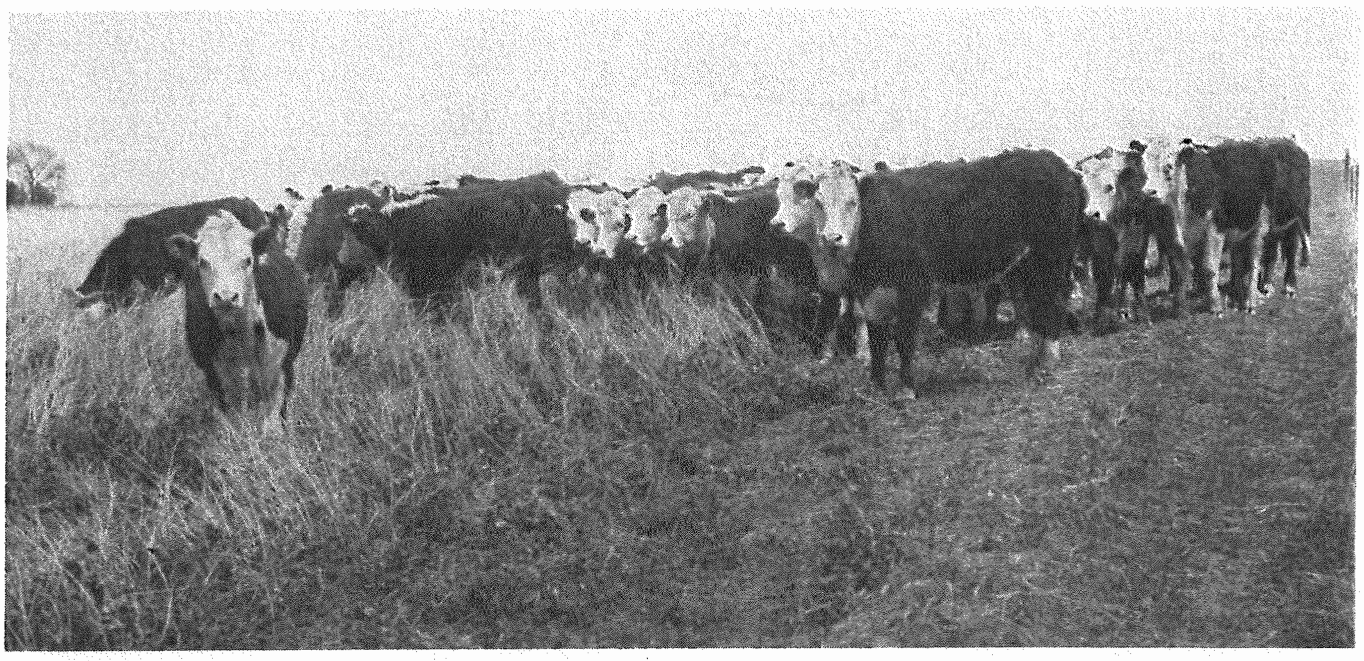
Report of Progress 433
April 1983

1983 Report of Agricultural Research

Agricultural Experiment Station
Kansas State University, Manhattan
John O. Dunbar, Director

Southeast Kansas Branch Station



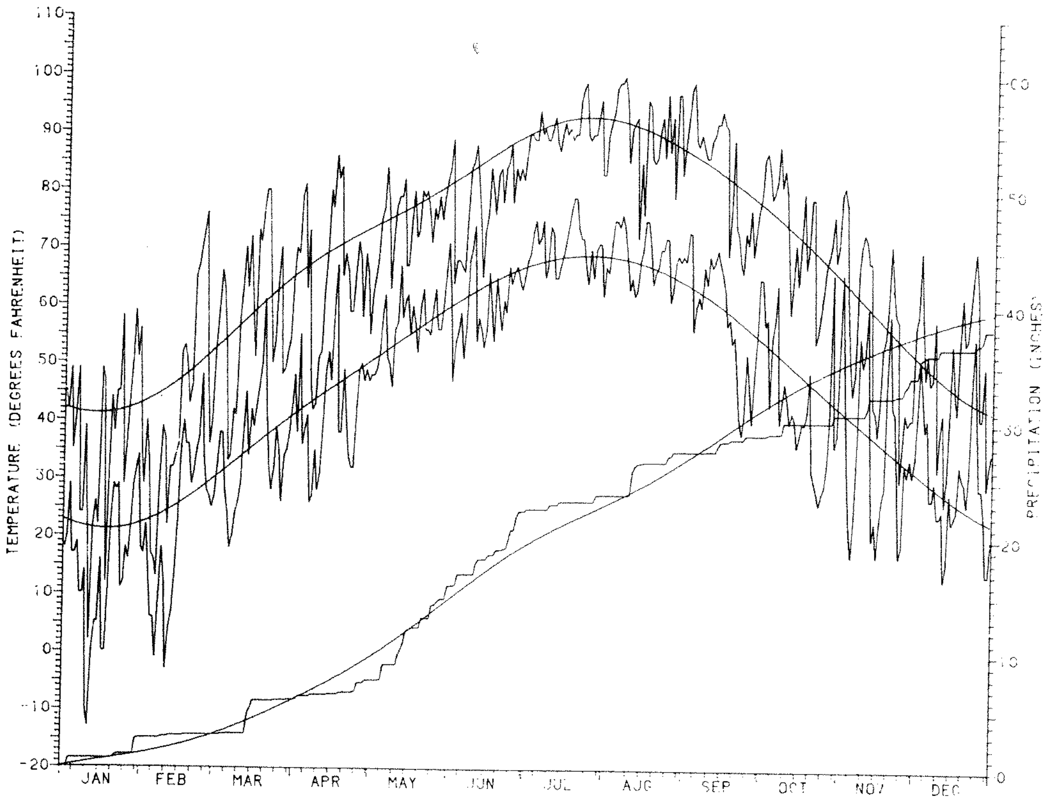
Agricultural Research at the Southeast Kansas Branch Experiment Station during 1982 [1]

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 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 60 years.

This report for 1982 covers three areas of research emphasis: Crops, Forages, and Beef Cattle. We sincerely hope that it will be useful to area producers and consumers, industry cooperators, Extension personnel and others.

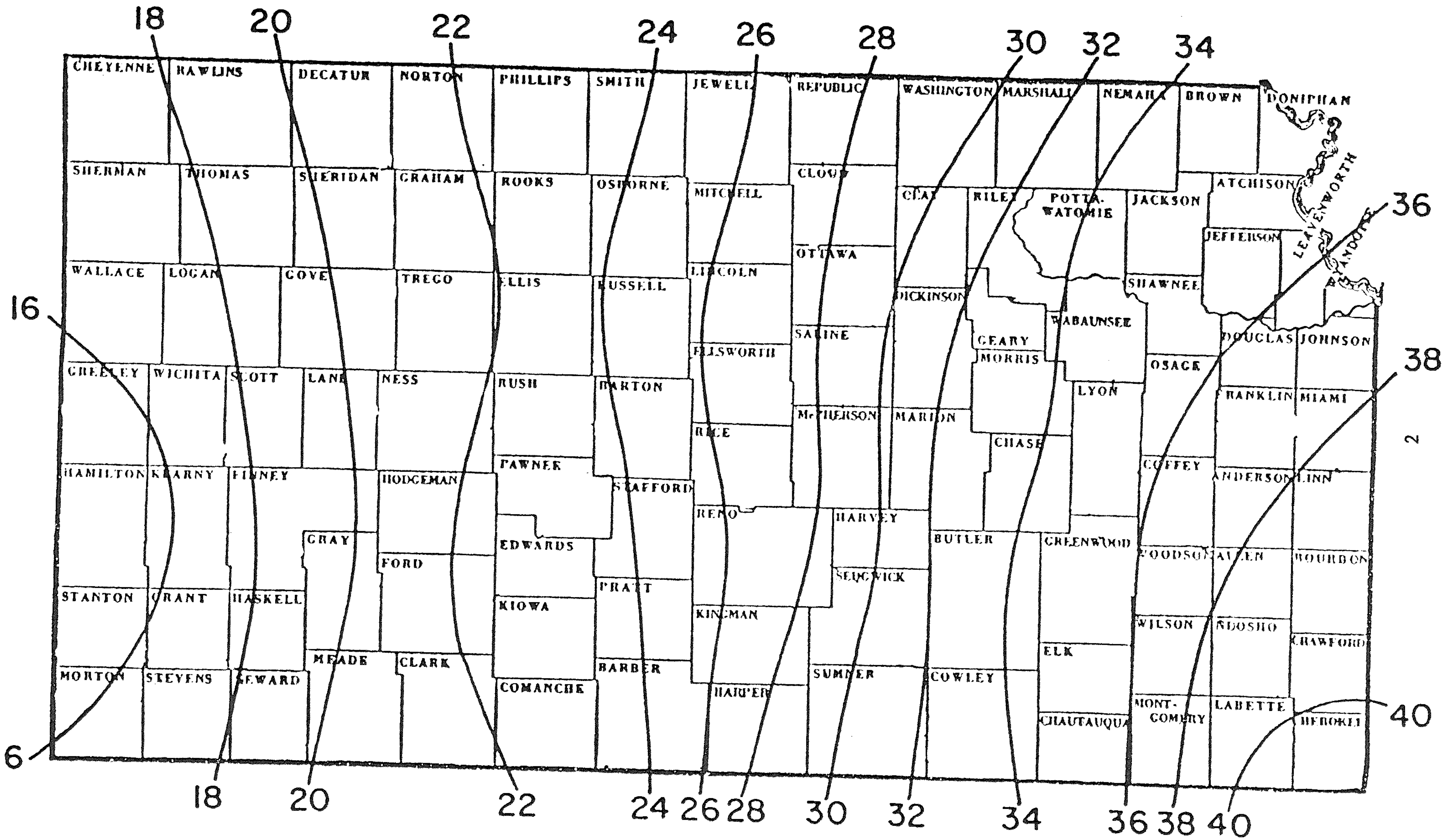
The following chart summarizes temperature and precipitation for 1982. It may help explain some of the reported experimental results that may be difficult to interpret because of weather effects. The second chart gives a 30-year average of annual precipitation for the entire state of Kansas illustrating the great range from southwest to southeast.



GRAPHICAL WEATHER SUMMARY FOR PARSONS 1982

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

[1] Contribution no 83-110-S, Southeast Kansas Branch Experiment Station, Parsons, and Kansas Agricultural Experiment Station, Kansas State University, Manhattan.



NORMAL ANNUAL PRECIPITATION FOR KANSAS, 1951-1980

L. D. Bark

Kansas Agriculture Experiment Station

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NOTE: When trade names are used in Kansas State University publications, no endorsement of them or criticism of similar products not named is intended.

CROPS RESEARCH

Kenneth W. Kelley

Crops Agronomist

Performance Tests for Small Grain Varieties

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

Procedure: In 1982, 24 wheat varieties, seven barley varieties, three winter oat varieties, and six spring oat varieties were compared. Wheat, barley, and winter oat planting date was November 17, while spring oats were planted March 3. Wheat plots were fertilized with 100 lbs N, 75 lbs P_2O_5, and 75 lbs K_2O per acre. Barley and oat plots were fertilized with 60 lbs N, 50 lbs P_2O_5, and 60 lbs K_2O per acre.

Wheat results: Wet weather in the fall of 1981 was not favorable for wheat planting in southeastern Kansas, so wheat did not emerge until early spring. Although extremely cold temperatures existed during the winter, winterkilling was not noticeable in the wheat plots. Tillering was reduced due to the late emergence. Climatic conditions also hampered wheat growth in the early spring due to the saturated soil moisture conditions during May and June. Several plant diseases (powdery mildew, septoria leaf blotch, leaf rust, and head blight) were present near plant maturity, which reduced grain yields substantially.

Despite all of the climatic problems, the average wheat yield over all plots was 45 bushels per acre. Tam 105 was the top yielder at 53 bushels per acre. Three-year averages and 1982 results of the more popular varieties are listed below. (Complete wheat-yield results for Kansas are compiled in Agric. Expt. Station Report of Progress 421.)

Wheat variety	1982 Yield, bu/a	1980-82 Yield, bu/a
Agripro Hawk	41	- -
Agripro Wings	49	53
Centurk 78	48	53
Newton	38	50
Parker 76	44	48
Payne	47	46
Pioneer PL 145	45	- -
Pro Brand 835	49	- -
Tam 105	53	55
Triumph 64	42	46
Vona	37	50
McNair 1003	50	- -
Hart	45	54
LSD .05	4	4

Wheat conclusions: Several wheat varieties seemed to have more resistance to the plant diseases that were encountered under the wet, humid conditions of 1982. However, the stage of plant maturity at the time of disease infestation was a major factor.

Barley results: Because of severe plant lodging in 1982, plots were not harvested for yield, but agronomic information is listed below.

Barley variety	Lodging, %	Height, in	Heading date
Kanby	50	30	May 15
Paoli	100	29	May 14
Nebar	50	32	May 19
Post	20	30	May 18
Wintermalt	10	32	May 20
Nebr. 76129	80	26	May 17
Nebr. 76147	15	29	May 19

Barley conclusions: Based upon data over several years, Post is one of the better varieties for the area.

Winter oat results and conclusions: All winter oat varieties were completely winter-killed in 1982. Spring oats are a better choice.

Spring oat results:

Variety	Yield, bu/a 1982	Yield, bu/a 1979-82	Test wt., lbs/bu	Height, in	Heading date
Pettis	26	76	30	39	May 20
Trio	50	73	27	39	May 23
Spear	50	76	28	37	May 24
Larry	50	--	29	34	May 22
Lang	68	89	29	36	May 23
Bates	72	89	29	40	May 22
LSD .05	6		1	--	--

Spring oat conclusions: Lang and Bates have been the most consistent varieties. Larry is a newer variety that is somewhat shorter.

Selected Wheat Varieties With High Yield Potential Compared at Three Nitrogen Rates

Fertility requirements of the higher yielding, semi-dwarf and soft wheat varieties that now dominate the wheat acreage in southeastern Kansas have not been evaluated. Because of their higher yield potential, these new varieties probably have higher fertility requirements than the old standard varieties.

Procedure: Beginning in 1980, six semi-dwarf hard wheat varieties and three soft wheat varieties were compared against a standard variety at three levels of N (50, 100, and 150 lbs/a). Phosphate and potassium were applied at a constant rate of 80 pounds of elemental material per acre. Nitrogen was applied in late winter as ammonium nitrate.

Results: Due to wet conditions in the fall of 1981, wheat planting was delayed until mid-November and emergence was not until early spring. The late wheat growth probably affected the utilization of nitrogen because there was no significant response to the higher N rates in 1982. Results in 1981 were similar, although dry conditions were the influencing factor then.

With the usually wet conditions in the spring of 1982, the semi-dwarf varieties experienced several leaf diseases that reduced grain yields and test weight. Tam 105 was the best semi-dwarf at 58 bu/a and McNair 1003 (a soft wheat) was the overall top yielder at 72 bu/a. Results of 1982 are shown in Table 1.

Conclusions: Because of the extreme weather patterns in 1981 and 1982, wheat has not responded significantly to nitrogen fertilization. This study will be continued in 1983.

Table 1. Selected Wheat Varieties Compared With 3 Levels of Nitrogen Fertilizer, Parsons Field, 1982.

	Yield, bu/A				Test wt., lbs/bu				Date headed	Height, in				Lodging, %				Disease resistance 1/		
	50	100	150	Avg	50	100	150	Avg		50	100	150	Avg	50	100	150	Avg	Leaf rust Rating	Septoria leaf spot Rating	Overall plant disease Rating
	- -lbs N/a- -				- -lbs N/a- -					- -lbs N/a- -				- -lbs N/a- -						
(Hard Wheat)																				
Newton	45.2	47.3	44.8	45.8	50.7	50.3	50.7	50.6	May 14	33	33	33	33	2	2	4	3	7	7	7
Vona	51.6	53.2	50.9	51.9	55.0	55.3	55.3	55.2	May 7	27	28	28	28	5	7	4	5	5	6	6
Pioneer PL145	52.3	54.6	48.9	51.9	52.3	52.3	52.0	52.2	May 14	33	33	33	33	4	3	12	6	5	5	4
Payne	45.9	49.2	48.3	47.8	53.3	53.3	53.3	53.3	May 10	31	31	32	31	13	15	16	15	2	5	6
Tam 105	58.6	58.3	56.3	57.7	54.7	54.3	52.7	53.9	May 11	33	32	32	32	23	15	22	20	3	4	4
Agripro Wings	52.5	54.8	59.1	55.5	57.0	58.3	57.7	57.7	May 7	31	31	31	31	16	17	12	15	7	7	7
Parker 76	54.7	56.4	59.9	57.0	58.3	58.3	58.7	58.4	May 10	34	33	34	34	3	4	3	3	2	6	4
(Soft Wheat)																				
McNair 1003	72.9	69.7	73.5	72.0	50.7	53.0	51.0	51.6	May 12	33	33	33	33	2	2	2	2	5	2	2
Pioneer S78	59.1	56.1	56.5	57.2	53.3	54.0	53.3	53.5	May 14	31	30	31	31	2	4	6	4	4	6	5
Hart	53.9	56.0	59.9	56.6	54.0	54.3	53.0	53.8	May 10	33	32	32	32	4	3	2	3	7	7	7

1/ Disease resistance rating: 1 = excellent, 10 = poor.

	Grain Protein, %			
	50	100	150	Avg
	--lbs N/a--			
(Hard Wheat)				
Newton	13.6	13.9	14.0	13.8
Vona	13.0	13.5	13.5	13.3
Pioneer PL145	13.0	14.2	14.5	13.9
Payne	13.3	13.8	13.0	13.4
Tam 105	13.4	13.6	13.2	13.4
Agripro Wings	12.2	13.4	12.6	12.7
Parker 76	13.5	13.6	13.6	13.6
(Soft Wheat)				
McNair 1003	12.2	12.8	12.9	12.6
Pioneer S78	13.0	13.3	13.5	13.3
Hart	13.6	13.8	14.2	13.9
Means	13.1	13.6	13.5	- -

LSD COMPARISONS:

Grain Yield
N rate LSD .05 = NS
Variety LSD .05 = 4.8 (comparing variety means averaged over all N rates)
N rate x variety LSD .05 = NS

Test Weight
N rate LSD .05 = NS
Variety LSD .05 = 1.00 (comparing variety means averaged over all N rates)
N rate x variety LSD .05 = NS

Height
N rate LSD .05 = NS
Variety LSD .05 = 1.00
N rate x variety LSD .05 = NS

Lodging
N rate LSD .05 = NS
Variety LSD .05 = 6
N rate x variety LSD .05 = NS

Protein
N rate LSD .05 = 0.14 (comparing N rates averaged over varieties)
Variety LSD .05 = 0.50 (comparing varieties averaged over N rates)
N rate x variety LSD .05 = NS

Effects of P Rates and Application Methods on Two Wheat Varieties

Higher yielding, semi-dwarf wheat varieties as well as some soft wheats now dominate the wheat acreage in southeast Kansas. These new varieties have high yield potentials, but their fertility requirements have not been fully investigated.

Procedure: In 1980 work was begun to compare a semi-dwarf variety (Newton) and an old standard variety (Centurk) at three P rates (40, 80, and 120 lb P_2O_5/a) and two methods of P application (knifed and broadcast). N rate was 120 lb/a.

Results: 1982 results (Table 2) showed an excellent P response by both varieties. The 80 lb P_2O_5/a rate produced significantly higher yields than 40 lb P_2O_5. There were no significant differences between the two methods of P application (knifed versus broadcast). In 1982 Centurk yielded significantly higher than Newton, but 2-year averages for the two varieties were the same.

Conclusions: Results of this preliminary P study indicate that the phosphorus requirement of the newer semi-dwarf wheat varieties is not any higher than that of the standard varieties.

Table 2. Effects of P Rates and Application Methods on Two Winter Wheat Varieties.

N (Lbs/a)	P_2O_5 (Lbs/a)	P Method	Variety	1982 Grain yield bu/a	2-year Average bu/a	1982 Test Weight
120	0	- - -	Newton	19	36	49
120	40	Knifed	"	29	44	51
120	80	"	"	39	54	53
120	120	"	"	40	55	53
120	40	Broadcast	"	29	45	56
120	80	"	"	30	48	52
120	120	"	"	33	49	51
120	0	- - -	Centurk	20	31	53
120	40	Knifed	"	37	48	55
120	80	"	"	37	51	55
120	120	"	"	40	50	55
120	40	Broadcast	"	33	46	54
120	80	"	"	39	49	55
120	120	"	"	44	53	55
Treatment LSD (.05)				9	--	2
Mean Values:						
P_2O_5	40			32	46	53
	80			36	50	54
	120			39	52	54
	LSD (.05)			5	--	NS

(continued)

Table 2. Effects of P Rates and Application Methods on Two Winter Wheat Varieties (continued).

N	P_2O_5	P Method	Variety	1982 Grain yield bu/a	2-year Average bu/a	1982 Test Weight
Lbs/a						
P Method		Knifed		37	50	54
		Broadcast		35	48	53
LSD (.05)				NS	--	NS
Variety			Newton	33	48	52
			Centurk	38	48	55
LSD (.05)				4	--	1

Effects of N and P Rates and Application Methods for Winter Wheat

Many of the soils in southeast Kansas are responsive to P application. With the cost of P fertilizer on the increase there is much interest in getting the best possible efficiency of applied P.

Procedure: This study compared methods of P application and P rates for winter wheat. P rates were 30, 60, and 90 lbs P_2O_5/a. Methods of P application were dual-knifing (simultaneously injecting NH_3 and 10-34-0 eight inches deep on 15-inch centers), broadcast and banding with a drill. The study was established on an area that had only 4 lb/a available P. N rate was constant at 75 lb N/a.

Results: 1982 yield response to added P was excellent, as wheat on the control plot (0 P_2O_5) produced 9 bu/a and wheat receiving the 60 P_2O_5/a rate produced 28 bu/a. There was no significant yield difference between 60 and 90 lbs P_2O_5/a in 1982 nor from the period 1980-82, but both of these rates produced significantly higher yields than the 30 lbs P_2O_5/a rate.

In 1982, as well as over the 3-year period, banding P near the seed at planting time gave the highest grain yield. Also in 1982, broadcast P gave significantly lower grain yield than P that was knifed or banded. However, the 3-year average for broadcast and knifed P was nearly the same.

Conclusions: Results of this work show that P fertilization can increase wheat yields effectively on low-P soils. Where soils tested low in P, banding the P fertilizer near the seed produced the highest yields.

Table 3. Effects of P Rates and Application Methods on Winter Wheat Yield.

N (lbs/a)	P_2O_5 (lbs/a)	P Method	1982 Grain yield bu/a	3-year Average yield bu/a	1982 Test wt lbs/bu
0	0	- - -	4	13	45
75	0	- - -	9	15	46
75	30	Dual-Knife	15	31	49
75	60	" "	27	45	52
75	90	" "	31	48	52
75	30	Broadcast	15	35	47
75	60	"	17	42	49
75	90	"	20	44	49
75	30	Band	29	44	53
75	60	"	41	50	54
75	90	"	45	52	55
Treatment LSD (.05)			9	- -	3
Mean Values:					
P_2O_5 Rate					
	30		20	37	50
	60		28	46	52
	90		32	48	53
LSD (.05)			6	--	2
P Method:		Dual-Knife	25	41	51
		Broadcast	18	40	48
		Band	38	48	54
		LSD (.05)	6	--	2

Wheat Yields Compared with Long and Short Term Fertility Treatments in a Cropping Sequence Evaluation

Wheat and soybeans are the major cash crops in much of southeast Kansas. The sequence of the two crops varies among producers, but doublecropping of soybeans after wheat is common, as well as the practice of growing three crops in 2 years (wheat-doublecrop soybeans-full season soybeans). Fertility requirements for wheat and soybeans in these systems have not been determined fully.

Procedure: Long term fertility treatments have been maintained at the Columbus Field for a number of years. Beginning in the fall of 1980, we started adding phosphate and potassium (potash) fertilizers and lime to some plots that had not previously received any. Two cropping sequences also were established. One rotation involves growing three crops in 2 years (wheat-double-crop soybeans-full season soybeans); the other rotation will give two crops in 2 years (wheat-soybeans) without any doublecropped soybeans. All of the fertilizer is applied to the wheat crop.

Manure has been applied at 10 tons per acre before growing full season soybeans. Lime has been added on the original plots to keep pH near 6.8.

Results: Wheat and soybean yields were surprisingly good where lime, phosphate, and potash were added to some control plots in the long-term rotation that had not previously received any fertilizer for a number of years. Highest grain yields, however, continually come from the plots that have had a balanced fertility program for several years.

Conclusions: Wheat and soybean yields have increased dramatically in a rather short period of time where P and K fertilizers were added to plots that were extremely deficient in these nutrients. However, a longer period of time is required before the soil test levels of these nutrients reach an optimum level under current fertilizer application rates.

Table 4. Wheat and Soybean Yields Compared in a Long-term Fertility and Cropping Rotation, Columbus Field, 1982.

Fertility treatments	Wheat yield bu/a	Soybean yield bu/a
[Wheat-doublecrop soybean] - soybean rotation		
Lime	8	14
Lime, 75 P_2O_5	25	23
Lime, 50 P_2O_5, 50 K_2O	46	28
Lime, 75 P_2O_5, 75 K_2O	45	30
Lime, 100 P_2O_5, 100 K_2O	45	26
Lime, manure	44	30
Lime, manure, 75 P_2O_5	46	35
Lime, manure, 75 P_2O_5, 75 K_2O	47	33
No lime or fertilizer	3	5
Wheat-full season soybean rotation		
Lime, (75 P_2O_5), (75 K_2O)	33	--
Lime, 75 P_2O_5, (75 K_2O)	48	--
Lime, 50 P_2O_5, 50 K_2O	49	--
Lime, 75 P_2O_5, 75 K_2O	53	--
Lime, 100 P_2O_5, 100 K_2O	49	--
Lime, manure	51	--
Lime, manure, 75 P_2O_5	57	--
Lime, manure, 75 P_2O_5, 75 K_2O	50	--
(Lime), (75 P_2O_5), (75 K_2O)	45	--

All P and K fertility treatments were applied to the wheat. Treatments in parenthesis have only been applied since 1980.
Lime applied as needed to keep pH near 6.8.
Manure applied at 10 tons/a before full season soybeans were planted.
Nitrogen applied at 75 lbs/a to all plots.

Table 5. Wheat and Soybean Yields Compared in a Long-term Fertility and Cropping Rotation, Columbus Field, 1981-82.

Fertility treatments	1981 Wheat yield	Soybean yield 1981	Soybean yield 1982	Soil test, 1982 1/ pH	Avail. P	Exch. K
[Wheat - doublecrop soybean] - soybean rotation						
	bu/a	--- bu/a ---		--	--- bu/a ---	
Lime, (75, P_2O_5), (75 K_2O)	41	20	14	6.9	13	127
Lime, 75 P_2O_5, (75 K_2O)	46	23	21	7.2	29	132
Lime, 50 P_2O_5, 50 K_2O	46	26	26	7.1	27	143
Lime, 75 P_2O_5, 75 K_2O	49	25	28	7.0	22	169
Lime, 100 P_2O_5, 100 K_2O	47	27	25	7.1	23	145
Lime, manure	45	28	27	7.4	48	180
Lime, manure, 75 P_2O_5	49	27	34	7.2	64	195
Lime, manure, 75 P_2O_5, 75 K_2O	46	27	37	7.2	62	225
(Lime), (75 P_2O_5), (75 K_2O)	43	20	26	7.1	17	141
Wheat - full season soybean rotation						
Lime	16	--	26	7.0	8	93
Lime, 75 P_2O_5	41	--	29	7.0	22	88
Lime, 50 P_2O_5, 50 K_2O	47	--	33	7.0	23	129
Lime, 75 P_2O_5, 75 K_2O	47	--	32	7.2	24	129
Lime, 100 P_2O_5, 100 K_2O	49	--	34	7.2	20	127
Lime, manure	47	--	34	7.4	40	130
Lime, manure, 75 P_2O_5	50	--	35	7.2	44	143
Lime, manure, 75 P_2O_5, 75 K_2O	49	--	42	7.2	41	168
No lime or fertilizer	11	--	15	5.4	7	70

All P and K fertility treatments were applied to the wheat. Treatments in parenthesis have only been applied since 1980. Manure applied at 10 tons/a before full-season soybeans.

Nitrogen applied at 75 lbs/a to all plots.

1/ Soil test taken after fall soybean harvest.

Effect of Metribuzin on Controlling Cheatgrass in Winter Wheat

Cheatgrass and downy bromegrass are two winter annual weeds that often invade wheat fields, especially where wheat follows wheat in the cropping sequence. Recently, clearance was received for applying the herbicide metribuzin (Sencor and/or Lexone) to control winter annual grasses in wheat fields planted to Newton, Tam W-101, Tam 105, and Eagle.

Procedure: In 1982 metribuzin (Sencor) was applied to winter wheat in Neosho County at three rates (0.25, 0.38, and 0.50 lb a.i./a) and on two different dates (Dec. 30 and Mar. 1) for cheatgrass control.

Results: Adequate rainfall for herbicide activation occurred shortly after both application dates, so good cheatgrass control was obtained. The lower rate of 0.25 lb a.i./a was not as effective as the two higher rates of 0.38 and 0.50 lb a.i./a, but some crop injury was observed at the higher rate.

Conclusions: Where cheatgrass is a problem, herbicide application should be made as soon as the wheat plant has three tillers and secondary roots are at least two inches in length. If wheat reaches the correct growth stage in the fall, better weed control normally would result from herbicide treatment then rather than waiting until spring when the cheatgrass is larger and more difficult to control. The proper rate of application will depend on the particular soil type.

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 1982, fifty-eight hybrids were compared at the Parsons field under dryland conditions. Fertilization rate was 125 lbs N, 75 lbs P_2O_5, and 75 lbs K_2O per acre. Planting date was June 22.

Results: Overall test yield average was 63 bushels per acre. Grain yields ranged from 55 to 74 bushels per acre. Dry weather from heading until plant maturity reduced yields substantially.

Conclusion: Complete results of grain sorghum yields for Kansas in 1982 are compiled in Agric. Expt. Station Report of Progress 425.

Effect of Planting Date on Grain Sorghum Production - Early, Medium, and Late Maturing Hybrids

Grain sorghum is planted from late April through late June in southeastern Kansas. More information is needed, however, to determine the optimum planting date for hybrids of a specific maturity.

Procedure: Beginning in 1979, selected grain sorghum hybrids, representing early, medium, and medium-late maturity, have been planted on four different dates. However, in 1982 only two planting dates were compared (late April versus late June) because of wet soil conditions during May and June. In 1982 plots were fertilized with 125 lbs N, 75 lbs P_2O_5, and 75 lbs K_2O per acre. Hybrids were planted in 30-inch rows and hand-thinned to a population of 30,000 plants per acre.

Results: Hybrids planted in late April averaged 88 bushels per acre, while those same hybrids planted in late June averaged only 55 bushels per acre (Table 6). In previous years the late June planting date has often given the highest grain yields. However, dry conditions during late August through October in 1982 were not favorable for late planted grain sorghum.

Conclusion: More data is needed before recommendations can be made regarding which grain sorghum hybrid of a given maturity should be planted for a specific planting date.

Table 6. Comparisons of Selected Grain Sorghum Hybrids at Two Different Planting Dates, Parsons Field, 1982.

Hybrid	Planting date	Yield bu/a	Test wt lbs/bu	Date of half bloom
DeKalb B-38+ (early)	April 27	89.4	58	July 13
	June 22	54.7	57	Aug 11
Pioneer 8790 (early)	April 27	91.5	58	July 11
	June 22	56.0	57	Aug 13
Pioneer 8585 (medium)	April 27	97.5	58	July 15
	June 22	63.4	57	Aug 15
DeKalb DK-42Y (medium)	April 27	76.2	53	July 17
	June 22	49.3	52	Aug 16
NC + 172 (medium)	April 27	90.8	55	July 17
	June 22	57.4	56	Aug 16
Stauffer 734 (medium-late)	April 27	86.9	57	July 18
	June 22	58.8	56	Aug 17
Pioneer 8272 (medium-late)	April 27	70.1	54	July 18
	June 22	58.0	55	Aug 18
Asgrow colt (late)	April 27	99.3	58	July 20
	June 22	43.0	57	Aug 22

<u>LSD .05</u> Comparing one hybrid with another hybrid at the same planting date = 7 bu.
Comparing one date with another date with the same hybrid = 12 bu.

Soybean Variety Performance Test

Southeastern Kansas is the leading soybean producing area in Kansas. Developing high-yielding varieties that are adapted to the area is of prime importance to area farmers.

Procedure: In 1982, thirty-six soybean varieties were planted in 30-inch rows on July 2 at the Columbus field.

Results: Despite the late planting date, good growing conditions existed through July and August, although September and October were extremely dry during the critical pod filling stage. Yields of the more commonly grown varieties are shown below. Complete variety results are compiled in Agric. Expt. Station Report of Progress 426.

Variety	1982 Yield, bu/a	1980-82 Yield, bu/a
Bay	36.0	- -
Forrest	30.7	29.2
Essex	32.3	28.2
Asgrow 5474	31.7	28.4
Asgrow 5618	30.1	29.3
Agri Pro 350	29.2	23.3
Ring Around 480	28.4	28.3
Agri Pro 420	26.1	- -
Ring Around 502	25.4	- -
Crawford	25.9	24.2
Douglas	23.9	23.0
DeSoto	23.8	22.5
Williams	20.5	- -
LSD .05	2.3	

Conclusions: Varieties of Group V maturity (Essex to Forrest maturity) have normally given highest and most consistent grain yields.

Effects of Row Spacing on Yield of Soybeans

In recent years planting soybeans in narrow rows has increased in popularity in southeastern Kansas. Better weed control with herbicides and improved planting equipment have been largely responsible. Narrower rows also have been advocated as a way to boost soybean yields. However, the yield benefit from narrower row spacing needs further investigation with the long-season varieties grown in southeastern Kansas.

Procedure: In 1982 Essex and Crawford were compared in 7 and 30-inch row spacings at the Columbus field. Planting date was July 5. Similar row spacing studies with Group IV and Group V varieties have been in progress since 1977.

Results: Growing conditions during July and August were ideal for soybean growth but dry conditions during September and October resulted in substantially lower yields. Essex yielded significantly more in narrow rows, while row spacing comparisons with Crawford were about equal. Results are shown in Table 7.

Conclusions: The yield advantage advocated for narrower row spacing has been erratic in our evaluations with medium to full-season soybean varieties.

Table 7. Effects of Row Spacing on Yield of Essex and Crawford Soybean Varieties, Columbus Field.

Variety	Row spacing, in	Yield, bu/a 1982	1980-82	1977-82
Crawford	7	25.4	24.9	- -
Crawford	30	24.0	22.5	- -
Essex	7	27.5	26.0	25.8
Essex	30	22.7	24.0	25.2
LSD .05		2.1	- -	- -

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.

Results: Full-season soybeans can be compared in the four cropping rotations every two years. In 1982 continuous soybeans yielded significantly lower than soybeans following wheat or grain sorghum in the rotation. Results are shown in Table 8.

Conclusion: Preliminary results show the need to rotate soybeans in the cropping rotation. Another study on wheat and soybean cropping sequences was started in 1981 at the Parsons field to evaluate the agronomic effects of continuous doublecropping of soybeans after wheat, compared with doublecropping every other year.

Table 8. Effects of Cropping Sequence on Soybean Yield, Columbus Field.

Cropping sequence 1/	$N - P_2O_5 - K_2O$ lbs/a	Soybean yield, bu/a 1980	1982
[Wheat - doublecrop soybeans] - Soybeans	80-80-80	12.6	28.0
Grain sorghum - Soybeans	120-80-80	13.3	30.4
Wheat - Soybeans	80-80-80	12.8	31.9
Continuous soybeans	0-40-40	10.3	27.2
LSD .05		1.0	3.0

1/ Full-season soybean yields can be compared between treatments every other year.

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

Comparison of Tillage Method for Doublecrop Soybeans After Wheat

Producers in southeastern Kansas typically 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 goal is to plant soybeans as quickly as possible after wheat harvest and to produce acceptable yields as economically as possible.

Procedure: In 1982 four tillage methods were compared when Essex soybeans were planted after wheat harvest at the Columbus field. Tillage methods compared were plow, disc, burn then discing, and no-till. Soybeans were planted July 6 in 30-inch row spacing.

Results: Excellent stands were obtained with all four tillage methods (Table 9). With the no-till plots there was some soil compaction where the combine tires had passed resulting in plants that were somewhat stunted. However, at harvest time, there were no significant differences in yield between any of the four tillage methods. Weed control was satisfactory, although all plots were cultivated.

Conclusion: More data is needed before valid conclusions are made regarding the most efficient tillage method for planting doublecrop soybeans.

Table 9. Comparison of Tillage Methods for Doublecrop Soybeans, Columbus Field, 1982.

Tillage treatment	Yield, bu/a
Plow, disc, field cult., plant, spray, cultivate	26.1
Burn wheat stubble, disc, field cult., plant, spray, cultivate	25.8
Disc 1/, disc 2/, plant, spray, cultivate	26.6
Plant no-till, spray, cultivate	26.3
Treatment LSD .05	n.s.

1/ First tillage pass was with a larger disc that had 9-inch blade spacing and 22-inch blades.

2/ Second tillage pass was with a smaller disc that had 7 1/2-inch blade spacing and 20-inch blades.

Herbicide: Lasso - 2 qts/a
Lorox-4L - 1 pt/a

No-till plots also received 1.5 pts/a Paraquat + 0.5 pt/a of 2,4-D ester.

Effects of Primary Tillage Methods on Soybeans Yields

Primary tillage methods for soybeans following soybeans normally involves plowing, chiseling, or discing. Long term, as well as short term, comparisons of tillage methods are of interest to area farmers.

Procedure: Tillage methods compared at the Columbus field include the moldboard plow, chisel plow, tandem disc, and no-till. For the past three years, soybeans have followed soybeans in the cropping rotation. Herbicides and cultivation were used to control weeds with all tillage methods.

Results: Yield results of 1982, as well as 3-year averages, are shown in Table 10.

Conclusion: There have been no significant yield differences between the moldboard plow and the chisel plow methods over the 3-year average. Planting no-till has produced significantly lower yields.

Table 10. Effects of Primary Tillage Methods on Soybean Yields, Columbus Field.

Tillage treatment	Yield, bu/a	
	1982	3-yr avg
Plow	24	37
Chisel	24	36
Disc	22	33
No-till	19	27
LSD .05	2	--

Soybean Herbicides Compared for Broadleaf Weed Control

Broadleaf weeds such as velvetleaf, cocklebur, pigweed, and moringglory are prevalent in many soybean fields of southeastern Kansas. Soybean yields are reduced substantially where moderate weed infestations occur. In many cases, a complete herbicide program involving both preemerge and postemerge herbicides are needed in order to obtain satisfactory weed control.

Procedure: In 1982 several soybean herbicide studies were established in Cherokee county in fields where specific broadleaf weed problems occurred. Due to the wet soil conditions in May and June, planting was delayed until early July and more emphasis was on the evaluation of postemerge herbicides for broadleaf weed control.

Results: Weed control results are shown in Tables 11, 12, and 13. General observations of the various studies are as follows:

Cocklebur: Metribuzin (Sencor and/or Lexone) applied prior to or immediately after planting gave 85 to 90% cocklebur control at one location. Applying metribuzin as a split application (part of it incorporated prior to planting and the remainder applied after planting) gave better cocklebur control than individual preplant or preemerge herbicide treatments.

In the postemerge herbicide studies, Basagran generally gave better cocklebur control than Blazer, especially where weeds were taller than 6 to 8 inches in height. Adding 2 to 4 ounces of 2,4-DB to Basagran or Blazer did not appear to improve weed control under the spray conditions we encountered in 1982. Adding crop oil appeared to give slightly better control in some situations where weeds were taller than optimum size for spraying. Applying tank-mixes of Basagran and Blazer at various rates did not control cocklebur any better than applying those herbicides individually.

Table 11. Comparisons of Soybean Herbicides for Cocklebur Control, Cherokee County, 1982.

Treatments	Rate, lbs or qts/a	When applied	Coc control 1/	Crop injury 2/	Yield, bu/a
Sencor-DF	0.67	PPI	90	0	33.8
Sencor-DF	0.50	PPI	85	0	33.4
Sencor-DF (split applic)	0.50 + 0.33	PPI + Pre	95	0	35.6
Basagran + crop oil (1 Qt/a)	0.50	Post	95	1	33.2
Basagran + crop oil (1 Qt/a)	0.75	Post	95	1	34.6
Basagran + crop oil (1 Qt/a)	1.00	Post	95	1	35.0
Basagran	1.00	Post	95	0	33.8
Blazer	0.75	Post	80	2	29.2
Blazer	1.00	Post	80	2	29.8
Dyanap	3.00	Post	95	5	33.2
Blazer + Basagran	0.5 + 0.5	Post	95	2	34.0
Blazer + Basagran + 2,4-DB (2 oz/a)	0.5 + 0.5	Post	95	2	35.1
Blazer + Basagran + 2,4-DB (2 oz/a)	0.75 + 0.5	Post	95	2	33.7
Control	- - -	- -	0	-	20.1
Treatment LSD .05					5.1

1/ Cockleburs were 2 to 8 inches tall when postemerge sprays were applied.
2/ Crop injury rating: 0 = no injury, 10 = dead plants.

PPI (preplant incorporated) treatments applied July 3, 1982.
Essex soybeans planted July 3.
Pre-emerge treatment applied July 5.
Postemerge treatments applied Aug. 2.

Table 12. Effects of Postemergence Herbicides on Broadleaf Weed Control in Soybeans, Cherokee County, 1982.

Treatments 1/	Rate, Pts/a	Weed control, % 2/ Coc Site-1	Coc Site-2	Ropw Site-2	Ilmg Site-1	Crop injury 3/ Site-1	Site-2
Blazer	1.5	98	80	75	80	3	2
Blazer + AG-98 (.5% V/V)	1.5	98	80	75	80	3	2
Blazer + crop oil (1 pt/a)	1.5	98	85	80	80	4	3
Blazer	2.0	98	80	80	85	3	2
Blazer + AG-98 (.5% V/V)	2.0	98	80	80	85	3	2
Blazer + crop oil (1 pt/a)	2.0	98	85	85	85	4	3
Blazer + 2, 4-DB (2 oz/a)	1.5	98	80	80	80	2	2
Blazer + 2, 4-DB (4 oz/a)	1.5	98	80	80	80	2	2
Blazer + 2, 4-DB (2 oz/a)	2.0	98	80	80	85	3	2
Blazer + 2, 4-DB (4 oz/a)	2.0	98	80	85	85	3	2
Basagran	1.5	98	90	20	70	1	1
Basagran + 2, 4-DB (2 oz/a)	1.5	98	90	20	70	1	1
Basagran + 2, 4-DB (4 oz/a)	1.5	98	95	40	75	1	1
Basagran + crop oil (1 pt/a)	1.5	98	95	40	70	2	2
Basagran	2.0	98	95	40	70	1	1
Basagran + crop oil (1 pt/a)	2.0	98	95	50	70	2	2
Blazer + Basagran + crop oil (1 pt/a)	1.0 + 1.0	98	90	80	80	4	3
Blazer + Basagran	1.5 + 1.0	98	90	85	85	3	3
Blazer + Basagran	2.0 + 1.0	98	90	90	85	3	3
Blazer + Basagran + 2, 4-DB (2 oz/a)	1.0 + 1.0	98	90	75	85	2	2
Dyanap	6.0	98	95	90	85	8	6
Control	- -	0	0	0	0	-	-

1/ Treatments were applied to Site-1 on July 21, 1982 after a 0.5 inch rain. Cockleburs were 2 to 6 inches tall and morningglory was in the 2- to 4-leaf stage. Treatments applied to Site-2 on July 19, 1982 when soil surface was somewhat drier. Rough pigweed and cocklebur were 4 to 8 inches tall.

2/ Coc = cocklebur; Ropw = rough pigweed; Ilmg = ivyleaf morningglory.

3/ Crop injury rating (3 days after herbicide application): 1 = no injury, 10 = dead plants.

Table 13. Comparison of Herbicides for Velvetleaf Control in Soybeans, Cherokee County, 1982.

Treatments	Rate, lbs or Qts/	When applied	Vel[1] Control, %	Crop[2] injury	Yield bu/a
Applied May 3					
Sencor-DF	0.50	PPI	20	0	17.9
Sencor-DF	0.67	PPI	20	0	18.2
Applied July 3					
Sencor-DF	0.33	PPI	80	0	25.9
Sencor-DF	0.50	PPI	85	0	26.2
Sencor-DF	0.33	Pre	82	0	24.3
Sencor-DF (split applic)	0.33 + 0.33	PPI + Pre	95	0	28.2
Lorox-L	0.75	Pre	85	0	27.3
Applied July 17 (soil surface was dry)					
Basagran	0.75	Post	75	0	24.2
Blazer + 2,4-DB (2 oz/a)	0.75	Post	30	2	17.9
Blazer	1.00	Post	30	2	18.7
Applied July 21 (soil surface was damp following a 0.5-inch rain)					
Blazer	1.00	Post	75	2	25.8
Blazer + AG-98	1.00	Post	75	2	25.2
Blazer + crop oil (1 pt/a)	1.00	Post	80	3	26.3
Basagran	1.00	Post	95	1	29.7
Basagran + crop oil (1 pt/a)	1.00	Post	95	2	28.1
Control	- -	- -	0	-	17.5
Treatment LSD .05					3.9

1/ Velvetleaf was in the 2- to 4-leaf stage when postemerge treatments were applied.

2/ Crop injury rating: 0 = no injury, 10 = dead plants.

Essex soybeans were planted July 3, 1982.

Velvetleaf: Where Sencor was applied preplant in early May and soybean planting was delayed until early July because of wet soil conditions, velvetleaf control was unsatisfactory. However, where Sencor was applied immediately prior to or after planting, velvetleaf control was 80 to 85% effective. A split application of Sencor gave the best overall control of velvetleaf.

Where postemerge herbicides were evaluated, the soil moisture condition was limiting at the soil surface, weed control was unsatisfactory. Basagran was the best postemerge herbicide treatment for velvetleaf.

Pigweed: Various herbicide treatments and tank-mixes were applied postemerge where a heavy infestation of rough pigweed occurred. At the time of application, the soil surface was somewhat dry. Blazer treatments were the best, averaging near 80% pigweed control.

Conclusion: Broadleaf weeds that are troublesome in many soybean fields can be effectively controlled with herbicides. However, herbicide selection, proper rate, and time of application in relation to the size of weeds are critical factors in determining the degree of weed control.

Experimental Postemergent Soybean Herbicides Evaluated for Annual and Perennial Grass Control

Perennial grasses, such as johnsongrass, as well as annual grasses, like crabgrass and fall panicum, can be problem weeds in some soybean fields of southeastern Kansas. Recently developed experimental herbicides provide control for annual and perennial grasses in soybeans, but these products have not been evaluated fully.

Procedure: In 1982, three experimental postemergent soybean herbicides (DOWCO 453, Fusilade, and Poast) were evaluated at various rates for the control of annual crabgrass and perennial rhizome johnsongrass control.

Results: In 1982, as well as in 1981, all of the experimental herbicides evaluated gave excellent control of crabgrass and rhizome johnsongrass. All of the herbicides also are very safe for soybean plants.

Conclusions: Although the herbicides evaluated do not have full-label clearance for farm use, they have potential for effective control of annual and perennial grasses that was not previously possible through postemergent herbicides.

Comparison of Herbicides Where Soybeans Were Planted No-Till in Wheat Stubble

It is a common practice to plant soybeans after wheat harvest in southeastern Kansas. However, planting soybeans in wheat stubble with a no-till planter is a new concept on which more research is needed.

Procedure: Essex soybeans were planted in early July in wheat stubble with a John Deere 7000 planter equipped with minimum-till attachments. Herbicides were applied immediately after planting.

Results: Climatic conditions in 1982 were ideal for soybeans planted no-till in wheat stubble. Weed control also was very good. Results are shown in Table 14.

Conclusions: Grain yields in 1982 were good for no-till doublecrop soybeans, but herbicide cost per acre was high. More research is needed to determine if consistent weed control and good yields can be achieved under the clay-pan soil conditions of southeastern Kansas.

Effects of Time of Day When Herbicides Are Applied on Weed Control and Crop Injury With Selected Postemerge Soybean Herbicides

The recent development of newer and more effective postemerge soybean herbicides have allowed farmers another method of controlling troublesome broadleaf weeds that previously was not possible. There is some question as to the effects of time of day when herbicides are applied on herbicide control and crop injury.

Procedure: In 1982, two postemerge herbicides (Dyanap and Butyrac 200) were applied at different times of the day and at two different soybean growth stages (1 week before bloom and at mid-bloom).

Results: The main factor evaluated in 1982 was the effect of time of day herbicides were applied on crop injury. Results are shown in Table 15.

Conclusion: This was a preliminary study and more research is needed under varying temperature and relative humidity conditions and with additional postemerge herbicides.

Table 14. Comparison of Herbicides Where Soybeans Were Planted No-till into Wheat Stubble, Cherokee County, 1982.

Treatments 1/	Rate, lbs ai/a	Weed control, % Initial burned	Residual Grass	Residual Brlf	Crop injury	Yield bu/a
Lasso + Lorox-L + Roundup	2.0 + 0.625 + 1.0	95	95	95	0	29.2
Lasso + Lorox-L + Paraquat	2.0 + 0.625 + 0.5	95	95	95	0	31.0
Dual + Lorox-L + Roundup	1.75 + 0.625 + 1.0	95	95	95	0	30.5
Dual + Lorox-L + Paraquat	1.75 + 0.625 + 0.5	95	95	95	0	28.9
Surflan + Lorox-L + Roundup	1.0 + 0.625 + 1.0	95	95	95	0	29.3
Surflan + Lorox-L + Paraquat	1.0 + 0.625 + 0.5	95	95	95	0	28.1
Lasso + Lexone-DF + Roundup	2.0 + 0.33 + 1.0	95	95	95	0	29.8
Lasso + Lexone-DF + Paraquat	2.0 + 0.33 + 0.5	95	95	95	0	30.4
Dual + Lexone-DF + Roundup	1.75 + 0.33 + 1.0	95	95	95	0	28.7
Dual + Lexone-DF + Paraquat	1.75 + 0.33 + 0.5	95	95	95	0	29.3
Surflan + Lexone-DF + Roundup	1.0 + 0.33 + 1.0	95	95	95	0	31.0
Surflan + Lexone-DF + Paraquat	1.0 + 0.33 + 0.5	95	95	95	0	30.2
Surflan + Lorox-L + 2,4-D ester 2/	1.0 + 0.625 + 0.25	85	85	85	0	27.1
Surflan + Lexone-DF + 2,4-d ester 2/	1.0 + 0.33 + 0.50	85	85	90	0	27.1
Surflan + Lexone-DF + 2,4-D ester 2/	1.0 + 0.33 + 0.75	85	85	90	1	26.0
Surflan + Lexone-DF + 2,4-D ester 2/	1.0 + 0.33 + 1.0	85	85	90	1	28.2
Control	---					4.5
LSD .05						4.2

1/ Treatments applied July 8, 1982. Essex soybeans were planted with a JD 7000 maxi-merge planter on July 6.

2/ 2,4-D ester is not currently labelled for preemerge soybean herbicide use.

Initial weeds present at the time of spraying included annual smartweed, smooth pigweed, common ragweed, yellow nutsedge, marestail, fall panicum, and large crabgrass. Weeds were less than 6 inches tall, and main competitors were smartweed, marestail and pigweed. Later weed competition was mainly from smartweed, pigweed, and fall panicum.

Table 15. Effects of 2,4-DB and Dyanap on Soybean Yields when Applied Postemerge at Two Different Stages of Soybean Growth, Columbus Field, 1982.

Herbicide	Rate/a	Soybean growth stage	Time of day	Soybean yield, bu/A	
				Sprayed	Control
2, 4-DB	0.8 pt	1 wk before bloom	8:00 A.M.	22.2	23.5
	0.8 pt	"	2.00 P.M.	21.1	22.6
	0.8 pt	mid-bloom	2:00 P.M.	21.9	21.6
Dyanap	1 gal	1 wk before bloom	8:00 A.M.	19.7	21.6
	1 gal	"	2:00 P.M.	20.5	21.0
	1 gal	mid-bloom	2:00 A.M.	20.3	20.5

Variety: Essex

Date of Spray Applications:
1 wk before bloom = Aug 10
mid-bloom = Aug 18

Temp. Conditions:
Aug. 10 - 8:00 A.M. (75° F)
2:00 P.M. (90° F)
Aug. 18 - 2:00 P.M. (85° F)

Control plots were located adjacent to sprayed areas so that direct yield comparisons could be made.

FORAGE CROPS RESEARCH

J. L. Moyer

Forage Agronomist

Dryland Alfalfa Fertilization: Methods, Types, and Amounts of Phosphate and Potash Application

Efficient methods of fertilizer application are needed for optimum alfalfa production. The taprooted habit of alfalfa indicates that subsurface application might increase fertilizer efficiency.

This study was designed to estimate fertilizer response to preplant and postplant applications by broadcast or knifed methods.

Procedure: Plots at the Parsons State Hospital were seeded September 4, 1979 to Pioneer '521' alfalfa at 20 lb/acre. The soil tested: pH 6.5, available P of 37 lb/acre, exchangeable K of 108 lb/acre, and B of 1.5 lb/acre. Preplant fertility applications were made August 22, 1979 to plots 20 ft x 8 ft in four replications. Dry fertilizers were supplied as treble superphosphate (0-46-0) and KCl (0-0-60), while 0-26-25 from the TVA was used to formulate liquid treatments.

Plots were harvested May 13 and June 30 in 1980, April 28, June 1, and July 7 in 1981, and May 4 and June 21 in 1982. Droughts curtailed late-summer production in 1980 and 1981, but wet "killed spots" forced abandonment of plots in 1982.

Results: Complete yield data tabulated by treatment were published elsewhere (Kansas Fertilizer Research Report of Progress 423, 1982). No significant treatment effects of alfalfa yield occurred the first year but the highest-yielding fertility treatment (knifed, 0-50-50 + 0-80-80 as liquid) was significantly superior to the control.

The first cutting of 1982 indicated significant responses to P and K, with the 50-lb initial rate of P_2O_5 or K_2O followed by a postplant 80-lb application being superior to the other combinations.

Three individual cutting yields, plus the overall 1981 data indicated that knifed liquid fertilizer was superior to the other two methods of application. In two other cuttings, knifing the liquid fertilizer produced significantly better yields than broadcasting dry fertilizers.

Alfalfa Fertilization: Rates of Potash, and Rates and Methods of Phosphate Fertilization on Supplementally Irrigated Alfalfa [1]

Optimum rates of phosphate, potash, and micronutrients have yet to be determined under supplemental irrigation in southeastern Kansas. This study was to determine those rates, evaluate the benefit of knifing phosphate, and to help determine the economic feasibility of irrigating alfalfa on claypan soils in southeastern Kansas.

Procedure: Plots were treated with benefin premergence herbicide, fertilized, and seeded at 25 lb/acre with 'Classic' alfalfa in April, 1980. Initial soil tests indicated pH of 5.9, available P at 46 lb/acre, and exchangeable K of 201 lb/acre.

Plots were clipped in 1980, but no yields were taken during that droughty year because scarce water was not used to irrigate the alfalfa plots. Five cuttings were taken in 1981, totalling an average of 5.8 tons/acre, but water was still sometimes limiting and no treatment differences were found. Plots were sprayed in spring 1981 to control aphids.

For 1982, the irrigation pond was enlarged, and uniformity of spray coverage was improved. Phosphate and potash treatments were applied again in March. About 1.5 acre-inches was applied to plots in late July, and about 3" in late August. Plots were cut five times for yield, and moisture samples assayed from the last cutting for N, P, and K contents.

Results: Complete data were listed previously (Kansas Fertilizer Research Report of Progress 423, 1982). Drought stress was noted in mid-July and early August, despite watering. Thus, of the five cuttings, the last two were somewhat reduced in yield by drought, but yields averaged more than 7.5 tons/acre.

Yields responded best to K_2O application. The 200-lb K_2O rate produced 8.22 ton/acre for the year, while 7.35 and 8.22 tons/acre were produced by the 0 and 100-lb rate, respectively. Forage nitrogen concentration and total nitrogen removed in forage were also increased by potash application, along with K content and uptake.

Phosphate fertility levels had no overall effect on alfalfa yields or constituents, except for forage P concentration. Knifing phosphorus made no consistent difference in phosphate responses, and P uptake actually decreased slightly because of knifing.

[1] With the collaboration of R. E. Lamond, Northeast Area Extension Specialist, Crops & Soils, KSU, Manhattan.

Effect of Nitrogen - Containing Fertilizer on Alfalfa Yield

Legumes like alfalfa may not respond with yield increases to applied nitrogen because of their ability to fix and use atmospheric nitrogen. However, most commercially available fertilizers contain some nitrogen, so the question was raised about possible side-effects of this N.

This study was designed to determine the effect of N levels representing several types of commercial fertilizers on performance and persistence of established alfalfa. Unfortunately, wet May and June conditions forced abandonment of the plots after two years.

Procedure: Plots (3 replications) were laid out in a field of Pioneer Brand 521 alfalfa, which had been established in spring, 1979. Treatments were applied January 23, 1981 and March 11, 1982. Rates of 0-60-60 (from treble superphosphate and muriate of potash), 15-60-60 (from 6-24-24), 23-60-60 (from diammonium phosphate and muriate of potash), and 40-60-60 (from ammonium nitrate, treble superphosphate, and muriate of potash) lb of $N-P_2O_5-K_2O$ per acre, respectively were used.

Plots were harvested for yield determination once in 1981 (April 29), and twice in 1982 (May 4 and June 21). Two other cuttings were removed in 1981, and the field was destroyed after the second 1982 cutting.

Results: No effect of any fertilizer treatment could be detected. The average yield per cutting for the three cuts measured was 1.6 tons/acre @12% moisture, and no treatment varied more than 0.07 ton. Neither was any trend evident by the last cutting.

Alfalfa Varieties in Southeastern Kansas

Performance of 24 varieties were reported through the 1981 crop year (Ag Facts No. 86, May, 1982). This report updates the earlier one with three cuttings obtained in 1982. The second cutting followed an extremely wet period in the growing season, and the varieties reacted in ways sometimes inconsistent with their previous performance.

Procedure: Plots were seeded in spring, 1978, and managed for the first 4 years as indicated in the previous report. In 1982, the plots were fertilized and harvested May 4, June 21, and July 20 for yield determination.

Results: Several varieties that previously had undistinguished performance records excelled in the wet conditions preceding the second cutting (Table 16). This enabled 'Weevlchek' and 'Olympic' to improve their rankings when compared to the previous publication of this test.

Table 16. Alfalfa Forage Production from 24 Varieties Planted in Spring, 1978, Mound Valley Unit, SEK Experiment Station.

Variety	Source	Forage Yield (tons/acre @12% moisture)				
		1982 Production				5-Year
		5/4	6/21	7/20	Total	Production
Thor	Northrup-King	2.92	2.50	1.30	6.72	19.38
Weevlchek	FFR	3.14	2.49	1.61	7.24	19.12
130	DeKalb	2.52	2.58	1.39	6.49	19.09
Apollo	NAPB	2.55	2.68	1.43	6.66	19.03
Olympic	NAPB	3.13	2.51	1.42	7.05	19.03
Hi-Phy	FFR	2.61	2.59	1.40	6.61	18.90
Vanguard	NAPB	2.57	2.59	1.34	6.50	18.86
120	DeKalb	2.64	2.82	1.49	6.96	18.80
Pacer	Land O'Lakes	2.64	2.76	1.29	6.69	18.75
Epic	Land O'Lakes	2.43	2.76	1.53	6.73	18.73
531	Pioneer	2.63	2.67	1.46	6.76	18.52
545	Pioneer	2.68	2.50	1.37	6.55	18.48
Atlas	NAPB	2.81	2.31	1.18	6.30	18.34
Gladiator	Northrup-King	3.01	2.29	0.85	6.15	18.37
Arc	USDA	2.57	2.43	1.30	6.30	18.31
Sunrise	NC+	2.57	2.21	1.09	5.87	18.30
Riley	USDA-KSU	2.79	2.28	1.13	6.20	18.20
Kanza	USDA-KSU	3.19	1.95	1.14	6.27	18.09
Vernal	USDA-Wisc	2.65	2.42	1.22	6.29	17.96
Tempo	FFR	2.44	2.20	1.26	5.90	17.80
521	Pioneer	2.32	2.59	1.21	6.12	17.74
Cody	USDA-KSU	2.43	2.25	1.57	6.25	17.66
Saranac	USDA-NY	2.57	1.99	1.25	5.81	17.57
Baker	USDA-Neb	2.67	2.49	1.03	6.18	17.42
LSD		NS	0.47	0.37	NS	--
Average		2.69	2.45	1.30	6.44	18.43

Bermudagrass Variety Performance

Bermudagrass can be a valuable high-input, high production 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 should be monitored closely to speed adoption of improved types.

Procedure: Thirteen lines were planted in 1980 and harvested for yield determination twice each in 1981 and 1982. Two others, 'Tift 44' and 'Harris' were sprigged in 1981 and harvested in 1982. Weeds were controlled with simazine, and plot borders were maintained with glyphosate. Plots were fertilized regularly, receiving 200-40-74 lb/acre of $N-P_2O_5-K_2O$ on April 29, 1982, and 100 lb/acre of N on July 15.

Spring green-up was rated May 26, 1982, and plots were cut June 30 and August 30.

Results: Plots of 'Tift 44' and 'Harris' were not well established in 1982. 'Tift 44' was least green April 29 while 'Hardie' and experimental hybrid 74 x 14-1 were earliest (Table 17). 'Midland' was near the test average for green-up.

Forage yields of the 15 lines averaged 3.18 and 2.59 tons/acre (12% moisture) from the first and second cuttings, respectively. 'Hardie', 'Midland', and experimental hybrid 74 x 12-6 produced the highest first-cut yields, followed closely by two seed-producing types, Guymon x 9959 and SS16 x SS21. In the second cutting, the former three lines were again top producers.

Total production was 7.48, 7.29, and 7.20 tons/acre for 'Midland', 'Hardie', and 74 x 12-6 respectively. The seed-producing strain SS16 x SS21 produced 6.49 tons/acre in 1982, 90% of the average yield of the top three sprigged bermudagrasses.

Table 17. Spring Green-up, and Forage Yield in 1982 of Bermudagrass Varieties, Mound Valley Unit, SEK Branch Experiment Station

Variety	Spring Green-up Rating [1/]	Yield, tons/acre @12% moisture cut 1	cut 2	Total
74 X 12-1	3.3	3.08	2.18	5.26
74 X 9-1	1.0	2.46	2.62	5.08
74 X 12-5	3.8	3.55	2.44	5.99
74 X 14-1	4.0	3.46	2.86	6.32
74 X 12-6	2.8	3.83	3.37	7.20
74 X 12-12	1.8	2.00	2.31	4.31
LCB 7-25	2.2	2.75	2.63	5.38
Hardie	4.2	3.92	3.37	7.29
Midland	2.9	3.85	3.64	7.49
Tift 44 [2/]	0.5	1.32	2.26	3.58
Harris [2/]	1.4	2.79	1.63	4.42
SS16 X SS21	3.0	3.75	2.75	6.50
Guymon X 10978	3.1	3.42	2.07	5.49
Guymon X 9959	3.4	3.77	2.18	5.95
Guymon X 8845	3.2	3.35	2.51	5.86

1/ Rated on a scale of 0-5, where 5 is completely green on May 26, 1982.

2/ Established Spring, 1981.

Timing Nitrogen Fertilization for Bermudagrass

Nitrogen is the most costly variable input for producing optimum yields of bermudagrass. The efficiency of the N applied can often be increased by split applications, but is reduced when soil moisture is limiting to growth.

We used three set rates of single annual application, and split rates varying with the previous month's rainfall to determine the optimum scheduling for N application. Two other factors, K rate and cutting regimen, also were varied but will not be reported here.

Procedure: Plots were laid out in spring, 1981 and fertilized with ammonium nitrate according to the schedule in Table 18. Initial applications were May 6, 1981, and May 5, 1982, and plots receiving N after cutting were fertilized July 16 and July 15 in 1981 and 1982, respectively.

Results: First-cut yields in 1981 apparently benefitted from residual soil nitrogen, since the check plots yielded so well (Table 18). Yields in 1982 do not reflect the split N treatments because regrowth was not adequate to warrant a second harvest. Thus far, we obtained the best returns per unit of N from treatments receiving 150 lb N/acre at the first application. We cannot determine yet the best rate for the second application of the season.

Table 18. Bermudagrass Forage Yields for 1981 and 1982 as Affected by Nitrogen Fertility Rate and Timing.

Nitrogen Treatment	Total N Applied, 1981-82	Forage Production, tons/acre @ 12% moisture			
		1981			Total
------ lb/a ------		cut 1	cut 2	1982	1981-82
0	0	2.51	1.23	1.30	5.04
150	300	3.31	2.10	3.34	8.74
300	600	2.90	2.79	4.69	10.38
450	900	3.40	4.05	5.16	12.61
150 + 100/cut	500	3.11	3.49	4.33	10.93
150 + Variable 1/	550	3.24	3.50	4.67	11.40
Variable + 100/cut	400	2.92	3.56	3.68	10.16
LSD (.05)		0.54	0.62	0.99	

1/ Variable rates after each cut were 100 N 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.

Cool-Season Grass Performance

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

Procedure: Plots were established on the Parsons State Hospital grounds by seeding at 25 lb/acre in spring, 1981. Plots were fertilized preplant with 40-40-40 lb/acre, and in February, 1982 with 100-40-40. Grasses were visually evaluated July 6, 1981, and clipped for hay. Yield data were collected June 8, 1982, and regrowth was evaluated June 29.

Results: Seedling vigor, as evaluated in 1981 had little relation to 1982 yields, except where stands were poor. Bromegrass varieties produced the most first-cut forage, followed by Reed canarygrass, tall fescue, and orchardgrass (Table 19). Perennial ryegrass and western wheatgrass yielded the least in 1982.

Reed canarygrass lines and tall fescue had the best summer regrowth in the test. Of the bromes, 'Rebound' had the best regrowth, while 'Regar' meadow brome had poorest recovery. Orchardgrasses as a group showed the poorest recovery,along with intermediate wheatgrass.

Table 19. Yield and Summer Regrowth of Cool-season Grass in 1982 at Parsons Training Center, SEK Branch Experiment Station.

Variety	Species	Source	Yield, [1] tons/a	Summer Regrowth Rating [2]
Achenbach	Smooth bromegrass		5.05	2.0
Dart	Orchardgrass	L. L.	4.33	2.3
Baylor	Smooth bromegrass	NAPB	5.50	2.0
Blair	" "	NAPB	5.93	2.7
NAPB 7601	" "	NAPB	5.17	2.3
Bromex	" "	N-K	5.35	2.3
Rebound	" "	S. D.	4.84	3.0
Barton	" "	L. L.	4.68	2.0
Regar	Meadow bromegrass	USDA	4.23	2.0
Ky 31	Tall fescue		4.43	4.0
Sterling	Orchardgrass	Ia.	4.13	2.0
Able	"	FFR	3.58	2.3
Hallmark	"	FFR	4.30	2.3
Prime	"	N-K	3.80	2.7
Comet	"	N-K	3.74	2.7
Orion	"	N-K	3.47	3.0
DS-4	"	L. L.	4.12	2.7
Ioreed	Reed canarygrass	Ia.	4.56	4.0
NCRC-1	"	USDA	4.07	3.7
Mn 76	"	Mn	4.24	4.0
Mn 72	"	Mn	4.75	4.3
Vantage	"	NAPB	4.18	4.3
Rise	"	NAPB	3.41	4.0
Flare	"	L. L.	3.39	4.7
Linn	Perennial ryegrass	Ore.	2.70	2.3
Tetrablend 30	" "	N-K	3.22	3.0
Barton	Western wheatgrass		3.30	2.3
Oahe	Intermediate wheatgrass		3.68	1.3
OG-1	Orchardgrass	Mo.	3.63	1.7
OG-2	"	Mo.	3.81	2.0
LSD (.05)			0.97	0.9

1/ Expressed on basis of 12% moisture. Cutting date was June 8.

2/ Rated June 29 on a scale of 0-5, where 5 was the most regrowth in the plot.

Methods and Rates of Fertilizer Application on Tall Fescue[1]

Cool-season grass pastures, especially tall fescue, are very important in southeast Kansas for hay as well as pasture. Many soils will respond to P and K application, along with N. Knifing the fertilizer sometimes has increased fertilizer efficiency, especially of N. Two types of experiment are being conducted to measure the response of fescue to the fertilizer nutrients when they are broadcast or knifed into the soil.

Procedure: One study begun in 1980 was continued in 1982 to evaluate N rates (12, 100, and 150 lb/acre), P rates (0 or 40 lb P_2O_5/acre), and K rates (0 or 40 lb K_2O/acre). The N-P-K treatments were applied in February either broadcast on the surface or knifed about 8 inches deep on 15-inch centers. Nitrogen was from UAN solution, P from 10-34-0, and K was from 0-0-10 solution. Broadcast treatments were applied with flat-spray nozzles. The site for this experiment tested in the low range for available soil P and K.

Another study begun in 1981 sought to determine whether fall knifing, or every three years at the higher P and K rates was feasible. The site tested very low in available P, high in K.

Results: Fescue yields were relatively good for both studies in 1982. Nitrogen rates of up to 150 lb/acre increased forage production and N levels. Complete yield listings were published elsewhere (Kansas Fertilizer Research Report of Progress 423, 1982). In the first experiment, phosphate increased forage production by about 800 lb/acre, along with forage P concentrations. Potash had no effect on forage yield, and little on forage K content. Knifing fertilizer boosted forage yields by nearly 1000 lb/acre over the broadcast plots, and a similar trend was seen each year of the experiment.

The second study also produced a good N response, but yield response to P was not found, and K responses were inconsistent. Knifing did not generally increase yields there, because a slight tendency for fall knifing to increase yield was cancelled by relatively poor performance by spring-knifed plots.

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[1] With the collaboration of R. E. Lamond, Northeast Area Extension Specialist, Crops & Soils, KSU, Manhattan.

Source and Timing of Nitrogen for Tall Fescue [1]

Tall fescue generally responds favorably to split applications of N, especially ammonia sources. Cogranulated urea-phosphate was produced to slow volatilization losses, and perhaps allow higher single application rates with minimal losses.

This study was to test whether N effectiveness varied between urea and urea-phosphate when applied in practical amounts and at times of up to three split applications per year.

Procedure: Plots 25' x 8' were laid out in a 'Fawn' tall fescue meadow at the Parsons Unit. Five application regimens were chosen as practical from the 16 possible combinations of one to three applications per year having 50-lb increments and totalling 150 lb/acre/year, and a control was included. Initial applications (August 27, 1981) also included 67 lb P_2O_5/acre to all plots designated for urea to balance phosphate added in urea-phosphate. Appropriate treatments also were applied December 29, 1981 and March 31, 1982.

Plots were harvested May 18, 1982 for yield determination. Subsamples of the forage were taken for moisture, N and P analyses.

Results: Yield response to 150 lb N/acre was good, except for the single August application (Table 20). Other application regimens did not differ significantly for yield, N uptake, or P uptake. Application schedules that included March applications contained generally higher concentrations of forage N and P, but were offset by slight yield reductions.

No differences in forage yield, N, or P were found between the sources, nor were any time x source interactions indicated.

[1] With the collaboration of D. E. Kissel, Soil Fertility Specialist, Dept. of Agronomy, KSU, Manhattan.

Table 20. Average Effect of Application Schedule or N Sources on Tall Fescue Forage Yield, and Uptake, Parsons Unit.

Amount/Time 1/ lb N/acre	Source	Forage Yield, lb/acre @12% moisture	Forage Content %N	Forage Content %P	Forage Uptake lb N/a	Forage Uptake lb P/a
	Urea-P 2/	6324	1.64	0.23	91.5	12.9
	Urea	6164	1.65	0.23	89.4	12.5
LSD .05		NS	NS	NS	NS	NS
150 Aug		4661	1.47	0.22	60.8	9.0
50 Aug/100 Dec		6869	1.49	0.22	90.0	13.2
50 Aug/50 Dec/50 Mar		6401	1.76	0.24	98.6	13.7
150 Dec		6775	1.69	0.23	99.4	13.6
100 Dec/50 Mar		6513	1.81	0.24	103.5	13.9
LSD .05		797	0.25	0.02	13.7	1.5

1/ Indicated amounts of N were applied August 27, 1981, December 29, 1981, and March 21, 1982.

2/ Urea-P was cogranulated urea-phosphate (34-17-0) supplied by TVA. Plots treated with urea received 67 lb P_2O_5/acre as treble superphosphate August 27, 1981 to equal the phosphate contained in the cogranulated urea-phosphate.

Effect of Fertility, Mechanical Renovation and Lime on Tall Fescue and Interseeded Red Clover

Interseeding a legume into tall fescue can reduce fertilizer costs, improve forage quality, and lengthen the season of productivity. This study was designed to test the effects of three factors important to legume establishment on the amount and quality of forage produced.

Procedure: Plots were located south of Girard on the Joe Murnane farm, where soil pH was less than 6.0 in the top two inches. Three rates of lime were used November 2, 1979: 0(control), 2500 and 5000 lb of effective calcium carbonate (E. C. C.) equivalent.

Fertilizer was applied April 14, 1980 at 80-40-40 lb/acre to plots left in fescue, and at 0-40-40 or 0-80-80 in plots for interseeding, and one qt/acre of Paraquat was applied April 15. Half the plots were mechanically renovated April 22 by "ripping" at 3-5 inch depth with 2-inch chisel points on 9-inch spacings, then smoothed with two passes of a spike-tooth harrow. 'Kenstar' red clover was interseeded at 12 lb/acre with a Midland "Zip" seeder.

Red clover seedlings died because of 1980 drought, so plots were reseeded in February, 1981. Plots were fertilized as before in 1981 and 1982, and plot yields were taken each year.

Results: Two cuttings were obtained in 1982, on June 10 and August 25. Interseeded plots averaged 4.7 tons/acre of forage in the first cut, much of it red clover, 10% greater than the fescue plots fertilized with 80-40-40. The second cutting contained mostly red clover, so interseeded plots produced 1 and 2/3 ton/acre or more than twice the forage of the fescue plots. Yields totalled 5.1, 6.2, and 6.6 tons/acre, respectively, for fescue-only, interseeded with 0-40-40, and interseeded with 0-80-80 fertilizers.

Lime and renovation were not independent of one another in affecting yields. For instance, increasing lime increased yields of renovated plots, but had no effect on yields of unrenovated plots in 1982. On the other hand, renovation generally reduced yields of unlimed plots, but tended to increase yields of limed plots.

Fertility and Weed Control in Native Meadow

Native vegetation produces a substantial portion of the forage in southeastern Kansas. Native "grass", used as pasture or hay, is a mixture of warm-season perennial grasses with some forbs and other grasses. Fertilization can increase the proportion of forbs and less desirable grasses at the expense of desirable forage grasses. A series of experiments was designed to determine effects of various amounts of fertilizer on forage production and weedy invasion, as well as control practices.

Procedure: One experiment was begun in 1980 to look specifically at spring fertilization and weed control. Fertilizer treatments included a control, 24-24-24 and 48-48-48 lb/acre of N-P_2O_5-K_2O. The latter treatments included a check at each fertilizer rate, along with spring-burned plots, 2,4-D treatment (1 lb a.i./acre), and fall atrazine applications (1 lb a.i./acre).

Other experiments started more recently dealt with fertilizer (especially phosphorus) rates and frequency of application, and the effects of liming.

Results: Forage yields in 1982 from the first experiment averaged 1.98 tons/acre (12% moisture) in unfertilized plots and 2.25 and 3.19 tons/acre, respectively, from plots fertilized with 24-24-24 and 48-48-48. Broadleaf weeds were noted where the highest fertilizer rate was used, especially in the untreated and atrazine-treated plots.

Burned plots produced the lowest yield of any treatment (1.98 ton/acre). Treatment with 2, 4-D may have reduced yields slightly from the control (2.41 vs 2.69 tons/acre), but part of the reduction was from fewer weeds at the highest fertilizer rate. Atrazine-treated plots yielded slightly more than controls (2.81 ton/acre), but the increase was only in fertilized plots, where weed production accounted for much of the difference.

The other experiment indicated that nitrogen was the most limiting factor. This was shown by the low yield response to any treatment that did not include nitrogen.

Birdsfoot Trefoil Varieties in Southeastern Kansas

Birdsfoot trefoil is a widely adapted, non-bloating forage legume. One variety, 'Dawn', has shown 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 1982 with a fertilizer application of 50 lb P_2O_5 and 100 lb K_2O/acre. Plots were cut late (June 21) because of wet conditions. Subsequent growth was too short for mechanical harvest.

Results: 'Empire' and 'Dawn' yielded significantly more forage in 1982 than all cultivars which yielded below the test average (Table 21). As much forage was produced from the single 1982 cutting as from two cuttings in 1981. While only 60% of the alfalfa varieties' yield was harvested from trefoil plots, trefoil tolerated the wet conditions and delayed harvest of 1982 better than did alfalfa.

Table 21. Birdsfoot Trefoil Variety Forage Yields from April, 1980 Seeding, Mound Valley Unit

Cultivar	Forage Yield, tons/acre @12% moisture 1981[1/]	1982[2/]	Total, 1981-82
Empire	4.23	4.27	8.50
Mo 20	4.27	4.05	8.32
Fergus	4.18	4.09	8.27
Daron	4.02	4.22	8.24
Viking	3.92	3.93	7.85
NC-83 germ pool	4.02	3.60	7.62
Carroll	3.74	3.84	7.58
Leo	3.74	3.73	7.47
Norcen	3.69	3.66	7.35
Average	3.98	3.93	7.91
LSD	NS	0.38	0.64

1/ Sum of two cuttings.

2/ Cut June 21, 1982. Subsequent growth insufficient for cutting.

Cattle Performance on Annual Pastures: Spring Pasture on Wheat or Triticale, Summer Pasturing Sorghum-Sudan or Sudangrass Hybrids [1]

Annual pastures are extensively used to supplement carrying capacity of permanent pastures. Two experimental pastures (5 acres each) at the Mound Valley Unit are maintained in year-round forage production to determine carrying capacity, production costs, and net returns to such a system.

PHASE I - Grazing Winter Annuals

Procedure: We tilled and fertilized the two pastures with 50-40-40 lb/acre of N-P_2O_5-K_2O for seeding September 10, 1981. About 90 lb/acre of foundation 'Newton' wheat was seeded in one pasture (#2), and 100 lb/acre of Kershen (now Dessert) Grazer Blend No. 1 triticale was seeded in the other pasture (#5).

Moisture was inadequate to produce fall pasture, so animals were not grazed until February 3, 1982. Ten steers initially averaging 530 lb each were placed in each pasture, weighed each 28 days, and grazed until May 20. Initial and final weights were taken following a 16-hr shrink from feed and water. In the meantime, 100-40-40 lb/acre of fertilizer was applied to each pasture March 15 (partly for the following sudan), and forage samples were collected from three

[1] With the collaboration of L. W. Lomas, Animal Scientist, SEK Experiment Station, Parsons, KS.

1-ft^2 areas inside exclosures in early April.

Results: Average daily steer gains for the 106-day test were 0.67 lb from the wheat pasture and 1.27 lb from triticale. Gains from wheat were slightly better than from triticale for the first weigh period, but subsequent weight gains favored triticale. Pastures, especially wheat, were overstocked, since gains near the end of the test were poor.

Forage sampled from pasture exclosures showed little difference in forage yield and composition between the pastures in early April. (See Table 22).

Table 22. Forage Production and Composition from Exclosures in Wheat and Triticale Pastures April 3, 1982, Mound Valley Unit.

Factor	Wheat	Triticale
Dry Matter, %	15.1	14.3
Dry Matter, lb/acre	5050	4340
Crude Protein, %	24.0	27.2
Phosphorus, %	0.38	0.42

PHASE II - Sorghum-sudan and Sudangrass Hybrids for Summer Pasture

Procedure: Pastures were tilled for seeding DeKalb SX-17$^+$ Sudax (sorghum-sudangrass hybrid, pasture #2) and Northrup-King Trudan 8 hybrid sudangrass (pasture #5) at 20 lb/acre on June 9, 1982. Pastures had received 100-40-40 lb/acre of fertilizer in March while in cool-season pasture. Fifty lb/acre of N was added just before cattle were turned in. Eight steers per pasture began grazing July 7. Extra steers were used to maintain similar grazing pressure on the two pastures, and their grazing days were added to determine carrying capacity and total animal production.

Steers were weighed off the test after 44 days (August 20) to enable establishment of the cool-season phase of the study. Initial and final weights were taken following a 16-hr shrink from feed and water.

Results: Individual animal performance was good for both pastures, with 0.73 lb average daily gain on sorghum-sudan, and 0.54 lb for Trudan 8. Carrying capacities were 448 animal days for sorghum-sudan, and 330 for sudangrass. Animal acceptance and forage regrowth appeared better for sudan than for the sudan-sorghum cross.

Effects of K-Mag Fertilization on Cattle Grazing Tall Fescue [1]

Fescue forage Mg levels are often low in southeast Kansas, and occasionally there is an outbreak of grass tetany, a physiological disorder in beef cattle that is attributed to low blood serum Mg levels. Results from our 1981 work indicated that fescue forage Mg levels were significantly increased by K-Mag applications, but the Mg was ineffective in raising blood serum Mg levels. The objectives of our 1982 work were 1) to see if K-Mag can increase Mg levels in fescue forage and 2) to find out where the added Mg was going in the beef animals.

Procedure: Four 5-acre tall fescue pastures were used in the study. Applications were split so that half of each treatment was applied February 23, the other half on April 2. Solutions of 14-0-5-2.5Mg-5S were applied to one pair of pastures, and 14-0-5-0Mg-5S to the other pair. Total nutrients supplied to the two K-Mag pastures were 112N, 40 K_2O, 20Mg, and 40S, while the other pastures received the same except no Mg.

Twelve randomly selected Hereford-Angus-Simmental cross heifers were turned into each of the four pastures on April 2, just after the second application. All heifers were weighed and bled weekly for four weeks, and rumen fluid and feces were collected at the same time from two heifers per pasture.

Forage samples were taken from each of the four pastures on April 2 prior to the second application, on April 6 after the second application and 0.27 inch of hard rain, and on April 30 after considerable rain had been received. Samples were analyzed for N, P, K, Ca, and Mg.

Blood serum samples were analyzed for K, Ca, and Mg. Rumen fluid samples and fecal samples were analyzed for NH_4, K, Ca, and Mg.

Results and Conclusions: Heifer gains were not affected by the Mg in the K-Mag. Average daily gains were 1.57 lb on K-Mag pastures and 1.62 lb on the control.

K-Mag suspensions significantly increased forage Mg levels. The greatest amount was just after the second K-Mag application (0.32% Mg), declining to 0.26% by the fourth week, while the control remained at about 0.22% Mg. However, these increased forage Mg levels did not show up in blood serum. There was essentially no difference in serum Mg levels of animals grazing treated and untreated pastures, only among individual animals.

Where was the additional Mg? Rumen fluid analysis showed no real trends because wide fluctuations existed in rumen fluid levels.

Was the additional Mg being passed out in the feces? Based on fecal material analysis, one can't account for the additional Mg being passed in

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[1] With the collaboration of R. E. Lamond and L. W. Lomas.

the feces.

Overall, the results were inconclusive. We know that we can elevate fescue forage Mg levels by adding K-Mag suspensions, but saw no effect in the beef animals' blood serum, rumen fluid, or feces as a result of the increased forage Mg levels.

OTHER FORAGE RESEARCH

The following topics were also research in 1982, and are worthy of mention.

Tall Fescue Variety Trial

Twelve cultivars of tall fescue were seeded at the Mound Valley unit in fall, 1981. Plots were clipped in June, 1982, and will be used to collect forage yield data beginning in 1983.

Forage Sorghum Performance Test

Eighteen lines of sorghum were tested for silage production with the Agronomy Department at KSU.

Results were published elsewhere ("Kansas Sorghum Performance Tests", Kans. Agr. Exp. Sta. Report of Progress, 425). Silage yields averaged 19 tons/acre (70% moisture), ranging from 13 to 25 tons/acre for the late-planted (July 1) test.

Forage Species in a Neosho Bottomland Pecan Orchard

Several grasses, legumes, and grass-legume mixtures were planted on the Pecan Research Field near Chetopa in fall, 1981. Plots were cut May 24, 1982, and the Neosho River flooded the area in June for 4-5 days. Portions of the field were inundated for up to 10 days. Surviving plots with adequate regrowth were cut July 21 and September 17.

Reed canarygrass was most tolerant of the flooding. It was also the highest yielding forage line, and had the best regrowth. Tall fescue had fair survival, good production, and good regrowth. Of the legumes, birdsfoot trefoil survived and produced best, while alfalfa was elimated from almost all plots. Red clover and alsike clover performed slightly better than alfalfa.

Nitrogen Timing and Rate for Fescue-Lespedeza

Many beef producers have lespedeza in their tall fescue to help their cattle over the "summer slump" of fescue production. Fertilizing with sufficient N for optimum fescue production may inhibit lespedeza production, but adjusting the rates and timing of N could help achieve a balance between the two species.

Fall and spring N have been applied in several combinations since spring, 1980, but lespedeza was not established in the plot until 1982. Stands were obtained only in plots receiving low N, but effects of lespedeza will not be evident until 1983.

1982 Bermudagrass Pasture Production

Three 5-acre experimental pastures are maintained at the Parsons Unit. Pastures were used from May 19 to September 7, and carried cow-calf pairs a total of 668 unit-days. The fifteen acres also produced 57 round bales weighing more than 1100 lb each.

BEEF CATTLE RESEARCH

Lyle W. Lomas

Animal Scientist

Effect of Bovatec[1] and Synovex-S[2] Implants on Finishing Steer Performance

Bovatec is the tradename for lasalocid sodium, a feed additive similar to Rumensin. Both antibiotics were used as poultry coccidiostats before they were used a feed additives for cattle. Both additives alter the proportion of rumen volatile fatty acids toward more propionate and less acetate. Bovatec was cleared for use in feedlot cattle by the Food and Drug Administration in August, 1982. The approved dosage is 10 to 30 grams per ton of ration dry matter.

Procedure: Eighty-four Simmental steers from a ranch in Southeast Kansas averaging 842.5 lb were randomly allotted by weight to 12 pens of seven head each for a finishing study. Treatments were: 1) control (neither Bovatec nor Synovex-S; 2) Bovatec only (30 gm per ton of dry ration); 3) Synovex-S implant only; and 4) Bovatec and Synovex-S implant combined. Each treatment was replicated in 3 pens. The pens had no cover or wind protection. Water and feed were available at all times. When the study began on October 28, 1981, cattle were fed 30% concentrate and 70% corn silage (dry basis). Then the concentrate was increased and the silage decreased by 5% daily, until 80% concentrate and 20% corn silage was obtained. Initial and final weights were taken after a 16-hour shrink from feed and water. Cattle designated to be implanted were administered Synovex-S at the onset of the study only. One steer was removed from each of the Synovex-S implant and Bovatec plus Synovex-S treatments during the trial for health reasons unrelated to the experimental treatments. The trial terminated on March 19, 1982. Cattle were slaughtered on March 23, 1982 and individual carcass data were collected for each steer.

Results: During the 142-day finishing study, gains with and without Bovatec were similar ($P > .10$) (Table 23). Feeding the steers Bovatec decreased their feed intake 18.3% ($P = .0386$) and improved feed efficiency 19.4% ($P = .0563$). Bovatec had no effect on external fat thickness, ribeye area, marbling score, quality grade and yield grade in this study.

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1 Bovatec is the trademark name for lasalocid sodium produced by Hoffmann-La Roche, Inc., Nutley, N.J. 07110, which provided feed additive and partial financial assistance.

2 Synovex-S is the trademark name for steer finishing implants containing progesterone and estradiol benzoate produced by Syntex Agribusiness Inc., Des Moines, IA 50303, which provided implants and partial financial assistance.

Cattle implanted initially with Synovex-S gained 8.2% more (P = .0048), had larger ribeye areas (P = .0025) and lower numerical yield grades (P = .0639) than nonimplanted steers. In this trial implants had no effect on daily feed intake, feed efficiency, fat thickness, marbling score or quality grade.

<u>Conclusions</u>: Cattle fed Bovatec consumed 18.3% less feed and were 19.4% more efficient in feed conversion than controls, with no effect on gain. Synovex-S implants improved gain 8.2% with no effect on feed intake and feed efficiency. Bovatec and Synovex-S combined had a complementary additive effect on feedlot performance.

Table 23. Effect of Bovatec and Synovex-S on Feedlot Performance (142 days) of Simmental Steers.

Item	Effect of Bovatec			Effect of Synovex-S		
	No Bovatec	Bovatec, 30g/ton	Statistical significance[a]	No Implant	Synovex-S	Statistical significance[a]
No. of steers	41	41	- - -	42	40	- - -
Initial wt., lb	841.0	844.0	- - -	840.7	844.4	- - -
Final wt., lb	1271.0	1282.1	- - -	1258.3	1295.6	- - -
Gain, lb	430.0	438.1	N.S.[a]	417.6	451.2	.0048
ADG, lb	3.03	3.08	N.S.	2.94	3.18	.0048
Daily DM intake, lb	28.03	22.89	.0386	24.49	26.43	N.S.
Feed/gain	9.26	7.46	.0563	8.39	8.33	N.S.
Fat thickness, in.	.31	.26	N.S.	.30	.28	N.S.
REA, sq. in.	13.6	13.8	N.S.	13.4	14.1	.0025
Marbling score[b]	5.1	5.2	N.S.	5.1	5.2	N.S.
Quality grade[c]	9.8	10.0	N.S.	9.8	10.1	N.S.
Yield grade	2.5	2.3	N.S.	2.5	2.3	.0639

[a]N.S. = Not statistically different ($P > .10$).

[b]Marbling score: Small = 5; modest = 6.

[c]Quality grade: Gd^{+} = 9; Ch^{-} = 10; Ch° = 11.

Effect of Ammoniated Wheat Straw on the Performance of Backgrounded Steers

Many acres of wheat are grown in Kansas and as a result a large quantity of wheat straw is available for feeding beef cattle. Various methods of providing supplemental protein to straw are available. However, little is known about the relative merit of each with respect to economics and animal performance. This study evaluated performance of steers fed oat straw or wheat straw supplemented with protein blocks and wheat straw probed with anhydrous ammonia.

Procedure: Sixty steer calves with an average initial weight of 589 lb were equally divided into three groups of 20 head each on January 5, 1982 and were wintered in dry lots on one of the following straw treatments: 1) wheat straw supplemented with protein blocks; 2) wheat straw probed with 3.5% anhydrous ammonia; and 3) oat straw supplemented with protein blocks. Protein blocks fed contained 37% crude protein with 16.2% crude protein equivalent from nonprotein nitrogen. All straw was packaged in big round bales and fed in round slant bar feeders *ad libitum*. Bales treated with anhydrous ammonia were individually wrapped with 6 ml black plastic and probed with 3.5% anhydrous ammonia a month prior to the start of the trial. At the start of the study all steers were implanted with Ralgro. One steer was removed from the ammonia-treated straw for reasons unrelated to the experimental treatment. All steers received 5 lb of rolled milo per head daily and all had free access to a mineral mixture of equal parts steamed bone-meal and trace-mineralized salt. Initial and final weights were taken following a 16-hour shrink from feed and water. The study was terminated April 22, 1982 (107 days).

Results: Results of this study are presented in Table 24. Gains of cattle fed wheat straw supplemented with protein blocks or anhydrous ammonia were not significantly different ($P > .10$). Oat straw supplemented with protein blocks produced 30.6% ($P < .10$) and 73.0% higher ($P < .01$) gains than wheat straw supplemented with protein blocks and anhydrous ammonia, respectively. Lowest gains were obtained with the anhydrous ammonia treated wheat straw. Intake of supplemental crude protein for these cattle was calculated, assuming an ammonia recovery value of 60%. Samples collected to determine actual ammonia recovery were lost in a barn fire at our Mound Valley location. The low performance of these cattle was likely due to a lower level of energy intake. Cattle supplemented with protein blocks received additional energy from this protein source. Calves of this size also may not be able to efficiently use this much non-protein-nitrogen on a low energy diet. Straw intake was highest for cattle fed oat straw. The gain and intake from this treatment suggests that it has a higher digestibility value than wheat straw.

Conclusions: Steer calves fed oat straw gained more than those fed wheat straw. Anhydrous ammonia treatment of wheat straw produced gains similar to those from untreated wheat straw supplemented with protein blocks.

Table 24 Effect of Straw Type and Protein Supplementation Method on Steer Performance (107 days).

	Wheat Straw + Protein block	Wheat Straw + Anhydrous	Oat Straw + Protein block
No. of steers	20	19	20
Initial wt., lb	589	593	586
Final wt., lb	642	634	654
Total gain, lb	53	41	68
Average daily gain, lb	.49[c]	.37[a]	.64[b,d]
Daily supplemental protein intake, lb	.31	1.08	.28
Daily straw intake, lb	10.8	10.1	11.2

[a,b]Means on the same line with different superscripts are significantly different ($P < .01$).

[c,d]Means on the same line with different superscripts are significantly different ($P < .10$).

Effect of Salt Form and Processing Method on Salt Intake and Beef Cattle Performance[1]

Whether to feed beef cattle loose salt or a salt block has been a controversial subject for many years. Cattle that have free access to loose salt will generally consume more than when salt is furnished in the form of compressed blocks. Since less salt is consumed when it is provided in the block form, many cattlemen are in disagreement as to whether enough salt is obtained from licking blocks in the feedbunk or in the pasture.

Rapid escalation of energy costs during the past decade has encouraged its conservation. In an effort to reduce energy useage and lower production costs in the processing of salt, a compressed rock salt block was developed.

The following study compared the rock salt with the white evaporated block with respect to cattle acceptability (intake) and performance. Salt form (loose vs block) also was evaluated with respect to salt intake and cattle performance.

Procedure:

Experiment A -Eleven groups of cows were provided free access to both evaporated and rock blocks which were placed in separate feeders located side by side in late winter, spring and summer of 1982. No other source of salt was available. Salt consumption was determined on a regular basis by difference between initial weight and weight of the unconsumed portion remaining in the feeder.

Experiment B - Fifty-six crossbred steers with an average initial weight of 643 lb were randomly allotted to 8 five-acre brome pastures on May 12, 1982. A 2 x 2 factorial design with 2 replicates was used to evaluate the following salt treatments:

1) rock salt block
2) evaporated salt block
3) rock mixing salt
4) evaporated mixing salt

All salt was fed in covered windvane type feeders. Consumption of each type of salt was determined on a weekly basis by weighing the unconsumed portion remaining in the feeder. All steers were implanted at the onset of the study with Synovex-S and were fed 150 mg Rumensin in 3 lb dry rolled milo for the first 84 days of the study and 200 mg Rumensin in 4 lb dry rolled milo during the last 28 days.

Cattle were rotated among pastures every 14 days and were weighed at 28-day intervals. Initial and final weights were obtained following a 16 hr. shrink from feed and water. The study was terminated September 1, 1982 (112 days).

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

Results:

Experiment A - Results of Experiment A are presented in Table 25. This table summarizes salt consumption from 11 different groups of cows. There was no significant difference ($P > .20$) in average salt consumption between the evaporated and rock blocks. Therefore, it can be concluded that processing method had no effect on salt intake.

Experiment B - Results of Experiment B are summarized in Table 26. Processing method (evaporated vs rock) had no effect ($P > .20$) on cattle weight gain or salt consumption. Salt form (loose vs block) had no effect on steer performance ($P > .20$) but did have an effect on salt intake. Cattle consumed 2.18 times more loose salt than block salt ($P < .05$). This research would indicate that grazing steers can sufficiently meet their salt requirement from salt blocks. Steers consumed more than twice as much loose salt but did not gain any more weight than those fed salt in the block form.

Conclusions: Processing method (evaporated vs rock) had no effect on salt consumption or weight gain of stocker cattle. Grazing steers consumed 2.18 times more loose salt than block salt but there was no difference in weight gain.

Table 25. Cattle Preference for Rock Salt or Evaporated Block Salt.

			Salt Consumption (oz/hd/day)	
Location	No. Days	No. Cows	Evaporated	Rock
A	139	34	.26	.19
B	93	19	.26	.32
C	94	18	.21	.28
D	94	25	.14	.14
E	131	13	.37	.47
F	131	21	.20	.23
G	69	15	.92	.84
H	62	14	.65	.65
I	131	35	.42	.22
J	131	13	.63	.51
K	131	16	.30	.39
Average	110	20	.40[a,b]	.39[a,b]

[a,b]Values in the same row with different superscripts differ significantly ($P < .20$).

Table 26. Effect of Salt Form and Processing Method on Salt Intake and Performance of Beef Cattle.

	Evaporated	Rock	Mean
Loose			
Daily gain (lb/head)	1.24	1.40	1.32
Daily salt intake (oz/head)	1.78	1.67	1.72[a]
Block			
Daily gain (lb/head)	1.38	1.26	1.32
Daily salt intake (oz/head)	.72	.86	.79[b]
Mean			
Daily gain (lb/head)	1.31	1.33	
Daily salt intake (oz/head)	1.20	1.22	

[a,b] Values in the same column with different superscripts differ significantly ($P < .05$).

Effect of Synovex-H[1], Ralgro[2] and MGA[3] on the Performance of Backgrounding Heifers

Cattlemen are frequently faced with the decision of which implants and feed additives to use on their cattle. Much research has been conducted with implants and feed additives for feedlot cattle, but in most cases information is limited for grazing cattle. Synovex-H and Ralgro are currently the only growth-promoting implants approved for use in heifers. Melengestrol acetate (MGA) is widely used to promote growth and feed efficiency in feedlot heifers, but has been used on a very limited scale with stocker heifers. This study was designed to study the efficacy of Synovex-H, Ralgro and MGA for backgrounding heifers through the winter.

Procedure: Seventy-two crossbred heifers with an initial weight of 467 lb were randomly allotted to the following treatments (12 head per treatment)

[1] Synovex-H is the tradename for heifer finishing implants containing testosterone propionate and estradiol benzoate produced by Syntex Agribusiness, Inc., Des Moines, IA 50303, which provided implants.

[2] Ralgro is the trademark name for zeranol implants produced by International Minerals and Chemical Corp., Terre Haute, IN 47808, which provided implants.

[3] MGA is the trademark name for melengestrol acetate produced by the TUCO Division of The Upjohn Company, Kalamazoo, Michigan 49001, which provided MGA.

on November 18, 1981: 1) control - no implant or MGA; 2) MGA only; 3) Ralgro only; 4) Synovex-H only; 5) MGA and Ralgro; and 6) MGA and Synovex-H. Each group of heifers was wintered in a five-acre fescue pasture and fed big round bales of mixed grass hay *ad libitum* in round slant bar feeders. Heifers designated to be implanted were implanted only once at the beginning of the study. Ralgro was implanted at the base of the ear and Synovex-H in the center one-third of the ear. All heifers were fed 4 lb of rolled milo per head daily. Heifers designated to receive MGA were fed .5 mg of MGA per head daily mixed with the rolled milo. Initial and final weights were taken following a 16-hour shrink from feed and water. The study was terminated March 11, 1982 (112 days).

Results: Results from this study are presented in Table 27. Since there were no significant interactions, MGA treatments were pooled within implant treatments and implant treatments were pooled within MGA treatments. In this study, Synovex-H produced 11.4% ($P < .10$) and 10.4% ($P < .10$) greater gain than no implant or implanting with Ralgro, respectively. Heifers implanted with Ralgro had similar performance to the nonimplanted control group. This is contrary to most other previous research with Ralgro. Ralgro usually results in 5 to 10% higher gain than nonimplanted controls.

Heifers fed MGA gained 4.7% more than those that did not receive the additive, but this difference was not significant ($P > .20$).

Conclusions: Synovex-H resulted in 10.4% higher gains for backgrounding stocker calves through the winter than did Ralgro and 11.4% higher gains than nonimplanted controls. MGA did not significantly affect gain.

Table 27. Effect of Implants and MGA on Backgrounding Heifer Performance (112 days).

	Implant Treatment			MGA Treatment	
	No implant	Ralgro	Synovex-H	Without	With
No. of head	24	24	24	36	36
Initial wt., lb	468	469	464	462	472
Final wt., lb	587	589	596	583	599
Total gain, lb	119[a]	120[b]	132[b]	121	127
Average daily gain, lb	1.05[a]	1.06[a]	1.17[b]	1.07	1.12

[a,b] Implant treatment means in the same row with different superscripts are significantly different ($P < .10$).

Effect of Synovex-S and Ralgro on Gains of Backgrounding Steers

Growth promoting implants usually result in a 8 to 15% faster gain in growing and finishing cattle. Producers face the decision of whether to implant and what implant to use. This study was designed to evaluate the effect of Synovex-S and Ralgro on gains of steers backgrounded through the winter.

Procedure: One hundred fifty mixed steers on the Ron Wells ranch near Gridley, KS, with an average initial weight of 554 lb were randomly allotted to one of the following implant treatments on November 5, 1981: 1) control - no implant; 2) Ralgro; and 3) Synovex-S. Steers were implanted initially and again 100 days later. All cattle were handled as one management unit and were grazed in the same pasture. Seventeen steers were removed from the study for reasons unrelated to the experimental treatments. Initial and final weights were taken following a 16-hour shrink from feed and water. The study was terminated on May 24, 1982 (200 days).

Results: Results of this study are presented in Table 28. Steers implanted with Synovex-S had 14.1% higher gains ($P < .05$) than the non-implanted controls. However, there was no significant difference ($P > .10$) in gain between steers implanted with Ralgro and Synovex-S. Implanting with Ralgro resulted in a 8.2% higher gain than the nonimplanted controls, but this difference was not significant ($P > .10$).

Conclusions: Implanting can increase gains of backgrounding steers from 8 to 14%. Synovex-S produced a slightly larger gain response than Ralgro.

Table 28. Effect of Synovex-S and Ralgro on Gains of Backgrounding Steers (200 days)

	Control	Ralgro	Synovex-S
No. of head	44	47	42
Initial wt., lb	541	550	540
Final wt.,	711	734	734
Total gain, lb	170^a	184	194^b
Average daily gain, lb	$.85^a$	.92	$.97^b$

[a,b] Means on the same row with different superscripts are significantly different ($P < .05$).

Alfalfa Hay Compared with Grain as Creep Feed for Fall Calves

Creep feeding has generally increased weaning weights of beef calves by 40 to 80 lb. Greatest response to creep feeding has been obtained with calves dropped in the fall, calves born to cows that are poor milkers or to cows that are two or more than none years old, and when pasture conditions are poor. In recent years, creep feeding has declined in popularity due to one or more of the following reasons: high feed costs, low feeder-calf prices, retained ownership of cattle in a high forage program following weaning, and fleshly calves being sold at a discount. All of these drawbacks of creep feeding, with the exception of low feeder calf prices, can be overcome by feeding a high protein creep ration with more bulk and less energy than found in traditional creep rations.

There is also concern about creep feeding of heifers reducing their subsequent productivity as brood cows. A University of Illinois study with British bred cattle showed that when heifers were creep fed while nursing as calves, they produced less milk and weaned lighter calves after calving at two years of age than their noncreep-fed counterparts. However, recent Montana State research showed that subsequent milk production of heifers sired by large-framed exotic sires was not adversely affected by creep feeding them during the nursing period when they were calves. Based on these studies, it appears that small framed, early maturing heifers are more likely to have subsequent milk production adversely affected by creep feeding than are large framed, late maturing heifers. Adding a high-quality roughage or increasing the production of oats in the creep ration would likely result in less reduction in subsequent milk production of nursing heifers and less fleshiness at weaning time than traditional high energy creep rations. In this study, ground alfalfa hay and a grain mixture of 2/3 oats and 1/3 corn were compared as creep rations for fall calves. This is a replication of a similar study conducted a year earlier at Southeast Kansas Experiment Station.

Procedure: Fourteen fall-dropped Angus and Simmental x Hereford calves (11 steers and 3 heifers) were allotted by weight, sex, and breed on December 16, 1981. One group was creep-fed ground alfalfa hay (19.5% crude protein on 100% dry matter basis). The other group received a grain mixture of 2/3 whole oats and 1/3 whole 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* in round, slant-bar feeders. Calves were weaned on April 26, 1982 when they were approximately 7 months old.

Results: Calves that were creep-fed alfalfa hay gained 1.59 lb per day, while those fed grain had an average daily gain of 1.88 lb (Table 29). Although the grain-fed calves gained 18.2% (38 lb) more than did the calves creep-fed alfalfa hay, the difference was not statistically significant ($P > .05$) due to the small number of calves involved in the study and the large amount of variation between calves within each treatment. Consumption of alfalfa hay and grain were each 1.75 lb per head daily.

Results of this study are similar to an earlier study conducted at this station which compared alfalfa hay and grain as creep rations for fall dropped calves. In that study gains between calves creep-fed alfalfa hay and grain were not statistically different ($P > .05$), although calves creep-fed grain gained 9.9% (33 lb) more than calves creep-fed alfalfa hay. However, daily consumption of alfalfa hay and grain was 5.01 and 5.62 lb, respectively.

Creep-feeding alfalfa hay resulted in 57 lb of additional gain ($P < .05$) for fall calves when compared to a control group that received no creep feed in an earlier study conducted at this station.

Conclusions: Alfalfa hay is an alternative ingredient for creep rations that can compete favorably with grain with respect to calf performance.

Table 29. Alfalfa Hay Compared with Grain as Creep Ration (131 Days).

Item	Alfalfa	Grain
No. of calves	7	7
Initial wt., lb.	175	172
Final wt., lb.	383	418
Total gain, lb.	208	246
Average daily gain, lb.	1.59	1.88
Average daily creep feed intake, lb.[1]	1.75	1.75

[1]As-fed basis.

ACKNOWLEDGMENTS

Crop Research

American Cyanamid Company
BASF Wyandotte Corporation
Baugher Equipment
Chevron Chemical Company
CIBA-Geigy Corporation
DeKalb Ag Research, Inc.
DeLange Seed House
Dow Chemical Company
E. I. duPont de Nemours & Co.
Elanco Products Company
I. C. I. Americas Inc.
Midwest Minerals, Inc.
Mobay Chemical Corporation
Monsanto Agricultural Products Co.
Pioneer Seed Company
Phone-Poulene Chemical Co.
Stauffer Seeds
Shell Chemical Company

Cooperation of the following agricultural scientists and individuals is appreciated:

- Paul Frazee, Columbus
- Roy Kelley, Columbus
- Dee Shaffer, Columbus
- Gary Kilgore, SEK Area Extension Agronomist, Chanute
- D. Kissel, soil fertility research scientist, Dept. of Agronomy, KSU, Manhattan
- W. T. Schapaugh, research soybean geneticist, Dept. of Agronomy, KSU Manhattan
- T. L. Walter, crops research scientist (crop performance testing), Dept. of Agronomy, KSU, Manhattan
- D. A. Whitney, research soil chemist, Dept. of Agronomy, KSU, Manhattan

Forage Crops Research

Contributions of the following organizations are appreciated:

Acco Paymaster
Baugher Forage Equipment
Cargill Seeds
Conlee Seed Co.
DeKalb-Pfizer Seed
Dessert Seed
Duval Chemical Co.
Elanco Products Co.
Garst Seed Co.
George Warner Seed Co.
J. A. DeLange Seed
Johnson Seed Co.
North American Plant Breeders
Northrup-King and Co.
Pioneer Seeds
Sharp Bros. Seed Co.
Stauffer Seed Co.
Taylor-Evans Seed Co.
Tennessee Valley Authority

Cooperation of these scientist and individuals is appreciated:

A. D. Dayton, consulting research statistician, Dept. of Statistics, KSU, Manhattan
A. Every, Parsons
G. Huntington, Clear Creek Ranch, Longton
D. E. Kissel, soil fertility specialist, Dept. of Agronomy, KSU, Manhattan
J. Meisenheimer, D. C., SCS-USDA, Altamont
J. Murnane, Girard
G. L. Posler, forage utilization agronomist, Dept. of Agronomy, KSU, Manhattan
William Reid, superintendent, Pecan Experimental Field, KSU, Chetopa
E. L. Sorensen, USDA plant geneticist, Dept. of Agronomy, KSU, Manhattan
C. M. Taliaferro, grass breeder, Dept. of Agronomy, Oklahoma State Univ., Stillwater, OK
T. L. Walter, crops research scientist, Dept. of Agronomy, KSU, Manhattan

Technical assistance by the following classified employees is also acknowledged:

C. M. Middleton, Farmer II
C. M. Cramer, Farmer II
K. R. McNickle, Farmer II
J. L. Cramer, Farmer I

Beef Cattle Research

The Southeast Kansas Experiment Station sincerely thanks the following individuals and companies for support of beef cattle research through research grants, products, or services.

Carey Salt, Hutchinson, KS
Hillcrest Farms, Steve Clark, Havana, KS
Hoffmann-La Roche Inc., Nutley, N.J.
International Minerals and Chemical Corporation, Terre Haute, IN
KSU Dept. of Animal Sciences and Industry, Manhattan, KS
KSU Dept. of Grain Science and Industry, Manhattan, KS
Lilly Research Laboratories, Division of Eli Lilly, Greenfield, IN
New Breeds Industries, Inc., Manhattan, KS
Power Play Associates, Jackson, MO
Prophet Associates, Hebron, OH
Syntex Agribusiness, Inc., Des Moines, IA
The Upjohn Company, Kalamazoo, MI
U.S.S. Agri-Chemicals, Atlanta, GA
Ron Wells, Gridley, KS
W-W Manufacturing Co., Dodge City, KS

Agricultural Experiment Station, Kansas State University, Manhattan 66506

Report of Progress 433 April 1983

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