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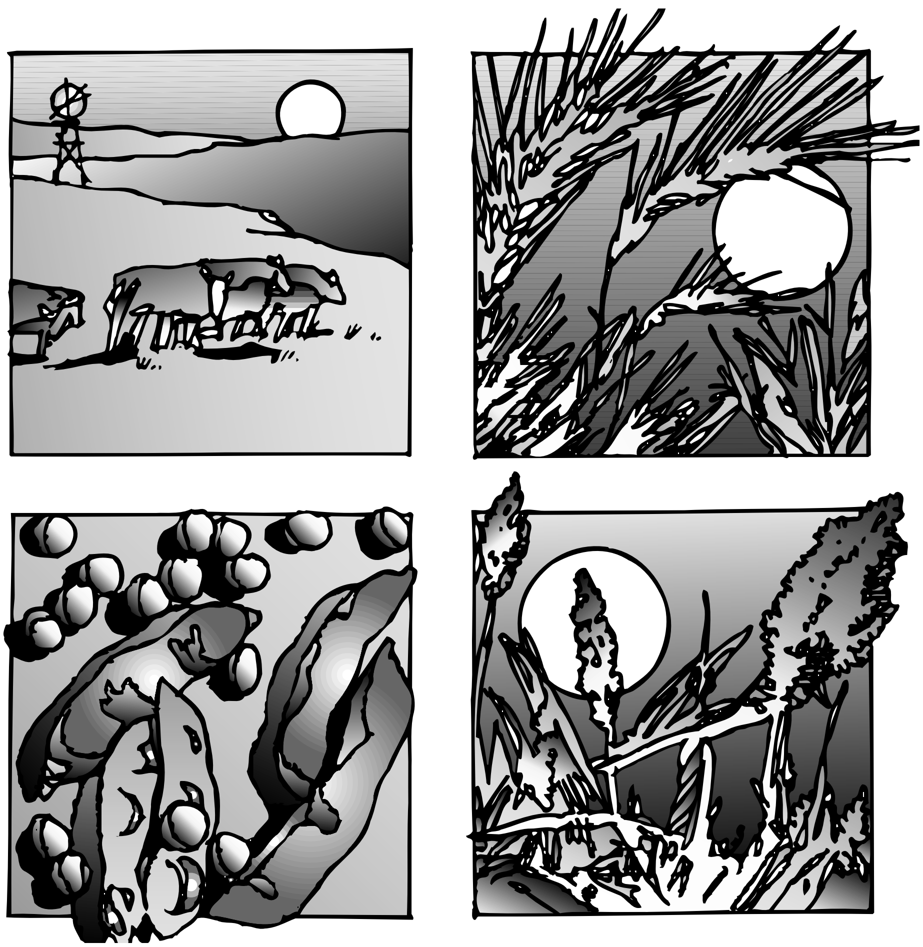
2000 AGRICULTURAL RESEARCH



50th Anniversary

SOUTHEAST AGRICULTURAL RESEARCH CENTER

Report of Progress 853

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. degree 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.

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Contribution No. 00-369-S from the Kansas Agricultural Experiment Station.

SOUTHEAST AGRICULTURAL RESEARCH CENTER KANSAS STATE UNIVERSITY

EFFECTS OF INTERSEEDING LESPEDEZA INTO CRABGRASS PASTURE ON FORAGE PRODUCTION AND CATTLE PERFORMANCE

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

Summary

A total of 80 steers grazed 'Red River' crabgrass pastures that were fertilized with additional nitrogen (N) or interseeded with lespedeza during the summers of 1998 and 1999. Wheat also was grazed in 1999 prior to crabgrass emergence. Legume cover, forage dry matter production, grazing steer performance, and subsequent feedlot performance were measured. Available forage dry matter, grazing steer performance, and overall steer gains were similar between pastures of crabgrass fertilized with additional N and those interseeded with lespedeza. Finishing gain and ribeye area were higher ($P < .05$) in 1999 for steers that grazed the pastures with lespedeza.

Introduction

Cattlemen in southeastern Kansas, eastern Oklahoma, and western Arkansas need high quality forages to complement grazing of tall fescue. Complementary forages are needed especially during the summer months, when fescue forage production declines and animal performance is reduced by the endophyte that typically is found in most fescue grown in this area. Crabgrass could fill this niche by providing high-quality forage for summer grazing. A high level of nitrogen (N) fertilization is required for crabgrass, but adding a legume such as lespedeza could reduce N level, 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 the rate of 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 also was broadcast at this time on all 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 pastures without lespedeza in early August. In 1998, all pastures were clipped to a height of approximately 7 in. on July 6 and mowed for hay on August 17 to control weeds.

'Jagger' hard red winter wheat was planted

[1]Southeast Area Extension Office.

[2]Southeast Area Extension Office.

on October 15, 1998 at the rate of 106 lb/a for grazing in 1999. Korean lespedeza was seeded on April 7, 1999 at the rate of 19.5 lb/a on the same five 4-acre pastures that had been seeded with lespedeza during 1998. 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; and 48.5 lb of N/a on May 28, 1999. An additional 50 lb N/a was applied to pastures without lespedeza on July 16, 1999.

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 sq ft) 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, 50 mixed-breed steers with an initial weight of 639 lb were weighed on consecutive days, stratified by weight, and allotted randomly to the 10 pastures on March 30 to graze out wheat and then graze crabgrass. Cattle grazed wheat from March 30 until May 26 (57 days) and then grazed crabgrass from May 26 until September 1 (98 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. Pastures then were stocked at 1 head/a until grazing was terminated and steers were weighed on August 31 and September 1.

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 on a dry matter basis for 142 days. Steers were implanted with Synovex S® on days 0 and 84 of the finishing period. Cattle that grazed in 1998 were slaughtered in a commercial facility at the end of the finishing period, and carcass data collected. Steers that were grazed in 1999 are currently being finished for slaughter.

Results and Discussion

Pastures

Available forage dry matter (DM) for 1998 is presented in Figure 1. It was similar between pastures that received additional N fertilizer and those that were interseeded with lespedeza. Available forage DM decreased dramatically for both treatments after mid August following mowing for hay coupled with below normal precipitation. Legume coverages averaged 4.7% in pastures interseeded with lespedeza and 1.3% in those that received additional N fertilization.

Available forage DM and lespedeza canopy coverage for 1999 are shown in Fig. 2. Available forage DM was not significantly different ($P < .05$) between treatments at any time during the growing season or overall. 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 appeared lower in much of 1999 than in 1998. This difference was likely due to less rainfall during the summer months, a higher initial stocking rate, and grazing wheat prior to crabgrass in 1999.

Lespedeza canopy coverage apparently peaked in 1999 on July 20 at 3.1% (Fig. 2). However, no real change (P > .10) occurred in coverage after May 26, when lespedeza canopy coverage averaged 2.1%.

Cattle Performance

Performances of steers that grazed crabgrass pastures fertilized with additional N and those interseeded with lespedeza are presented in Tables 1 and 2 for 1998 and 1999, respectively. In 1998, grazing gains, subsequent feedlot performance, and overall performance were similar between pastures with lespedeza and those that received an extra application of N; grazing gains were 1.27 and 1.23 lb/head daily, respectively. Cattle should have been removed from pastures 2 weeks earlier in 1998 to achieve maximum gains. In 1999, grazing gains were also similar between pastures with lespedeza and those that received an extra application of N during the wheat phase (2.22 and 2.26 lb/head daily), crabgrass phase (1.30 and 1.25 lb/head daily), and overall (1.64 and 1.62 lb/head daily), 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.

This study will be continued for at least 2 more years. Wheat will be planted in the fall and grazed out in the spring. Cattle then will graze crabgrass during the summer months. We are hopeful that the crabgrass will be able to reseed itself each year.

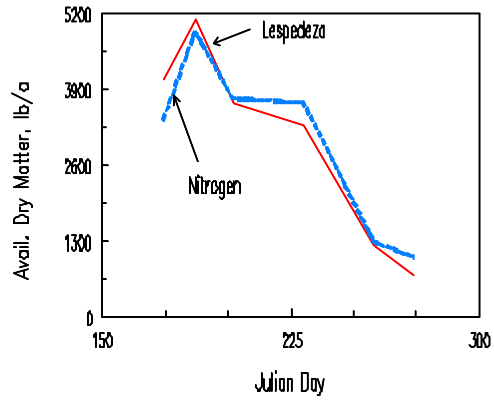

Figure 1. Available Forage in Crabgrass Pastures, 1998, Southeast Agricultural Research Center.

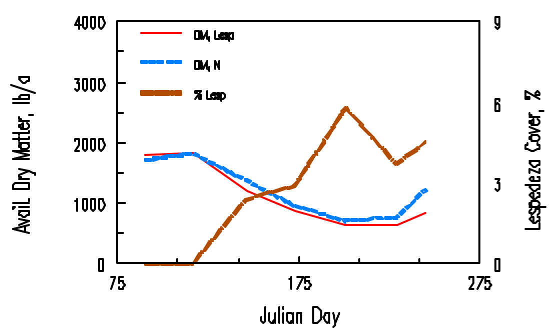

Figure 2. Available Forage and Lespedeza Canopy Cover in Crabgrass Pastures, 1999, Southeast Agricultural Research Center.

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

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

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

Item	Nitrogen Fertilization	Lespedeza
Grazing Phase - Wheat (57 Days)		
No. of head	25	25
Initial wt., lb	639	639
Ending wt., lb	768	766
Gain, lb	129	127
Daily gain, lb	2.26	2.22
Gain/a	161	158
Grazing Phase - Crabgrass (98 Days)		
Initial wt., lb	772	766
Final wt., lb	895	893
Gain, lb	123	127
Daily gain, lb	1.25	1.30
Gain/a	142	145
Overall Grazing Performance (Wheat + Crabgrass) (155 Days)		
Gain, lb	252	254
Daily gain, lb	1.62	1.64
Gain/a	303	304
Finishing Phase (114 Days)		
Initial wt., lb	895	893
Final wt., lb	1350	1400
Gain, lb	456[a]	507[b]
Daily gain, lb	4.00[a]	4.45[b]
Daily DM intake, lb	29.7	33.3
Feed/gain	7.42	7.49
Hot carcass wt., lb	794	824
Backfat, in	.60	.54
Ribeye area, sq in	12.3[a]	13.2[b]
Yield grade	3.5	3.0
Marbling score	SM^{46}	SM^{93}
% Choice	67	92
Overall Performance (Grazing + Finishing Phase) (269 Days)		
Gain, lb	708	761
Daily gain, lb	2.64	2.83

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

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EFFECTS OF PREVIOUS MANAGEMENT AND ENDOPHYTE LEVEL ON LADINO CLOVER ESTABLISHMENT AND STEER PERFORMANCE IN TALL FESCUE PASTURES

Lyle W. Lomas and Joseph L. Moyer

Summary

A total of 48 steers was used to evaluate the effect of nitrogen (N) fertilization in previous years on establishment of ladino clover in tall fescue pastures with and without the endophyte. Legume cover and grazing steer performance were measured. Legume canopy coverage after grazing showed no significant ($P > .05$) differences among treatments. Steers grazing low-endophyte pastures tended to gain more than those on high-endophyte pastures, but the difference was not significant ($P > .05$). Steers that grazed pastures interseeded with ladino clover in previous years had similar gains as those grazing pastures that had been fertilized with N and managed for fescue only in previous years.

Introduction

Previous research at the Southeast Agricultural Research Center has shown that performance of stocker steers grazing tall fescue improved significantly when 'Regal' ladino clover was broadcast on the pastures in late winter. However, legume establishment has sometimes been slow in pastures previously fertilized with nitrogen (N) and managed for fescue production only. This study was conducted to evaluate the effect of N fertilization in previous years on establishment of ladino clover in ‘Kentucky 31' tall fescue pastures with and without the endophyte.

Experimental Procedures

Sixteen 5-acre pastures of ‘Kentucky 31' tall fescue 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) were used in an experiment with a randomized complete block design. 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). Within each fescue type, one-half of the pastures were interseeded with ladino clover in previous years, and the other half were managed for fescue production only and received N fertilization at the rate of 80 lb/a in the spring and 40 lb/a in the fall during 1994, 1995, and 1996. All pastures received 40 lb of P_2O_5 and 40 lb of K_2O/a annually in 1993, 1994, and 1995. Pastures were fertilized in September, 1996, 1997, and 1998 with 16-40-40 lb/a of N-P_2O_5-K_2O. Agricultural lime had been applied previously to all pastures according to soil test analysis. Regal ladino clover seed was broadcast on February 17, 1997 and February 24, 1998 at the rate of 3 lb/a and 4.25 lb/a, respectively, on the four high-endophyte and the four low-endophyte pastures that had been managed previously for fescue production only. All 16 pastures were no-till seeded with 3.4 lb/a of ladino clover on March 30, 1999.

Forty-eight mixed-breed steers were weighed on consecutive days, stratified by weight, and allotted randomly to the 16 pastures. Grazing was initiated on April 14, 1999. Initial average weight of steers utilized was 551 lb. Cattle were treated for internal and external parasites prior to being turned out to pasture and later were vaccinated for protection from pinkeye. Steers grazed for 223 days. 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. Grazing was terminated and the steers were weighed on November 22 and 23. Legume composition was determined on all pastures by visual estimation on July 23.

Following the grazing period, cattle were placed in a finishing facility, where they are currently completing the finishing phase of this study.

Results and Discussion

Steer grazing performance and legume coverage are listed in Table 1. Because no significant interactions occurred between endophyte level and previous legume treatment, previous treatment was pooled within endophyte level, and endophyte level was pooled within previous legume treatment. Endophyte level and previous legume treatment had no effects (P > .05) on grazing performance. However, cattle that grazed low-endophyte pastures tended to have higher gains than those that grazed high-endophyte pastures. Although not significant (P > .05), legume cover tended to be higher in low-endophyte than high-endophyte pastures. This may have been due to cattle grazing low-endophyte pastures closer than high-endophyte pastures, thereby removing more of the legume, and the greater competitiveness of the high-endophyte plants. Legume cover also tended to be higher in pastures previously seeded with clover than those previously fertilized with N, but these differences were not significant (P > .05).

Table 1. Effects of Endophyte Level and Previous Treatment on Establishment of Ladino Clover and Grazing Steer Performance in Tall Fescue Pastures, Mound Valley Unit, Southeast Agricultural Research Center, 1999.

	Endophyte Level		Previous Treatment	
Item	Low	High	No Legume	Legume
No. of head	24	24	24	24
Initial wt., lb	551	551	551	551
Ending wt., lb	983	933	965	952
Gain, lb	433	383	415	401
Daily gain, lb	1.94	1.72	1.86	1.80
Legume Cover, %	18	13	13	18

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

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

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

Summary

In 1998 and 1999, a total of 90 steers grazed high-endophyte tall fescue pastures that had been interseeded with either lespedeza, red clover, or ladino clover during 1995, 1996, and 1997. No additional legume was seeded in 1998 or 1999 in order to evaluate legume persistence. Legume cover, forage dry matter production, and grazing steer performance were measured. In 1998, cattle grazing pastures interseeded with ladino clover gained significantly ($P < .05$) more than those grazing pastures interseeded with lespedeza or red clover. Gains from pastures interseeded with red clover or lespedeza were similar ($P > .05$). Steers that grazed pastures inteseeded with red clover gained more ($P < .05$) during the finishing phase than those that grazed pastures interseeded with ladino clover. Final weight at the end of the finishing phase, hot carcass weight, and overall daily gain were lower ($P < .05$) for steers that grazed pastures interseeded with lespedeza than for those interseeded with red clover or ladino clover. In 1999, grazing performance was similar among pastures previously interseeded with the three legumes.

Introduction

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

Experimental Procedures

Pastures

Nine 5-acre pastures located at the Parsons Unit of the Kansas State University - Southeast Agricultural Research Center were used in an experiment with a randomized complete block design containing 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) and had been interseeded with lespedeza (‘Marion’ in 1995 and Korean in 1996 and 1997), ‘Regal’ ladino clover, or ‘Kenland’ red clover using a no-till drill in each of the previous 3 years. No additional

[1]Southeast Area Extension Office.

legume seed was planted in 1998 or 1999 in order to determine the persistence of legumes planted in previous years. All pastures were fertilized with 16-40-40 lb/a of N-P_2O_5 in September of each year.

Available forage was determined at the initiation of grazing and during the season with a disk meter calibrated for tall fescue. Three exclosures (15-20 sq ft) 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 and 1999, 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 and March 30 in 1998 and 1999, respectively. Initial weights of steers utilized in 1998 and 1999 were 573 and 565 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 1999 and one from one of the ladino clover pastures in 1999 for reasons unrelated to experimental treatment. Pastures were grazed continuously at a stocking rate of 1 steer/a. Grazing was terminated and steers were weighed on November 9 and 10 (223 days) and November 3 and 4 (218 days) in 1998 and 1999, respectively.

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

Results and Discussion

Pastures

Available forage dry matter for each legume treatment for 1998 and 1999 are shown in Figures 1 and 2, respectively. Pastures interseeded with ladino clover or red clover had higher available forage dry matter than those interseeded with lespedeza during the early part of the study. Available forage dry matter production was similar among legume treatments during the latter part of the study.

Legume cover for each legume treatment is shown in Figure 3. Legume cover was higher in pastures interseeded with ladino clover than in those seeded with red clover or lespedeza. Legume cover was similar in pastures interseeded with red clover or lespedeza.

Cattle Performance

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

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

Grazing performance for 1999 is presented in Table 2. Legume treatment had no effect (P > .05) on grazing performance. Cattle that grazed these pastures during 1999 are currently completing the finishing phase of this study. This project will be continued for one more grazing season, and the longevity of the various legumes will be evaluated.

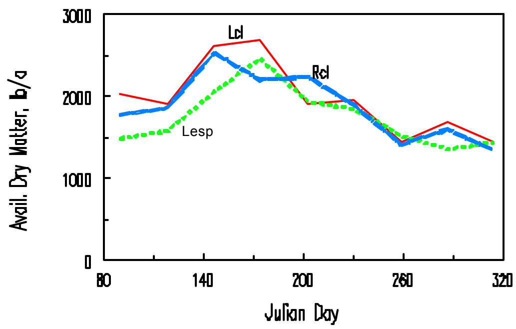

Figure 1. Available Forage in Tall Fescue Pastures, 1998, Southeast Agricultural Research Center.

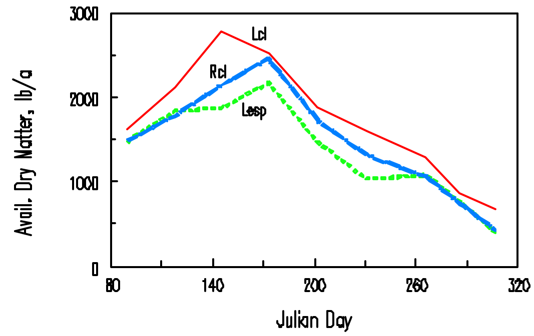

Figure 2. Available Forage in Tall Fescue Pastures, 1999, Southeast Agricultural Research Center.

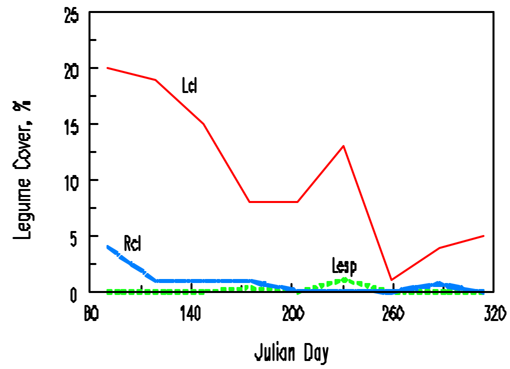

Figure 3. Legume Canopy Cover in Tall Fescue Pastures, 1998, Southeast Agricultural Research Center.

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

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

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

Table 2. Effects of Interseeding Legumes into Endophyte-Infected Fescue Pastures on Performance of Grazing Steers (218 Days), Southeast Agricultural Research Center, 1999.

	Legume		
Item	Lespedeza	Red Clover	Ladino Clover
No. of head	15	15	14
Initial wt., lb	565	565	565
Ending wt., lb	775	784	779
Gain, lb	210	219	214
Daily gain, lb	.97	1.01	.98

SOUTHEAST AGRICULTURAL RESEARCH CENTER KANSAS STATE UNIVERSITY

EFFECT OF GRAZING SYSTEM ON PERFORMANCE OF COW-CALF PAIRS GRAZING BERMUDAGRASS PASTURES INTERSEEDED WITH WHEAT AND LEGUMES

Lyle W. Lomas, Joseph L. Moyer, George A. Milliken[1], and Kenneth P. Coffey[2]

Summary

A total of 96 fall-calving cows and 64 calves grazed bermudagrass interseeded with wheat and legumes during 1996, 1997, and 1998 in either a continuous or rotational system stocked at equal rates. Legume cover, available forage dry matter, residual hay production, gains of cows and calves grazing wheat, and gains of cows grazing bermudagrass interseeded with legumes were measured. Grazing system had no effect on legume cover, available forage dry matter, gains of cows and calves grazing wheat, and gains of cows grazing bermudagrass interseeded with legumes. However, rotationally grazed pastures produced more residual hay than those grazed continuously.

Introduction

Short duration rotational grazing at higher than normal stocking rates has been used to improve forage utilization of underutilized pastures. Most of the previous grazing research evaluating grazing systems has been conducted with the rotationally grazed pastures stocked at a higher rate than the continuously grazed pastures, which resulted in higher gain per acre and lower individual grazing gains for the rotational system. Because stocking rates were different for each grazing system, it is difficult to determine whether the differences in grazing performance were due to grazing system or stocking rate. Rotational grazing also may be beneficial for establishment of legumes. This study was conducted to compare legume establishment, available forage, and grazing performance of fall-calving cows and calves grazing bermudagrass pasture interseeded with wheat, red clover, ladino clover, and lespedeza managed as continuous or rotationally grazed systems. Cattle numbers and land area were equal for each grazing system.

Experimental Procedures

Four 10-acre 'Hardie' bermudagrass pastures were used in a completely randomized design with two replications per grazing system to evaluate performance of fall-calving cows and calves grazing bermudagrass pastures interseeded with wheat, red clover, ladino clover, and lespedeza managed as continuous or rotationally grazed systems. 'Jagger' wheat was no-till seeded at the rate of 90 lb/a on October 3, 1995; September 12, 1996; and September 18, 1997. Pastures were interseeded on April 1, 1996 with 17.75 lb of Korean lespedeza, 9.6 lb of 'Kenland' red clover, and 2.4 lb of 'Regal' ladino clover per

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[2]University of Arkansas.

acre and on March 10, 1997 with 17 lb of Korean lespedeza, 7.4 lb of Kenland red clover, and 1.9 lb of Regal ladino clover per acre. All pastures were fertilized with 50-40-40, 60-51-48, and 64-56-64 lb of N-P_2O_5-K_2O/a in mid-May of 1996, 1997, and 1998 and 50 lb of N/a in late July of 1996, 1997, and 1998. Eight fall-calving cows were allotted randomly to each pasture on May 21, 1996, and 8 fall-calving cow-calf pairs were assigned randomly to each pasture on March 21, 1997 and April 7, 1998. Rotationally grazed units were subdivided into eight paddocks that were grazed for 3.5 day (1996 and 1997) or 2-day intervals (1998). Cows and calves in 1997 and 1998 initially grazed hard red winter wheat for 56 days; then calves were removed from the pastures, and cows grazed bermudagrass interseeded with legumes for the remainder of the summer. Wheat was not available for grazing in 1996 because of below-normal precipitation, and grazing was initiated with cows at the beginning of the bermudagrass-legume phase. Cows grazed bermudagrass interseeded with legumes for 113, 88, and 91 days in 1996, 1997, and 1998. Hay was harvested from all pastures in late July of each year in order to maintain the bermudagrass in a vegetative state. Legume cover, available forage dry matter, gains of cows and calves grazing wheat, and gains of cows grazing bermudagrass interseeded with legumes were measured.

Results and Discussion

A summary of grazing performance is presented in Table 1. No significant ($P > .05$) year by treatment interactions were observed. Legume cover and available forage dry matter did not differ ($P > .05$) between grazing systems during both the wheat and bermudagrass phases. However, residual hay production was higher ($P < .05$) from rotationally grazed pastures than from pastures grazed continuously. Available dry matter during the wheat phase was higher ($P < .05$) in 1998 than in 1997. Legume cover did not differ during the wheat phase in 1997 and 1998. Legume cover and hay production were higher ($P < .05$) during the bermudagrass phase in 1997 than in 1998.

Grazing system had no effect ($P > .05$) on gains of cows and calves grazing wheat or gains of cows grazing bermudagrass interseeded with legumes. Because legume cover and available dry matter did not differ between grazing systems, differences in grazing performance would not be expected. Gains of calves grazing wheat, cows grazing wheat, and cows grazing bermudagrass interseeded with legumes were 2.78, 1.29, and 1.63 lb per day, respectively. Although diffrences ($P < .05$) in cattle weights occurred between years, cow and calf gains were similar ($P > .05$).

Table 1. Effect of Grazing System on Performance of Cow-Calf Pairs Grazing Bermudagrass Pastures Interseeded with Wheat and Legumes.

Item	Grazing System		Year		
	Continuous	Rotation	1996	1997	1998
Wheat Phase					
No. of cow-calf pairs	32	32	-	32	32
No. of days	56	56	-	56	56
Calf initial wt., lb	508	509	-	468[a]	549[b]
Calf final wt., lb	666	662	-	628[a]	701[b]
Calf gain, lb	158	153	-	160	152
Calf daily gain, lb	2.82	2.74	-	2.85	2.71
Cow initial wt., lb	1341	1343	-	1272[a]	1412[b]
Cow final wt., lb	1415	1414	-	1344[a]	1485[b]
Cow gain, lb	73	71	-	72	73
Cow daily gain, lb	1.31	1.27	-	1.28	1.30
Legume cover, %	19.9	18.8	-	23.2	15.5
Available dry matter, lb/a	1630	1555	-	1392[a]	1792[b]
Bermudagrass Phase					
No. of cows	48	48	32	32	32
No. of days	97	97	113	88	91
Cow initial wt., lb	1307	1300	1081[a]	1344[b]	1485[c]
Cow final wt., lb	1459	1468	1289[a]	1516[b]	1585[c]
Cow gain, lb	153	168	208[a]	172[a,b]	100[b]
Cow daily gain, lb	1.56	1.70	1.84	1.95	1.10
Legume cover, %	7.0	10.0	6.5[a,b]	16.2[a]	2.9[b]
Available dry matter, lb/a	3667	3868	3850	3830	3622
Hay production, lb of dry matter/a	1727[a]	3075[b]	2200[a,b]	3087[a]	1917[b]

[a,b,c]Grazing system and year 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 winter field pea in lieu of nitrogen (N) fertilizer for wheat in bermudagrass reduced spring calf and cow gains and forage availability compared to wheat-bermudagrass plus an N application during the wheat phase because of legume winterkill. Red clover in bermudagrass in lieu of one summer N application did not affect cow gains.

Introduction

Bermudagrass [*Cynodon dactylon* (L.) Pers.] is a productive forage species when intensively managed. However, it has periods of dormancy and requires proper use to maintain forage quality and adequate nitrogen (N) fertilizer to optimize forage yield and quality. Interseeding wheat or other small grains can lengthen the grazing season but requires additional N fertilization. Legumes in the bermudagrass sward could improve forage quality and reduce fertilizer usage but 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. Austrian winter field pea is a vigorous winter annual legume that has survived some winters in southeastern Kansas. This study was designed to compare cow-calf and dry cow performance on a wheat-bermudagrass pasture system that included a winter and a summer legume with a single 60 lb/a N application (Legumes) versus wheat-bermudagrass with two additional N applications of 50 lb/a and no legumes (Nitrogen).

Experimental Procedures

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

'Jagger' wheat (100 lb/a) was interseeded (no-till) into bermudagrass sod on September 10, 1998. The next day, 32 lb/a of Austrian winter field pea was interseeded into the four pastures assigned to the legume treatment. Stands of wheat and field pea were assessed as "good" to "excellent". The four Nitrogen pastures were fertilized on February 26, 1999 with 55 lb/a of N as urea.

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

The wheat grazing phase ended on May 18-19, when cows and calves were weighed and calves were weaned. Cows were returned to assigned pastures to continue grazing the bermudagrass phase until August 25, when they were removed to begin calving. Nitrogen pastures received 50 lb/a of N as urea on July 12.

Available forage and legume canopy coverage were monitored throughout the grazing season with a calibrated disk meter. Pastures were clipped in July to remove excess, low-quality forage.

Results and Discussion

The fall stand of field pea was totally winterkilled in December. Gain during the wheat grazing period (57 days) was greater ($P < .05$) for calves and cows in the Nitrogen than in the Legumes pasture system (Table 1). Average available forage dry matter in the wheat grazing phase was 19% less ($P < .05$) for the Legume than the Nitrogen system, but the difference was much greater at certain times (data not shown). The legume canopy coverage was 1% for the Legume treatment, mostly white clover, because the winter field pea had winterkilled.

Cow gains during the bermudagrass phase were similar for the two grazing systems (Table 1, $P > .05$). Average available forage was also similar ($P < .05$) for the Nitrogen and the Legumes system. Average canopy coverage of red clover was greater ($P < .05$) for the Legumes system. For the wheat and bermudagrass phases in the 1999 grazing season, total cattle gain was higher ($P < .05$) in the Nitrogen than the Legumes treatment.

Table 1. Performance of Cow-Calf Pairs Grazing Bermudagrass Pastures Interseeded with Wheat and Fertilized with Nitrogen or Interseeded with Legumes, Southeast Agricultural Research Center, 1999.

	Management System	
Item	Nitrogen	Legumes
Wheat Phase		
No. of cow-calf pairs	16	16
No. of days	57	57
Stocking rate, cow-calf pairs/a	0.8	0.8
Calf initial wt., lb	465	467
Calf final wt., lb	626	601
Calf gain, lb	161[a]	135[b]
Calf daily gain, lb	2.83[a]	2.36[b]
Cow initial wt., lb	1289	1289
Cow final wt., lb	1414[a]	1318[b]
Cow gain, lb	125[a]	29[b]
Cow daily gain, lb	2.19[a]	0.51[b]
Cow + calf gain, lb/a	229[a]	131[b]
Legume cover, %	0[a]	1[b]
Average available DM, lb/a	1710[a]	1420[b]
Bermudagrass Phase		
No. of cows	16	16
No. of days	97	97
Stocking rate, cows/a	0.8	0.8
Cow initial wt., lb	1414[a]	1325[b]
Cow final wt., lb	1556	1505
Cow gain, lb	142	181
Cow daily gain, lb	1.47	1.86
Cow gain, lb/a	114	145
Legume cover, %	1[a]	4[b]
Average available DM, lb/a	2820	1640
Total cow + calf gain, lb/a	342[a]	276[b]

[a,b]Means within a row followed by the same letter are not significantly different at $P < 0.05$.

SOUTHEAST AGRICULTURAL RESEARCH CENTER KANSAS STATE UNIVERSITY

ALFALFA VARIETY PERFORMANCE IN SOUTHEASTERN KANSAS

Joseph L. Moyer

Summary

Final stands of the test of 18 alfalfa entries seeded in 1995 were evaluated in 1999. After 5 seasons, 'ZC 9346' and 'DK 127' had better stands than 'Kanza', 'Riley', and seven other entries. A 28-line test seeded in 1998 was cut four times in 1999. Yields ranged from 4.98 to 6.09 tons/a. For the year, 'Cimarron 3i', 'Amerigraze 401', and 'Stamina' yielded significantly ($P < .05$) more than 'WL 325 HQ' and 'Gold Plus'.

Introduction

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

Experimental Procedures

An 18-line test seeded (15 lb/a) on April 6, 1995 at the Mound Valley Unit was evaluated visually for stand density on October 1, 1999. Plots had been fertilized each year. Cutting usually was done at the early bloom stage, with no cuttings between September 10 and first freeze.

A 28-line test was seeded (15 lb/a) on April 14, 1998 at the Mound Valley Unit. The plot area was fertilized in 1999 with 20-50-200 lb/a of N-P_2O_5-K_2O, on April 1. Alfalfa weevils were controlled by spraying 1.5 pt/a of Lorsban® on April 20.

Moisture was excessive in early summer, preventing a timely second cutting. However, rainfall for July and August was substantially below normal, reducing third- and fourth-cutting yields (see weather summary).

Results and Discussion

Final stand ratings for the variety test seeded in 1995 are listed in Table 1, along with total yields for the previous 4 years. Stands after five seasons were poorest for Kanza, Riley, and 'Perry', which were significantly ($P < .05$) lower than stands of ZC 9346, DK 127, ABI 9141, 'Innovator + Z', and 'ABI 9231 Exp'. Poor stand maintenance seemed related to low yields, because the three entries with poorest stands were also lowest in 4-year production.

In the test seeded in 1998, cut 1 yields were significantly ($P < .05$) higher from Cimarron 3i than from 22 other entries (Table 2). Yields of the second cut were higher from Perry than from Kanza and WL 325 HQ. In the third cut, 'ZC 9751A' had higher yield than eight other entries. In the fall cut (no. 4), 'Sendero' and Cimarron 3i produced more ($P < .05$) forage than seven other entries.

Total 1999 yield of Cimarron 3i was higher

(P < .05) than total yields of 23 other entries (Table 3). The three highest-yielding entries, Cimarron 3i, 'Amerigraze 401 + Z', and 'Stamina', produced more than WL 325 HQ and 'Gold Plus'. Two-year total production was greater (P < .05) from Cimarron 3i, 'WL 324', Perry, and Amerigraze 401 + Z than from WL 325 HQ and 'CW 75044 Exp'.

Table 1. Final Stand Ratings and Total Forage Yields (12% moisture) of the Alfalfa Variety Test Seeded in 1995, Mound Valley Unit, Southeast Agricultural Research Center.

Source	Entry	Final Stand	Total Yield, 4-Yr
		%	tons/a
AgriPro Biosciences, Inc.	ABI 9141	55	27.81
AgriPro Biosciences, Inc.	SUPERCUTS	40	27.28
AgriPro Biosciences, Inc.	ABI 9231 EXP	50	26.84
AgriPro Biosciences, Inc.	INNOVATOR + Z	55	26.18
AgriPro Biosciences, Inc.	TOTAL + Z	35	27.42
AgriPro Biosciences, Inc.	ZC 9346	65	26.64
DEKALB Plant Genetics	DK 127	60	25.82
DEKALB Plant Genetics	DK 133	35	26.48
Forage Genetics	3T26 EXP	45	25.64
Great Plains Research	HAYGRAZER	35	26.34
Mycogen Plant Sciences	TMF GENERATION	35	27.12
Northrup King Co.	RUSHMORE	40	25.70
Ohlde Seed Co.	MAGNUM IV	35	26.85
W-L Research, Inc.	WL 252 HQ	30	26.38
W-L Research, Inc.	WL 323	45	26.44
Public-Nebraska AES	PERRY	25	25.34
Public-Kansas AES	KANZA	15	24.73
Public-Kansas AES	RILEY	20	25.23
Average		40	26.35
LSD(.05)		20	1.29

Table 2. Forage Yields (tons/a @ 12% moisture) of Four Cuttings in 1999 for the 1998 Alfalfa Variety Test, Mound Valley Unit, Southeast Agricultural Research Center.

Source	Entry	5/10	7/6	8/6	10/22
AgriPro Biosciences, Inc	ZC9750A	1.82efg[a]	1.77abc	0.79abc	0.99abcd
AgriPro Biosciences, Inc.	ZC9751A	1.87bcdefg	1.91abc	0.84a	0.97abcd
AgriPro Biosciences, Inc.	ZC9651	1.87bcdefg	1.86abc	0.71abcdef	0.98abcd
AgriPro Biosciences, Inc.	AMERIGRAZE 401 + Z	2.08abcd	2.00ab	0.72abcdef	0.96abcde
AgriPro Biosciences, Inc.	EMPEROR	1.95bcdefg	1.86abc	0.78abcd	0.87de
AgriPro Biosciences, Inc.	ZC 9650	1.88bcdefg	1.86abc	0.78abcd	0.95bcde
ALLIED - STAR	SENDERO	1.85defg	1.91abc	0.64def	1.10a
ALLIED - STAR	SPUR	1.85defg	1.90abc	0.68bcdef	0.93bcde
ALLIED - STAR	STAMINA	2.09abcd	2.02ab	0.64def	1.01abcd
CAL/WEST Seeds	CW 5426 Exp.	1.91bcdefg	1.92abc	0.82ab	0.86de
CAL/WEST Seeds	CW 6408 Exp.	1.87bcdefg	1.93abc	0.76abcde	0.81e
CAL/WEST Seeds	CW 74013 Exp.	1.92bcdefg	1.92abc	0.76abcde	0.91cde
CAL/WEST Seeds	CW 74031 Exp.	2.06abcde	1.73abc	0.77abcde	0.88de
CAL/WEST Seeds	CW 74034 Exp.	1.89bcdefg	1.80abc	0.80abc	1.00abcd
CAL/WEST Seeds	CW 75044 Exp.	1.76g	1.80abc	0.74abcde	0.96abcde
CAL/WEST Seeds	GOLD PLUS	1.81fg	1.83abc	0.67cdef	0.95bcde
DAIRYLAND	DS9612	2.11ab	1.86abc	0.74abcde	1.00abcd
DAIRYLAND - MBS	PROGRO	1.94bcdefg	1.84abc	0.71abcdef	1.00abcd
DEKALB Plant Genetics	DK 141	1.87bcdefg	2.02ab	0.62ef	0.93bcde
DEKALB Plant Genetics	DK142	1.91bcdefg	1.86abc	0.77abcde	0.97abcd
GARST SEED	631	2.03bcdef	1.84abc	0.78abcd	0.93bcde
Germains	WL 324	1.95bcdefg	1.91abc	0.77abcde	1.00abcd
Germains	WL 325 HQ	1.87bcdefg	1.65bc	0.58f	0.88de
Germains	WL 326 GZ	1.96bcdefg	1.76abc	0.70abcdef	1.00abcd
Great Plains Research	CIMARRON 3i	2.28a	1.97ab	0.77abcde	1.08ab
PIONEER	54H55	1.86cdefg	1.79abc	0.67cdef	1.04abc
Public - Kansas AES	Kanza	1.89bcdefg	1.57c	0.79abcd	1.06abc
Public - Nebraska AES	Perry	2.10abc	2.10a	0.66cdef	0.86de
Average		1.94	1.86	0.73	0.96

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

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

Source	Entry	1998	1999	2-Year Total
AgriPro Biosciences, Inc	ZC9750A	2.32	5.36	7.68
AgriPro Biosciences, Inc.	ZC9751A	2.42	5.58	8.00
AgriPro Biosciences, Inc.	ZC9651	2.36	5.42	7.78
AgriPro Biosciences, Inc.	AMERIGRAZE 401 + Z	2.42	5.75	8.17
AgriPro Biosciences, Inc.	EMPEROR	2.50	5.45	7.95
AgriPro Biosciences, Inc.	ZC 9650	2.40	5.46	7.86
ALLIED - STAR	SENDERO	2.50	5.49	7.00
ALLIED - STAR	SPUR	2.26	5.36	7.62
ALLIED - STAR	STAMINA	2.26	5.74	8.00
CAL/WEST Seeds	CW 5426 Exp.	2.33	5.50	7.83
CAL/WEST Seeds	CW 6408 Exp.	2.33	5.37	7.70
CAL/WEST Seeds	CW 74013 Exp.	2.51	5.50	8.01
CAL/WEST Seeds	CW 74031 Exp.	2.41	5.44	7.85
CAL/WEST Seeds	CW 74034 Exp.	2.29	5.49	7.78
CAL/WEST Seeds	CW 75044 Exp.	2.28	5.26	7.54
CAL/WEST Seeds	GOLD PLUS	2.38	5.24	7.63
DAIRYLAND	DS9612	2.38	5.69	8.07
DAIRYLAND - MBS	PROGRO	2.50	5.49	8.00
DEKALB Plant Genetics	DK 141	2.57	5.44	8.01
DEKALB Plant Genetics	DK142	2.41	5.51	7.92
GARST SEED	631	2.52	5.58	8.10
Germains	WL 324	2.57	5.62	8.19
Germains	WL 325 HQ	2.32	4.98	7.30
Germains	WL 326 GZ	2.47	5.41	7.88
Great Plains Research	CIMARRON 3i	2.46	6.09	8.56
PIONEER	54H55	2.49	5.36	7.84
Public - Kansas AES	Kanza	2.50	5.30	7.80
Public - Nebraska AES	Perry	2.45	5.73	8.18
Average		2.41	5.49	7.90
LSD 0.05		0.19	0.39	0.47

PERFORMANCE OF WARM-SEASON, PERENNIAL, FORAGE GRASSES

Joseph L. Moyer and Kenneth W. Kelley

Summary

A test of warm-season, perennial grasses seeded in spring, 1996 was harvested for forage production on July 20, 1999. Production averaged 2.07 tons/a. ‘Kanlow’ switchgrass produced more forage than all other entries. ‘WW Ironmaster’ Old World bluestem and ‘Pete’ and ‘WW 2745’ eastern gamagrasses produced less than the other five entries.

Introduction

Warm-season, perennial grasses can be used to 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 and 1998, but not in 1999. A 20 ft x 3 ft area was harvested on July 20, 1999 with a Carter flail harvester at a height of 2-3 inches, and the remainder of the area was clipped.

Results and Discussion

Forage yields from the warm-season cultivar test are shown in Table 1. Stands were generally satisfactory except for eastern gamagrass entries. Much of the forage harvested from plots seeded with eastern gamagrass thus consisted of weedy grass species.

Forage production in 1999 averaged 2.07 tons/a total and 2.39 tons/a without the eastern gamagrass entries (Table 1). ‘Kanlow’ switchgrass produced more forage than any other entry. ‘Kaw’ and PI-483446 big bluestems, ‘Blackwell’ switchgrass, and ‘Osage’ indiangrass produced more than WW Ironmaster Old World bluestem and the eastern gamagrass entries, which had only partial stands.

Table 1. Forage Yields of Warm-Season Grass Cultivars in 1999, Parsons Unit, Southeast Agricultural Research Center.

Cultivar	Species	Forage Yield
		tons/a@12% moisture
Kaw	Big bluestem	2.63
PI-483446	Big bluestem	2.65
Pete[1]	Eastern gamagrass	0.98
WW 2745[1]	Eastern gamagrass	1.20
Osage	Indiangrass	2.36
WW Ironmaster	Old World bluestem	1.11
Blackwell	Switchgrass	2.40
Kanlow	Switchgrass	3.21
LSD(.05)		0.45

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

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 (1998), yield was increased by 60% with the first 45 lb/a of nitrogen (N) application and 41% with the next 45 lb. With 90 lb/a of N applied in 1998, the 1999 yield was increased by 40% compared to no N and by 23% compared to 45 lb/a of N applied in 1998. Knifed N application at the 90 lb/a rate resulted in higher yields compared to broadcast application for the 2-cut system in both 1998 and 1999.

Introduction

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

Experimental Procedures

Established (15-year-old) 'Pete' eastern gamagrass was fertilized with 54 lb P_2O_5/a and 61 lb K_2O/a in each of the past 8 years and burned each spring except in 1996. In 1998, N (urea-ammonium nitrate, 28% N) treatments of 45, or 90 lb/a were applied on April 23 to 8 ft by 20 ft plots by broadcast or knife (4-inch) placement. No-N control plots received no N but were knifed. Nitrogen was not applied in 1999, so that residual responses could be tested.

Plots were cut with a flail-type harvester on 6 July and 20 August from the 2-cut system and on 19 July from the 1-cut system. Yields were determined from a 3 ft by 20 ft strip of each plot, and a subsample was taken for moisture determination.

Results and Discussion

Yields in 1998 were increased ($P < .05$) by 60% with the first 45 lb/a increment of N and by an additional 41% with the next 45-lb increment (Fig. 1). Application of 90 lb/a of N in 1998 compared to no N resulted in 40% greater ($P < .05$) forage yield in 1999. Also in 1999, yield was 23% higher for the 90 lb/a N rate compared to 45 lb/a of N applied in 1998 (Fig. 1).

Knifing N in 1998 resulted in significant ($P < .05$) yield interactions between N rate and N placement factors for the 2-cut system in both 1998 and 1999. Figure 2 illustrates that in 1998, total yield for the 2-cut system increased ($P < .05$) with each increment of added N, and that knife placement increased yield more than broadcast at the 90 lb/a N rate. In 1999, yield was increased ($P < .05$) by 1998 knife placement of 90 lb N/a compared to all other 1998 treatments (Fig. 2).

The 2-harvest system resulted in similar total yields in 1998. In 1999, however, the 1-cut harvest system resulted in 20% more total yield than the 2-cut system, 2.99 vs. 2.49 tons/a. No interaction occurred between N application treatments; i.e., 1-cut and 2-cut harvest systems responded similarly to the N treatments (data not shown).

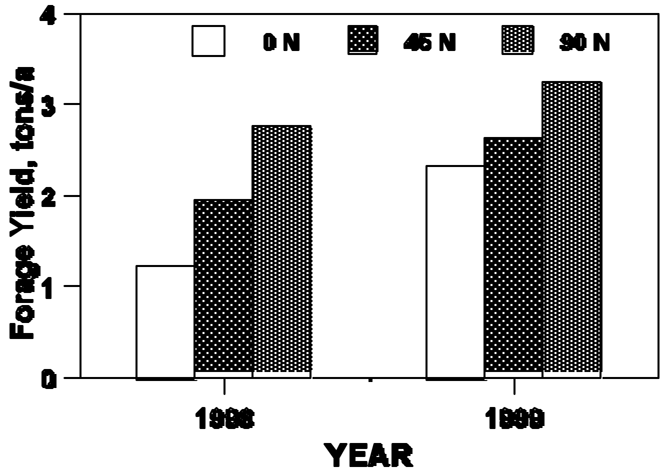

Figure 6. Eastern Gamagrass Forage Yields (12% moisture) for 1998 and 1999 with Different N Application Rates in 1998, Mound Valley Unit, Southeast Agricultural Research Center.

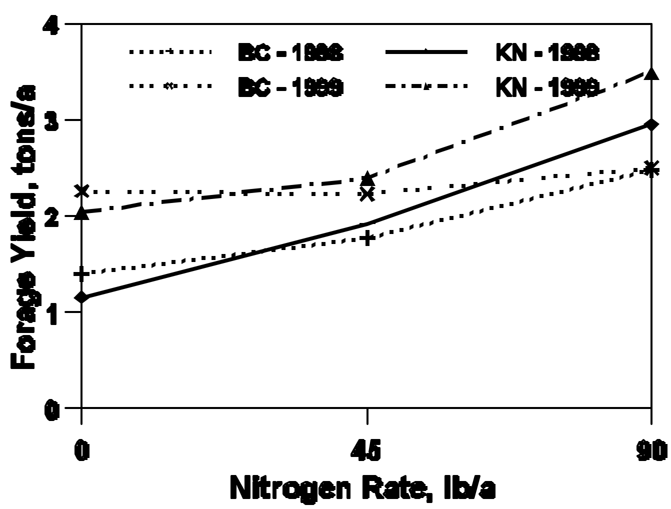

Figure 7. Eastern Gamagrass Forage Yields (12% moisture) in the 2-Cut System for 1998 and 1999 with Different N Application Methods and Rates in 1998, Mound Valley Unit, Southeast Agricultural Research Center.

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HAY QUALITY OF WARM-SEASON ANNUAL GRASSES

Joseph L. Moyer

Summary

Twenty-nine entries of sudan-type grasses, including three millets, were evaluated for hay quality. Contents of neutral-detergent fiber (NDF) and acid-detergent fiber (ADF) in first-cut forage were determined. Total NDF content ranged from 55.3% for ‘Ga 337’ sudangrass, lower ($P < .05$) than five other cultivars, up to 59.2%. The ADF content of Ga 337 (29.1%) was lower than the ADF content of 19 other cultivars.

Introduction

A hay test of warm-season annuals, which included yield and quality evaluations, was offered in 1998 for commercial entrants on a fee basis. Check and/or public lines were added to the 26 commercial entries to make 29 entries, three of them millets. Yield, crude protein content, and leaf:stem ratio were reported in the 1999 Agricultural Research (Rep. Prog. 834).

Experimental Procedures

The test was seeded in 30' by 5' (six 10-in rows) plots at the rate of 450,000 live seeds/a, replicated four times in a randomized complete block, on 14 May, 1998 at the Mound Valley Unit. Plots were fertilized preplant with 130-70-230 lb/a of N-P_2O_5-K_2O, and with 60 lb/a of N after the first cut. Three harvests were obtained, on 29 June, 27 July, and 12 October. The first harvest was from early boot to the head emergence stage. Growing conditions were dry by late August (see weather summary). No particular insect or disease problems were noted.

Results and Discussion

Neutral-detergent fiber (NDF) contents for forage components from the first cutting are shown in Table 1. Leaf NDF contents ranged from 54.3% for ‘Greenleaf’ to 59.2% for X18347. Stem NDF contents ranged from 54.7% for three entries to $\geq$61.5% for the three millets. Total NDF was lowest for Ga 337 at 55.3% and ranged up to $>$59% for two entries. The three lowest total NDFs were less ($P < .05$) than the three highest total NDFs.

Acid-detergent fiber (ADF) contents for forage components from the first cutting are shown in Table 2. Leaf ADF contents ranged from 27.8% for Ga 337 to 30.9% for two cultivars. Stem ADF contents ranged from 30.4% for Ga 337 to 36.1% for ‘Trudan 10'. Total ADF was lowest for Ga 337 at 29.1% and ranged up to 33.5% for Trudan 10. The total ADF for Ga 337 was lower ($P < .05$) than the ADF contents of 19 other cultivars. The three lowest total ADFs were less ($P < .05$) than the 11 highest total ADFs.

Table 1. Neutral-detergent Fiber (NDF) Content of the First Cutting of Summer Annual Grasses Grown for Hay in 1998, Mound Valley Unit, Southeast Agricultural Research Center.

Source/Brand	Entry[a]	Type[b]	Leaf NDF	Stem NDF	Total NDF
			-----------	%	-----------
Cargill	X25477	SX	58.9	54.7	56.5
	X18347	SX	59.2	54.7	57.1
Dekalb	SX-8	SX	58.6	55.2	56.7
	ST6 E	SX	57.8	56.0	56.8
	SX-17	SX	57.7	54.7	56.1
Golden Harvest	Re-Gro H-22B	SX	55.3	56.1	55.7
	GH EX 5	SX	57.4	55.9	56.6
	GH EX 6	SX	57.8	57.2	57.6
	GH EX 7	SX	56.8	56.7	56.7
	GH EX 8	SX	58.2	57.1	57.7
Mycogen Seed	T-E Haygrazer	SX	57.1	56.6	56.8
Novartis	Trudan 10	S	57.2	60.6	59.2
	Trudan 8	S	58.4	57.7	58.0
Seed Resource	Exp S-96-3	SX	56.5	55.3	55.8
	Exp M-97-1	M	55.2	62.0	57.0
Sharp Bros.	Buffalo Brand	SX	58.3	56.4	57.2
	Grazex II	SX	57.2	57.5	57.3
	Grazex II w	SX	55.7	56.7	56.3
	BMR Exp.	SX	56.2	56.6	56.4
Triumph	Sooner Sweet	SX	55.4	57.7	56.7
	Super Sweet10	SX	57.3	55.3	56.3
	Super Mil 60	M	55.0	61.5	56.8
Wayne Hanna	Tift Exp. #4	SX	56.8	58.0	57.3
	Tift Exp. #5	SX	56.2	58.6	56.9
	Ga 337	S	55.3	55.3	55.3
	Tifleaf 3	M	54.8	61.6	57.0
Check	Piper	S	56.1	60.9	59.1
	NB 280S	SX	56.5	57.1	56.9
	Greenleaf	S	54.3	58.6	56.5
		Average	56.8	57.3	56.9
		LSD(0.05)	2.2	2.1	1.7

[a]All entries were between the boot and head emergence stages of growth.
[b]SX = sudan-sorghum hybrid, S = true sudangrass cultivar, M = millet.

Table 2. Acid-Detergent Fiber (ADF) Content of the First Cutting of Summer Annual Grasses Grown for Hay in 1998, Mound Valley Unit, Southeast Branch Experiment Station.

Source/Brand	Entry[a]	Type[b]	Leaf ADF	Stem ADF	Total ADF
			- - - - - - - - - - -	%	- - - - - - - - - - -
Cargill	X25477	SX	29.8	32.6	31.4
	X18347	SX	30.3	32.2	31.3
Dekalb	SX-8	SX	30.9	32.1	31.5
	ST6 E	SX	29.7	33.0	31.6
	SX-17	SX	30.3	31.7	31.1
Golden Harvest	Re-Gro H-22B	SX	27.9	33.2	30.9
	GH EX 5	SX	29.6	31.0	30.2
	GH EX 6	SX	29.6	32.1	31.0
	GH EX 7	SX	29.0	30.7	29.8
	GH EX 8	SX	30.7	31.4	31.0
Mycogen Seed	T-E Haygrazer	SX	29.5	34.1	32.3
Novartis	Trudan 10	S	30.0	36.1	33.5
	Trudan 8	S	30.3	34.2	32.7
Seed Resource	Exp S-96-3	SX	30.3	34.0	32.5
	Exp M-97-1	M	29.0	33.7	30.2
Sharp Bros.	Buffalo Brand	SX	30.9	31.7	31.4
	Grazex II	SX	29.3	35.1	32.5
	Grazex II w	SX	29.3	34.5	32.3
	BMR Exp.	SX	29.1	32.2	30.8
Triumph	Sooner Sweet	SX	28.6	34.6	32.0
	Super Sweet10	SX	29.3	31.3	30.4
	Super Mil 60	M	29.2	32.6	30.1
Wayne Hanna	Tift Exp. #4	SX	29.7	31.7	30.4
	Tift Exp. #5	SX	29.0	31.7	29.8
	Ga 337	S	27.8	30.4	29.1
	Tifleaf 3	M	29.2	33.3	30.5
Check	Piper	S	29.0	34.9	32.8
	NB 280S	SX	29.6	34.3	32.4
	Greenleaf	S	28.4	33.8	31.2
	Average		29.5	32.9	31.3
	LSD(0.05)		1.7	1.7	1.4

[a]All entries were between the boot and head emergence stages of growth.
[b]SX = sudan-sorghum hybrid, S = true sudangrass cultivar, M = millet.

PRODUCTION AND LONGEVITY OF BERMUDAGRASS CULTIVARS IN SOUTHEASTERN KANSAS

Joseph L. Moyer and Charles M. Taliaferro*

Summary

Average 3-year production was highest from 74 X 11-2, followed by LCB84 X 16-66 and LCB84 X 19-16. Stand ratings made in spring, 1996 and fall, 1999 were consistently high for LCB84 X 19-16 and LCB84 X 16-66, but low for 'Midland' and 'World Feeder'.

Introduction

Bermudagrass can be a high-producing, warm-season, perennial forage for southeastern Kansas. Producers have profited from the use of the variety 'Midland' compared to the common bermudas. Further developments in bermudagrass breeding should be monitored closely to speed adoption of improved types. Stand longevity could be an important factor in cultivar selection, as well as forage yield and quality.

Experimental Procedures

Plots were sprigged with plants in peat pots on June 28, 1991 at the Mound Valley Unit. Plots were 15 x 20 ft each, in four randomized complete blocks. Applications of 160-53-60 lb/a of N-P_2O_5-K_2O were made early each summer, followed by fertilization with 64 lb/a of N in midsummer. Strips 20 x 3 ft were cut 3 to 4 times each summer, 1992-95. Subsamples were collected for determination of moisture.

The stand of each plot was assessed visually on May 15, 1996 and on October 1, 1999.

Results and Discussion

Average yields for the last 3 years are shown in Table 1. Relative yields of entries varied by year, as indicated by the significant ($P < .01$) year x entry interaction. However, 74 X 11-2 averaged 53% higher in yield than Midland and 71% higher than 'Greenfield'. LCB84 X 16-66 averaged 37% and 52% higher in forage yield than Midland and Greenfield, respectively, and the relative yield advantages of LCB84 X 19-16 over the same two cultivars were 35% and 50%.

Stand ratings of the bermudagrass cultivars in spring, 1996 and in fall, 1999 also are shown in Table 1. The rankings of the two ratings varied considerably, partly because the fall stand reflected the current year's cover that was affected by growing conditions in 1999, whereas spring ratings largely resulted from winter survival and spring vigor. The only current cultivar that was scored at or above the median in the ratings at both times was 'Hardie'. However, Midland, 'Tifton 44', and World Feeder scored below the median in both ratings. Two cultivars that were ranked relatively highly in both ratings were LCB84 X 19-16 and LCB84 X 16-66.

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Table 1. Three-Year Average Forage Yields of Bermudagrass, 1993-1995, and Subsequent Stand Ratings, Mound Valley Unit, Southeast Agricultural Research Center.

Entry	Forage Yield, 3-Year Average	Stand Rating 5/15/96	Stand Rating 10/1/99
	tons/a@12% moisture	- - - - - - - - - % - - - - - - - - -	
74 X 11-2	7.75	31	48
LCB84 X 16-66	6.92	60	60
LCB84 X 19-16	6.82	80	55
74 X 12-6	6.69	22	45
LCB84 X 15-49	6.65	59	40
74 X 12-12	6.62	34	80
Hardie	6.62	44	60
LCB84 X 9-45	6.53	51	28
LCB84 X 19-31	6.37	24	48
Tifton 44	6.02	6	42
LCB84 X 14-31	5.82	61	38
LCB84 X 19-23	5.60	29	8
LCB84 X 12-28	5.40	59	35
LCB84 X 15-26	5.14	69	38
Midland	5.05	12	35
LCB84 X 21-57	4.74	32	55
LCB84 X 18-62	4.64	59	52
Greenfield	4.54	38	62
World Feeder	4.28	16	27
LCB84 X 16-55	4.00	48	50
Average	5.81	43	46
LSD(.05)	- -[a]	21	18

[a]Entry x year interaction was significant ($P < .01$), so entry mean comparisons across years are not shown.

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

Daniel W. Sweeney and Charles W. Marr*

Summary

In 1999, irrigation increased the number of harvestable ears by more than 25%. Planting at the earlier date resulted in 70% more ears than planting at the later date. Applying more than 40 lb/a of nitrogen increased fresh weight of individual ears.

Introduction

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

Experimental Procedures

The experiment was established on a Parsons silt loam in spring 1999 as a split-plot arrangement of a randomized complete block with three replications. The whole plots included four irrigation schemes: 1) no irrigation, 2) 2 in. at V12 (12-leaf stage), 3) 2 in. at R1 (silk stage), 4) 1 in. at both V12 and R1 and two planting dates (targets of late April and mid-May). The subplots consisted of three N rates of 40, 80, and 120 lb/a. Because of delays caused by unfavorable rainy conditions, plots were planted on May 11 and 27, 1999. Sweet corn from the first planting date was picked on July 21 and 27 and that from the second planting date was picked on August 2 and 6, 1999.

Results and Discussion

The total number of harvestable ears was more than 20,000/a when sweet corn was planted at the earlier date, but was only 12,000/a from the later date (Table 1). On average, irrigation increased the number of harvestable ears by more than 25%, but no differences occurred among irrigation schemes. Nitrogen rate had no effect on ear number.

The effect of planting date was even greater on the total weight of the harvested ears (Table 1); planting at the earlier date more than doubled the total ear weight. This increase also was evident in the individual ear weight; individual ear weight from the early planting was more than 20% greater than that from the later planting. The effect of irrigation on total weight likely was a result of the effect on total number of ears, because individual ear weight was unaffected by irrigation. Although total ear weight was not affected by N rate, rates of 80 and 120 lb N/a

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resulted in greater individual ear weights than obtained with only 40 lb, and this effect was more pronounced for the second planting date (interaction data not shown).

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./acre	ton/a	g/ear
Planting Date			
Date 1	20800	6.21	272
Date 2	12000	2.98	224
LSD $_{(0.05)}$	2100	0.60	15
Irrigation Scheme			
None	13400	3.76	244
V12 (2")	17600	5.03	259
R1 (2")	16900	4.65	243
V12-R1 (1" at each)	17700	4.93	247
LSD $_{(0.05)}$	2900	0.86	NS
N Rate, lb/a			
40	16300	4.40	239
80	16300	4.65	251
120	16700	4.73	254
LSD $_{(0.05)}$	NS	NS	10

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

Daniel W. Sweeney

Summary

In 1999, overall grain sorghum yields were low with no difference between tillage systems. Adding nitrogen increased yields, with knifed anhydrous ammonia generally resulting in greater yields than broadcast solid urea or urea-ammonia nitrate solution.

Introduction

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

Experimental Procedures

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

Results and Discussion

In 1999, grain sorghum yields were low because wet weather delayed planting (July 8), averaging about 40 bu/a. Under these conditions, yield was unaffected by tillage (Table 1). Adding N fertilizer increased grain sorghum yields by two to three times. In general, knifed anhydrous ammonia resulted in greater yields than broadcast solid urea or UAN liquid. However, in the no-tillage system, no significant differences occurred among those three N sources (interaction data not shown).

Table 1. Effects of Tillage and Nitrogen Fertilization on Yield of Grain Sorghum Grown in Rotation with Soybean, Southeast Agricultural Research Center.

Treatment	Yield	
	1999	Avg. 1983-1999
	-------------------- bu/a	--------------------
Tillage		
Conventional	41.6	66.9
Reduced	39.3	64.4
No tillage	38.6	51.1
LSD $_{(0.05)}$	NS	4.1
N Fertilization		
Check	20.8	36.4
Anhydrous NH_3	61.3	74.3
UAN broadcast	39.0	65.1
Urea broadcast	38.2	67.3
LSD $_{(0.05)}$	6.5	3.4
T x N Interaction	0	NS

MANAGEMENT OF PHOSPHORUS-STRATIFIED SOIL FOR EARLY-SEASON CORN PRODUCTION[1]

Daniel W. Sweeney, Greg J. Schwab[2], and David A. Whitney[2]

Summary

In 1999, short-season corn yield was unaffected by soil phosphorus (P) stratification or tillage. Knife placement of P fertilizer resulted in nearly 7 bu/a greater yield regardless of stratification or tillage.

Introduction

Phosphorus (P) stratification in soils in reduced- or no-tillage cropping systems has been well documented. If dry conditions occur during the summer, P uptake from the surface few inches can be limited. This can be alleviated by redistribution of the stratified P or by subsurface placement of additional fertilizer P. The objective of this study was to determine the effectiveness of tillage and/or P placement to alleviate the effects of P stratification in soil on short-season corn grown with no tillage.

Experimental Procedures

Two adjacent sites were established for this study. Site 1 was backgrounded with a soybean crop in 1996 followed in 1997 and 1998 with the short-season corn experiment; site 2 was backgrounded in 1997 and followed in 1998 and 1999 with short-season corn. Stratified or nonstratified areas were established prior to planting the background soybean crop. This was accomplished by applying P fertilizer and incorporating by chisel, disk (deep), and field cultivation for the unstratified profile or only incorporating to a depth of 2 in. with a field cultivator for the stratified profile. These main plots were subdivided in 1997 for Site 1 and in 1998 for Site 2 by tillage (chisel/disk and no tillage), and sub-subplots were P placement methods (no P, broadcast 40 lb P_2O_5/a, and knife 40 lb P_2O_5/a at 4 in.). Corn was planted on April 24, 1997 and April 22, 1998. However, wet weather delayed planting in 1999 until June 10.

Results and Discussion

In 1999 at Site 2, average corn yields were about 24 bu/a because of late planting and dry weather later in the growing season. Neither stratification nor tillage affected yields. Knife placement of fertilizer P resulted in nearly 7 bu/a greater yield than no P application, regardless of the presence of stratification or tillage selection.

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[1]Research partially supported by the Kansas Fertilizer Research Fund.

[2]Department of Agronomy, KSU.

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

Daniel W. Sweeney

Summary

In 1999, fertilization doubled yields even though they were low. Applying all the nitrogen (N) in the spring increased yields in a reduced-tillage system, but N timing had no effect with no-tillage. Yields of double-cropped soybeans were less with no tillage than with reduced tillage but were unaffected by N-P-K timing.

Introduction

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

Experimental Procedures

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

Results and Discussion

In 1999, fertilization doubled the 12 bu/a wheat yields obtained with no fertilizer (data not shown.) Applying all of the N in the spring resulted in greater wheat yields than all N applied in the fall in the reduced-tillage systems, whereas no difference occurred in wheat yields regardless of when N was applied in the no-tillage system (Figure 1). Wheat yields were unaffected by the timing of P-K fertilization (data not shown). Double-cropped soybean yields were nearly 4 bu/a less with no-tillage than reduced tillage, but were unaffected by the timing of N-P-K fertilization applied to the wheat crop (data not shown).

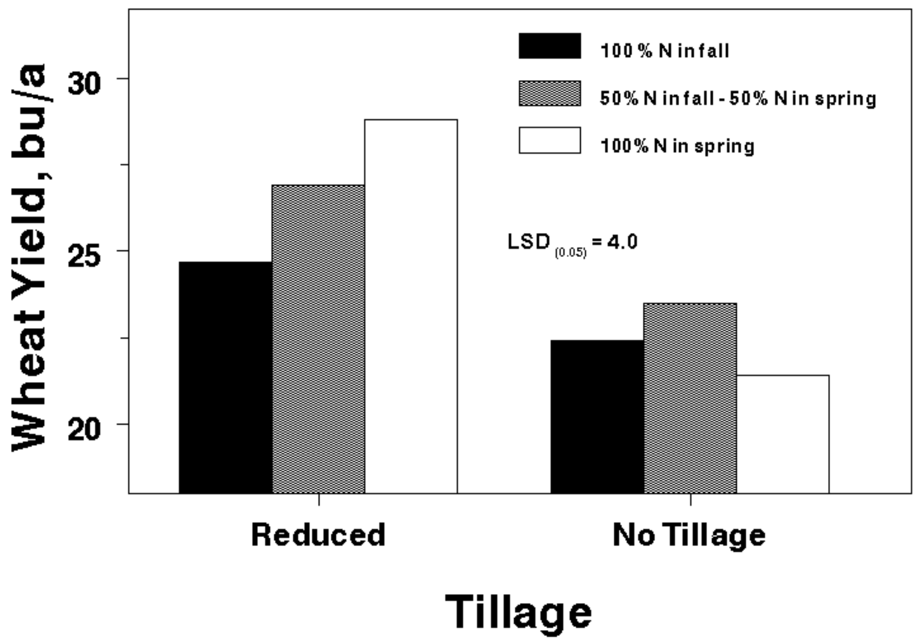

Figure 1. Effects of Tillage and Nitrogen Fertilization Timing on Wheat Yield in a Continuous Wheat — Double-Cropped Soybean Rotation, Southeast Agricultural Research Center.

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

Daniel W. Sweeney

Summary

In 1999, overall soybean yields were low. Increasing soil phosphorus level increased yield by increasing the number of seeds per plant, but soil potassium level had no effect on soybean yield or yield components.

Introduction

Because the response of soybean to phosphorus (P) and potassium (K) fertilization can be sporadic, 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 at approximately 140,000 seed/a with no tillage.

Results and Discussion

In 1999, wet conditions during the early part of the growing season followed by dry conditions resulted in low overall yields of less than 14 bu/a (data not shown). Increasing soil test level from 5 ppm to over 10 ppm increased yield about 20%. This was primarily because of an increased number of seeds per plant. Soil P levels did not affect population or seed weight. Soil test K levels had no effect on yield or yield components.

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 higher nitrogen (N) rates. Forage aftermath was increased with increasing N rates up to 150 lb/a and subsurface applications (knife or spoke) 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 be important for 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 (December 2, 1998) and late winter (February 24, 1999). 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 receive broadcast applications of 50 lb P_2O_5/a and 50 lb K_2O/a. Seed harvest was on June 11, 1999, and forage aftermath was harvested on June 14, 1999.

Results and Discussion

In 1999, late fall application of N at rates up to 200 lb/a resulted in increased clean seed yield (Figure 1). This likely was caused by an increase in the number of panicles/sq m. With late winter application, yield increased with increasing rates to 100 lb N/a but decreased with higher N rates. Caryopsis (individual seed) weight and the number of seeds/panicle were unaffected by N management.

Production of forage aftermath was not affected by timing of N fertilization (data not shown). However, yield 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 either knife or spoke resulted in greater aftermath forage than broadcast N applications.

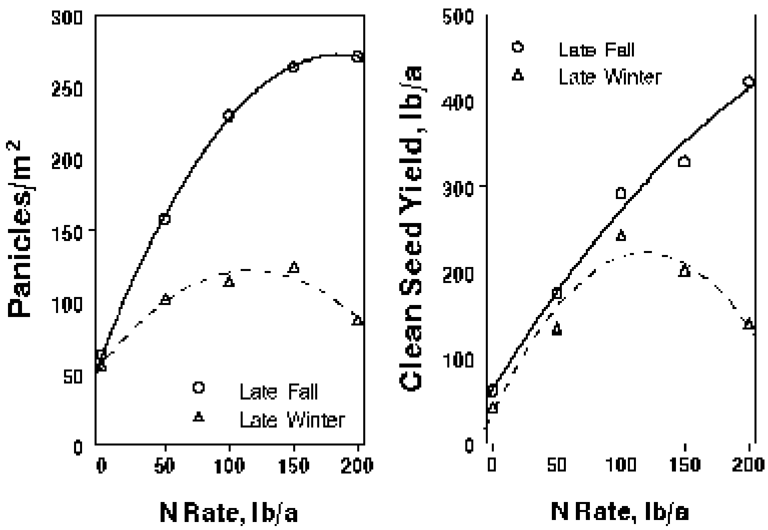

Figure 1. Effects of Nitrogen Timing and Rate on Clean Seed Yield and Panicle Count of Endophyte-Free Tall Fescue, Southeast Agricultural Research Center.

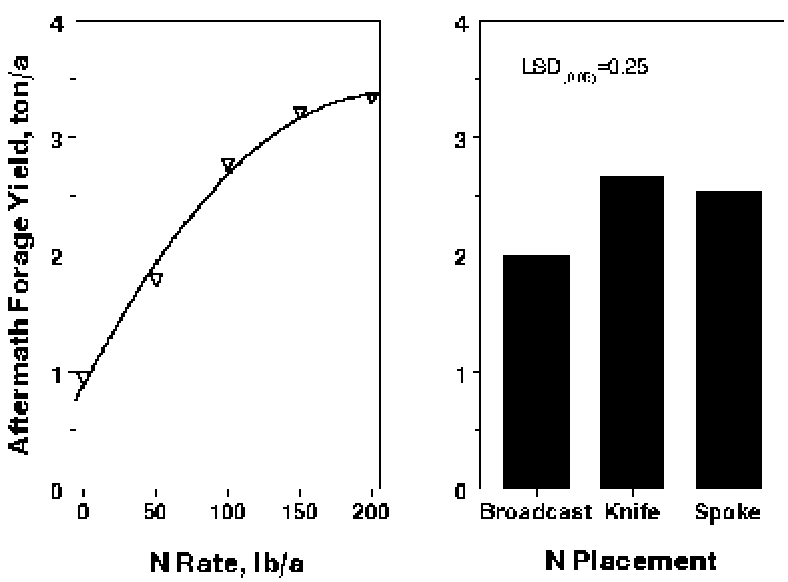

Figure 2. Effects of Nitrogen Rate and Placement on Yield of Forage Aftermath following Seed Harvest of Endophyte-Free Tall Fescue, Southeast Agricultural Research Center.

EFFECTS OF PREVIOUS CROP, NITROGEN RATE, AND NITROGEN METHOD ON NITROGEN REQUIREMENT FOR WINTER WHEAT

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 that evaluated both reduced- and no-tillage systems, grain yields were highest for wheat following soybean with reduced tillage and lowest for wheat planted no-till following grain sorghum. 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 that evaluated only no-tillage, wheat yields also were influenced by previous crop and fertilizer N and phosphorus (P) application method and N rate. Grain yields averaged nearly 40 bu/a following short-season corn or soybean, but only 25 bu/a following grain sorghum. 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 residues 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 (Table 1)

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 tillage prior to wheat planting. Urea ammonium nitrate 28% N solution (UAN) was the N source, except for one comparison treatment where urea was used as a split application (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 (P) and potassium (K) fertilizers were broadcast applied on all plots prior to planting. Both reduced and no-till plots were planted with a no-till drill.

No-Tillage (Table 2)

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 the soil surface. Phosphorus was applied at a constant rate of 68 lbs $P_2 0_5$/a, except for the control plot. The N source was liquid 28% N, and the P source was liquid 10-34-0. Potassium fertilizer was broadcast applied to all treatments at a constant rate of 120 lbs K_2 0/a. All fertilizer was fall-applied prior to planting. Wheat was planted with a no-till drill.

Results and Discussion

Conventional and No-Tillage (Table 1)

Wheat yield was influenced significantly by previous crop, tillage method, N rate, and N placement. Yield averaged 10 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. Yields were reduced in 1999 because of above normal rainfall during April and May, which produced water-logged soil conditions.

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. Plant N analyses for 1999 are still pending as of this date; however, grain yield results suggest that wheat was able to utilize subsurface knifed N applications more efficiently. 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. However, when wheat followed soybeans, the preplant broadcast N treatment gave higher yields than the urea split application, especially for the no-till system. Rainfall was above normal in the fall after wheat planting, which likely moved broadcast N below the soil surface. However, in the case of wheat following grain sorghum, fertilizer N likely was immobilized to a greater extent because of higher residue levels compared to soybean.

No-Tillage (Table 2)

When wheat was planted no-till, yields were influenced significantly by previous crop, N-P application method, and N rate. Grain yields averaged nearly 40 bu/a following short-season corn or soybean, but only 25 bu/a following grain sorghum. 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. Where wheat followed grain sorghum, the 120 lb N rate likely was not high enough to optimize grain yield because of greater immobilization of fertilizer N compared to wheat following corn or soybean.

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, 2 ppm following grain sorghum, and 15 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.), and soil P level was 17 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 and from March through early June, 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 appearred to be related primarily to greater availabilities of N and P following corn or soybean and to immobilization of applied N following grain sorghum.

Table 1. Effects of Previous Crop, Tillage Method, Nitrogen Rate, and Nitrogen Method on Nitrogen Requirements for Hard Winter Wheat, Parsons, KS, 1999.

			Wheat Yield After			
N	N	N	Grain Sorghum		Soybean	
Rate	Method	Source	NT	RT	NT	RT
lb/a			------------------------- bu/a -------------------------			
0	---	---	12.9	13.0	21.3	22.5
60	B'cast	UAN	18.3	19.4	27.9	31.1
60	Knife	UAN	28.4	30.5	37.5	39.1
120	B'cast	UAN	25.8	28.9	39.9	42.4
120	Knife	UAN	42.6	48.0	49.9	55.4
120[1]	B'cast	Urea	34.0	35.7	32.3	41.1
Avg.			27.0	29.3	34.8	38.6
Means: (No N and 120 N as urea omitted)						
Grain sorghum				30.2		
Soybean				40.4		
LSD (0.05)				1.1		
Reduced tillage				36.8		
No-tillage				33.8		
LSD (0.05)				1.1		
B'cast				29.2		
Knife				41.4		
LSD (0.05)				1.0		
60 lb N/a				29.0		
120 lb N/a				41.6		
LSD (0.05)				1.0		

[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. All plots received 60 lbs/a P_20_5 and 75 lbs/a K_20.
NT = no tillage, RT = reduced tillage (disk). Planting date = Oct. 25, 1998; variety = Jagger.

Table 2. Effects of Previous Crop, Nitrogen and Phosphorus Method, and N Rate for Hard Winter Wheat, Parsons, KS, 1999.

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	30.1	18.4	32.1
Knife	40	68	36.9	21.4	39.6
Knife	80	68	45.8	37.9	51.3
Knife	120	68	52.3	43.5	52.8
Strip band	20	68	34.0	14.5	32.2
Strip band	40	68	38.1	21.6	38.1
Strip band	80	68	45.2	27.9	42.6
Strip band	120	68	49.1	35.3	47.7
Broadcast	20	68	28.6	13.8	32.5
Broadcast	40	68	36.3	18.6	35.2
Broadcast	80	68	41.1	23.1	41.5
Broadcast	120	68	46.3	30.2	45.3
Knife control	0	0	22.8	14.2	25.3
Control	0	0	24.3	14.1	27.3
LSD (0.05)			2.6	2.6	2.6
Means: (controls omitted)			40.3	25.5	40.9
N-P Application Method					
Knife			41.3	30.3	43.9
Strip band			41.6	24.8	40.1
Broadcast			38.1	21.4	38.6
LSD (0.05)			1.3	1.3	1.3
N Rate (lb/a)					
20			30.9	15.5	32.2
40			37.1	20.5	37.6
80			44.0	29.6	45.1
120			49.2	36.3	48.6
LSD (0.05)			1.5	1.5	1.5

N source = urea ammonium nitrate 28% N solution; P source = 10-34-0.
Planting date = Oct. 24, 1998; variety = Jagger. All plots received 120 lbs/a of K_2O.

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 southeast 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 results in alkaline soil conditions (pH greater than 7.0), which also reduces nutrient availability and increases persistence of some herbicides.

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. Since 1996, the crop rotation has consisted of [wheat - double-cropped soybean] - grain sorghum - soybean and uses conventional tillage practices.

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. In 1999, when spring rainfall was well above normal, wheat yield response to pH was more variable than in previous years.

Table 1. Effects of Soil pH on Grain Sorghum, Soybean, and Wheat Yields, Parsons Unit, Southeast Agricultural Research Center.

Soil pH		Grain Yield							
		Grain Sorghum		Full-Season Soybean		Wheat		Double-Cropped Soybean	
0-4"	4-8"	1993	1997	1994	1998	1996	1999	1996	1999
		bu/a							
5.3	5.3	59.4	112.4	25.0	25.4	27.4	45.4	19.0	15.9
6.2	5.7	65.6	123.8	25.9	26.4	32.5	44.1	21.5	17.7
6.4	5.9	70.3	134.8	35.6	27.5	33.5	41.2	22.5	19.6
6.8	6.2	82.6	134.1	36.2	28.9	37.2	43.5	24.2	20.3
7.3	6.9	84.2	129.7	38.3	30.0	38.7	40.6	22.6	19.8
LSD (0.05)		4.5	3.7	3.7	1.1	3.3	3.6	1.2	4.3

Soil pH after fall harvest in 1999.

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EFFECTS OF CROPPING SEQUENCES ON SOYBEAN YIELD

Kenneth W. Kelley

Summary

Cropping sequence had a significant effect on soybean yields in 2 of 3 years. In 1998 and 1999, yields were significantly higher for first-year soybean following 5 years of grain sorghum. Yields declined as soybeans were grown more frequently in the crop rotation and were lowest for continuous soybeans.

Introduction

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

Experimental Procedures

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

Results and Discussion

Soybean yield responses for the various soybean and grain sorghum cropping sequences are shown in Table 1. In 1998 and 1999, soybean yields were highest for first-year soybean following 5 years of grain sorghum. Yields declined as soybeans were grown more frequently in the crop rotation and were lowest for continuous soybeans. In 1997, in a high yielding environment, soybean yields were not affected significantly by cropping sequence. More data are needed over varying weather conditions; however, results suggest that environment influences the “rotation effect”.

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

	Soybean Yield		
Soybean Sequence	1997	1998	1999
	---------------------------- bu/a ----------------------------		
Continuous soybean	39.5	24.3	23.6
Fifth-year soybean	42.3	25.3	25.0
Fourth-year soybean	40.1	25.7	25.6
Third-year soybean	43.6	27.1	26.5
Second-year soybean	42.8	29.3	27.5
First-year soybean	40.9	30.4	29.5
Soybean - grain sorghum (2-yr rotation)	42.5	30.0	27.4
LSD (0.05):	NS	1.3	1.2

NS = not significant at the 5% level of probability.

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EFFECTS OF PREVIOUS CROP AND TILLAGE ON FULL-SEASON AND DOUBLE-CROPPED SOYBEAN YIELD

Kenneth W. Kelley and Daniel W. Sweeney

Summary

Full-season soybean yields have been similar following corn and grain sorghum in a 3-yr crop rotation study. However, tillage systems have significantly influenced full-season soybean yield at the Columbus Unit, but not at the Parsons Unit. At Columbus, full-season soybean yields have been significantly higher with conventional chisel-disk tillage than with no-tillage. In a 2-yr crop rotation study, double-cropped soybean yields have been affected more by the crop preceding wheat than by tillage. The yields were significantly higher when corn or grain sorghum preceded wheat than when full-season soybean preceded wheat. In 2 of 3 years, double-cropped soybean yields have been similar between disk tillage and no-tillage.

Introduction

In southeastern Kansas, approximately 1,600,000 acres are devoted to crop production, which consists primarily of soybean, grain sorghum, corn, and wheat. The acreage of double-cropped soybean planted no-till has increased significantly in recent years; however, only a limited acreage of spring crops are planted no-till. In the fall, some wheat is planted no-till into previous crop residues, although wheat typically is planted with reduced disk tillage. Tillage may be necessary to incorporate no-till double-cropped wheat and soybean residues before planting a spring crop, such as corn and grain sorghum, in order to reduce nitrogen immobilization and to increase soil temperature for faster seed emergence and early seedling growth benefits. However, for full-season soybean following corn or grain sorghum, tillage may or may not be beneficial. Where double-cropped soybean follows wheat, planting no-till is more labor efficient, conserves valuable topsoil moisture, and reduces soil erosion. However, herbicide cost are often higher in no-till double-cropped soybean systems than in conventional tillage systems. This research seeks to investigate the combined effects of both crop rotation and tillage on yields of full-season and double-cropped soybean.

Experimental Procedures

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

In 1996, a 2-yr crop rotation study consisting of [corn / grain sorghum / soybean] - [wheat - double-crop soybean] was started at the Columbus Unit. Tillage treatments include: 1) plant all crops with conventional tillage or 2) plant all crops with no-tillage.

Results and Discussion

In the 3-yr crop rotation (Table 1), full-season soybean yield has been similar following corn and grain sorghum at both the Columbus and Parsons Units. Tillage system has influenced soybean yield more at the Columbus Unit than at the Parsons Unit. At the Columbus Unit, full-season yield has been significantly higher with conventional chisel - disk tillage compared to no-tillage. However, the continuous no-till method has been superior to planting every other crop no-till.

In the 2-yr crop rotation (Table 2), double-cropped soybean yields have been influenced more by the crop preceding wheat than by tillage. The yields were significantly higher when corn or grain sorghum preceded wheat than when full-season soybean preceded wheat. It is unclear why this yield benefit occurred. Having both full-season and double-cropped soybean in the rotation, even though wheat was grown between the two crops, may have contributed to the yield decline. In 1997 and 1998, tillage did not significantly influence double-cropped soybean yield. However, in 1999, yields were significantly higher with no-till compared to disk tillage, regardless of previous cropping history.

This research has been supported by Kansas Soybean Check-Off funding.

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

		Full-Season Soybean Yield			
		Columbus		Parsons	
Previous Crop	Tillage	1996	1999	1996	1999
		---------- bu/a ----------			
Corn	NT	48.5	17.9	45.6	15.6
Corn	CT	54.8	20.4	46.7	15.4
Corn	Alt-CT	54.2	20.0	45.6	15.9
Corn	Alt-NT	45.6	14.5	42.7	14.5
Grain sorghum	NT	48.3	18.3	45.1	16.0
Grain sorghum	CT	52.9	20.1	43.7	15.5
Grain sorghum	Alt-CT	54.5	20.1	45.9	16.2
Grain sorghum	Alt-NT	46.4	13.9	44.6	15.2
		3.8	1.2	NS	NS
Means:					
Corn		50.8	18.2	45.2	15.4
Grain sorghum		50.5	18.1	44.8	15.7
LSD (0.05):		NS	NS	NS	NS
NT		48.4	18.1	45.3	15.8
CT		53.9	20.3	45.2	15.5
Alt-CT		54.4	20.0	45.8	16.0
Alt-NT		46.0	14.2	43.7	14.9
LSD (0.05):		4.9	1.3	NS	NS

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

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

Previous Crop		Double-Cropped Soybean Yield		
(before wheat)	Tillage	1997	1998	1999
		----------	bu/a	----------
Corn	No-till	38.5	31.8	27.7
Corn	Conv-till	39.3	31.2	24.5
Grain sorghum	No-till	39.4	30.9	28.4
Grain sorghum	Conv-till	40.3	32.2	26.0
Soybean	No-till	33.2	26.2	26.9
Soybean	Conv-till	32.8	26.3	20.8
LSD (0.05):		3.2	4.1	3.4
<u>Means:</u>				
Corn		38.9	31.5	26.1
Grain sorghum		39.9	31.6	27.2
Soybean		33.0	26.3	23.9
LSD (0.05):		2.3	3.0	2.4
No-till		37.0	29.6	27.7
Conv-till		37.5	29.9	23.8
LSD (0.05):		NS	NS	1.9

Conventional tillage: chisel - disk - field cultivate for spring crops and disk twice for double-crop soybean.

GRAIN SORGHUM AND SOYBEAN HERBICIDE RESEARCH

Kenneth W. Kelley

Summary

Herbicide performance evaluations with grain sorghum and soybean were conducted at the Columbus and Parsons Units. Complete results of the various herbicide research studies are available from the author.

Introduction

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

Experimental Procedures

In 1999, grain sorghum herbicide trials were conducted both at the Parsons and Columbus Units. Soybean herbicide research was conducted at the Columbus Unit. All trails were replicated three times, and individual plot size was four 30 in. rows by 30 ft. in length. Herbicide treatments were applied with a tractor-mounted compressed air sprayer with a spray volume of 20 gal/a. Weed control ratings were made in mid summer, and plots were harvested for grain yield.

Results and Discussion

Complete results of the various herbicide studies conducted in 1999 can be obtained by contacting the author.

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PERFORMANCE TEST OF DOUBLE-CROPPED SOYBEAN VARIETIES

James H. Long and Gary L. Kilgore*

Summary

Eighteen double-cropped soybean varieties were planted following winter wheat in Parsons, Kansas and evaluated for yield and other agronomic characteristics throughout the summer of 1999. Grain yields were below average, yet variety differences were seen under the dry growing conditions. Yields ranged from 13.0 bu/a to 22.5 bu/a. The short-season Maturity Group (MG) IV varieties matured during the second week of October, whereas long-season varieties in MG V matured 7-10 days later, after a light frost. Generally, varieties were less than 2 ft tall.

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 have not only high yield potential under these conditions but also the plant structure to allow them to set pods high enough to be harvested. They also should mature before a threat of frost.

Experimental Procedures

Soybean varieties were planted to moisture following winter wheat harvest at the Southeast Agricultural Research Center at Parsons. The soil is a Parsons silt loam. The wheat stubble was burned, then Squadron herbicide was applied, and the area was field cultivated prior to planting. Soybean then was planted on July 7, 1999 at 10 seed per ft of row. Harvest occurred on November 2, 1999.

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 came in late July and August and persisted into September.

Yields ranged from 13.0 bu/a to 22.5 bu/a (Table 1). Several varieties yielded near 20 bu/a and could be considered as top yielders in 1999. Consideration also should be given to plant height and maturity during years such as 1999. Overall plant heights were short, ranging from 15 to 26 in., and this caused some harvest problems. Luckily many pod heights were over 4.0 in., which aided in harvest. Several varieties matured after October 20, which caused anxious moments with the mild early frost in 1999.

*Southeast Area Extension Office.

Table 1. Yield of Variety Test for Double-Cropped Soybeans 1994-1999 and 1999 Characteristics at Columbus, Parsons, and Altamont, Kansas.

Brand	Variety	Yield 1999	1998	1997	1996	1995	1994	1999 Characteristics Plant Ht.	Pod Ht.	Mat. days after 10/1
		bu/a						in.		
Cargill	484RR/CN	17.3	--	--	--	--	--	19.0	3.5	17.3
Cargill	544RR/CN	18.8	--	--	--	--	--	19.0	3.5	22.3
Garst	D478	14.0	--	--	--	--	--	17.0	4.0	13.0
Garst	EX9484	14.6	--	--	--	--	--	17.0	4.0	17.3
Golden Harv.	H-1500	18.8	--	--	--	--	--	16.5	5.0	22.5
Golden Harv.	X95447STS	20.2	--	--	--	--	--	19.0	4.5	22.8
Midland	8486	14.7	--	--	--	--	--	18.5	3.5	14.0
Midland	8530	22.5	--	--	--	--	--	19.5	6.0	24.8
Novartis	51T1	17.8	--	--	--	--	--	26.0	5.0	24.8
Novartis	S57-11	19.3	--	--	--	--	--	18.0	3.5	18.0
Pioneer	9492	16.1	2.3	--	--	--	--	18.0	3.5	14.3
Pioneer	95B33	19.9	6.7	--	--	--	--	17.5	5.5	22.0
Pioneer	93B32	19.3	--	--	--	--	--	15.0	4.0	22.5
Triumph	TR4718RR	14.4	--	--	--	--	--	19.0	3.0	14.0
<u>Check Varieties</u>										
Early MG IV	Flyer	13.0	2.8	40.1	10.1	14.9	17.0	16.0	3.0	10.0
Mid MG IV	KS4694	13.0	1.8	40.2	6.5	--	--	16.0	3.5	13.8
Early MG V	KS4997	21.1	--	--	--	--	--	17.0	4.0	18.8
Early MG V	Manokin	--	7.8	43.5	17.4	19.8	26.5	--	--	--
Early MG V	KS5292	15.5	2.7	39.5	13.3	13.8	25.4	19.0	5.5	22.5
LSD (0.05)		2.7	1.4	5.2	5.6	--	--	3.0	1.8	1.7
Averages		17.2	3.5	38.2	11.4	15.6	23.6	--	--	--

PERFORMANCE TEST OF RIVER-BOTTOM SOYBEAN VARIETIES

James H. Long and Gary L. Kilgore*

Summary

Eighteen 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 1999. Grain yields were excellent, and variety differences were seen with the very productive soils. Yields ranged from 33.9 bu/a to over 44 bu/a. The shorter-season Maturity Group (MG) IV varieties yielded as well or better than the MG V varieties. The soybeans were tall, and some lodging did occur.

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

Eighteen soybean varieties were grown following corn in 1998. 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, Squadron herbicide was applied, and the soil was field cultivated prior to planting. Soybean then was planted on May 28, 1999 at 10 seeds per ft. of row. Plants emerged to form an excellent stand. Basagran was applied postemergent to help control cocklebur. The soybeans were harvested on October 18, 1999.

Results and Discussion

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

Yields ranged from 33.9 bu/a to 44.2 bu/a (Table 1). Several varieties yielded more than 40 bu/a for the 1999 growing season. Consideration should be given to plant height and its effect on lodging as well as plant maturity. Overall plant height ranged from 19.3 to 39.3 in. With respect to plant maturity, the indeterminate, early to mid MG IV varieties yielded as well or better than the determinate growth habit, MG V varieties.

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*Southeast Area Extension Office.

Table 1. Yield of River-Bottom Soybean Variety Test 1996-1999 and 1999 Characteristics at Erie, Kansas.

		Grain Yield						1999 Characteristics		
Brand	Variety	1999	1998	1997	1996	2yr Avg	3 yr Avg	Lodging[1]	Height of Plant	Maturity Days from 9/1
		bu/a							in	
Cargill	434RR/CN	35.3	--	--	--	--	--	2.7	39.3	35
Cargill	544RR/CN	43.2	--	--	--	--	--	2.7	33.0	43.7
Garst	EXP9450	38.9	--	--	--	--	--	3.0	37.3	38.3
Garst	D445N	40.4	--	--	--	--	--	1.0	28.3	33.7
Golden	H1500	36.3	43.7	--	--	40.0	--	1.3	24.7	36.7
Harvest	X95447	43.9	--	--	--	--	--	1.3	31.0	42.3
Midland	388SE	44.2	--	--	--	--	--	1.7	31.0	27
Midland	8450/STS	37.1	--	--	--	--	--	2.0	35.0	32.7
Novartis	S46-W8	39.7	--	--	--	--	--	1.7	36.3	35
Novartis	S57-11	42.7	--	--	--	--	--	1.3	32.3	44.3
Pioneer	9421	40.7	41.8	60.5	--	41.3	47.7	4.0	35.7	26.7
Pioneer	9492	36.3	41.4	--	--	38.9	--	2.3	34.3	38.5
Pioneer	93B-82	44.0	--	--	--	--	--	2.7	33.3	26.7
Triumph	4339RR	39.4	--	--	--	--	--	2.7	36.0	33.7
<u>Check Varieties</u>										
Early IV	Flyer	36.0	--	--	--	--	--	1.7	35.1	24.7
Mid IV	KS4694	33.9	37.8	53.1	65.7	35.9	41.6	2.0	31.7	35
Late IV	KS4997	36.3	--	--	--	--	--	1.3	19.3	36
Early V	KS5292	38.1	34.3	56.9	58.1	36.2	43.1	1.0	26.7	43.3
Averages		39.2	41.9	58.2	62.8	40.6	46.4	2.1	32.2	--
LSD (0.05)		6.8	5.0	5.8	6.9	--	--	1.2	3.7	3.8

[1] Lodging based on a scale of 1 to 5 with 1 standing upright and 5 flat on the ground.

SOUTHEAST AGRICULTURAL RESEARCH CENTER
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CULTURAL PRACTICES TO CONTROL THE SOYBEAN CYST NEMATODE

James H. Long and Tim Todd*

Summary

Studies have been conducted since 1991 to determine the effect of cultural practices on the soybean cyst nematode (*Heterodera glycines*). Long-term studies have found that crop rotation, although reducing the number of cyst nematode in the soil was of little help in preventing damage to a following crop of soybean. Explosive growth in the numbers of the nematode during the growing season reduced grain yield of a susceptible variety by 30 % compared to a resistant variety. The use of a resistant variety was the only reliable cultural practice that could prevent substantial grain yield losses.

Introduction

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

Experimental Procedures

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

Results and Discussion

Crop rotation was of little help in controlling damage by the soybean cyst nematode (Table 1). Stafford soybeans grown even after 3 years of nonhosts such as grain sorghum and wheat and a resistant variety were no higher yielding than continuous Stafford soybeans. The large numbers of the cyst nematode present after the season in the continuous soybeans and those in rotation indicate the explosive growth of the nematode population that occurs when a susceptible soybean is once again introduced in the cropping rotation. The use of the resistant variety, Manokin, was the only component of the cropping rotation that reduced cyst nematode numbers during the season and preserved grain

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yields. The increase in grain yields came as a result of greater numbers of pods being retained during the growing season. Many small pods at the top of the plants resulted in fewer seeds per pod but more total grain.

Table 1. Yield and Yield Components of Soybeans with Corresponding Cyst Nematode Numbers from the Period 1995-1998 at Martin Farms in Columbus, Kansas.

	Yield				Cyst Nematode Population		
Cropping System	Bu/a	Pods/ft	Seeds/pod	Seed wt,g	Pi	Pf	Pf/Pi
Full season:							
S-S-S	26.9bc	200b	2.1a	0.097a	5305a	5897a	1.6c
N-N-S	26.3bc	180bc	2.1a	0.095a	2260bc	8873a	14.5ab
N-R-N-S	29.2b	182b	2.1a	0.100a	741c	9288a	21.5a
N-S-N-R	38.1a	272a	1.8b	0.101a	8259ab	864b	0.1c
Double-cropped:							
N-R-N-S	21.6c	153c	2.1a	0.099a	694c	3501a	7.9b
N-S-N-R	29.7b	194b	2.0ab	0.103a	1710c	1044b	0.5c

Means within a column followed by the same letter are not different according to Fisher's LSD (0.05).
S-S-S - continuous susceptible soybean, N-N-S - susceptible soybean following 2 years of nonhost, N-R-N-S - susceptible soybean following 2 years of a nonhost crop and one of a resistant variety, N-S-N-R - resistant variety following 2 years of a nonhost crop and one of a susceptible variety.
Pi is the initial number of nematode eggs and juveniles; Pf is the final number after soybeans were grown; and Pf/Pi indicates the increase in the nematode where 1.0 is no growth in the population.

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ANNUAL SUMMARY OF WEATHER DATA FOR PARSONS - 1999

Mary Knapp*

1999 DATA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg. Max	42.0	54.9	54.3	66.9	75.1	80.9	91.8	93.6	78.9	72.0	66.7	50.0	68.9
Avg. Min	23.7	34.5	33.5	46.5	53.5	64.2	70.5	65.4	56.4	42.8	40.2	28.4	46.6
Avg. Mean	32.9	44.7	43.9	56.7	64.3	72.6	81.2	79.5	67.7	57.4	53.4	39.2	57.8
Precip	1.4	2.58	3.22	7.2	6.61	8.96	1.02	0.45	4.26	0.88	1.20	4.04	41.84
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*	996	634	653	253	72	10	0	0	80	257	352	800	4106
Cool DD*	0	0	0	5	51	237	501	450	160	20	5	0	1427
Rain Days	5	5	8	11	11	14	3	3	10	2	2	5	79
Min < 10	5	1	0	0	0	0	0	0	0	0	0	0	6
Min < 32	25	14	15	0	0	0	0	0	0	5	9	23	91
Max > 90	0	0	0	0	0	1	22	24	6	0	0	0	53

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

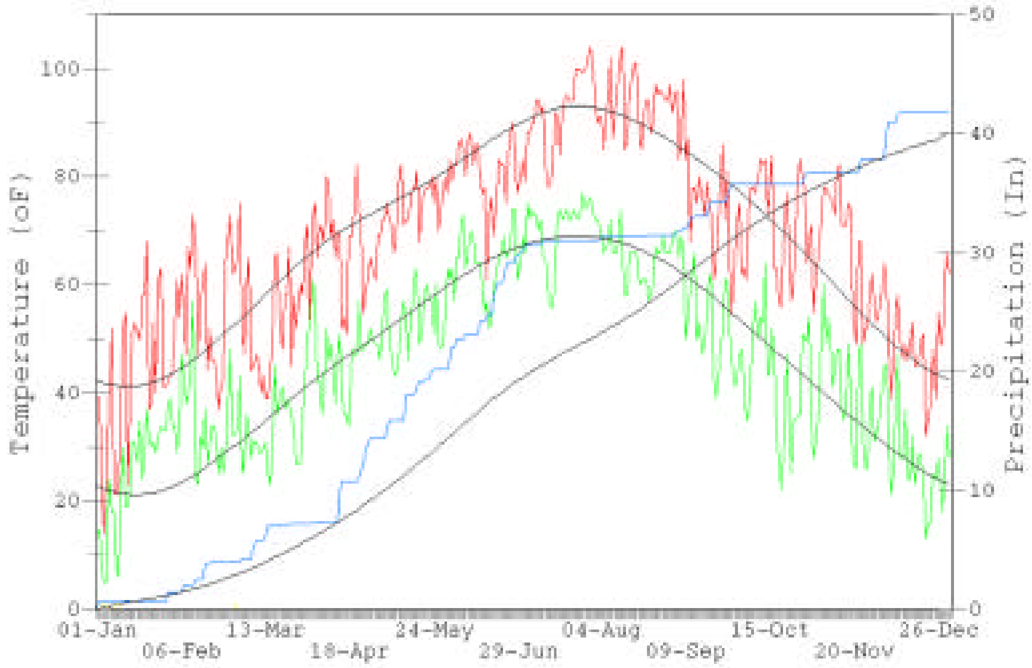
DEPARTURE FROM NORMAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Avg. Max	1.5	8.3	-2.8	-1.3	-1.7	-4.3	0.1	3.5	-2.6	0.7	9.9	5.5	1.4
Avg. Min	4.4	9.7	-0.7	0.7	-2.0	0.1	1.5	-1.0	-2.7	-4.5	4.5	3.6	1.1
Avg. Mean	3.0	9.0	-1.8	-0.3	-1.9	-2.1	0.9	1.2	-2.6	-2.0	7.1	2.2	1.1
Prcip	0.08	1.12	-0.18	3.42	1.35	4.35	-2.13	-3.18	-0.54	-3.04	-1.71	2.28	1.82
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	-92	-186	55	-9	-16	10	0	0	49	37	-209	-139	-500
Cool DD	0	0	0	-17	-75	-57	27	38	-31	-26	5	0	-135

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

*Assistant Specialist, Weather Data Library, KSU.

Parsons Weather -- 1999



ACKNOWLEDGMENTS

Listed below are individuals, organizations, and firms that have contributed to this year's research programs through financial support, product donations, or services.

ABI Alfalfa, Ames, IA
AgriPro Biosciences, Inc., Shawnee Mission, KS
AGSECO, Girard, KS
Allied Seed Coop., Angola, IN
American Cyanamid Co., Wayne, NJ
Bartlett Coop Association
BASF Wyandotte Corp., Parsippany, NJ
Bayer Corp., Kansas City, MO
John Burns, Pittsburg, KS
Cal-West Seeds, Woodland, CA
Cargill Hybrid Seed, Inc., Minneapolis, MN
Cash Grain, Weir, KS
Dairyland Research International, Clinton, WI
DeKalb Genetics Corp., DeKalb, IL
DeLange Seed Co., Girard, KS
Dow Agro Sciences, Indianapolis, IN
Roger Draeger, Weir, KS
DuPont Agrichemical Co., Wilmington, DE
Elanco Products Co., Greenfield, IN
Farm Talk, Parsons, KS
Farmland Industries, Kansas City, MO
Fluid Fertilizer Foundation, Manhattan, KS
FMC Corp., Philadelphia, PA
Forage Genetics, Minneapolis, MN
Ft. Dodge Animal Health, Overland Park, KS
Garst Seed Co., Slater, IA
Germain’s Seed Co. Hill City, KS
Golden Harvest Seed Co., Waterloo, NE
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Johnson Seed Co., Mound Valley, KS
Jones Farm Services, Willard, MO
Kansas Corn Commission, Topeka, KS
Kansas Fertilizer Research Fund, Topeka, KS
Kansas Forage & Grassland Council, Chanute, KS
Kansas Grain Sorghum Commission, Topeka, KS
Kansas Soybean Commission, Topeka, KS
Kansas Wheat Commission, Topeka, KS
Markley Seed Farms, Dennis, KS
Martin Farms, Columbus, KS
Merial Limited, Rathaway, NJ
Monsanto Agricultural Products, St. Louis, MO
Moorman Manufacturing Co., Quincy, IL
Mycogen Seeds, St. Paul, MN
Novartis Crop Protection, Greensboro, NC
Novartis Seeds, Inc., Minneapolis, MN
Parsons Livestock Market, Parsons, KS
Pfizer, Inc., Lee's Summit, MO
Mark Piper, Parsons, KS
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Zeneca Ag Products, Wilmington, DE

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Contribution No. 00-369-S from the Kansas Agricultural Experiment Station.

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SRP 853 May 2000

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