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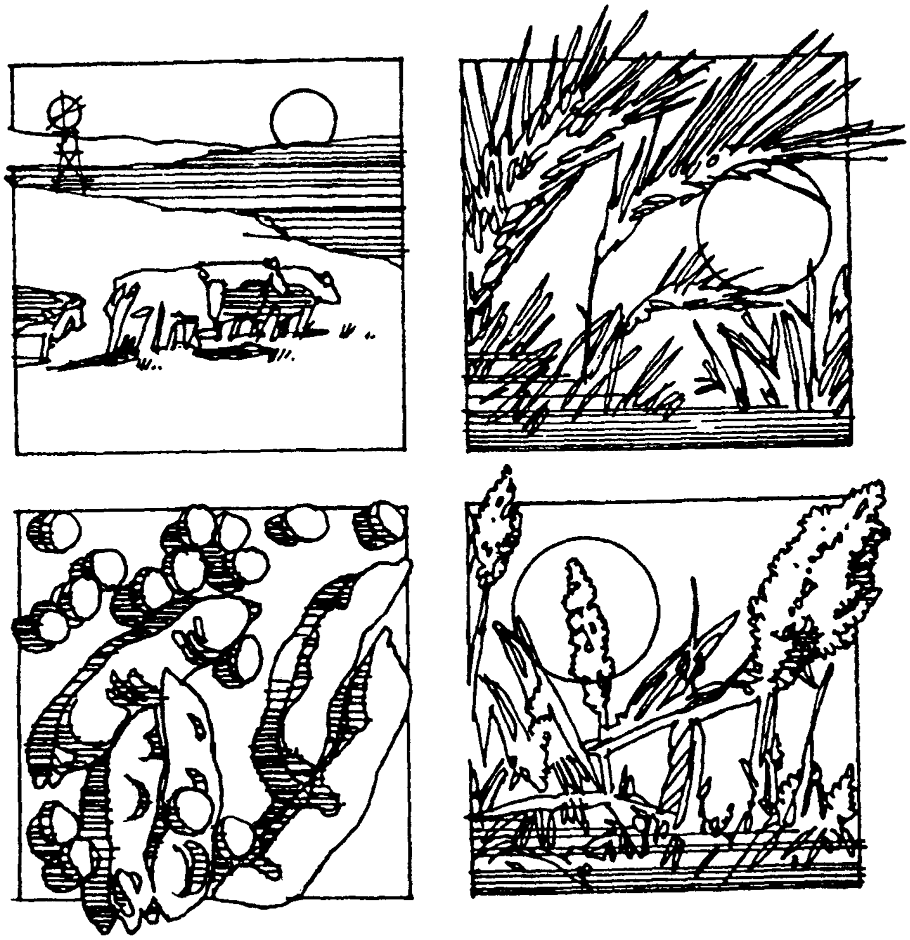
1995 AGRICULTURAL RESEARCH



Report of Progress 733

Agricultural Experiment Station

Kansas State University, Manhattan

Marc A. Johnson, Director

SOUTHEAST AGRICULTURAL RESEARCH CENTER

LYLE LOMAS, Research Center Head, 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 and is responsible for Research Center administration. Lyle joined the staff in 1979 as Animal Scientist. His research interests are beef cattle nutrition, production, and management.

KEN COFFEY, Animal Scientist, received a B.S. degree in Animal Science from the University of Tennessee, a M.S. degree in Animal Science from the University of Kentucky, and a Ph.D. degree in Animal Science from the University of Missouri. He joined the staff in 1986. His research focuses on ruminant nutrition and improving forage utilization by grazing beef cattle.

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

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

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

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

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Contribution No. 95-454-S from the Kansas Agricultural Experiment Station.

EFFECT OF PREVIOUS SPRING STOCKING RATE ON FALL GRAZING AND SUBSEQUENT FEEDLOT PERFORMANCE OF STEERS[1]

Kenneth P. Coffey and Joseph L. Moyer

Summary

One hundred twenty-one mixed-breed steers (730 lb avg BW) were allowed to graze in the fall on fescue (IF) or fescue-ladino clover (IFL) pastures for an average of 91 days. Pastures had been grazed previously at different stocking rates in the spring and left idle in the summer. Previous spring stocking rate had little influence on fall grazing performance and pasture carrying capacity. Feedlot gain, feed consumption, and feed cost declined ($P < .05$) and dressing % increased ($P < .05$) with increasing previous spring stocking rate. When averaged within forages but across the previous stocking rates, calves grazing IFL gained 56% and 40% more ($P < .05$) /head and /acre, respectively on 10 fewer ($P < .05$) grazing days/acre. However, when placed in the feedlot, steers that previously grazed IFL had 4% lower ($P = .05$) gain, and 3% higher ($P < .05$) intake but tended ($P < .10$) to have higher marbling scores than steers that previously grazed IF. Therefore, grazing fescue pastures at higher stocking rates in the spring may have little effect of subsequent fall grazing performance and carrying capacity. Ladino clover addition to IF pastures should have a substantial positive impact on cattle grazing performance.

Introduction

In a previously reported study (KAES Rep. Prog. 708), performance by steers grazing IF and IFL pastures declined as spring stocking rates were increased from approximately one steer/a to over three steers/a. Available forage remaining at the end of the spring grazing period varied substantially with spring stocking rate. The purpose of this study was to determine what effects grazing IF and IFL pastures at different stocking rates in the spring would have on fall grazing performance and carrying capacity and subsequent feedlot performance by steers.

Experimental Procedures

A total of 243 mixed-breed stocker steers were divided into light- and heavy-weight groups during the spring stocking rate study. Animals in the heavy-weight group was used as tester steers in the spring stocking rate study, and steers in the light-weight group were added as necessary to create different stocking rates. At the end of the spring stocking rate comparisons, steers in the heavy-weight group were moved to the SEARC feedlot facility at Mound Valley, and steers in the light-weight group (121 head) were moved to bermudagrass pastures for the summer grazing period. On October 10 and 11, 1991; September 3 and 4, 1992; and September 22 and 23, 1993; steers in the light-weight group were dewormed and allotted randomly to one of eight 5-acre IF or IFL pastures. Initial stocking rates for the fall

[1]Appreciation is expressed to SmithKline Beecham, West Chester, PA for providing Bovishield 4 + L5, Ultrabac/somnubac, and Boveye vaccinations; to Syntex Animal Health, West Des Moines, IA for providing oxfendazole and Synovex-S; to Mallinckrodt Veterinary, Mundelein, IL for De-Lice and Saber Extra fly tags; and to Steve Clark for use of experimental animals.

grazing period were determined based on initial available forage in each pasture, and a put-and-take grazing system was used to maintain similar quantities of available forage across pastures. Pastures were fertilized each fall with 40 lb/a each of nitrogen, phosphate, and potash. Tester steers grazed their respective pastures for an average of 91 days and then were processed according to routine procedures and fed a high-concentrate diet for an average of 140 days in the SEARC feedlot facility. Following the feedlot period, steers were transported to Emporia, KS and slaughtered at a commercial slaughter facility. Carcass data were collected following a 24-hour chill.

Costs of gain and economic return were calculated using the following assumptions. Estimated purchase price for the steers was calculated each year based on local market prices on the sale date most recent to the beginning of the fall grazing period. Charges for processing, fertilizer, seed, mineral, and feed were based on actual prices at the time of the study. Charges for seeding and fertilization were based on rates published in the Kansas Custom Rates Bulletin. An interest rate of 10% and a land cost of $20/acre were assumed. Seed and seeding charges as well as charges for phosphate and potash fertilization were assessed at half price, with the remaining half assessed to the spring grazing period.

Results and Discussion

Spring stocking rate had little effect on fall grazing performance on IF or IFL pastures (Table 1). However, the subsequent feedlot period following the fall grazing period was affected by previous spring stocking rate. Generally, feedlot gain, intake, and feed cost declined ($P < .05$) with previous spring stocking rate (Table 2). The possibility of this relationship actually being real and expected is difficult to believe and explain. Because fall pasture performance and stocking rates were not significantly affected by previous spring stocking rate, we conclude that the effect happened without a clear cause and effect relationship.

Grazing IFL pastures in the fall did prove to be advantageous during the grazing period compared with grazing IF pastures (Table 3). Steers grazing IFL pastures gained 41.6 lb more ($P < .01$) during the grazing period and .48 lb more/day ($P < .05$) on 10 fewer ($P < .05$) grazing days/a. Fescue - ladino clover pastures produced 30.8 lb more ($P < .05$) steer weight/a than IF pastures. Calculated pasture returns above land and variable costs were negative when averaged across the 3-year grazing study. These returns are based on purchasing steers weighing 730 lb in the fall. This way, the returns are based on the value of the cattle going onto the pastures and may not reflect actual costs because the cattle actually were purchased earlier and grazed on fescue then bermudagrass pastures. Less ($P < .05$) money was lost with steers grazing IFL than those grazing IF pastures when calculated as described. When placed in the feedlot, steers previously grazing IF pastures gained 17.5 lb more ($P = .05$) per head while consuming .71 lb less ($P < .05$) DM per day than steers previously grazing IFL pastures. This increase in performance by IF steers in the feedlot period probably was due to compensatory gain. Steers previously grazing IFL pastures tended ($P < .10$) to have higher marbling scores than those previously grazing IF pastures. This higher marbling score has been shown in other studies from SEARC.

One recommendation to overcome much of the toxic effect on cattle grazing infected tall fescue is more closely managing the fescue. This entails grazing fescue heavily in the spring to reduce seedhead formation and stimulate more leafy regrowth. In our previous study, this practice substantially reduced spring grazing performance. Even with the pastures left idle during the summer and apparent differences in available forage for the fall grazing period, little difference existed in fall performance because of the different spring stocking rates. Therefore, this practice, although it logically appears to have merit, does not seem to benefit animal performance or overall return above land and variable costs.

Table 1. Effect of Previous Spring Stocking Rate on Performance by Steers Grazing Fescue or Fescue-Ladino Clover Pastures in the Fall

	Previous Stocking Rate on Fescue				Previous Stocking Rate on Fescue - Ladino			
Item	1.2	1.8	2.4	3.2	1.0	1.6	2.2	2.8
Pasture phase								
Initial wt., lb.	729.9	730.5	731.5	733.6	729.9	722.9	729.2	731.3
Final wt., lb.	802.3	791.8	821.5	807.9	840.1	840.0	842.7	854.9
Gain, lb.	72.4	61.3	90.0	74.3	110.2	117.1	113.5	123.6
Daily gain, lb.	.89	.80	1.21	.89	1.39	1.44	1.39	1.49
Graz. days/a	98.0	106.6	89.8	92.2	87.0	94.9	85.2	81.1
Gain/a, lb.	80.0	71.0	83.0	77.2	99.7	119.7	107.4	107.7
Return, $/head[b]	(22.80)	(34.20)	(22.20)	(21.70)	(13.40)	.12	(6.17)	(1.69)
Feedlot phase								
Final wt., lb.	1259	1231	1261	1241	1290	1261	1249	1268
Gain, lb.[a]	456	440	439	425	450	421	407	413
Daily gain, lb.[a]	3.51	3.38	3.39	3.28	3.48	3.24	3.14	3.19
DM intake, lb/day[a]	27.1	25.5	25.5	24.4	28.0	25.7	26.5	25.3
Feed:gain	8.02	7.69	7.67	7.55	8.41	8.05	8.73	8.13
Feed cost, $	200.62	192.44	188.72	181.48	207.10	189.33	195.77	186.81
$/cwt. gain	45.30	44.10	43.30	42.60	46.80	45.20	48.90	45.50
Return, $/hd	(27.00)	4.53	(5.48)	4.75	(2.62)	2.48	(33.90)	(29.50)
Overall Return, $/hd	(49.90)	(29.70)	(27.60)	(16.90)	(16.00)	2.60	(40.10)	(31.20)

[a]Linear effect of stocking rate ($P < .05$).
[b]Costs included the following: $5.08 processing, $10.69/a for fertilizer and seed cost on IFL, $25.25/a for fertilizer on fescue, $18.00/cwt for mineral, 10% interest on calf and fertilizer costs.

Table 2. Carcass Characteristics of Steers Previously Grazing on Fescue or Fescue-Ladino Clover Pastures at Different Spring Stocking Rates

	Stocking Rate on Fescue				Stocking Rate on Fescue - Ladino			
Characteristic	1.2	1.8	2.4	3.2	1.0	1.6	2.2	2.8
Dressing %[a]	58.7	58.8	59.9	60.0	59.4	59.2	59.73	60.6
Hot carcass wt., lb	738.7	723.3	755.9	743.3	764.5	746.3	746.8	767.8
Backfat, in	.3	.29	.31	.33	.3	.37	.34	.33
Ribeye area, in^{2}[b]	13.8	13.3	14.7	14.3	13.5	13.9	14.0	14.6
Marbling score[c]	558	553.3	553.3	560.3	590.0	625.0	575.8	569.2
USDA Yield Grade	1.8	1.8	1.5	1.8	2.0	1.9	1.9	1.6

[a]Linear effect of stocking rate ($P < .05$).
[b]Linear effect of stocking rate ($P < .10$).
[c]400-499 = Select°; 500-599 = Select⁺; etc.

Table 3. Performance by Steers Grazing Fescue or Fescue-Ladino Clover Pastures in the Fall Averaged across Previous Spring Stocking Rate

Item	Fescue	Fescue-Ladino
Pasture		
Initial wt., lb.	731.4	728.3
Final wt., lb.	805.9[b]	844.4[a]
Gain, lb.	74.5[b]	116.1[a]
Daily gain, lb.	.95[d]	1.43[c]
Graz. days/a	96.7[c]	86.8[d]
Gain/a, lb.	77.8[d]	108.6[c]
Return, $/head	(25.23)[d]	(5.29)[c]
Feedlot phase		
Final wt., lb.	1247.9	1267.1
Gain, lb.	440.1[e]	422.6[f]
Daily gain, lb.	3.39[e]	3.26[f]
DM intake, lb/day	25.6[d]	26.4[c]
Feed:gain	7.7[d]	8.3[c]
Feed cost, $	190.82	194.75
$/cwt. gain	43.82[f]	46.59[e]
Return, $/hd	(5.81)	(15.90)
Overall Return, $/hd	(31.02)	(21.16)

[ab]Means within a row and main effect with unlike superscripts differ ($P < .01$).
[cd]Means within a row and main effect with unlike superscripts differ ($P < .05$).
[ef]Means within a row and main effect with unlike superscripts differ ($P < .10$).

Table 4. Carcass Characteristics of Steers Previously Grazing Fescue or Fescue-Ladino Clover Pastures in the Fall Averaged across Previous Spring Stocking Rate

Characteristic	Fescue	Fescue-Ladino
Hot carcass wt., lb	740.3	756.4
Dressing %[a]	59.4	59.7
Backfat, in	.31	.34
Ribeye area, in^2	14.0	14.0
Marbling score[b]	556[d]	590[c]
USDA Yield Grade	1.7	1.9

[a]Based on actual nonshrunk weight.
[b]400-499 = Select$^{\circ}$; 500-599 = Select^{+}; etc.
[c]Means within a row without a common superscript letter differ (P < .10).

EFFECT OF FEEDLOT IMPLANT PROGRAM ON PERFORMANCE BY STEERS PREVIOUSLY GRAZING INFECTED FESCUE PASTURES[1]

Kenneth P. Coffey, Frank K. Brazle[2], and Joseph L. Moyer

Summary

Thirty-nine mixed breed steers were allowed to graze on a common *Acremonium coenophialum*-infected fescue pasture for 77 days beginning on April 1. On June 17, steers were allotted randomly to six pens to provide two replicates of three different implant procedures. Implant programs consisted of zeranol initially and at reimplanting 76 days later (Z-Z), progesterone-estradiol initially and at 76 days (PE-PE), and zeranol initially and progesterone-estradiol at 76 days (Z-PE). Steers implanted with PE-PE had greater ($P < .10$) feedlot gain and daily gain than those implanted with Z-Z. Steers implanted with Z-PE and PE-PE tended to have lower ($P < .15$) feed to gain ratios, lower ($P < .15$) feed cost of gain, and heavier ($P < .10$) hot carcass weights than those implanted with Z-Z. Therefore, progesterone-estradiol appeared to be a better feedlot phase implant than zeranol for calves previously grazing infected fescue and being finished during the summer months. Due to the seasonality of fescue toxicity, extrapolation of this data to other times of the year should be avoided.

Introduction

Tall fescue is the predominant cool-season forage in Southeast Kansas and much of the southeastern United States. Much of this forage is infected with the endophytic fungus *A. coenophialum*, which produces alkaloids that provide insect resistance for the plant but are toxic to cattle. The production of these alkaloids and their effects on cattle are very seasonal. In earlier studies, cattle previously consuming infected fescue showed a greater response to zeranol implants than those consuming noninfected fescue. This implies that at least some of the toxic fescue effects were offset by the implant. This study was designed to compare the effects of feedlot implants on performance by steers previously grazing infected fescue in late spring.

Experimental Procedures

Eighty mixed-breed steers were grazed on a common 40 acre *A. coenophialum*-infected tall fescue pasture for 77 days beginning on April 1. All steers had been vaccinated previously against respiratory and clostridial organisms upon arrival and had been treated for internal and external parasites on April 1. Steers received a pair of insecticide ear tags and were vaccinated against pinkeye on May 9. On June 17, steers were divided into light- and heavy-weight groups. The

[1]Appreciation is expressed to SmithKline Beecham, West Chester, PA for providing Bovishield 4 + L5, Ultrabac/somnubac, and Boveye vaccinations; to Syntex Animal Health, West Des Moines, IA for providing oxfendazole and Synovex-S; to Mallinckrodt Veterinary, Mundelein, IL for Ralgro, De-Lice, and Saber Extra fly tags; and to Steve Clark for use of experimental animals.

[2]Southeast Kansas Area Extension Livestock Specialist, Chanute, KS.

light-weight group was moved to bermudagrass, and the heavy-weight group (40 steers) was transported to the Mound Valley Unit of SEARC. These steers were vaccinated against respiratory and clostridial organisms and allotted randomly to six pens to provide two replicates of three different implant procedures. Implant programs consisted of zeranol initially and at reimplanting 76 days later (Z-Z), progesterone-estradiol initially and at 76 days (PE-PE), and zeranol initially and progesterone-estradiol at 76 days (Z-PE).

Steers were fed a diet of 80% ground grain sorghum, 15% corn silage, and 5% protein supplement on a dry matter basis. The protein supplement was formulated to provide 50% crude protein and to meet or exceed NRC requirements for minerals and vitamins. Following a 154-day feedlot period, steers were transported to Emporia, KS and slaughtered at a commercial slaughter facility. Carcass measurements were collected following a 24-h chill.

Results and Discussion

Steers implanted with PE-PE had 40 lb greater ($P < .10$) feedlot gain and .26 lb greater ($P < .10$) daily gain than those implanted with Z-Z (Table 1). Feedlot gain by steers implanted with Z-PE was intermediate and did not differ ($P > .10$) from that of steers implanted with either Z-Z or PE-PE. Steers implanted with Z-PE and PE-PE tended ($P < .15$) to have lower feed to gain ratios and lower feed cost of gain than those implanted with Z-Z.

From previous trials, we postulated that zeranol reduced the impact of fescue toxins in feedlot cattle. If this was the case, and a progesterone-estradiol combination would not reduce this toxic impact, steers implanted with zeranol should have shown an advantage on earlier feedlot weights. Because no weight differential was detected from early weights, we postulate that for calves grazing late spring fescue and finished in the summer, the toxic-reducing effects of zeranol and progesterone-estradiol are similar.

Steers implanted with Z-PE and PE-PE had heavier ($P < .10$) hot carcass weights than those implanted with Z-Z (Table 2). No other carcass measurements differed ($P > .10$) among implant treatments, although net carcass value was numerically ($P = .25$) lower from steers implanted with Z-Z than from those implanted with Z-PE and PE-PE. Therefore, progesterone-estradiol appeared to be a better feedlot phase implant than zeranol for calves previously grazing infected fescue and being finished during the summer months.

We have observed a tremendous seasonality in the response of cattle to both fescue toxicosis and compounds that may reduce its impact. Therefore, one should use these data only for the time frame of the study and should be cautious in extrapolating them to other times of the year. We are currently evaluating the same treatments during a winter feeding period from steers grazing infected fescue in the fall. This study should help determine if a seasonal difference occurs in the response to feedlot implants for steers previously grazing infected fescue.

Table 1. Effect of Feedlot Implant Program on Performance by Steers Previously Grazing Infected Fescue Forage

Item	Initial and Second Implant: Zeranol / Zeranol	Zeranol / Prog.-Est.	Prog. + Est. / Prog. + Est.
Pasture gain, lb	108	106	109
Feedlot weights, lb			
6/16	728	727	730
7/15	791	793	796
9/1	975	967	992
10/5	1114	1128	1131
11/18	1229	1261	1272
Feedlot gain, lb	501[b]	522[ab]	541[a]
Daily gain, lb	3.25[b]	3.39[ab]	3.51[b]
DM intake, lb	23.1	22.7	23.3
Feed:gain	7.11[c]	6.71[d]	6.65[d]
Feed cost, $	189.55	186.25	191.05
$/cwt. gain	37.80[c]	35.70[d]	35.30[d]

[ab]Means within a row without a common superscript letter differ (P < .10).
[cd]Means within a row without a common superscript letter differ (P < .15).

Table 2. Effect of Feedlot Implant Program on Carcass Characteristics of Steers Previously Grazing Infected Fescue Forage

Characteristic	Initial and Second Implant: Zeranol / Zeranol	Zeranol / Prog. + Est.	Prog. + Est. / Prog. + Est.
Dressing %[a]	59.0	60.3	59.9
Hot carcass wt., lb	724.6[c]	759.5[b]	761.2[b]
Backfat, in	0.34	0.33	0.33
Ribeye area, in^2	14.4	15.2	14.8
Marbling score[d]	505.4	461.7	520.2
% choice	54.8	33.4	50.0
USDA Yield Grade	1.95	1.58	1.64
Net carcass value, $	792.20	820.70	829.50

[a]Based on actual nonshrunk weight.
[bc]Means within a row without a common superscript letter differ (P < .10).
[d]400-499 = $Select^{\circ}$; 500-599 = $Select^{+}$

PERFORMANCE BY STEERS GRAZING INFECTED AND NONINFECTED FESCUE PASTURES WITH AND WITHOUT LADINO CLOVER OVERSEEDING[1]

Kenneth P. Coffey, Joseph L. Moyer, and Frank K. Brazle[2]

Summary

A total of 80 mixed-breed steers were allowed to graze on infected (IF) and noninfected (FF) fescue pastures with (+L) and without (-L) ladino clover for an average of 209 days in a 2-year grazing study. In 1993, steers grazing +L gained 83% more ($P < .05$) weight than steers grazing -L pastures. In 1994, steers grazing FF gained 74 lb more ($P < .15$) than those grazing IF. Environmental conditions had a substantial impact on steer performance, with wet cool summer seasons favoring greater clover production and greater animal gains.

Introduction

Tall fescue is the predominant cool season forage in Southeast Kansas and much of the southeastern United States. A large percentage of the fescue in the United States is infected with the endophytic fungus *Acremonium coenophialum*. This fungus produces alkaloids that assist the plant with pest tolerance but are toxic to livestock consuming the forage. Overseeding infected fescue pastures with ladino clover has resulted in a substantial performance benefit to livestock grazing those infected pastures. This study was conducted to compare performance by steers grazing infected or noninfected fescue with and without ladino clover overseeding.

Experimental Procedures

A total of 80 mixed-breed steers was used in 1993 and 1994 to determine the effects of forage type on grazing performance. In each year, steers were vaccinated against respiratory, clostridial, and pinkeye infections and treated for internal and external parasites. Steers were weighed on consecutive days, stratified by weight and allotted randomly into groups of four head each. The groups were placed on 5-acre pastures of infected (IF) or noninfected (FF) fescue pastures with (+L) and without (-L) ladino clover. Grazing periods extended from April 27 - Nov. 11, 1993 and from Mar. 27 - Oct. 27, 1994.

All pastures were fertilized in the fall of each year with 40 lb/ac each of nitrogen (N), phosphate, and potash. Pastures having no ladino clover overseeding (-L) were fertilized with an additional 80 lb N/a in the winter.

Results and Discussion

Data were analyzed statistically across years, but a significant ($P < .05$) year × fescue or clover treatment interaction was detected. This indicates that the treatments did not respond the same relative to each other in both years. Therefore, the data were analyzed within a year and are presented in Table 1. No fescue type × legume

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[1]Appreciation is expressed to SmithKline Beecham, West Chester, PA for providing Bovishield 4+L5, Ultrabac/somnubac, and Boveye vaccinations; to Syntex Animal Health, West Des Moines, IA for providing oxfendazole and Synovex-S; to Mallinckrodt Veterinary, Mundelein, IL for De-Lice, and Saber Extra fly tags; and to Steve Clark for use of experimental animals.

[2]Southeast Kansas Area Extension Livestock Specialist, Chanute, KS.

interaction was detected (P < .05) in either year. Therefore, the effect of +L or -L was relatively the same whether on IF or FF. In 1993, steers grazing FF gained 63 lb more than those grazing IF, but the differences were not statistically significant. Steers grazing +L showed a performance advantage (P < .10) over those grazing -L by July 15, and this advantage increased throughout the grazing season (Figure 1). Steers grazing +L pastures gained 190 lb more (P < .05) than those grazing -L pastures.

In 1994, steers grazing FF pastures gained 74 lb more (P < .15) than those grazing IF. Fifty-one lb of the 74 lb gain differential was achieved by May 25 (Figure 2). Gains were similar between steers grazing +L and -L pastures in 1994.

The substantial advantage from +L in 1993 and the failure of an advantage of +L in 1994 are probably attributable to different weather conditions. 1993 was a wet year with generally cooler temperatures during the summer months. These types of weather conditions generally favor clover production. Weather conditions in 1994 were much more arid during the late spring and early summer of 1994, resulting in poor clover production. In previous studies, steer gains have benefitted greatly during wet years and not benefitted in dry years from ladino clover overseeding. Therefore, one should consider these factors when considering clovers for pastures in southeastern Kansas and should look at the long-term benefits of clover rather than the short-term failures.

Table 1. Performance by Steers Grazing Infected and Noninfected Fescue Pastures with and without Ladino Clover Overseeding

	Fescue Type		Ladino clover	
Item	Non-infected	Infected	Present	Absent
1993				
Initial wt., lb.	500	512	510	501
Final wt., lb.	854	803	928[a]	729[b]
Gain, lb	354	291	418[c]	228[d]
Daily gain, lb	1.74	1.43	2.05[c]	1.12[d]
1994				
Initial wt., lb.	457	455	457	456
Final wt., lb.	877[e]	801[f]	835	843
Gain, lb	420[e]	346[f]	379	388
Daily gain, lb	1.95[e]	1.60[f]	1.75	1.79

[ab]Means within a row and main effect with unlike superscripts differ (P < .10).
[cd]Means within a row and main effect with unlike superscripts differ (P < .05).
[ef]Means within a row and main effect with unlike superscripts differ (P < .15).

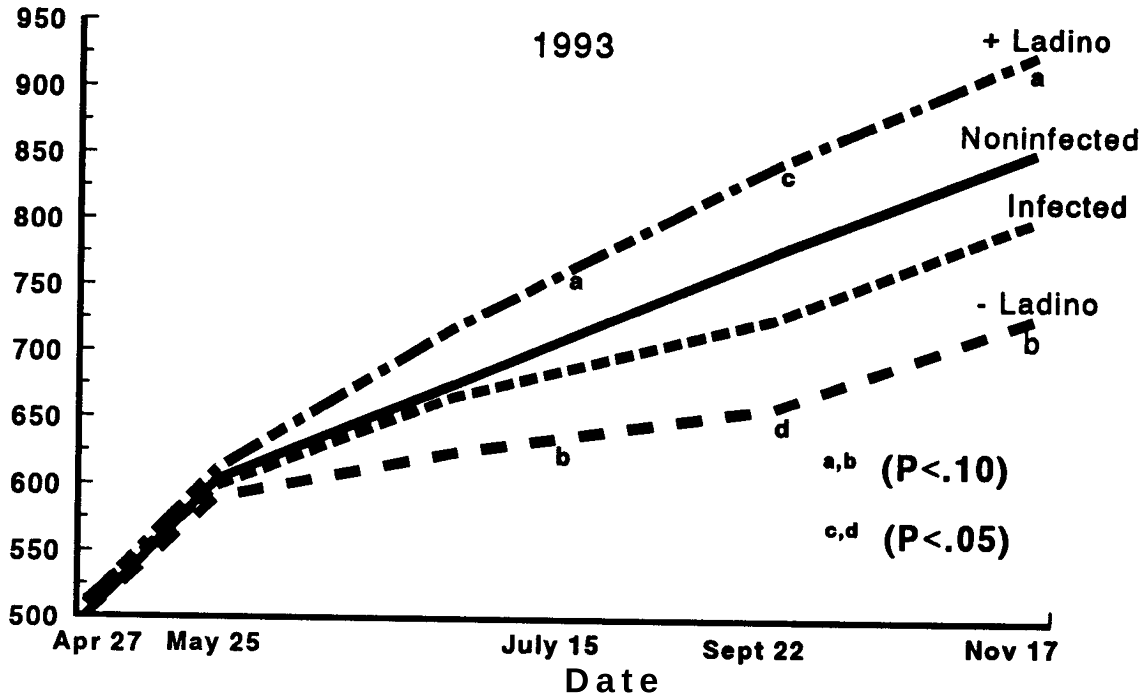


Figure 1. Weight of Steers Grazing Fescue Pastures in 1993.

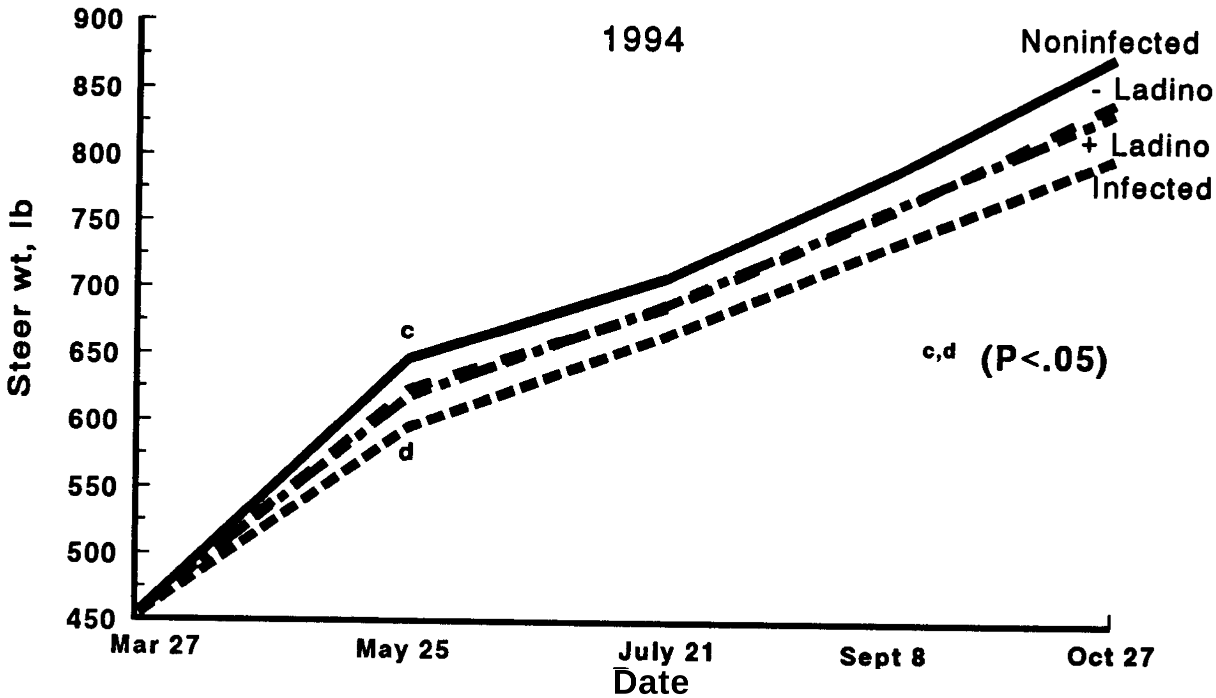


Figure 2. Weight of Steers Grazing Fescue pastures in 1994.

PERFORMANCE BY STEERS GRAZING RYE/BERMUDAGRASS PASTURES WITH AND WITHOUT LADINO CLOVER OVERSEEDING[1]

Kenneth P. Coffey and Joseph L. Moyer

Summary

Eighty mixed-breed steers were allowed to graze on pastures of rye/bermudagrass (B) or rye/bermudagrass overseeded with ladino clover (BL) for 189 days beginning on March 15. Grazing gains were 48 lb greater ($P < .05$) but feedlot gains were 18 lb less ($P > .10$) from steers grazing B compared with those grazing BL. A higher percentage of B steers than BL steers graded USDA Choice. Ladino clover production was limited by arid weather conditions in late spring and early summer. Under these conditions, ladino clover overseeding did not positively benefit performance by steers grazing bermudagrass pastures.

Introduction

Bermudagrass is a highly productive warm-season forage capable of exceptional production if moisture and fertilizer are available. Bermudagrass quality declines dramatically as it reaches maturity. Ladino clover could provide an additional high-quality forage for cattle grazing this lower-quality bermudagrass and thereby improve cattle gain and reduce nitrogen fertilizer usage.

Experimental Procedures

Eighty mixed-breed steers were allowed to graze on pastures of bermudagrass (B) or bermudagrass overseeded with ladino clover (BL) for 189 days beginning on March 15. Steers received vaccinations against respiratory, clostridial, and pinkeye organisms; were treated for internal and external parasites; and were implanted with zeranol. Steers were weighed on consecutive days, stratified by weight, and allotted randomly to one of eight bermudagrass pastures that had been no-till drilled with 100 lb/a of cereal rye the previous fall. Pastures were allotted randomly such that four of the eight pastures were overseeded with 4 lb/a of ladino clover. All pastures were fertilized with 50 lb nitrogen (N)/a for the rye and fertilized to soil test for phosphate and potash for the bermudagrass. Pastures overseeded with clover were fertilized with 50 lb N/a and those without clover were fertilized with 100 lb N/a on May 19 and 20. All pastures were clipped with a rotary mower on July 6 and 7 and received an additional 50 lb N/a on July 7 and Aug 5.

Steers were weighed on 9/19 and 9/20, transported to a commercial feedlot facility, and fed a finishing ration for 140 days. Following the finishing period, steers were transported to Emporia, KS and slaughtered at a commercial slaughter facility. Carcass measurements were collected following a 24-h chill.

[1]Appreciation is expressed to SmithKline Beecham, West Chester, PA for providing Bovishield 4 + L5, Ultrabac/somnubac, and Boveye vaccinations; to Syntex Animal Health, West Des Moines, IA for providing oxfendazole; to Mallinckrodt Veterinary, Mundelein, IL for Ralgro, De-Lice, and Saber Extra fly tags; to Cal-West Seeds, Woodland, CA for providing ladino clover seed; and to Richard Porter for use of experimental animals.

Results and Discussion

Steers grazing B gained 43 lb more ($P < .05$) than those grazing BL during the entire 189-day grazing period (Table 1). Overall gains during the grazing period were low and averaged .88 lb/day. Low rainfall amounts in spring reduced forage production during the rye grazing period, resulting in gains of approximately one-half the amount normally produced during this time. Gains during the bermudagrass growing period were somewhat below the 1.25 - 1.5 lb/day that we have attained in the last 2 years since changing to a more intensive management system (Figure 1). The greatest portion of gain occurred between May 10 and July 6, with minimal gains occurring after July 6. Because of low and erratic rainfall, bermudagrass production was reduced, thus limiting available forage for the grazing animals. Ladino clover production was minimal as well, presumably also because of the low and erratic rainfall. Considering the combination of poor clover production with lower N fertilization of BL, we can conclude that the reduced animal performance by BL was due to less bermudagrass production and lower quality of the forage produced.

During the feedlot phase, steers previously grazing BL tended ($P > .10$) to gain more than those previously grazing B. All steers were fed in a common pen, so feed efficiency data could not be collected.

Steers previously grazing B had a higher % USDA Choice than those previously grazing BL (Table 2). Other carcass measurements did not differ between previous forage type. In previous studies at SEARC, steers grazing fescue pastures overseeded with ladino clover have had a higher % USDA Choice than those previously grazing fescue pastures without clover. This reversed trend probably was due to greater grazing gains by steers grazing pastures without clover.

Therefore, results of one grazing season, indicate that overseeding bermudagrass pastures with ladino clover may not be beneficial to animal performance. However, should rainfall amounts be adequate in future years, the results might reverse.

Table 1. Performance by Steers Grazing Rye/Bermudagrass Pastures with and without Ladino Clover Overseeding

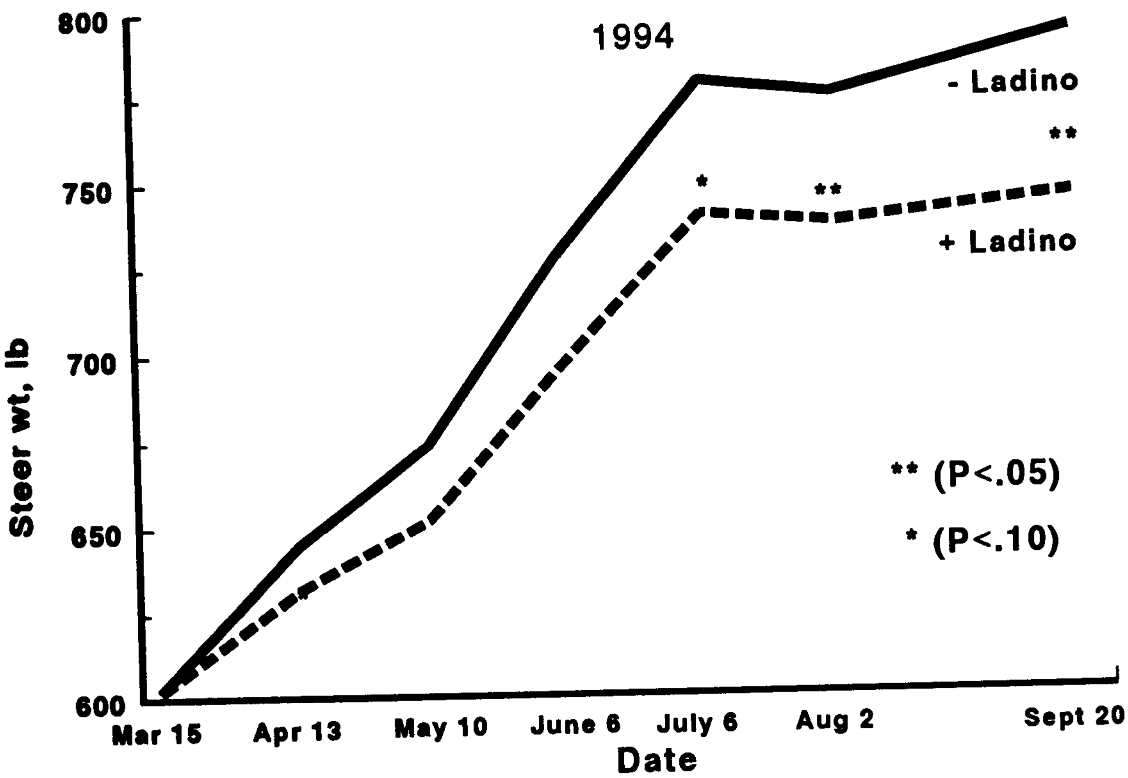
Item	- Ladino	+ Ladino
Pasture phase		
Initial wt., lb.	602.1	602.2
Final wt., lb.	793.1^{c}	744.5^{d}
Gain, lb	191.0^{c}	143.2^{d}
Daily gain, lb	1.011^{c}	0.758^{c}
Feedlot phase		
End wt., lb	1247.8	1218
Gain	451.3	469.5
Daily gain, lb	3.201	3.33

^{ab}Means within a row and main effect with unlike superscripts differ ($P < .10$).
^{cd}Means within a row and main effect with unlike superscripts differ ($P < .05$).

Table 2. **Carcass Characteristics of Steers Previously Grazing Rye/Bermudagrass Pastures with and without Ladino Clover Overseeding**

Characteristic	- Ladino	+ Ladino
Hot carcass wt., lb	773.5	755.2
Backfat, in	0.542	0.526
Marbling score	613.82	590.88
% USDA Choice	70.7[a]	53.0[b]
USDA Yield grade	2.67	2.562
Net carcass value, $	894.38	868.03

[ab]Means within a row and main effect with unlike superscripts differ (P< .05).



Flgure 1. Weight of Steers Grazing Bermudagrass Pastures.

PERFORMANCE BY FINISHING STEERS OFFERED MAGNESIUM-MICA IN THE FEEDLOT RATION[1]

Kenneth P. Coffey and Frank K. Brazle[2]

Summary

Forty-eight mixed breed steers from two sources were used in a 141-day feedlot study to compare a control ration (C) with a ration containing magnesium-mica (MM; 9 lb/ton). No diet × cattle source interactions were detected. Steer gain, efficiency, or cost of gain did not differ ($P < .10$) between diets. Marbling score tended ($P < .10$) to be greater and the percentage of cattle grading USDA Choice and net carcass value were greater ($P < .05$) from steers fed MM. Steers raised at the KSU - Southeast Agricultural Research Center (SEARC) gained more ($P < .10$) weight, consumed more ($P < .05$) dry matter, and had higher ($P < .10$) feed cost/head than purchased mixed-breed steers. SEARC steers had heavier ($P < .01$) hot carcass weights, tended ($P < .10$) to have greater marbling scores, had higher ($P < .01$) USDA yield grades, and had higher ($P < .01$) net carcass value than purchased steers. Therefore, feeding magnesium-mica in a feedlot ration may have a substantial economic impact on feedlot cattle.

Experimental Procedures

Twenty-four mixed breed steers previously grazing tall fescue pastures and 24 Angus × Simmental crossbred steers previously grazing smooth bromegrass were allotted in a random stratified manner within cattle source into eight groups of six head each on January 20, 1994. The groups then were allotted randomly to receive one of two finishing diets. Finishing diets consisted of 80% ground grain sorghum, 15% corn silage, and 5% protein supplement (50% CP) on a dry matter basis (Table 1). The control supplement consisted primarily of soybean meal, wheat middlings, urea, and minerals to meet NRC (1984) requirements. In the other supplement, 9% of the wheat middlings was replaced by magnesium-mica. The soybean meal level was altered to replace the protein differential between wheat middlings and magnesium-mica.

Steers were vaccinated against IBR, BVD, PI_3, leptospirosis (5 strains), BRSV, and clostridial infections (7-way); dewormed; and implanted (Synovex-S®) upon arrival at the feedlot. Steers were reimplanted after 83 days in the feedlot. Cattle received the finishing diet for 141 days and then were slaughtered at a commercial packing plant. Carcass data were collected following a 24-hour chill.

Economic information was calculated using actual feed costs and carcass values. Carcass prices were $106/cwt of hot carcass weight with discounts of $7 for USDA Select grade and $20 for USDA Yield Grade 4 or carcass weights over 950 lb. Net carcass value was calculated using the base price of $106 with appropriate discounts. Live value of the steers was calculated by

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[1]Appreciation is expressed to Micro-Lite, Inc., Chanute, KS for providing financial support; to SmithKline Beecham, West Chester, PA for providing Bovishield 4+L5, and Ultrabac/somnubac vaccinations; and to Syntex Animal Health, West Des Moines, IA for providing oxfendazole and Synovex-S.

[2]Southeast Kansas Area Extension Livestock Specialist, Chanute, KS.

dividing net carcass value by the ending live weight pencil shrunk 4%.

Results and Discussion

No diet by cattle source interaction was detected in the study. Therefore, data are expressed within main effects. Steers receiving MM were ($P < .05$) heavier at 83 days than those receiving C (Table 2). However, they were somewhat heavier at the initiation of the study than C steers were. Final weight and gain did not differ ($P > .10$) between diets. Feed cost, feed efficiency, and feed cost per /lb of gain likewise did not differ ($P > .10$) between diets. However, total feed cost was numerically \$16.47 lower per steer and cost of gain was numerically \$3.00 less per 100 lb of gain for steers fed MM than for steers fed C.

Steers of known parentage raised at SEARC were 119 lb heavier ($P < .01$) at the beginning of the feedlot period, were 198 lb heavier ($P < .01$) at the end of the 141-day study, and gained .56 lb/day more ($P < .10$) than purchased steers of unknown parentage. Furthermore, SEARC steers consumed 4.4 lb more ($P < .05$) DM/day and had a \$45.63/head higher feed cost than purchased steers.

Hot carcass weight, dressing percentage, fat thickness, and USDA Yield Grades did not differ ($P > .10$) between diets (Table 3). Marbling scores were 113 points or over one third of a quality grade higher ($P < .10$) from steers fed MM. Steers in this study graded poorly. Therefore, this increase in marbling score resulted in a substantial increase ($P < .01$) in the percentage of steers grading USDA Choice. This increase in the percentage of steers grading USDA Choice resulted in a \$50.92 higher ($P < .05$) carcass value and \$3.02/cwt higher ($P = .11$) live value for steers fed MM.

SEARC steers had 124 lb heavier ($P < .01$) hot carcass weights, higher ($P < .01$) USDA Yield Grades, and 111 points higher ($P < .10$) marbling scores than purchased steers. These factors contributed to a \$123.39 greater ($P < .01$) net carcass value of SEARC steers. However, live value did not differ ($P > .10$) between cattle sources.

Data from this experiment are comparable in many ways to data from other experiments at SEARC using magnesium-mica. It has not shown any adverse effects on DM consumption or performance in previous studies. Furthermore, in those studies, magnesium-mica has been somewhat beneficial for fiber digestion and in altering VFA profiles. In the current experiment, no adverse effects on feedlot gain, consumption, or efficiency were observed by substituting magnesium-mica for wheat middlings in the supplement. Magnesium-mica apparently had no effect on carcass weight or fat thickness, but had an apparent substantial effect on carcass marbling. One must remember that this study utilized a limited number of animals (48) and that marbling score is a highly variable measurement. However, the fact that, of the 24 head per diet, 13 of the steers fed magnesium-mica graded Choice, whereas only three of the steers fed the control diet graded Choice certainly casts a shadow of doubt on the possibility that the difference could be due to random chance. However, a biological explanation for the improved marbling score by steers fed magnesium-mica is also not clear. However, this improvement represents a significant economic benefit, if other studies show similar findings.

Table 1. Composition of Diets Offered to Finishing Steers

Ingredient	Control	Magnesium-Mica
Ground grain sorghum	80.0	80.0
Corn silage	15.0	15.0
Soybean meal	2.5	2.6
Wheat middlings	.81	.25
Ground limestone	.50	.50
Urea	.43	.45
TM salt	.25	.25
Cane molasses	.15	.15
Dicalcium phosphate	.13	.13
Potassium chloride	.13	.13
Vitamin A,D,E premix	.10	.10
Rumensin premix	.0125	.0125
Magnesium-mica	-	.45

Table 2. Performance by Finishing Steers Offered Magnesium-Mica (9 lb/ton) in the Feedlot Ration

Item	Diet		Cattle Source[a]	
	Control	Magnesium Mica	Purchased	SEARC
Period 1 (day 0 - 83)				
Initial wt., lb.[b]	862	879	811	930
83-day wt., lb.[bc]	1141	1169	1076	1235
Gain, lb.[d]	279	291	265	305
Daily gain., lb.[d]	3.4	3.5	3.2	3.7
Daily DM intake, lb.[d]	25.6	25.4	24.5	26.4
Gain/feed, lb/lb	.133	.138	.130	.141
Feed cost, $[d]	113.33	112.53	108.58	117.28
$/cwt. gain	36.44	35.00	36.97	34.47
Total (day 0 - 141)				
Initial wt., lb.[b]	862	879	811	930
Final wt., lb.[b]	1340	1354	1248	1446
Gain, lb.[e]	478	475	437	516
Daily gain, lb.[e]	3.4	3.4	3.1	3.7
Daily DM intake, lb.[d]	29.0	28.3	26.4	30.9
Gain/feed, lb/lb	.117	.119	.118	.119
Feed cost, $[e]	257.25	240.78	226.20	271.83
$/cwt. gain	53.98	50.98	51.78	53.18

[a]Purchased steers were exotic mixed-breed steers. SEARC steers were Angus × Simmental and Simmental × Angus crossbred steers.
[b]Differences between cattle sources were detected ($P < .01$).
[c]Differences between diets were detected ($P < .05$).
[d]Differences between cattle sources were detected ($P < .05$).
[e]Differences between cattle sources were detected ($P < .10$).

Table 3. Carcass Characteristics of Finishing Steers Offered Magnesium-Mica (9 lb/ton) in the Feedlot Ration

Characteristic	Diet: Control	Diet: Magnesium Mica	Cattle Source[a]: Purchased	Cattle Source[a]: SEARC
Hot carcass wt., lb.[b]	804	814	747	871
Dressing %[c]	60.0	60.0	59.8	60.3
Fat thickness, in.	.30	.28	.28	.30
Longissimus eye area, in^2	13.8	13.8	13.6	14.1
Marbling score[def]	386	499	387	498
% USDA Choice[gh]	4.2	54.2	20.8	45.8
USDA Yield Grade[b]	1.4	1.6	1.2	1.8
Net carcass value, $[bi]	786.80	837.72	750.56	873.95
Live value, $/cwt.[jk]	61.19	64.24	62.61	62.82

[a]Purchased steers were exotic mixed-breed steers. SEARC steers were Angus × Simmental and Simmental × Angus crossbred steers.
[b]Differences between cattle sources were detected ($P < .01$).
[c]Calculated using actual unshrunk live weight.
[d]400 = $Select^0$; 500 = $Select^+$.
[e]Differences between diets were detected ($P < .10$).
[f]Differences between cattle sources were detected ($P < .10$).
[g]Differences between diets were detected ($P < .01$).
[h]Differences between cattle sources were detected ($P < .05$).
[i]Differences between diets were detected ($P < .05$).
[j]Calculated by dividing net carcass value by the end live weight shrunk 4%.
[k]Differences between diets were detected ($P = .11$).

EFFECT OF MAGNESIUM-MICA DURING GRAZING AND/OR FEEDLOT PHASES ON PERFORMANCE AND RUMEN FERMENTATION PRODUCTS OF STEERS[1]

Kenneth P. Coffey, Lyle W. Lomas, Joseph L. Moyer, and Frank K. Brazle[2]

Summary

Seventy-two mixed breed steers (679 lb avg. BW) grazing smooth bromegrass pastures were allotted randomly to one of eight groups of nine steers each and fed 2.2 lb/day of either a control supplement (PC) or one containing .075 lb./day of magnesium-mica (PMM). Following the 112-day grazing period, steers were placed in a feedlot by pasture group and fed a high-concentrate diet. The pasture groups were split upon arrival at the feedlot such that two of the groups offered each pasture supplement were offered a control supplement (FC) and the two groups were offered a supplement containing 10% magnesium-mica (FMM). Steers fed PMM tended to gain 10 lb ($P > .10$) or .09 lb/day more than those fed PC during the pasture phase. Supplemental magnesium-mica had no apparent effect on total volatile fatty acid (VFA) production, but steers supplemented with PMM had lower ($P < .01$) propionic acid molar concentrations and higher ($P < .05$) acetic to propionic acid ratios on May 6. Neither previous pasture supplement nor feedlot supplement affected ($P > .10$) steer gain or efficiency. Steers fed PMM had higher dressing % ($P < .05$) and net carcass value ($P < .06$) and numerically ($P > .10$) had higher marbling scores and % USDA Choice than those fed PC. No differential effect of feedlot supplement was detected for carcass measurements. Positive benefits on performance by supplementing grazing cattle with magnesium-mica were minor, possibly because of high levels of gain by all of the cattle used in this study. Considering these data and those from a previous study, the effect of magnesium-mica on subsequent marbling scores does appear to be real. Also, the effect may be established if magnesium-mica is fed in a pasture or finishing phase.

Introduction

Previous work at SEKES has shown a tendency for increased total VFA concentrations and a more favorable VFA profile from cattle offered magnesium-mica. Similar changes with other commercially available compounds has improved performance by grazing cattle. Carcass marbling scores and the percentage of steers grading Choice was higher from feedlot steers fed magnesium-mica (MM) compared with steers fed our typical feedlot diet in another study. Our objective was to measure rumen fermentation products, grazing and subsequent feedlot performance, and carcass characteristics of cattle offered magnesium-mica in the grazing and/or feedlot phases.

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[1]Appreciation is expressed to Micro-Lite Inc., Chanute, KS for providing financial support; to SmithKline Beecham, West Chester, PA for providing Bovishield 4+L5, Ultrabac/somnubac, and Boveye vaccinations; to Syntex Animal Health, West Des Moines, IA for providing oxfendazole and Synovex-S; and to Mallinckrodt Veterinary, Mundelein, IL for Ralgro, De-Lice, and Saber Extra fly tags.

[2]Southeast Kansas Area Extension Livestock Specialist, Chanute, KS.

Experimental Procedures

Seventy-two mixed-breed steers were received at the KSU - Southeast Agricultural Research Center in November, 1993. Upon arrival, steers were vaccinated against seven clostridial strains, *Hemophilus somnus*, IBR, BVD, PI_3, BRSV, and five strains of leptospirosis and were dewormed. Steers were distributed randomly onto 10 10-acre smooth bromegrass pastures, fed hay ad libitum, and fed 2 lb/day of a 20% CP supplement during the winter. Steers were weighed without prior removal of feed and water on April 6 and 7 to determine an initial weight and allotted randomly by weight into eight groups of nine head each. Rumen samples were collected randomly via stomach tube from three steers per group of nine head at the time of weighing on the second day. Steers also were vaccinated against pinkeye, dewormed, and implanted (zeranol) on April 7. The eight groups of steers were allotted randomly to one of eight 10-a smooth bromegrass pastures. Half of the steer groups were fed a control supplement (C) containing 84% ground grain sorghum, 15% cottonseed meal, and 1% soybean oil, whereas half were offered a supplement containing 80.63% ground grain sorghum, 15% cottonseed meal, 1% soybean oil and 3.37% magnesium-mica at a rate of 2.2 lb/head daily (MM). This level was fed to provide .075 lb of magnesium-mica/head daily. Steers were rotated through the pastures at 14-day intervals to minimize the effect of pasture variation and were weighed at 28-day intervals throughout the 112-day grazing study. Rumen samples were collected from three steers determined randomly per group on days 0, 28, 56, and 112 of the study, and VFA concentrations were determined. Final weights were measured without prior removal of feed and water on July 27 and 28, and the steers were transported to the SEARC feedlot facility at Mound Valley, KS.

Groups of steers were blocked by previous pasture treatment and allotted randomly to receive one of two finishing diets. Finishing diets consisted of 80% ground grain sorghum, 15% corn silage, and 5% protein supplement (50% CP) on a dry matter basis. The control supplement (FC) consisted primarily of soybean meal, wheat middlings, urea, and minerals to meet NRC (1984) requirements (Table 1). The other supplement contained magnesium-mica (FMM) at 10% replacing wheat middlings. The soybean meal level was altered to replace the protein differential between wheat middlings and magnesium-mica. Steers were vaccinated against IBR, BVD, PI_3, leptospirosis (5 strains), BRSV, and clostridial infections (7-way); treated for internal and external parasites; and implanted upon arrival at the feedlot. Steers were re-implanted after 69 days in the feedlot. At the end of a 120-day finishing period, steers were slaughtered at a commercial packing plant, and carcass data were collected following a 24-hour chill.

Results and Discussion

Steers fed PMM tended ($P > .10$) to weigh 12.5 lb more at the end of the 112-day grazing period and to gain 10 lb more during the study than steers fed PC (Table 2). No differences were detected ($P > .10$) for total VFA at any of the sampling dates (Table 3). Molar concentrations of propionate were greater ($P < .01$) from PC than from PMM on May 6, but no differences were detected on the other sampling dates. The acetic to propionic acid ratio was greater ($P < .05$) from PMM than from PC on May 6. Molar percentages of other VFA on May 6 and other dates did not differ ($P < .10$) between PC and PMM.

No significant pasture treatment × feedlot treatment interactions were detected ($P < .05$) for any of the performance or carcass measurements. Therefore, feedlot data were pooled across the main effects of pasture treatment and feedlot treatment. Neither pasture treatment nor feedlot treatment affected ($P < .10$) feedlot gain, efficiency, or cost of gain (Table 4). These data are in agreement with those from the previous study conducted at SEARC. One must recognize that the steers were large according to today's feedlot standards. The steers gained extremely well during the pasture phase and, therefore, were heavier going into the feedlot period. During the time frame when the steers were slaughtered, heavy-weight steer carcasses were being discounted as much as $23/cwt. This encouraged us to market the steers earlier than they should have been to prevent a substantial economic loss.

Feedlot supplements had no effect on any of the carcass measurements evaluated in this study. However, previous pasture supplement had an effect on several measurements (Table 5). Steers fed PMM tended to have heavier ($P = .11$) hot carcass weights and had a higher ($P < .05$) dressing percentage than those fed PC. Although not statistically different ($P < .10$), steers fed PMM had a 50% increase in the percentage grading USDA Choice compared with steers fed PC. These factors combined to produce a $19.92 higher ($P < .06$) net carcass value and a $1.50/cwt. higher ($P < .05$) live value for those steers. The low percentage of steers grading Choice may be attributed to the earlier marketing. The reason for the tendency for a difference in the percentage of steers grading USDA Choice between pasture supplements is not clear. The lack of a pasture treatment × feedlot treatment interaction is indicative of similar responses to treatments across production phases. Of the steers fed PC, five of the 18 steers fed FC and five of the steers fed FMM graded USDA Choice. Of the steer fed PMM, seven of the 18 steers fed FC and eight of the 18 steers fed FMM graded USDA Choice. Therefore, no advantage in % USDA Choice was gained by feeding PC steers magnesium-mica in the feedlot period, and no additional advantage was gained by feeding PMM steers magnesium-mica in the feedlot. Therefore, the response appears to be primarily due to the pasture phase magnesium-mica supplementation.

It is possible that the high rates of gain observed during the pasture phase in this study offset the advantage of supplemental magnesium-mica, and that a greater advantage might be observed should overall grazing gains be lower. Considering the feedlot data and those of our previous feedlot study, we can conclude that magnesium-mica fed at a level of 9-10 lb/ton of dry matter should have minimal effects on gain and efficiency of feedlot steers. Therefore, feed cost then becomes the issue in determining whether or not to include magnesium-mica in the ration when looking at growth parameters. The effect of the pasture- phase supplemental magnesium-mica on subsequent carcass quality and value is perplexing in light of the absence of an effect of feedlot-phase magnesium-mica supplementation in this study. Some of the feedlot effect may have been masked by previously receiving magnesium-mica in the pasture supplement. However, the lack of a pasture treatment by feedlot treatment interaction does not substantiate this. The real advantage, other than cost, of including magnesium-mica in steer rations or supplements appears to be in increasing the number of steers that will grade USDA Choice and, thereby, increasing the net carcass value to the producer.

Table 1. Composition of Supplements Offered to Finishing Steers[a]

Ingredient	Control	Magnesium-Mica
Soybean meal	50.0	53.0
Wheat middlings	13.0	-
Ground limestone	14.0	14.0
Urea	8.9	8.9
TM salt	5.0	5.0
Cane molasses	2.85	2.85
Potassium chloride	4.0	4.0
Vitamin A,D,E premix	2.0	2.0
Rumensin 80 premix	.25	.25
Magnesium-mica	-	10.0

[a]Supplement was fed at 5% of the ration dry matter.

Table 2. Grazing Performance by Steers Grazing Smooth Bromegrass Pastures and Fed Magnesium-Mica in a Grain Supplement[a]

Item	Control	Magnesium-Mica
Initial wt., lb.	677.5	680.0
Final wt., lb.	937.9	950.4
Gain, lb.	260.4	270.4
Gain, lb/day	2.32	2.41

[a]No significant differences ($P < .10$) were detected.

Table 3. Ruminal Fermentation Products by Steers Grazing Smooth Bromegrass and Fed Magnesium-Mica in a Grain Supplement[a]

Item	May 6 PC	May 6 PMM	June 5 PC	June 5 PMM	July 28 PC	July 28 PMM
Total VFA, mM	89.8	89.9	70.1	73.7	70.3	69.1
	----------	----------	mole/100 mole		----------	----------
Acetic	64.2	64.9	70.3	70.4	67.7	69.3
Propionic	18.0[b]	16.7[c]	15.8	15.7	15.2	15.0
Isobutyric	1.5	1.4	1.2	1.2	1.7	1.7
Butyric	13.6	14.2	10.6	10.6	11.8	11.5
Isovaleric	1.6	1.5	1.3	1.2	2.0	2.0
Valeric	1.2	1.2	.8	.8	1.0	1.1
Acetic: propionic	3.6[c]	3.9[b]	4.5	4.5	4.5	4.6

[a]C = control supplement; MM = supplement containing .075 lb/d magnesium-mica.
[b,c]Means within a row and date without a common superscript letter differ ($P < .05$).

Table 4. Performance by Finishing Steers Offered Magnesium-Mica[a] in a Pasture or Feedlot Supplement[b]

Item	Pasture Treatment[c] PC	Pasture Treatment[c] PMM	Feedlot Treatment FC	Feedlot Treatment FMM
Total (day 0 - 120)				
Initial wt., lb.	938	950	945	943
Final wt., lb.	1335	1336	1334	1336
Gain, lb.	396	385	389	392
Daily gain, lb.	3.4	3.3	3.3	3.3
Daily DM intake, lb.	24.2	24.1	24.2	24.2
Gain/feed, lb/lb	.136	.133	.134	.135
Feed cost, $	147.03	146.21	146.85	146.40
$/cwt. gain	37.13	38.03	37.85	37.30

[a]Magnesium-mica levels were .075 lb/day in the pasture supplement and 10 lb/ton DM in the feedlot ration.
[b]No significant differences were detected ($P < .10$).
[c]PC and PMM = control and magnesium-mica supplements during the pasture phase; FC and FMM = control and magnesium-mica supplements during the feedlot phase.

Table 5. Carcass Characteristics of Finishing Steers Offered Magnesium-Mica[a] in a Pasture or Feedlot Supplement

Characteristic	Pasture Treatment[c]		Feedlot Treatment	
	PC	PMM	FC	FMM
Hot carcass wt., lb.[c]	784	796	791	790
Dressing %[de]	58.8	59.7	59.3	59.1
Fat thickness, in.	.28	.32	.29	.31
Longissimus eye area, in^2	14.1	13.9	14.0	13.9
Marbling score[f]	418	441	439	420
% USDA Choice	27.8	41.7	33.3	36.1
USDA yield grade	1.9	1.9	1.8	1.9
Net carcass value, $[g]	852.28	872.20	861.73	862.75
Live value, $/cwt.[eh]	66.55	68.05	67.38	67.23

[a]Magnesium-mica levels were .075 lb/day in the pasture supplement and 10 lb/ton DM in the feedlot ration.
[b]PC and PMM = control and magnesium-mica supplements during the pasture phase; FC and FMM = control and magnesium-mica supplements during the feedlot phase.
[c]Differences between pasture supplements were detected (P = .11).
[d]Calculated using actual unshrunk live weight.
[e]Differences between pasture supplements were detected (P < .05).
[f]400 = $Select^0$; 500 = $Select^+$.
[g]Differences between pasture supplements were detected (P < .06).
[h]Calculated by dividing net carcass value by the end live weight shrunk 4%.

EFFECTS OF YEAST AND SODIUM BICARBONATE ON RUMINAL DIGESTION AND INTAKE OF HIGH CONCENTRATE DIETS[1]

Kenneth P. Coffey

Summary

Two experiments were conducted to compare responses on intake and rumen fermentation to supplemental sodium bicarbonate and yeast. In both experiments, four ruminally fistulated non-pregnant nonlactating Tarentaise cows were used in a 4-period experiment during which each of four diets was fed to the four cows. In Exp. 1, cows were fed a basal diet of corn and alfalfa hay and supplemented with sodium bicarbonate twice daily (B), yeast either once (1Y) or twice daily (2Y), or a control supplement (C). Intake, ruminal pH, and ruminal volatile fatty acids (VFA) did not differ ($P < .10$) among treatments. In situ (nylon bag) dry matter (DM) and neutral-detergent fiber (NDF) disappearance at 48 h tended ($P < .10$) to be greater from cows fed B compared with those fed 1Y and 2Y, and DM digestion lag phase tended to be lower ($P < .10$) from those cows than those fed 1Y and 2Y. Dry matter digestion lag phase tended ($P < .10$) to be lower from cows fed 1Y and 2Y than from cows fed C. In Exp. 2, ruminally fistulated cows were fed a basal diet of corn silage, dry-rolled corn, ground (1 inch) alfalfa hay, and soybean meal. Sodium bicarbonate was fed twice daily (B) whereas yeast was fed once daily alone (Y) or in combination with bicarbonate (YB). Intake, ruminal pH, and ammonia did not differ ($P < .10$) among treatments. When averaged across sampling times, cows fed B had greater molar concentrations of acetic ($P < .10$) and isovaleric acids ($P < .05$). In situ dry matter (DM) disappearance at 24 and 48 h tended ($P < .10$) to be greater, and the digestion rate was numerically ($P = .19$) greater from cows fed B than from those not fed B. In situ neutral-detergent fiber (NDF) disappearance tended ($P < .10$) to be greater at 24 h and was greater ($P < .05$) at 48 h from cows fed B compared with those not fed B. Cows fed Y tended ($P < .16$) to have greater NDF disappearance at 96 h and a slower NDF digestion rate and tended ($P < .10$) to have a shorter digestion lag and greater digestible NDF fraction than cows not fed Y. Cows fed Y had a greater ($P < .05$) weight change during the experimental periods than those not fed Y, possibly indicative of accumulation of greater fill which ultimately could lead to greater animal performance. Therefore, cattle fed a high concentrate diet and supplemented with yeast once daily and/or sodium bicarbonate did show limited improvements in some measurements dealing with fiber digestion. However, neither supplement apparently affected intake or ruminal fermentation to the extent of altering ruminal pH or VFA production. Therefore, other than limited improvements in some measurements, all treatments proved ineffective in improving parameters that might benefit animal performance.

[1]Appreciation is expressed to Agrimerica, Inc., Northbrook, IL for financial assistance.

Experimental Procedures

Experiment 1

Four nonpregnant nonlactating Tarentaise cows fitted with rumen cannulae were offered a basal diet of approximately 69% dry-rolled corn, 30% ground (1 inch) alfalfa hay, and 1% soybean oil in a four-period experiment. The experiment was designed such that each of four treatments was fed to one cow during each period, and each cow received each treatment once during the experiment. Treatments consisted of 1) a control supplement offered twice daily (C); 2) a supplement containing .5g yeast offered at 7AM and a control supplement offered at 3PM (1Y); 3) a supplement containing 50 g sodium bicarbonate offered at 7AM and 3PM (B); and 4) a supplement containing .25 g yeast offered at 7AM and 3PM (2Y). Supplements consisted primarily of ground corn and molasses and were formulated to meet or exceed NRC requirements for macro and trace minerals, vitamins, and MGA. Supplements were used as carriers for yeast and bicarbonate and were fed at a rate of .5 lb at 7AM and 3PM. Yeast and bicarbonate were weighed individually and mixed into the supplement prior to each feeding.

Each period consisted of a 10-d dietary adaptation followed by a 4-d sample collection period. Rumen samples were collected 0, 4, and 8 hours following the 7AM feeding and 2 h after the 3PM feeding on 2 consecutive days and ruminal pH was measured. Nylon bags containing alfalfa hay were suspended in the rumen for times up to 96 hours. Periods two and four immediately followed periods one and three, respectively. Cows were removed from the metabolism facility following period two for a 7-day rest and exercise period. During that time, they were offered the basal diet with the control supplement.

Experiment 2

Four nonpregnant nonlactating Tarentaise cows fitted with rumen cannulae were used in a four-period experiment similar to that described for Exp. 1. A basal diet of approximately 40.5% corn silage, 39.6% dry-rolled corn, 15.2% ground (1 inch) alfalfa hay, and 4.7% soybean meal was supplemented with (Y) or without (No Y) yeast, and with (B) or without (No B) sodium bicarbonate. Yeast was fed at 7:30AM at a rate of .5g blended with the daily supplement. Sodium bicarbonate was fed at 7:30AM and 3:30PM at a rate of 50 g sodium bicarbonate blended with the daily supplement. The supplement consisted primarily of ground corn and molasses and was formulated to meet or exceed NRC requirements for macro and trace minerals, vitamins, and MGA. Periods and sampling procedures were similar to those described for Exp. 1.

Results and Discussion

Experiment 1

Dry matter intakes did not differ ($P > .10$) among treatments (Table 1) and averaged 2% of body weight. Ruminal pH was affected ($P < .05$) by sampling time but not by treatment (Table 2), and a treatment × sampling time interaction was not detected ($P > .10$) for ruminal pH. Total VFA as well as molar proportions of acetic, isobutyric, butyric, isovaleric, and valeric acid, and the acetic to propionic acid ratios varied ($P < .05$) across sampling times. The treatment × sampling time interaction tended ($P < .10$) to be significant for molar proportion of acetic acid. However, total VFA concentration or molar percentages of different VFA did not differ ($P < .10$) between treatments when averaged across sampling times and days.

In situ (nylon bag) DM disappearance at 48 hours of incubation tended to be greater ($P < .10$) from cows offered B than from those offered 1Y or 2Y (Table 3). In situ disappearance at 48 hours from cows offered either 1Y or 2Y did not differ ($P < .10$) from that by cows offered C. Cows fed B tended to have a lower ($P < .10$) in situ indigestible DM fraction and a shorter ($P < .01$) DM digestion lag phase than cows fed the other treatments. In situ digestible and indigestible DM fractions did not differ (P < .10) among cows fed 1Y, 2Y, or C, but cows fed 1Y or 2Y had shorter (P < .01) DM digestion lag phases than cows fed C. Dry matter disappearance rates did not differ (P < .10) among treatments.

In situ NDF disappearance at 48 hours of incubation tended to be greater (P < .10) from cows fed B than from those fed 1Y or 2Y (Table 4). The digestible NDF fraction from cows fed 2Y tended to be lower (P < .10) than that from cows fed B or 1Y. Disappearance rates of NDF did not differ among treatments.

Experiment 2

Dry matter intakes did not differ (P > .10) between main effects (Table 5) and averaged 1.8% of body weight. Average weight tended (P < .10) to be greater from B than No B, and weight change during the experimental periods was greater (P < .05) from Y than from No Y. This is probably indicative of the cows fed Y achieving greater ruminal fill than those fed No Y. Ruminal pH and ammonia were affected (P < .01) by sampling time but not by supplements (Table 6), and sampling time interactions with either main effect were not detected (P < .05). Isovaleric acid concentrations were higher (P < .05) from cows fed B than from those fed No B. However, total VFA concentration and molar percentages of the other VFA did not differ (P < .10) between main effects when averaged across sampling times and days.

In situ DM disappearance at 24 and 48 hours of incubation tended to be greater (P < .10) from cows fed B than from those fed No B (Table 7). However, disappearance at 72 and 96 hours of incubation did not differ (P > .10) between cows fed B and those fed No B. This indicates that supplemental sodium bicarbonate did not affect the maximum extent of digestion but that the extent was reached at a shorter incubation time. This is verified by similar digestible fractions (f_d) between cows fed B and No B while in situ DM disappearance rate tended (P = .19) to be faster from cows fed B than from those fed No B. These factors typically might lead to improved intake in cattle consuming diets with a high roughage content. In this study, cows fed B consumed 5.3 % more DM than those fed No B, but the difference was not statistically significant. Yeast did not affect in situ DM disappearance.

In situ NDF disappearance at 24 hours of incubation tended to be greater (P < .10) and disappearance at 48 hours was greater (P < .05) from cows fed B than from those fed No B (Table 8). However, sodium bicarbonate supplementation had no effect (P < .10) on digestible or indigestible NDF fractions or on NDF digestion rate. Yeast did not affect NDF disappearance at any digestion time, but the digestible NDF fraction from cows fed Y tended to be higher (P < .10) than that from cows fed No Y. Cows fed Y also tended to have a shorter (P < .10) digestion lag time but a slower (P = .12) digestion rate than cows fed No Y. Altering NDF digestion can have a substantial impact on intake of high roughage diets, but has much less of an effect in a high concentrate diet because of intake regulation by chemostatic mechanisms rather than from gut distention. Therefore, the impact of NDF digestion rate on interpretation of other data is probably not as effective as it might be in a diet with a higher roughage content.

At the levels fed in this experiment, supplemental yeast had little effect on intake, ruminal fermentation, or in situ disappearance of alfalfa hay DM. Although supplementation with yeast did have a positive effect on NDF digestible fraction and digestion lag, these improvements were not effective in improving intake. Supplementation of the high-concentrate diet with sodium bicarbonate did have an apparent positive effect on alfalfa hay disappearance from nylon bags suspended in therumen, but had little effect on intake or ruminal fermentation products.

However, the magnitude of improvements demonstrated here would not lead one to believe that animal performance would be improved substantially by either product evaluated in these studies.

Table 1. Intake of a Corn-Alfalfa Hay Diet by Cows Fed Sodium Bicarbonate or Yeast - Exp. 1.[a]

Item	Treatment C	B	1Y	2Y
Animal weight, lb	1212	1226	1212	1213
14-d DM intake, lb	25.0	25.6	22.0	22.5
14-d DM intake, % BW	2.1	2.1	1.8	1.9

[a]No significant differences were detected ($P < .10$).

Table 2. Ruminal pH and Volatile Fatty Acid Concentrations from Cows Fed a Corn-Alfalfa Hay Diet Supplemented with Sodium Bicarbonate or Yeast - Exp. 1.[a]

Item	Treatment C	B	1Y	2Y
pH	6.0	6.2	6.0	6.0
Total VFA, mM	112.4	104.5	106.1	111.4
	---------- mole/100 mole ----------			
Acetic	58.8	58.6	57.6	56.8
Propionic	25.1	22.4	25.6	26.0
Isobutyric	.9	.9	.9	.9
Butyric	11.7	14.3	11.9	13.0
Isovaleric	2.2	2.5	2.3	1.9
Valeric	1.4	1.3	1.7	1.5
Acetic:propionic	2.5	2.7	2.4	2.3

[a]Treatment differences or treatment × time interactions were not detected ($P < .10$).

Table 3. In Situ (Nylon Bag) Dry Matter Digestibility from Cows Fed a Corn-Alfalfa Hay Diet Supplemented with Sodium Bicarbonate or Yeast - Exp. 1.

	Treatment			
Item	C	B	1Y	2Y
Time, hours				
6	15.9	15.2	18.1	18.4
12	33.5	28.5	24.7	28.3
18	42.1	42.6	35.3	38.4
24	46.8	47.3	43.2	43.6
48	52.8^{ab}	56.7^{a}	51.3^{b}	49.5^{b}
72	56.3	59.4	53.9	52.7
96	57.7	60.7	56.7	54.9
f_d, %	35.4^{ab}	37.5^{a}	35.3^{ab}	33.3^{b}
f_i, %	28.0^{a}	25.2^{b}	29.1^{a}	29.7^{a}
f_s, %	36.6	37.3	35.6	37.0
k_{d1}, h^{-1}	.106	.086	.077	.087
k_{d2}, h^{-1}	.045	.056	.045	.050
lag time, hours	9.0^{a}	1.7^{c}	5.3^{b}	5.4^{b}

^{a,b,c}Means within a row without a common superscript letter differ ($P < .10$).

f_d = the potentially digestible fraction; f_i = the potentially indigestible fraction; f_s = the soluble fraction of the substrate; k_{d1} = the fractional digestion rate constant calculated using non-linear SAS; k_{d2} = the fractional digestion rate constant calculated using regression of the natural logarithm of the potentially digestible substrate remaining against time.

Table 4. In Situ (Nylon Bag) Neutral-Detergent Fiber Digestibility from Cows Fed a Corn-Alfalfa Hay Diet Supplemented with Sodium Bicarbonate or Yeast - Exp. 1.

Item	Treatment C	B	1Y	2Y
Time, hours				
6	9.1	9.6	11.6	12.2
12	21.4	18.7	17.7	17.3
18	26.6	29.2	23.5	24.3
24	29.9	33.6	29.9	29.2
48	39.5[ab]	45.1[a]	38.2[b]	35.1[b]
72	43.0	47.4	41.6	38.6
96	45.9	49.5	45.5	42.0
f_d, %	40.8[ab]	45.7[a]	41.8[a]	36.5[b]
f_i, %	51.4[ab]	47.1[b]	53.2[a]	55.0[a]
f_s, %	7.8	7.2	5.0	8.5
k_d, h^{-1}	.073	.060	.048	.063
k_d, h^{-1}	.036	.053	.040	.037
lag time, hours	5.7	-.83	.25	.22

[a,b]Means within a row without a common superscript letter differ ($P < .10$).
f_d = the potentially digestible fraction; f_i = the potentially indigestible fraction; f_s = the soluble fraction of the substrate; k_{d1} = the fractional digestion rate constant calculated using non-linear SAS; k_{d2} = the fractional digestion rate constant calculated using regression of the natural logarithm of the potentially digestible substrate remaining against time.

Table 5. Intake of a High-Concentrate Diet by Cows Fed Sodium Bicarbonate or Yeast - Exp. 2.

Item	Yeast: Control	Yeast	Sodium Bicarbonate: Control	Bicarb.
Animal weight, lb[a]	1360	1351	1343	1368
14-d DM intake, lb	24.0	24.2	23.5	24.7
14-d DM intake, % bw	1.8	1.8	1.8	1.8
Weight change, lb.[b]	2	38	28	13

[a]Diets supplemented with sodium bicarbonate differed ($P < .10$) from those that were not supplemented with sodium bicarbonate.
[b]Diets supplemented with yeast differed ($P < .05$) from those that were not supplemented with yeast.

Table 6. Ruminal pH, Ammonia and Volatile Fatty Acid Concentrations from Cows Fed a High-Concentrate Diet Supplemented with Sodium Bicarbonate or Yeast - Exp. 2.

	Yeast		Sodium Bicarbonate	
Item	Control	Yeast	Control	Bicarb.
pH	6.2	6.2	6.2	6.2
Ruminal ammonia, mM	.9	1.0	.9	1.0
Total VFA, mM	91.8	93.0	94.0	90.9
	---------- mole/100 mole ----------			
Acetic[a]	63.8	63.2	62.6	64.3
Propionic	20.5	20.0	21.5	19.1
Isobutyric	1.2	1.2	1.1	1.3
Butyric[a]	11.7	12.7	12.1	12.3
Isovaleric[b]	1.4	1.5	1.3	1.6
Valeric	1.4	1.4	1.4	1.4
Acetic:propionic	3.3	3.3	3.2	3.4

[a]Sodium bicarbonate × time interaction was significant ($P < .05$).
[b]Diets supplemented with sodium bicarbonate differed ($P < .05$) from those not supplemented with sodium bicarbonate.

Table 7. In Situ (Nylon Bag) Dry Matter Digestibility (%) from Cows Fed a High-Concentrate Diet Supplemented with Sodium Bicarbonate or Yeast - Exp. 2.

	Yeast		Sodium Bicarbonate	
Item	Control	Yeast	Control	Bicarb.
Time, hours				
6	18.5	18.9	19.1	18.4
12	33.8	33.2	32.4	34.6
18	44.6	44.3	43.7	45.2
24[a]	51.9	51.4	51.1	52.3
48[a]	57.9	58.3	57.2	59.1
72	59.6	60.1	59.9	59.8
96	60.7	61.3	61.1	60.9
f_d, %	39.6	40.0	39.8	39.7
f_i, %	25.7	25.6	25.5	25.9
k_d, h^{-1}	.082	.080	.070	.093
lag time, hours	1.7	1.6	1.3	2.1

[a]Diets supplemented with sodium bicarbonate differed ($P < .10$) from those that were not supplemented with sodium bicarbonate. f_d = the potentially digestible fraction; f_i = the potentially indigestible fraction; k_d = the fractional digestion rate constant calculated using non-linear SAS.

Table 8. In Situ (Nylon Bag) Neutral-Detergent Fiber Digestibility (%) from Cows Fed a High-Concentrate Diet Supplemented with Sodium Bicarbonate or Yeast - Exp. 2.

	Yeast		Sodium Bicarbonate	
Item	Control	Yeast	Control	Bicarb.
Time, hours				
6	10.8	11.7	11.3	11.2
12	19.8	20.7	19.9	20.7
18	29.3	29.8	27.9	31.1
24[a]	37.7	37.3	36.6	38.5
48[b]	44.5	45.8	43.5	46.9
72	46.8	48.1	46.9	48.0
96[c]	48.3	49.9	48.8	49.4
f_d, %[d]	42.9	45.4	43.2	45.1
f_i, %	47.2	46.1	47.3	46.0
k_d,h^{-1} [c]	.077	.061	.066	.072
lag time, h[d]	4.2	2.1	3.1	3.3

[a]Diets supplemented with sodium bicarbonate differed (P < .10) from those that were not supplemented with sodium bicarbonate.
[b]Diets supplemented with sodium bicarbonate differed (P < .05) from those that were not supplemented with sodium bicarbonate.
[c]Diets supplemented with yeast differed (P < .16) from those that were not supplemented with yeast.
[d]Diets supplemented with yeast differed (P < .10) from those that were not supplemented with yeast.
f_d = the potentially digestible fraction; f_i = the potentially indigestible fraction; k_d = the fractional digestion rate constant calculated using non-linear SAS.

ALFALFA VARIETY PERFORMANCE IN SOUTHEASTERN KANSAS

Joseph L. Moyer

Summary

Alfalfa yields for 1994 included five cuttings. For the year, 'Riley yielded less than 12 other cultivars. Over the 5-year period, Garst 630 has consistently produced more than Riley.

Introduction

The importance of alfalfa as a feed crop and/or cash crop has increased in recent years. The worth of a particular variety is determined by many factors, including its pest resistance, adaptability, longevity under specific conditions, and productivity.

Experimental Procedures

The 15-line test was seeded (12 lb/a) in April, 1990 at the Mound Valley Unit. Plots were fertilized with 20-50-200 lb/a of N-P_2O_5-K_2O on 11 March, 1993. Five harvests were obtained in 1994. Growing conditions were generally favorable (see weather summary), except a bit dry in July for optimum growth. No particular insect or disease problems were noted.

Results and Discussion

Forage yields of each of the five cuttings, total 1994 production, and 5-year totals are shown in Table 1.

Cut 1 yield was higher from 630 than from DK 135, Riley, or WL-320. Yield of 5472 was higher in cut 3 than that of Riley and DK 135 and higher in cut 4 than that of 10 cultivars. Total 1994 yields of 5472, 630, 'Magnum III', 'Apollo Supreme', and WL 317 were higher than yields of Riley, DK 135, and 'Cimmaron VR'. After 5 years of testing, yields of the highest- and lowest-ranking cultivars were separated by more than 12 percentage points (3.5 tons).

Table 1. Forage Yields of the Alfalfa Variety Test in 1994, Mound Valley Unit, Southeast Agricultural Research Center

Source	Variety	1994 5/6	6/7	7/5	8/3	9/13	Total	5-Yr Total
		- - - - - - tons/a @ 12% - - - - - -						
ICI (Garst)	636	2.30abc[a]	1.71abcd	0.37abc	1.56a	1.31abc	7.25abc	30.76a
Dairyland	Magnum III	2.36ab	1.68abcd	0.52ab	1.60a	1.27bc	7.44a	30.86a
Cargill	Trident II	2.17abcd	1.68abcd	0.44abc	1.68a	1.27bc	7.26abc	30.67a
Garst	630	2.43a	1.86a	0.40abc	1.79a	1.22bc	7.71a	30.94a
America's Alfalfa	Apollo Supreme	2.27abc	1.63bcd	0.48abc	1.65a	1.36abc	7.40a	30.58a
Pioneer	5364	2.33abc	1.58bcd	0.40abc	1.57a	1.21bc	7.10abc	30.28ab
Pioneer	5472	2.17abcd	1.80ab	0.57a	1.72a	1.52a	7.78a	30.70a
W-L Research	WL 317	2.28abc	1.60bcd	0.41abc	1.79a	1.31abc	7.38a	30.26ab
Agripro	Dart	2.30abc	1.78abc	0.40abc	1.58a	1.16c	7.22abc	30.04ab
Agripro	Ultra	2.12abcd	1.69abcd	0.49abc	1.59a	1.41ab	7.30ab	30.09ab
W-L Research	WL 320	2.05bcd	1.70abcd	0.42abc	1.70a	1.26bc	7.14abc	29.63ab
Pioneer	5432	2.15abcd	1.68abcd	0.46abc	1.64a	1.26bc	7.20abc	29.50ab
Great Plains Res.	Cimarron VR	2.10abcd	1.56cd	0.35abc	1.49a	1.12c	6.62bcd	28.73bc
DeKalb	DK 135	1.93d	1.52de	0.33bc	1.53a	1.24bc	6.56cd	27.93c
KS AES & USDA	Riley	2.00cd	1.35e	0.26c	1.56a	1.19bc	6.36d	27.48c
	Average	2.20	1.66	0.42	1.63	1.27	7.18	29.90
	LSD(.05)	0.28	0.20	0.20	0.36	0.20	0.64	1.40

[a]Means within a column followed by the same letter do not differ (P=.05) according to Duncan's test.

FORAGE PRODUCTION OF BERMUDAGRASS CULTIVARS IN SOUTHEASTERN KANSAS

Joseph L. Moyer and Charles M. Taliaferro[2]

Summary

In the third harvest year of the test, experimental 74 X 11-2 yielded more first-cut and total forage than all other cultivars, including all four named varieties. Total 1994 production was higher from 'Hardie' and six experimentals than from nine other cultivars.

Introduction

Bermudagrass can be a high-producing, warm-season, perennial forage for southeastern Kansas. Producers have profited considerably from the replacement of the common bermudas with the variety 'Midland'. Developments in bermudagrass breeding should be monitored closely to speed adoption of improved types.

Experimental Procedures

Plots were sprigged with plants in peat pots on 28 June, 1991 at the Mound Valley Unit. Plots were 15 x 20 ft each, in four randomized complete blocks. Plots were sprayed on 4 April with 1.5 lb/a of metolachlor. Application of 161-54-61 lb/a of N-P_2O_5-K_2O was made on 19 May, followed by fertilization with 53 lb/a of N on 4 August. Strips 20 x 3 ft were cut on 10 June, 29 July, and 10 October, 1994. Subsamples were collected for determination of moisture. Visual ratings of vegetative spread were made on 24 June.

Results and Discussion

In the first cutting, Experimental 74 X 11-2 yielded more forage than any other cultivar (Table 1). However, 74 X 11-2 has spread very little from the original plants in the 3 years since sprigging, barely covering the width of the harvest strip. Experimental LCB84 X 16-66 yielded more than 14 other cultivars, including 'Midland', 'World Feeder', 'Greenfield', and 'Tifton 44'. The top three experimentals and 'Hardie' produced more first-cut forage than seven other cultivars.

In the second cutting, 74 X 11-2 again produced the most. Hardie and seven experimental cultivars yielded more than 10 other cultivars, including three named cultivars. In the third cut, Hardie and seven experimental cultivars yielded more than eight other cultivars. One experimental that yielded well in the second cutting, 74 X 12-6, also ranked highest in cut 3 forage yield, producing more than 15 other cultivars.

Total 1994 production was higher from cultivar 74 X 11-2 than any other cultivar. Hardie and six experimentals yielded more than nine other cultivars.

Yields for the 3 years are shown in Table 2. Relative yields of cultivars varied by year, as indicated by the significant ($P < .01$) year x cultivar interaction.

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

Table 1. Bermudagrass 1994 Forage Yield, Mound Valley Unit, Southeast Agricultural Research Center

Cultivar	Spread[a]	Cut 1	Cut 2	Cut 3
		- - - - - - tons/a @ 12% moisture - - - - - -		
LCB84 X 9-45	2.0cde[b]	3.35ab	1.26abc	1.76abc
LCB84 X 16-66	2.5abcde	3.90ab	1.44a	1.78bcd
74 X 12-12	2.8abcd	2.61def	1.34ab	2.18a
LCB84 X 19-16	2.5abcde	2.98abcd	1.05cde	2.02ab
LCB84 X 15-49	2.2bcde	3.00abc	0.95def	2.09a
Hardie	1.8def	2.93bcd	1.26abc	1.78bcd
LCB84 X 12-28	2.2bcde	3.07ab	1.12cd	1.75cd
74 X 11-2	0.2g	2.88bcde	1.22bc	1.80bcd
LCB84 X 14-31	3.0abc	3.14ab	1.15bcd	1.60def
LCB84 X 19-31	2.2bcde	2.63cdef	1.15bcd	1.96abc
LCB84 X 19-23	2.7abcd	2.84bcde	1.05cde	1.65de
LCB84 X 21-57	3.5a	2.79bcde	1.11cd	1.34gh
Tifton 44	2.5abcde	2.29fg	1.23bce	1.71cde
LCB84 X 15-26	1.5ef	3.09ab	0.96def	1.06i
LCB84 X 18-62	3.6abc	2.27fg	0.97def	1.38fg
74 X 12-6	1.0fg	2.02g	0.89efg	1.70cde
Greenfield	3.2ab	2.51ef	0.90efg	1.13hi
Midland	2.8abcd	2.14g	0.78fg	1.48efg
LCB84 X 16-55	3.5a	2.61cdef	0.70g	0.97i
World Feeder	3.2ab	2.18gh	0.99f	1.13h
Average	2.4	2.88	1.66	2.15
LSD(.05)	0.9	0.44	0.26	0.36

[a]Visual rating (0-5), where 0 is no spread from original plants and 5 is 100% plot coverage. [b]Means within a column followed by the same letter are not significantly (P<.05) different, according to Duncan's test.

Table 2. Bermudagrass Forage Yield, 1992-1994, Mound Valley Unit, Southeast Agricultural Research Center

Cultivar	1992	1993	1994	Average[a]
	- - - - - - - - - - - tons/a @ 12% moisture - - - - - - - - - - -			
LCB84 X 9-45	7.88	6.38	7.52	7.26
LCB84 X 16-66	7.16	6.31	8.18	7.22
74 X 12-12	7.38	6.12	7.22	6.91
LCB84 X 19-16	7.01	6.05	8.36	7.14
LCB84 X 15-49	7.49	6.04	8.01	7.18
Hardie	7.12	5.97	7.85	6.98
LCB84 X 12-28	8.09	5.94	6.04	6.69
74 X 11-2	7.82	5.91	9.54	7.76
LCB84 X 14-31	7.14	5.88	6.99	6.67
LCB84 X 19-31	7.50	5.74	7.41	6.88
LCB84 X 19-23	6.64	5.54	6.52	6.23
LCB84 X 21-57	6.68	5.24	4.25	5.39
Tifton 44	7.45	5.23	7.05	6.57
LCB84 X 15-26	7.37	5.10	5.16	5.87
LCB84 X 18-62	6.47	4.62	4.88	5.32
74 X 12-6	7.08	4.60	8.10	6.59
Greenfield	6.87	4.54	4.28	5.23
Midland	6.60	4.40	5.88	5.62
LCB84 X 16-55	7.12	4.28	3.86	5.08
Average	7.20	5.47	6.69	6.45
LSD(.05)	0.90	0.59	0.79	- -

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

LEGUME PERSISTENCE UNDER HAY PRODUCTION MANAGEMENT

Joseph L. Moyer

Summary

Alfalfa cultivars selected for grazing vs. haying may differ in longevity in southeastern Kansas. Four alfalfas and 'Fergus' birdsfoot trefoil were fall-seeded in Cherokee County for comparison of longevity and productivity. Initial populations of trefoil were less than those of alfalfa cultivars. All populations declined to similar levels during the summer of 1993. Production of all cultivars was similar by the middle of the first summer.

Introduction

Soils in southeastern Kansas are characterized by having slowly permeable subsoils. These soils can shorten the longevity of stands of alfalfa and other hay-type legumes, particularly during wet periods. Alfalfa cultivars that were selected to tolerate grazing by livestock may be longer-lived under some conditions. This test was designed to compare alfalfas that were selected for different purposes, and birdsfoot trefoil for persistence and productivity in southeastern Kansas.

Experimental Procedures

The test was seeded in a prepared seedbed on the James Hefley farm on a Taloka silt loam soil in southern Cherokee County on 9 September, 1991. Plots 10 x 30 ft were seeded in 10-inch rows at the rate of 12 lb/a for alfalfas and 8 lb/a for Fergus birdsfoot trefoil in a randomized complete block design with three replications. Two alfalfas, ICI 630 and NK 'Commandor', are hay-producing types. NK 'Spredor II' was selected for its ability to spread vegetatively by root propagation. 'Alfagraze' was developed to tolerate grazing pressure. Plots were fertilized preplant and on 1 May, 1993 with 10-50-200 lb/a of N-P_2O_5-K_2O. No pest control measures were applied during the study.

Visual ratings of the initial stands were made for plots on 21 October, 1991. Plant population was determined by counting crowns within two randomly chosen 15 x 13-inch areas of each plot. Crowns were counted after the first cutting in 1992 and near the beginning and end of the 1993 and 1994 growing seasons.

The area was hayed four times each in 1992 and 1994 and three times in 1993. Forage disk meter readings (3/plot) were taken to estimate standing forage production just prior to cuttings 2, 3, and 4 in 1992 and cuttings 1 and 2 in 1993.

Results and Discussion

Initial stand ratings in the first fall were similar for the alfalfas, averaging 4.4 of a possible 5 (data not shown). However, the stand of trefoil rated 2.7, significantly lower than any alfalfa. Fall seeding of birdsfoot trefoil did not result in a satisfactory stand before the first winter.

Plant populations of legume cultivars over time are indicated by the crown density data in Fig. 1. Trefoil had the lowest population in the first spring. The only difference in population of the alfalfas was that 630 had a greater stand density than Spredor II in the first spring. By 26 months after seeding, populations of all cultivars had declined to an average 1.6 crowns/ft^2, a level that was maintained for the next year.

Forage production estimates were similar for the cultivars, except for the first measurement (data not shown). Birdsfoot trefoil produced less forage than the alfalfas in that first measurement (cut 2) after seeding. All cultivars produced similarly low yields for the last cut of the first season because of droughty conditions. Production was highest from cut 1 of the second season (fourth measurement) but declined significantly for cut 2. This production decline was during a wetter-than-normal period in June, 1993 and just prior to an extremely wet August and September. During this time the most significant decline in stands also occurred (see Fig. 1). Thus, little difference was apparent among the cultivars in tolerance to wet soil conditions.

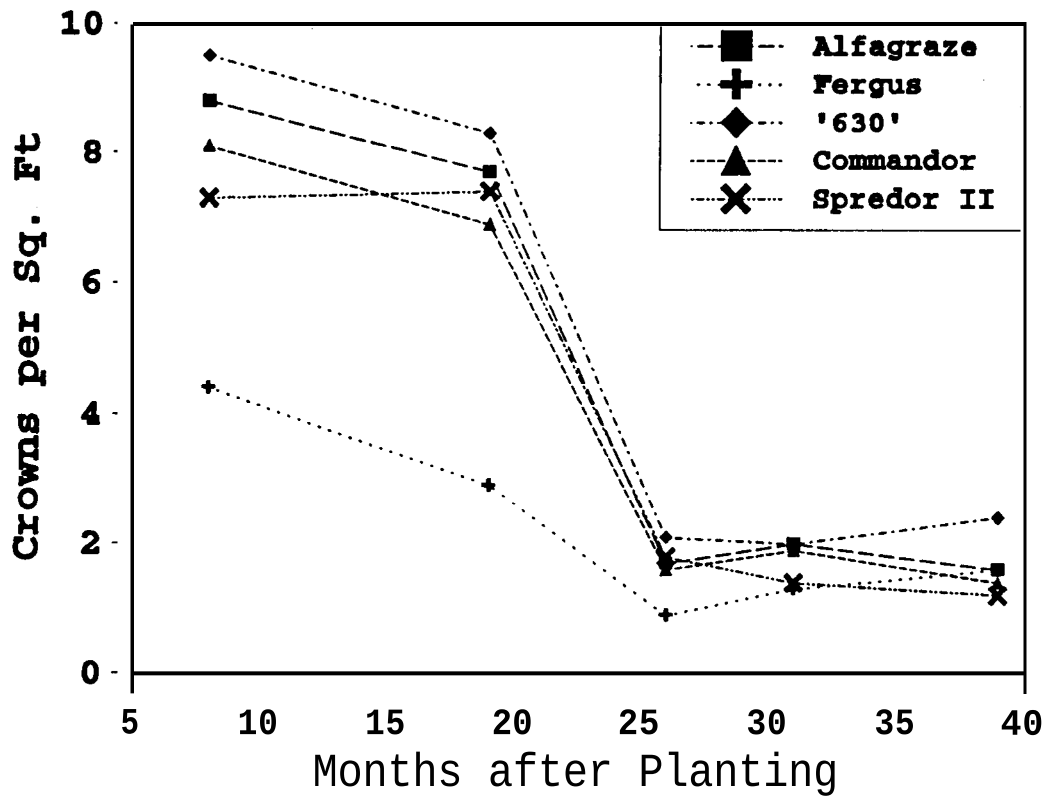

Figure 1. Populations of Four Alfalfa Cultivars and 'Fergus' Birdsfoot Trefoil over Time, Cherokee County, KS.

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

Joseph L. Moyer and Daniel W. Sweeney

Summary

Eastern gamagrass was fertilized with three nitrogen (N) rates applied by broadcast or knife placement. Hay crops were taken under 1-cut or 2-cut harvest systems. Forage yield was increased under the 2-cut system as compared to 1-cut in 2 of 3 years. Nitrogen increased total yield by 40-45% with the first 45 lb/a increment, and by an additional 14-18% with the next 45-lb increment. Broadcast and knife N placements caused no differences in total seasonal yield or in first-cut yield of either harvest system. Second-cut yields (2-cut system) were higher ($P < .05$) from knife compared to broadcast N placement at higher N rates in 1992 and 1993.

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 N and more harvests. This study was established to determine the response of eastern gamagrass to N fertilizer rates and placement under a 1-cut or 2-cut harvest system.

Experimental Procedures

Established (15-year-old) 'Pete' eastern gamagrass was burned in April of 3 years and fertilized in late April with 54 lb P_2O_5/a and 61 lb K_2O/a. Nitrogen (urea-ammonium nitrate solution, 28% N) treatments of 0, 45, or 90 lb/a were applied in late April to 8 x 20 ft plots by broadcast or knife (4-inch) placement.

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

Results and Discussion

Total forage yields for 1992-1994 are shown in Table 1. Total forage yield was increased under the 2-cut system as compared to 1 cut in 1992 and 1994, but not in 1993. Nitrogen increased total forage yield in the different years by 40-45% with the first 45 lb/a increment and by an additional 14-18% with the next 45-lb increment. Similarly, yields from the 1-cut system were increased 57% (data not shown), and first-harvest yields of the 2-cut system (Fig. 1) were increased 49% with the first 45-lb/a increment of N. An additional 45 lb/a of N increased yields of those cuttings by 14% and 18%, respectively.

Broadcast and knife N placement resulted in no difference in total seasonal yield (Table 1) or in first-cut yield of either harvest system (data not shown). Second-cut yields (2-cut system) were higher ($P < .05$) from knife compared to broadcast N placement in 1992 and 1993 but not in 1994 (Fig. 2). Significant interactions between N rate and placement occurred in 1992 and 1993, because the placement response was found in 1993 at only the 90-lb N rate and in 1992 at both the 45- and 90-lb rates.

Table 1. Eastern Gamagrass Forage Yields under Two Harvest Systems with Different Nitrogen Rates and Placement

Harvest System	Nitrogen Rate	Nitrogen Placement	Forage Yield 1992	1993	1994
	lb/a		- - - tons/acre (12% moisture) - - -		
1-Cut	0	Broadcast	2.18	2.14	1.18
		Knife	2.32	2.01	1.25
	45	Broadcast	3.72	3.07	1.65
		Knife	3.45	3.44	1.79
	90	Broadcast	3.88	3.69	1.84
		Knife	4.26	3.75	2.14
2-Cut	0	Broadcast	3.07	2.25	1.47
		Knife	2.61	2.31	1.42
	45	Broadcast	3.63	2.95	2.03
		Knife	3.90	3.21	2.01
	90	Broadcast	4.12	3.57	2.30
		Knife	4.78	3.48	2.52
LSD(.05)			0.71	0.60	0.46
Means, Nitrogen Placement					
		Broadcast	3.43	2.94	1.74
		Knife	3.55	3.03	1.85
		LSD(.05)	NS	NS	NS
Means, Nitrogen Rate					
	0		2.54	2.18	1.33
	45		3.67	3.17	1.87
	90		4.26	3.62	2.20
	LSD(.05)		0.35	0.30	0.23
Means, Harvest System					
1-Cut			3.30	3.02	1.64
2-Cut			3.68	2.96	1.96
LSD(.05)			0.29	NS	0.19

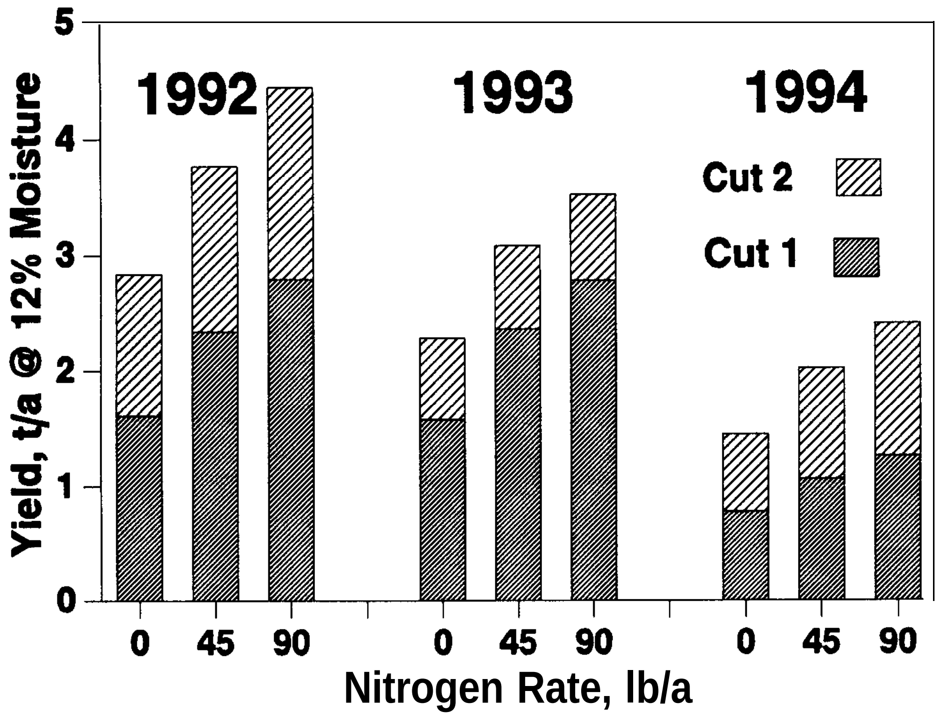

Figure 1. Effect of N Fertilization Rate on Forage Yield of Eastern Gamagrass under a 2-Cut Harvest System.

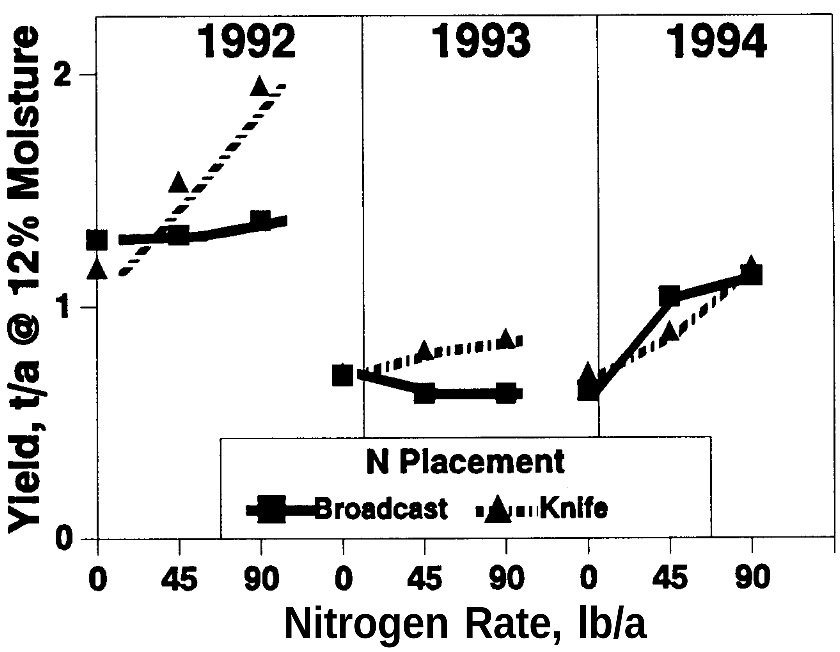

Figure 2. Effect of N Fertilization Rate and Placement on Forage Yield of the Second Cutting of Eastern Gamagrass in a 2-Cut System.

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

Daniel W. Sweeney

Summary

In 1994, the twelfth cropping year of a grain sorghum-soybean rotation, tillage systems or residual nitrogen (N) fertilization did not affect soybean yields.

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 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, discing, and field cultivation. The reduced-tillage system consisted of discing 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 1983, 1985, 1987, 1989, 1991, and 1993 grain sorghum were a) no N (check), b) anhydrous ammonia knifed to a depth of 6 inches, c) broadcast urea-ammonium nitrate (UAN - 28% N) solution, and d) broadcast solid urea. 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

Soybean yield in 1994 was not affected by tillage or residual fertilizer N (data not shown). The average yield was 42.2 bu/a.

TIMING OF LIMITED-AMOUNT IRRIGATION TO IMPROVE YIELD AND QUALITY OF EARLY-MATURING SOYBEAN

Daniel W. Sweeney, James H. Long, and Mary Beth Kirkham[1]

Summary

Limited-amount irrigation resulted in increased soybean yield, but above average July rainfall may have masked any differences caused by irrigation timing or amount. Protein and oil contents were not affected by irrigation treatments.

Introduction

Production of early-maturing soybeans may spread economic risk by crop diversification. Previous research has shown that early-maturing soybeans often can have yields comparable to those of full-season soybeans. However, one disadvantage of early-maturing soybeans has been reduced quality. This potential for poor quality may be due to late reproductive growth that generally occurs in July when rainfall is typically low. Irrigation may improve not only yield of early-maturing soybeans, but also quality. Even though large irrigation sources such as aquifers are lacking in southeastern Kansas, supplemental irrigation could be supplied from the substantial number of ponds in the area. Thus, the objective of this study is to determine the effect of timing and quantity of limited-amount irrigation for improving yield and quality of early-maturing soybeans.

Experimental Procedures

The study was established in 1991 on a Parsons silt loam soil. The experiment was a split plot arrangement of a randomized complete block design. The main plots comprised a 3x2 factorial arrangement of irrigation timing and amount. The three timings were irrigation at the R4, R5, and R6 soybean growth stages. The two amounts were 1 and 2 inches. Also included was a nonirrigated check plot. The subplots were two Maturity Group I soybean cultivars, 'Hodgson 78' and 'Weber 84'. Cultivars were drilled at 200,000 seeds/a on May 10, 1994.

Results and Discussion

Below average rainfall in June may have partially reduced yield levels to 22 to 25 bu/a without irrigation (Table 1), but above average rainfall in July may have partially masked yield response to irrigation applied during reproductive growth stages. Irrigation increased average yields of Weber 84 and Hodgson 78 by approximately 7 bu/a above yields without irrigation. However, yields were similar regardless of timing or amount of irrigation. Protein content of seeds was slightly higher for Hodgson 78 than Weber 84, but was not affected by irrigation treatment (Table 1). Similarly, irrigation had little effect on oil content.

[1] Department of Agronomy, KSU.

Table 1. Effect of Timing of Limited-Amount Irrigation on Early-Maturing Soybean Seed Yield and Quality

Growth Stage	Amount	Cultivar	Yield	Protein	Oil
	inches		bu/a	-------- %	---------
R4	1	Hodgson 78	28.5	36.6	18.5
		Weber 84	31.4	36.6	17.7
	2	Hodgson 78	30.9	36.6	18.5
		Weber 84	34.4	36.4	17.4
R5	1	Hodgson 78	28.8	36.8	18.4
		Weber 84	31.3	36.5	17.7
	2	Hodgson 78	27.0	36.8	18.1
		Weber 84	33.7	36.4	17.7
R6	1	Hodgson 78	30.1	36.5	18.5
		Weber 84	32.8	35.8	18.1
	2	Hodgson 78	29.6	36.2	18.5
		Weber 84	33.0	36.2	18.0
Check	None	Hodgson 78	22.4	36.9	18.4
		Weber 84	25.3	36.3	17.6
	LSD (0.05)		NS	NS	0.5
Treatment Means:					
Growth Stage					
R4			31.3	36.5	18.0
R5			30.2	36.6	18.0
R6			31.4	36.2	18.3
	LSD (0.05)		NS	NS	NS
Amount (inches)					
1			30.5	36.5	18.1
2			31.4	36.4	18.0
	LSD (0.05)		NS	NS	NS
Cultivar					
Hodgson 78			29.2	36.6	18.4
Weber 84			32.8	36.3	17.8
	LSD (0.05)		1.6	0.2	0.2
Interaction(s)			NS	NS	NS
Contrasts:					
None vs. all irrigation			**	NS	NS
None vs. 1"			**	NS	NS
None vs. 2"			**	NS	NS

GRAIN SORGHUM RESPONSE TO LEGUME RESIDUAL AS AFFECTED BY PHOSPHORUS AND POTASSIUM[1]

Daniel W. Sweeney, Joseph L. Moyer, and David A. Whitney[2]

Summary

Type of legume residual did not affect the yield of the first grain sorghum crop after legumes were killed. Phosphorus (P) increased grain sorghum yields, but potassium (K) did not in 1994.

Introduction

With the attention recently given to sustainable agriculture, interest has been renewed in the use of legumes in cropping systems. Because sustainability of our agricultural resources needs to coincide with profitability, achieving and maintaining adequate soil fertility levels are essential. The residual from legumes such as alfalfa and birdsfoot trefoil can benefit subsequent row crops by supplying nitrogen. However, little information is available on the importance of soil P and K in the residual effect of alfalfa and birdsfoot trefoil on a subsequent grain sorghum crop.

Experimental Procedures

The experiment was established on a Parsons silt loam in spring 1994. Since 1983, different soil test levels have been maintained in whole plots by fertilizer applications. Phosphorus levels at the start of this study ranged from below 10 to more than 60 lb/a and K levels from approximately 120 to more than 200 lb/a. The experimental design was a split-split-plot. The whole plots comprised a factorial arrangement of P and K rates. Phosphorus rates were 0, 40, and 80 lb P_2O_5/a, and K rates were 0, 125, and 250 lb K_2O/a. Subplots were alfalfa and birdsfoot trefoil residual. Sub-subplots were 0 and 100 lb N/a applied as urea. Three-year- old alfalfa and birdsfoot trefoil were killed by offset discing on March 22, 1994. Grain sorghum was planted at 62,000 seeds/a on June 13, 1994.

Results and Discussion

In 1994, the first crop year after alfalfa and birdsfoot trefoil were killed, grain sorghum yield was not affected by type of legume residual (data not shown). Maintaining the P level with 40 and 80 lb P_2O_5/a increased yield to 119 and 128 bu/a, respectively, from 88 bu/a with no P applications. Potassium did not affect yields in 1994.

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

[2] Department of Agronomy, KSU.

LAND APPLICATION OF COMPOSTED MUNICIPAL SOLID WASTE FOR GRAIN SORGHUM PRODUCTION[1]

Daniel W. Sweeney and Gary Pierzynski[2]

Summary

Municipal solid waste compost as the only organic amendment increased grain sorghum yield, but appeared to suppress the benefit of cow manure except at the highest compost rate. Cow manure and fertilizer applications generally increased growth and yield.

Introduction

One of the most pressing environmental issues that will face communities in the near future is solid waste disposal. In recent years, news media coverage of landfill problems has become common. With diminishing capacity of existing landfills and the reluctance of the general populace to create new landfills at their own "back door", other alternatives to straight landfilling of municipal solid waste (MSW) need to be explored. Incineration may reduce waste volume, but likely raises as many environmental concerns as landfilling. However, composting of MSW may be more environmentally acceptable and should substantially reduce waste volume. Landfill longevity could be further extended by finding alternatives to landfilling the composted MSW. Composted MSW has potential uses in agriculture, horticulture, silviculture, and reclamation. Thus, the objective of this study was to determine the effect of application rate of composted MSW, with or without cow manure and with or without commercial fertilizer, on the growth, composition, and yield of grain sorghum and on selected soil chemical properties.

Experimental Procedures

A field study was established in 1992 on a Zaar silty clay soil at an off-station site in Montgomery County. The experimental design was a split plot arrangement of a randomized complete block with three replications. The whole plots comprised a 4 x 2 factorial arrangement of four rates of MSW compost with or without cow manure. The four rates of MSW compost were 0 or 4.5, 9, and 13.5 ton/a applied each year. These rates were selected to be more in line with a "utilization" rather than a "disposal" mentality. The cow manure rates were 0 or 4.5 ton/a applied yearly. The subplots were with or without commercial fertilizer, 100-60-30 lb N-P_2O_5-K_2O/a. Compost and cow manure were applied on June 2, and fertilizer was applied on June 3. Grain sorghum was planted at 62,000 seed/a on June 7.

Results and Discussion

Adding MSW compost did not increase dry matter accumulation at the 9-leaf, boot, or soft dough growth stages as compared with no compost. In contrast, the highest MSW compost addition resulted in higher grain sorghum yield than with no compost. However, an interaction between MSW compost and cow manure suggested that, although compost alone appeared to increase yield, compost seemed to suppress the benefit of cow manure except at the highest rate of compost application. Adding cow manure or fertilizer generally increased growth and yield of grain sorghum.

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[1] With the cooperation of Resource Recovery, Inc.

[2] Department of Agronomy, KSU.

Table 1. Effect of Composted Municipal Solid Waste (MSW), Cow Manure (CM), and Fertilizer on Grain Sorghum Growth and Yield

Treatment	Dry Matter Production 9-Leaf	Boot	Soft Dough	Yield
	lb/a			bu/a
MSW (t/a)				
0.0	740	2900	9400	67.4
4.5	700	2710	9500	66.5
9.0	750	3280	10200	69.7
13.0	830	3380	10900	74.9
LSD 0.05	NS	NS	NS	5.9
CM (t/a)				
0.0	680	2800	9300	64.6
4.5	830	3340	10700	74.6
LSD 0.05	110	460	NS	4.1
Fertilizer (lb/a)				
0	720	2820	9600	60.5
100-60-30	790	3320	10400	78.7
LSD 0.05	NS	240	600	9.0
Interaction(s)	NS	NS	NS	MxC

FOLIAR POTASSIUM THIOSULFATE AND BORON FERTILIZATION OF DRYLAND ALFALFA

Daniel W. Sweeney and Joseph L. Moyer

Summary

Foliar applications of potassium (K) and sulfur (S) as potassium thiosulfate and boron (B) as Solubor did not affect total annual alfalfa yields in 1993 or 1994. Soil applications of K, S, and B at "green-up" produced small increases in total alfalfa production during the 2 years.

Introduction

Production of alfalfa under dryland conditions requires good management of plant nutrients. Besides requiring fertilization with macronutrients such as phosphorus (P) and K, alfalfa nutritional needs also include adequate amounts of secondary nutrients and micronutrients. Data from previous studies have indicated that, in the claypan soils of southeastern Kansas, alfalfa may be more responsive to P than to K fertilization. However, in those studies, K concentrations in the plant were often low. If soil-applied K is becoming partially unavailable, foliar-applied K may benefit alfalfa production. Sulfur is a secondary nutrient that may be low in the topsoils of the area, and fertilization with S also may improve production and quality. The current availability of potassium thiosulfate (KTS) liquid fertilizer presents the opportunity to apply both K and S to foliage as one compound. Boron is a micronutrient that is important for alfalfa production and can be marginal in the soils of southeastern Kansas. Applications of K and S as KTS and B as Solubor may provide increases in yield of alfalfa.

Experimental Procedures

The experiment was conducted on a new alfalfa stand planted in fall of 1992 at the Parsons field. The experiment was a 3x2x2 factorial arrangement. The three rates of foliar KTS supplied i) 0 lb K_2O/a and 0 lb S/a, ii) 3.0 lb K_2O/a and 2.1 lb S/a, and iii) 6.0 lb K_2O/a and 4.2 lb S/a. Foliar applications of B were 0 or 0.5 lb B/a. Foliar applications of KTS and B were made when plants were approximately 8 inches tall prior to the first and second cuttings. Soil applications of K, S, and B were made at "green-up" to supply 80 lb K_2O/a, 28 lb S/a, and 2 lb B/a. Cuttings were taken from a 3 x 25 ft area of each plot.

Results and Discussion

During 1993 and 1994, foliar applications of KTS or B did not affect yields (data not shown). Soil applications of K, S, and B significantly increased total annual yield by 0.4 tons/a (3.8 tons/a without fertilization and 4.2 tons/a with fertilization).

EFFECTS OF PLANTING DATE AND FOLIAR FUNGICIDE ON WINTER WHEAT

Kenneth W. Kelley

Summary

Wheat planted in mid- to late October produced higher grain yields compared to wheat planted in early October or in mid-November. Grain yields and test weights were significantly higher where a foliar fungicide had been applied.

Introduction

Wheat often is planted over a wide range of dates in southeastern Kansas because of the varied cropping rotations. Wheat following early corn, early grain grain sorghum, or wheat is planted in late September and early October, whereas wheat following soybeans typically is planted from early October through early November. This research seeks to determine how planting date affects grain yield of selected hard and soft winter wheat cultivars with variable disease resistance.

Experimental Procedures

In 1994, six winter wheat cultivars were planted on four different dates at the Parsons Unit. Cultivars were selected for various foliar disease resistances: 1) moderately resistant soft wheat cultivars ('Caldwell' and Pioneer 2551), 2) susceptible hard wheat cultivars ('Chisholm' and 'TAM 107'), and 3) resistant hard wheat cultivars ('Karl' and 2163). Cultivars were seeded at the recommended rate for each planting date (850,000 seeds/a for early Oct.; 1,050,000 seeds/a for mid- to late Oct.; and 1,250,000 seeds/a for early Nov. plantings). Tilt, a systemic foilar fungicide, was applied at 4 oz/a to half of the plot area for each planting date when the wheat was at Feekes' growth stage 8 (flag leaf just visible from the boot).

Results and Discussion

Grain yields and test weights were highest for the mid- to late October planting dates (Table 1), but wheat planted in early October yielded significantly higher than that planted in November. In 1994, foliar disease pressure was relatively light for most of southeast Kansas; however, at the Parsons Unit, septoria leaf blotch was severe near the critical wheat heading period, which reduced grain yield and grain quality. Because of the septoria disease pressure, grain yield and test weight were significantly higher for all cultivars where Tilt had been applied. Wheat heading date was approximately 1 week later with the last planting date compared to the first (approximately 6 weeks apart).

Table 1. Effects of Planting Date and Foliar Fungicide on Wheat Yield and Test Weight of Selected Cultivars, Parsons Unit, 1994

Planting Date Cultivar	Grain Yield Fungicide No	 Yes	Test Weight Fungicide No	 Yes	Heading Date
	--- bu/a ---		--- lb/bu ---		
Early October (Oct. 4)					
2163	46.4	71.5	51.9	54.7	May 4
Caldwell (S)	43.7	63.3	51.2	54.3	May 5
Chisholm	41.2	59.3	54.9	57.2	May 2
Karl	45.3	52.4	55.7	56.2	May 3
Pioneer 2551 (S)	49.2	70.9	49.7	53.0	May 6
TAM 107	40.5	49.8	54.2	56.1	May 1
(AVG)	44.4	61.1	52.9	55.3	
Mid-October (Oct. 14)					
2163	51.5	71.5	52.7	55.2	May 6
Caldwell (S)	50.5	66.4	52.4	54.7	May 7
Chisholm	47.5	69.5	55.9	58.1	May 4
Karl	53.1	66.0	56.9	57.3	May 5
Pioneer 2551 (S)	52.3	71.5	50.9	53.7	May 8
TAM 107	54.2	74.7	54.5	57.2	May 3
(AVG)	51.5	69.9	53.9	56.1	
Late October (Oct. 28)					
2163	55.1	69.9	53.9	55.2	May 8
Caldwell (S)	49.4	69.8	53.2	55.7	May 9
Chisholm	54.4	72.5	56.5	58.7	May 5
Karl	65.7	71.3	57.7	58.1	May 6
Pioneer 2551 (S)	39.2	59.1	48.8	51.9	May 11
TAM 107	58.3	79.4	56.0	57.9	May 5
(AVG)	53.7	70.3	54.4	56.3	
Early November (Nov. 10)					
2163	36.4	46.8	51.0	52.2	May 11
Caldwell (S)	37.9	51.7	49.8	52.2	May 12
Chisholm	38.9	50.6	54.4	57.0	May 10
Karl	49.3	56.1	56.8	57.7	May 10
Pioneer 2551 (S)	34.3	38.3	48.1	50.1	May 14
TAM 107	43.1	52.6	53.4	55.9	May 9
(AVG)	40.0	49.4	52.3	54.2	
LSD (0.05):					
Cultivar within same (F) & same (DOP)	4.6		0.8		
Cultivar for different (F) & same (DOP)	4.8		1.0		

S = soft wheat cultivar. Foliar fungicide = Tilt, applied at 4 oz/a at Feekes' GS 8 (early boot stage).

WHEAT AND SOYBEAN ROTATIONS COMPARED

Kenneth W. Kelley

Summary

Full-season soybeans have averaged 5 bu/a higher yields than double-crop soybeans over the 14-year period. Full-season soybean yield also has been highest where no double-cropping occurred in the previous year. Since 1988, wheat yield has been 10 bu/a higher following wheat compared to wheat following late-maturing soybeans (MG 4 and 5), whereas wheat yield following early-maturing soybeans (MG 1 and 3) has been nearly the same as wheat yield following wheat.

Introduction

In southeastern Kansas, producers often rotate wheat after soybeans or plant double-crop soybeans following wheat harvest. Management practices of one crop, therefore, may affect the production of the subsequent crop. This research seeks to determine the long-term effects of wheat and soybean rotations on yield and soil properties.

Experimental Procedures

Beginning in 1981, three different wheat and soybean rotations were established at the Parsons Unit: 1) [continuous wheat - double-crop soybeans, 2) [wheat - double-crop soybean] - full-season soybean, and 3) full-season soybean following wheat with no double-cropping. Prior to 1988, full-season soybeans were maturity group (MG) V and double-crop, MG III or IV. Beginning in 1988, MG I, III, IV, and V were compared in both full-season and double-crop rotations (Rotation # 2). Group I maturity was planted in early May in 7-inch row spacing, whereas the other full-season maturity groups normally were planted in late May or early to mid-June. Double-crop soybeans were planted in late June or early July after wheat. In 1994, additional cultivars with varying resistance to soybean cyst nematode (SCN) were included. Prior to 1988, wheat was planted after all double-crop and full-season soybeans had matured, regardless of rotation. However, since 1988, wheat has been planted at different times with respect to individual crop rotations.

Results and Discussion

Table 1 shows the yearly soybean yields for the different wheat and soybean rotations for the past 14 years. Double-crop soybean yields have averaged nearly 20 bu/a, with no difference in yield from continuous double-cropping versus double-cropping every other year. Full-season soybean yields following summer-fallowed wheat have averaged 2 bu/a higher than those following double-crop soybeans. Full-season soybean yields have averaged 5 to 7 bu/a higher than double-crop soybean yields, but the variation from year to year has been significant. During the years when wet weather conditions delayed full-season planting (1982, 1985, 1989, and 1992) until the same time as double-crop planting, no significant differences occurred in yields among rotations.

Since 1988, soybean maturity has significantly influenced full-season soybean yield, but when averaged over 7 years, grain yield differences between maturity groups were less than 2 bu/a (Table 2). In double-crop systems (Table 3) , MG IV has consistently produced the highest yield. In 1994, growing conditions were excellent for both double-crop and full-season soybean (Table 4). Although significant yield differences occurred in grain yield between maturity groups, results suggest that the SCN is not a problem at this site.

Wheat yield as affected by the different crop rotations is shown in Table 4. Yield differences have been more pronounced since wheat has been planted at different dates according to the particular rotation scheme. Since 1988, wheat yields have averaged 10 bu/a higher following wheat compared to wheat following full-season soybeans. Wheat following 2 years of soybeans (double-crop and full-season) has yielded nearly the same as wheat following only 1 year of full-season soybeans. Wheat yields have been lowest in the continuous double-crop system. Wheat planted after early-maturing soybeans (MG I) has yielded nearly the same as wheat after wheat, whereas wheat yields have been lowest following late-maturing soybeans (MG V).

Table 1. Effects of Wheat and Soybean Cropping Systems on Soybean Yield, Southeast Agricultural Research Center, Parsons, KS

Crop Year	(Rot. 1) Wh - DC Soy	(Rot. 2) Wh - DC Soy FS Soy	(Rot. 2) Wh - DC Soy FS Soy	(Rot. 3) Wh - Wh FS Soy	LSD (0.05)
	---------- bu/a ----------				
1981	18.7	18.0	25.8	25.7	3.7
1982*	23.6	23.0	24.3	24.9	NS
1983	17.9	16.9	15.5	14.5	NS
1984	2.1	2.0	11.1	12.8	2.9
1985*	33.2	31.6	32.6	32.1	NS
1986	19.9	17.5	21.2	23.9	3.8
1987	19.5	19.3	35.4	42.6	2.5
1988	9.1	8.4	22.7	25.1	1.5
1989*	27.6	28.0	28.3	29.8	1.7
1990	22.1	23.9	19.6	22.0	1.2
1991	18.6	15.2	24.9	27.3	0.8
1992*	36.6	35.0	37.1	38.7	2.3
1993	22.1	22.5	28.9	35.3	1.3
1994	30.9	29.1	39.6	45.9	3.8
Avg.	21.6	20.7	26.2	28.6	--

(*) Full-season and double-crop soybeans were planted on the same dates in 1982, 1985, 1989, and 1992.
DC = Double-crop soybeans; FS = full-season soybeans.
Cultivars planted: Double-crop (MG IV); full-season (MG V).

Table 2. Comparison of Soybean Maturity Groups in a Full-Season Soybean Crop Rotation, Southeast Agricultural Research Center, Parsons, KS

Maturity Group	Cultivar	Full-Season Soybean Yield 1988	1989	1990	1991	1992	1993	1994	Avg.
		------	------	------	------	bu/a	------	------	
I	Weber 84	31.8	31.5	22.0	3.9	38.8	24.4	27.2	25.7
III	Flyer	24.0	30.8	14.5	23.8	36.4	28.9	38.1	28.1
IV	Stafford	26.9	28.8	16.0	24.0	36.5	30.0	45.7	29.7
V	Hutcheson	22.7	28.3	19.6	24.9	37.1	28.9	39.6	28.7
LSD (0.05)		1.5	1.8	1.3	0.8	2.2	1.3	3.8	

Rotation is [Wheat - double-crop soybean] - full-season soybean.

Table 3. Comparison of Soybean Maturity Groups in a Double-Crop Soybean Crop Rotation, Southeast Agricultural Research Center, Parsons, KS

Maturity Group	Cultivar	Double-Crop Soybean Yield 1988	1989	1990	1991	1992	1993	1994	Avg.
		------	------	------	------	bu/a	------	------	
I	Weber 84	2.0	28.7	10.9	4.2	29.3	13.4	19.9	15.5
III	Flyer	2.2	28.9	16.6	14.7	31.6	19.4	35.1	21.2
IV	Stafford	8.4	28.0	23.9	15.1	35.0	22.5	29.1	23.1
V	Essex	6.5	22.8	20.7	12.1	32.7	19.6	26.6	20.1
LSD (0.05)		1.5	1.8	1.3	0.8	2.2	1.3	3.8	

Rotation is [Wheat - double-crop soybean] - full-season soybean.

Table 4. Comparison of Soybean Cultivars with Varying Maturity and SCN Resistance in Full-Season and Double-Crop Rotations, Southeast Agricultural Research Center, 1994, Parsons, KS

Cultivar	Maturity Group	SCN Resistance	Soybean Yield Full-Season	Soybean Yield Double-Crop	Plant Maturity Full-Season	Plant Maturity Double-Crop
			bu/a	bu/a		
Weber	I	No	27.2	19.9	Aug 24	Sept 30
Jack	II	Yes	29.6	31.6	Sept 5	Oct 10
Flyer	III	No	38.1	35.1	Sept 30	Oct 10
Del-Soy 4210	III	Yes	37.7	33.1	Sept 30	Oct 10
Stafford	IV	No	45.7	29.1	Oct 10	Oct 24
Manokin	IV	Yes	46.9	30.2	Oct 11	Oct 25
Hutcheson	V	No	39.6	28.1	Oct 15	Oct 25
5292	V	Yes	43.0	26.6	Oct 19	Oct 28
LSD (0.05):			3.8	3.8		

SCN has not been detected at this site.
Rotation is [Wheat - double-crop soybean] - full-season soybean.

Table 5. Effect of Wheat and Soybean Cropping Rotations on Wheat Yield, Southeast KS Agricultural Research Center, Parsons, KS

Year	(Rot. 1) (Wh-DC Soy)	(Rot. 2) (Wh-DC Soy) FS Soy	(Rot. 3) Wheat Wheat FS Soy	(Rot. 3) Wheat Wheat FS Soy	LSD (0.05)
	bu/a				
1982	58.9	55.4	52.1	51.6	4.1
1983	48.4	53.4	51.6	51.9	1.4
1984	51.4	55.1	55.0	54.6	1.6
3-yr avg	52.9	54.6	52.9	52.7	
1988	49.5	52.6	60.5	61.6	6.2
1989	50.3	64.8	64.3	68.6	6.5
1990	30.4	29.5	33.4	23.7	4.5
1991	39.4	46.1	39.5	60.0	6.6
1992	56.1	56.6	56.2	72.9	3.0
1993	10.2	14.2	13.9	39.8	2.4
1994	44.6	38.3	39.3	36.8	3.0
7-yr avg	40.1	43.2	43.9	51.9	

Wheat was not harvested from 1985 through 1987 because of wet soil conditions.
Spring oats were planted in 1986 and 1987 as a substitute crop for wheat.
Soybean maturity group:
Rotation 1: MG III or MG IV
Rotation 2 & 3: MG V
From 1982 - 1984, wheat for all rotations was planted on the same date, which was after the latest maturing soybeans.
Since 1988, wheat has been planted at different times according to the particular cropping system.

Table 6. Effects of Soybean Maturity Group on Wheat Yield, Southeast KS Agricultural Research Center, Parsons Unit

Soybean Maturity	Wheat Yield 1989	1990	1991	1992	1993	1994	Avg.
	bu/a						
MG I	71.4	25.1	58.2	69.1	43.1	40.5	51.2
MG III	68.1	27.5	54.9	67.5	40.5	41.8	50.1
MG IV	71.9	36.0	48.3	65.7	17.9	42.1	47.0
MG V	64.8	29.5	46.1	57.6	14.2	38.3	41.8
LSD (0.05)	5.8	5.1	5.8	2.4	2.5	3.0	---

Crop rotation: [Wheat - double-crop soy] - full-season soybeans
Planting dates:
1989: Oct. 14, 1988 (MG I, III, & IV)
Oct. 25, 1988 (MG V)
1990: Oct. 16, 1989 (MG I & III)
Oct. 27, 1989 (MG IV & V)
1991: Oct. 5, 1990 (MG I & III)
Oct. 16, 1990 (MG IV & V)
1992: Oct. 7, 1991 (MG I, III, & IV)
Oct. 23, 1991 (MG V)
1993: Oct. 14, 1992 (MG I & III)
Nov. 2, 1992 (MG IV & V)
1994: Oct. 11, 1993 (MG I & III)
Oct. 28, 1993 (MG 4 & 5)

LONG-TERM EFFECTS OF CROPPING SYSTEMS ON SOYBEAN YIELDS

Kenneth W. Kelley

Summary

In the absence of soybean cyst nematode (SCN), continuous soybeans have yielded nearly 10% less than soybeans grown in a 2-yr rotation following double-crop soybeans, grain sorghum, or fallowed wheat. However, in the presence of SCN, soybean yield has declined nearly 25% in the monoculture soybean system.

Introduction

Soybean is a major crop for farmers in southeastern Kansas. Typically, soybeans are grown in several cropping sequences with wheat, grain sorghum, and corn or in a double-cropping rotation with wheat. However, soybeans can follow soybeans, if a producer elects to enter the federal farm program and does not have a large enough wheat and feed-grain base to permit adequate crop rotation of available crop acreage. With the recent arrival of soybean cyst nematode (SCN) into extreme southeastern Kansas, more information is needed to determine how crop rotations can be used to manage around the nematode problem.

Experimental Procedures

In 1979, four cropping systems were started at the Columbus Unit: 1) [wheat - double-crop soybean] - soybeans, 2) [wheat - summer fallow] - soybeans, 3) grain sorghum - soybeans, and 4) continuous soybeans. Full-season soybeans were compared across all rotations in even-numbered years. Beginning in 1984, an identical study was started adjacent to the initial site, so that full-season soybeans also could be compared in odd-numbered years. All rotations received the same amount of phosphorus and potassium fertilizers (80 lb/a each), which were applied to the crop preceeding full-season soybeans. Beginning in 1991, an SCN-susceptible and an SCN-resistant cultivar were compared within each of the four cropping systems. In 1994, additional cultivars with varying resistance to SCN were included in the rotation. During alternate years, a susceptible cultivar is planted in full-season and double-crop rotations.

Results and Discussion

Soybean yields from the initial study (no SCN) from 1980 through 1992 are shown in Table 1, with the 1994 results shown in Table 2. Continuous soybeans have yielded 10% less than soybeans grown in rotation. However, in the continous soybeans, yield has not been depressed as much as anticipated, considering that soybeans have been grown continuously on that site for the past 14 years.

Soybeans yields from the adjacent study that was started in 1984 are shown in Table 3. At this site, SCN were detected in 1989, and soybean yield has been reduced nearly 25% in the continuous soybean rotation. Soybean yield differences between resistant (5292) and susceptible (Stafford) cultivars have not been as pronounced as in other SCN research sites in Cherokee County. It is unclear why the yield response has been different at this SCN site; however, soil analyses of SCN populations are not completed at this time.

Table 1. Effect of Long-Term Cropping Systems on Soybean Yield in the Absence of SCN, Southeast KS Agricultural Research Center, Columbus Unit

Yr	Full-Season Soybean Following				LSD
	Wh - DC Soy	Gr Sorg	Wheat[1]	Soy	
	---------------------------- bu/a --------------------------				
1980	12.6	13.3	12.8	10.3	1.0
1982	28.0	30.4	31.9	27.2	3.0
1984	11.8	10.8	12.0	12.1	NS
1986	21.9	23.6	23.9	21.8	1.8
1988	31.3	30.1	32.8	25.2	3.0
1990	22.4	23.4	24.9	22.4	NS
1992	44.1	42.8	43.8	35.6	3.8
Avg.	24.6	24.9	26.0	22.1	

[1] Lespedeza was grown in the summer fallow period from 1988 - 1992.

Table 2. Comparison of Soybean Cultivars with Varying Maturity and SCN Resistance in Four Crop Rotations in the Absence of SCN, Columbus Unit, 1994

Cultivar	Maturity Group	SCN Resist.	Full-Season Soybean Following				Avg.
			Wheat DC Soy	Grain Sorgh	Wheat Fallow	Cont. Soy	
			-------------- bu/a --------------				
Jack	II	Yes	28.2	30.0	39.8	26.9	31.2
Sherman	III	No	33.1	35.5	36.5	27.6	33.2
Flyer	III	No	42.1	42.9	47.0	32.9	41.2
DelSoy 4210	IV	Yes	41.4	44.7	44.1	39.0	42.3
Stafford	IV	No	41.2	43.2	45.1	28.1	39.4
Manokin	IV	Yes	44.6	41.9	44.5	36.9	42.0
Hutcheson	V	No	41.8	45.2	49.1	38.1	43.5
Forrest	V	Yes	43.8	46.8	45.3	36.1	43.0
Avg.			39.5	41.3	43.9	33.2	
LSD 0.05:							
Comparing cultivars within same crop rotation:			8.7	8.7	8.7	8.7	
Comparing means of different crop rotations:							5.7
Comparing means of soybean cultivars:							3.3

Table 3. Effects of Long-Term Cropping Systems on Soybean Yield in the Presence of Soybean Cyst Nematode, Columbus Unit

Yr[1] - Cultivar	Full-Season Soybean Following				LSD
	DC Soy	Gr Sorgh	Wheat	Soy	
	--------------------- bu/a -----------------------				
1985-SCN-Susceptible	31.9	30.9	29.5	27.9	3.2
1987-SCN-Susceptible	30.7	31.5	33.2	28.2	3.8
1989-SCN-Susceptible	27.0	27.5	33.4	20.7	4.5
1991-SCN-Resistant	32.3	35.8	38.3	33.2	3.2
1991-SCN-Susceptible	33.4	39.1	39.4	30.6	7.1
1993-SCN-Resistant	33.3	35.8	40.9	27.9	4.5
1993-SCN-Susceptible	32.5	36.9	37.1	25.3	3.8
Avg - SCN-S	31.1	33.2	34.5	26.5	

[1] Beginning in 1991, plots were split to include an SCN-resistant cultivar (5292) and an SCN-susceptible cultivar (Stafford).

SOYBEAN HERBICIDE RESEARCH[3]

Kenneth W. Kelley

Summary

Various soybean herbicide treatments and application methods were compared for weed control in no-tillage and conventional-tillage conditions. Weed control generally was good to excellent in both tillage systems.

Introduction

Soybeans occupy approximately 40% of the crop acreage in southeastern Kansas. Herbicide studies are conducted to compare herbicide performance and application methods for the control of annual broadleaf and grassy weeds in soybeans. Because of the interest in conservation tillage practices, several studies evaluated herbicide performance in no-till conditions as well as with conventional tillage.

Experimental Procedures

Soybean herbicide trials were conducted at the Columbus Unit and at an off-station site in Cherokee County. Soybeans were grown in 30-inch row spacing. All treatments were applied with a tractor-mounted, compressed air sprayer, with a spray volume of 20 GPA. Plot size was 4 rows wide by 30 ft in length, with three replications. The center two rows of each plot were harvested for yield. Preplant treatments were incorporated with a field cultivator, equipped with a three-bar tine mulcher. Weed ratings were taken on 20 July.

Herbicides, application methods, and times of application were compared at a site in Cherokee County that was infected heavily with soybean cyst nematode (SCN). The objective was to evaluate effects of different modes of action on soybean crop injury and subsequent weed weed control in the presence of SCN.

Results and Discussion

No Tillage

Results of three herbicide trials with no tillage are shown in Tables 1, 2, and 3. Soybeans were planted no-till into standing grain sorghum stubble that had been rotary mowed. Weed control and soybean yields were good to excellent. Early preplant applications of Roundup and 2,4-D,LVE (low-volatile ester) gave excellent burn-down weed control. When residual broadleaf herbicides (Canopy, Scepter, Broadstrike) were added to early burn-down treatments, weed control generally was good to excellent, except where heavy cocklebur populations existed. In those cases, a postemergent broadleaf herbicide application was needed to supplement the early residual applications. However, in 1994, dry soil conditions during late June resulted in less effective postemergent weed control than in prior years. Adding crop oil concentrate (1 qt/a) to postemergent herbicide applications gave better broadleaf weed control than nonionic surfactant. Early burn-down applications of Roundup and 2,4-D,LVE followed by residual herbicide treatments applied either preplant or preemergent after planting also provided good weed control. Wet soil conditions near soybean maturity delayed harvest; however, harvest delays were minimal on no-till plots because of firmer soil conditions.

SCN-Infected Site

Grain yield and weed control results for the SCN site are shown in Table 4. In 1994, soils were warmer than normal when early preplant

[3]Products without label registration are mentioned for informational purposes only and are not recommended for use.

herbicide treatments were applied in early May, which may have reduced possible herbicide crop injury effects. Rainfall shortly after planting activated preemergent herbicide treatments; however weed control was less than ideal for postemergent herbicide treatments because of dry soil conditions in late June. Grain yields varied among herbicide treatments, although yields appeared to be influenced more by degree of weed control than time of application.

This study will be conducted again in 1995 at the same site to further evaluate soybean response to different herbicide modes of action. Soybean plants infected with SCN often show reduced root growth. Dinitroaniline herbicides also have been shown to inhibit early soybean root growth on some light-textured soils; thus, root growth might be affected even more where dinitro-aniline herbicide tankmixes are applied preplant in SCN-infected soils.

Conventional Tillage

Early preplant and preplant herbicide results are shown in Table 5. Broadleaf and grass weed control was good to excellent for nearly all treatments, although herbicides applied immediately ahead of planting gave slightly better weed control than those applied 4 weeks earlier. Postemergent herbicide results are shown in Table 6; nearly all treatments gave good to excellent broadleaf weed control. Crop injury ratings after herbicide applications varied greatly among treatments. However, even where crop injury was rather severe initially after herbicide application, soybean plants resumed normal growth within a few days. Conventionally tilled herbicide plots at the Columbus Unit were not harvested for grain yield because of extremely wet soil conditions in October and November.

Table 1. Comparison of Herbicides for Soybeans Planted No-Till, Trial 1, Columbus Unit

Trt	Time	Herbicide	Rate	Yield	Weed Control WA	BL	GR
			Product/a	bu/a	%	%	%
1	EPP	Roundup + 2,4-DE	1 pt + 1 pt	35.5	100	87	98
	PP	Canopy + crop oil	6 oz + 1 qt				
	PO	Assure II + crop oil	8 oz + 1 qt				
2	EPP	Canopy + 2,4-DE	6 oz + 1 pt	33.8	100	98	77
	EPP	Crop oil	1 qt				
	PP	Roundup	1 pt				
	PO	Basagran + crop oil	1 pt + 1 qt				
	PO	Assure II + crop oil	8 oz + 1 qt				
3	EPP	Scepter + 2,4-DE	2.8 oz + 1 pt	35.4	100	96	98
	EPP	Crop oil	1 qt				
	PP	Roundup	1 pt				
	PO	Select + crop oil	8 oz + 1 qt				
4	EPP	Roundup + Canopy	1 pt + 6 oz	35.2	100	82	98
	PO	Classic + crop oil	0.5 oz + 1 qt				
	PO	Assure II + crop oil	8 oz + 1 qt				
5	EPP	Roundup + Scepter	1 pt + 2.8 oz	36.4	100	93	98
	PO	Select + crop oil	8 oz + 1 qt				
6	EPP	Roundup	1 pt	39.4	100	87	98
	PP	Roundup	1 pt				
	PO	Basagran + crop oil	1.5 pt + 1 qt				
	PO	Poast (+) + crop oil	1.5 pt + 1 qt				
7	PP	Roundup	1.5 pt	35.4	100	90	91
	PP	Canopy + Dual	6 oz + 1.5 pt				
8	PP	Roundup	1.5 pt	34.0	100	91	89
	PP	Squadron	3 pt				
9	PP	Roundup	1.5 pt	39.1	100	98	92
	PP	Broadstrike + Dual	2.25 pt				
	PO	Basagran + crop oil	1 pt + 1 qt				
10	PP	Roundup	1.5 pt	28.3	100	98	83
	PP	Lasso + Sencor	2 qt + 8 oz				
	PO	Basagran + NIS	1 pt + 0.25%				

Table 1. Continued

Trt	Time	Herbicide	Rate	Yield	Weed Control WA	BL	GR
		Product/a	bu/a	%	%	%	
11	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	36.2	100	90	91
	PRE	Dual + Canopy	1.5 pt + 5 oz				
12	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	35.6	100	86	91
	PRE	Squadron	3 pt				
13	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	37.9	100	98	90
	PP	Dual + Broadstrike	2.25 pt				
	PO	Basagran + crop oil	1 pt + 1 qt				
14	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	37.5	100	98	93
	PRE	Lasso + Sencor	2 qt + 5.33 oz				
	PO	Basagran + NIS	1 pt + 0.25%				
15	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	36.7	100	93	96
	PO	Classic + NIS	0.5 oz + 0.25%				
	PO	Assure II + crop oil	8 oz + 1 qt				
16	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	33.0	100	93	89
	PP	Prowl	2.4 pt				
	PO	Scepter + NIS	1.4 oz + 0.25%				
17	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	36.4	100	96	98
	PO	Basagran + NIS	1 pt + 0.25%				
	PO	Poast (+) + Dash	1.5 pt + 1 qt				
18	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	39.6	100	94	98
	PO	Pursuit + N + COC	2 oz + 1 qt + 1 qt				
	PO	Select + crop oil	6 oz + 1 qt				
19	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	38.4	100	96	98
	PO	Cobra + NIS	12 oz + 0.25%				
	PO	Select + crop oil	8 oz + 1 qt				
20	--	No herbicide	-----	11.3	0	0	0
		LSD: (0.05)		6.8	---	6	6

EPP = early preplant (5/12), PP = preplant (5/24), PRE = preemergent (6/7), PO = postemergent (6/28) and (7/6). Weed rating July 20. WA = winter annuals (Carolina foxtail, shepherdspurse, smallflowered bittercress, bushywallflower), BL = cocklebur, GR = crabgrass.

Table 2. Comparison of Herbicides and Time of Application for Soybeans Planted No-Till, Trial 2, Columbus Unit

Trt	Time	Herbicide	Rate	Yield	Weed Control WA	BL	GR
		Product/a	bu/a	%	%	%	
1	EPP	Roundup	1.5 pt	42.0	96	87	88
	EPP	Pursuit Plus	2.5 pt				
	PO	Basagran + Cobra	1 pt + 6 oz				
	PO	Crop oil + 28% N	1 qt + 1 qt				
2	EPP	Roundup	1.5 pt	40.2	93	89	88
	EPP	Lasso + Canopy	2 qt + 5 oz				
3	EPP	Roundup	1.5 pt	41.9	89	89	89
	EPP	Squadron + Command	3 pt + 4 oz				
4	EPP	Roundup	1.5 pt	39.2	98	88	89
	EPP	Dual + Broadstrike	2.25 pt				
	PO	Basagran	1.5 pt				
	PO	Crop oil + 28% N	1 qt + 1 qt				
5	EPP	Roundup	1.5 pt	32.9	100	45	83
	EPP	Lasso + Sencor	2 qt + 8 oz				
	PO	Basagran + NIS	1 pt + 0.25%				
6	EPP	Canopy + Command	5 oz + 1 pt	38.3	98	93	81
	EPP	Crop oil	1 qt				
	PO	Assure + crop oil	8 oz + 1 qt				
7	PP	Roundup	1.5 pt	40.0	95	91	92
	PRE	Pursuit Plus	2.5 pt				
	PRE	Sun-it II	1.5 pt				
8	PP	Roundup	1.5 pt	41.0	100	88	91
	PRE	Lasso + Canopy	1.5 qt + 5 oz				
	PRE	Sun-it II	1.5 pt				
9	PP	Roundup	1.5 pt	38.2	96	83	91
	PRE	Squadron	3 pt				
	PRE	Sun-it II	1.5 pt				
10	PP	Roundup	1.5 pt	41.2	97	91	92
	PRE	Dual + Broadstrike	2.25 pt				

Table 2. Continued

Trt	Time	Herbicide	Rate	Yield	Weed Control WA	BL	GR
		Product/a	bu/a	%	%	%	
11	PP	Roundup	1.5 pt	41.4	98	87	92
	PRE	Lasso + Sencor	2 qt + 6 oz				
	PRE	Crop oil	1 qt				
	PO	Basagran + Cobra	1 pt + 6 oz				
	PO	Crop oil + 28% N	1 qt + 1 qt				
12	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	40.4	100	87	92
	PO	Basagran + Blazer	1 pt + 1 pt				
	PO	NIS + 28% N	0.25 % + 1 qt				
	PO	Poast (+) + Dash	1.5 pt + 1 qt				
	PO	Cobra + 2,4-DB	8 oz + 3 oz				
13	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	39.0	100	90	94
	PO	Classic + Pinnacle	0.5 oz + 0.125 oz				
	PO	NIS + 28% N	0.125% + 1 qt				
	PO	Assure II + crop oil	8 oz + 1 qt				
14	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	38.1	100	90	94
	PO	Pursuit + Cobra	3 oz + 3 oz				
	PO	NIS + 28% N	0.25% + 1 qt				
	PO	Select + crop oil	8 oz + 1 qt				
15	--	No herbicide	-----	7.5	0	0	0
		LSD: (0.05)		6.1	5	11	18

EPP = early preplant (5/12), PP = preplant (5/24), PRE = preemergent (6/7),
PO = postemergent (6/28) and (7/6). Weed rating July 20.
WA = winter annuals (Carolina foxtail, shepherdspurse, smallflowered bittercress, bushywallflower),
BL = velvetleaf and cocklebur, GR = crabgrass.

Table 3. Comparison of Herbicides and Time of Application for Soybeans Planted No-Till, Trial 3, Columbus Unit

Trt	Time	Herbicide	Rate	Yield	Weed Control WA	BL	GR
			Product/a	bu/a	%	%	%
1	EPP	Roundup + 2,4-DE	1 pt + 1 pt	36.4	100	84	89
	PP	Canopy + crop oil	6 oz + 1 qt				
*	PO	Classic + 2,4-DB	0.5 oz + 2 oz				
	PO	Assure + crop oil	8 oz + 1 qt				
2	EPP	Canopy + 2,4-DE	6 oz + 1 pt	34.4	100	96	82
	EPP	Crop oil	1 qt				
	PO	Classic + crop oil	0.5 oz + 1 qt				
	PO	Assure + crop oil	8 oz + 1 qt				
3	PP	Roundup	1.5 pt	36.9	100	89	94
	PP	Canopy	6 oz				
	PP	Dual	1.5 pt				
*	PO	Classic + 2,4-DB	0.5 oz + 2 oz				
4	PP	Roundup	1.5 pt	35.7	88	94	94
	PP	Squadron	3 pt				
5	PP	Roundup	1.5 pt	35.9	100	88	90
	PP	Broadstrike + Dual	2.25 pts				
	PO	Basagran + crop oil	1.5 pt + 1 qt				
6	PP	Roundup + Sencor	1.5 pt + 8 oz	34.1	100	86	89
	PP	Lasso	2 qt				
	PO	Basagran + Blazer	1 pt + 1 pt				
	PO	Crop oil	1 pt				
7	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	34.6	100	92	83
*	PO	Classic + Cobra	0.5 oz + 3 oz				
	PO	Assure + crop oil	8 oz + 1 qt				
8	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	37.5	100	96	90
*	PO	Scepter + Cobra	1.4 oz + 3 oz				
9	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	36.2	100	93	85
*	PO	Pursuit + Cobra	3 oz + 3 oz				

Table 3. Continued

Trt	Time	Herbicide	Rate	Yield	Weed Control WA	BL	GR
			Product/a	bu/a	%	%	%
10	PP	Roundup + 2,4-DE	1.5 pt + 1 pt	36.5	100	89	92
*	PO	Basagran + Cobra	1 pt + 3 oz				
	PO	Poast (+) + crop oil	1.5 pt + 1 qt				
11	--	No herbicide	------	9.4	0	0	0
		LSD: (0.05)			NS	6	7

(*) Nonionic surfactant (0.25% v/v) added to postemergent treatments.
EPP = early preplant (5/12), PP = preplant (5/24), PO = postemergent (6/28) and (7/6).
WA = winter annuals (Carolina foxtail, shepherdspurse, smallflowered bittercress, bushy wallflower), BL = cocklebur and smooth pigweed, GR = crabrass.
Weed rating July 20.

Table 4. Effects of Herbicides and Time of Application on Soybean Yield and Weed Control on Soil Infected with Soybean Cyst Nematode, Cherokee County

Trt	Time	Herbicide	Rate	Yield	Weed Control BL	Weed Control GR
			Product/a	bu/a	%	%
1	EPP	Squadron	3 pt	26.0	86	84
2	EPP	Treflan	1.5 pt	24.4	96	91
	EPP	Canopy	6 oz			
3	EPP	Treflan	2 pt	28.6	88	91
	EPP	Broadstrike				
4	EPP	Treflan	1.5 pt	27.1	85	91
	PO	Basagran	0.75 pt			
	PO	Blazer	0.75 pt			
	PO	NIS	0.25%			
5	PP	Squadron	3 pt	22.5	90	88
6	PP	Treflan	1.5 pt	24.4	95	90
	PP	Canopy	6 oz			
7	PP	Treflan	2 pt	29.3	84	90
	PP	Broadstrike				
8	PP	Treflan	1.5 pt	25.7	88	86
	PP	Sencor	6 oz			
	PO	Basagran	1 pt			
	PO	NIS	0.25%			
9	PP	Lasso	2 qt	28.3	90	93
	PP	Scepter	2.8 oz			
10	PP	Lasso	2 qt	25.9	94	89
	PP	Canopy	6 oz			
11	PP	Dual	2.25 pt	22.6	83	93
	PP	Broadstrike				
12	PP	Dual	1.5 pt	23.3	87	91
	PP	Sencor	6 oz			
	PO	Basagran	1 pt			
	PO	NIS	0.25%			

Table 4. Continued

Trt	Time	Herbicide	Rate	Yield	Weed Control BL	GR
			Product/a	bu/a	%	%
13	PP	Prowl	2.4 pt	29.2	93	92
	PO	Scepter	1.4 oz			
	PO	Cobra	6 oz			
	PO	NIS	0.25%			
14	PP	Lasso	2 qt	23.4	86	89
	PO	Classic	0.5 oz			
	PO	Cobra	6 oz			
	PO	NIS	0.25%			
15	PRE	Lasso	2 qt	26.8	87	94
	PRE	Scepter	2.8 oz			
16	PRE	Lasso	2 qt	23.3	86	94
	PRE	Canopy	5 oz			
17	PRE	Dual	2.25 pt	17.1	78	89
	PRE	Broadstrike				
18	PRE	Dual	1.5 pt	28.0	85	93
	PRE	Sencor	5.33 oz			
	PO	Basagran	1 pt			
	PO	NIS	0.25%			
19		Weed free	----	32.0	97	97
20		No herbicide	----	6.0	0	0
		LSD: (0.05)		6.0	9	9

EPP = early preplant incorporated (5/23), PP = preplant incorporated (6/7),
PRE = preemergent (6/7), PO = postemergent (6/28).
BL = cocklebur and smooth pigweed, GR = annual crabgrass.
Weed rating July 20.

Table 5. Comparison of Early Preplant and Preplant Herbicides for Conventionally Tilled Soybeans, Columbus Unit

Trt	Time	Herbicide	Rate	Weed Control BL	Weed Control GR
			Product/a	%	%
1	EPP	Squadron	3 pt	94	92
2	EPP	Tri-Scept	2.33 pt	89	92
3	EPP	Freedon + Scepter	3 pt + 2.1 oz	91	88
4	EPP	Treflan + Broadstrike	2 pt	84	92
5	EPP	Dual + Broadstrike	2.25 pt	83	92
6	EPP	Treflan + Canopy	1.5 pt + 6 oz	88	92
7	PP	Squadron	3 pt	95	98
8	PP	Tri-Scept	2.33 pt	93	98
9	PP	Freedom + Scepter	3 pt + 2.1 oz	97	95
10	PP	Treflan + Broadstrike	2 pt	91	98
11	PP	Dual + Broadstrike	2.25 pt	87	98
12	PP	Treflan + Canopy	1.5 pt + 6 oz	93	98
13	--	No herbicide		0	0
		LSD: (0.05)		6	NS

EPP = early preplant incorporated (5/12), PP = preplant incorporated (6/13).
BL = cocklebur, GR = crabgrass.
Weed rating July 20.

Table 6. Comparison of Postemergent Herbicides for Conventionally Tilled Soybeans, Columbus Unit

Trt	Time	Herbicide	Rate	Broadleaf Weed Control	Crop Injury
			Product/a	%	
1	PRE	Prowl	2.4 pt	88	1.0
	PO	Scepter	1.4 oz		
	PO	NIS + 28% N	0.25% + 1 qt		
2	PRE	Prowl	2.4 pt	95	3.0
	PO	Classic	0.5 oz		
	PO	NIS + 28% N	0.25% + 1 qt		
3	PRE	Prowl	2.4 pt	93	3.0
	PO	Classic + Pinnacle	0.25 oz + 0.25 oz		
	PO	NIS + 28% N	0.125 % + 1 qt		
4	PRE	Prowl	2.4 pt	94	3.0
	PO	Storm	1.5 pt		
	PO	NIS + 28% N	0.25% + 1 qt		
5	PRE	Prowl	2.4 pt	92	3.0
	PO	Cobra	12 oz		
	PO	NIS + 28% N	0.25% + 1 qt		
6	PRE	Prowl	2.4 pt	93	1.5
	PO	Pursuit	4 oz		
	PO	NIS + 28% N	0.25% + 1 qt		
7	PO	Scepter	1.4 oz	89	1.0
	PO	Select + crop oil	7 oz + 1 qt		
8	PO	Pursuit	4 oz	93	1.5
	PO	Select	4 oz		
	PO	Crop oil + 28% N	1 qt + 1 qt		
9	PO	Cobra	8 oz	93	3.0
	PO	Select	6 oz		
	PO	Crop oil + 28% N	1 qt + 1 qt		
10	PO	Scepter	1.4 oz	94	3.0
	PO	Cobra	6 oz		
	PO	Select	6 oz		
	PO	Crop oil + 28% N	1 pt + 1 qt		

Table 6. Continued

Trt	Time	Herbicide	Rate	Broadleaf Weed Control	Crop Injury
			Product/a	%	
11	PO	Pursuit	4oz	94	3.0
	PO	Cobra	4 oz		
	PO	Select	6 oz		
	PO	Crop oil + 28% N	1 pt + 1 qt		
12	PO	Storm	1.5 pt	92	3.0
	PO	Poast Plus	1.5 pt		
	PO	Crop oil + 28% N	1 qt + 1 qt		
13	PO	Classic + Pinnacle	0.25 oz + 0.25 oz	93	4.0
	PO	Assure II	8 oz		
	PO	Crop oil + 28% N	1 pt + 1 qt		
14		No herbicide	---	0	1.0
		LSD: (0.05)		6	0.5

PRE = preemergent (6/12), PO = postemergent (7/6).
BL = cocklebur and smooth pigweed.
CI = crop injury rating for postemergent herbicide treatments = 1 no injury and 5 = severe leaf chlorosis.
Weed rating July 20.

SOYBEAN VARIETY TRIAL FOR CYST NEMATODE RESISTANCE

James H. Long, William T. Schapaugh[1], Ted Wary[2], and Timothy Todd[3]

Summary

Soybeans varieties with resistance to cyst nematodes have prevented as much as 50 % of grain yield loss over varieties without such resistance in Cherokee County, Kansas since 1991. Severe drought occurred in 1991, whereas 1992, 1993 and 1994 were wet years. Several varieties in both Maturity Groups IV and V had very good yield potential and adequate resistance to soybean cyst nematode. These could be used in suitable rotations to combat the pest.

Introduction

The appearance of soybean cyst nematode in Southeastern Kansas has complicated the production of soybeans by requiring a definite plan to combat the pest. Part of this planning is to use varieties that are resistant to the nematode. Ongoing trials to identify adapted resistant varieties were established in an area of the southeast region, Cherokee County, known to have damaging populations of the pest.

Experimental Procedures

Forty one varieties of soybeans, some rated as resistant to cyst nematode, were planted on June 10, 1994. This trial was grown at the Cyst Nematode Research Area located on the Martin Farms in Columbus. Seed were planted at 8 per row foot in 30-inch rows. Fertilizer application included 290 lb/a of 6-24-24 before planting in 1994. Maturities were rated in September and October, and plots were harvested with a plot combine on October 28, 1994. Test weight and seed moisture were measured with a Dickey-John analyzer, and grain yields were adjusted to 13 % moisture.

Results and Discussion

Varieties with resistance to soybean cyst nematode prevented yield losses of 40 % or more during the years 1991 - 1994 (Table 1). Resistant varieties such as 'Manokin', and 'Pioneer 9521' averaged yields of approximately 34 bu/a over the 4-year period. Susceptible varieties of similar maturity such as 'Essex' had average yields of only 20 bu/a during the same period. Soybean maturity grouping also may have played a role in grain yield. Over a 3-year period, susceptible varieties such as maturity group V 'Hutcheson' averaged yields of 26.1 bu/a, whereas the earlier maturing, late group IV 'Stafford' averaged yields of only 23.0 bu/a and the early group IV 'Flyer' averaged 18.3 bu/a (Table 1). More variety test information can be found in Report of Progress 723, 1994 Kansas Performance Tests with Soybean Varieties.

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[1]Department of Agronomy, KSU.

[2]Formerly Cherokee County Agricultural Extension Agent.

[3]Department of Plant Pathology, KSU.

Table 1. Grain Yield of Cyst Nematode-Resistant and-Susceptible Soybean Varieties at the Wilkinson and Martin Farms, 1994 and Summaries

			Grain Yield				Average Yield		
Brand	Variety	MG[2]	1991	1992	1993	1994	2-yr	3-yr	4-yr
			---bu/a---						
Asgrow	A4715	IV	--	32.4	32.8	39.4	36.1	34.9	--
Asgrow	A5112	V	--	39.5	32.4	36.2	34.3	36.0	--
Dekalb	CX469C	IV	--	--	--	34.5	--	--	--
Delange	DS 464	IV	--	--	--	34.3	--	--	--
Hyperformer	HY458	IV	--	--	--	37.2	--	--	--
Hyperformer	HSC501	V	--	--	33.2	41.8	37.5	--	--
Merschman	Houston III	IV	--	--	--	35.9	--	--	--
Midland	XP452	IV	--	--	--	36.7	--	--	--
Midland	8475	IV	--	--	--	39.3	--	--	--
NC+	4A27	IV	--	--	--	41.3	--	--	--
NC+	5A15	V	--	--	32.5	38.1	35.3	--	--
Northrup	S46-44	IV	--	--	--	33.6	--	--	--
King	S52-25	V	--	--	--	41.3	--	--	--
Pioneer	9491	IV	--	--	--	39.5	--	--	--
Pioneer	9521	V	15.7	38.0	39.2	42.5	40.9	39.9	33.9
Ohlde	4120N	IV	--	--	--	35.7	--	--	--
Ohlde	4262N	IV	--	--	--	35.5	--	--	--
Ohlde	4440	IV	--	--	--	30.8	--	--	--
Ohlde	5020N	V	--	--	--	39.6	--	--	--
Ohlde	5200N	V	--	--	--	41.8	--	--	--
Stine	4322CN	IV	--	--	--	33.9	--	--	--
Terra	E4292	IV	--	--	--	34.8	--	--	--
Terra	E461	IV	--	--	--	25.7	--	--	--
Terra	E4792	IV	--	--	33.8	33.4	33.6	--	--
Terra	E474	IV	--	--	--	31.7	--	--	--
Willcross	9447-A	IV	--	--	--	29.1	--	--	--
Willcross	9447-B	IV	--	--	--	29.2	--	--	--
Public	Flyer	IV	--	16.0	18.8	20.2	19.5	18.3	--
Public	Stafford	IV	9.6	18.0	21.8	29.3	25.6	23.0	19.7
Public	Essex	V	7.5	22.4	22.9	28.8	25.9	24.7	20.4
Public	Holladay	V	--	--	--	34.9	--	--	--
Public	Hutcheson	V	11.6	21.4	25.4	31.5	28.5	26.1	22.5
Public	Avery	IV/V	19.8	33.5	31.1	36.6	33.8	33.7	30.2
Public	Delsoy 4210	IV	--	--	--	38.8	--	--	--
Public	Delsoy 4500	IV	--	--	--	36.4	--	--	--
Public	Delsoy 4710	IV	--	--	36.9	39.2	38.1	--	--
Public	Delsoy 4900	IV	17.3	35.7	35.7	36.9	36.3	36.1	31.4
Public	Manokin	IV/V	19.9	37.7	36.2	42.2	39.2	38.7	34.0
Public	Forrest	V	20.0	34.5	34.7	39.5	37.1	36.2	32.2
Public	Hartwig	V	--	37.9	34.5	36.1	35.3	36.2	--
Public	KS 5292	V	14.3	38.1	35.2	34.6	34.9	36.0	30.5
	Average		14.2	31.6	29.5	35.6	--	--	--
	L.S.D. (0.05)		2.9	5.5	2.3	3.6	--	--	--

PERFORMANCE TRIAL OF DOUBLE-CROP SOYBEAN VARIETIES

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

Summary

Twenty double-crop soybean varieties were planted following winter wheat in Columbus, Kansas and evaluated for yield and other agronomic characteristics throughout the summer of 1994. Grain yields were good, and variety differences were seen under the favorable growing conditions. Yields ranged from 18 bu/a to near 30 bu/a. The short-season MG (maturity group) III and IV varieties matured during the first week of October, whereas long-season varieties in MG V matured as much as 3 weeks later. Generally, the longer the MG, the higher the pod set. 'Avery' and 'Manokin' matured in late October and set first pods higher than other varieties maturing at the same time.

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 allow harvest. They also should mature before a threat of frost.

Experimental Procedures

Twenty soybean varieties were evaluated in a double-crop variety trial following winter wheat harvest at Columbus on a Parsons silt loam soil. Wheat was harvested on June 17, 1994. The wheat stubble was burned, and the soil field-cultivated twice prior to planting. Squadron was applied at 3.0 pt/a before the field cultivations. Soybeans then were planted on June 23, 1994 at 10 seed per foot of row. The soybeans were harvested on October 19, 1994, with the exception of KS5292 which was harvested on October 25, 1994. The latter date was for the MG V soybean, which matured only after frost in late October.

Results and Discussion

Yields ranged from 17 bu/a to 29.5 bu/a. Several varieties yielded 25 bu/a or more. Careful consideration should be given to maturity and the height to the first pod. The height to the first pod ranged from 3.5 in to 7.8 in. Most varieties matured before October 15.

Table 1. Yield of Double-Crop Variety Trial for Soybeans at Parsons, Kansas, 1992

Brand	Variety	Yield 1994	Yield 2 yr Avg	Yield 3 yr Avg	1994 Characteristics Ht	Ht to 1st Pod	Mat	Mat 3 yr
		----------bu/a---------			------in------		Oct	Oct
Golden Harvest	X465	25.0	--	--	20.8	7.3	11.5	--
Golden Harvest	1483	23.7	26.7	31.0	22.5	3.5	7.3	13.6
Jacques	396	24.8	25.2	29.1	19.5	3.5	3.3	7.7
Jacques	445	23.6	--	--	21.5	6.0	4.5	--
Jacques	467	23.2	25.0	28.5	15.8	3.5	6.8	14.6
Midland	8413	20.7	--	--	17.8	3.8	6.5	--
Midland	8410	19.2	21.5	--	16.0	2.5	1.4	--
N K	S44-77	22.8	23.4	27.4	19.0	5.0	1.5	7.6
N K	S52-25	21.9	--	--	24.3	8.0	14.8	--
Ohlde	4386	29.5	27.6	32.6	24.5	4.5	6.3	13.2
Ohlde	4440	21.3	23.2	--	18.5	4.8	6.3	--
Ohlde	4510	20.6	23.8	--	17.8	4.5	9.0	--
Pioneer	9491	25.3	26.2	--	18.5	5.8	9.3	--
Pioneer	9521	23.1	--	--	23.3	4.5	14.3	--
Stine	4550	27.5	--	--	21.8	6.0	11.3	--
Public	Manokin	26.5	--	--	26.0	7.5	14.3	--
Public	Hutcheson	26.2	--	--	23.5	6.5	15.0	--
Public	Flyer	17.0	18.9	23.4	18.0	3.8	1.8	6.4
Public	Avery	24.0	24.0	27.2	23.8	7.3	11.5	17.0
Public	KS5292	25.4	24.8	29.2	25.5	7.8	20.5	26.1
(L.S.D. 0.05)		6.2	--	--	3.4	1.6	2.5	

VARIETY RESISTANCE AND ROTATIONS FOR SOYBEAN CYST NEMATODE

James H. Long and Timothy Todd[1]

Summary

The keys to reducing the effect of soybean cyst nematode include the use of resistant soybean varieties and rotation of crops to minimize its impact. Results from the cyst nematode management studies at the Martin Farms Research Area in Columbus indicate that the effect of using resistant varieties is greater than previously thought. Rotation also reduces the impact of the cyst nematode. However, results from 4 years show that holding a field out of susceptible soybean varieties for 2 or even 3 years may not be sufficient to overcome the problem.

Introduction

The soybean cyst nematode (SCN) is a serious problem in the eastern U.S. It is persistent in the soil and will continually rob soybean yield if good management practices are not used each year. Many cropping strategies, including resistant varieties, have been used to overcome this pest, yet it has now spread to Kansas.

Each region of the U.S. has had to develop locally adapted soybean varieties and cropping rotations suited for that area's agricultural soils and climate. Southeast Kansas is a region with shallow clay-pan soils that are drought prone and a climate that permits growth of long maturity crops such as MG (maturity group) V soybeans. Because of the need to develop cropping strategies and evaluate varietal resistance under southeast Kansas conditions, a study was started in 1991 at the Martin Farms Cyst Nematode Research Area in Columbus, Kansas.

Experimental Procedures

Six cropping systems ranging from 0 to 3 years out of susceptible soybeans and with no soybeans were started in 1991. The systems include:

1. Continuous susceptible soybeans. (no crop rotation)
2. Grain sorghum followed by susceptible soybeans (1 year out).
3. Grain sorghum followed by a small grain that is followed by susceptible soybeans (2 years out).
4. Grain sorghum followed by resistant soybeans followed by grain sorghum then susceptible soybeans (3 years out).
5. Grain sorghum followed by a small grain that is double-cropped to resistant soybeans followed by grain sorghum then a small grain double-cropped to susceptible soybeans (3 years out).
6. Grain sorghum followed by a small grain (no rotation to soybeans).

The susceptible soybean variety was 'Bay' and the resistant variety was 'Pioneer 9531', both early to mid MG V soybeans. Two sister studies with the same rotations were run. One was on heavily infested soils at the Martin Farms Cyst Nematode Research Area, and the second was at the Southeast Agricultural Research Center -

[1] Department of Plant Pathology, KSU.

Columbus Field, an area that has no detectable levels of the cyst nematode.

Results and Discussion

After 4 years, differences could be seen in 1994 (Table 1). The continuous susceptible Bay soybeans at Martin Farms in 1994 yielded only two-thirds as much as the resistant variety, Pioneer 9531, that is being grown in rotation. The continuous Bay variety also ended 1994 with 5 to 10 times more eggs/100 cm^3 than found for Pioneer 9531 in rotation (Figure 1). After 4 years, some rotations have been held out of soybeans for 3 years. Grain yield (Table 1) and cyst nematode differences among rotations, seen in 1992 when soybeans were grown after a non-susceptible crop, were not evident in 1993 or 1994. This is probably due to several factors, one of which is high rainfall that enabled continuous susceptible soybeans to grow relatively well. Thus, grain yield of susceptible soybeans is very dependent on rainfall during the growing season. In addition, yields of susceptible soybeans after 3 years out of soybeans still did not equal resistant soybean yields. This may be due to egg and cyst levels developing rapidly during the growing season on susceptible soybeans, even when crop rotation gave relatively low early-season levels of the pest. Indications are that holding fields out of susceptible soybeans for 3 years may still not be enough to completely overcome the cyst nematode and allow the planting of susceptible soybeans.

Results indicate that crop rotation can have an impact on grain yield and cyst numbers, depending on the year. However, even after 3 years out of soybeans, susceptible soybeans will probably be affected severely in fields that were initially infested heavily with the soybean cyst nematode. Selection of a resistant variety has the most consistent and largest effect on grain yield.

Table 1. Effect of Crop Rotation on Soybean Grain Yield in Cyst Nematode-Infested Soil.

Rotation	Year			
	1991	1992	1993	1994
Bay/Bay	12.1	11.4	25.0	21.2
Bay 1 yr out	-	24.3	27.6	17.1
Bay 2 yr out	-	-	26.8	22.0
Bay 3 yr out	-	-	-	19.5
Pioneer 9531	16.8	35.1	38.8	33.4
LSD (0.05)	5.0	8.8	11.2	9.1

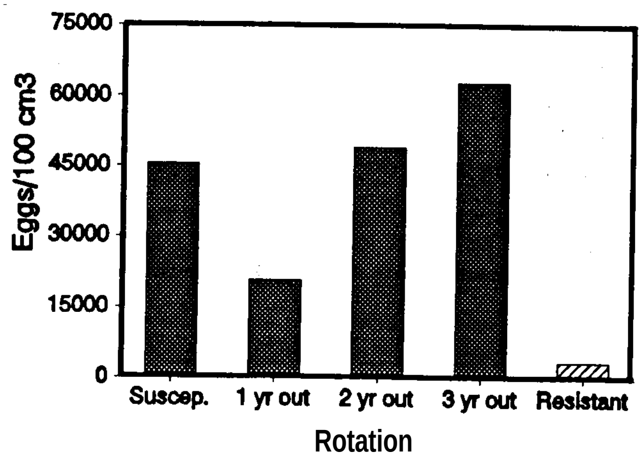

Figure 1. Effect of Crop Rotation on Soybean Cyst Nematode Egg Numbers in Cyst Nematode Infected Soils in 1994.

THE EFFECT OF CROP ROTATION AND VARIETY SELECTION ON CHARCOAL ROT AND SOYBEAN GRAIN YIELD

James H. Long, Timothy Todd [1], Daniel Sweeney, and George Granade[2]

Summary

Rotating from grain sorghum to soybean benefits both crops; however, the positive effects on the soybean crop are not well understood. Levels of the plant disease, charcoal rot (*Macrophomina phaseolina*), were followed on soybeans grown continuously and in rotation with grain sorghum. Soybean grain yield increased 12 % when a group IV maturity soybean, Delsoy 4210, was grown in rotation with grain sorghum. In addition Delsoy 4210 yielded less than a full-season group V maturity soybean, KS 5292, in 1994.

Introduction

Charcoal rot, a plant disease widespread in Kansas, can reduce the yield of soybean and other crops. It rapidly infests the plant during early reproductive growth and adversely affects the plant's root system and lower stem. No genetic resistance is known, although longer maturity varieties may escape the most devastating effects of the disease by setting pods later in the summer when rainfall is more likely and temperatures are cooler.

Crop rotation is known to increase the yield of soybeans, although the reasons are uncertain. In an effort to better define the effect of crop rotation on soybean, a field study was begun in 1993 to compare grain yield and plant disease levels of continuously grown soybean with soybean following grain sorghum.

Experimental Procedures

Several cropping systems were established in 1988 at the Columbus unit of the Southeast Agricultural Research Center to help determine the effect of crop rotation on soybean. This report includes two of the systems:

1. Continuous soybeans.
2. Soybeans for 1 year then grain sorghum.

The early MG (maturity group) IV variety Delsoy 4210 and the a full season MG V variety, KS5292, have been grown since 1993 as part of a study looking at crop rotation, soybean varieties, and plant populations. Data were recorded from 1993 and 1994 and included grain yield, yield components, and charcoal rot from the roots of the soybean plants. The soil was a Parsons silt Loam (Mollic Albaqualf). Rainfall averages 41 inches/yr at the site. Data on soybean grain yield from two maturity groups (IV and V) and the crop rotations are reported here.

Results and Discussion

The effects of charcoal rot on soybeans could be seen clearly in 1994, especially in the maturity group IV variety Delsoy 4210. The variety KS5292 outyielded Delsoy 4210 by 34 % in 1994 (Table 1.). Rotation also had a great effect in both years, with continuous Delsoy 4210 yielding 12 less than Delsoy 4210 grown in rotation with grain sorghum. Crop rotation did not have as great an effect on the full season KS 5292.

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[1] Department of Plant Pathology, KSU.

[2] Formerly at Southeast Kansas Experiment Station.

Table 1. Effect of Variety on Soybean Grain Yield During 1993 and 1994

Year	1993	1994
	----------bu/a-----------	
Delsoy 4210	29.1	20.8
KS 5292	29.5	31.6
L.S.D.(.05)	------- 6.4 ---------	

Table 2. Effect of Crop Rotation on Soybean Grain Yield

Rotation	Soy-Soy	Soy/Sorghum
	------------bu/a----------	
Delsoy 4210	23.5	26.8
KS 5292	30.5	30.8
L.S.D.(.10)	-------- 3.1 --------	

ANNUAL WEATHER SUMMARY FOR PARSONS - 1994

Mary Knapp[1]

1994 DATA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Max	38.0	43.6	60.4	67.5	74.4	89.6	87.5	88.1	77.7	70.6	56.0	46.6	66.7
Avg. Min	21.3	22.2	36.3	44.5	53.5	66.6	66.1	64.1	55.9	47.9	39.1	29.1	45.5
Avg. Mean	29.6	32.9	48.3	56.0	63.9	78.1	76.8	76.1	66.8	59.3	47.5	37.9	56.1
Precip	1.28	3.33	1.53	13.6	2.62	1.39	6.74	4.37	1.94	5.06	7.05	0.77	49.70
Snow	5	2	0	0	0	0	0	0	0	0	0	0	7
Heat DD*	1097	899	521	289	102	0	0	1	59	219	524	842	4551
Cool DD*	0	0	3	18	69	393	366	346	112	41	0	0	1347
Rain Days	5	4	6	10	7	5	10	6	9	12	10	6	90
Min < 10	7	3	0	0	0	0	0	0	0	0	0	1	11
Min ≤ 32	26	23	12	2	0	0	0	0	0	2	7	20	92
Max ≥ 90	0	0	0	0	0	19	11	12	0	0	0	0	42

NORMAL (1961-1990 Average)

	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	34.7	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	3	1.5	0	0	0	0	0	0	0	2	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

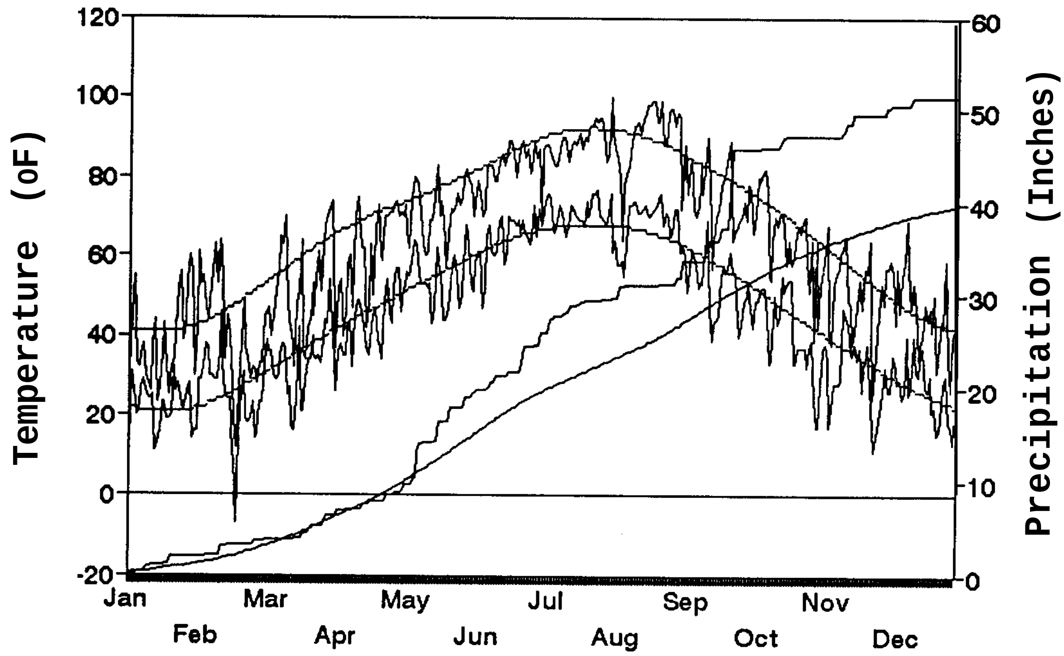
DEPARTURE FROM NORMAL

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Max	-2.5	-3.0	3.3	-0.7	-2.4	4.4	-4.2	-2.0	-3.8	-0.7	-0.8	2.1	-0.8
Avg. Min	2.0	-2.6	2.1	-1.3	-2.0	2.5	-2.9	-2.3	-3.2	0.6	3.4	4.3	0.0
Avg. Mean	-0.3	-2.8	2.6	-1.0	-2.3	3.4	-3.5	-2.2	-3.5	-0.1	1.2	3.2	-0.4
Precip	-0.04	1.87	-1.87	9.82	-2.64	-3.22	3.59	0.74	-2.86	1.14	4.14	-0.99	9.68
Snow	3	-1	-1.5	0	0	0	0	0	0	0	-2	0	-1.5
Heat DD*	9	79	-78	28	14	0	0	1	28	-1	-37	-98	-55
Cool DD*	0	0	3	-3	-56	99	-108	-67	-78	-5	0	0	-215

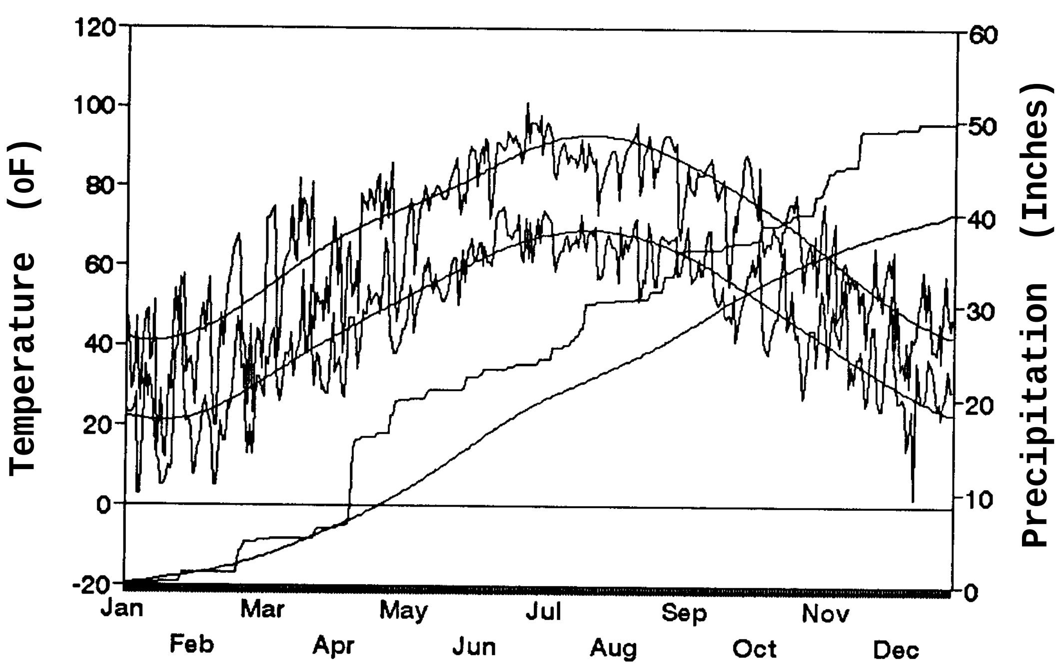
* Daily values were computed from mean temperatures. Each degree that a day's mean temperature is below (or above) 65° F is counted as one heating (or cooling) degree day.

WEATHER SUMMARY FOR PARSONS

1993



1994



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RESEARCH CENTER PERSONNEL

Lyle Lomas . . . . Research Center Head

Mildred Beck . . . . Office Assistant II
Tommie Phillippi . . . . Office Assistant II
Larry Buffington . . . . Custodial Worker
TaLana Erikson . . . . Laboratory Technician III
Marla Sexton . . . . Accounting Specialist

Kenneth Coffey . . . . Animal Scientist

Fredrick Black . . . . Animal Science Technician I
Larry Ellis . . . . Animal Science Technician I
Terry Green . . . . Animal Science Technician I
Ronald McNickle . . . . Animal Science Technician II
Robert Middleton . . . . Animal Science Technician II

James Long . . . . Crop Variety Development Agronomist

Joyce Erikson . . . . Plant Science Technician I
Charles Middleton . . . . Plant Science Technician II

Kenneth Kelley . . . . Crops and Soils Agronomist

Michael Dean . . . . Plant Science Technician II
Bobbie Hite . . . . Plant Science Technician II
Bobby Myers . . . . Plant Science Technician II

Joseph Moyer . . . . Forage Agronomist

Mike Cramer . . . . Plant Science Technician II
Kenneth McNickle . . . . Plant Science Technician I

Daniel Sweeney . . . . Soil and Water Management Agronomist

Phillip Markley . . . . Plant Science Technician II
David Kerley . . . . Plant Science Technician I

KSU
KANSAS STATE UNIVERSITY

Agricultural Experiment Station, Kansas State University, Manhattan 66506-4008

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