast Agricultural Research Center. The soil was a Parsons silt loam, a typical claypan soil of the area. Initial soil test values were 6.9 pH (1:1 soil:water), 31 ppm P (Bray-1), and 135 ppm K (1M ammonium acetate).

Experiment 1 was a 3 x 4 factorial arrangement of a randomized complete block design with four replications. The three placements of the starter fertilizer were 2x2, 2x0 (two inches to the side of the row on the surface), and 0x0 (over the row on the surface). The four starter rates were 15-30-10, 30-30-10, 45-30-10, and 60-30-10. All 12 treatments had additional UAN broadcast prior to planting for a total N rate of 120 lb/a. Two additional reference treatments were included in each replication: 120-30-10 applied broadcast before planting and a 0-0-0 control. Experiment 2 was a 3 x 2 factorial arrangement of a randomized complete block design with four replications. The three pop-up fertilizer rates were 5-15-5, 15-15-5, and 30-15-5. The second factor was NBPT (urease inhibitor) applied at 0 or 2.4 qts per ton of 28% UAN. These six treatments also had additional UAN broadcast prior to planting to make a total N rate of 120 lb/a. Three additional reference treatments were included in each replication: 120-15-5 applied broadcast before planting with or without NBPT and a 0-0-0 control. In both experiments, fertilizer solutions were formulated using UAN (28% N) and 7-21-7.

Pioneer 8500c grain sorghum was planted in 30-in. rows in both experiments in both years. Planting dates for Experiment 1 were June 13, 2000 and May 23, 2001 and for Experiment 2 were July 5, 2000 and May 23, 2001. In both experiments, whole plant samples were taken at the 8-leaf, boot, soft dough, and physiological maturity (black layer) growth stages. Yield was determined by harvesting with a plot combine. In addition, initial stand, head count, and seed

[1]This research was partially funded by the Fluid Fertilizer Foundation and the Kansas Fertilizer Research Fund.

weight were measured and the number of kernels per head was calculated.

Results and Discussion

Environmental conditions in both years were generally hot and dry, especially in early July, all of August, and early September. Conditions were more severe in 2000, but even in 2001 plants appeared stressed by low rainfall amounts that likely did not satisfy ET requirements.

Experiment 1

Across both years, the main effects of starter placement or rate or their interaction did not significantly affect dry matter production at the 8-leaf, boot, soft dough, or physiological maturity growth stages. Contrasts showed no differences between starter treatments compared to the 120-30-10 broadcast reference treatment. However, adding fertilizer compared to the unfertilized control resulted in 30-50% greater dry matter production.

Similar to dry matter production, across both years, the main effects of starter placement or rate or their interaction did not significantly affect yield or yield components. Contrasts (p=0.05) show that applying starter fertilizers did not improve yield or alter yield components compared to the 120-30-10 broadcast reference treatment. However, at p=0.10, yield was significantly greater when 120-30-15 was broadcast prior to planting than when using a starter. Yield was approximately doubled by adding fertilizer compared to the unfertilized control primarily because of increased number of kernels/head.

Experiment II

Across years, pop-up fertilizer rate, NBPT, or their interaction did not affect dry matter production. Contrasts showed that pop-up fertilization did not increase dry matter over that obtained by broadcasting 120-15-5 prior to planting. Also, fertilization appeared to result in greater dry matter only at boot and soft dough compared to the no-fertilizer control.

Increasing the pop-up rate decreased the number of heads/a, but this was not significantly reflected in yield, although the trend was suggestive (data not shown). Contrasts again failed to show any difference between pop-up fertilization and broadcasting 120-15-5 prior to planting. Fertilization increased yield by increasing the number of kernels/head.

Poor growing conditions and late planting dates appeared to result in little effect of starter or pop-up fertilizers on grain sorghum growth, yield, or yield components in the claypan soils of southeastern Kansas.

EFFECTS OF PREVIOUS CROP, TILLAGE, NITROGEN RATE, AND NITROGEN PLACEMENT METHOD ON WINTER WHEAT GRAIN YIELD

Kenneth W. Kelley and Daniel W. Sweeney

Summary

Wheat yields were influenced significantly by previous crop, tillage method, fertilizer nitrogen (N) placement, and N rate. In the first study (Tables 1and 2), where both reduced- and no-tillage systems were evaluated, grain yields averaged over 5 years were highest for wheat following soybean with reduced tillage and lowest for wheat planted no-till following grain sorghum; however, in 2001, yields varied somewhat from the 5-yr average. Applying fertilizer N (28% UAN) below crop residues with a coulter-knife applicator also significantly increased grain yield compared with broadcast fertilizer N treatments, regardless of previous crop or tillage system. In the second study (Table 3), where only no-tillage was evaluated, wheat yields also were influenced by previous crop and fertilizer N and phosphorus (P) application method and N rate. Grain yields averaged nearly 52 bu/a following short-season corn and grain sorghum and 65 bu/a following soybean. Averaged over previous crops and N rates, grain yields were highest with knifed N-P applications, intermediate for surface strip banding, and lowest for surface broadcast treatments.

Introduction

In southeastern Kansas, wheat often is planted after a summer crop as a means of crop rotation; however, previous crop, as well as the amount of plant residues remaining after harvest, affects fertilizer nitrogen (N) efficiency. Placement of fertilizer also becomes an important factor, especially for wheat planted no-till into previous crop residues. When fertilizer N, such as urea or liquid urea ammonium nitrate solutions, is surface-applied, there is potential for greater N loss through volatilization and immobilization, particularly when residue levels are high. This research seeks to evaluate how the previous crop (corn, grain sorghum, or soybean) affects the utilization of applied N fertilizer by winter wheat. Placement of fertilizer as well as various N rates were evaluated in both reduced- and no-till previous cropping systems.

Experimental Procedures

Conventional and No-Tillage

The experiment was a split-plot design with previous crop (grain sorghum and soybean) and tillage method (no-till and reduced) as main plots and a factorial arrangement of N rates (60 and 120 lbs/a) and N placement methods (broadcast and knifed) as subplots. All N treatments were fall-applied and, in reduced tillage, were incorporated with a tandem disk and/or field cultivator prior to wheat planting. Urea ammonium nitrate 28% N solution (UAN) was the N source, except for one comparison treatment where urea was split-applied (fall and late-winter). Knifed N treatments were banded on 15-in. centers with a coulter-knife applicator at a depth of 4 to 6 in. Phosphorus and potassium fertilizer were broadcast applied on all plots prior to planting. Both reduced and no-till plots were planted with a no-till drill.

No-Tillage

The experiment was a split-plot design in which the main plots were previous crops (corn, grain sorghum, and soybean) and subplots included a factorial arrangement of four N rates (20, 40, 80, and 120 lbs N/a) with three N-P application methods - 1) liquid N and P knifed on 15-in. centers at a depth of 4 to 6 in., 2) liquid N and P surface-applied in 15-in. strip bands, and 3) liquid N and P broadcast on soil surface. Phosphorus (P) was applied at a constant rate of 68 lbs P_20_5/a, except for the control plot. Nitrogen source was liquid 28% N and P source was liquid 10-34-0. Potassium fertilizer was broadcast applied to all treatments at a constant rate of 120 lbs K_20/a. All fertilizer was fall-applied prior to planting. Seeding rate was 100 lbs/a.

Results and Discussion

Conventional and No-Tillage (Tables 1 and 2)

Wheat yields in 2001 (Table 1) varied somewhat from the average 5-yr grain data (Table 2). In 2001, grain yields were relatively high and differences between previous crop, tillage method, and N fertilizer application method were smaller than for the 5-yr average. However, significant interactions occurred among treatment effects. When wheat followed grain sorghum, grain yields were generally highest where fertilizer N was knifed below crop residues. However, when wheat followed soybean, yields were often higher where fertilizer N was broadcast applied. Rainfall was above normal in the fall of 2000 after wheat planting, which likely moved broadcast N below the soil surface. Also, in 2000, soybean was not harvested for grain because of summer drought conditions. Thus, residual soil N levels were higher than normal, which resulted in significantly greater wheat lodging where fertilizer N was knifed below residues, especially at the higher N rate.

Wheat yields for the 5-yr period (1993, 1995, 1997, 1999, and 2001) were influenced significantly by previous crop, tillage method, N rate, and N placement (Table 2). Yields averaged 7 bu/a higher for wheat following soybean compared to wheat following grain sorghum. Reduced tillage (disking) resulted in slightly higher grain yield than no-till, regardless of previous crop. Fertilizer N placement and N rate also affected grain yields for all previous crop and tillage systems. Grain yields were significantly higher when liquid 28% N was placed below crop residues with a coulter-knife applicator compared with broadcast N treatments, regardless of previous crop or tillage system. Grain yield results suggest that wheat was able to utilize sub-surface knifed N applications more efficiently than fertilizer applied on the soil surface. When wheat followed grain sorghum, the split application (fall and late-winter) of urea, gave higher yields than the preplant broadcast treatment at the same N rate of 120 lbs/a. Where wheat followed grain sorghum, fertilizer N likely was immobilized to a greater extent because of higher residue levels compared to soybean.

No-Tillage (Table 3)

When wheat was planted no-till, yields were influenced significantly by previous crop, N-P application method, and N rate (Table 3). Grain yields averaged 52 bu/a following short-season corn or grain sorghum and 65 bu/a following soybean. Averaged over previous crops and N rates, grain yields were highest with knifed N-P applications, intermediate for surface strip banding, and lowest for surface broadcast treatments. Grain yields also increased with increasing N rates, except for the knifed application following soybean. When wheat followed soybean, the 80 lb N rate was nearly the same as the 120 lb N rate. However, grain yield differences among previous crops were greater at the lower N rates for all N-P application methods.

Soil samples taken in the fall after harvest and before wheat fertilization showed that residual nitrate-N levels in the top 12 in. of soil were 10 ppm following corn and grain sorghum and 26 ppm following soybean. Ammonium-N levels were similar across all previous crops, averaging slightly less than 20 ppm in the top 12 in. Soil organic matter averaged 2.7% (0 to 6 in.), while soil P level was 20 ppm in the top 6 in. and 5 ppm at the 6 to 12 in. depth.

Although above normal rainfall occurred in the fall after planting, yield results suggest that N losses from leaching or denitrification were minimal at this site, where soil slope prevented ponding of surface water. In this study, previous crop residues did not appear to affect wheat germination or early seedling growth through the process of allelopathy. Thus, wheat yield differences between previous crops and N-P placement methods appear to be primarily related to greater N availability of N following soybean, and to immobilization of applied N following higher residue crops, such as grain sorghum and corn. However, effects of previous crop on wheat yields were greatly reduced when fertilizer N (120 lb/a) was knifed below crop residues.

Table 1. Effects of Previous Crop, Tillage, Nitrogen Rate, and Nitrogen Placement Method on Hard Winter Wheat Grain Yield, Parsons, KS, 2001.

			Wheat Yield after			
N	N	N	Grain Sorghum		Soybean	
Rate	Method	Source	RT	NT	RT	NT
lb/a			-------------------- bu/a --------------------			
0	---	---	21.3	25.4	54.2	51.2
60	B'cast	UAN	57.8	55.4	64.4	71.1
120	B'cast	UAN	66.8	73.1	57.3	67.6
60	Knife	UAN	64.5	66.2	60.8	66.0
120	Knife	UAN	71.8	69.0	62.6	61.5
120[1]	B'cast	Urea	65.4	70.2	61.5	65.9
Avg.			57.9	59.9	60.1	63.9
Means: (No N and 120 N as urea omitted)						
Grain sorghum				65.6		
Soybean				63.9		
LSD (0.05)				NS		
Reduced tillage				63.2		
No-tillage				66.2		
LSD (0.05)				NS		
B'cast				64.2		
Knife				65.3		
LSD (0.05)				NS		
60 lb N/a				63.3		
120 lb N/a				66.2		
LSD (0.05)				2.0		

[1]60 lb N/a applied in the fall and 60 lb N/a top-dressed in late Feb.
UAN = urea ammonium nitrate 28% N solution.
NT = no tillage, RT = reduced tillage (disk)

Table 2. Effects of Previous Crop, Tillage, Nitrogen Rate, and Nitrogen Placement Method on Hard Winter Wheat Grain Yield, Parsons, KS, 5-yr average.

			Wheat Yield after			
			Grain Sorghum		Soybean	
N Rate	N Method	N Source	RT	NT	RT	NT
lb/a			-------------------- bu/a --------------------			
0	---	---	18.8	17.7	34.8	31.3
60	B'cast	UAN	35.2	30.5	45.5	41.8
120	B'cast	UAN	46.3	44.3	52.2	51.5
60	Knife	UAN	41.8	41.4	50.3	49.0
120	Knife	UAN	53.9	51.8	58.8	54.6
120[1]	B'cast	Urea	50.6	46.6	53.8	50.3
Avg.			41.1	38.7	49.2	46.4
Means: (No N and 120 N as urea omitted)						
Grain sorghum				43.2		
Soybean				50.4		
LSD (0.05)				1.0		
Reduced tillage				48.0		
No-tillage				45.6		
LSD (0.05)				1.0		
B'cast				43.4		
Knife				50.2		
LSD (0.05)				0.6		
60 lb N/a				41.9		
120 lb N/a				51.7		
LSD (0.05)				0.6		

[1]60 lb N/a applied in the fall and 60 lb N/a top-dressed in late Feb.
UAN = urea ammonium nitrate 28% N solution.
NT = no tillage, RT = reduced tillage (disk)

Table 3. Effects of Previous Crop, Nitrogen and Phosphorus Placement Method, and N Rate on Hard Winter Wheat Grain Yield, Parsons, KS, 2001.

N and P	Fertilizer Rate		Wheat Yield after		
Applic. Method	N	P_2O_5	Corn	Grain Sorghum	Soybean
	----- lbs/a -----		----------------------------- bu/a -----------------------------		
Knife	20	68	41.5	43.6	58.5
Knife	40	68	52.0	51.0	65.9
Knife	80	68	66.2	65.1	71.4
Knife	120	68	72.3	70.2	69.9
Strip Band	20	68	36.4	38.0	56.6
Strip Band	40	68	45.0	45.9	63.3
Strip Band	80	68	55.1	57.7	69.2
Strip Band	120	68	64.9	67.5	72.5
Broadcast	20	68	36.0	32.9	56.5
Broadcast	40	68	45.1	40.4	61.7
Broadcast	80	68	52.9	55.9	67.6
Broadcast	120	68	61.1	60.3	69.9
Knife Control	0	0	30.8	32.1	55.8
Control	0	0	29.6	27.6	57.4
Means: (controls omitted)			52.4	52.4	65.2
N-P application method					
Knife			58.0	57.5	66.4
Strip Band			50.3	52.3	65.4
Broadcast			48.7	47.4	63.9
LSD (0.05)	(Same crop)		1.7	1.7	1.7
	(Different crop)		2.2	2.2	2.2
N Rate (lb/a)					
20			37.9	38.2	57.2
40			47.4	45.8	63.6
80			58.0	59.5	69.4
120			66.1	66.0	70.7
LSD (0.05)	(Same crop)		2.0	2.0	2.0
	(Different crop)		2.5	2.5	2.5

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

Kenneth W. Kelley and Daniel W. Sweeney

Summary

Wheat yields have been similar with different previous crops (corn, grain sorghum, and soybean) when fertilizer N and P were knifed below crop residues. Wheat yields also were affected very little by tillage method (no-till vs. disk). Previous crop before wheat has significantly influenced double-crop soybean yields in nearly all years. Soybean yields have been highest when corn and grain sorghum preceded wheat and lowest when soybean preceded wheat.

Introduction

Winter wheat is often rotated with other crops, such as soybean, grain sorghum, and corn, to diversify cropping systems in southeastern Kansas. Wheat typically is planted with reduced tillage, although the acreage of wheat planted no-tillage has increased significantly in recent years. In extreme southeastern Kansas, double-crop soybean traditionally is planted following wheat harvest. Like wheat, more double-crop acreage is being planted with conservation tillage methods. This research investigates the combined effects of both crop rotation and tillage on yields of winter wheat and double-crop soybean in a 2-yr crop rotation.

Experimental Procedures

In 1996, a 2-yr crop rotation study consisting of [corn / grain sorghum / soybean] - wheat - double-crop soybean] was started at the Columbus Unit on two adjacent sites. Tillage treatments include: 1) plant all crops with conventional tillage and 2) plant all crops with no-tillage. Fertilizer N (120 lb N/a as liquid 28 % N) and P (68 lb P_20_5/a as liquid 10 - 34 - 0) were applied preplant at a depth of 4 to 6 in. with a coulter-knife applicator. Potassium fertilizer (120 lb K_20/a) was broadcast applied. In conventional tillage systems, disk tillage was performed prior to fertilizer application and planting. Wheat was planted with a no-till drill in 7.5-in. rows at a seeding rate of 90 to 120 lb/a, depending on date of planting. In the no-till system, weeds that emerged prior to planting were controlled with a preplant application of glyphosate (1 pt/a). In early spring, wheat was sprayed with a postemerge herbicide to control broadleaf weeds when needed.

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

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

Results and Discussion

Wheat Results (Table 1)

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

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

Double-crop Soybean Results (Table 2)

Previous crop before wheat has significantly influenced double-crop soybean yields in nearly all years. Soybean yields have been highest when corn and grain sorghum preceded wheat and lowest when soybean preceded wheat. Nutrient analyses of double-crop soybean plants has shown very little difference in nutrient uptake between previous crops. More research is needed to determine why the observed yield response occurs.

In the initial years of the study, double-crop soybean yields were similar between reduced and no-till methods. However, in the last few years, which have been drier than normal during the growing season, double-crop soybean yields have been significantly higher when planted no-till. Initially, there was concern that soybean root growth would be reduced in no-till systems, but recent data suggest that no-till planted double-crop soybean are better able to withstand drought stress conditions. Additional research is planned to further evaluate the effects of conservation management practices on soil quality, such as soil carbon and organic matter levels.

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

Previous crop before wheat	Tillage	Winter wheat yield 1997	1998	1999	2000	2001	5-yr avg
		---------- bu/a ----------					
Corn	No-till	36.7	57.2	40.1	61.9	70.8	53.3
Corn	Disk	39.1	61.8	40.5	61.6	65.9	53.8
Grain sorghum	No-till	34.1	59.1	40.0	55.1	70.8	51.8
Grain sorghum	Disk	37.5	61.2	44.6	59.8	68.2	54.3
Soybean	No-till	36.4	61.6	37.5	65.0	73.7	54.8
Soybean	Disk	36.0	63.1	43.4	63.1	72.3	55.6
<u>Means:</u>							
Corn		37.9	59.5	40.3	61.8	68.4	53.6
Grain sorghum		35.8	60.1	42.3	57.5	69.5	53.0
Soybean		36.2	62.3	40.5	64.0	73.0	55.2
LSD (0.05)		NS	2.4	NS	3.2	NS	
No-till		35.7	59.3	39.2	60.6	71.7	53.3
Disk		37.5	62.0	42.8	61.5	68.8	54.5
LSD (0.05)		NS	2.0	NS	NS	NS	
Planting date		12/12	10/22	11/25	10/25	10/25	

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

Previous crop before wheat	Tillage	Double-crop soybean yield 1997	1998	1999	2000	2001	4-yr avg†
		---------- bu/a ----------					
Corn	No-till	38.5	31.8	27.7	9.4	36.9	33.7
Corn	Disk	39.3	31.2	24.5	10.0	30.4	31.4
Grain sorghum	No-till	39.4	30.9	28.4	11.5	36.8	33.9
Grain sorghum	Disk	40.3	32.2	26.0	9.8	32.2	32.7
Soybean	No-till	33.2	26.2	26.9	9.7	31.7	29.5
Soybean	Disk	32.8	26.3	20.8	8.6	25.8	26.4
Means:							
Corn		38.9	31.5	26.1	9.7	33.7	32.6
Grain sorghum		39.9	31.6	27.2	10.7	34.5	33.3
Soybean		33.0	26.3	23.9	9.1	28.7	28.0
LSD (0.05)		2.3	3.0	2.4	1.3	2.6	
No-till		37.0	29.6	27.7	10.2	35.1	32.4
Disk		37.5	29.9	23.8	9.4	29.5	30.2
LSD (0.05)		NS	NS	1.9	NS	2.2	

† 2000 yields, which were influenced by summer drought and early freeze damage, were not included in the 4-yr average.

EFFECTS OF CROPPING SEQUENCES ON SOYBEAN YIELD

Kenneth W. Kelley

Summary

Cropping sequence had a significant effect on soybean yield. Yields declined significantly as soybean was grown more frequently in the crop 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 yields are affected by various cropping sequences and yearly weather conditions.

Experimental Procedures

Beginning in 1992, various sequences of soybean and grain sorghum have been compared at the Parsons Unit. Treatments include: 1) continuous soybean 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 often not significantly different from soybean following grain sorghum in the 2-year rotation. Yields declined as soybean was grown more frequently in the crop rotation.

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

	Soybean Yield				
Soybean Sequence	1997	1998	1999	2000	2001
	---bu/a---				
Soybean - grain sorghum (2-yr rot.)	42.5	30.0	27.4	13.7	32.8
First-year soybean	40.9	30.4	29.5	14.1	34.0
Second-year soybean	42.8	29.3	27.5	14.0	29.3
Third-year soybean	43.6	27.1	26.5	12.8	28.0
Fourth-year soybean	40.1	25.7	25.6	12.7	27.4
Fifth-year soybean	42.3	25.3	25.0	12.1	26.7
Continuous soybean	39.5	24.3	23.6	11.3	26.1
LSD (0.05):	NS	1.3	1.2	0.8	1.1

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

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

	Grain Yield			
Soil pH	Grain Sorghum (3-yr avg)	Full-Season Soy (3-yr avg)	Double-Crop Soy (2-yr avg)	Wheat (2-yr avg)
(0 - 6 in.)	bu/a	bu/a	bu/a	bu/a
4.9	78.4	26.5	17.5	34.1
5.3	84.5	28.7	19.6	38.3
6.1	91.8	32.8	21.1	38.5
6.5	95.6	33.4	22.3	41.2
7.0	94.7	34.3	21.2	40.8
LSD (0.05)	4.2	2.3	2.8	3.5

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

Kenneth W. Kelley

Summary

Soybean yields were highest when planted in 7.5- or 15-in. rows, regardless of tillage method. Yield differences between tillage systems were small.

Introduction

In recent years, improved equipment and herbicide technology has prompted more interest in planting soybean using conventional tillage practices. In addition, the acreage of soybean 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 soybean and grain sorghum was established at the Columbus Unit. Main plot treatments consist of a factorial combination of conventional (CT) and no-tillage (NT) with three different row spacings (7.5-, 15-, and 30-in.). Subplot treatments 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 2001 are shown in Table 1. Soybean yields were highest when planted in 7.5- or 15-in. rows, regardless of tillage method. Yield differences between tillage systems were small. 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.

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

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

Row Spacing	Tillage Method	Herbicide Treatment: PPI + 3 wks	3 wks	3 + 2 wks	10 wks	Avg.
		--- Soybean Yield (bu/a) ---				
7.5	CT	31.7	32.9	33.9	30.0	32.1
15	CT	35.7	33.8	34.6	31.7	33.9
30	CT	29.7	28.2	29.4	20.8	27.0
7.5	NT	34.7	35.1	34.7	32.1	34.2
15	NT	35.6	34.3	33.1	29.4	33.1
30	NT	33.0	31.3	32.7	23.1	30.0
Means:						
Row	7.5	33.1				
	15	33.5				
	30	28.5				
	LSD (0.05)	1.6				
Tillage	CT	31.0				
	NT	32.4				
	LSD (0.05)	NS				
Herbicide	PPI + 3 wks	33.4				
	3 wks	32.6				
	3 + 2 wks	33.1				
	10 wks	27.9				
	LSD (0.05)	1.3				

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 on 1.5 qt/a of glyphosate. Preplant treatment consisted of Prowl applied at 2.4 qt/a.

HERBICIDE EVALUATIONS FOR GRAIN SORGHUM, SOYBEAN, AND COTTON

Kenneth W. Kelley

Summary

Various herbicide treatments were evaluated for grain sorghum, soybean, and cotton.

Introduction

Herbicide selection is an important management decision, regardless of crop. In southeastern Kansas, a broad spectrum of weed species often compete with the growing crop each year, although weed spectrum typically varies from field to field. The objective of this research is to evaluate commonly used herbicides as well as newer herbicides for weed control.

Experimental Procedures

Several herbicide trials were conducted at the Columbus Unit in 2001. All herbicides were applied with a tractor-mounted compressed air sprayer with a spray volume of 20 gal/a. Plot size was 4, 30-in. rows by 30-ft., with 3 to 4 replications. Weed control was determined by a visual rating after herbicide applications.

Results and Discussion

Grain Sorghum (Table 1)

Most tank-mix herbicide treatments gave good to excellent grass and broadleaf weed control. Aatrex, applied alone either preemerge or postemerge, provided only fair control of crabgrass, which also reduced grain yields.

Soybean (Tables 2 and 3)

Two different studies were evaluated. In one study, only residual soybean herbicides were evaluated, and in the second study, residual herbicides were applied for initial weed control, then glyphosate was applied postemerge.

Where only residual or contact postemerge herbicides were applied, annual grass and broadleaf weed control was generally good to excellent. Crabgrass control was reduced with some treatments of Prowl and Select, but grain yields were affected very little. Weed control with glyphosate and residual herbicides were also good to excellent. Applying a residual herbicide at planting reduced early weed control compared to a single application of glyphosate at 3 wks after planting; however, grain yields generally were similar among treatments.

Cotton (Table 4)

Weed control varied widely among treatments and also over the growing season. Tank-mix treatments with Cotoran and or Staple, applied preemerge, provided excellent weed control for the entire growing season. A preplant treatment of Treflan and Staple followed by a postemerge application of glyphosate also gave excellent weed control.

Table 1. Evaluation of Grain Sorghum Herbicides for Effects on Weed Control and Yield, Columbus Unit, 2001.

Trt	Herbicide	Applic. Time	Rate	Weed Control GR	Weed Control WA	Weed Control VEL	Yield
			prod/a	%	%	%	bu/a
1	Aatrex	PRE	1.5 qt	66	100	98	88.2
2	Bullet	PRE	3 qt	98	100	100	94.9
3	Bicep II Mag.	PRE	1.6 qt	96	100	100	99.0
4	Guardsman	PRE	2 qt	98	100	100	93.3
5	Lasso	PRE	2 qt	98	100	98	91.3
5	Permit	PO	0.66 oz				
5	Aatrex	PO	1 qt				
5	Crop oil	PO	1 %				
6	Dual II Mag.	PRE	1.33 pt	98	100	93	88.2
6	Peak	PO	0.5 oz				
6	Aatrex	PO	1 qt				
6	Crop oil	PO	1 %				
7	Outlook	PRE	14 oz	93	100	98	92.8
7	Laddock S-12	PO	1.66 pt				
7	Crop oil	PO	1 qt				
7	28 % N	PO	2 qt				
8	Dual II Mag.	PRE	1.33 pt	97	100	98	92.8
8	Buctril + Atraz.	PO	1 qt				
8	NIS	PO	0.25%				
9	Dual II Mag.	PRE	1.33 pt	98	100	96	93.9
9	Marksman	PO	2 pt				
10	Outlook	PRE	14 oz	100	100	97	94.9
10	Paramount	PO	5.4 oz				
10	Aatrex	PO	1 qt				
10	Crop oil	PO	1 %				

Table 1. (Continued).

Trt	Herbicide	Applic. Time	Rate	Weed Control GR	WA	VEL	Yield
			prod/a	%	%	%	bu/a
11	Dual II Mag.	PRE	1.33 pt	94	100	98	91.7
11	Aim	PO	0.33 oz				
11	Aatrex	PO	1 qt				
11	NIS	PO	0.25 %				
12	Lasso	PRE	2 qt	95	100	100	89.1
12	Shotgun	PO	1 qt				
13	Aatrex	PO	2 qt	68	100	100	66.9
13	Crop oil	PO	1 qt				
14	No Herbicide	—	—	0	0	0	34.2
	LSD (0.05)			7	8	9	8

Planting date: April 26, 2001
Date of herbicide application:
PRE (preemerge) = May 2, 2001; PO (postemerge) = May 7 (Trts 10 & 13);
PO = May 23 (Trts 5, 6, 7, 8, 9, & 11); PO = May 25 (Trt 12).
Weed species: GR = (grass), crabgrass; WA = common waterhemp; VEL = velvetleaf

Table 2. Evaluation of Soybean Herbicides for Effects on Weed Control and Yield, Columbus Unit, 2001.

Trt	Herbicide	Applic.. Time	Rate	Weed Control BL	Weed Control GR	Yield
			prod/a	%	%	bu/a
1	Squadron	PPI	3 pt	100	94	18.9
1	Authority	PPI	4 oz			
2	Tref. + Br'strike	PPI	1 qt	100	97	17.9
2	Sencor	PPI	4 oz			
2	Basagran	PO	1 pt			
2	Crop oil	PO	1 qt			
2	28 % N	PO	2 qt			
3	Prowl	PPI	1 qt	100	91	18.4
3	Canopy XL	PPI	6 oz			
4	Dual + Br'strike	PRE	1 qt	100	100	21.8
4	First Rate	PO	0.3 oz			
4	Basagran	PO	1 pt			
4	Crop oil	PO	1 %			
4	28 % N	PO	2 qt			
5	Command	PRE	1 qt	100	88	21.3
5	First Rate	PRE	0.6 oz			
5	Authority	PRE	4 oz			
6	Dual II Mag.	PRE	1.33 pt	100	98	21.8
6	Canopy XL	PRE	3 oz			
6	Authority	PRE	3 oz			
7	Outlook	PRE	12 oz	100	98	19.4
7	Canopy XL	PRE	3 oz			
7	Synchrony STS	PO	0.5 oz			
7	Crop oil	PO	1 %			
7	28 % N	PO	2 qt			

Table 2. (Continued).

Trt	Herbicide	Applic. Time	Rate	Weed Control BL	Weed Control GR	Yield
			prod/a	%	%	bu/a
8	Prowl	PRE	1 qt	91	84	19.8
8	Canopy XL	PRE	3 oz			
8	Authority	PRE	3 oz			
9	Boundary	PRE	1.5 pt	100	100	20.3
9	Flexstar	PO	0.75 pt			
9	First Rate	PO	0.3 oz			
9	Crop oil	PO	1 %			
10	Valor	PRE	2 oz	100	84	22.3
10	Phoenix	PO	6 oz			
10	Select	PO	7 oz			
11	Lasso	PRE	2 qt	96	88	19.4
11	Storm	PO	1.5 pt			
11	Crop oil	PO	1 pt			
11	28 % N	PO	2 qt			
12	No herbicide	—	—	0	0	12.6
	LSD (0.05)			6	8	3.1

Planted: June 19 (Asgrow 4301 RR & STS)
Herbicide application dates: PPI (preplant incorporated) = June 19;
PRE (preemerge) = June 19; PO (postemerge) = July 19
Weed species: GR (grass) = crabgrass; BL (broadleaf) = common waterhemp and cocklebur

Table 3. Evaluation of Soybean Herbicides for Effects on Weed Control and Yield, Columbus Unit, 2001.

		Applic..		Weed Control		
Trt	Herbicide	Time	Rate	BL	GR	Yield
			prod/a	%	%	bu/a
1	Prowl	PRE	1 qt	95	100	16.0
1	Roundup Ultra	PO	1 qt			
1	AMS	PO	3 lb			
2	Command	PRE	1 pt	90	100	19.4
2	Roundup Ultra	PO	1 qt			
2	AMS	PO	3 lb			
3	Boundary	PRE	1.25 pt	95	100	16.9
3	Roundup Ultra	PO	1 qt			
3	AMS	PO	3 lb			
4	Dual II Mag.	PRE	1 pt	95	100	17.1
4	Roundup Ultra	PO	1 qt			
4	AMS	PO	3 lb			
5	Outlook	PRE	12 oz	95	100	17.4
5	Roundup Ultra	PO	1 qt			
5	AMS	PO	3 lb			
6	Domain	PRE	10 oz	95	100	16.0
6	Roundup Ultra	PO	1 qt			
6	AMS	PO	3 lb			
7	First Rate	PRE	0.3 oz	90	100	17.9
7	Roundup Ultlra	PO	1 qt			
7	AMS	PO	3 lb			

Table 3. (Continued).

Trt	Herbicide	Applic. Time	Rate	Weed Control BL	Weed Control GR	Yield
			prod/a	%	%	bu/a
8	Valor	PRE	1.66 oz	90	100	16.5
8	Roundup Ultra	PO	1 qt			
8	AMS	PO	3 lb			
9	Canopy XL	PRE	2.5 oz	95	100	16.5
9	Roundup Ultra	PO	1 qt			
9	AMS	PO	3 lb			
10	Roundup Ultra	PO	1.5 pt	98	100	19.0
10	Roundup Ultra	PO	1 pt			
10	AMS	PO	3 lb			
11	Roundup Ultra	PO	1 qt	80	80	16.9
11	AMS	PO	3 lb			
12	Touchdown	PO	1 qt	80	80	18.4
12	AMS	PO	3 lb			
13	No herbicide	—	—	0	0	10.1
	LSD (0.05)			6	10	3.3

Planted: June 19 (Asgrow 4301 RR & STS)
Herbicide application dates: PPI (preplant incorporated) = June 19;
PRE (preemerge) = June 19; PO (postemerge) = July 19
Weed species: GR (grass) = crabgrass; BL (broadleaf) = common waterhemp, ivyleaf morningglory and cocklebur

Table 4. Evaluation of Cotton Herbicides for Weed Control, Parsons Unit, 2001.

		Applic.		Early Weed Control		Late Weed Control	
Trt	Herbicide	Time	Rate	BL	GR	BL	GR
			prod/a	%	%	%	%
1	Treflan	PPI	2 pt	100	100	97	100
1	Cotoran	PRE	3.2 pt				
2	Dual II Mag	PRE	1.33 pt	95	97	87	95
2	Cotoran	PRE	3.2 pt				
3	Treflan	PPI	2 pt	94	95	78	90
3	Karmex	PRE	1.25 lb				
4	Treflan	PPI	2 pt	99	89	95	87
4	Staple	PRE	0.8 oz				
5	Treflan	PPI	2 pt	100	98	100	97
5	Staple	PRE	0.6 oz				
5	Karmex	PRE	1.0 lb				
6	Treflan	PPI	2 pt	100	100	100	99
6	Staple	PRE	0.6 oz				
6	Cotoran	PRE	3.2 pt				
7	Treflan	PPI	2 pt	92	93	81	90
7	Caparol	PRE	3.2 pt				
8	Treflan	PPI	2 pt	82	89	68	83
8	Cotoran	PO	3.2 pt				
8	NIS	PO	0.25%				
9	Treflan	PPI	2 pt	92	89	84	87
9	Staple	PO	1.2 oz				
9	NIS	PO	0.25%				

Table 4. (Continued)

Trt	Herbicide	Applic. Time	Rate	Early Weed Control BL	Early Weed Control GR	Late Weed Control BL	Late Weed Control GR
			prod/a	%	%	%	%
10	Treflan	PPI	2 pt	99	96	94	95
10	Roundup Ultra	PO	2 pt				
10	AMS	PO	2 lb				
11	Treflan	PO	2 pt	100	100	100	100
11	Staple	PO	1.2 oz				
11	Roundup Ultra	PO	2 pt				
11	AMS	PO	2 lb				
12	Cotoran	PRE	3.2 pt	100	98	97	97
12	Roundup Ultra	PO	2 pt				
12	AMS	PO	2 lb				
13	Roundup Ultra	PO	2 pt	95	87	78	73
13	AMS	PO	2 lb				
14	Staple	PO	1.2 oz	100	93	98	84
14	Roundup Ultra	PO	2 pt				
14	AMS	PO	2 lb				
15	No Herbicide	—	—	0	0	0	0
	LSD (0.05)			9	5	17	9

Planting Date: May 14, 2001
Cotton variety: Paymaster 2156 RR
Herbicide application dates:
PPI (preplant incorporated) = May 14, 2001
PRE (preemerge) = May 16, 2001
PO (postemerge) = June 15, 2001
Weed species: BL (broadleaf) = common waterhemp and cocklebur; GR (grass) = crabgrass.
Weed ratings: early = July 9; late = Oct. 5

PERFORMANCE TEST OF DOUBLE-CROPPED SOYBEAN VARIETIES

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

Summary

Eighteen double-cropped soybean varieties were planted following winter wheat in Columbus, Kansas and evaluated for yield and other agronomic characteristics throughout the summer of 2001. Overall, grain yields were below average, however, variety differences were seen even under the dry growing conditions. Yields ranged from 4.3 bu/a to 19.7 bu/a. Late MG IV to early V varieties had the highest yields.

Introduction

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

Experimental Procedures

Soybean varieties were planted no-till, into good moisture following winter wheat harvest at the Southeast Agricultural Research Center at Columbus. The soil is a Parsons silt loam. The wheat stubble was burned, soybeans were then planted without tillage with a John Deere 7000 planter. Squadron® herbicide was applied following planting. Soybean was planted on June 11, 2001 at 10 seed per ft of row. Harvest occurred October 25, 2001.

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 and August.

Yields ranged from 4.3 bu/a to 19.7 bu/a (Table 1). Several varieties yielded from 15 to 19.7 bu/a, and could be considered as top yielders in 2001. Consideration also should be given to plant height from data in 2001. Overall plant heights were short, reflecting the very dry conditions, and this caused some harvest problems.

[1]Southeast Area Extension Office

Table 1. Yields for a Variety Test of Double-Cropped Soybean at Columbus, Parsons, and Altamont, Kansas, 1996-2001.

Brand	Variety	2001 Height	2001 Mature	2001 Grain Yield	2000	1999	1998	1997	1996
		in	from 10/1	bu/a					
Croplan	4848	17.8	2.9	16.1	–	–	–	–	–
Croplan	5252	18.0	13.0	19.7	–	–	–	–	–
Croplan	5454	18.3	9.6	17.1	–	–	–	–	–
Golden Harvest	15015	19.3	8.7	12.3	–	–	–	–	–
Hoegemeyer	501	18.0	2.9	12.6	–	–	–	–	–
Midland	532N	14.8	9.5	14.8	–	–	–	–	–
Syngenta	46W8	18.3	1.0	13.0	–	–	–	–	–
Syngenta	52U3	16.8	18.0	14.7	–	–	–	–	–
Pioneer	94B73	17.3	- 0.3	15.8	–	–	–	–	–
Pioneer	94B81	20.3	1.3	15.4	10.7	–	–	–	–
Pioneer	95B32	14.0	10.8	13.5	–	–	–	–	–
Triumph	4810RR	19.0	2.9	7.0	–	–	–	–	–
Triumph	4807RR	15.0	3.0	8.4	–	–	–	–	–
Check Varieties									
LateIII/EarlyIV	Macon	14.0	0.9	4.3	6.5	–	–	–	–
Mid MG IV	KS4694	14.5	3.0	9.3	9.3	13.0	1.8	40.2	6.5
Early MG V	KS4997	16.0	5.3	12.2	10.3	21.1	–	–	–
Early MG V	Manokin	16.5	7.8	15.9	10.2	–	7.8	43.5	17.4
Early MG V	KS5292	16.5	9.5	15.5	8.5	15.5	2.7	39.5	13.3
LSD (0.05)		2.7	1.1	3.7	1.7	2.7	1.4	5.2	5.6
Averages		16.9	6.1	13.2	8.1	17.2	3.5	38.2	11.4

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PERFORMANCE TEST OF RIVER-BOTTOM SOYBEAN VARIETIES

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

Summary

Seventeen soybean varieties, typically grown on deep river-bottom soils, were planted at Erie, Kansas and evaluated for yield and other agronomic characteristics throughout the summer of 2001. Grain yields were good and variety differences were seen with the very productive soils. Yields ranged from 27.2 bu/a to 42.8 bu/a. The shorter-season Maturity Group (MG) IV varieties yielded as well or better than the MG V varieties. The soybeans were tall, but only three varieties lodged. Manokin was severely lodged.

Introduction

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

Experimental Procedures

Seventeen soybean varieties were grown following corn in 2000. The farmer/cooperator was Joe Harris. The soil is a Lanton deep silt loam that sits on the Neosho flood plain approximately 1750 feet from the river channel. The soil was chiseled and disked, Dual II herbicide was applied at the rate of 3 pints per acre, and the soil was field cultivated prior to planting. Soybean then was planted on June 18, 2001 at 10 seeds per foot of row. Plants emerged to form an excellent stand. Storm, at 1 pt/a was applied postemergent on July 3 and August 1, while Select and Classic were applied at 12 ounces and 0.25 ounces per acre, respectively, on August 1 to help control cocklebur and grasses. The soybeans were harvested on October 18, 2001.

Results and Discussion

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

Yields ranged from 27.2 bu/a to 42.8 bu/a (Table 1). Several varieties yielded more than 40 bu/a for the 2001 growing season. Consideration should be given to plant height and its effect on lodging as well as plant maturity. Overall plant height ranged from 24.3 to 38.0 in. With respect to plant maturity, the indeterminate, early to mid MG IV varieties yielded as well or better than the determinate growth habit, MG V varieties.

[1]Southeast Area Extension Office

Table 1. Yields for a Variety Test of River-Bottom Soybean at Erie, Kansas, 1996-2001.

Brand	Variety	Height (2001)	Mature (2001)	Lodge (2001)	2001 Grain Yield	1999 Grain Yield	1998 Grain Yield	1997 Grain Yield	1996 Grain Yield
		in	from 10/1	%	bu/a	bu/a	bu/a	bu/a	bu/a
Croplan	3737	25.8	8.0	0.0	27.2	–	–	–	–
Croplan	4444	32.5	14.5	0.0	42.8	–	–	–	–
Golden Harvest	4658RR	32.8	15.0	0.0	30.6	–	–	–	–
Golden Harvest	4807RR	30.3	16.3	0.0	37.6	–	–	–	–
Hoegemeyer	501	35.8	17.8	0.0	40.3	–	–	–	–
Midland	442N	35.3	12.5	0.0	40.1	–	–	–	–
Midland	462N	35.0	13.0	0.0	32.0	–	–	–	–
Garst	4572	34.5	11.3	0.0	42.8	–	–	–	–
Pioneer	93B72	32.5	6.8	8.5	38.3	–	–	–	–
Pioneer	93B85	34.0	11.3	0.0	41.2	–	–	–	–
Pioneer	94B23	36.8	13.5	0.0	30.4	–	–	–	–
Triumph	4462RR	38.0	13.3	0.0	42.7	–	–	–	–
Check Varieties									
LateIII/EarlyIV	Macon	27.3	3.5	0.0	35.4	–	–	–	–
Mid MG IV	KS4694	31.0	15.0	0.0	35.6	33.9	37.8	53.1	65.7
Early MG V	KS4997	24.3	16.8	0.0	42.3	36.3	–	–	–
Early MG V	Manokin	30.5	16.8	43.8	38.8	–	–	–	–
Early MG V	KS5292	28.8	17.8	2.5	38.7	38.1	34.3	56.9	58.1
LSD (0.05)		3.5	3.2	8.0	4.9	6.8	5.0	5.8	6.9
Averages		32.3	13.0	3.2	37.4	39.2	41.9	58.2	62.8

PERFORMANCE TEST OF COTTON VARIETIES

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

Summary

Eleven cotton varieties were planted at Parsons, Kansas, and evaluated for yield and other agronomic characteristics throughout the summer of 2001. Lint yields were exceptional, and variety differences were seen. Yields ranged from 842 lb/a to 970 lb/a of lint. Quality is reported on the individual varieties. Quality should be strongly considered as it will affect the final price of the crop.

Introduction

Cotton is a new crop for southeastern Kansas but is already grown on 40,000 acres in the state. The crop is somewhat drought tolerant. Many of the varieties tested are grown on the high plains of Texas and in Oklahoma. Some factors that may influence the amount of cotton grown in this region are potential insect problems and the management decisions associated with cotton, such as having an early harvest before fall rains arrive.

Experimental Procedures

Eleven cotton varieties were grown following grain sorghum. 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 Treflan® herbicides were applied, and the soil was field cultivated prior to planting. Cotton then was planted on May 8, 2001. Populations were thinned to 43,000 and 87,000 plants/acre. Plants emerged to form an excellent stand. Cotoran was applied postemergent to help control broadleaf weeds. Gramoxone® was applied on September 24 as a conditioner then again on October 1 to open the bolls and to control regrowth. Cotton lint was harvested on October 4, 2001. 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 warmer and dry. Cotton grew well throughout the season even with the lack of moisture. July and August were hotter and drier than usual with 2310 cotton growing degree days (GDD) in 2001compared to a normal 2151GDD.

Yields ranged from 842 lb/a to 970 lb/a (Table 1). Several varieties yielded more than 900 lb/a for the 2001 growing season and should considered top yielders. There are now two years of data for cotton lint yield. Consideration should be given to quality factors and their effect on the price received for the crop.

Quality characteristics indicate differences between varieties that may affect the price at the

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

gin and these should be considered, especially if the qualities are much lower than average.

Turnout was high this year due, in part, to a burr extractor on the cotton stripper.

Table 1. Yield and Quality of Cotton Varieties at Parsons, Kansas during 2001.

Company	Variety	Cotton Yield		2001 Quality Characteristics					
		Lint Yield	Turn out	Micronaire	Length	Uniformity	Strength	Color	Grade
		lb/a	%		in	%	g/tex		
Fibermax	5013	957	0.35	5.2	1.00	81.7	29.3	61	1
Garst	1500RR	852	0.37	4.9	1.03	81.1	28.1	52	1
Novartis	2108SS	970	0.38	5.0	1.02	81.5	27.8	51	3
Novartis	2165C	873	0.38	5.1	1.00	81.2	27.7	51	4
Paymaster	2145RR	888	0.38	5.2	0.94	80.0	29.0	52	2
Paymaster	2167RR	842	0.37	5.3	0.94	80.6	26.3	52	1
Paymaster	2156RR	863	0.37	5.3	0.95	80.8	25.5	52	1
Paymaster	2200RR	870	0.36	5.1	1.01	81.7	27.7	41	4
Paymaster	2280BGRR	887	0.36	4.4	1.00	80.8	29.5	51	1
Stoneville	ST2454R	876	0.37	5.4	1.00	83.1	29.5	51	3
Paymaster	2266RR	942	0.35	5.1	1.01	82.1	29.8	62	1
$LSD_{(0.05)}$		237	0.01	0.3	0.04	2.1	1.8	–	–
Mean		893	0.37	5.1	0.99	81.7	27.8	–	–
C.V.		12	2.0	3.0	2.0	1.0	3.0	–	–

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ANNUAL SUMMARY OF WEATHER DATA FOR PARSONS - 2001

Mary Knapp[1]

2001 DATA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
Avg. Max	39.7	48.4	52.2	72.2	79.0	83.5	92.5	94.4	81.3	70.7	62.1	50.3	68.9
Avg. Min	21.0	25.1	31.7	49.4	56.6	63.0	71.7	67.1	56.1	45.2	41.0	29.3	46.4
Avg. Mean	30.3	36.8	42.0	60.8	67.8	73.2	82.1	80.7	68.7	57.9	51.6	39.8	57.6
Precip	2.52	2.97	1.92	2.7	4.07	7.13	1.33	2.57	4.08	4.21	3.36	0.96	37.77
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*	1075	791	714	191	53	13	0	0	49	235	405	782	4304
Cool DD*	0	0	0	64	140	260	530	488	161	16	1	1	1658
Rain Days	6	8	5	6	12	9	7	8	6	5	7	5	84
Min < 10	2	2	0	0	0	0	0	0	0	0	0	0	4
Min < 32	29	23	20	2	0	0	0	0	0	2	8	21	105
Max > 90	0	0	0	0	1	1	20	26	6	0	0	0	54

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	-0.8	1.8	-4.9	4.0	2.2	-1.7	0.8	4.3	-0.2	-0.6	5.3	5.8	1.3
Avg. Min	1.7	0.3	-2.5	3.6	1.1	-1.1	2.7	0.7	-3.0	-2.1	5.3	4.5	0.9
Avg. Mean	0.4	1.1	-3.7	3.8	1.6	-1.5	1.8	2.4	-1.6	-1.5	5.2	2.8	0.9
Prcip	1.2	1.51	-1.48	-1.15	-1.19	2.52	-1.82	-1.06	-0.72	0.29	0.45	-0.8	-2.25
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	-14	-30	116	-70	-36	12	0	0	18	15	-156	-158	-302
Cool DD	0	0	0	42	14	-34	56	76	-30	-30	1	1	96

* 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.

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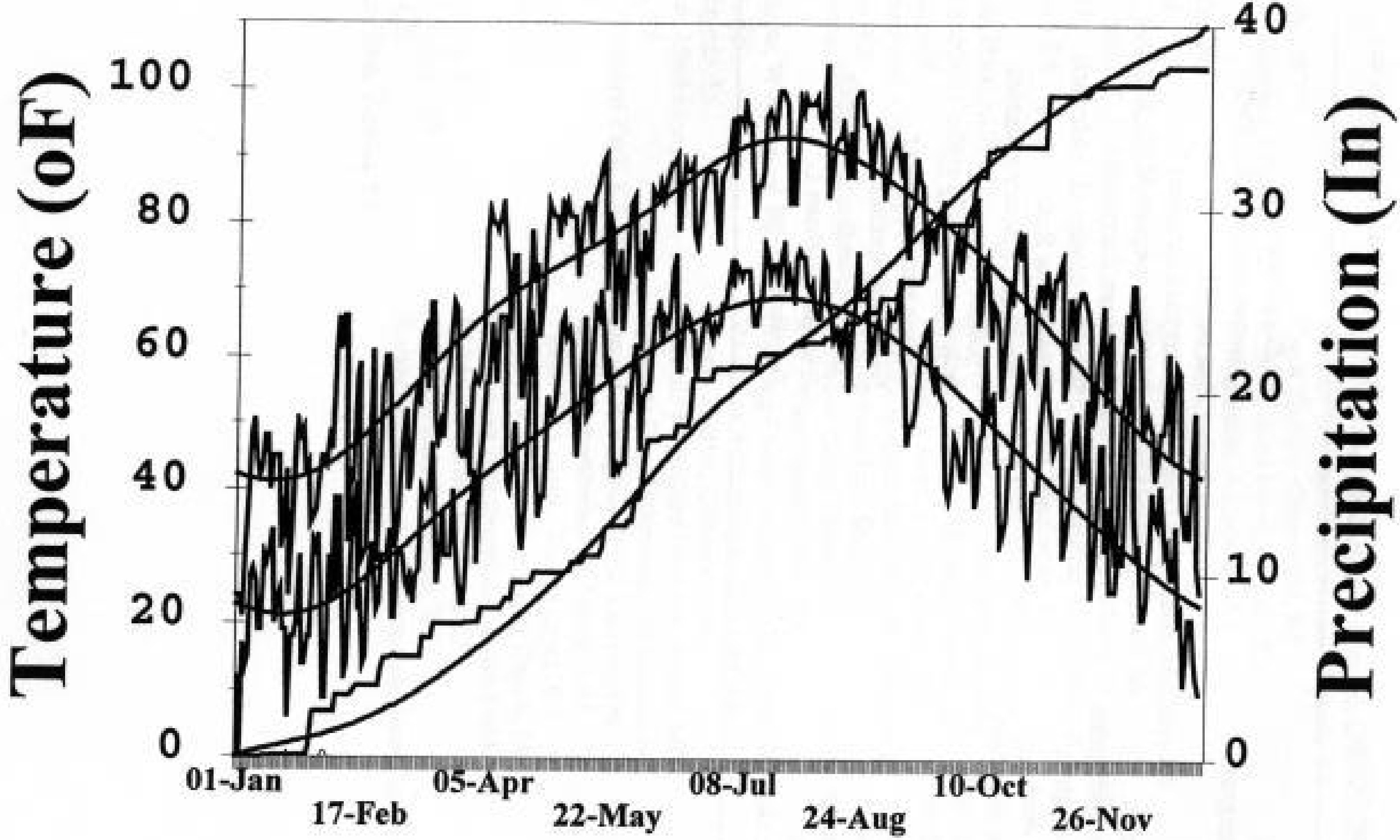
[1]Assistant Specialist, Weather Data Library, KSU.

Parsons Weather -- 2001



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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Bioworks, Inc., Geneva, NY
Cal-West Seeds, Woodland, CA
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