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Abstract

Through annual research reports, the Southeast Kansas Branch Experiment Station attempts to keep the area's consumers and producers of agricultural products informed on the Station's research accomplishments. In serving the area, we conduct research at fields located at Parsons, site of the headquarters; at Mound Valley, the original location of the Branch Station; and at Columbus, which has been in the Kansas State University research system for over 60 years. This report for 1984 covers five areas of research emphasis: Beef Cattle, Crops, Forages, Soil and Water Management, and Crop Varietal Development. We sincerely hope that it will be useful to area producers and consumers, industry cooperators, Extension personnel, other Branch Station and Main Station colleagues and others.

Keywords

beef cattle, forage, wheat, soybeans, weeds, grain sorghum, soil, water management

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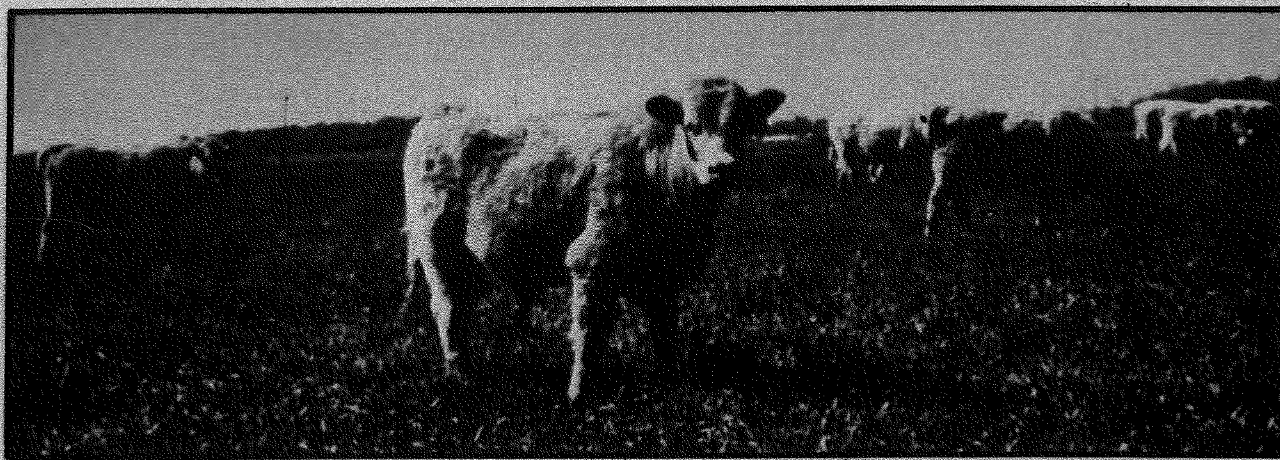

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Agricultural Research at the Southeast Kansas Branch Experiment Station during 1984 [1]

INTRODUCTION

Through annual research reports, the Southeast Kansas Branch Experiment Station attempts to keep the area's consumers and producers of agricultural products informed on the Station's research accomplishments. In serving the area, we conduct research at fields located at Parsons, site of the headquarters; at Mound Valley, the original location of the Branch Station; and at Columbus, which has been in the Kansas State University research system for over 60 years.

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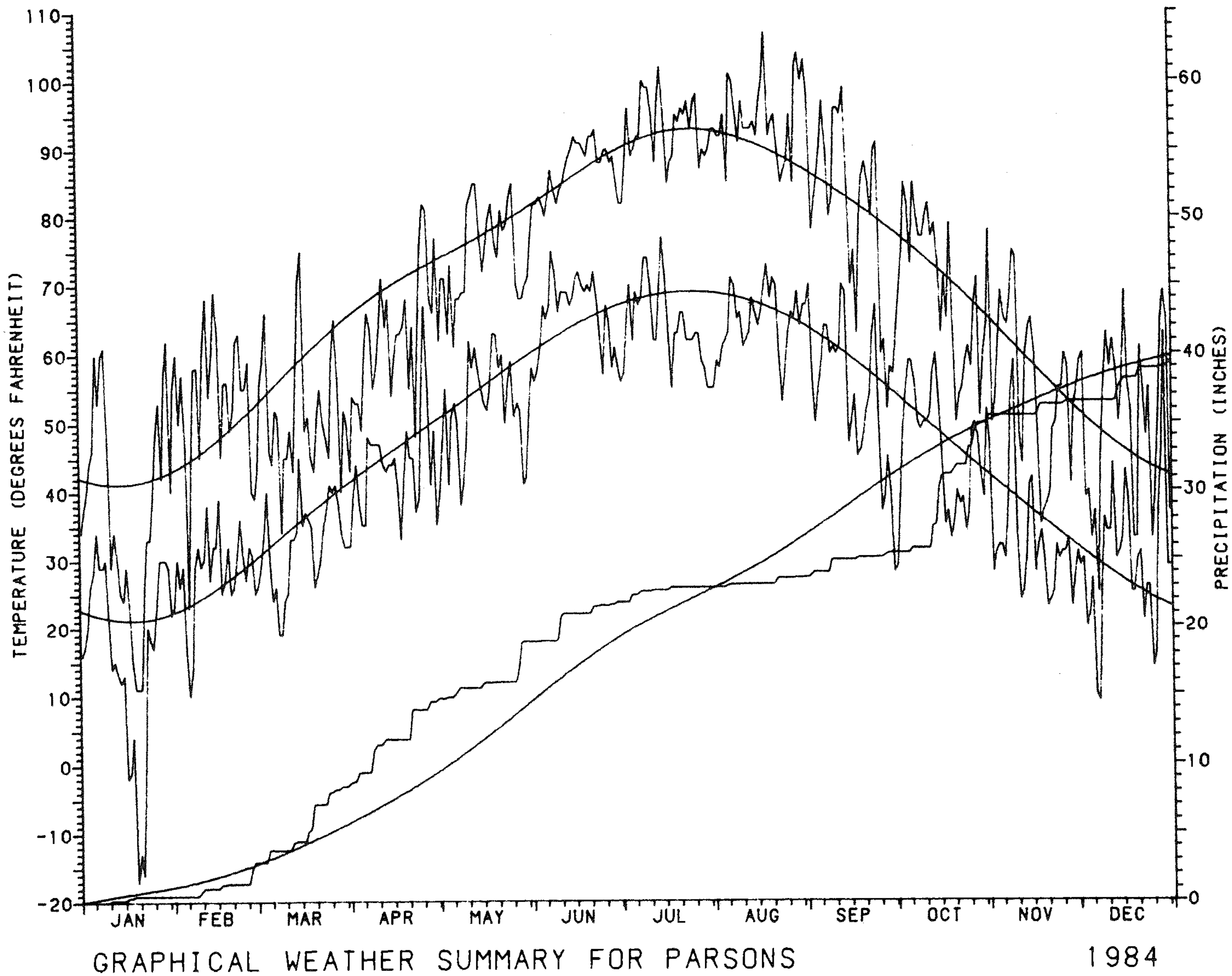
[1] Contribution no 85-342-S, Southeast Kansas Branch Experiment Station, Parsons, and Kansas Agricultural Experiment Station, Kansas State University, Manhattan.



PRODUCED WITH THE AID OF THE KANSAS AGRICULTURAL EXPERIMENT STATION WEATHER DATA LIBRARY

Figure 1. This chart summarizes temperatures and precipitation for 1984. It may help explain some of the reported experimental results, which may be difficult to interpret because of weather effects.

BEEF CATTLE RESEARCH

Lyle W. Lomas

Alfalfa Hay and Corn vs Oats and Corn as Creep Feed for Suckling Calves

Creep feeding usually increases weaning weights of beef calves by 40 to 80 lb. Greatest response to creep feeding is obtained with fall calves or calves born to cows that are poor milkers, and when pasture conditions are poor. Cost of creep feed, feeder-calf prices, and age when calves are to be marketed determines the profitability of creep feeding.

Some producers are concerned that creep feeding of replacement heifers may reduce their subsequent productivity as brood cows. An Illinois study showed that creep-fed, British bred heifers produced less milk and weaned lighter calves as mature cows than their noncreep-fed counterparts. Montana research has shown that subsequent milk production of heifers sired by large-framed exotic sires was not adversely affected by creep feeding them as nursing calves. Based on these studies, it appears that body composition rather than creep feeding per se is the factor that determines subsequent milk production of nursing calves. Small-framed, early maturing heifers have a tendency to fatten quickly and, as a result, creep feeding will probably cause them to become excessively fat and future milk production will likely be adversely affected. Larger framed, later maturing heifers tend to utilize creep feed more efficiently by growing and increasing in frame and lean muscle mass rather than becoming excessively fat. Another way of discouraging creep-fed heifers from becoming excessively fat is to feed a bulky creep ration that is higher in protein and lower in energy. This study compared two such rations. A mixture of 2/3 ground alfalfa hay + 1/3 corn was compared to a mixture of 2/3 oats + 1/3 corn as creep rations for fall-dropped calves.

Procedure: Twenty-two fall-dropped Angus, Angus x Hereford, Simmental x Angus, and Simmental x Hereford calves (10 steers and 12 heifers) were allotted equally by weight, sex, and breed to two groups on January 3, 1984 and all steer calves were implanted with Ralgro (R). One group was creep fed a mixture of 2/3 ground alfalfa hay and 1/3 corn while the other group was creep fed a mixture of 2/3 oats and 1/3 corn. Each group of calves and their respective dams were wintered on 15-acre fescue pastures and were fed big round bales of mixed grass hay *ad libitum*. Calves were weaned on May 22, 1984 when they were approximately 7 months old.

Results: Results of this study are presented in Table 1. Average daily gains of calves creep fed alfalfa hay + corn and oats + corn were 2.09 and 2.04 lb per head daily, respectively. These gains were not significantly different ($P > .20$). Average daily consumption of alfalfa hay + oats and oats + corn was 5.73 and 5.81 lb per head daily, respectively.

Conclusions: Fall calves creep fed a mixture of 2/3 alfalfa hay + 1/3 corn had similar gains as those creep fed 2/3 oats + 1/3 corn.

Table 1. Alfalfa Hay + Oats vs Corn + Oats as Creep Ration (140 days).

Item	Alfalfa + Oats	Corn + Oats
No. of calves	11	11
Initial wt., lb	241	241
Final wt., lb	534	526
Total gain, lb	293	285
Average daily gain, lb	2.09	2.04
Average daily creep feed intake, lb	5.73	5.81

Effect of Processing Method and Trace Mineral Addition on Salt Intake by Beef Cattle [1]

Of all the minerals required by farm animals, salt is needed in greatest quantity. It is such a common mineral that quite often it is neglected in many livestock rations. The functions of salt are numerous but one of the most important is stimulation of appetite. It is also needed for acid base balance, for formation of hydrochloric acid in gastric juice, and for maintenance of osmotic pressure in body cells. Sodium and chloride ordinarily do not appear in natural feedstuffs in adequate amounts to meet the needs of the animal, so they must be supplied. The common practice is to provide salt free-choice at all times. The following studies were conducted to determine cattle preference between trace mineral and rock salt blocks and to compare intake of evaporated and rock salt blocks.

Procedure:

Experiment A - Sixty-four steer calves with an initial weight of 508 lb were randomly allotted to eight 5-acre fescue pastures on October 26, 1983 and grazed until May 18, 1984. There were two covered weathervane type mineral feeders located side by side in each pasture. On November 22, 1983, a trace mineral salt block was placed in one feeder and a rock salt block was placed in the other feeder. All salt blocks were weighed initially and periodically thereafter until the study was terminated on May 18, 1984. Salt consumption was determined by difference between the weight of the salt placed in the feeder and the amount remaining at the end of the study. Cattle were fed 200 mg of monensin in 4 lb of rolled milo per head daily and big round bales of mixed grass hay *ad libitum* throughout the study. No other salt was fed.

Experiment B - Twenty-two cow-calf pairs were randomly allotted to two 15-acre fescue pastures on January 3, 1984. There were two covered weathervane type mineral feeders located side by side in each pasture. A white evaporated salt block was fed in one feeder and a gray rock salt block was fed in the other feeder. All blocks were weighed initially and then periodically thereafter until the study was terminated on May 21, 1984. Salt consumption was determined by difference between the weight of the salt placed in the feeders and the amount remaining at the end of the study. All cows were fed big round bales of mixed grass hay and a liquid supplement *ad libitum* throughout the study.

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[1] Salt and partial financial assistance provided by Carey Salt, Hutchinson, KS.

Results:

Experiment A - Results of this 178-day study are presented in Table 2. Average daily consumption of trace mineral and rock salt blocks was .30 and .14 oz per head daily, respectively. Cattle consumed 2.14 times more trace mineral block than rock block. This was a statistically significant difference in salt consumption ($P < .025$).

Since rock salt is contained in the trace mineral blocks, it would appear that differences in consumption between the trace mineral and rock salt blocks would be due to either the presence of the trace minerals or to flavoring, which is added to the trace mineral block at a very low level.

Experiment B - Results of this 139-day study are presented in Table 3. Average daily consumption of evaporated and rock salt blocks was .26 and .30 oz per head daily, respectively. Although cattle consumed slightly more of the rock block, there was no significant difference ($P > .20$) in intake of the two types of salt blocks. This is in agreement with earlier studies that have also shown intake of evaporated and rock salt blocks to be similar.

Conclusions: Cattle consumed over twice as much salt from trace mineral blocks as from rock salt blocks. Intake of evaporated and rock salt blocks was similar.

Table 2. Average Daily Consumption of Trace Mineral and Rock Salt Blocks.

Pasture	Salt Intake (oz/head/day) Trace Mineral Block	Salt Intake (oz/head/day) Rock Block
1	.12	.19
2	.15	.12
3	.56	.17
4	.31	.12
5	.40	.15
6	.45	.09
7	.22	.15
8	.18	.11
MEAN	.30[a]	.14[b]

[a,b]Means with different superscripts differ significantly ($P < .025$).

Table 3. Average Daily Consumption of Evaporated and Rock Salt Blocks.

	Salt Intake (oz/head/day)	
Pasture	Evaporated Block	Rock Block
North	.20	.19
South	.32	.40
MEAN	$.26^{a,b}$	$.30^{a,b}$

[a,b]Means with different superscripts differ significantly ($P < .20$).

Effect of Treating Tall Fescue Pasture with Mefluidide on Performance of Grazing Steers [1]

Mefluidide is a relatively new plant growth regulator that is capable of improving forage quality and subsequently increasing weight gains of livestock consuming this forage. Mefluidide increases forage quality by delaying maturity and suppressing seed head formation. In 1984, the Environmental Protection Agency approved an experimental use permit for evaluation of mefluidide on tall fescue, orchardgrass, and smooth bromegrass in Kansas. This study was conducted under this permit to evaluate the effect of treating tall fescue with mefluidide on performance of grazing steers.

Procedure: Four 5-acre Kentucky 31 fescue pastures with an average *Epichloe typhina* endophyte infestation level of 85% were used to evaluate the effect of mefluidide treatment on grazing steer performance. All pastures were topdressed with 80-40-40 lb of N-P_2O_5-K_2O per acre on February 6, 1984 and again on September 13, 1984 with 50 lb of N per acre. On April 17, 1984, 1 pint of Embark 2-S(R) in 30 gallons of water per acre was applied to two of the pastures using a field sprayer with flat fan nozzles, plus X-77 surfactant at 1 pint per 100 gallons of spray solution. At the time of mefluidide application, the fescue was approximately 4 inches tall. Two control pastures were not treated with mefluidide.

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[1] Mefluidide and partial assistance provided by 3-M Agricultural Products, St. Paul, MN 55144.

Thirty-two Angus x Hereford steers were used to graze these pastures. On April 17, all steers were implanted with Ralgro (R), dewormed with Tramisol(R), and randomly assigned to the four pastures (8 steers/pasture). Grazing was initiated on control pastures on April 17, but steers were not allowed to graze the mefluidide-treated pastures until May 1 because of a 14-day grazing restriction following mefluidide application. During this 14-day period, steers assigned to the mefluidide pastures were grazed on smooth bromegrass and then reweighed before they were turned on the fescue. Initial and final weights were taken following a 16-hour shrink from feed and water. Forage samples were collected and analyzed for crude protein throughout the study. All steers received 150 mg of Rumensin (R) in 2 lb rolled milo per head daily throughout the study and were reimplanted with Ralgro (R) on August 21. This study was terminated on November 27, 1984.

Results: A summary of the effect of mefluidide on fescue crude protein content is presented in Table 4. Mefluidide significantly ($P < .05$) increased average crude protein content of fescue pasture with the greatest increase occurring in late June.

Results of steer performance are listed in Table 5. Average daily gains on the control and mefluidide pastures were 1.47 and 1.68 lb per head daily, respectively. Steers grazing pastures treated with mefluidide gained 14.3% more (.21 lb per head daily) than those grazing control pastures. Steers grazing mefluidide-treated pastures tended to shed their winter hair earlier in the summer than steers grazing control pastures. Pastures treated with mefluidide produced 37.6 lb more steer liveweight gain per acre than untreated control pastures. Mefluidide application resulted in approximately 90-95% seed head suppression.

Conclusions: Treating fescue pasture with mefluidide (Embark (R)) increased the crude protein content of forage and improved daily gain of grazing steers by 14.3% (.21 lb per head daily). The results of this trial indicate that mefluidide may be a useful management tool for producers of cattle that graze fescue during the summer months.

Table 4. Effect of Mefluidide on Fescue Crude Protein Content.

Date	Crude Protein Content, %	
	Control	Mefluidide
May 3	20.1	21.6
29	9.6	10.6
June 12	7.9	10.8
26	11.4[a]	15.4[b]
July 10	6.5	7.2
25	8.4	9.4
Aug. 6	9.6	10.3
Sept. 28	13.4	15.6
Oct. 19	22.6	21.0
AVERAGE	12.2[a]	13.5[b]

[a,b]Means with different superscripts differ significantly ($P < .05$).

Table 5. Effect of Mefluidide on Grazing Steer Performance.

Item	Control	Mefluidide
No. of steers	16	16
Initial wt., lb	416	446
Final wt., lb	746	799
Total gain per steer, lb	330	353
Days on experiment	224	210
Average daily gain, lb	1.47[a]	1.68[b]
Stocking rate, steers/acre	1.6	1.6
Liveweight gain, lb/acre	528	565

[a,b]Means with different superscripts differ significantly ($P < .01$).

Fescue vs Fescue-Ladino Clover for Backgrounding Steers

Interseeding legumes into established stands of cool-season grasses is a management practice that dates back many years. Recently, this practice has gained a lot of attention for several reasons. Legumes fix nitrogen into the soil, thereby reducing nitrogen fertilizer requirements. Cool-season pastures interseeded with legumes also produce higher gains by grazing beef cattle during the summer months. Legumes interseeded in tall fescue reduce the toxicity effects caused by the endophyte *Epichloe typhina* and extend the length of the grazing season further into the summer months. While interseeding of legumes has been successful in other states, limited success has been obtained at this station. Red clover has been interseeded in fescue previously, but due to dry weather and the high clay content of the soil most of it died during the summer. This past year, ladino clover was interseeded in tall fescue and despite the dry summer of 1984, much of it managed to survive. The following study was conducted to compare performance of cattle grazing tall fescue and fescue interseeded with ladino clover.

Procedure: On October 26, 1983, 64 steer calves (507 lb) were implanted with Ralgro (R), dewormed with Tramisol (R) and allotted randomly to eight 5-acre Kentucky 31 fescue pastures with 8 head per pasture. These pastures had an *Epichloe typhina* infestation level of approximately 65%. Four of these pastures had previously been interseeded with red clover, which died out during the summer of 1983, and the other four pastures contained fescue only. Cattle were wintered on these pastures and fed 100 mg Rumensin (R) in 4 lb of rolled milo per head daily and mixed grass hay *ad libitum* from big round bales.

Regal ladino clover seed was broadcast at 5 lb per acre on the four pastures that had been previously interseeded with red clover on February 14, 1984. Pastures to be interseeded with ladino were fertilized with 16-40-40 lb of N-P_2O_5-K_2O per acre in August 1983 and the pastures with fescue only received 50-40-40 lb of N-P_2O_5-K_2O in August 1983 and 60 lb of N per acre in April 1984.

During the winter phase, two steers were removed from the study for reasons unrelated to the experimental treatment. The winter phase was terminated on April 19, 1984 and all steers were reimplanted with Ralgro (R). During the spring phase steers were grazed from April 19 until May 17, 1984.

Seventeen steers were divided into two groups and grazed on these pastures during the summer phase, which extended from June 15, 1984 until September 19, 1984. Eight steers were grazed on fescue-ladino clover and nine steers were grazed on fescue only. Rotational grazing was practiced during the summer phase with each group of steers being moved to a different pasture every 14 days. No supplemental feed was provided during the spring and summer phases.

Initial and final weights for all phases were taken following a 16-hour shrink from both feed and water.

Results: Performance during the winter phase is presented in Table 6-A. During this phase (October 26, 1983 until April 19, 1984), the steers on fescue gained 10.7% more (20 lb) ($P < .05$) and consumed 18.6% less hay ($P < .05$) than those grazing fescue interseeded with ladino clover. Fescue pastures produced 18.0% more gain ($P < .05$) (49 lb) per acre during this phase than pastures interseeded with ladino clover.

Performance during the spring phase is listed in Table 6-B. During this phase, gains from pastures interseeded with ladino clover were equivalent to those from pastures of fescue only.

Performance during the summer phase is listed in Table 6-C. During this phase, which extended from June 15 until September 19, steers grazing pastures interseeded with ladino clover gained 1.85 times more ($P < .01$) (60 lb) than those grazing a pure stand of fescue. Interseeded pastures produced 1.47 times more ($P < .01$) (27 lb) gain per acre than those in straight fescue.

Season-long production is summarized in Table 6-D on a liveweight gain per acre basis. Overall performance favored pastures in straight fescue. These pastures produced 8.2% more ($P < .15$) (36 lb) gain per acre than those interseeded with ladino clover.

Conclusions: The quantity of beef produced per acre during a year of grazing slightly favored the pure stand of fescue over the fescue interseeded with ladino clover. The pure stand of fescue produced a significantly greater amount of gain during the winter with less hay being required than did the fescue interseeded with ladino. However, during the summer, steer performance was significantly greater on the pastures interseeded with legumes than on the ones in straight fescue. It appears that a producer would need both types of pasture to maximize beef production from a program utilizing tall fescue year-round.

Fescue vs Fescue-Ladino Clover

Table 6-A Winter Phase 10-26-83 to 4-19-84 (176 days)

Item	Fescue	Fescue + Ladino Clover
No. of steers	32	30
Initial wt, lb	508	506
Final wt, lb	709	687
Total gain, lb	201	181
Average daily gain, lb	1.14[a]	1.03[b]
Stocking rate, steers/acre	1.6	1.5
Liveweight gain, lb/acre	321[a]	272[b]
Daily hay consumption, lb	7.11[a]	8.73[b]

[a,b]Means with different superscripts differ significantly ($P < .05$)

Table 6-B Spring Phase 4-19-84 to 5-17-84 (28 days)

Item	Fescue	Fescue + Ladino Clover
No. of steers	32	30
Initial wt., lb	709	687
Final wt., lb	795	773
Total gain, lb	86	86
Average daily gain, lb	3.07	3.07
Stocking rate, steers/acre	1.6	1.5
Liveweight gain, lb/acre	138	129

Fescue vs Fescue-Ladino Clover (continued)

Table 6-C Summer Phase 6-15-84 to 9-19-84 (96 days)

Item	Fescue	Fescue + Ladino Clover
No. of steers	9	8
Initial wt., lb	818	818
Final wt., lb	851	911
Total gain, lb	33	93
Average daily gain, lb	.34[a]	.97[b]
Stocking rate, steers/acre	.45	.40
Liveweight gain, lb/acre	15[a]	37[b]

[a,b]Means with different superscripts differ significantly (P< .01).

Table 6-D Total Grazing Season Production.

Item	Fescue	Fescue + Ladino Clover
Winter phase gain, lb/acre	321[a]	272[b]
Spring phase gain, lb/acre	138	129
Summer phase gain, lb/acre	15[c]	37[d]
Total gain, lb/acre	474[e]	438[f]

[a,b]Means with different superscripts differ significantly (P < .05).

[c,d]Means with different superscripts differ significantly (P < .01).

[e,f]Means with different superscripts differ significantly (P < .15).

Comparison of Rye and Triticale as Forages for Grazing Stocker Cattle

Winter annual small grains are frequently grazed during late fall and early spring in southeastern Kansas. Wheat is often the crop of choice, expecially if grain production is the primary objective. If pasture is the main consideration, there are probably other small grains that will yield more forage and produce a greater quantity of beef cattle weight gain per acre than wheat.

Research has been conducted at the Southeast Kansas Experiment Station to determine which winter annual small grains will result in maximum forage and beef production in a graze-out program. A study conducted in 1981-82 revealed that triticale produced nearly twice as much beef liveweight gain per acre as Newton wheat. Results from a 1982-83 study indicated that a mixture of 2/3 rye and 1/3 wheat produced over three times as much beef liveweight per acre as triticale. The following study was conducted to compare rye and triticale with respect to performance of grazing stocker cattle.

Procedure: On September 19, 1983, two 5-acre fields were seeded with winter annuals. One field was seeded with 105 lb of triticale per acre and the other was seeded with 89 lb of Bonel rye per acre. At seeding time, 25-65-70 lb of N-P_2O_5-K_2O per acre was applied and on November 14, 1984, 50 lb of N per acre was applied to each pasture. Pastures were stocked according to availability of forage. All steers were implanted with Ralgro(R) and dewormed with Tramisol before being turned onto the pastures. Two lb of rolled milo containing 200 mg Rumensin(R) was fed to each steer daily throughout the study. Cattle were weighed following a 16-hour shrink from feed and water before they were turned out and removed from the pastures.

Results: Results of this study are presented in Table 7. Triticale produced 24.3% more (76 lb) beef liveweight gain and 22 more animal grazing days per acre than rye, but there was no significant difference ($P > .20$) in average daily gain. In this study, daily gains were similar but liveweight gain and animal grazing days per acre favored the triticale. This is in contrast to an earlier study in which a mixture of 2/3 rye and 1/3 wheat was greatly superior to triticale. This difference is largely due to the time of year in which grazing occurred. Initiation of grazing was delayed in 1984 because of muddy field conditions in late winter and early spring. As a result, much of the early forage production from rye was not utilized and total season production tended to slightly favor the triticale, which produces most of its forage later in the spring.

Conclusions: Daily gains were similar between stocker steers grazing rye and triticale, but liveweight gain and steer grazing days per acre favored the triticale.

Table 7. Rye vs Triticale for Grazing Stocker Cattle.

Item	Rye	Triticale
Liveweight beef gain, lb/acre	313	389
Animal days/acre	124	146
Average daily gain, lb	2.52	2.66

Effect of Energy Supplementation on Gains of Steers Grazing Bermudagrass

Supplementation with energy is an effective way of increasing gains of grazing stocker cattle. Energy supplementation also serves as a carrier for monensin and other feed additives that might be beneficial. Hand feeding energy supplement gives the cattleman an opportunity to check his cattle and observe them for possible problems. Cattle supplemented with energy while on pasture may also go on feed faster in the feedlot and require fewer days on feed before ready for slaughter. This study was conducted to evaluate the effect of energy supplementation on gains of stocker cattle grazing bermudagrass.

Procedure: Forty-five yearling mixed crossbred steers with an initial weight of 704 lb were randomly allotted by weight and divided into three equal groups of 15 head each on June 15, 1984 and placed on three 5-acre Midland bermudagrass pastures, which had been previously fertilized with 150-40-60 lb of $N-P_2O_5-K_2O$ per acre on May 14, 1984. Fifty lb of N per acre was applied to all pastures on August 8, 1984. One group of steers received no energy supplementation, while the other two groups received 2 or 4 lb of rolled milo plus 150 mg monensin per head daily. Steers were rotated among pastures at 14-day intervals to minimize the effect of pasture differences. All steers were implanted with 36 mg of Ralgro (R) and dewormed with Tramisol (R) at the start of the study. Initial and final weights were taken following a 16-hour shrink from feed and water. The study was terminated on September 19, 1984.

Results: Results of this study are presented in Table 8. One steer was removed from the control group for reasons unrelated to the experimental treatment. Steers receiving 2 and 4 lb of energy supplement per head daily gained 4.27 times more (60 lb) ($P < .01$) and 6.07 times more (87 lb) ($P < .01$), respectively, than the unsupplemented control group. Feeding 4 lb of rolled milo produced 34.2% more gain (27 lb) ($P < .05$) than feeding 2 lb per head daily. Due to an extremely dry summer, gains from all treatments were lower than anticipated. Following termination of this study, steers were placed in the feedlot to determine the effect of this energy supplementation on subsequent performance. These results will be reported in a future publication.

Conclusions: Energy supplementation significantly improved gains of stocker steers grazing bermudagrass. Highest gains were obtained from feeding 4 lb of rolled milo per head daily.

Table 8. Energy Supplementation of Steers Grazing Bermudagrass (96 days).

Item	Level of Milo (lb/head/day)		
	0	2	4
No. of steers	14	15	15
Initial wt., lb	703	705	705
Final wt., lb	718	780	807
Total gain, lb	15^{c}	$75^{a,d}$	$102^{b,d}$
Average daily gain, lb	$.15^{c}$	$.79^{a,d}$	$1.06^{b,d}$

^{a,b}Means with different superscripts differ significantly ($P < .05$).

^{c,d}Means with different superscripts differ significantly ($P < .01$).

Birdsfoot Trefoil vs Smooth Bromegrass for Growing Steers

Birdsfoot trefoil is a widely adapted, nonbloating forage legume. The variety 'Dawn' has shown good persistence and yield potential in eastern Kansas. Very little birdsfoot trefoil is grown in Kansas and as a result there is limited knowledge about its feeding value. This study compared birdsfoot trefoil with smooth bromegrass in rations for growing steers.

Procedure: On December 22, 1983, 8 Angus, Angus x Hereford, and Angus x Simmental crossbred steers were equally allotted by weight and breed into two groups and fed 2/3 birdsfoot trefoil hay + 1/3 corn (11.9% crude protein) or 2/3 smooth bromegrass hay + 1/3 corn (10.0% crude protein) for 64 days. Both rations were ground, mixed, and fed *ad libitum* in self-feeders. All steers were implanted with Ralgro (R) and dewormed with Tramisol (R) at the start of the study and confined in dirt lots. Initial and final weights were taken following a 16-hour shrink from feed and water.

Results: Results of this study are presented in Table 9. Performance of steers fed 2/3 birdsfoot trefoil hay + 1/3 corn was similar to that of steers fed 2/3 smooth bromegrass hay + 1/3 corn. Average daily gain of steers fed birdsfoot trefoil and brome were 2.43 and 2.36 lb per head daily, respectively. Feed intake was slightly higher with trefoil but feed efficiency favored the bromegrass.

Conclusions: The feeding values of birdsfoot trefoil and smooth bromegrass hay for growing steers appear to be similar.

Table 9. Birdsfoot Trefoil vs Smooth Bromegrass for Growing Steers (64 days).

Item	Trefoil	Brome
No. of steers	4	4
Initial wt., lb	736	736
Final wt., lb	892	886
Total gain, lb	156	150
Average daily gain, lb	2.43	2.36
Average daily dry matter intake, lb	23.20	20.92
Dry matter intake/gain	9.55	8.88

Effect of Backgrounding Implant Treatment on Subsequent Performance of Finishing Steers [1]

Growth-promoting implants usually increase gains of growing and finishing cattle by 8 to 15%. Implants are slowly absorbed into the blood stream over a period of 70 to 200 days and are composed of naturally occurring hormones or compounds that stimulate production and release of growth-promoting hormones in the body. Currently there are four implants approved for use in growing and finishing steers in this country. These include Synovex-S (R) and Steeroid (R), which both contain 20 mg estradiol benzoate and 200 mg progesterone; Ralgro (R), which contains 36 mg zeranol; and Compudose (R), whose active ingredient is 24 mg of estradiol 17β. The effective life of Synovex-S (R), Steeroid (R), and Ralgro (R) is thought to be approximately 100 days, while Compudose (R) is supposed to have an effective life of 200 days. Ralgro (R) is currently the only implant with a required withdrawal time before slaughter. Implanting must not be done within 65 days of slaughter.

The following study was conducted to determine the effect of implanting stocker cattle on subsequent feedlot performance.

Procedure: A 201-day grazing study was conducted in 1983 in which yearling steers were allotted to the following implant treatments: 1) control - no implant; 2) Synovex-S (R); 3) Ralgro (R); 4) Compudose (R). A single dose of each implant was administered at the start of the study following procedures recommended by their respective manufacturers. Cattle were implanted initially and no additional anabolic treatment was given during the 201-day grazing phase, from April 7, 1983 until October 25, 1983.

Following the grazing phase, all cattle were implanted with Ralgro (R), dewormed with Tramisol (R), and placed in the feedlot for a 112-day finishing period. During the finishing phase, all cattle were started on 60% corn silage, 30% dry whole shelled corn, and 10% supplement. The level of silage was decreased and the level of corn increased 5% daily until the final ration of 15% corn silage, 75% dry whole shelled corn, and 10% supplement on a 100% dry matter basis was reached. Rumensin (R) and Tylan (R) were fed at 30 grams and 10 grams per ton of dry matter, respectively. Cattle were fed *ad libitum* once daily in fenceline bunks in dirt lots with no cover or wind protection. Initial and final weights were taken following a 16-hour shrink from feed and water. Final weights were taken on February 14, 1984. Cattle were slaughtered on February 21, 1984 and carcass data collected for each steer.

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[1] Synovex-S, Ralgro and Compudose implants were provided by Syntex Agribusiness Inc., International Minerals and Chemical Corporation, and Elanco Products Co., respectively.

Results: Results of the 201-day grazing phase are listed on Table 10-A. During this phase steers implanted with Ralgro (R) and Compudose (R) gained 13.7% (38 lb) more (P < .05) and 9.9% (28 lb) more (P < .10), respectively, than nonimplanted controls. Cattle implanted with Synovex-S (R) gained 5.3% (15 lb) more than controls, although this was not a significant difference (P > .10). There was no significant difference (P > .10) in gain between Synovex-S (R) and Ralgro (R) or Compudose (R). Gains from steers implanted with Ralgro (R) and Compudose (R) were similar (P > .10).

Results of the 112-day finishing phase in which all steers were implanted with Ralgro (R) are listed in Table 10-B. Steers that were not implanted during the grazing phase gained 9.7% (36 lb) more (P < .01) and 10.4% (38 lb) more (P < .01), during the finishing phase than steers that had been implanted during the grazing phase with Ralgro (R) and Compudose (R), respectively. Cattle that were implanted with Synovex-S (R) during the grazing phase gained 10.0% (37 lb) more (P < .05) and 10.7% (39 lb) more (P < .05) during the finishing phase than steers that had previously been implanted with Ralgro (R) and Compudose (R), respectively. Steers previously implanted with Synovex-S (R) during the grazing phase were the most efficient gainers during the finishing phase. These steers required 8.9% (.58 lb) less (P < .10) and 23.1% (1.78 lb) less (P < .10) dry matter intake per lb of gain than cattle previously not implanted and implanted with Ralgro (R), respectively. Cattle previously implanted with Ralgro (R) during the grazing phase consumed more feed (P < .10) during the finishing phase than steers that received the other grazing implant treatments. Backgrounding implant treatment had little effect on carcass parameters. Steers that were not implanted during the grazing phase had larger ribeye areas than those implanted with Synovex-S (R) (P < .05) and Compudose (R) (P < .10), respectively.

Overall performance (grazing, and finishing phases combined) is listed by backgrounding implant treatment in Table 10-C. There was no significant difference (P > .10) in overall performance due to backgrounding implant treatment.

Conclusions: Although backgrounding implant treatments tended to increase gains during the grazing phase, cattle that were not implanted during this phase tended to compensate when implanted during the finishing phase. Overall performance from beginning of grazing phase through end of finishing phase was not significantly affected by backgrounding implant treatment.

Table 10-A. Effect of Implants on Grazing Steer Performance (201 days).

Item	Control	Synovex-S	Ralgro	Compudose
No. of steers	15	13	16	13
Initial wt., lb	580	576	574	568
Final wt., lb	843	854	875	859
Total gain, lb	263	278	301	291
Average daily gain, lb	1.31[a,c]	1.38	1.49[b,d]	1.44[b]

[a,b]Means with different superscripts differ significantly ($P < .10$).

[c,d]Means with different superscripts differ significantly ($P < .05$).

Table 10-B. Effect of Backgrounding Implant on Finishing Steer Performance (112 days).

Item	Control	Synovex-S	Ralgro	Compudose
No. of steers	15	13	16	13
Initial wt, lb	843	854	875	859
Final wt., lb	1247	1259	1243	1225
Total gain, lb	404	405	368	366
Average daily gain, lb	$3.61^{a,c}$	3.62^{c}	$3.29^{b,d}$	$3.27^{b,d}$
Average daily dry matter intake, lb	23.48^{e}	21.49^{e}	25.26^{f}	23.64^{e}
Dry matter intake/gain	6.52^{e}	5.94^{f}	7.72^{e}	7.14
Hot carcass wt, lb	792	788	788	779
Ribeye area, in^2	$13.6^{c,e}$	$12.7^{d,f}$	13.1	12.8^{f}
Fat thickness, in	.53	.52	.55	.52
Quality grade	Ch^-	Ch^-	Ch^-	Ch^-
Yield grade	2.7	2.7	2.8	2.7

^{a,b}Means with different superscripts differ significantly ($P < .01$).

^{c,d}Means with different superscripts differ significantly ($P < .05$).

^{e,f}Means with different superscripts differ significantly ($P < .10$).

Table 10-C. Effect of Backgrounding Implant on Overall Performance (313 days).

Item	Control	Synovex-S	Ralgro	Compudose
No. of steers	15	13	16	13
Initial wt, lb	580	576	574	568
Final wt, lb	1247	1259	1243	1225
Total gain, lb	667	683	669	657
Average daily gain, lb	2.13	2.18	2.13	2.10

Effect of Energy Supplementation of Steers Grazing Bermudagrass on Subsequent Feedlot Performance

Energy supplementation is an effective way of improving gains of stocker cattle. However, if a producer retains ownership of his cattle to slaughter, the profitability of this practice needs to be further evaluated. This study evaluates subsequent feedlot performance of steers that received various levels of energy supplement while grazing bermudagrass.

Procedure: Forty-five thin, mixed yearling steers (518 lb) were randomly allotted by weight and divided into three equal groups of 15 head each on June 9, 1983 and placed on three 5-acre bermudagrass pastures and grazed until September 29, 1983 (112 days). One group received no energy supplementation, while the other two groups received 2 or 4 lb of rolled milo plus 200 mg Rumensin (R) per head daily. Following the grazing phase, all steers were placed in the feedlot and finished for slaughter. During the finishing phase, all cattle were started on 60% corn silage, 30% dry whole shelled corn, and 10% supplement. The level of silage was decreased and the level of corn increased 5% daily until the final ration of 15% corn silage, 75% dry whole shelled corn, and 10% supplement on a 100% dry matter basis was reached. Rumensin (R) and Tylan (R) were fed at 30 grams and 10 grams per ton of dry matter, respectively. Cattle were fed *ad libitum* once daily in fenceline bunks in dirt lots with no cover or wind protection. Initial and final weights were taken following a 16-hour shrink from feed and water. Cattle were fed for 155 or 176 days and then slaughtered and carcass data collected for each steer.

Results: Results of the 112-day grazing phase are listed in Table 11-A. During this phase, steers receiving 2 lb and 4 lb of rolled milo per head daily gained 54.3% (43 lb) more ($P < .01$) and 121.4% (97 lb) more ($P < .01$), respectively, than the unsupplemented control group. Feeding 4 lb of rolled milo produced 43.5% (54 lb) ($P < .01$) more gain than feeding 2 lb of grain.

Results of the finishing phase are listed in Table 11-B. During the finishing phase steers that had received 4 lb of milo per head daily during the grazing phase gained 6.5% (.16 lb) more ($P < .05$) per head daily than those that received 2 lb of milo per head daily while grazing bermudagrass. Steers that received no energy supplementation during the grazing period gained 9.7% (.22 lb) more ($P < .10$) per head daily than those that were fed 2 lb of milo per head daily while on pasture. Feed conversion also favored cattle that were previously unsupplemented or fed 4 lb of milo per head daily during the grazing phase. Cattle that received 4 lb of energy supplementation on bermudagrass produced heavier carcasses ($P < .05$) with larger ribeye areas ($P < .05$) than steers that received no energy supplementation during the grazing phase.

Overall performance from beginning of grazing phase through end of finishing period is listed in Table 11-C. Overall performance favored feeding 4 lb of milo to steers during the grazing phase. Steers on this treatment gained 27.5% (.40 lb) more ($P < .01$) and 21.1% (.38 lb) more ($P < .01$) than steers that received no supplement and 2 lb per head daily on pasture, respectively.

Conclusions: Feeding 4 lb of rolled milo to steers grazing bermudagrass resulted in higher subsequent feedlot gains, fewer days in the feedlot, heavier carcass weights, and higher overall performance than steers that had been fed 0 or 2 lb of milo while grazing bermudagrass.

Table 11-A Energy Supplementation of Steers Grazing Bermudagrass (112 days).

	Level of Milo (lb/head/day)		
Item	0	2	4
No. of steers	15	15	15
Initial wt., lb	518	519	518
Final wt., lb	595	639	692
Total gain, lb.	77	120	174
Average daily gain, lb.	.70[a]	1.08[b]	1.55[c]

[a,b,c]Means with different superscripts differ significantly ($P < .01$).

Table 11-B Effect of Backgrounding Energy Supplementation on Finishing Steer Performance.

Item	Level of Backgrounding Energy Supplement (lb/head/day)		
	0	2	4
No. of steers	15	15	15
Initial wt., lb	595	639	692
Final wt., lb	1032	1037	1101
Total gain, lb	437	398	409
Days on feed	176	176	155
Average daily gain, lb	2.48[c]	2.26[a,d]	2.64[b]
Average daily dry matter intake, lb	20.57	21.22	22.83
Dry matter intake/gain	8.30	9.39	8.66
Hot carcass wt, lb	648[a]	658	689[b]
Ribeye area, in^2	11.2[a]	11.4	12.0[b]
Fat thickness, in	.42	.45	.46
Quality grade	Ch^-	Ch^-	Ch^-
Yield grade	2.5	2.7	2.4

[a,b]Means with different superscripts differ significantly ($P < .05$).

[c,d]Means with different superscripts differ significantly ($P < .10$).

Table 11-C. Effect of Backgrounding Energy Supplementation on Overall Steer Performance.

	Level of Backgrounding Energy Supplement (lb/head/day)		
Item	0	2	4
No. of steers	15	15	15
Initial wt., lb	518	519	518
Final wt., lb	1032	1037	1101
Total gain, lb	514	518	583
Days on experiment	288	288	267
Average daily gain, lb	1.78[a]	1.80[a]	2.18[b]

[a,b]Means with different superscripts differ significantly ($P < .01$).

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CROPS RESEARCH

Kenneth W. Kelley

Performance Testing of Small Grain Varieties

The small grain variety tests are conducted to help southeastern Kansas growers select varieties best adapted for the area.

Procedure: In 1984, 36 wheat varieties, four barley varieties, and four spring oat varieties were compared. Wheat and barley varieties were planted November 1, while spring oats were planted February 23. Seeding rates were 1,000,000 seeds per acre for wheat and 96 lbs/a for barley and spring oats. Wheat and barley were fertilized with 75 lb N, 65 lbs P_2O_5, and 65 lbs K_2O per acre. Spring oats was fertilized with 50 lbs N, 50 lbs P_2O_5, and 50 lbs K_2O per acre.

Wheat results: Average yield for all varieties was 59 bu/a. The spring of 1984 was again cool and wet, which slowed wheat development and final maturity. Yield results of the more commonly grown varieties or hybrids are shown on the following page, but complete wheat results for Kansas are compiled in Agric. Expt. Station Report of Progress 459.

Wheat conclusions: Newer varieties and or hybrids appear to be better adapted to the wet and cool conditions that are normally encountered in southeastern Kansas, however, yield potential and disease resistance are significantly different even among the newer releases.

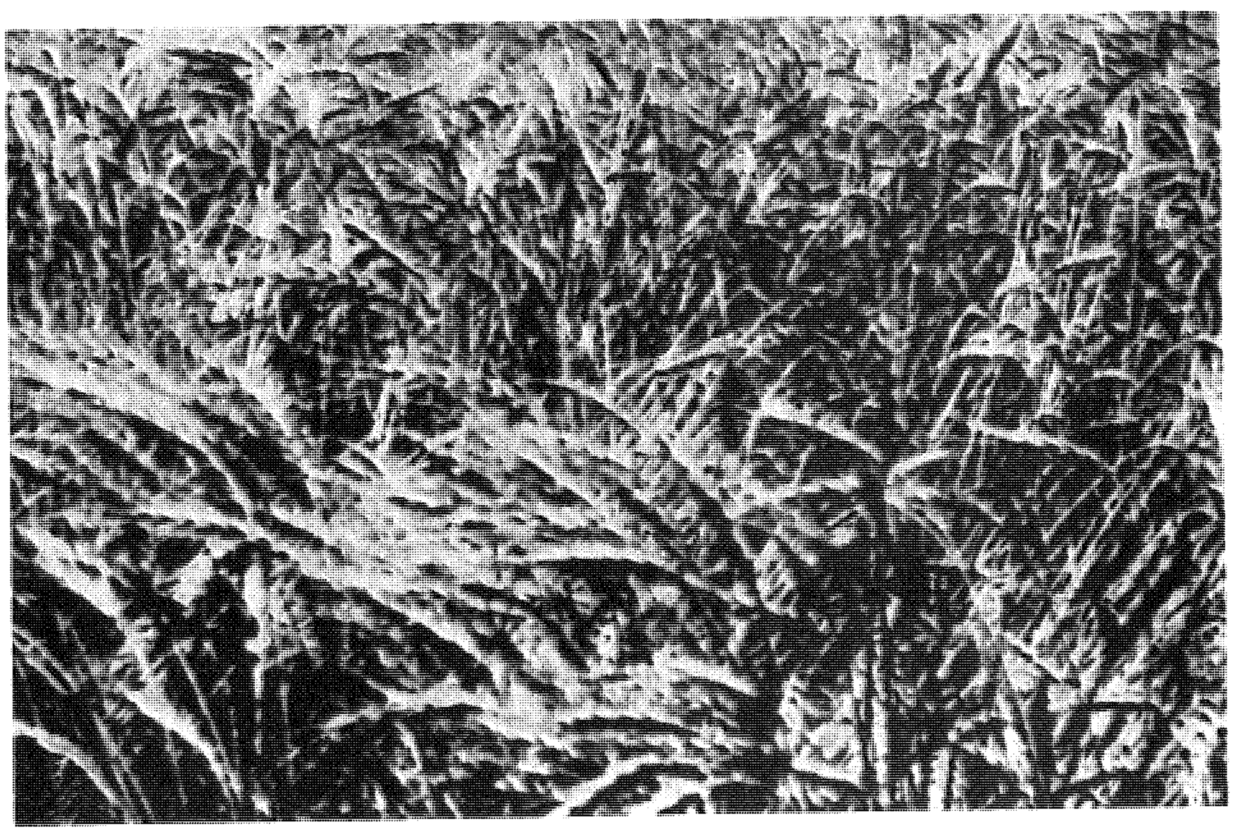

Table 12-A. Wheat Variety Results, Parsons, 1984.

Brand	Variety or Hybrid	1984 Yield	1982-84 Yield
		----- bu/a	-----
AGRIPRO	Mustang	57	- -
AGRIPRO	Hawk	54	38
AGRIPRO	Wings	60	46
AGRIPRO	Wrangler	64	- -
- - -	Arkan	67	54
Bounty	201	66	- -
Bounty	202	67	- -
Bounty	203	71	- -
Bounty	301	64	- -
Bounty	310	64	- -
- - -	Chisholm	61	- -
Garst	HR53	54	- -
Garst	HR64	56	- -
Hybrex	HW1010	60	- -
Hybrex	HW1019	51	- -
Hybrex	HW1030	54	- -
- - -	Newton	56	41
- - -	Payne	62	57
Pro Brand	830	57	55
- - -	TAM 105	63	49
- - -	TAM 107	70	- -
- - -	Vona	51	40
- - -	Hart	66	55
- - -	Pike	67	60
LSD .05		6	5

Table 12-B. Barley Variety Results, Parsons, 1984.

Variety	1984 Yield, bu/a	Height in.	Lodging %	Maturity
Kanby	48	41	100	May 18
Post	66	38	100	May 20
Dundy	59	32	100	May 20
Schuyler	76	36	25	May 22
LSD .05	14	2	5	

Barley conclusions: Schuyler, developed in New York, appears to have good yield potential with good straw strength.

Table 12-C. Spring Oats Variety Results, Parsons, 1984.

	Yield, bu/a		Test wt.	
Variety	1984	1981-84	lbs/bu.	Maturity
Bates	97	84	37	May 25
Lang	97	80	36	May 26
Larry	99	74	36	May 27
Ogle	105	--	34	May 29
LSD .05	8	--	2	

Spring oat conclusions: Bates has a somewhat higher yield potential, but Lang and Larry have stronger straw strength. Ogle has not been tested over enough years to determine its agronomic characteristics.

Selected Wheat Varieties Compared at Three Nitrogen Rates

The new semi-dwarf hard and soft wheat varieties have a high yield potential, but the effects of high nitrogen rates on yield and other agronomic traits have not been evaluated on the upland soils of southeastern Kansas.

Procedure: Beginning in 1980, selected hard and soft wheat varieties were compared at three levels of N (50, 100, and 150 lbs/a) at the Parsons field. Potassium was broadcast prior to planting at the rate of 75 lbs/a. Phosphate was banded with the seed at planting time (50 lbs/a). Nitrogen was applied in late winter as ammonium nitrate or urea. Since 1980, some varieties have been dropped and others added to the study. Wheat has been following soybeans in the cropping sequence on a new area each year of the study.

Results: Grain yields in 1984 followed the general trend of the past three years, with the highest yields being produced where N rates were 50 to 100 lbs/a (Table 13). Nitrogen rates over 100 lbs/a have lowered yields. McNair 1003, a soft wheat variety, has been the consistent high yielder. In 1984, TAM 105, Arkan, and Vona were the top hard wheat varieties.

Conclusions: When wet, cool conditions exist during late spring in southeastern Kansas, high nitrogen rates have been detrimental to grain yields. It may be that the higher N rates put more stress on the developing wheat plants or encourage a higher incidence of leaf diseases. For the upland soils, results show that 50 to 100 lbs/a of nitrogen is sufficient to produce 50 bu/a wheat.

Beginning in the fall of 1984, selected wheat varieties will be compared where N applications are split between fall and late winter to evaluate the efficiency of applied nitrogen.

Table 13. Selected Wheat Varieties Compared With 3 Levels of Nitrogen Fertilizer, Parsons Field, 1984.

Variety	Yield, bu/a Nitrogen Rate 50	100	150	Avg	Test Wt., lbs/bu Nitrogen Rate 50	100	150	Avg	Lodging, % Nitrogen Rate 50	100	150	Avg	Grain Protein, % Nitrogen Rate 50	100	150	Avg	Date Headed
	- - - lbs/a - - -				- - - lbs/a - - -				- - - lbs/a - -				- - - lbs/a - - -				
Hard Wheat																	
Newton	43.4	42.0	39.1	41.5	55	56	54	55	20	15	3	13	14.8	14.7	14.4	14.6	May 24
Vona	54.7	53.4	49.2	52.4	58	56	56	57	7	32	0	13	12.5	13.1	13.3	12.9	May 21
Payne	38.0	38.9	36.3	37.7	56	56	55	56	18	13	5	12	14.0	13.7	13.9	13.8	May 24
Pioneer PL145	40.3	37.1	35.8	37.7	53	55	53	54	57	30	32	39	14.5	14.6	14.8	14.7	May 24
Tam 105	55.6	50.6	48.5	51.6	57	56	56	56	18	20	5	14	13.6	14.5	14.0	14.0	May 23
AGRIPRO HAWK	51.9	47.6	45.4	48.3	56	55	55	55	8	25	10	14	14.0	14.4	14.4	14.3	May 23
ARKAN	54.4	52.0	45.9	50.7	57	56	58	57	83	94	77	85	14.2	14.0	14.7	14.3	May 20
PRO BRAND 830	42.6	42.5	40.3	41.8	55	56	55	55	2	0	0	1	14.2	13.7	13.8	13.9	May 25
Soft Wheat																	
McNair 1003	64.6	65.9	63.4	64.6	55	55	54	55	3	0	2	2	11.8	12.4	12.9	12.4	May 22
Pioneer 2553	50.2	48.1	45.9	48.1	55	55	55	55	0	3	2	2	13.2	13.5	13.3	13.3	May 23
MEANS	49.6	47.8	45.0		56	56	55		22	23	14		13.7	13.9	14.0		
LSD .05																	
Any comparison				4.4				2				27				0.9	
Same level of nitrogen				3.9				2				21				0.7	
Variety means				2.3				1				12				0.4	
Nitrogen means				2.4				N.S.				N.S.				N.S.	

Table 14. Selected Wheat Varieties Compared with 3 Levels of Nitrogen Fertilizer, Parsons Field, 1982-84.

	Yield, bu/a 2-yr avg (83-84) Nitrogen Rate				Yield, bu/a 3-yr avg (82-84) Nitrogen Rate			
Variety	50	100	150	AVG	50	100	150	AVG
	- - - lb/a - - -				- - - lb/a - - -			
Hard Wheat								
Newton	35.0	29.7	26.1	30.3	38.4	35.6	32.3	35.4
Vona	41.3	38.2	36.4	38.6	44.7	43.2	41.2	43.0
Payne	42.3	46.7	42.8	43.9	43.5	47.5	44.6	45.2
Pioneer PL 145	30.7	23.6	26.6	27.0	37.9	33.9	34.0	35.3
Tam 105	43.8	41.4	35.4	40.2	48.7	47.0	42.4	46.0
Agripro Hawk	34.3	28.3	28.9	30.5	- -	- -	- -	- -
Arkan	44.1	42.6	39.1	41.9	- -	- -	- -	- -
Pro Brand 830	50.6	44.9	42.7	46.1	- -	- -	- -	- -
Soft Wheat								
McNair 1003	76.4	73.0	70.4	73.3	75.2	71.9	71.4	72.8
Pioneer 2553	60.9	51.3	49.8	54.0	- -	- -	- -	- -
MEANS	45.9	42.0	39.8		48.1	46.5	44.3	

Selected Wheat Varieties Compared at Two Planting Dates and Three Seeding Rates

Wheat is planted over an extended period from late September into November in southeastern Kansas because of the various cropping sequences. Wheat may be planted early on land that had been in wheat or on land where grain sorghum and early maturing soybeans were harvested. Later planted wheat ususally follows a full-season soybean crop, which may not be harvested until late October. The agronomic effects of planting dates and varying seeding rates need to be evaluated for the cropping conditions of the area.

Procedure: Four selected wheat varieties representative of a hard red winter, a soft red winter, and a hybrid selection were planted at the Parsons field in early October and mid-November in 1983 at three seeding rates - 60, 90, and 120 lbs/a. Fertilizer rate was 70 lbs N, 70 lbs P_2O_5, and 70 lbs K_2O per acre.

Results: Nearly all varieties yielded significantly more when planted early and seeded at the 60 lb/a rate. Arkan, Tam 105, and Bounty 310 seemed to be affected more by the higher plant populations than the soft wheat, Caldwell. For the early planting date, as seeding rates were increased over 60 lb/a, grain yields declined and lodging increased. Lodging of Arkan was especially severe at the higher seeding rates.

At the later planting date in mid-November, all varieties yielded more when the seeding rate was increased to 90 lbs/a. Grain yield of Bounty 310, a hybrid, was significantly lower at the late planting date than that of the other three varieties. This may have been due to the later maturity of Bounty 310, which extended the grain filling period into the season when air temperature was getting higher.

Conclusion: High plant populations have a negative effect on grain yields when wheat is planted in early October. A higher seeding rate, however, is beneficial when wheat is planted in November and less tillers are produced per plant.

An expended study is planned in 1985 to evaluate the agronomic effect of planting dates and seeding rates where wheat follows wheat or short-season and full-season soybeans.

Table 15. Selected Wheat Varieties Compared at Two Planting Dates and Three Seeding Rates, Parsons Field, 1984.

Variety or Hybrid	Yield, bu/a Seeding Rate 60	90	120	AVG	Test Wt., lbs/bu Seeding Rate 60	90	120	AVG	Lodging, % Seeding Rate 60	90	120	AVG	Heading Date
	- - lbs/a - - -				- - lbs/a - - -				- - lbs/a - - -				
Early Planting Date - October 3													
Arkan	67.4	60.0	51.5	59.6	59	60	60	60	33	78	83	65	May 13
Tam 105	64.0	61.7	58.0	61.2	60	59	59	59	0	5	10	5	May 17
Bounty 310	75.2	71.8	64.0	70.3	61	61	60	61	0	0	0	0	May 18
Caldwell	75.0	77.8	70.5	74.5	60	59	59	59	0	10	15	8	May 16
Means:	70.4	67.8	61.0	- -	60	60	60	--	8	23	27	--	- - - -
Late Planting Date - November 18													
Arkan	54.6	53.6	50.5	52.9	58	59	58	59	22	43	67	44	May 20
Tam 105	49.0	55.0	53.4	52.5	57	57	57	57	0	0	7	2	May 23
Bounty 310	38.8	38.4	37.5	38.2	55	55	55	55	0	0	5	2	May 25
Caldwell	54.4	62.6	60.1	59.1	57	57	58	57	0	0	7	2	May 22
Means:	49.2	52.4	50.4	- -	57	57	57	--	5	11	21	--	- - - -

LSD .05 (Yield) = Among the same planting date and seeding rate = 6.4 bu/a.
Among the same planting date and variety = 5.8 bu/a

(Test wt.) = Among variety means at the same planting date = 1.0 lbs/bu.

(Lodging) = Among the same planting date and seeding rate = 5%.
Among the same planting date and variety = 4%.

Agronomic Effects of Three Different Wheat and Soybean Cropping Sequences on Crop Yields

In southeastern Kansas, wheat and soybeans are the sole cash crops for many producers, who do not grow feed-grain crops like milo or corn. They are typically grown in three different types of cropping sequences - (1) continuous doublecropping, (2) doublecropping once every two years, or (3) full-season crops with no doublecropping.

The objectives of this study were (1) to determine the agronomic effects of continuous doublecropping soybeans after wheat and (2) to determine the amount of nitrogen contributed to the wheat crop by the soybeans in different cropping sequences.

Procedure: Beginning in 1982, a cropping rotation study involving wheat and soybeans was established at the Parsons field with a silt loam soil type. Three different cropping sequences were initiated - (1) wheat - doublecrop soybeans, (2) wheat - doublecrop soybeans - full season soybeans, and (3) wheat - wheat - full season soybeans. Essex is used for the full season variety and Crawford or Sparks for the shorter maturing variety in doublecropping treatments. Wheat straw has been burned and disced where soybeans were doublecropped.

All fertilizer was applied to the wheat crop in each of the cropping sequences. Phosphorus (75 lbs/a P_2O_5) and potassium (75 lbs/a K_2O) were broadcast and incorporated prior to planting.

Five nitrogen treatments (0, 25, 50, 75, 100 lbs/a) were included as sub-plots for each of the main cropping sequence plots. Nitrogen was applied as urea in late winter.

Wheat has been harvested for grain yield from each of the N subplots, while soybean yields have been averaged over all N treatments.

Results: Wheat yields from 1982-84 have not been significantly affected by the different cropping sequences. Wheat has responded to N treatments, with 50 and 75 lbs/a of N producing the top yields. Wet and cool conditions in late spring have not been very favorable for growing wheat the past few years.

Severe summer drought conditions in 1984 affected soybean yields dramatically. Doublecrop soybeans were essentially a complete failure and full-season soybeans yielded only 10 and 12 bu/a. Soybean yields from 1981-84, however, shows only a four to five bushel difference between doublecrop and full-season soybeans. Full-season soybeans in 1982 and 1983 were lower than normal because of dry conditions during the reproductive stage of development.

Conclusions: More data are needed before any valid conclusions are made regarding the agronomic effects of doublecropping or how wheat yields are influenced by cropping rotations and applied nitrogen rates.

Table 16. Effects of Wheat and Soybean Cropping Sequences at Varying Nitrogen Levels on Wheat Yields, Parsons, 1982-1984.

Cropping Sequence 1/	Wheat Yield, bu/a Nitrogen Rate 0	25	50	75	100	AVG
	- - - -	- - - -	lbs/a	- - - -	- - - -	- - - -
[Wheat* - soybean]	45.2	51.7	56.6	57.1	54.0	52.9
[Wheat* - soybean] - soybean	49.1	54.2	58.4	56.9	54.5	54.6
Wheat - Wheat* - soybean	46.9	51.4	56.5	56.1	52.8	52.9
Means:	47.2	52.2	56.8	56.4	53.9	

LSD.05 : Comparing N levels horizontally within the same cropping sequence = 1.6 bu/a

Comparing N levels between cropping sequences = 2.1 bu/a

1/ Crops enclosed within [ ] represent doublecropping.

(*) Indicates the crop for which yields are reported.

Table 17. Effects of Wheat and Soybean Cropping Sequences on Soybean Yields, Parsons Field, 1981-84.

Cropping Sequence 1/	Soybean Yield, bu/a 1984	1981-84
[Wheat - soybean*]	2.1	15.5
[Wheat - soybean*] - soybean	2.0	15.0
[Wheat - soybean] - soybean*	11.1	19.2
Wheat - wheat - soybean*	12.8	19.5
LSD .05	2.9	1.5

1/ Crops enclosed within [ ] represent doublecropping.

(*) Indicates the crop for which yields are reported.

Effects of Cropping Sequence on Soybean Yields

Soybeans are the major cash crop for many farmers in southeastern Kansas. Typically, they are grown in several cropping sequences with wheat and grain sorghum, or in a doublecropping rotation with wheat. More information is needed to determine the agronomic effects of cropping sequences on soybean yields.

Procedure: In 1979, four cropping rotations were initiated at the Columbus field: (1) wheat - doublecrop soybeans - soybeans, (2) wheat - fallow - soybeans, (3) grain sorghum - soybeans, and (4) continuous soybeans. Essex variety of soybeans was used in all cropping rotations. Fertilizer was applied only to the wheat or grain sorghum crop, with the exception of continuous soybeans, which were fertilized annually.

Results: Yield results of the four cropping sequences are shown in Table 18. Three-year yield averages (1980-82-84) for full-season soybeans show significantly lower yields for the continuous soybean rotation compared with the wheat and grain sorghum rotations. Average results may have been greater, but 1984 soybean yields were nearly equal for all cropping sequences because of the drought conditions from mid-June through September.

Conclusions: More data are needed on how various cropping sequences affect soybean yields, especially where soybeans are grown continuously. Rotating soybeans with wheat, grain sorghum, or corn, however, is beneficial for higher production.

This study will be continued for several more years to monitor soil nutrient levels and possible plant disease problems.

Table 18. Effects of Cropping Sequence on Soybean Yield, Columbus Field.

Cropping Sequence 1/	Fertilizer N P_2O_5 K_2O	Yield 1979-81-83	Yield 1980-82-84
	- - lbs/a - -	- - - - - bu/a	- - - - -
Wheat -	80 - 80 - 80	52.4	
Doublecrop soybean		18.6	
Soybean			17.5 ab
Grain sorghum -	80 - 80 - 80	95.2	
Soybean			18.2 ab
Wheat	80 - 80 - 80	52.7	
Soybean			18.9 b
Soybean (continuous)	0 - 40 - 40	28.0	16.5 a

a,b Means with different superscripts differ significantly ($P < .05$).

1/ Fertilizer applied only to wheat or grain sorghum except for continuous soybeans, which receive a yearly application of phosphorus and potassium.

Soybean variety: Essex.

Wheat and Soybean Yields Compared in a Long-term Fertility and Cropping Rotation

Wheat and soybeans are the major cash crops in much of southeast Kansas. Doublecropping soybeans after wheat, as well as growing three crops in 2 years (wheat - doublecrop soybeans - full season soybeans) is a common practice. Fertility requirements for wheat and soybeans in these systems have not been fully determined over a long period.

Procedure: The current cropping rotation consists of growing three crops in 2 years - (wheat - doublecrop soybeans - full season soybeans). All of the fertilizer is applied to the wheat crop, including various rates of phosphorus and potassium and a constant rate of 70 lbs/a of nitrogen for all treatments. Manure has been a residual fertility treatment since 1982. Lime has been applied as needed to keep soil pH near 6.8.

Results: The highest wheat and soybean yields have been from the plots that have received a balanced fertility program. As of this date, the higher fertility rates of P and K have not increased grain yields over the lower level of 50 lbs/a. Residual manure treatments that have received additional P and K yield the highest, mainly because of higher levels of soil P.

Conclusions: Where cropland in southeastern Kansas is intensively farmed, such as growing three crops in two years, soil fertility levels should be monitored closely in order to maintain adequate nutrition for the growing crops. In the low fertility soils of southeastern Kansas, lime and phosphorus are probably the most limiting nutrients for normal yield conditions, however, potassium also is needed to give a balance fertility program so that maximum yields can be obtained.

Table 19. Wheat and Soybean Yields Compared in a Long-Term Fertility and Cropping Rotation, Columbus Field.

Fertility Treatments 1/	1984 Wheat Yield	1984 Wheat Test wt.	1981-84 Yield
	bu/a	lbs/bu	bu/a
Lime	20	55	13
Lime + 75 P_2O_5	39	59	33
Lime + 50 P_2O_5 + 50 K_2O	41	58	43
Lime + 75 P_2O_5 + 75 K_2O	44	58	43
Lime + 100 P_2O_5 + 100 K_2O	48	59	45
Lime + manure	51	60	45
Lime + manure + 75 P_2O_5	54	60	49
Lime + manure + 75 P_2O_5 + 75 K_2O	55	59	49
No lime or fertilizer	12	54	11

1/ All plots received 75 lbs/a of nitrogen.

Fertility Treatments 1/	Soybean yield 1984	Soybean yield 1982-84	Soil test 2/ Avail P	Soil test 2/ Exch K
	- - - bu/a - - -		- - - lbs/a - - -	
Lime	3	13	8	90
Lime + 75 P_2O_5	5	16	29	85
Lime + 50 P_2O_5 + 50 K_2O	6	18	30	150
Lime + 75 P_2O_5 + 75 K_2O	5	17	29	155
Lime + 100 P_2O_5 + 100 K_2O	5	18	26	120
Lime + manure	6	18	20	140
Lime + manure + 75 P_2O_5	8	20	64	140
Lime + manure + 75 P_2O_5 + 75 K_2O	12	25	42	180
No lime or fertilizer	6	10	7	70

1/ Fertilizer applied to the wheat crop in a wheat - doublecrop soybean - full season soybean rotation. Manure is a residual fertility treatment.

2/ Soil samples taken in the fall of 1983 after the doublecrop soybean crop.

Comparison of Tillage Methods for Doublecrop Soybeans after Wheat

Producers in southeastern Kansas typically grow doublecrop soybeans after wheat, where soil moisture and time permit. Various tillage methods are used, depending to some degree on the type of equipment that is available. The primary goals of doublecropping are to plant soybeans as quickly as possible after wheat harvest and produce acceptable grain yields as economically as possible. The long-term agronomic effects of doublecrop tillage methods, however, should also be considered.

Procedure: Beginning in 1982, four tillage methods have been compared for doublecrop soybeans after wheat harvest at the Columbus field. Tillage methods were (1) plow under stubble, (2) disc stubble, (3) burn stubble and then disc, and (4) plant no-till in stubble. Grain yield and soil moisture data have been collected from the tillage treatments. The tillage study is alternated each year between two different sites where the cropping rotation is wheat - doublecrop soybeans - full season soybeans.

Results: Grain yield was not collected in 1984 because of the drought condition that existed from mid-June through September. Initial stands were best in the burned plots that had been disced and in the plowed areas, while the disced stubble and no-till planting had the poorest stands. At the mid-bloom stage in mid-August, there was no significant difference in soil moisture at the 4- to 8-inch and 8- to 12-inch depth for the plowed, burned, or disced treatments. The no-till plot had the highest soil moisture, which would be expected. Table 20 shows the yield results of 1982-83.

Conclusions: More data is needed before valid tillage comparisons can be made for doublecrop soybeans after wheat.

Table 20. Comparison of Tillage Methods for Doublecrop Soybeans, Columbus Field.

Tillage Method	Yield, bu/a 1982	1983
Plow, disc, field cult., plant	26.1	25.2
Burn, disc, field cult., plant	25.8	24.2
Disc (2X), plant	26.6	23.2
Plant no-till	26.3	20.5
LSD 0.05	ns	3.6

No yield data in 1984 because of poor stands and summer drought conditions.

Comparisons of Date and Rate of Metribuzin Herbicide for Velvetleaf Control in Soybeans on Light-Textured Soils

Broadleaf weeds, such as velvetleaf, are a problem in many soybean fields in southeastern Kansas. On light-textured, silt loam soils with less than 1.5% organic matter, the application rate of metribuzin herbicide (Sencor/ Lexone) is critical in order to obtain control of broadleaf weeds without causing excessive soybean injury. A split-shot method of metribuzin application (part applied preplant and a second application after planting but before soybean emergence) has been promoted in order to obtain better broadleaf weed control with less injury to the soybean plant. This method has not been fully evaluated for the light-textured soils of southeastern Kansas.

Procedure: Metribuzin was applied either three weeks prior to planting, immediately before planting, right after planting, or as a split-shot application. Application rates were 0.25, 0.38, 0.50, and 0.62 lbs/a of active ingredient (metribuzin). Preplant treatments were incorporated with a field cultivator equipped with a tine mulcher. Several other soybean herbicides were applied preplant, preemerge, and postemerge to compare with metribuzin for velvetleaf control. The plot area had a silt loam texture with 1.0 to 1.5% organic matter and heavily infested with velvetleaf.

Results: Weed control and yield results are shown in Table 21. Because of the severe dry summer and charcoal rot disease problem associated with the drought conditions, grain yields were low and some what variable. The yields, however, were generally correlated directly with the degree of velvetleaf control.

The split-shot application of metribuzin gave the most consistent full-season control of velvetleaf. Where 0.38 lb metribuzin was applied 3 weeks before planting, a preemerge rate of 0.12 lb was as good as the higher rate of 0.25 lb metribuzin. When the lower rate of 0.25 lb metribuzin was applied 3 weeks before planting, the higher preemerge rate of 0.25 lb was needed for good velvetleaf control. If 0.25 lb or 0.38 lb metribuzin were incorporated immediately before planting, velvetleaf control was still satisfactory in 1984, although applying another 0.12 of 0.25 lb preemerge after the lower 0.25 lb rate of metribuzin applied preplant gave better full-season velvetleaf control.

Because of dry soil conditions in July, the postemerge treatments of Amiben and Basagran gave poor weed control. The preplant incorporated herbicide named Reward provided good velvetleaf control in 1984.

Conclusion: After two years, data indicate that a split-shot application of metribuzin is beneficial where velvetleaf is a major weed problem in soybean fields of southeastern Kansas. This study will be done again in 1985 to gather more information over varying climatic conditions.

Table 21. Comparisons of Soybean Herbicides and Time of Application for Velvetleaf Control, Columbus Field, 1984.

Herbicide Treatment	Rate a.i./A	When Applied	Yield bu/a	Vele Control, % Aug 1	Oct 1
Lexone-DF	.62	21-day preplant	7.1	92	84
Lexone-DF	.50	21-day preplant	6.0	87	72
Lexone-DF	.38	21-day preplant	6.2	83	70
Lexone-DF	.38	preplant	7.1	99	96
Lexone-DF	.38	preemerge	7.2	78	79
Lexone-DF	.25	21-day preplant	4.5	58	37
Lexone-DF	.25	preplant	6.1	95	87
Lexone-DF	.25	preemerge	6.6	47	45
Lexone-DF	.38 + .12	21-day preplant + preemerge	6.1	95	92
Lexone-DF	.38 + .12	preplant + preemerge	6.8	99	99
Lexone-DF	.38 + .25	21-day preplant + preemerge	8.0	96	96
Lexone-DF	.38 + .25	preplant + preemerge	7.2	99	96
Lexone-DF	.25 + .12	21-day preplant + preemerge	6.6	80	77
Lexone-DF	.25 + .12	preplant + preemerge	8.4	95	92
Lexone-DF	.25 + .25	21-day preplant + preemerge	7.4	98	96
Lexone-DF	.25 + .25	preplant + preemerge	9.4	94	91
Lexone-DF + Lorox-L	.25 + .25	preemerge	8.0	83	78
Lexone-DF + Lorox-L	.25 + .38	preemerge	6.5	75	73
Basagran + oil	1.0 + 1%	postemerge	6.5	78	67
Amiben-DF + oil	2.4 + 1%	postemerge	5.3	50	42
Reward	2.4	preplant	7.6	98	85
Cultivation	- -	- - -	4.5	40	30
No herbicide	- -	- - -	3.6	0	0
LSD .05			2.8	14	18

Preplant (21-day) = May 31, preplant = June 20, preemerge = June 20, and postemerge = July 18.

Variety: Essex

There were no significant herbicide injury effects from the treatments.

Comparison of Postemerge Herbicides for Cocklebur Control in Soybeans Planted in Narrow and Wide Row Spacings

Cocklebur is one of the major problem weeds in many of the soybean fields of southeastern Kansas. It is a strong competitor for available water, light, and nutrients. Of the herbicides that are currently available, the postemerge type has given more consistent control of cockleburs. Various postemerge soybean herbicides are available to control cockleburs at different growth stages, but the length of weed competition affects soybean yields. Some herbicides also tend to cause more leaf burning, which may affect yields when the herbicides are applied near the flowering stage. The effect of row widths may influence the competition of cockleburs, depending on the time of herbicide application.

Procedure: Ten postemerge soybean herbicides were compared in 1984 at the Columbus field. The herbicide treatments were applied to each of three main blocks, which consisted of narrow rows (7-inch), wide rows (30-inch), and wide rows that were cultivated once. Herbicides were applied when the cockleburs were from 4 to 6 inches tall until they reached approximately 24 inches.

Results: Grain yields were very low because of drought conditions in 1984 and charcoal rot disease problems associated with the dry weather at the pod filling stage. Herbicide treatments that were cultivated were significantly higher in grain yield. Basagran treatments that were applied in late June were more effective than later treatments because of the dry soil conditions at the later application dates. Salvage type treatments were essentially a failure in 1984. Cocklebur control was better in narrow rows than the uncultivated wide rows. Evidently, the shading and canopy effect of the narrower rows reduced the cocklebur competition.

Conclusions: This study will be continued in 1985 to collect more agronomic and herbicide information on how cockleburs compete with soybeans in different row spacings and what the competitive effects are over a given period of time.

Table 22. Comparison of Postemerge Herbicides for Cocklebur Control in Soybeans Planted in Narrow and Wide Row Spacings, Columbus Field, 1984.

Herbicide Treatment	Rate, a.i./A	Appl. Time (Days after planting)	Yield, bu/a Row Spacing			Cocklebur Control, % Row Spacing			Crop Injury Row Spacing		
			Narrow	Wide	Wide + Cult.	Narrow	Wide	Wide + Cult.	Narrow	Wide	Wide + Cult.
Basagran + AG-98	.5 + 1/4 %	13	2.2	4.9	8.7	83	73	93	1.4	1.3	1.4
Basagran + 2,4-DB + AG-98	.5 + .03 + 1/4 %	13	2.5	1.8	6.8	88	77	98	1.5	1.4	1.4
Basagran + AG-98	.75 + 1/4 %	13	2.0	2.8	6.5	89	81	97	1.7	1.6	1.4
Basagran + 2, 4-DB + AG-98	.75 + .03 + 1/4 %	13	3.8	4.0	7.2	89	79	99	1.5	1.6	1.7
Basagran + Blazer + AG-98	.5 + .25 + 1/4 %	13	2.1	2.2	7.4	84	65	97	2.5	2.3	2.5
Dyanap	2.25	20	1.1	1.0	4.6	67	52	83	2.8	2.8	2.7
Basagran + AG-98	1.0 + 1/4 %	34	0.3	1.0	1.6	38	40	63	1.2	1.2	1.2
Basagran + 2,4-DB + AG-98	1.0 + .03 + 1/4 %	34	0.8	1.0	1.8	45	37	67	1.3	1.2	1.2
Dyanap + 2,4-DB	3.0 + .03	34	0.3	0.8	0.8	47	43	58	2.2	2.1	2.0
Rescue + COC	1.55 + 1/2 %	42	0.4	1.0	1.5	50	50	65	3.5	3.5	3.5
No herbicide	- - -	--	0.1	0.1	0.2	0	0	27	0	0	0
Means:			1.4	1.9	4.3	62	54	77	1.8	1.7	1.7
LSD .05	Row spacing			1.6			11			n.s.	
	Herbicide treatments			1.4			8			0.14	
	Row sp x herb trt interaction			- -			n.s.			n.s.	
	Same row spacing			2.4			- -			- -	
	Any comparison			2.7			- -			- -	

Planted: June 6
Variety: Essex
Post Herbicide treatments: June 19 & 26, July 10 & 18
Weed control rating: Oct 5
Crop injury rating: 5 days after each herbicide application
0 = no injury, 10 = dead plants

Herbicide Systems Compared For Weed Control in Soybeans With Narrow and Wide Row Spacings

Soybeans producers now have a good selection of available herbicides to apply for annual grass and broadleaf weed control. Herbicides can now be applied before planting with a tillage operation, after planting but before crop emergence, or after the crop and weeds have emerged. The particular method and time of application depends upon the herbicides selected, the weed species present, the climatic conditions, and the individual producer's management and labor scheme. More information is needed on how these different herbicide systems compare in wide and narrow row spacings for weed control in the soybean fields of southeastern Kansas.

Procedure: In 1984, 10 herbicide treatments were compared for annual grass and broadleaf weed control in a split-plot design at the Columbus field. The three main treatments included a narrow row spacing (7-inch), a wide row spacing (30-inch), and a wide row spacing (30-inch) that was cultivated. The herbicide treatments were applied to each of the three main row spacing blocks. The treatments were selected to be representative of the different methods of herbicide application - incorporated preplant, preemerge, postemerge, or combinaions of these.

Results: Grain yields were severely affected by the drought of 1984 and charcoal rot disease problems associated with the dry soil conditions at the reproductive stage of plant development. Although not statistically significant, there was a trend for higher yields in 30-inch rows that were cultivated. There were no significant differences in yield between the various herbicide methods, although grass and broadleaf weed control ratings varied among treatments.

Conclusions: This study will be continued for several more years to gather more information on how the various herbicide systems compare in different row spacings and climatic conditions.

Table 23. Herbicides Systems Compared for Weed Control in Soybeans with Narrow and Wide Row Spacings, Columbus Field, 1984.

Herbicide Treatment	When Applied	Rate, a.i./A	Yield, bu/a Row Spacing Narrow	Wide	Wide + Cult.	Broadleaf Control, % Row Spacing Narrow	Wide	Wide + Cult.	Grass Control, % Row Spacing Narrow	Wide	Wide + Cult.	Crop Injury Row Spacing Narrow	Wide	Wide + Cult.
Treflan + Lexone	PPI	.75+ .38	8.0	7.0	11.6	86	88	98	95	95	98	0	0	0
Dual + Lexone	Shal. PPI	1.5 + .38	6.8	7.0	10.9	87	89	98	96	96	98	0	0	0
Dual + Lexone	Pre	1.5 + .25	5.3	8.0	11.1	95	96	98	98	98	98	0	0	0
Verdict + Blazer + Basagran	Post	.06 + .25 + .5	7.6	6.3	10.4	90	89	98	90	90	98	2.3	2.3	2.5
Treflan + Lexone + Lexone	PPI + Pre	.75 + .25 + .25	9.5	7.2	9.2	98	98	98	95	95	98	1.6	1.7	1.4
Lexone + Basagran	Pre + Post	.25 + .5	6.3	8.3	10.1	95	95	98	89	90	98	1.4	1.4	1.3
Treflan + Blazer + Basagran	PPI + Post	.75 + .25 + .5	8.6	7.8	9.6	95	95	98	94	96	98	1.7	1.5	1.7
Treflan	PPI	.75	9.3	6.9	9.2	90	90	98	96	97	98	0	0	0
Lexone	Pre	.38	6.2	7.3	10.0	95	95	98	89	89	98	0	0	0
Blazer + Basagran	Post	.25 + .5	8.0	6.8	10.3	96	92	98	22	18	95	1.7	1.8	1.6
No herbicide	- -	- - - -	6.2	5.3	9.6	0	0	92	0	0	88	0	0	0
Means			7.4	7.1	10.2	84	84	97	79	79	97	0.8	0.8	0.8
LSD .05 Row spacing				n.s.			--			--			n.s.	
Herbicide treatments				n.s.			--			--			0.2	
Row sp. X herb. trt. interaction				- -									n.s.	
Any comparison				6.5			2			3				
Comparison in the same row spacing				2.0			2			3				

Planted: June 6, 1984
Variety: Essex
Herbicide treatments: PPI = June 6, Pre = June 7, Post = June 28
Cultivated: July 3
Weed rating: August 1
Crop injury rating: June 20 and July 5 (0 = no injury; 10 = dead plants)
Weed species: Large crabgrass and smooth pigweed

Soybean Herbicides Compared For Annual Grass and Broadleaf Weed Control

There are many preplant, soil-incorporated, preemergence, and post-emergence herbicides that selectively control annual grass and many broad-leaf weeds in soybeans. Varying climatic conditions, soil types, and application rates affect herbicide performance. Herbicide performance studies are useful to compare the currently labelled products under the climatic conditions of southeastern Kansas.

Procedure: Thirty soybean herbicides were compared on a silt loam soil at the Columbus field in 1984. Herbicide treatments were applied in 20 gallons per acre of water.

Results: Grain yields from the various herbicide treatments were not taken because of the summer drought and a severe charcoal rot disease problem. The preemerge treatments were activated by rainfall within one week of application and provided the best overall broadleaf and grass control. Post-emerge treatments generally were ineffective for crabgrass control because of the extremely dry soil conditions at the time of application. Soil incorporated treatments, also, were not as effective as preemerge applications.

Conclusions: Yearly climatic conditions affect herbicide performance especially in a summer drought like that of 1984. Methods of application and rates of newer products will continue to be compared against standard soybean herbicide products for annual weed control in southeastern Kansas.

Table 24. Soybean Herbicides Compared for Annual Grass and Broadleaf Weed Control, Columbus Field, 1984.

Herbicide Treatment	When Applied	Rate a.i./a	Weed Control, % Smpw	Lacg
Treflan + Lexone	PPI	.75 + .38	90	92
Prowl + Lexone	PPI	1.0 + .38	94	91
Sonalan + Lexone	PPI	.75 + .38	87	90
Treflan + Reward	PPI	.75 + 2.3	86	90
Prowl + Reward	PPI	1.0 + 2.3	92	93
Treflan + Lasso	Shal. PPI	.75 + 2.0	80	83
Treflan + Dual	Shal. PPI	.75 + 1.5	83	88
Treflan + Lexone	Shal. PPI	.75 + .25	83	86
Treflan + Blazer + Basagran	PPI + Post	.75 + .25 + .5	93	88
Prowl + Blazer + Basagran	PPI + Post	1.0 + .25 + .5	89	87
Sonalan + Blazer + Basagran	PPI + Post	.75 + .25 + .5	83	81
Lasso + Lexone	Shal. PPI	2.0 + .38	88	84
Dual + Lexone	Shal. PPI	1.5 + .38	90	87
Lasso + Blazer + Basagran	Shal. PPI + Post	2.0 + .25 + .5	95	84
Dual + Blazer + Basagran	Shal. PPI + Post	1.75+ .25 + .5	94	89
Lasso + Lexone	Pre	2.0 + .25	97	97
Dual + Lexone	Pre	1.5 + .25	99	99
Surflan + Lexone	Pre	.75 + .25	98	98
Lasso + Lorox	Pre	2.0 + .5	96	97
Dual + Lorox	Pre	1.5 + .5	98	98
Surflan + Lorox	Pre	.75 + .5	98	93
Dual + Lexone + Lorox	Pre	1.5 + .25 + .5	98	98
Lexone + Lorox	Pre	.25 + .5	96	95
Lexone	Pre	.38	95	90
Lasso + Amiben	Pre	2.0 + 1.8	94	95
Poast + Blazer + Basagran	Post (seq)	.2 + .25 + .5	83	73
Fusilade + Blazer + Basagran	Post (seq)	.25 + .25 + .5	85	67
Verdict + Blazer + Basagran	Post (seq)	.18 + .25 + .5	92	70
Assure + Blazer + Basagran	Post (seq)	.06 + .25 + .5	88	70
Blazer + Basagran	Post	.25 + .5	84	10
Cultivated	- - -	- - -	65	65
LSD .05			6	7

Planted: June 4, 1984

Variety: Essex

Herbicide treatments:

PPI and Shal. PPI = June 4

Pre = June 5

Post = June 26 and July 3

Weed rating: August 1

Weed species = Smooth pigweed and large crabgrass

No grain yields taken because of summer drought and a severe charcoal rot disease problem.

Grain Sorghum Hybrids Compared

Grain sorghum performance trials are designed to evaluate hybrids from private seed companies for grain yield and overall performance under southeastern Kansas climatic conditions.

Procedure: In 1984, 78 hybrids were compared at the Parsons field under dryland conditions. Hybrids were planted in 30-inch rows on May 4 and hand thinned to 24,000 plants per acre. Fertilization rate was 125 lbs N, 50 lbs P_2O_5 and 50 lbs K_2O per acre. Ramrod-atrazine was applied for weed control and Furadan was banded at planting for greenbug control. Plots were harvested August 24.

Results: Average grain yield for all hybrids was 59 bu/a, with a range from 80 to 37 bu/a. Drought conditions existed from mid-June through August. Nearly all hybrids headed-out well, but soil moisture was rapidly depleted during grain formation. Plots were harvested before lodging became severe.

Conclusions: Complete results of grain sorghum yields for Kansas in 1984 are compiled in Agric. Expt. Station Report of Progress No. 465.

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BASF Wyandotte Corporation
Cargill Seeds
CIBA-GEIGY Corporation
Columbus Chamber of Commerce
Dow Chemical Company
DuPont Agrichemical Company
Elanco Products Company
I. C. I. Americas Inc.
Kansas Soybean Commission
Monsanto Agricultural Products Co.
Pioneer Hi-Bred Intl., Inc.
Rohm and Haas Co.
Uniroyal Chemical Company

Cooperation of the following agricultural scientists and individuals is appreciated:

Gary Kilgore, SEK Area Extension Agronomist, Chanute.
K. Kissel, soil fertility research scientist, Dept. of Agronomy, KSU, Manhattan.
D. Shaffer, land owner of the Columbus Experimental Unit.
T. L. Walter, crops research scientist, Dept. of Agronomy, KSU, Manhattan.
D. A. Whitney, research soil chemist, Dept. of Agronomy, KSU, Manhattan.

CROP VARIETAL DEVELOPMENT

George V. Granade

Soybean Variety Performance Test

Southeastern Kansas had 30 percent of the state's soybean acreage. Developing and testing varieties that are adapted to the area is of prime importance to the area farmers.

Procedures: In 1984, 18 soybean varieties from maturity group III, 22 soybean varieties from maturity group IV, and 13 soybean varieties from maturity group V were planted in 30-inch rows on 14 June at the Columbus field.

Results: Adequate moisture for good growth existed throughout June; however, conditions were extremely dry during the later part of July, August, and most of September. Most varieties were affected by charcoal rot. Yields of some commonly grown and new varieties are shown below. Complete variety results are compiled in Agric. Expt. Stn. Report of Progress 466.

Brand	Variety	Maturity Group	1984 Yield	1982-84 Yield
			-bu/a-	-bu/a-
	Zane	III	16.3	- - -
Fontanelle	5454	III	16.2	- - -
	Forrest	V	16.1	21.2
	Narow	V	15.8	- - -
Merschman	Dallas	IV	15.8	- - -
Coker	393	III	15.4	- - -
NeCo	1000	III	15.4	- - -
Jacques	J-130	III	15.4	- - -
Pioneer	5482	V	15.3	- - -
	Crawford	IV	13.9	16.0
	Pershing	V	13.6	- - -
	Essex	V	13.5	18.1
	Sparks	IV	13.4	- - -
	Bay	V	12.6	21.8
	Douglas	IV	12.1	13.2

Conclusions: Maturity group V varieties have given the most consistent high yields in southeastern Kansas. In earlier maturing varieties, yields are often reduced from drought stress and charcoal rot.

Maturity Group V and VI Soybean Varieties

Many soybean varieties in maturity group V are not currently tested in southeastern Kansas. Private industry has not promoted soybeans in maturity group V in the area. The possibility exists that maturity group VI soybean varieties may be grown.

Procedure: Soybean varieties from maturity group V and VI were obtained and planted at the Columbus field. Planting was 14 June in 30-inch rows with eight viable seeds per foot in linear row (139,400 seeds per acre).

Results: Soybean yields ranged from 2 to 11 bushels per acre with Bay being the highest yielding variety (Table 25). Soybean varieties from maturity group V resulted in higher yields than maturity group VI varieties. Coker 156 was the highest yielding in maturity group VI (Table 25).

Conclusions: More testing of both maturity group V and VI soybean varieties needs to be done. By planting the maturity group VI soybeans in mid-May instead of mid-June, yields may be increased. Yields were decreased for both maturity groups because of drought stress and an earlier than normal frost.

Table 25. Maturity Group V and VI Soybean Varieties Yields and Yield Components.

Brand-Variety	Maturity Group	Yield	Plant Height	Maturity	Seed Quality[1]	Seed per Pound
		Bu./A.	In.	Month-day		
Bay	V	11.4	26	10-15	2.1	2703
Deltapine 105	V	11.0	29	10-21	2.1	3394
Deltapine 345	V	10.5	28	10-19	1.9	3322
Pioneer 5482	V	10.5	27	10-13	1.9	3427
Forrest	V	10.0	29	10-16	1.8	3897
Pioneer 9561	V	9.1	26	10-18	2.0	3108
Coker 425	V	8.6	22	10-11	2.1	3490
Coker 355	V	8.0	26	10-15	2.1	3744
Coker 156	VI	7.8	23	11-8	2.6	3854
N77-114	V	7.6	25	10-12	1.8	3572
Bedford	V	6.9	30	10-24	1.9	4071
Bradley	VI	6.8	25	10-29	1.9	3917
V75-183	V	6.4	23	10-11	1.6	3235
Coker 485	V	5.6	26	11-10	2.8	3681
Deltapine 246	VI	5.5	27	11-10	2.9	3804
Deltapine 506	VI	5.2	28	11-14	3.4	3684
Essex	V	4.9	22	10-11	2.0	3859
Tracy M	VI	4.8	27	11-14	2.8	3460
S69-96	VI	4.6	26	11-12	3.4	4053
Davis	VI	4.6	28	11-9	2.4	3969
Pioneer 9571	V	4.5	26	10-24	2.6	3422
Centennial	VI	1.9	26	11-15	3.8	3822
L.S.D. (0.05)		1.96	2.7	- - -	0.51	240.3
C.V. (%)		16.7	13.5	- - -	4.2	6.5

[1]Based on a scale of 1 to 5 with 1 = excellent, 5 = poor.

Biosorb Effects on Soybean Germination

Biosorb is an absorbant material used as a coating on seeds to increase the potential for absorbing moisture from soil or air and making it available to the seed. This ability may help speed up germination in soils where moisture availability is becoming limiting.

Procedure: A test was conducted in a germination chamber on 6 July and 11 July with 15 soybean varieties (maturity groups III, IV, V, and VI) with and without Biosorb. Treated seeds were coated with Biosorb at the rate of 27 ounces for every 100 pounds of seed as recommended. Fifty seeds were placed on moist germination paper, then a moist sheet of germination paper was placed on top and rolled. This was done for each seed treatment. After 24 hours, seeds with a radicle were counted.

Results: A significant difference (P= 0.05) was found between seeds treated with Biosorb (69 percent germination) and seeds without Biosorb (59 percent germination) after 24 hours. The germination of varieties was different (P= 0.05), probably due to the seed size and quality. The interaction of Biosorb by variety was not significant.

Conclusions: Biosorb did increase the number of seeds germinating in 24 hours, however, after 5 days there was no significant difference. This does not mean that the length of the radicles of the Biosorb-treated seeds was not longer, but that at this time just as many untreated seeds were germinated as treated seeds. Also, field experiments were conducted at the Parsons and the Columbus Units with and without Biosorb treatment on soybean seeds. The same 15 soybean varieties were planted after wheat in the first part of July, when soil conditions were very dry at both locations. The seeds did not emerge until a rain and then there was no noticeable difference between treatments. Yields were not determined because an early frost killed the soybean plants.

Although it appears that Biosorb does have potential in the agricultural industry, more work needs to be done to determine the critical point at which Biosorb would be helpful.

Other Soybean Research

The following topics were also studied in 1984, and are worthy of mention.

Soybean Varieties - Tillage - Row Spacing. Doublecropping soybeans after wheat is an important practice in southeastern Kansas. Soybean varieties may respond differently in various tillage systems. Thus, a study was planted at the Parsons field to examine six soybean varieties in three tillage systems and two row spacings after wheat. Soybean varieties used were Essex, Pershing, Narow, and K77-50-53-I from maturity group V; Sparks, from maturity group IV; and Williams 82, from maturity group III. The tillage systems used were (a) burn, disc several times, and plant; (b) minimum tillage, double-disc and plant; and (c) no-tillage, plant directly in the wheat stubble. The two row spacings were 15 and 30 inches.

Unfortunately, low rainfall after planting and an earlier than normal frost prevented harvesting the soybeans for yields.

Plant Rows. Crosses made in 1983 were planted at Parsons. These were harvested and taken to W. T. Schapaugh, soybean breeder at Kansas State, for further evaluation.

Uniform Tests. Soybean lines from maturity group IV and V were evaluated in southeastern Kansas as part of a regional testing program.

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FORAGE CROPS RESEARCH

J. L. Moyer

Birdsfoot Trefoil Varieties in Southeastern Kansas

Birdsfoot trefoil is a widely adapted, non-bloating forage legume. One variety, 'Dawn', earlier showed good persistence and yield potential in eastern Kansas. Other varieties and cultivars are being tested in pure stands for hay production and adaptation to our conditions.

Procedure: Plots established in spring, 1980 were maintained in 1984 with a fertilizer application of 44 lb P_2O_5 and 100 lb K_2O/acre on June 5. Plots were cut May 22 and July 10, and stands were rated visually June 18.

Results and Conclusions: Forage yield of 'Empire' was significantly lower in 1984 than the six highest-yielding cultivars (Table 26). Four-year yield totals were not significantly different (5% level) but 'Fergus' ranked highest and 'Leo' lowest. Stands of 'Fergus' were significantly better than all other cultivars, except 'MO 20' and NC-83 germ pool.

Table 26. Birdsfoot Trefoil Forage Yields for 1984, Four-year Total, and Stand Ratings. Mound Valley Unit, Southeast Kansas Experiment Station.

Variety	Forage Yield, tons/a @12% moisture				Stand
	5/22/84	7/10/84	1984 Total	4-Yr Total	Rating [1/]
NC-83 Pool	2.86	2.01	4.88	16.23	4.0
Leo	2.72	1.79	4.51	15.26	3.6
Fergus	3.02	1.82	4.83	16.89	4.6
Carroll	2.87	1.86	4.74	15.54	3.4
Dawn	2.92	1.48	4.39	16.61	2.6
Mo-20	3.00	1.71	4.71	16.56	4.4
Empire	2.56	1.51	4.08	16.00	2.4
Viking	3.09	1.76	4.85	16.22	2.9
Norcen	2.98	1.81	4.79	15.73	3.8
LSD (0.05)	N.S.	0.26	0.47	N.S.	0.8

[1/] Rated on 0-5 scale, June 18, 1984, where 5 is a "perfect" stand.

Cool-Season Grass Performance

Introduced cool-season grasses have proven themselves valuable for forage in southeast Kansas. This test was established to evaluate varieties of several species for adaptation and productivity under our conditions.

Procedure: Plots were established in spring, 1981, and fertilized each year. In 1984, 100 lb N/acre was applied February 7. Plots were cut June 14 for yield determination.

Results and Conclusion: Tall fescue (Ky 31) yielded more than any other grass in 1984, except for 'Rise' reed canarygrass. Fescue yielded significantly (5% level) more than 22 of 29 other grasses in the test. Two reed canarygrasses, four smooth bromegrasses, and an orchardgrass were in the high-yield group along with fescue.

Three-year average yields of Mn 72 reed canarygrass were highest in the test. 'Blair' and 'Bromex' smooth bromegrasses were followed in 3-year average yield by tall fescue and NAPB 7601 smooth brome. (See Table 27).

Forage Yield From Tall Fescue Cultivars

Tall fescue is the most widely grown forage grass in southeastern Kansas. New cultivars with possible agronomic advantages were tested for adaptation to the area.

Procedure: Plots seeded in fall, 1981 were fertilized with 80 lb N/acre April 19, 1984. Harvest date in 1984 was June 1.

Results: 'Kentucky 31' tall fescue, obtained locally, produced the highest average yield, significantly greater than six of the 11 other cultivars in the test. Conversely, 'Kenhy' produced significantly less than the six highest yielding cultivars. (See Table 28).

Table 27. Yield of Cool-season Grasses in 1984 at Parsons Training Center, SEK Branch Experiment Station.

Variety	Species	Source	Yield, tons/acre @12% moisture 1984 [1/]	3-Yr Average
Achenbach	Smooth bromegrass		4.31	4.02
Dart	Orchardgrass	L.L.	3.78	3.53
Baylor	Smooth bromegrass	NAPB	4.40	4.27
Blair	" "	NAPB	4.35	4.53
NAPB 7601	" "	NAPB	3.89	4.31
Bromex	Smooth bromegrass	N-K	4.25	4.36
Rebound	" "	S.D.	3.68	4.04
Barton	" "	L.L.	4.03	3.73
Regar	Meadow bromegrass	USDA	2.81	2.38
Ky 31	Tall fescue		5.30	4.34
Sterling	Orchardgrass	IA.	3.28	3.12
Able	"	FFR	4.01	3.62
Hallmark	"	FFR	3.71	4.02
Prime	"	N-K	3.64	3.53
Comet	"	N-K	4.50	3.91
Orion	Orchardgrass	N-K	3.08	2.99
DS-4	"	L.L.	3.74	3.55
Ioreed	Reed canarygrass	IA.	3.60	4.07
NCRC-1	"	USDA	3.84	3.93
Mn 76	"	Mn	3.73	3.82
Mn 72	Reed canarygrass	Mn	4.91	4.78
Vantage	"	NAPB	4.09	3.76
Rise	"	NAPB	5.44	4.20
Flare	"	L.L.	3.55	3.44
Linn	Perennial ryegrass	Ore	3.69	3.32
Tetrablend 30	" "	N-K	3.34	3.02
Barton	Western wheatgrass		3.31	3.38
Oahe	Intermediate wheatgrass		3.59	3.03
OG-1	Orchardgrass	Mo.	2.98	3.04
OG-2	"	Mo.	3.27	3.57
LSD (.05)			1.18	- -

[1/] Cutting date was June 14.

Table 28. Forage Yields of Tall Fescue Cultivars and Varieties in 1984, Mound Valley Unit, SEK Experiment Station.

Entry	Source	Forage Yield 1/ 1984	Forage Yield 1/ 2-Yr Average 2/
Kenhy	U. Kentucky	2.58	3.22
K5-30	Northrup-King	3.08	3.80
Ky 03G1-327	U. Kentucky	2.73	3.44
WG 3B	U. Missouri	2.74	3.38
Mozark	U. Missouri	2.63	3.44
Ky 31	Common	3.00	3.90
H 1	U. Missouri	2.91	3.76
Forager	FFR	2.83	3.47
Mo 96	U. Missouri	2.84	3.58
Martin	U. Missouri	2.85	3.79
WG 2B	U. Missouri	2.81	3.50
HMR	U. Missouri	3.13	3.82
LSD (.05)		N.S.	0.35

1/ tons/acre @12% moisture.

2/ No significant (.05) interaction between years.

Bermudagrass Variety Performance

Bermudagrass can be a valuable, high input-requiring, high-producing summer forage for southeast Kansas cattlemen. Producers have benefitted considerably from the replacement of the original common bermudas with the variety 'Midland'. Developments in bermudagrass breeding should be monitored closely to speed adoption of improved types.

Procedure: Thirteen lines were planted in 1980 and harvested for yield determination twice each year for 3 years. Two others, 'Tift 44' and 'Harris', were sprigged in 1981. Weeds were controlled with simazine, and plot borders were maintained with glyphosate.

Plots were fertilized regularly, receiving 150 lb N/acre on May 21 in 1984, and 100 lb N/acre on July 12. Harvests in 1984 were on June 27 and October 8.

Results: This year was unusual in that both late-sprigged entries yielded much higher, relative to other cultivars, than in the past two years. Also, 'Midland' yielded significantly (5% level) less than 'Hardie' for the first time. Four-year average yields maintained 'Hardie' and 'Midland' as most productive in the long term, however.

The two lowest-yielding cultivars, 74 x 12-12 and GX 10978, suffered some stand loss prior to and during 1984.

Table 29. Forage Yields of Bermudagrass Variety Test, Mound Valley Unit, SEK Experiment Station.

Cultivar	1984 Yields, 6/27	1984 Yields, 10/8	1984 Yields, Total	4-yr Average
	- - - - - - - tons/a @12% moisture			- - - - - -
74 X 12-1	2.77	3.44	6.21	5.18
74 X 9-1	2.81	3.03	5.84	4.53
74 X 12-5	3.62	3.16	6.78	5.29
74 X 14-1	2.89	3.15	6.04	5.50
74 X 12-6	2.78	3.61	6.39	5.76
74 X 12-12	1.06	2.33	3.39	3.91
LCB 7-25	2.50	2.85	5.35	5.01
HARDIE	3.38	3.75	7.13	6.33
MIDLAND	2.49	3.58	6.07	6.14
TIFT 44	3.60	3.79	7.39	4.99 2/
HARRIS	3.43	3.46	6.89	5.15 2/
SS16 X SS21 1/	2.27	2.79	5.06	5.46
G X 10978 1/	2.27	1.43	3.70	3.98
GUYMON 1/	3.20	2.84	6.04	5.01
G X 9945 1/	3.08	2.52	5.60	4.80
LSD (.05)	0.51	0.60	0.90	- -

1/ Seeded cultivars.

2/ Three-year average; established in spring, 1981.

Effect of Fertilizer Placement on Tall Fescue Forage Yield and Quality [1]

Objectives: Two experiments were performed to determine how forage yield, quality, and N use of tall fescue were affected by (1) depth and method of UAN placement at 2-, 4-, and 6-inch depths of subsurface band placement ("knifed"), as well as surface broadcasting and banding ("dribble"); (2) N rates when using broadcast, dribble, or knifed N application methods; (3) single or split application of N; and (4) supplemental fertilization with P, K, S, B, and Zn with UAN applied by broadcast, dribble, or knifed methods.

Procedures:

Experiment I

The first two objectives were addressed by using a UAN applicator to apply broadcast, dribble, or one of three knife depths, with 0, 75, or 150 lb N/acre on April 19, 1984. Uniform applications of 39 lb P_2O_5/acre and 77 lb K_2O/acre were made to all plots April 18.

Forage samples were clipped May 3 for estimation of N uptake, and total forage production was harvested May 30, with subsampling to determine yield and quality. Kjeldahl N analysis was performed on all forage samples, and soil was sampled for N analyses at 2.5-, 5-, and 7.5-inch depths before treatment and at each harvest.

Experiment II

Two off-station locations were used to study objectives three and four. Initial applications of 150 lb N/acre as UAN by broadcast, dribble, or 6-inch knife methods were made February 24, 1984. At the same time, some treatments received 40 lb P_2O_5/acre from liquid 10-34-0 with the UAN, other plots also received 40 lb K_2O/acre from 3-10-10, while 12-0-0-26, sodium borate, and 10% Zn chelate were used to provide a 150-40-40-30-2B-1Zn lb/acre analysis to yet another set of plots (Table 31). Check plots received each treatment except for N, or no treatment.

Plots for split N applications received a 100-40-40-30-2B-1Zn lb/acre analysis fertilization February 24. Fall application of 50 lb N/acre as UAN by each method was made October 2.

Forage produced after the first fertilization was harvested May 31, with subsampling as in Experiment I. Soil was sampled to an 8-inch depth before treatment and at harvest for N analyses.

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[1] Written with the collaboration of D. W. Sweeney.

Results:

Experiment I

Forage yields were responsive to N rate, but the increase from the 75-lb rate to the 150 lb/acre N rate was nonsignificant (Table 30). Methods of N application resulted in significantly different forage yields, independent of N rate. Knifing N at the 4-inch depth produced higher yields than did any other treatment, but the advantage over the dribble method was nonsignificant (5% level). Knifing N at the 2-inch depth produced yields significantly lower than yields from the 4-inch knife and the dribble N treatments.

Forage nitrogen concentration and uptake responded highly significantly (1% level) to both N rate and placement, but the interaction between the two was also significant (5% level). This was because N use from the 2-inch placement depth was relatively poorer at the 75- than at the 150- lb/acre N rate. Treatment effects on forage N were otherwise consistent with effects on forage yield.

Experiment II

Results from Experiment II are summarized in Tables 31 and 32. Yields at both locations responded to N (at least up to 100 lb/acre), but yields were not increased further from added P and K. However, when S, B, and Zn were added to N-P-K, yields at the Hanson location were significantly increased (Table 32). Fertilizers and methods of application responded independently (i.e., there was no interaction), and the only significant yield difference due to method was at Johnson's, where the dribble method was superior to knifing fertilizers at 6-inch depth.

Total forage N (N uptake) responses were similar to yield responses at Johnson's location. At Hanson's location, responses of N uptake were more dramatic both from fertilizer and placement treatments, and there was no interaction between the two factors. Besides the obvious response to N rate, fertilization with P increased N uptake significantly. Fertilizer placement methods were each significantly different in N uptake from the others, such that 6" knife > dribble > broadcast.

Forage N concentrations were more responsive to placement and some fertility treatments than were yield or forage N uptake. Knifing produced significantly higher forage N concentrations than the other two methods, but an interaction was present at the Johnson location because of differentially higher forage concentrations at higher N and secondary nutrient levels.

Conclusions: Broadcast application of UAN generally produced lower forage yields and N content than dribble or knife methods, especially at high fertilizer N rates. One location's yield responded positively to the application of secondary nutrients, but neither responded to added P and K.

Table 30. Effect of UAN Placement on 'Fawn' Tall Fescue Spring Forage Production and N Content, Parsons Unit, 1984.

Treatment				Forage Nitrogen	
No.	N Amount	N Location	Yield	Concentration	Uptake
			tons/acre 1/	%	lb/acre
1	0 (Control)	- - -	1.35	1.12	27
2		Knife 2"	1.48	1.16	30
3		Knife 4"	1.66	1.22	36
4		Knife 6"	1.37	1.14	28
5	75 lb N/acre	Broadcast	2.42	1.36	58
6		Dribble	2.44	1.40	61
7		Knife 2"	1.75	1.22	38
8		Knife 4"	2.61	1.55	71
9		Knife 6"	2.54	1.36	62
10	150 lb N/acre	Broadcast	2.22	1.74	68
11		Dribble	2.77	1.68	81
12		Knife 2"	2.34	1.95	81
13		Knife 4"	2.94	2.10	109
14		Knife 6"	2.30	1.52	62
	LSD (.05)		0.54	0.24	19
		Means, N Rate			
	0 N		1.44 2/	1.15 3/	29 3/
	75 N		2.35	1.38	58
	150 N		2.52	1.80	80
	LSD (0.05)		0.23	0.11	8
		Means, Application Method			
	Broadcast		2.00 2/	1.41 3/	51 3/
	Dribble		2.19	1.40	56
	Knife 2"		1.86	1.44	49
	Knife 4"		2.40	1.62	72
	Knife 6"		2.07	1.34	50
	LSD (0.05)		0.30	0.14	11

1/ At 12% moisture.

2/ No significant (0.05) interaction between factors.

3/ Significant (0.05) interaction between factors.

Table 31. Effect of Fertilizers and Application Methods on Tall Fescue Spring Forage Yields and N Content, Hanson Place, 1984.

Treatment Number	Method	Fertilizer	Forage Yield	Forage Nitrogen Concentration	Forage Nitrogen Uptake
		lb/acre	tons/acre 1/	%	lb/acre
1	Broadcast	150-0-0	3.17	1.23	68
2	Dribble		4.30	1.35	102
3	Knife		3.59	1.47	93
4	Broadcast	150-40-0	3.76	1.34	88
5	Dribble		3.64	1.56	100
6	Knife		3.97	1.66	116
7	Broadcast	150-40-40	3.63	1.07	70
8	Dribble		4.37	1.43	109
9	Knife		3.37	1.54	91
10	Broadcast	150-40-40-30-2B-1Zn	4.22	1.17	87
11	Dribble		4.35	1.45	111
12	Knife		4.15	1.75	128
13	Broadcast	100-40-40-30-2B-1Zn	3.72	1.31	87
14	Dribble		4.05	1.19	85
15	Knife		3.77	1.52	101
16	Broadcast	0-40-40-30-2B-1Zn	1.96	1.23	43
17	Dribble		1.53	1.09	29
18	Knife		2.06	1.12	45
19	Check	- - -	1.45	1.05	27
	LSD (0.05)		0.82	0.35	29
		Means, Fertilizer 2/			
		150-0-0	3.68	1.35	88
		150-40-0	3.79	1.52	101
		150-40-40	3.79	1.35	90
		0-40-40-30-2B-1Zn	1.95	1.15	39
		100-40-40-30-2B-1Zn	3.84	1.34	91
		150-40-40-30-2B-1Zn	4.24	1.46	109
		LSD (0.05)	0.46	0.21	16
		Means, Application Method 2/			
	Broadcast		3.41	1.23	74
	Dribble		3.71	1.34	89
	Knife 6"		3.53	1.51	96
	LSD (0.05)		NS	0.15	12

1/ At 12% moisture.

2/ No significant (0.05) interaction between factors.

Table 32. Effect of Fertilizers and Application Methods on Tall Fescue Spring Forage Yields and N Content, Johnson Place, 1984.

Treatment Number	Method	Fertilizer	Forage Yield	Forage Nitrogen Concentration	Forage Nitrogen Uptake
		lb/acre	tons/acre 1/	%	lb/acre
1	Broadcast	150-0-0	2.42	1.36	57
2	Dribble		2.68	1.58	75
3	Knife		2.56	1.60	71
4	Broadcast	150-40-0	2.62	1.47	68
5	Dribble		2.40	1.42	60
6	Knife		2.32	1.57	64
7	Broadcast	150-40-40	2.82	1.56	77
8	Dribble		2.82	1.54	77
9	Knife		2.32	1.51	61
10	Broadcast	150-40-40-30-2B-1Zn	2.98	1.52	79
11	Dribble		2.69	1.32	63
12	Knife		2.52	1.85	82
13	Broadcast	100-40-40-30-2B-1Zn	2.69	1.32	63
14	Dribble		3.10	1.37	74
15	Knife		2.60	1.34	62
16	Broadcast	0-40-40-30-2B-1Zn	1.83	1.17	38
17	Dribble		2.25	1.16	45
18	Knife		1.74	1.18	37
19	Check	- - - -	1.56	1.13	31
	LSD (0.05)		0.56	0.23	16
		Means, Fertilizer			
		150-0-0	2.55 3/	1.51 2/	68 3/
		150-40-0	2.44	1.48	64
		150-40-40	2.66	1.54	72
		0-40-40-30-2B-1Zn	1.95	1.17	40
		100-40-40-30-2B-1Zn	2.80	1.34	66
		150-40-40-30-2B-1Zn	2.73	1.56	75
		LSD (0.05)	0.33	0.13	10
		Means, Application Method			
	Broadcast		2.56 3/	1.40 2/	64 3/
	Dribble		2.66	1.40	66
	Knife 6"		2.35	1.51	63
	LSD (0.05)		0.23	0.09	N.S.

1/ At 12% moisture.

2/ Significant (0.05) interaction between factors.

3/ No significant (0.05) interaction between factors.

Rate and Time of Nitrogen Fertilization For Bermudagrass At Two Potash Rates and Two Cutting Regimens

Bermudagrass can be a valuable high-input, high-production, summer forage. The main input, N, can sometimes be used more efficiently with split than with single applications. Best responses are obviously obtained when soil moisture is plentiful, and stands are vigorous.

This study used three set rates of single annual application, and split applications at rates varying with the previous month's rainfall, to help find the most efficient N schedule for bermudagrass in southeast Kansas. Two other factors that could affect stand vigor, K rate and cutting schedule, were also varied to check yield and winter hardiness responses. The first two years' response were reported previously (KAES Report of Progress 423, 1982).

Procedure: Plots were laid out and fertilized with the amount of N and K_2O indicated in Table 33. Nitrogen was applied June 14, 1983 and May 21, 1984 for the initial annual application. Potash at 50 or 100 lb/acre was applied at the same time, along with 50 lb P_2O_5/acre on all plots.

Plots were cut July 6, 1983 and July 3, 1984. Split N-treatments were made July 14, 1983 and July 12, 1984. No second cutting was obtained in 1983 because of drought, but a late cutting was taken October 8, 1984.

Results and Conclusions: Little opportunity was found to vary cutting schedules between "standard" and "intensive" because of limited summer regrowth. Thus, yields did not vary between the two regimes.

Potash at 100 lb/acre significantly increased forage yield over the 50-lb rate only for the first cutting of 1984 in the highest yielding N treatments. Total yields for 1984 were the same for both potash rates, however, and the 1983 cutting showed a significant inverse relation between potash rate and forage yield.

Yield responses to single, annual N applications of up to 450 lb/acre were practically linear (Table 33). However, split N applications were more efficient than single annual applications, since 250 lb N/acre in two applications/season always produced more forage than 300 lb/acre in a single application. Annual 450-lb single N applications increased forage production only about 10% over the 250-lb split application, while requiring 80% more total N fertilizer. Nitrogen use efficiency, defined as units of added forage per unit of added N, was almost as high at the 150 + 100 lb/acre split N rate as at the single 150-lb rate, while producing 30% more forage per unit land area.

Table 33. Bermudagrass Forage Yields, 1981-84 as Affected by N Fertility Rate and Timing, Mound Valley.

Annual N Rate	Total N Applied, 1981-84	Forage Production 1983	1984 7/3	1984 10/8	1984 Total	Total Production 1981-84	N Use Efficiency [4/]
------- lb/a	---------	--- tons/a @ 12% moisture	----	----	----	----	
0	0	0.32	0.52	1.08	1.60	6.96	-----
150	600	1.23	2.50	1.80	4.30	14.27	24.4
300	1200	1.59	3.02	2.10	5.12	17.09	16.9
450	1800	2.35	3.01	2.69	5.70	20.66	15.2
150 + 100/cut	1000	1.86	2.69	3.24	5.93	18.72	23.5
150 + Variable [1/]	950	1.78	2.46	1.82	4.28	17.46	22.1
Variable [2/] + 100/cut	950	1.93	2.52	3.04	5.56	17.65	22.5
LSD (.05)		0.27	0.31 [3/]	0.34	0.47		

[1/] Variable rates after cutting were 100 lb N/acre if precipitation 30 days before application was 70-130% of normal, 0 if less precipitation was received, and 150 N if more than 130% of normal was received.

[2/] Variable initial rates were 150 lb N/acre if precipitation 30 days before application was 70-130% of normal, 100 lb/acre if less precipitation was received, and 200 lb N/acre if more than 130% of normal was received.

[3/] N fertility treatment significantly interacted with K_2O rate.

[4/] [Yield treatment minus Yield check (lb)]/lb N applied.

Alfalfa Varieties in Southeastern Kansas

The importance of alfalfa as a feed crop and/or cash crop has increased in recent years. This study is to help producers decide which variety to select for their needs.

Procedure: The 20-line test was seeded in fall, 1982. Annual fertilization was applied June 5, 1984, at the rate of 44 lb P_2O_5 and 100 lb K_2O/acre. Plots were cut May 21, and June 27, and September 20.

Results and Conclusions: Forage yields for 1984 are in Table 34. Average total yield was slightly over 5 tons/acre, despite extreme July drought. The three top varieties were 'Advantage', 'Armor', and experiment K81-10, while the poorest producer was 'Southern Special.'

OTHER FORAGE RESEARCH

The following topics were also studied in 1984, and are worthy of mention.

Cool-Season Annual Legumes - Plots seeded in fall, 1982 were harvested in summer, 1983, and some reseeding occurred. Four legumes had thick enough pure stands for mechanical forage harvest in 1984. Common vetch ('Vanguard') and crimson clover were harvested May 22, while 'Yucchi' arrowleaf clover and 'Geraldton' subclover matured later, and were harvested June 27. Yields averaged 4.73, 3.12, 2.33, and 2.18 tons/acre (12% moisture) for arrowleaf clover, crimson clover, subclover, and vetch, respectively.

Warm-Season Annual Forages - Eighteen forage sorghums (silage-type) were tested in 1984 in cooperation with the KSU Agronomy Department. The entries averaged 17 tons/acre (70% moisture), ranging from 14-22 tons in silage yield (see 1984 Sorghum Performance Tests, Report of Progress 465). Grain sorghums were tested in cooperation with the KSU Animal Science Department, and dry matter production compared favorably with forage sorghums, with the grain sorghum having higher grain: stover ratios.

Studies of Tall Fescue Infested by the Endophyte, *Epichloe typhina* - Use of an experimental growth regulator improved summer gains, but had no apparent effect on infestation levels. Paraquat and glyphosate applied at 0.5 and 1.5 lb a.i./acre, respectively, gave good control (79%) of infested fescue. Topsoil from a self-reseeded fescue pasture was collected August 20, and produced 50-80 seedlings/ft^2. Plots were established with seed from seedlots containing high fungus infestation levels; half were treated to control the fungus and half were not, in an attempt to obtain plots differing in infestation rates.

Table 34. Alfalfa Forage Production From 20 Lines Planted in Fall, 1982, Mound Valley Unit, SEK Experiment Station.

		Forage Yield, tons/acre @12% moisture					
			1983 Production				2-Year
Brand	Cultivar	1983	5/21	6/27	9/20	Total	Total
DK-PFIZER	DEKALB 120	2.99	2.55	1.30	1.32	5.17	8.16
DK-PFIZER	DEKALB 130	2.72	2.37	1.38	1.37	5.12	7.84
DK-PFIZER	ADVANTAGE	2.82	2.64	1.58	1.35	5.56	8.38
NAPB	ARMOR	2.92	2.68	1.41	1.26	5.35	8.27
NK	PIKE	2.73	2.24	1.28	1.37	4.89	7.62
NK	RAIDOR	2.74	2.51	1.10	1.40	5.00	7.74
PAYMASTER	EXPO	3.16	2.35	1.50	1.25	5.10	8.26
PIONEER	555	2.51	2.40	1.30	1.32	5.02	7.53
PIONEER	531	2.86	2.62	1.22	1.25	5.10	7.96
PIONEER	532	3.11	2.63	1.39	1.18	5.20	8.31
W-L RESEARCH	WL 318	2.85	2.23	1.46	1.28	4.98	7.83
W-L RESEARCH	SOUTHERN SPECIAL	2.50	2.04	1.32	1.22	4.58	7.08
- - - -	RILEY	2.74	2.53	1.14	1.43	5.10	7.84
- - - -	KANZA	2.51	2.29	1.30	1.37	4.96	7.47
- - - -	K81-7	3.14	2.47	1.34	1.24	5.04	8.18
- - - -	K81-10	3.26	2.58	1.31	1.36	5.26	8.52
- - - -	K81-17	2.96	2.22	1.32	1.42	4.95	7.91
- - - -	K80-11	2.96	2.34	1.20	1.34	4.89	7.85
- - - -	K80-17	2.94	2.30	1.33	1.24	4.87	7.81
- - - -	KS157	2.65	1.98	0.96	1.45	4.38	7.04
LSD (0.05)		0.40	0.25	0.18	0.23	0.40	- -

Effect of Mefluidide on Forage Yield and Crude Protein of Two Sorghums - Sorghum-sudan and hybrid sudangrass were treated with the experimental compound in early growth. The material reduced first-cut yields, but increased crude protein by three percentage points. Second-cut yields of treated plots regained some of the yield loss by outyielding the control, but regrowth forage had similar protein contents in treated and untreated plots.

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SOIL AND WATER MANAGEMENT RESEARCH

Daniel W. Sweeney

Effect of Irrigation Timing and N Application Method on Grain Sorghum

Irrigation of grain sorghum is not extensive in Southeast Kansas. This, in part, is due to the lack of large irrigation sources. Limited irrigation, such as could be supplied by the substantial number of ponds in the area, could be used to help increase grain sorghum yields. The objectives of this experiment were to determine the optimum growth stage for irrigation with a limited water supply and to determine if applying 50% of the N fertilizer through the irrigation can result in an increase in yield.

Produce: Irrigation timing by plant growth stage and N application were examined utilizing a 6 x 2 factorial arrangement of a completely randomized design replicated three times. The six irrigation treatments were at the 9-leaf (9L), boot (B), soft dough (SD), 9L-B, 9L-SD, and B-SD stages. A total of 2" was applied in each irrigation treatment. Thus, either 2" were applied at one growth stage or 1" was applied at two growth stages. The N application was either 100 lb N/a applied preplant or 50 lb N/a applied preplant with 25 lb N/a injected with each inch of irrigation. Thus, each treatment area received 100 lb N/a. Also included were two check treatments; one receiving 100 lb N/a preplant with no supplemental irrigation and the other receiving neither nitrogen nor irrigation. The nitrogen source for this study was urea-ammonium nitrate (UAN, 28%) solution. The grain sorghum was planted on 14 June 1984.

In addition to yield, kernel weight, kernels per head, and %N in harvested grain were measured. Whole plant samples (1 m^2) were taken at the 9-leaf, boot, and soft dough stages and analyzed for dry weight and %N. These samples were taken immediately prior to irrigation events scheduled at the growth stage.

Results and Conclusions: Total precipitation values for July and August were very low, 1.09 and 0.69, respectively. Thus, the primary source of water for the grain sorghum was irrigation. With one exception, all irrigation treatments showed a response (0.10 level) in yield as compared to the checks (Table 35). However, no significant response in yield to either irrigation timing or N application was found. This, in part, can be explained by response of kernel weight and kernels per head to the different irrigation timings. In general, earlier irrigations resulted in lower kernel weight but higher number of kernels per head, while the reverse was true for later irrigations. Applying 100% of the N preplant resulted in a increase in kernel weight, as compared to the fertigation application. No significant differences were found for %N in harvested grain (data not shown).

For each growth stage, no significant differences were found for dry weight (data not shown). However, samples collected at boot and soft dough stages showed significant differences for %N in the plant as affected by irrigation timing (Table 36). Since samples collected at each growth stage were taken prior to irrigation, %N in the plant was responding to the preceding irrigation. For example, %N in samples collected at soft dough was higher in plants that received irrigation at the boot stage. In general, nitrogen uptake by grain sorghum at each sampling time was increased by irrigation. However, nitrogen content was unaffected by nitrogen application.

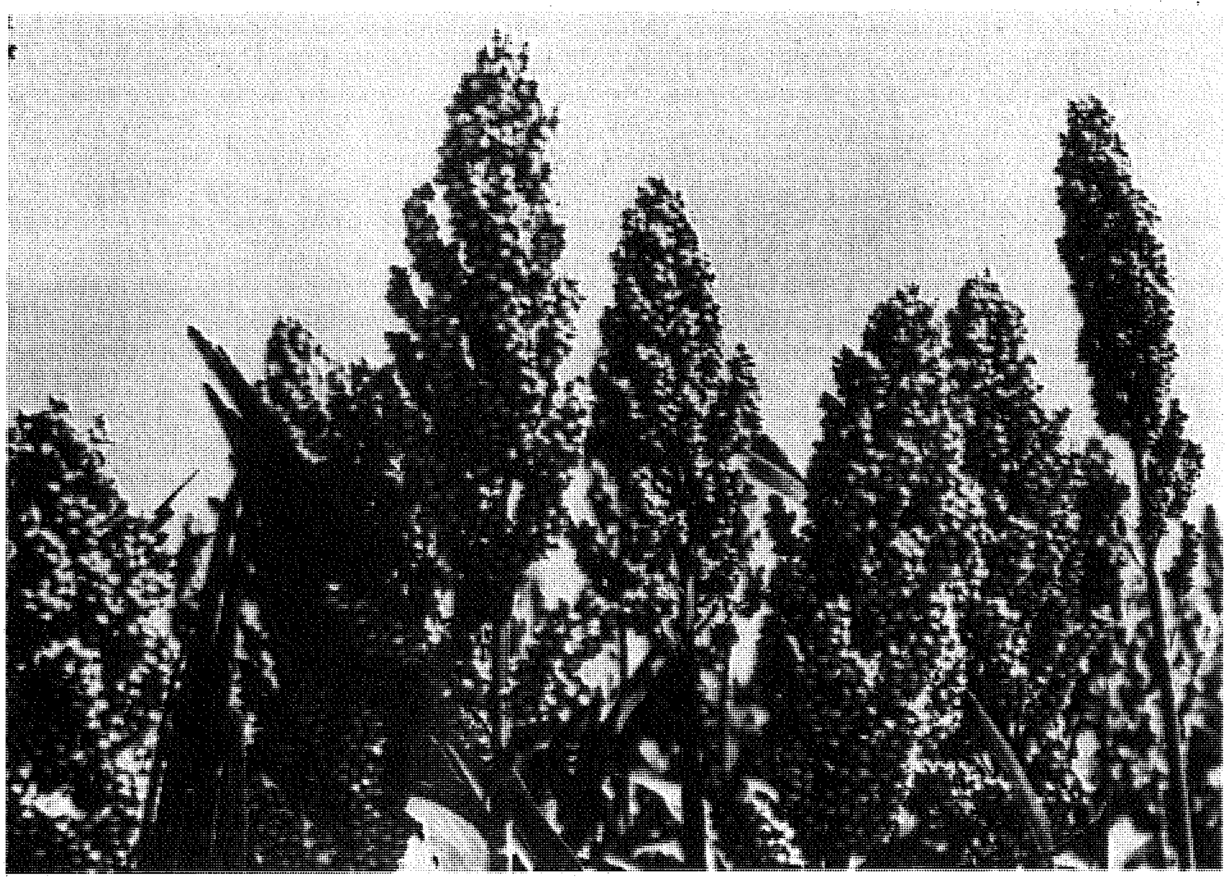


Table 35. Yield and Yield Components of Grain Sorghum as Affected by Irrigation Timing and N Application Method.

Irrigation by Growth Stage[1]	N Application[2]	Yield @12.5%	Kernel Weight	Kernels per Head
	- - - lb/a - - -	- bu/a -	- mg -	
9 Leaf Stage (9L)	100P	58.0	17.6	2730
	50P - 50I	65.3	17.7	2520
Boot (B)	100P	70.3	23.9	2630
	50P - 50I	63.4	18.8	2340
Soft Dough (SD)	100P	64.2	24.7	2190
	50P - 50I	69.2	23.1	2310
9L,B	100P	65.0	18.3	3150
	50P - 50I	64.1	18.7	2770
9L,SD	100P	68.4	25.1	2620
	50P - 50I	68.7	20.8	2570
B,SD	100P	66.3	25.6	2370
	50P - 50I	62.6	21.7	2180
None	100P	51.0	20.6	2330
	Zero	47.7	17.8	2210
LSD (0.05)		NS	4.7	NS
LSD (0.10)		11.3	3.9	490
Mean Values:				
Irrigation by Growth Stage				
9L		61.6	17.7	2630
B		66.9	21.4	2490
SD		66.7	23.9	2250
9L,B		64.5	18.5	2970
9L,SD		68.6	23.0	2600
B,SD		64.4	23.7	2280
LSD (0.05)		NS	2.9	430
N Application Method				
100P		65.4	22.5	2620
50P - 50I		65.5	20.1	2450
LSD (0.05)		NS	1.7	NS
Irrigation x N Appl. Method Inter.		NS	NS	NS

[1]All irrigation systems received a total of 2"; 2" at one growth stage or 1" at two growth stages.

[2]100P indicates 100 lb N/a applied preplant; 50P - 50I indicates 50 lb N/a applied preplant, 50 lb/a applied through the irrigation at a rate of 25 lb N/a per inch of irrigation water.

Table 36. Nitrogen Content in Grain Sorghum Plants at Two Growth Stages as Affected by Irrigation Timing and N Application Method.

Irrigation by Growth Stage[1]	N Application[2]	Nitrogen Content in Plant			
		Plant Growth Stage			
		Boot	Soft Dough	Boot	Soft Dough
	--- lb/a ---	----- % -----		--- lb/a ----	
9 Leaf Stage (9L)	100P	1.99	1.47	74.1	92.9
	50P - 50I	2.31	1.51	71.2	82.9
Boot (B)	100P	1.72	1.90	48.7	81.9
	50P - 50I	2.13	1.76	60.5	79.9
Soft Dough (SD)	100P	1.51	1.23	45.6	59.9
	50P - 50I	1.76	1.28	49.9	68.8
9L,B	100P	2.19	1.66	63.6	96.5
	50P - 50I	2.05	1.65	65.3	102.5
9L,SD	100P	2.03	1.43	62.0	83.7
	50P - 50I	1.76	1.29	55.6	60.6
B,SD	100P	1.74	1.52	45.3	74.6
	50P - 50I	1.39	1.40	38.4	71.3
None	100P	1.73	1.31	49.2	57.6
	Zero	1.25	1.03	40.1	52.4
LSD (.05)		0.46	0.26	NS	21.7
Mean Values:					
Irrigation by Growth Stage					
9L		2.15	1.49	72.6	87.9
B		1.93	1.83	54.6	80.9
SD		1.64	1.26	47.8	64.3
9L,B		2.12	1.66	64.5	99.5
9L,SD		1.90	1.36	58.8	72.2
B,SD		1.57	1.46	41.9	73.0
LSD (0.05)		0.34	0.19	18.5	16.1
N Application Method					
100P		1.86	1.53	56.6	81.6
50P - 50I		1.90	1.48	56.8	77.7
LSD (0.05)		NS	NS	NS	NS
Irrigation x N Appl. Method Inter.		NS	NS	NS	NS

[1]All irrigation systems received a total of 2"; 2" at one growth stage or 1" at two growth stages.

[2]100P indicates 100 lb N/a applied preplant; 50P - 50I indicates 50 lb N/a applied preplant, 50 lb/a applied through the irrigation at a rate of 25 lb N/a per inch of irrigation water.

Effect of Liquid Nitrogen Application Method on Yield and Growth of Grain Sorghum in Reduced and No-Tillage Systems

The development of reduced tillage systems has required defining options for soil fertility management. The use of UAN (urea-ammonium nitrate) solution is one way of supplying the nitrogen requirement of grain sorghum. Broadcasting, surface (dribble), and subsurface (knife) banding are UAN-application alternatives. The objective of this study was to compare the effect of broadcast, and 15 and 30" spacings of dribble and knife applications of UAN on yield and growth of grain sorghum in reduced and no-tillage systems. An auxiliary objective was to measure the interception of surface-applied UAN on the previous year's grain sorghum residues.

Procedure: A split-plot design with four replications was used with tillage as main plots and UAN-application method as subplots. The two tillage systems were reduced and no-tillage. Five UAN-placement systems and three checks comprised the subplots. Dribble and knife applications at both 15 and 30" spacings as well as broadcasting were the UAN methods. Checks of knives only at 15 and 30" were included with a "no-pass" check to allow for the possibility that knife passage through the soil may affect crop response. The UAN (28%) solution was applied preplant at the rate of 100 lb/a for all methods.

Whole plant samples (1 m^2) were taken at the 9-leaf, boot, and soft dough stages and analyzed for dry weight and %N. Residue samples (1 m^2) from all but knifed plots were collected before, immediately after, and 32 days after UAN application and analyzed for dry weight and %N.

Results and Conclusions: Extremely dry conditions (1.06 and 0.69" total precipitation for July and August, respectively) resulted in very low yields with no significant difference due to treatments (Table 37). The drought conditions also resulted in no significant differences due to treatment for %N and dry weight, as well as for N uptake by the plant at any growth stage.

Within each tillage system, broadcast application increased the %N in the residue as compared to the check in samples collected after UAN application (Table 38). One dribble application - spacing method in each tillage system resulted in higher %N than in the checks. These increases were not large; however, since the samples were air-dried before grinding, a substantial portion of the UAN intercepted on the residue may have been lost due to volatilization. No significant difference in %N due to UAN-application method was found in samples collected in the field 32 days after UAN application (data not shown). These data suggest that although UAN intercepted on the previous year's residue may not become significantly unavailable due to immobilization on the residue, it still may be lost by volatilization.

Table 37. Overall Mean Values for Grain Sorghum Yield, % N and Dry Weight at Three Growth Stages.

Measured Parameter	Mean Value [1]
	--- bu/a ---
Yield @ 12.5% moisture	32.3
N in whole plant samples	--- % ---
1) at 9 leaf stage (19 July)	3.07
2) at boot stage (7 August)	1.80
3) at soft dough (30 August)	1.23
Whole plant dry weight	--- lb/a ---
1) at 9 leaf stage (19 July)	1010
2) at boot stage (7 August)	3420
3) at soft dough (30 August)	5810

[1] No differences due to treatment effects at the 0.05 level.

Table 38. Nitrogen Content in Grain Sorghum Residue Collected After UAN Application.

Tillage	UAN Application	N in Residue [1]
		--- % ---
Reduced	Check	0.62
	Broadcast	0.91
	Dribble - 15" spacing	1.07
	Dribble - 30" spacing	0.84
No-till	Check	0.71
	Broadcast	1.08
	Dribble - 15" spacing	0.85
	Dribble - 30" spacing	1.23
LSD (0.05)	Any Comparison	0.25
LSD (0.05)	Within Same Tillage Factor	0.24

[1] Significant interaction (0.05) between factors.

Effect of Ridge-planting, Reduced, and No-Tillage on Wheat and Soybean Yields[1]

Ridge - (or till-) planting is gaining interest in several areas of the state and country. Crops grown in soils that have a high clay content subsoil under a shallow topsoil, as in Southeast Kansas, may benefit from ridge-planting not only due to better drainage and/or warmer spring soil temperatures (as compared to no-till) but also from a deeper topsoil rooting depth. This study was initiated to study yield and plant growth responses to ridge-planting, reduced, and no-tillage systems in a wheat-doublecrop soybean-full season rotation.

Procedure: Plots were established at both the Parsons and Columbus fields. Wheat variety TAM 105 was planted at 1.5 bu/a on 15 Nov. 1983 at Parsons in four minimum tillage systems. Wheat was uniformly planted on 10-inch centers in three of the systems, ridge (hereafter referred to as ridge 10-10), reduced, and no-tillage. A fourth system (hereafter referred to as ridge 10-20) was included where wheat was planted at 1.5 bu/a in paired rows 10 inches apart on ridges on 30-inch centers, leaving a 20-inch unplanted area between ridges. The reduced tillage system consisted of field cultivation after soybean harvest. All plot areas received broadcast applications of 300 lb/a of 6-24-24 in the fall and 67 lb N/a as urea in the spring.

In addition to wheat yield, seeds/lb and %N in harvested grain were measured. Whole plant samples (1 m^2) were taken on 18 May and at harvest and analyzed for dry weight and %N.

At the Parsons location, two soybean varieties, Sparks and Essex (indeterminate and determinate, respectively) were planted on 28 June 1984 as a doublecrop after wheat harvest in each of the tillage systems. Both varieties were planted at approximately 150,000 seeds/a. All plots were sprayed with 1 gal/a Bronco and 1/3 lb/a Lexone 75 DF.

At the Columbus location, the experiment was initiated with full-season Essex soybeans planted at approximately 150,000 seeds/a on 8 June 1984 in the tillage systems. The tillage systems used were ridge, reduced, and no-tillage. (Two ridge systems were included to allow for later wheat planting systems.) Prior to planting on 1 May 1984, the no-till areas received 1.3 qt/a Roundup to kill volunteer wheat. After planting, plots were sprayed with a tank mix of 2 qt/a Lasso, 1/3 lb/a Sencor 75 DF, and 0.75 qt/a Paraquat. Fertilizer application was 174 lb/a of 6-24-24 banded with the planter.

---

[1] Written with the collaboration of J. B. Sisson.

In addition to soybean yield, seeds/lb were measured. Whole soybean plant samples (1 m^2) were taken on 16 Aug 1984 and analyzed for dry weight and %N. Gravimetric soil moisture measurements were taken on 19 June, 11 July, 6 Aug., and 12 Sept. 1984 at 4-8" and 13-17" (referred to as 6" and 15", respectively).

Results and Conclusions: Wheat planted in paired rows on ridges at Parsons (ridge 10-20) yielded approximately 10 bu/a more than wheat grown in reduced or no-tillage systems (Table 39). Intermediate yields were achieved by planting wheat uniformly 10 inches apart on ridges on 30-inch centers. No significant differences were found for seeds/lb or plant dry weight and %N on either 18 May 1984 or at harvest.

Doublecrop soybeans planted at Parsons were severely affected by the dry summer growing conditions and lacked sufficiant growth for harvest or other plant characteristic measurements.

Soybean yield at the Columbus location was unaffected by tillage treatments. Dry growing conditions resulted in very low yields. Overall mean yield value was 5.3 bu/a. Gravimetric soil moisture was unaffected by treatment at 6" or 15" at any sampling date during the season.

Table 39. Effect of Ridge-planting, Reduced, and No-tillage on Wheat Yields at the Parsons Field.

Tillage	Yield
	-bu/a-
Ridge 10-10 [1]	54.0
Ridge 10-20 [2]	59.7
Reduced	50.3
No-till	49.5
LSD .05	7.3

[1] Wheat planted uniformly 10 inches apart on ridges on 30-inch centers.

[2] Wheat planted in paired rows 10 inches apart on ridges on 30-inch centers, leaving a 20 inch unplanted area between ridges.

Effect of Wheat Residue Management on Yields in a Continuous Wheat - Doublecrop Soybean Rotation

Doublecropping soybeans after wheat is practiced by many producers in southeastern Kansas. Several options exist for dealing with straw residue from the previous wheat crop before planting the doublecrop soybeans. The method of managing the wheat residue may affect soil parameters, such as soil moisture, which in turn, may affect soybean yield.

Procedure: Three wheat residue management systems with three replications were established in 1983. The three residue management systems were no-tillage, disc only, and burn then disc. Sparks variety soybeans were planted 8 July 1983, following Newton wheat harvest. After planting, all plots received 1 gal/a Bronco (a package mix of Lasso and Roundup) and 1/3 lb/a Sencor 75 DF. After 1983 soybean harvest, the entire area was disced and field cultivated and planted to Arkan wheat at 90 lb/a on 17 Nov 1983. Between discing and field cultivation, 300 lb/a of 6-24-24 was broadcast in all plot areas. The wheat was topdressed with 67 lb N/a as urea on 15 Feb 1984. Wheat yield was collected from areas where the previous doublecrop residue management systems were imposed. After wheat harvest, Sparks soybeans were planted on 28 June 1984 with the same procedure as in 1983.

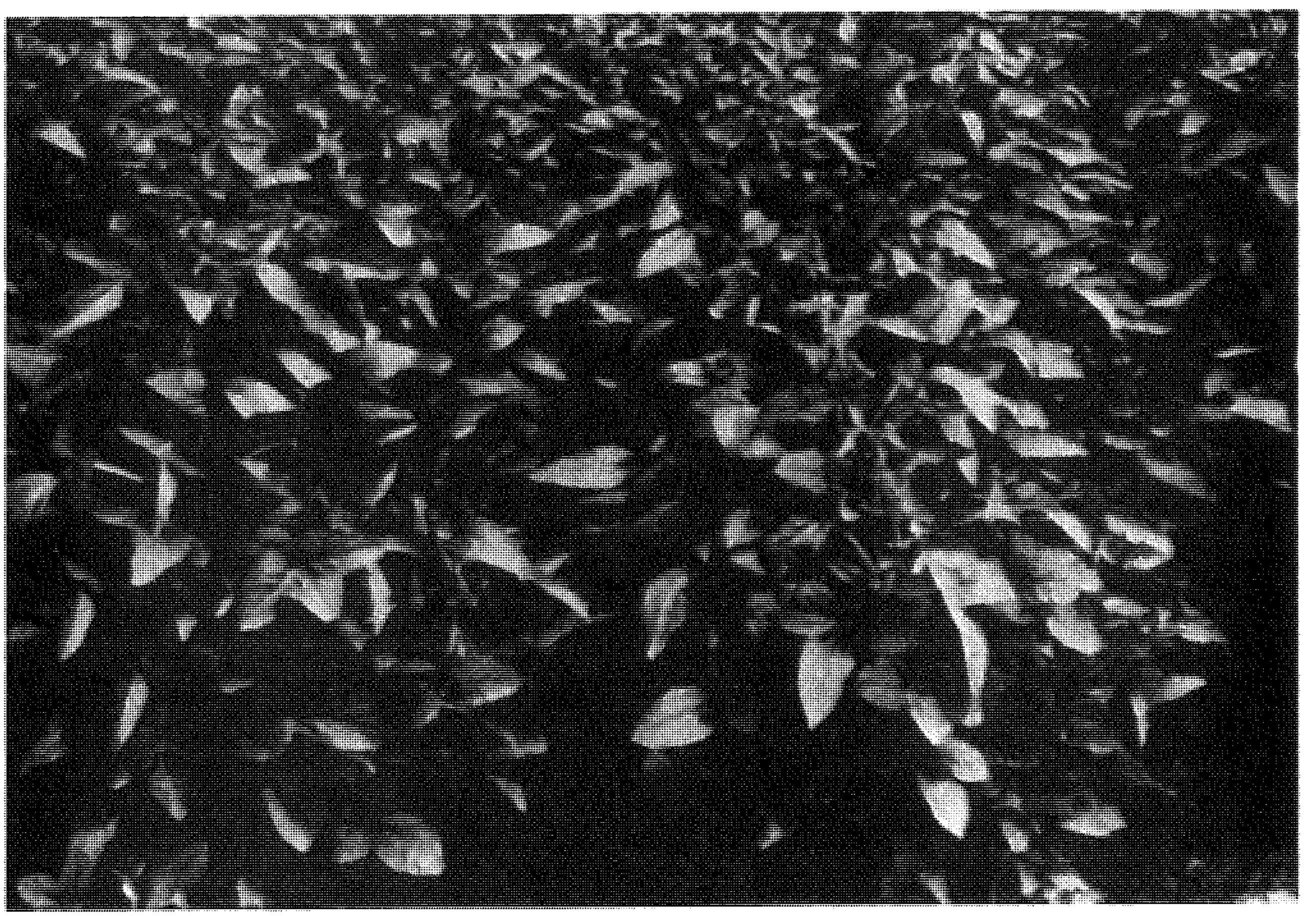
Results and Conclusions: Wheat residue management had no significant effect on the yield of soybeans in 1983. Drought conditions resulted in an overall mean yield of 5.4 bu/a. However, when wheat was planted in 1983 after uniform tillage in all plot areas, the wheat yield was significantly affected by the previous residue management system. Where soybeans had been grown no-till, wheat yield was 32% lower than where the previous years' wheat straw residue was burned then disced (Table 40). Wheat yield where the previous wheat residue was disced only before planting the doublecrop soybeans was 15.8 bu/a greater than where the soybeans were planted no-till, but was not significantly different from the yield obtained where the residue was burned then disced. Whole plant dry weight followed a similar trend. This indicates smaller and/or fewer wheat plants per unit area. No difference was noted for %N in the whole plant at harvest. However, at the 10% level, the % protein in the wheat grain was lower where no-till was employed for the previous doublecrop soybeans than in grain from the other treatments. This suggests a possible N immobilization when the previous years' wheat straw is tilled into the soil after no-till doublecrop soybeans immediately prior to wheat planting. (No significant occurance of disease, including tan spot, was evident in the plots.)

Soybeans planted doublecrop after the wheat harvest in 1984 were severely affected by the drought conditions. Soybean plants were too small to allow for harvest, therefore no harvest data were obtained.

Table 40. Effect of Previous Years' Wheat Straw Residue Management for Doublecrop Soybeans on Subsequent Wheat Yields and Selected Yield Characteristics.

1983 Residue Management	Yield	Protein in Grain	Whole Plant Dry Matter	N in Whole Plant
	-bu/a-	- - % - -	- - lb/a - -	- - % - - -
Burn, then Disc	62.7	14.7	7440	1.11
Disc only	58.7	14.5	6930	1.06
No-tillage	42.9	13.2	4850	1.10
LSD (.05)	12.5	1.1 †	890	NS

† at the 0.1 level



Tillage and Nitrogen Fertilization Effects on Yields in a Grain Sorghum - Soybean Rotation

A wide number of rotational systems are employed in southeastern Kansas. This experiment was designed to determine the effect of selected tillage and nitrogen fertilization options on the yield of grain sorghum and soybeans in rotation.

Procedure: A split-plot design with four replications was used with tillage systems as whole plots and N treatments as subplots. The three tillage systems were conventional, reduced, and no-till. The conventional system consisted of chiseling , discing, and field cultivation. The reduced tillage system consisted of discing and field cultivation. Roundup was applied in 1984 at 1.5 qt/a on the no-till areas. The four nitrogen treatments applied at 125 lb N/a to the 1983 grain sorghum were a) zero N applied, b) anhydrous ammonia knifed to a depth of 6 inches, c) broadcast urea-ammonium nitrate (UAN - 28% N) solution, and d) broadcast solid urea. Essex soybeans were planted in rotation in 1984 after the 1983 grain sorghum crop. Soybean harvest was taken from each subplot to determine the effect of previous N fertilization on yields, as well as tillage effects. Soybean whole plant samples were taken at bloom on 15 Aug. 1984 from each subplot. Moisture content in the soil profile as affected by tillage was measured at four depths (0.5, 1, 2, and 3.3 feet) by means of a neutron scattering technique. Soil moisture measurements were taken periodically during the growing season.

Results and Conclusions: No significant differences in grain sorghum yield were found in 1983. Overall mean grain sorghum yield was 45.2 bu/a. Soybean yields in 1984 were not affected by tillage but were affected by the 1983 N application (Table 41). However, since drought conditions existed in 1984 as well as in 1983, these yield differences are small. In general, plots that received anhydrous ammonia and broadcast urea applications resulted in higher plant mass per acre and %N in whole soybean plant samples taken at bloom. Increased tillage systems appeared to result in higher plant mass per acre, but did not affect %N in the plant (data not shown). At the 1-foot depth, measured soil moisture was higher in no-till plots throughout the growing season. Measurement of higher soil moisture under no-till was not as consistent at the 0.5, 2, or 3.3 foot depths. This experiment will be continued to gain information under possibly different growing conditions.

Table 41. Effect of Previous Year N Fertilization on Soybean Yield and Selected Plant Characteristics.

1983 N Application	Yield	Dry Matter (Bloom)	N Content (Bloom)
	-bu/a-	- - lb/a -	- - % - -
No N	5.4	2510	2.8
Knifed NH_3	5.9	2880	3.1
Broadcast UAN soln.	5.3	2370	2.9
Broadcast Urea	6.7	2680	3.1
LSD (0.05)	1.0	240	0.1

Yearly Alternating Row Spacings in Reduced Tillage Systems for a Soybean - Grain Sorghum Rotation

Research in various areas of the country has indicated that under certain conditions yields may be increased by narrow rows. However, in reduced tillage systems continuous narrow row planting may develop large amounts of residue, thus impeding planting and plant stands. A "paired-row" planting arrangement of two rows 10" apart, followed by a 20" interrow area (referred to as 10-20), may result in increased yields under favorable conditions, but also allow for postemerge spraying for weed control. The objective of this study was to determine whether alternating of semi-narrow paired-rows with a 30" row spacing on an annual basis is superior to continuous 30" row spacing in ridge-plant, reduced, and no-tillage systems.

Procedure: A split-plot design with three replications was used with tillage systems as whole plots and alternating row spacing as subplots. The three tillage systems were ridge-planting, reduced, and no-tillage. The three alternating row spacings were 30" followed by 30", 30" followed by 10-20", and 10-20" followed by 30". Grain sorghum was grown in rotation following soybeans in one area, while the reverse was true in an adjacent area.

Plots were established in May and June of 1984. Results obtained in 1984 are preliminary, due to the alternating nature of the experiment.

Results and Conclusions: In the area where soybeans were grown, tillage affected yield, whole plant dry weight on 15 August, and 100-seed weight (Table 42). Extreme drought conditions resulted in soybean yields of less than 4 bu/a in each system. Reduced tillage resulted in higher yield than ridge-planting or no-tillage. Reduced tillage and ridge-planting resulted in higher whole plant dry weight and 100-seed weight than no-tillage. No significant differences due to tillage were measured for leaf area index taken at bloom, %N in whole plant samples taken on 15 Aug., bulk density values, or soil moisture content taken at two depth at three sampling dates, with one exception. At the Aug. 28, 1984 sampling, reduced tillage resulted in a 0.3 higher value gravimetric % soil moisture content in the 4-8" soil zone than ridge-planting or no-tillage. No significant differences due to row spacing were found in any of the measured parameters. In the area where grain sorghum was grown, no significant differences were found due to tillage or row spacing for similar parameter measurements.

Table 42. Effect of Tillage on Soybean Yield, Seed Weight, and Plant Dry Weight.

Tillage	Yield	100-seed Weight	Dry Weight 15 Aug.
	-bu/a-	- -g- -	-lb/a-
Reduced	3.4	10.7	2450
Ridge-planting	2.4	10.6	2300
No-tillage	1.9	9.7	1950
LSD (0.05)	0.8	0.8	270

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