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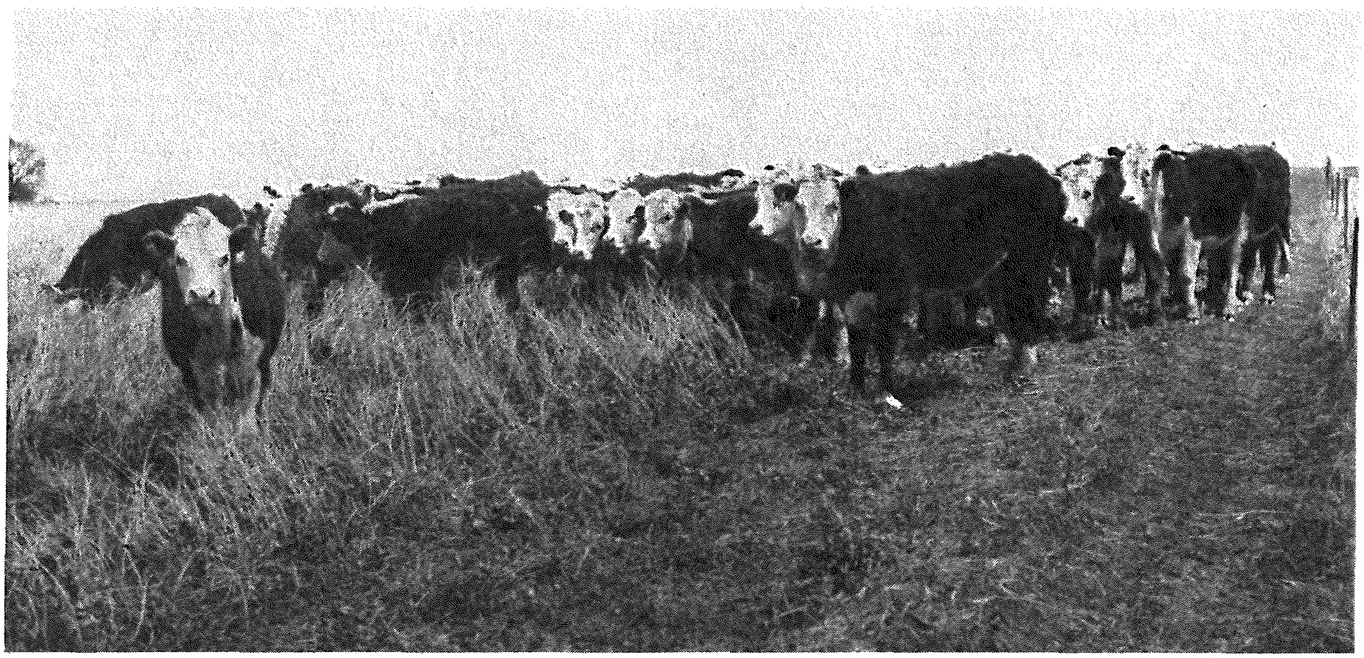


Agricultural Research at the Southeast Kansas

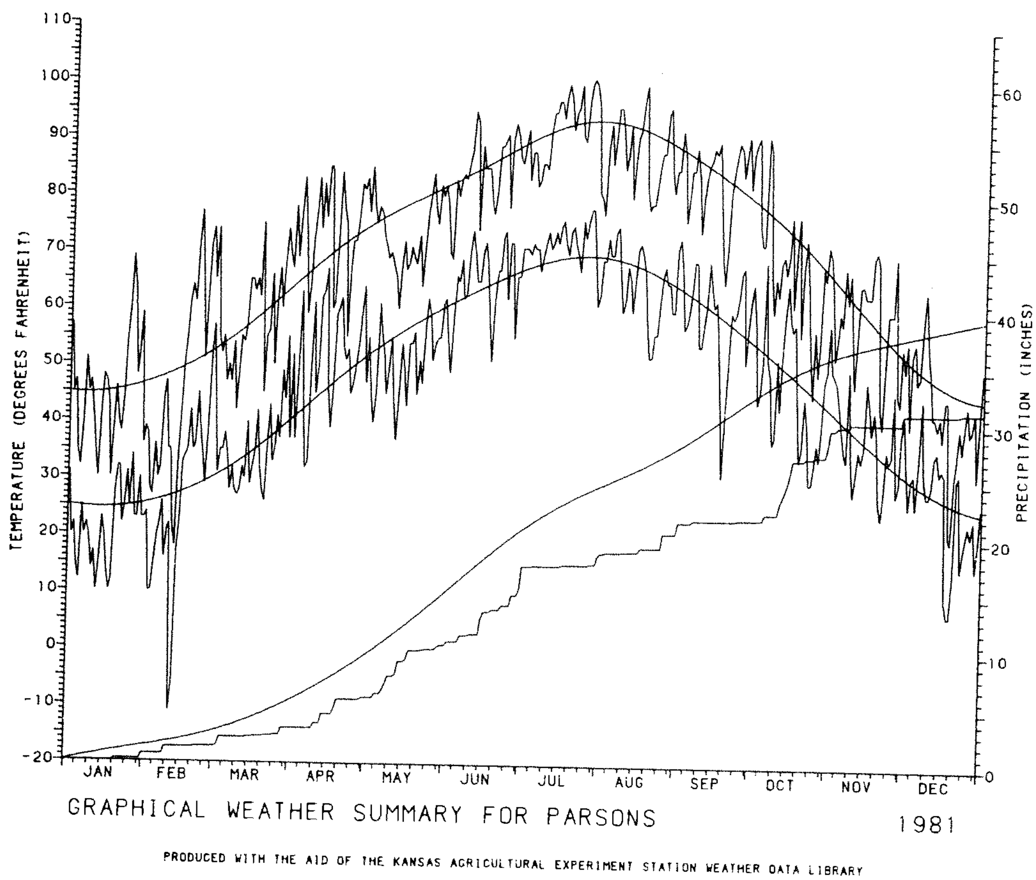
Branch Experiment Station during 1981

INTRODUCTION

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

This report for 1981 covers four areas of research emphasis: Soil and Water Management, Forages, Crops, and Beef Cattle. We sincerely hope that it will be useful to area producers and consumers, industry cooperators, Extension personnel and others.

The chart below summarizes temperature and precipitation for 1981. It may help explain some of the reported experimental results that were difficult, if not impossible, to interpret because of weather effects.



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SOIL AND WATER MANAGEMENT RESEARCH

Ray E. Lamond

Research Agronomist

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

Many of the soils in southeast Kansas respond to applied phosphorus. With the cost of P fertilizer increasing, there is much interest in getting the best efficiency of applied P as possible.

Procedure: This study was established (on an area that had only 4 lb/acre available P) to compare P methods of application and P rates for winter wheat. P rates were 30, 60, and 90 lbs P_2O_5/acre, applied by these methods: dual-knifed (simultaneously injecting NH_3 and 10-34-0 eight inches deep on 15-inch centers), broadcast, and banded with the drill. Nitrogen rate was constant at 75 lbs N/acre.

Results: Yield response to added P in 1981 was excellent (Table 1), as the control (0 P_2O_5) made 29 bu/acre and the 60 P_2O_5/acre rate was 61 bu/acre. There was no significant difference between 60 and 90 lbs P_2O_5/acre, but P applied at both those rates produced significantly higher yields than did the 30 lbs P_2O_5/ acre rate. Broadcast and banded P produced significantly higher yields than did knifed P, probably because of the dry fall (1980) and spring (1981). Very little subsoil moisture was present at planting and it was never replenished. Because moisture and nutrient uptake came from the surface in the spring, the deep-placed (knifed) P did not perform so well as did surface applied P.

Conclusions: Results of this work show that P fertilization can effectively increase wheat yields on low-P soils. Based on 2-year average yields, adding only 30 lbs P_2O_5/acre increased yields by 28 bushels per acre over those of the nonfertilized check plot. Effectiveness of methods of methods of application varied, but banding P with the seed produced the highest yields both years of the study.

Table 1. Effects of N and P rates and methods of application for winter wheat in southeastern Kansas, Parsons Field.

N (lbs/acre)	P_2O_5 (lbs/acre)	P method	1981 grain yield bu/acre	Leaf composition %N	Leaf composition %P	Grain protein	2-yr avg yield bu/acre
0	0	- - -	28	3.81	.15	14.2	17
75	0	- - -	29	4.05	.16	14.7	18
75	30	Dual knife	43	3.94	.16	13.4	39
75	60	"	58	4.04	.27	12.2	54
75	90	"	60	4.20	.29	12.0	56
75	30	Broadcast	56	4.26	.19	12.4	45
75	60	"	60	3.86	.22	12.1	54
75	90	"	62	3.95	.25	11.6	56
75	30	Band	60	3.94	.20	12.1	52
75	60	"	63	4.07	.25	11.4	55
75	90	"	59	4.11	.30	11.5	56
	Treatment	LSD (.05)	5	NS	.03	0.8	
Mean values:							
P_2O_5		30	53	4.05	.19	12.6	45
		60	61	3.99	.25	11.9	55
		90	60	4.09	.28	11.7	56
		LSD (.05)	3	NS	.02	0.3	
P method		Dual knife	54	4.06	.24	12.5	50
		Broadcast	59	4.02	.22	12.0	52
		Band	61	4.04	.25	11.7	54
		LSD (.05)	3	NS	.02	0.3	

Effects of P Rates and Methods on Two Wheat Varieties

Higher yielding, semi-dwarf wheat varieties as well as some soft wheats now dominate the wheat acreage in southeastern Kansas. The new semi-dwarf 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 older variety (Centurk) at three P rates (40,80, and 120 lb P_2O_5/acre) applied by two methods (knifed and broadcast). N rate was 120 lb/acre.

Results: Both varieties had an excellent P response in 1981 (Table 2). The 80 lb P_2O_5/acre rate produced significantly higher yields than did 40 lb P_2O_5/acre, but there were no differences between 80 and 120 pounds of P_2O_5. The semi-dwarf variety ('Newton') outyielded 'Centurk' by 5 bu/acre and responded more to the higher P rates. Yield effects due to P placement were minimal in 1981.

Conclusions: Further evaluations are needed to determine if the new, higher-yielding wheat types will respond to higher rates of fertilization. This study is being continued.

Effects of K Rates and Methods of Application on Wheat Yields

Though many soils in southeastern Kansas are low in potassium, yield responses to applied K are often small.

Procedure: This study was continued in 1981 to compare K rates (30, 60, and 90 lb K_2O/acre) and methods of application (broadcast and knifed) on wheat. K source was 0-0-10 liquid. N and P_2O_5 were constant at 75 and 50 lb/acre, respectively.

Results: 1981 yields were good, but adding K up to 90 lb K_2O/acre did not significantly affect yields. Method-of-application effects were also insignificant.

Conclusions: Based on 2-year average yields, adding of K did not significantly increase wheat-grain yields on a low-K soil. Likewise, method of K application did not significantly affect yields.

Table 2. Effects of P rates and methods on two wheat varieties, Parsons Field, 1981.

N	P_2O_5	P		Grain yield	Leaf composition		Grain
	lbs/acre	method	Variety	bu/acre	%N	%P	Protein, %
120	0	- - -	Newton	52	3.96	.18	13.4
120	40	Knifed	"	59	4.00	.21	12.4
120	80	"	"	69	4.21	.25	11.8
120	120	"	"	70	4.22	.28	12.1
120	40	Broadcast	"	61	4.11	.22	12.5
120	80	"	"	65	4.26	.27	11.9
120	120	"	"	64	4.31	.30	11.9
120	0	- - -	Centurk	42	4.13	.17	14.7
120	40	Knifed	"	58	3.96	.22	13.5
120	80	"	"	64	4.19	.27	13.1
120	120	"	"	59	4.35	.28	12.6
120	40	Broadcast	"	58	4.06	.21	14.0
120	80	"	"	58	3.96	.26	13.2
120	120	"	"	62	4.18	.32	13.2
	Treatment LSD (.05)			10	NS	.04	0.86
Mean values:							
P_2O_5	40			59	4.03	.21	13.1
	80			64	4.16	.26	12.5
	120			64	4.27	.30	12.5
		LSD (.05)		4	NS	.02	0.4
P method	Knifed			63	4.16	.25	12.6
	Broadcast			61	4.15	.26	12.8
		LSD (.05)		NS	NS	NS	NS
Variety	Newton			65	4.19	.26	12.1
	Centurk			60	4.12	.26	13.3
		LSD (.05)		3	NS	NS	0.3

Evaluation of Fertility-tillage Management Systems for Grain Sorghum and Soybeans

Farmer interest in reduced or no-tillage systems in southeastern Kansas is increasing. More research is needed to determine if these systems will work well in this area and, if so, whether fertility management will have to be changed.

Procedure: Work begun in 1979 at two sites (in Labette and Cherokee counties) to compare conventional, reduced, and no-tillage systems was continued in 1981. Several fertility-management variables were included in these studies. At the Labette county site, soybeans were the test crop, and grain sorghum was used at the Cherokee county site. Fertility rates used were 100-50-50 for grain sorghum and 40-50-50 for soybeans.

Results: Three years of data from the Labette county site, in a soybean-grain sorghum rotation, are summarized in Table 3; Three years of data from the Cherokee county site, in continuous grain sorghum, are summarized in Table 4.

Conclusions: Knifing of nutrients -- which gave higher yields (for both grain sorghum and soybeans) than did broadcast applications under either the conventional or the reduce-tillage system -- shows promise, especially in a reduced-tillage situation. Surface-applying UAN would seem not to be advisable in a no-till system, as reflected in lower yields and lower leaf N levels.

Finally, these data indicate that grain sorghum and soybeans can be grown successfully in a reduced-tillage system in southeastern Kansas; proper fertility management, however, is critical.

Table 3. Evaluations of fertility-tillage management systems on a soybean -- grain sorghum rotation, 1979-81, Labette County.

Tillage	N Carrier	N-P-K method [1]	Soybeans, 1979 Yield bu/a	Soybeans, 1979 Tissue analysis %N	%P	%K	Grain sorghum, 1980 Yield bu/a	Grain sorghum, 1980 Tissue analysis %N	%P	%K	Soybeans, 1981 Yield bu/a	Soybeans, 1981 Tissue analysis %N	%P	%K
Conventional	- - -	- - -	29	3.89	.36	1.68	22	2.37	.28	1.35	20	4.87	.45	1.83
Conventional	UAN	BC [2]	31	4.59	.37	1.77	31	2.87	.29	1.28	21	4.79	.45	1.81
Conventional	UAN	KN	31	4.67	.38	1.79	34	3.00	.30	1.32	23	4.87	.56	2.04
Conventional	NH_3	KN	28	4.43	.37	1.81	32	3.05	.31	1.35	24	4.66	.47	2.03
Reduced	UAN	BC	26	4.48	.35	1.75	27	2.90	.28	1.21	14	4.69	.44	1.84
Reduced	UAN	KN	28	4.59	.38	1.75	33	3.16	.31	1.21	20	4.68	.50	1.87
Reduced	NH_3	KN	28	4.40	.36	1.72	28	3.14	.30	1.24	21	4.76	.52	1.86
No-Till	UAN	BC	22	4.47	.35	1.67	21	2.97	.30	1.20	14	4.70	.40	1.76
No-Till	NH_4NO_3	BC	21	4.25	.35	1.70	27	3.05	.30	1.23	14	4.47	.41	1.90
Treatment LSD (.05)			5	NS	NS	NS	3	.24	.02	.08	6	NS	NS	NS

[1] N-P-K rates were 40-50-50 for soybeans and 100-50-50 for grain sorghum.

[2] BC is broadcast, KN is knifed.

Table 4. Evaluations of fertility-tillage management systems for continuous grain sorghum, 1979-1981, Cherokee County.

			1979				1980				1981				3-year
	N	N-P-K	Yield	Tissue analysis			Yield	Tissue analysis			Yield	Tissue analysis			Avg yield
Tillage	Carrier	method[1/]	bu/a	%N	%P	%K	bu/a	%N	%P	%K	bu/a	%N	%P	%K	bu/a
Conventional	- - -	- - -	98	2.24	.27	1.51	37	1.81	.25	1.04	61	2.40	.34	1.62	65
Conventional	UAN	BC[2/]	117	3.17	.34	1.45	42	2.17	.19	0.72	81	2.85	.37	1.46	80
Conventional	UAN	KN	126	3.17	.34	1.51	46	2.16	.19	0.97	83	2.98	.37	1.40	85
Conventional	NH_3	KN	123	3.01	.33	1.50	49	2.03	.18	0.80	85	2.94	.39	1.53	86
Reduced	UAN	BC	125	3.00	.34	1.52	47	2.06	.21	0.88	82	2.69	.34	1.42	85
Reduced	UAN	KN	117	3.09	.33	1.53	52	2.20	.18	0.87	99	2.74	.35	1.48	89
Reduced	NH_3	KN	121	2.86	.32	1.53	50	2.16	.20	0.78	93	2.65	.35	1.44	88
No-Till	UAN	BC	96	2.75	.31	1.45	35	2.26	.26	0.88	72	2.37	.31	1.42	68
No-Till	NH_4NO_3	BC	120	3.27	.33	1.45	46	2.36	.25	1.01	94	2.58	.32	1.30	87
Treatment LSD (.05)			19	.17	.01	NS	NS	NS	NS	.17	24	.28	.04	.12	—

1/ N-P-K rates applied were 100-40-40.

2/ BC is broadcast, KN is knifed.

Effects of Primary Tillage Methods on Grain Sorghum and Soybean Yields, 1979-81

Primary tillage methods for preparing the seedbed for grain sorghum and soybeans in southeastern Kansas have a wide range: from use of the moldboard plow or tandem disk to no tillage systems. This research was established in 1979 to evaluate the effects of several primary tillage methods on the yields of these crops.

Procedure: This work on comparing different tillage methods for grain sorghum and soybean production was continued at two locations in 1981: at the Parsons Field, in a grain sorghum-soybean rotation (grain sorghum in 1981); and at the Columbus Field, in continuous soybeans. The moldboard plow, chisel, disk, soil-saver, and no-till methods were compared.

Results: Primary tillage methods had no significant effects on grain sorghum yields at the Parsons Field in 1981. At the Columbus Field, however, use of plow or chisel produced significantly higher soybean yields than did either disk or no-till methods. The no-till method resulted in significantly lower grain yields than did any other treatment. These results are summarized in Table 5.

Conclusions: After three years of evaluation, we seemingly can conclude that grain sorghum yields are affected minimally by tillage system. Soybean yields generally, however, will be depressed in a no-till situation. This work was done on monocultured soybeans, and effects were greatly influenced by weather.

Table 5. Effects of primary tillage methods on grain sorghum and soybean yields.

Tillage treatment	Parsons Field 1979 Grain sorghum	Parsons Field 1980 Soybeans	Parsons Field 1981 Grain sorghum	Columbus Field, soybeans 1981	Columbus Field, soybeans 3-yr avg
	Yield, bu/acre			Yield, bu/acre	
Plow	97	16	50	41	33
Chisel	89	19	51	42	32
Disk	81	16	48	38	30
Soil-Saver [1/]	88	19	52	--	--
No-Till	75	21	53	28	23
LSD (.05)	19	NS	NS	3	--

1/ Manufactured by Glencoe, combination heavy disk and chisel.

Effects of N, P, and K Rates and Methods of Application on Tall Fescue

R. E. Lamond and J. L. Moyer

Cool-season grasses, especially tall fescue, are extremely important in southeastern Kansas not only for pasture but also as a hay crop. To optimize fescue production, N is routinely applied but many soils will respond to P and K. We are studying effects of N, P, and K on tall fescue.

Procedure: This study begun in 1980 and continued in 1981 had these objectives: to evaluate N rates (12, 100, 150 lb/acre), P rates (0, 40 lb P_2O_5/ acre), and K rates (0, 40 lb K_2O/acre), either applied broadcast on the surface or knifed in about 8 inches deep on 15-inch centers. N was supplied as UAN (28% N) solution, P as 10-34-0 liquid and K as 0-0-10 solution. Broadcast treatments were put through flat spray nozzles. The site for this study tested is in the low range for both P and K.

Results: Fescue yields in this study were impressive, especially in light of a dry spring in 1981 (Table 6). N application up to 150 lb/acre significantly increased forage production and N in the forage. Applying 40 lb of P_2O_5/acre also significantly increased forage production, boosting yields nearly 300 lb/acre. In addition, P concentrations in the forage were significantly increased by P fertilization, but K fertilization had no effect on forage yields. The knifed method of applying fertilizer boosted forage yields significantly, nearly 1,200 lb/acre above those by the broadcast method. For the third year in a row, the knifed method was given superior performance. Apparently, nutrient use by fescue is greater when the fertilizer is placed deeper in the root zone than when placed on the surface. This work will be continued in 1982.

Conclusions: A complete fertilization program is necessary to optimize fescue-forage production. Fescue will respond to P on low P soils. K fertilization has little effect on yield unless other limiting factors are eliminated. This research indicates that knifing in of nutrients on fescue is superior to broadcasting the nutrients on the surface. Optimum N rate appears to be 100 lbs N/acre.

Table 6. Effects of N-P-K rates and methods of application on tall fescue, Every farm, Neosho County.

N	P_2O_5	K_2O	N-P-K method	1981 Forage yield lbs/a	Forage composition %N	%P	%K	2-yr avg yield lbs/a
lbs/a								
12	0	0	Broadcast	2630	1.45	.17	1.45	2491
12	0	40	"	3200	1.31	.14	1.49	2702
12	40	0	"	3090	1.41	.18	1.58	2679
12	40	40	"	2854	1.35	.18	1.52	2741
100	0	0	"	3770	1.77	.14	1.52	3559
100	0	40	"	3276	1.82	.15	1.73	3297
100	40	0	"	3747	1.73	.20	1.63	3748
100	40	40	"	3438	1.62	.19	1.69	3637
150	0	0	"	3356	2.07	.16	1.67	3526
150	0	40	"	3389	1.91	.14	1.51	3467
150	40	0	"	4443	1.86	.20	1.57	4308
150	40	40	"	3692	1.84	.20	1.74	4142
12	0	0	Knifed	3342	1.29	.14	1.27	3001
12	0	40	"	3380	1.33	.14	1.35	2836
12	40	0	"	3760	1.28	.15	1.33	3553
12	40	40	"	4125	1.31	.15	1.42	3718
100	0	0	"	4240	1.57	.13	1.37	3941
100	0	40	"	4828	1.66	.14	1.61	4314
100	40	0	"	4829	1.69	.16	1.49	4461
100	40	40	"	5082	1.77	.17	1.58	4713
150	0	0	"	5226	1.77	.14	1.51	4652
150	0	40	"	5650	1.58	.13	1.39	4724
150	40	0	"	5452	1.90	.16	1.44	4972
150	40	40	"	5153	1.86	.16	1.43	4933
Treatment LSD (.05)				864	.22	.02	.21	
Mean values:								
N rate lbs/a	12			3298	1.34	.16	1.43	2966
	100			4151	1.70	.16	1.58	3959
	150			4545	1.85	.16	1.53	4341
	LSD (.05)			306	.08	NS	.07	
P_2O_5 rate lbs/a	0			3857	1.63	.14	1.49	3543
	40			4139	1.64	.18	1.54	3967
	LSD (.05)			250	NS	.01	NS	
K_2O rate lbs/a	0			3990	1.65	.16	1.49	3741
	40			4006	1.61	.16	1.54	3769
	LSD (.05)			NS	NS	NS	NS	
N-P-K method	broadcast			3407	1.68	.17	1.59	3358
	knifed			4589	1.58	.15	1.43	4152
	LSD (.05)			250	.06	.01	.06	

Effects of N, P, and K Rates and Methods of Application on the Yield of Grain Sorghum

Grain sorghum is an important crop in southeastern Kansas. This research, begun in 1979, to compare fertilizer rates and methods of application, is being continued on a long-term basis.

Procedure: N rates used were 0, 50, 100, and 150 lbs N (as NH_3) per acre. Rates of P and K were 0 and 50 pounds of P_2O_5 and K_2O per acre and were supplied as 10-34-0 and 0-0-10 solutions. P and K were applied broadcast and knifed. Where knifed, P and K were injected simultaneously, with the NH_3 at a depth of 8 inches on 15-inch centers.

Results: In 1981, sorghum yields responded significantly to fertilizer (Table 7). Little N response above the 50 lb N/acre rate was noted, but adding P and K increased yields, and knifing in these nutrients produced significantly higher yields than did broadcasting in 1981. Three-year average yields indicated a good N response and a good P-K response. On the three-year average, knifing of P and K gave 4 more bushels per acre than did broadcasting P and K.

Conclusions: In this study, yields of grain sorghum were depressed by dry conditions each year. But even with lower yields, because of the drought, the results reveal how important fertilization is and also indicate that southeastern Kansas farmers may find it profitable to knife in the nutrients or band them in the subsurface.

Table 7. Effects of N, P, and K rates and method of application on the yields of grain sorghum.

lbs/acre			P-K	Parsons Field, Labette Co.	
N	P_2O_5	K_2O	method	1981 yield bu/acre	1979-81 avg bu/acre
0	0	0	- - -	44	39
0	50	50	BC	48	47
0	50	50	KN	60	56
50	0	0	- - -	59	55
50	50	50	BC	55	55
50	50	50	KN	61	61
100	0	0	- - -	48	56
100	50	50	BC	58	58
100	50	50	KN	61	58
150	0	0	- - -	60	57
150	50	50	BC	61	59
150	50	50	KN	63	62
Treatment LSD (.05)				8	--
Mean values:					
N rate: 0				51	47
50				59	57
100				55	57
150				61	59
LSD (.05)				5	--
Method: No P-K				53	51
P-K BC				55	55
P-K KN				61	59
LSD (.05)				4	--

Effects of P Rates and Application Methods on the Yield of Grain Sorghum

With the rising costs of P fertilizer, there is considerable interest in increasing efficiency of applied P. In continuing this research, P rates and application methods for grain sorghum are being compared.

Procedure: P rates used in this study in 1981 were 10, 20, 40, and 80 lbs P_2O_5/acre, applied knifed, broadcast, or banded with the seed at planting. P was supplied as 10-34-0 and N (as NH_3) was balanced at 100 lbs N/acre. On the knifed treatments, the NH_3 and 10-34-0 were injected simultaneously 8 inches deep on 15-inch centers. The objective was to see if any of these methods of application could provide more efficient P use, especially at lower P rates. This work will be continued for several years.

Conclusions: Grain sorghum will respond to applied P on low-P soils. Based on 1981 data, it appears that P fertilizer efficiency can be increased either by banding with the seed or by subsurface banding (6-8" deep on 15" centers). This work will be continued on a long-term basis.

Effects of N Rates, Nitrification Inhibitors, and Time of N application on Grain Sorghum Yields

Often in southeastern Kansas, there is an opportunity in the fall to apply N for the next year's grain sorghum crop. Doing that has some advantages, but many farmers are concerned about possible losses of N applied in the fall. Use of nitrification inhibitors, now appearing on the market, is one alternative to consider. In 1979 we initiated research on applying N with the inhibitors.

Procedure: N was applied as NH_3, with and without the nitrification inhibitor, N-Serve, in the fall of 1980 and spring of 1981. N rates were 40, 80, 120, and 160 lbs N/acre. N-Serve was applied at the rate of 1 qt/acre.

Results: In 1981 sorghum yields responded well to applied N, although there were no differences in yields among N rates, probably because of a large carryover of N from 1980, a very dry year. There was no significant differences in yields because of N application.

Yields did increase significantly in 1981, however, when N-serve was used. That was somewhat surprising because we had a fairly dry growing season, so expected very little loss from N from denitrification or leaching. Two years of results (1980 and 1981) showed a 4-bushel increase in yields when N-Serve was used.

Conclusions: Data from this study and a similar one seem to indicate that fall-applied N for grain sorghum is feasible and will increase grain yields just as well as will spring-applied N. Based on the results of this work, however, it appears that it is not economically sound to use nitrification inhibitors in this area. Even though their use might increase yields slightly, the increase would not be enough to offset the price of the inhibitor.

Effects of P Rates and Methods of Application on the Yield of Irrigated Corn

Currently irrigated crops in southeastern Kansas are grown on an estimated 25,000 acres. Much of this acreage, representing various soil types, is in corn. We initiated research to find optimal fertility rates for irrigated corn, so that we can make recommendations on fertilizer use.

Procedure: This irrigated corn work was begun in 1980 and continued in 1981. P_2O_5 rates were 40, 80, 120, and 160 pounds per acre, applied broadcast and knifed. The knifed P (source, 10-34-0) was injected 8 inches deep on 15-inch centers. N was supplied as NH_3 to a constant rate of 240 lbs N/acre.

The corn was furrow-irrigated from a pit using a 6-inch gated pipe. Irrigation scheduling was by water depletion by using 12 and 24 tensiometers. The site was low in available P.

Results: Yields in 1981 were disappointing (Table 8). Even with more then 4 inches of supplemental irrigation, yields were only in the 90-110 bushel-per-acre range. But despite these low yields, response to P was significant. There was no significant difference in yield due to P application method, although knifed P gave higher yields.

Conclusions: Irrigated corn responded to P fertilization. On a low-medium P soil, applying 80 lbs P_2O_5/acre seemingly was near the optimal P fertilizer rate. Based on two years of data, the practice of "knifing in" the P fertilizer would appear to be profitable as doing that produced 8 more bushels of corn per acre than did broadcast P.

Table 8. Effects of P rates and methods of application on the yields of irrigated corn, 1980-81.

lbs/acre P_2O_5	Method of application	Parsons Field, Labette Co. 1981 yields bu/acre	Tissue composition %N	%P	%K	1980-81 avg yields bu/acre
0	- - -	82	2.41	.24	2.00	79
40	Broadcast	104	2.44	.24	1.97	93
80	"	99	2.31	.26	2.05	91
120	"	95	2.49	.25	1.89	89
160	"	97	2.54	.26	1.87	90
40	Knifed	95	2.43	.25	1.89	90
80	"	104	2.57	.26	1.92	98
120	"	101	2.38	.26	1.84	97
160	"	110	2.44	.26	1.96	105
Treatment LSD (.05)		13	NS	NS	NS	--
Mean values:						
P_2O_5	40	99	2.44	.25	1.93	91
	80	101	2.44	.26	1.98	94
	120	98	2.44	.25	1.87	93
	160	103	2.49	.26	1.92	97
	LSD (.05)	NS	NS	NS	NS	--
P Method	Broadcast	98	2.44	.25	1.94	90
	Knifed	103	2.46	.26	1.91	98
	LSD (.05)	NS	NS	NS	NS	--

Effects of K Rates on the Yield of Irrigated Corn

This study was done in conjunction with the P study on irrigated corn, previously discussed.

Procedure: K rates used on this irrigated corn were 0, 50, 100, 150, 200, and 250 lbs K_2O/acre. This site had an initial K soil test only 110 pounds exchangeable K per acre.

Results: Yields in 1981 were low, but yield response to applied K was highly significant (Table 9). Tissue K levels were also significantly increased by K application. Yield increases leveled out above the 150 lb K_2O/acre rate. The 2-year average yields indicated it is important to apply K to optimize irrigated corn production.

Conclusions: On low-K soils, it pays to apply K fertilizer to irrigated corn. K fertilization increased yields by 20 bushels per acre. Apparently 150 lbs K_2O/acre is near the optimal application rate.

Table 9. Effects of K rates on the yields of irrigated corn.

lbs/acre	Parsons Field, Labette Co.				
K_2O	1981 yields	Tissue composition			1980-81 avg yields
	bu/acre	%N	%P	%K	bu/acre
0	79	2.43	.27	1.54	92
50	85	2.24	.27	1.99	100
100	89	2.37	.27	1.99	104
150	105	2.38	.26	2.05	113
200	107	2.52	.27	2.05	114
250	106	2.27	.27	2.18	113
Treatment LSD (.05)	9	NS	NS	.19	- -

Effects of P Rates and Application Methods on Irrigated Soybean Yields

The acreage of irrigated soybeans in southeastern Kansas is increasing. In 1980 we began research to determine if fertility recommendations need to be changed as irrigating soybeans increase their yields.

Procedure: Work was continued in 1981 to evaluate P rates of 40, 80,120, and 160 lbs P_2O_5/acre as either broadcast or knifed applications. The beans were furrow-irrigated and received 5 inches of supplemental irrigation. Ammonium polyphosphate (10-34-0) was used as the P source. All P was applied preplant; the broadcast P was incorporated and the knifed P was injected 8 inches deep on 15-inch centers. Soybean variety used was 'Essex'.

Results: Excellent yields were obtained in 1981 and a very good P response was noted, although there were no differences among the P rates (Table 10). Knifed P applications gave significantly higher hields than did broadcast P applications. This work will be continued in 1982.

Conclusions: This work indicated P fertilization is necessary to maximize irrigated soybean yields on a low P soil. Knifing in P fertilizer seemingly produces higher yields than does broadcast P. More work needs to be done, so precise recommendations can be made.

Effects of K Rates on Irrigated Soybean Yields

This work was continued in conjunction with the irrigated soybean P study previously discussed.

Procedure: K rates of 50, 100, 150, 200, and 250 lbs K_2O/acre were applied preplant and incorporated. 'Essex' soybeans were furrow-irrigated with 5 inches of supplemental water.

Results: 1981 yields were excellent and a significant yield response to applied K was noted (Table 11). This work, which indicated a need for K fertilization to optimize yields of irrigated soybeans, will be continued in 1982.

Conclusions: On low K soils, K fertilization is necessary to maximize irrigated soybean yields. Based on this research, it appears that a K fertilizer application rate of 100 lbs K_2O/acre is near the optimal rate.

Table 10. Effects of P rates and method of application on the yields of irrigated soybeans.

lbs/a P_2O_5	Method of application	Parsons Field, Labette Co. 1981 yields bu/acre	Tissue composition %N	%P	%K	1980-81 avg yields bu/acre
0	- - -	47	5.43	.59	2.44	32
40	Broadcast	54	5.54	.66	2.55	37
80	"	53	5.55	.64	2.37	38
120	"	57	5.59	.66	2.50	40
160	"	54	5.55	.67	2.42	38
40	Knifed	56	5.47	.63	2.36	40
80	"	55	5.47	.63	2.43	40
120	"	59	5.37	.67	2.45	43
160	"	58	5.53	.66	2.44	42
Treatment	LSD (.05)	4	NS	.03	NS	--
Mean values:						
P_2O_5 rate:	40	55	5.51	.65	2.46	39
	80	54	5.52	.64	2.41	39
	120	58	5.48	.66	2.47	42
	160	56	5.54	.67	2.43	40
	LSD (.05)	NS	NS	.02	NS	--
P method	Broadcast	55	5.56	.66	2.46	39
	Knifed	57	5.46	.65	2.42	41
	LSD (.05)	2	NS	NS	NS	--

Table 11. Effects of K rates on the yields of irrigated soybeans.

lbs/a K_2O	Parsons Field, Labette Co. 1981 yields bu/acre	Tissue composition %N	%P	%K	1980-81 avg yields bu/acre
0	47	5.08	.54	1.97	32
50	51	5.00	.55	2.04	35
100	54	4.86	.57	2.22	37
150	55	4.93	.54	2.22	37
200	55	4.88	.57	2.25	36
250	53	5.01	.57	2.29	35
Treatment LSD (.05)	4	NS	NS	.13	--

Irrigation Scheduling for Corn and Soybeans

Irrigation in southeastern Kansas is strictly supplemental and usually involves applying only 1-3 inches of water. Because producers have only limited water to use, they need to know the best time to apply the water.

Procedure: Studies were continued in 1981 on corn and soybeans to find out at which growth stage it is the best to irrigate. Because of abundant rainfall, the corn was irrigated only once. Soybeans received 1 inch of water at first bloom, 1 inch at pod fill, or 1 inch at each of these growth stages.

Results: 1981 results showed that adding just 1 inch of water at the tassel stage of corn resulted in a yield increase of 17 bushels per acre. Soybean yields were increased by irrigating at either stage (Table 12). Highest yields occurred when the soybeans were irrigated at both growth stages.

Conclusions: To date, this research indicates that both corn and soybeans will respond well to supplemental irrigation. Irrigating beans at either first bloom or pod fill is equally effective.

Table 12. Irrigation scheduling for soybeans.

Irrigation, inches	Yield, bu/acre
No irrigation	42
1" at first bloom	46
1" at pod fill	46
1" at first bloom plus 1" at pod fill	48
LSD (.05)	3.8

Varieties and Population of Irrigated Corn, Evaluated

R. E. Lamond and K. W. Kelley

Little information is available on corn-variety performance under irrigated conditions in southeastern Kansas. Research is also needed to determine optimal irrigated corn populations.

Procedure: In 1980 and again in 1981 we evaluated twelve popular corn varieties grown in the area. Plant populations evaluated were 18,000, 22,000, and 26,000 plants per acre. The corn was irrigated from a large pond with a center-pivot system.

Results: 1981 results are shown in Table 13. Yield differences among varieties were highly significant. There were no significant yield differences due to plant population. Highest yields were produced at the 26,000 population.

Conclusions: Variety selection is a very important management tool that should be used by corn growers. More research is needed to evaluate population effects as well as new varieties.

Table 13. Varieties and populations of irrigated corn, evaluated, Vernon Egbert Farm, Crawford County.

Variety	Grain yield* bu/a @15.5%	Grain moisture, %	Test weight lbs/bu	2-year avg yield
DeKalb XL-74aa	130	22.7	53	- -
DeKalb XL-63	128	18.2	54	128
DeKalb XL-72aa	143	20.6	53	133
DeKalb XL-75	141	22.0	54	132
NC+ 8331	135	20.8	57	- -
NC+ 4710	128	18.4	55	- -
NC+ 59	152	23.1	54	135
NC+ 3990	115	16.2	57	111
Golden Harvest H-2500	154	20.5	55	139
Pioneer 3183	157	23.1	54	138
Pioneer 3090	160	22.1	55	- -
Prairie Valley 765	143	20.7	54	- -
LSD (.05)	21	1.6	1	- -
Populations				
18,000	137	20.9	55	128
22,000	140	20.7	55	131
26,000	144	20.5	54	129
LSD (.05)	NS	NS	NS	- -

*Variety yields averaged over the 3 populations.
Population yields averaged over the 12 varieties.

OTHER RESEARCH

Other research projects in soil and water management are either too preliminary or too inconclusive to justify reporting fully:

Residue Management Effects on Soil Chemical and Physical Properties. Burning, plowing under, removing, or leaving wheat straw are being compared as residue management variables, to see if soil chemical and physical properties are affected by residue management. To date, none of the properties being tested have been affected.

Fertility Management for Irrigated Alfalfa. Work is continuing to evaluate different fertility-management factors for irrigated alfalfa.

Evaluation of a Till-plant System for Southeastern Kansas. Research is underway to evaluate the till-plant or "ridge-plant" reduced tillage system for grain sorghum.

Evaluations of N Sources for No-till Grain Sorghum. Research is continuing to compare ammonium nitrate, urea, UAN solution, and urea-urea phosphate as N sources for a no-till grain sorghum.

Evaluations of Methods for Establishing Double-crop Soybeans. Work will be continued on comparing different ways of establishing soybeans after wheat.

Relay-intercropping of Soybeans and Wheat. Work has begun to evaluate relay-intercropping soybeans and wheat to conventional double-crop soybeans after wheat.

Evaluations of Magnesium Suspensions on Tall Fescue. Work is continuing to find out if directly applying magnesium suspensions to tall fescue will increase forage Mg levels and if doing that will affect blood serum Mg levels.

Evaluations of a Subsoiler on Southeastern Kansas Soils. Studies are underway to evaluate the effectiveness of a subsoiler or deep ripper as a tillage tool on southeastern Kansas soils.

Pearl Millet Evaluation. Several lines of pearl millet are being evaluated in southeastern Kansas as part of a regional testing program.

FORAGE CROPS RESEARCH

J. L. Moyer

Forage Agronomist

Performance of Alfalfa Varieties in Southeastern Kansas

Interest in alfalfa production has renewed as pests, notably alfalfa weevil, have become more manageable. This test was to help answer the question, "What variety should I plant to establish alfalfa?"

Procedure: Twenty-four alfalfa varieties were seeded at 12 lb/acre in spring, 1978. Benefin (balan) was applied preplant, as was 400 lb/acre of 6-24-24 fertilizer. In 1979, 200 lb/acre of 6-24-24 was applied after the first cutting and again after the last cutting. Fifty lb/acre of phosphate and 160 lb/acre of potash were applied January 23, 1981.

Results: Overall results from the four years of production are listed in KSU Ag Facts Sheet, "Performance of Alfalfa Varieties in Southeastern Kansas" (available from the county extension offices). Results from three alfalfa cuttings in 1981 are given in Table 14. With a warm, dry spring, the first cutting was early, and moist conditions after the second cutting made the third cutting most productive. Dry conditions in July and August did not permit regrowth.

'Kanza', on the strength of its first-cut performance, was the top-producing variety in 1981. Each previous year, however, 'Kanza' yielded below the test average.

'Thor' and Dekalb 130, the best overall performers, yielded, along with 'Hi Phy', significantly better than the 1981 test average (see Ag Facts Sheet). Yields of 'Vernal', 'Baker', and 'Saranac' were significantly below the test average in 1981, as well as below the 4-year averages of the top seven varieties.

Conclusions: After 'Kanza', the six highest-yielding varieties in 1981 were also the top six varieties in total 4-year production, making them the most consistent high-yielding varieties.

Table 14. Alfalfa varieties' forage yields for indicated dates in 1981, Mound Valley, KS. The test was seeded April 25, 1978.

Variety	Source	Tons/acre @12% moisture 4/29	6/3	7/6	Total
Vanguard	NAPB	1.32	1.35	1.80	4.46
Hi-Phy	NC+	1.26	1.35	1.90	4.50
521	Pioneer	1.21	1.16	2.02	4.39
545	Pioneer	1.15	1.28	1.83	4.26
Riley	KSU	1.21	1.23	1.86	4.30
Atlas	NAPB	0.98	1.41	1.66	4.18
Epic	Land 'O Lakes	1.22	1.20	1.80	4.22
Sunrise	NC+	1.18	1.36	1.91	4.46
531	Pioneer	1.00	1.21	1.86	4.07
Baker	USDA	1.31	1.16	1.45	3.93
Gladiator	Northrup-King	1.15	1.30	1.87	4.31
130	DeKalb	1.18	1.36	1.96	4.50
Tempo	NC+	0.90	1.20	2.07	4.18
Vernal	Univ. Wisconsin	0.88	1.40	1.62	3.90
Olympic	NAPB	1.08	1.31	1.76	4.16
120	DeKalb	0.96	1.25	1.82	4.03
Cody	KSU	0.92	1.24	1.84	4.01
Pacer	Land 'O Lakes	1.04	1.29	1.68	4.00
Arc	USDA	1.06	1.33	1.91	4.31
Thor	Northrup-King	1.04	1.59	1.88	4.52
Weevlchek	NC+	1.16	1.29	1.76	4.21
Saranac	Cornell	1.17	1.29	1.52	3.98
Apollo	NAPB	1.42	1.36	1.66	4.44
Kanza	KSU	1.41	1.39	1.82	4.62
LSD		0.28	0.20	NS	0.24
$\bar{X}$		1.13	1.30	1.79	4.23

Bermudagrass Variety Performance

Bermudagrass can be a valuable high-input, high-production summer forage supplement for southeastern Kansas cattlemen. Producers have benefitted considerably from the production that 'Midland' has added to that of the original common bermudas. So development in bermuda breeding should be monitored closely to speed adoption of future improved types.

Procedure: Sprigs or seed of 13 bermudagrass lines were started in peat pots (2" x 2") in the greenhouse March 17, 1980, and transplanted to field plots April 30. Varieties included four seed-producing types, plus two named varieties, 'Haride' amd 'Midland'. Weeds were controlled with granular simazine, and 60 lb/acre of N was applied. Drought prevented significant forage production in 1980, but rate-of-spread was estimated September 3, 1980. Simazine was applied again October 21 for weed control.

Grass was cut twice in 1981, and 100 lb/acre of N was applied on May 6 and again July 16. Borders were sprayed twice with glyphosate (Roundup) to prevent encroachment into neighboring plots.

Two other varieties, 'Tift 44' and 'Harris', were sprigged into the test in May, but no forage was cut from them in 1981.

Results: The strain 74 12-12 had the greatest amount of vegetative spread by fall, 1980, followed by SS16 x SS21 and LCB 7-25. Poorest spread was by Guymon x 9959 and 74 x 14-1; 'Hardie' and 'Midland' were at and slightly above the test average, respectively.

First-cutting, second-cutting, and total yields averaged 1.93, 2.04, and 3.96, respectively, for the test. Total and first-cutting yields of SS16 x SS21 were significantly greater than those of any other except 'Midland'. Second-cut yields of 'Midland' and of SS16 x SS21 were similar, significantly greater than yields of other strains except 74 x 12-12. 'Hardie' yields were above the test average each time.

Conclusions: The seed-producing strain, SS16 x SS21, shows promise, but forage yields of 'Midland' were practically as high. Yields of 'Hardie' were not quite so high, but forage quality and animal performance were not measured in 1981.

Nitrogen Sources and Times for Bermudagrass

Procedure: In 1980 nitrogen from three sources was applied at 300 lb/acre in single or split applications to 'Midland' bermudagrass plots on the Ron McNickle farm. In addition to ammonium nitrate (34-0-0), sulfur-coated urea (SCU, 36-0-0) and cogranulated urea-phosphate (34-17-0) were used. Treble-super phosphate (0-46-0) was used with the first two sources to equal P_2O_5 applied in urea-phosphate.

Single applications and the first half of the split applications were made May 6, and the first harvest of bermudagrass was June 18. The second half of the split applications was made July 16, and the second harvest was August 6.

Results: Forage yields totaled from 3.7 to 4.8 tons per acre at 12% moisture. The lowest production was from a split application of SCU; the highest production totals were from ammonium nitrate and the single-applied SCU. Urea-phosphate treatments resulted in below-average yields, with the split application slightly inferior to the single application.

Crude protein content averaged 13.6% for the first-cut and 12.7 for second-cut forage. With single-application treatments (except SCU), protein was generally slightly higher in first-cut forage and generally lower in second-cut forage, compared with split applications. Phosphorus averaged 0.25% in first-cut forage, with no apparent treatment differences.

Conclusions: Slow-release N sources so far have not proved to be superior to conventional N sources under current management systems.

Knifed versus Broadcast Application of Fertilizer Nutrients on Tall Fescue

J. L. Moyer and R. E. Lamond

We are accumulating evidence that fertilizer nutrients knifed into the root zone of fescue are used more efficiently than are the same fertilizers broadcast on the surface.

Procedure: Two experiments have been conducted to date, each for two years (1981 Report of Progress, 398). In 1981, the experiment conducted in Neosho County in 1980 was moved to the Every farm. Three N rates (12, 100, and 150 lb/acre), two P_2O_5 rates, and two K_2O rates (0 and 40 lb/acre, each) were applied either broadcast on the surface through spray nozzles or knifed 6-8 inches deep into the soil with ammonia shanks on 15-inch centers on February 19.

Another experiment was begun on the Johnson farm near Mound Valley. Here treatments of standard or knifed controls of 100 lb N/acre with 0, 40, or 120 lb P_2O_5/acre and 0, 25, or 50 lb K_2O/acre were similarily applied February 25 to determine whether increased rates of P and K could increase the effective udration of application effects.

Results: Fescue on the Every farm responded to phosphate but not potash, as did the Tollman fescue in 1980. Forage yields in 1981 averaged 3,847 lb/acre (12% moisture) without phosphate, and 4,139 lb/acre with the 40-lb rate of phosphate. Crude protein concentration in forage was not significantly increased by P rate, but crude protein per acre was significantly increased along with yield. Forage P was increased by phosphate fertilization.

Knifing fertilizer significantly increased yields over those of broadcast applications. The response to fertilizer placement at different N rates is illustrated for both 1980 and 1981 in Figure 1. The yield response of knifing relative to broadcast was greatest at the higher N levels.

Crude protein content of the forage was significantly increased by high N rates, from 8.4% at the 12-lb rate to 11.6% with 150 lb N/acre. Knifing decreased protein concentration from that of broadcast by an average of 0.6%, despite an increased total protein production, because of the total increase in forage yield. Knifing phosphate had a similar effect on phosphorus content of the forage: increased uptake, but lower P concentration (from 0.17% to 0.15% P) at a given fertility rate when phosphate was knifed versus when it was broadcast.

At Johnson's, yields and N response were poor because of fall and spring drought. Grass yields were not affected by K, and phosphate at the 40-lb/acre rate produced about a 40% increase whether broadcast or knifed. When 120 lb/acre (a 3-year application) was knifed into the soil, a further 25% forage yield increase was obtained, whereas yield from the broadcast application was similar to that from the 40-lb rate.

Complete listing of the data from these two studies can be found in the Kansas Fertilizer Research -- 1981 (Experiment Station Report of Progress 408).

Conclusions: Knifing N into fescue increased yield and fertilizer efficiency, and sometimes forage quality.

Fig. 1. Tall fescue forage yield response to knifed and broadcast fertilizers containing different rates of N.

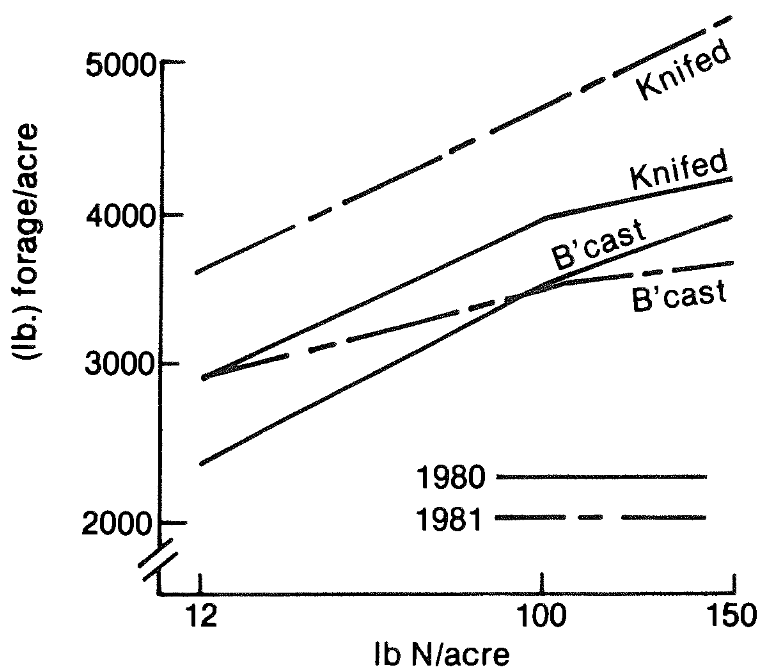

Figure 1.

Yield response of tall fescue forage to knifed and broadcast fertilizers containing different rates of N.

Seeding Rates of Wheat with Tall Fescue

Producers often include winter wheat in tall fescue seedings for erosion protection and quicker returns from the land. This experiment (reported in Kansas Agricultural Experiment Station's "Keeping Up with Research", No. 54) was to determine the effect of wheat seeding rates on the tall fescue stand and whether a higher fescue seeding rate would offset wheat competition.

Procedure: Tall fescue was seeded at 10, 20, or 30 lb/acre in plots without wheat (control), or with 40, 80, or 120 lb/acre of 'Trison' wheat on September 30, 1980, at Mound Valley. Plots were top-dressed January 23, and wheat was harvested June 26. Fescue stands were rated June 29 on a scale of 0-5, where "5" was a solid fescue stand and "0" was practically no fescue in the plot.

Results: Fescue seeded with no wheat made a perfect stand (5.0 rating), but with 120 lb/acre of wheat seed produced a poor (rating = 0.9) stand of fescue and 47 bu/acre of wheat. Seeding 80 lb/acre of wheat allowed little more fescue survival at a similar wheat yield, but a 40-lb wheat rate produced 42 bu/acre of wheat and a good (4.1 rating) fescue stand. A fescue seeding rate of 10-30 lb/acre made no difference in stand survival.

Conclusions: Wheat can be produced while establishing a fescue stand, but it should be seeded at less than 80 lb/acre. Fescue seeded at the recommended rate (15 lb/acre) and wheat slightly less than the recommended rate (about 50 lb/acre) should produce optimum wheat yields and fescue stands.

Birdsfoot Trefoil Varieties in Southeastern Kansas

Birdsfoot trefoil is a widely adapted, non-bloating forage legume. One variety in particular, 'Dawn', has shown relatively good persistence and yielding ability in eastern Kansas. Other varieties and cultivars were tested in pure stands in 1981 to see if they would adapt to our conditions.

Procedure: Plots were seeded in 10-inch rows at 8 lb PLS/acre April 23, 1980, after treatment with Eptam and 200 lb/acre of 6-24-24. The forage was harvested June 5 and August 7, 1981. The crop was sprayed for grasshoppers in mid-July.

Results: No harvestable forage was produced in 1980 because of drought and grasshopper feeding. All plots survived, however, and showed good vigor in spring, 1981.

Yields in 1981 are given in Table 15. The new variety, 'Norcen', seemed less adapted to the adverse conditions than did 'Empire'. Newer varieties, 'Mo 20' and 'Fergus' (from Kentucky), showed promise.

Conclusion: Trefoil is a hardy legume than can yield almost as much forage as alfalfa -- and that from one less cutting per year. Performance under a broader range of conditions must be observed to identify superior varieties.

Table 15. 1981 Birdsfoot trefoil performance, Mound Valley, KS.

Cultivar [1/]	Forage yield, tons/acre @12% moisture 6/5	8/7	Total
NC-83 germ pool	2.92	1.10	4.02
Leo	2.52	1.22	3.74
Fergus	3.09	1.09	4.18
Carroll	2.55	1.18	3.74
Dawn	3.12	0.90	4.02
Mo 20	3.13	1.13	4.27
Empire	3.19	1.04	4.23
Viking	2.68	1.24	3.92
Norcen	2.51	1.18	3.69
$\bar{X}$	2.86	1.12	3.98
$LSD_{.05}$	0.44	0.16	NS

[1/] Seeded April 23, 1980.

Warm-season Annual Grass Production

Silage-type sorghums are tested each year in cooperation with the Agronomy Department, Kansas State University. In 1981 we also tested hay production from sudan-type sorghums entered by sponsoring seed companies. We tested for forage quality as well as for yield.

Procedure: In the silage sorghum test, twenty-four entries were planted June 11 in 30-inch rows, and thinned to about 35,000 plants/acre. A mixture of N, P_2O_5 and K_2O was applied at 125-60-60 lb/acre. Plots were sprayed post-emergent with 2, 4-D, and mechanically cultivated. Plots were harvested October 7.

Thirty-three sudan-type sorghums were seeded in 10-inch rows June 9, after fertilization with 125-60-60. The first cutting was harvested July 22, and plots were top-dressed with 60N on July 23, to be ready for the second cutting September 9. Subsamples of whole plants were taken for leaf: stem determination from each plot at the first cutting, and from the first replication at the second cutting (four diverse types were sampled from all three replications to estimate variation). Moisture samples were ground for crude protein and *in vitro* digestibility determinations.

Results: The silage-type sorghum results are published in the Experiment Station's "Kansas Sorghum Performance Tests Report of Progress 411" (1981). Silage yields (70% moisture) ranged from 12 to 27 tons/acre with a 22-ton average.

Grain production was relatively poor because of mid-summer drought, and minor but significant lodging was found in five lines.

The sudan-type sorghums produced an average of 4.83 tons/acre at 12% moisture, ranging from more than six tons/acre to slightly more than three tons/acre. Leaf: stem ratios ranged from 0.75 to 1.86 at the first cutting, and from 0.38 to 1.15 for the second. Crude protein ranged from 13.0 to 17.8% for the first cutting; 12.8 to 17.8% for the second. The two estimates of forage quality did not necessarily agree in their varietal predictions. (Complete results will be listed in a separate publication in Spring, 1982.)

Conclusion: Sorghum plots produced below-average forage in 1981. Varieties and lines differed, however, in their production and quality under adverse conditions.

OTHER FORAGE RESEARCH

Results of the following research projects in 1981 but pending further study, are briefly outlined.

Cool-season Grass Performance. Thirty entries including bromes, fescue, orchardgrass, Reed canarygrass, perennial ryegrass, and two wheatgrasses were seeded in March, 1981. Fair-to-excellent stands and production were obtained.

Fertilization and Weed Control in Native Meadows. No fertilizer, 24-24-24, and 48-48-48 were applied to test burning, atrazine, and 2, 4-D as methods of weed control. In 1981 fertilizer responses were consistent with those of our previous study at Big Hill, but to date no weed problems have developed.

Effects of Lime and Fertilizer on Red Clover Interseeded into Tall Fescue. Plots that received two tons of ag lime, tillage treatment, and interseeding produced 1/3 more forage of higher quality than did controls.

Method and Frequency of P and K fertilization on Alfalfa. We began single and annual applications of fertilizer by knifing or broadcasting in August, 1979. Since then we have made only five cuttings because of droughtiness in 1980 and 1981. Only the preplant applications were made, and no treatment differences have yet appeared.

Fertilizer Sources for Alfalfa. Diammonium phosphate (18-46-0), a common carrier for alfalfa fertilization, also contains N. Fertilizers containing 0-60-60, 15-60-60, 24-60-60, and 40-60-60 per acre were applied in 1981 to test the effect of N fertilizers. Second-cut yields did not differ significantly, but 6-24-24 at 250 lb/acre produced the best apparent yield.

CROPS RESEARCH

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Performance Tests for Small Grain Varieties

The small-grain variety tests are conducted to help southeastern Kansas growers select winter wheat, barley, winter oat, and spring oat varieties best suited for the area.

Procedure: In 1981, 24 wheat varieties, six barley varieties, three winter oat varieties, and six spring oat varieties were compared. Wheat and barley plots were fertilized with 100 lb N, 75 lb P_2O_5, and 75 lb K_2O per acre. Oat varieties were fertilized with 50 lbN, 50 lb P_2O_5, and 50 lb K_2O per acre.

Wheat results: Yields in 1981 averaged 50 bushels per acre with Hart, Agripro Rocky, and Centurk 78 the top yielders at 57 bushels per acre. Four-year averages and 1981 results of the more popular varieties are listed below. (Complete wheat-yield results for Kansas are compiled in Agric. Expt. Station Report of Progress 404.)

Wheat variety	1981 Yield, bu/a	1978-81 Yield, bu/a
Agripo Rocky	57	56
Agripro Wings	53	56
Agripro Hawk	53	--
Centurk 78	57	55
Hart	57	58
Newton	55	55
Parker 76	46	53
Payne	38	53
Pike	56	--
Pioneer PL145	51	--
Tam W-101	49	54
Tam 105	52	--
Trison	44	48
Triumph 64	45	49
Vona	53	57
LSD .05	4	2

Wheat conclusions: Some years during the 4-year period semi-dwarf varieties yielded 5 to 10 bushels more per acre than did the commonly grown Triumph variety. Soft wheat varieties, like Hart, yielded slightly more than did the semi-dwarf types during the same period.

Barley results: Three-year averages and 1981 results of winter barley varieties are listed below.

Barley variety	1981 Yield, bu/a	1979-81 Yield, bu/a
Kanby	35	53
McNair 601	49	--
Nebar	44	--
Paoli	51	73
Post	56	70
Wintermalt	49	--
LSD .05	5	--

Barley conclusions: Paoli and Post varieties out-performed the older Kanby variety in 1981 and 1979-81.

Winter oat results: Three winter oat varieties were compared in 1980 and 1981.

Winter oat variety	1980-81 Yield, bu/a
Okay	76
Chilocco	78
Cimarron	67

Winter oat conclusions: Even though winter oats yielded well the past two years, they frequently winter-kill in southeastern Kansas.

Spring oat results: Dry weather during early spring reduced spring oat yields substantially in 1981.

Spring oat variety	1981 Yield, bu/a	1979-81 Yield, bu/a
Bates	57	94
Lang	57	96
Larry	55	--
Pettis	51	93
Spear	51	85
Trio	42	81
LSD .05	5	--

Spring oat conclusions: Lang and Bates were the best-yielding varieties during the past three years. In 1981 Larry, a newer and shorter variety almost equaled Lang and Bates in yield.

Effects of N Rates, N Carriers, and Time of N Application on Winter Wheat Yield

Nitrogen fertilizer is a major expense for wheat producers, who want to know when to apply nitrogen for maximum efficiency and if there are differences in methods of application.

Procedure: In 1981 we compared fall and late-winter N applications at 60, 90, and 120 pounds per acre on fields planted to Newton wheat. Fall N treatments, consisting of anhydrous ammonia injected into the soil, were compared with broadcasting ammonium nitrate prior to planting. As a late winter N treatment, ammonium nitrate was broadcast on the soil surface.

Results: Unusually dry conditions during the winter and early spring prevented the nitrogen from being used efficiently. As a result, the yield differences between N treatments were not significant. In some cases N even tended to reduce yields somewhat. Applying the N deeper in the soil profile as anhydrous ammonia did not improve efficiency under the dry conditions of 1981.

Nitrogen-fertilization studies with winter wheat at the Parsons Field are summarized in Table 16. Since 1976 the yield differences between fall and late-winter N applications have not been significant. During the 5-year period, high N rates did not improve wheat yields significantly; however, an expanded N test is underway to determine the optimum rate for high-yielding semi-dwarf or soft wheat varieties grown in southeastern Kansas.

Table 16. Effects of N rates, N carriers, and time of N application on wheat yields, 1976 through 1981.

1981	Yield, bu/a	1980	Yield, bu/a
Fall N	40	Fall N	62
Winter N	40	Winter N	62
LSD .05	NS	LSD .05	NS
0 lbs N/a	38	0 lbs N/a	47
60 " "	40	30 " "	54
90 " "	40	60 " "	60
120 " "	41	90 " "	63
LSD .05	NS	120 " "	60
		LSD .05	3
Anhydrous ammonia	41		
Ammonium nitrate	40	Anhydrous ammonia	63
LSD .05	NS	Urea	62
		LSD .05	NS
Variety: Newton		Variety: Newton	57
		Hart	60
		LSD .05	NS

(continued)

Table 16. Effects of N rates, N carriers, and time of N application on wheat yields, 1976 through 1981 (continued).

1979	Yield, bu/a	1976 to 1978	Yield, bu/a
Fall N	59	Fall N	44
Winter N	60	Winter N	43
LSD .05	NS	LSD .05	NS
0 lbs N/a	46	0 lbs N/a	37
30 " "	57	30 " "	42
60 " "	61	60 " "	45
90 " "	60	90 " "	44
LSD .05	3	LSD .05	3
N Source: Urea		Ammonium nitrate	44
		Urea	43
		LSD .05	NS
Variety: Newton	60	Variety: Triumph 64	(1978)
Trison	58	Centurk	(1977)
LSD .05	NS	Trison	(1976)

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

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

Procedure: In 1980 seven hard-wheat and three soft-wheat varieties were compared at three levels of nitrogen (applied at 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: The three soft-wheat varieties yielded better on the average than did the seven hard varieties. McNair 1003 was the top yielder at 65 bushels per acre with 100 lbs of N per acre.

Unusually dry conditions occurred during the winter and early spring prior to heading. Differences were noted among varieties in their ability to withstand drought stress. The soft-wheat varieties withstood the dry weather better than the semi-dwarf, hard-wheat varieties. Also, differences were observed among the semi-dwarf types. Payne was injured the most from the stress conditions, which accounted for the substantially lower yield.

Century II 4555 was seeded at a recommended lower rate than the other varieties; however, the plant population appeared too thin throughout the growing season. As a result of the thinner stand, grain yield of Century II 4555 was depressed.

As a result of the dry conditions prior to heading, nitrogen fertilizer was not efficiently used by the plant. Lower yields were noted with all varieties at the highest N rate (150 lb/acre). The yield response between 50 and 100 lbs of N was not significant and was somewhat variable. Grain proteins, however, did increase as N was increased.

Grain-test weights ranged from 55 to 57 lb/bu for all the soft and semi-dwarf types. Nitrogen had no effect on test weight.

Straw strength was probably weakened from the drought stress, although Newton, Pioneer PL145, and Hart did not have much lodging. Because nitrogen was not efficiently used, it had little influence on straw strength.

The varieties were harvested before the heavy rains in late June, so grain shattering was not so much of a problem as it would have been had harvest been delayed. Even so, soft wheat varieties tend to shatter more than do the hard, especially when climatic conditions at harvest are unfavorable.

Conclusions: Because the soil was dry in 1980-81, results were inconclusive after the first year. This study will be continued in 1982.

Wheat and Soybean Yields in a Cropping Sequence Involving Long and Short-term Fertility Treatments

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

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, potassium, and lime to some plots that previously had not received any.

Two cropping sequences also have been established. One rotation involves growing three crops in two years (wheat-doublecrop soybeans -- full-season soybeans); the other, growing two crops in two years (wheat-soybeans) without any doublecropped soybeans. Fertilizer is being applied only to the wheat crop.

Manure will be 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: In 1981 wheat yields were suprisingly good where lime (5 tons/a), phosphate (60 lb P_2O_5/a) and potassium (80 lb K_2O/a) were applied to a control plot that had not previously received any fertilizer, except for nitrogen, since the beginning of fertility studies in 1923. Grain yields increased nearly 30 bushels per acre in one year's time as a result of the applied fertilizer.

Grain yields from plots where manure has been applied for a number of years were comparable with those from plots receiving commercial phosphate and potassium fertilizer in 1981.

Doublecrop soybean yields were highest where manure had been applied.

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 and Tam W-101. When to apply the herbicide and at what rate have not been fully determined for southeastern Kansas.

Procedure: In 1981 metribuzin (Sencor) was applied to winter wheat in Labette county at three rates (0.25, 0.38, and 0.50 lb a.i./a) and on two different dates (Feb 18 and March 12) for cheatgrass control. The field had been planted to Newton wheat.

Results: Applying the herbicide in February was more effective than applying it in March because the cheatgrass was smaller in February. Applied at the rate of 0.38 lb a.i./a in mid-February, it controlled approximately 75% of the cheatgrass. There was no apparent herbicide injury to the wheat.

Conclusions: More research is needed in southeastern Kansas before recommendations can be made. However, once the wheat plant has established some secondary roots, an early herbicide application would appear to be more effective because the cheatgrass is easier to control when it is small.

Table 17. Yields of selected wheat varieties compared, based on nitrogen fertilizer applied at three levels, Parsons Field, 1981.

	Yield, bu/a				Test wt, lbs/bu				Grain protein, %				
	N rate, lbs/a				N rate, lbs/a				N rate, lbs/a				Date
Variety	50	100	150	Mean	50	100	150	Mean	50	100	150	Mean	headed
(Hard wheat)													
Newton	56.4	54.8	51.4	54.2	57	57	56	57	14.2	14.4	15.4	14.6	Apr 25
Vona	56.6	51.8	53.6	54.0	58	57	57	57	14.7	14.6	14.7	14.7	Apr 20
Payne	43.1	37.2	30.4	36.9	55	55	54	55	13.7	15.0	15.4	14.7	Apr 22
Pioneer PL 145	51.8	55.9	50.8	52.8	55	55	55	55	14.4	14.6	15.3	14.8	Apr 23
Centurk	55.1	52.8	50.0	52.6	57	57	57	57	15.0	15.6	15.5	15.4	Apr 26
Century II 4555	41.4	42.3	41.7	41.8	57	55	56	56	13.8	13.9	14.1	13.9	Apr 20
Triumph 64	47.4	43.7	41.8	44.3	59	59	59	59	14.4	14.5	14.7	14.5	Apr 20
(Soft wheat)													
McNair 1003	62.5	64.8	58.0	61.8	57	56	55	56	13.7	14.0	15.0	14.2	Apr 22
Pioneer S78	58.2	57.5	49.7	55.1	57	56	56	57	14.1	15.4	15.5	15.0	Apr 24
Hart	59.3	60.8	55.9	58.7	56	56	55	56	14.7	14.6	15.5	14.9	Apr 22
	53.2	52.1	48.3	- -	57	56	56	--	14.3	14.7	15.1	- - -	- - -

LSD comparisons

Grain yield

N rate LSD .05 = 3.8 (comparing N rate means averaged over all varieties)
Variety LSD .05 = 3.4 (comparing variety means averaged over all N rates)
N rate x Variety LSD .05 = N.S.

Test weight

N rate LSD .05 = 0.5 (comparing N rate means averaged over all varieties)
Variety LSD .05 = 0.8 (comparing variety means averaged over all N rates)
N rate x Variety LSD .05 = N.S.

Protein

N rate LSD .10 = 0.6 (comparing N rate means averaged over all N rates)
N rate x Variety LSD .05 = N.S.

Table 18. Wheat and soybean yields compared when evaluating long-term and short-term fertility treatments applied in a cropping sequence, Columbus Field, 1981.

Fertility treatments	Wheat yield bu/a	Soybean yield bu/a
[Wheat-doublecrop soybeans] - soybean rotation:		
Lime,[1/] 60 P_2O_5,[1/] 80 K_2O [1/]	40.8	20.3
Lime, 60 P_2O_5, [1/] 80 K_2O [1/]	43.1	20.3
Lime, 60 P_2O_5, 80 K_2O	46.3	22.8
Lime, 60 P_2O_5, 80 K_2O	48.6	27.3
Lime, manure	45.3	28.1
Lime, manure, 60 P_2O_5	48.9	27.1
Lime, manure, 60 P_2O_5	46.2	27.1
Wheat-soybean rotation:		
No fertilizer or lime	11.0	
Lime	15.5	
Lime, 60 P_2O_5	40.5	
Lime, 60 P_2O_5, 80 K_2O	47.1	
Lime, manure	47.3	
Lime, manure, 60 P_2O_5	49.7	
Lime, manure, 60 P_2O_5, 80 K_2O	48.9	

[1/] Underlined fertility treatments started in the fall of 1980.

Lime applied as need to keep pH near 6.8

Manure applied before full-season soybeans.

Phosphate and potassium applied only to the wheat.

Wheat also received 70 lb/a of N.

Effects of Soybean-herbicide Residues on Yields on Winter Wheat Planted After Soybeans Following a Dry Summer

It is a common practice in southeastern Kansas to plant wheat after the soybeans have been harvested. During the dry summer and fall of 1980, however, farmers were concerned about possible herbicide residues where wheat was being planted after soybeans.

Procedure: Newton wheat was planted in mid-October at the Columbus Field where a soybean herbicide study previously had been located. We applied the soybean herbicides in late June. Herbicide treatments were tank-mixes involving Lasso, Dual, Surflan, Treflan, Tolban, Basalin, Prowl, Lorox, Sencor, Lexone,Modown, and Goal. Treatments were applied at the recommended rate for silt loam soils.

Results: There was no visible herbicide injury to the wheat from any of the soybean herbicide treatments. Likewise, wheat yields showed no yield reduction from the herbicides.

Approximately 4.5 inches of rain fell from the time of herbicides were applied until the wheat was planted.

Conclusions: Even though the soil was dry in the summer and fall of 1980, there were no soybean herbicide residues present to cause injury to wheat planted after soybeans.

Performance Test for a Grain Sorghum Hybrid

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 1981 sixty hybrids were compared at the Parsons Field under dryland conditions. They were fertilized with 140 lbs N, 60 lbs P_2O_5, and 80 lbs K_2O per acre. Planting date was May 7.

Results: Overall test average was 63 bushels per acre. Dry weather during the critical heading stage reduced yields substantially and also resulted in severe stalk lodging because of fusarium disease organisms.

Conclusion: Complete results of grain sorghum yields for Kansas in 1981 are compiled in Agric. Expt. Station Report of Progress 410.

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: Since 1979 selected grain sorghum hybrids, representing early, medium, and medium-late maturity, have been planted on four different dates. In 1981 plots were fertilized with 140 lbs N, 60 lbs P_2O_5, and 80 lbs of K_2O per acre. Hybrids were hand-thinned to a population of 30,000 plants per acre.

Results: Medium or medium-late maturing hybrids planted in late June produced the highest grain yields in 1981 (Table 19). Planting in late April and May resulted in more stalk lodging than did later planting.

Conclusions: Grain sorghum of any maturity planted in mid-to-late June had higher grain yields and less stalk lodging than has grain sorghum planted on earlier dates. Mid-to-late June planting allows the grain sorghum plant to flower in August, when moisture and air temperatures are normally more suitable for flowering and seed formation.

Performance of Grain Sorghum Herbicide in No-till and Reduced-tillage Systems

Reduced-tillage systems are increasing in popularity among grain sorghum producers. More herbicide research, however, is needed to determine what is suitable for the soil conditions of southeastern Kansas.

Procedure: In 1981 grain sorghum herbicides were evaluated at the Columbus field in two types of tillage systems. In the no-till system, Paraquat or Roundup were used to control weeds before planting; in the reduced-tillage system, a tandem disc and field cultivator were used. In both systems, residual herbicides were applied after planting for weed control. The previous crop was soybeans.

Results: Excellent weed control was achieved in both tillage systems (Table 20). Some of the no-till plots produced higher grain yields than did comparable plots in the reduced-tillage system.

Conclusions: With good rainfall distribution throughout the growing season in 1981, grain sorghum yields were excellent in no-till and reduced-tillage systems. In both systems, weed control was excellent. More data are needed, however, to determine performance under less desirable growing conditions.

Table 19. Early, medium, and full-season grain sorghum hybrids compared at different planting dates, Parsons, 1981.

Hybrid	Planting date	Yield bu/a	Test wt. lbs/bu	Height in	Lodging %	Date of half bloom
DeKalb B-38+	April 24	54.6	57	45	4	July 7
(early)	May 22	61.2	61	39	4	July 15
	June 4	63.0	59	37	0	July 25
	June 25	67.6	56	38	0	Aug 14
Pioneer 8790	April 24	49.9	60	42	3	July 7
(early)	May 22	65.1	62	37	5	July 14
	June 4	64.3	59	35	0	July 25
	June 25	71.2	57	36	0	Aug 14
DeKalb C42-Y	April 24	59.2	58	44	2	July 12
(medium)	May 22	66.5	61	40	1	July 18
	June 4	68.0	57	38	0	July 30
	June 25	65.7	56	39	0	Aug 20
Pioneer 8585	April 24	61.2	60	43	4	July 11
(medium)	May 22	68.0	62	38	3	July 17
	June 4	60.3	61	38	0	July 28
	June 25	85.7	58	37	0	Aug 18
Prairie Valley 535	April 24	59.4	58	47	34	July 12
(medium)	May 22	65.2	60	42	23	July 16
	June 4	62.8	59	41	0	July 27
	June 25	84.1	58	41	0	Aug 17
NC+172	April 24	64.1	58	41	4	July 12
(medium)	May 22	63.4	61	37	9	July 16
	June 4	65.6	59	35	0	July 27
	June 25	84.2	57	36	0	Aug 17
Pioneer 8272	April 24	70.1	59	45	16	July 14
(medium-late)	May 22	56.9	58	38	7	July 20
	June 4	68.4	58	36	0	Aug 1
	June 25	86.2	54	39	0	Aug 20
Prairie Valley 734	April 24	68.7	61	41	11	July 14
(Medium-late)	May 22	59.7	60	36	8	July 18
	June 4	57.2	59	35	0	July 28
	June 25	86.2	54	36	0	Aug 18
DeKalb E-59S	April 24	79.2	57	43	30	July 15
(medium-late)	May 22	68.4	58	39	4	July 20
	June 4	85.1	57	37	0	Aug 1
	June 25	84.6	55	38	0	Aug 21

(continued)

Table 19. Early, medium, and full-season grain sorghum hybrids compared at different planting dates, Parsons, 1981 (continued).

Hybrid	Planting date	Yield bu/a	Test wt. lbs/bu	Height in	Lodging %
Mean values:					
Hybrid:					
DeKalb B-38+		61.6	58	40	2
Pioneer 8790		62.6	60	38	2
DeKalb C42-Y		64.9	58	40	1
Pioneer 8585		68.8	60	39	2
Prairie Valley 535		67.9	59	43	14
NC+172		69.3	59	37	4
Pioneer 8272		70.4	57	40	6
Prairie Valley 734		68.0	59	37	5
DeKalb E-59S		79.3	57	39	9
Planting date:					
April 24		62.9	59	43	12
May 22		63.8	60	38	7
June 4		66.1	59	37	0
June 25		79.5	56	38	0

LSD .05 values: Comparing one hybrid with another hybrid at the same planting date = 9.2 bu.

Comparing one date with another date with the same hybrid = 18.4 bu.

Table 20. Grain sorghum herbicides evaluated in reduced and no-till systems, Columbus Field, 1981.

Herbicide treatment	Rate, A.I./a	Yield, bu/a	Weed control, % Initial burn-down 1/ GR	BR	Residual GR 2/	BR 3/	Crop injury
Reduced tillage (soil was disc and field cultivated prior to planting)							
Bicep 4/	2.8	86.8	--	--	93	98	0
Bicep	2.8	70.2	--	--	96	98	0
Igran + AAtrex 4/	1.6 + 1.25	83.4	--	--	83	98	Stunting
Bexton + AAtrex	3.0 + 1.25	68.8	--	--	93	98	0
AAtrex	1.5	63.8	--	--	73	84	5% stand loss
Weedy check	- -	50.5	--	--	0	0	
LSD .05		16.7			13	11	
No-till (planted in last year's soybean residue)							
Paraquat 5/ + Bicep	.5 + 2.8	91.1	98	98	94	97	0
Roundup 5/ + Bicep	1.0 + 2.8	95.4	98	98	98	98	0
Paraquat 5/ + Igran + AAtrex	.5 + 1.6 + 1.25	40.8	98	98	85	95	50% stand
Paraquat 5/ + Bexton + AAtrex	.5 + 3.0 + 1.25	85.6	98	98	93	98	0
Roundup 5/ + AAtrex	1.0 + 1.5	90.6	98	98	87	97	sl.stunting
Weedy check -	- -	7.9	--	--	0	0	--
LSD .05		16.7			13	11	

1/ Initial weeds in no-till plots: pigweed, lambsquarter, common ragweed, and winter annuals (henbit, chickweed, mustard).

2/ Grass species: large crabgrass and fall panicum.

3/ Broadleaf species: common ragweed, smooth pigweed, lambsquarter, pennsylvania smartweed, and annual morningglory.

4/ In the reduced tillage plots, Bicep and Igran + AAtrex incorporated shallow with a field cultivator prior to planting.

Corn Herbicides Evaluated for Controlling Cocklebur

In recent years, more so than in the past, corn herbicides are being incorporated with some form of tillage equipment; however, cockleburs may not be controlled as effectively as a result of combining the herbicide application with the tillage operation.

Procedure: In 1981, we compared the effectiveness of 16 currently labelled corn herbicides applied on a Montgomery county site heavily populated with cockleburs. The herbicide tank-mixes included either AAtrex or Bladex in combination with a grass herbicide (Sutan, Dual, Lasso, and Prowl). Treatments were incorporated with a tandem disc (22" blades - 9" spacing) or a field cultivator equipped with a mulching bar were applied on the soil surface after the corn had been planted.

Results: No herbicide combination completely controlled the cocklebur. Control was slightly better where herbicides were applied after planting than where incorporated with a disc or field cultivator. AAtrex tank-mixes gave better cocklebur control than did similar Bladex combinations. AAtrex applied at 1.5 lbs a.i./a gave about 80% control; however, a higher rate probably would have provided better cocklebur control.

Conclusions: Where cockleburs are the main weed problem in corn, probably the best control is to apply atrazine, after planting, at the highest possible rate for a given soil type.

Herbicides in Established Alfalfa Stands Evaluated

After alfalfa has been established a few years, winter annual weeds and grasses often invade. Controlling such problem weeds with herbicides would increase alfalfa's productivity in southeastern Kansas.

Procedure: Alfalfa herbicide treatments were applied to an established field in Labette county in January of 1981. Similar treatments were applied to a Neosho county site in 1980.

Results: Winter annual weeds were excellently controlled by most herbicides tested. (Table 21).

Conclusion: Applying herbicides when alfalfa is dormant in late fall or early spring can effectively control winter annual weeds commonly found in established alfalfa fields.

Table 21. Evaluating alfalfa herbicides in established stands, 1980-81.

Herbicide	Rate lbs/prod/a	Winter annual weed control, % 1981 1/ Labette Co.	1980 2/ Neosho Co.	Crop injury
Princep 90DF	1.30	95	95	slight stunting
Karmex 80W	2.00	90	75	0
Kerb 50W	2.00	30	80	0
Sencor 75DF	0.75	95	95	slight stunting
Sinbar 80W	1.00	95	95	slight stunting
Control	- -	0	0	

1/ Herbicides applied Jan 27, 1981. Winter annual species: prickly lettuce, henbit, common chickweed, and indian mustard.

2/ Herbicides applied Mar 10, 1980. Winter annual weeds: chickweed, henbit, wild carrot, and shepherd's purse.

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 1981, 20 soybean varieties were planted June 12 at the Columbus field.

Results: Good growing conditions during the summer resulted in excellent soybean yields. Yields of the more commonly grown varieties are shown below. (Complete variety results are compiled in Agric. Expt. Station Report of Progress 410).

Variety	1981 Yield, bu/a	1979-81 Yield, bu/a
Asgrow 5618	44.2	26.6
Essex	43.6	26.2
Forrest	43.6	27.4
York	43.6	26.8
Ring Around 480	42.2	27.7
Asgrow 5474	42.2	----
Hood 75	40.1	26.2
Bedford	39.4	25.1
Crawford	36.0	25.3
Douglass	36.0	24.6
Delta	36.6	28.4
Ring Around 401	33.9	----
DeSoto	33.9	25.3
LSD .05	4.1	----

Effect of Planting Date on Yield and Maturity of Early, Medium, and Late Season Soybean Varieties

Soybean varieties of various maturities are planted in southeastern Kansas from mid-May until mid-July. It is important to select varieties and planting dates that will give maximum yields and still permit the soybeans to mature soon enough to fit the desired cropping sequence.

Procedure: Since 1976 five soybean varieties (Williams, DeSoto, Crawford, Essex, Forrest), representing early, medium, and late maturities have been planted from late May until mid July at the Columbus field. Varieties have been planted in 30-inch rows, with seeding rates of 8 to 10 seeds per foot of row.

Results: Complete yield and maturity effects from the various planting dates and varieties were averaged over five years and are shown in Table 22. Yield data from 1980 was omitted because of drought stress conditions and poor yields.

Full-season varieties, like Essex and Forrest, produced the highest yields during the five-year period. Optimum planting date for Forrest was from late May until June 25. The planting period of late May to early June, however, was somewhat better than the late June date. Planting Forrest beyond late June in extreme southeastern Kansas resulted in lower yields and delayed harvest until late October or early November. Essex also yielded best when planted from late May until late June. Good yields were achieved, however, when Essex soybeans were planted as late as July 10; they then could still be harvested by late October.

Crawford, a variety of medium maturity, yielded best when planted from mid June until July 10, although the mid-to-late June period was somewhat better. For an extremely late planting (mid July), Crawford maturity seemed to be the best yielding of the varieties tested.

Williams and DeSoto, representing varieties of early maturity, yielded better when planted in mid June. They also could be planted as late as July 10, however.

Conclusions: In extreme southeastern Kansas, medium to full season varieties have performed best. The choice of a particular variety, and planting date, however, will depend to some extent on the cropping sequence used. For example, if full season soybeans were to be planted in late May or early June before wheat harvest, Forrest or Essex maturity normally would be expected to give highest yields. Whereas, if doublecrop soybeans were planted in late June or early July after wheat harvest, Crawford or Essex maturity would be better selections. Although in a continuous doublecropping rotation of wheat and soybeans, a variety of Williams maturity might be desirable in some cases to allow adequate time in the fall for soybean harvesting and what planting.

Planting several varieties to spread out the time of maturity is a good form of insurance with the unpredictable rainfall pattern experienced in southeastern Kansas.

Table 22. Effects of planting dates on yield, seed quality, seed weight, and plant height of five soybean varieties for a 5-year period.

Planting date	Williams	DeSoto	Crawford	Essex	Forrest	Avg.
			Yield - bu/a			
Late May	24.1	22.2	25.2	28.0	29.7	25.8
Mid June	27.7	26.2	28.0	28.0	30.0	28.0
Late June	25.7	25.3	27.3	28.2	27.8	26.9
Early July	23.2	23.7	25.2	25.2	23.8	24.2
Mid July	16.7	17.9	19.3	18.0	16.7	17.7
Avg.	23.5	23.1	25.0	25.5	25.6	
			Seed weight - seeds/lb			
Late May	2951	2786	3020	3655	4092	3301
Mid June	2843	2889	3159	4022	4126	3408
Late June	2891	2889	3054	3954	4416	3441
Early June	3085	3106	3271	4205	4406	3615
Mid July	3189	3234	3438	4309	4577	3749
Avg.	2992	2981	3188	4029	4323	
			Seed quality rating [1/]			
Late May	2.3	2.4	1.8	1.7	1.7	2.0
Mid June	1.8	1.9	1.6	1.4	2.1	1.8
Late June	1.5	1.6	1.6	1.3	2.5	1.7
Early July	1.9	2.1	1.9	1.6	2.3	2.0
Mid July	2.2	2.3	2.4	2.1	2.9	2.4
Avg.	1.9	2.1	1.9	1.6	2.3	
			Plant height at maturity - inches			
Late May	29	30	31	25	33	30
Mid June	27	28	32	25	32	29
Late June	26	28	31	26	32	29
Early July	25	26	29	24	30	27
Mid July	21	22	25	20	26	23
Avg.	26	27	30	24	31	

Seed rating: 1 = excellent, 5 = poor

Table 23. Flowering dates, number of days from planting to flowering, maturity dates, and number of days from planting to maturity of five varieties of soybeans as affected by planting dates for a 5-year period.

Planting date	Williams	DeSoto	Crawford	Essex	Forrest
	Flowering date and number of days from planting to flowering.				
Late May	July 15(45)	July 16(46)	July 18(48)	July 28(58)	Aug 1 (62)
Mid June	July 25(42)	July 26(43)	July 29(46)	Aug 6 (54)	Aug 10(58)
Late June	Aug 3(40)	Aug 4(41)	Aug 6 (43)	Aug 14(51)	Aug 18(55)
Early July	Aug 13(38)	Aug 14(39)	Aug 15(40)	Aug 21(46)	Aug 26(51)
Mid July	Aug 22(36)	Aug 23(37)	Aug 24(38)	Aug 30(44)	Sept 4(49)
	Maturity date and number of days from planting to maturity.				
Late May	Sept 23(115)	Sept 25(117)	Sept 30(122)	Oct 5 (127)	Oct 9 (131)
Mid June	Sept 25(105)	Sept 27(107)	Oct 2 (112)	Oct 9 (119)	Oct 15(125)
Late June	Sept 30(98)	Oct 1 (99)	Oct 7 (105)	Oct 15(113)	Oct 21(119)
Early July	Oct 7 (91)	Oct 8 (92)	Oct 15(99)	Oct 24(108)	Oct 31(115)
Mid July	Oct 14(86)	Oct 15(87)	Oct 21(93)	Oct 30(102)	Nov 7 (110)

Effects of Row Spacing on Yield of Soybeans -- Medium and Late Maturing Varieties

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 has not been fully studied for the long-season varieties grown in southeastern Kansas.

Procedure: In 1981 three varieties (Crawford, Essex, and Forrest) were planted July 7 in three row spacings (7, 14, and 30 inches) at the Columbus field. Similar row-spacing studies on Essex and Forrest varieties have been in progress since 1977.

Results: In 1981 growing conditions at the Columbus field were ideal during July and August; September and early October, however, were dry. As a result, yields of late-planted soybeans were low. Results in 1981, as well as 5-year averages for Essex and Forrest, are presented in Table 24.

Conclusions: Five years of testing have shown that long season varieties, like Essex and Forrest, do not yield any higher when planted in rows narrower than 30 inches than when planted in 30-inch rows. Further studies, however, are being planned in 1982 to determine if different planting dates affect yields in narrower rows.

Table 24. Effects of row spacing on yield of medium and late maturity soybean varieties.

Variety	Row spacing (inches)	1981 Yield bu/a	1977-81 Yield bu/a
Crawford	7-inch	25.7	- -
	14-inch	22.3	- -
	30-inch	23.0	- -
Essex	7-inch	21.0	25.4
	14-inch	24.5	25.9
	30-inch	21.2	25.7
Forrest	7-inch	20.9	27.0
	14-inch	20.9	26.9
	30-inch	22.4	26.2
Treatment	LSD .05	3.2	N.S.

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 how different cropping sequences influence yields and net profits.

Procedure: In 1979 four cropping rotations were initiated at the Columbus field:

(1) [Wheat-doublecrop soybeans] - soybeans.

(2) Wheat - full-season soybeans.

(3) Grain sorghum -- full-season soybeans.

(4) Continuous soybeans fertilizer every year.

Results: Grain yields in bushels per acre of the various crops by year are shown below:

[Wheat - doublecrop soybeans] - soybeans

(1979) - 66 (1979) - 12 (1980) - 13

(1981) - 45 (1981) - 21

Grain sorghum - soybeans

(1979) - 107 (1980) - 13

(1981) - 105

Wheat - soybeans

(1979) - 66 (1980) - 13

(1981) - 45

Soybeans (fertilized)

(1979) - 28

(1980) - 10

(1981) - 37

Conclusions: After a few more years of data, results should be more meaningfull. By that time, economical considerations will have been made to determine net profits for the various cropping sequences. 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 or growing full-season crops with no doublecropping.

Table 25. Residual effects of phosphorus on soybean yields and soil P, Parsons Field, 1978-81.

Phosphorus carrier	lbs P_2O_5/a				Yield, bu/a					Soil P, lbs/a		
	1978	1979	1980	1981	1978	1979	1980	1981	4 yr avg	Initially	After 1st yr	After 4 y
Control	0	0	0	0	21.7	28.1	13.0	14.0	19.2	9	9	18
Ammonium ortho-P 1/	50	50	50	50	25.1	31.2	14.5	16.0	21.7	12	20	49
Ammonium ortho-P	100	0	100	0	25.0	30.8	15.5	17.0	22.1	11	21	31
Ammonium ortho-P	200	0	0	0	26.3	32.6	15.0	16.3	22.6	10	34	34
Ammonium poly-P 2/	50	50	50	50	23.8	30.4	14.5	15.8	21.1	14	23	29
Ammonium poly-P	100	0	100	0	27.0	31.4	14.0	16.1	22.1	11	24	31
Ammonium poly-P	200	0	0	0	27.5	32.7	14.5	17.0	22.9	12	34	35
LSD .05					2.2	2.2	NS	NS				

1/ = 18-46-0.

2/ = 15-62-0.

Residual Effects of Phosphorus on Soybean Yields

Many of the soils in southeastern Kansas are low in available phosphorus. When phosphorus fertilizer is applied, part of it becomes unavailable over time so that it cannot be taken up by the plant-root system. The amount of such phosphorous fixation is not fully known for the claypan acid soils of southeastern Kansas.

Procedure: In 1978, we initiated a study to see if heavy, first-year applications (200 pounds of P_2O_5 per acre) would be as effective for soybeans as would 100 pounds of P_2O_5 per acre applied every other year or as would 50 pounds per acre every year. After 4 years, all plots received the same amount of P_2O_5. The two P sources used were diammonium orthophosphate (AOP, 18-46-0) and ammonium polyphosphate (APP, 15-62-0). The initial phosphate level in the soil was 10 pounds per acre.

Results: During the 1978-81 study, soybeans did not respond to phosphorus as significantly as did grain sorghum in a similar study. During the first 2 years of the study, soil moisture was adequate and the applied P increased soybean yields 2 to 5 bushels per acre. The last 2 years, however, were dry during the growing season, so yields were below normal. Complete results are shown in Table 25.

Conclusions: Results of the 4-year evaluation show that soybeans can use residual P as well as directly applied P. Where soybeans are being grown on soils testing very low in available P (less than 15 lbs/a), a yield increase of 2 to 5 bushels per acre likely would be from applied phosphate.

Effects of Phosphate and Potassium Fertilizer on Soybeans Yields: Plowed Under Compared with Incorporated Shallow before Planting the Soybeans

Soybeans yields in southeastern Kansas have not increased significantly from phosphate and potassium fertilizer in recent years. Additional research is needed to determine under what soil conditions a fertilizer response is likely.

Procedure: In 1981 two rates of phosphate and potassium (40 and 80 lbs/a) were applied separately or in combination to a Cherokee county silt loam soil that tested low in P and K. Two methods of applying fertilizer were compared: the fertilizer was broadcast on the soil surface, then plowed under in early spring; or the broadcast fertilizer was incorporated shallow with a field cultivator before soybeans were planted.

Results: Fertility treatments did not significantly increase soybean yields in 1981, despite near-ideal soil moisture. The effect to plowing the fertilizer under was no different from incorporating it shallow with a field cultivator.

Conclusions: During the past 4 years, soybeans have shown insignificant yield benefit from phosphate and potassium fertilizer, regardless of how applied. The off-station test sites have been on soils testing 15 to 30 lbs/a of P and 80 to 130 lbs/a of K. Profitability of fertilizing soybeans on extreme southeastern Kansas soils with low-to-medium fertility appears to be small.

Evaluating Herbicides Applied with the Micromax™ Nozzle System Compared with the Conventional Flat-fan Nozzles

Controlled droplet applicators are the newest innovation in herbicide appliction. These new nozzles maintain a consistent droplet size and uniform pattern width through the use of rotary atomization. Low spray volumes (or more acres per day) have been the major claim for using controlled droplet applicators, such as Micromax™. Research, however, is lacking on their practical use and efficiency.

Procedure: In 1981 the Micromax nozzles were compared with flat-fan nozzles (Tee Jet 8003) in several studies involving grain sorghum and soybeans: (1) with grain sorghum, the nozzles were compared in a no-till study where Paraquat and Bicep were applied as a tank-mix; (2) in another study, a tank-mix of Paraquat, LOROX, LASSO, and 2, 4-D amine was applied to soybeans planted no-till in wheat stubble; and (3) in a conventional soybean tillage study, the nozzles were compared for applying herbicides preplant incorporated (Treflan + Sencor), preemerge (Lasso + Sencor), and postemerge (Blazer).

Results: Complete results are presented in Tables 26 and 27. The initial burn-down of existing weeds was excellent when the Paraquat tank-mixes were applied at the 6-gallon rate through the Micromax nozzle and also at the 20-gallon rate applied with flat-fan nozzles. Likewise, where other soybean herbicides were applied preplant incorporated, preemerge, or postemerge, there were no differences in weed control or crop injury between the two nozzle systems, compared at 6- and 20-gallon-per-acre application rates.

Conclusions: In 1981 field studies, the Micromax-controlled droplet applicator used to apply herbicide at the 6-gallon-per-acre rate, controlled weeds as effectively as did the conventional flat-fan nozzles used to apply the herbicide at the 20-gallon-per-acre rate. More information, however, is needed through field-scale studies to observe the amount of spray drift and any mechanical problems that might occur when operating this new nozzle apparatus.

Table 26. The Micromax-controlled droplet applicator and the conventional fan nozzle compared for applying Paraquat tank-mix herbicide to grain sorghum and soybeans planted no-till Columbus Field, 1981.

Herbicide treatment	Rate a.i./a	Nozzle type	Gallons per acre	Yield bu/a	Weed control, % Initial 1/ burn-down	Lacg, 2/ Fapa	Cocb 3/ Smpw
Grain sorhgum study (planted no-till on soybean stubble):							
Paraquat + Bicep	.5 + 2.8	Flat fan	20	120	98	95	90
Paraquat + Bicep	.5 + 2.8	Micromax	6	118	98	95	90
Control	- - -	- - -	--	15	0	0	0
LSD .05				5	--	--	--

1/ Initial weed population consisted of winter annual species (henbit, chickweed, mustard, smooth pigweed, and lambsquarter.

2/ Lacg = Large crabgrass.
Fapa = Fall panicum.

3/ Cocb = Common cocklebur.
Smpw = Smooth pigweed.

Herbicide treatment	Rate a.i./a	Nozzle type	Gallons per acre	Yield bu/a	Weed control, % Initial 1/ burn-down	Lacg, 2/ Vowh	Cocb 3/ Smpw
Soybean study (planted no-till after wheat harvest):							
Paraquat + 2,4-D, amine Lasso + Lorox	.38 + .25 1.5 + .5	Flat fan	20	23	95	60	60
Paraquat + 2,4-D, amine Lasso + Lorox	.38 + .25 1.5 + .5	Micromax	6	23	95	60	60
Paraquat + 2,4-D, amine Lasso + Lorox	.38 + .25 1.5 + .5	Micromax	2	21	95	60	60
Control	- - -	- - -	--	4	0	0	0
LSD .05				4	--	--	--

1/ Initial weed population: smooth pigweed, crabgrass, volunteer wheat, and morningglory.

2/ Lacg = Large crabgrass.
Vowh = Volunteer wheat.

3/ Cocb = Common cocklebur.
Smpw = Smooth pigweed.

Table 27. Soybean herbicides, method of incorporation, and spray-nozzle type, evaluated, Columbus Field, 1981.

Herbicide	Rate a.i./a	Method of incorporation 1/	Nozzle type 2/	Yield bu/a	Weed control Smpw 3/	Weed control Lacg 4/
Treflan + Sencor	.75 + .38	disc & field cult.	Micromax	35.7	90	90
Treflan + Sencor	.75 + .38	disc & field cult.	Flat fan	35.1	90	90
Treflan + Sencor	.75 + .38	field cult. (2X)	Micromax	36.5	90	90
Treflan + Sencor	.75 + .38	field cult. (2X)	Flat fan	36.0	90	90
Treflan + Sencor	.75 + .38	field cult. (1X)	Micromax	37.2	85	85
Treflan + Sencor	.75 + .38	field cult. (1X)	Flat fan	35.7	85	85
Lasso + Sencor	2.0 + .38	field cult. (1X)	Micromax	36.8	90	90
Lasso + Sencor	2.0 + .38	field cult. (1X)	Flat fan	37.1	90	90
Blazer + cult.	.5	- - -	Micromax	36.8	90	90
Blazer + cult.	.5	- - -	Flat fan	36.6	90	90
Weedy check	--	- - -	- - -	28.1	0	0
Treatment LSD .05				3.5	-	-

1/ Disc had 20-inch blades, with 7-inch spacing.
Field cultivator equipped with a 3-bar tine mulcher.

2/ Micromax nozzles, spaced 38 inches apart, delivered 6 gallons of spray per acre.
Flat fan nozzles (Tee Jet 8003) delivered 20 gallons of spray per acre.

3/ Smpw = Smooth pigweed.

4/ Lacg = Large crabgrass.

Effects of Primary Tillage Methods on Weed Control in Soybeans

Tillage methods have changed dramatically in recent years with the introduction of chisel plows, plowing discs, off-set discs, and other types of recuded-tillage implements. Compared with the moldboard plow, most of the newer implements leave more crop residue on the soil surface, but the effect of this crop residue on weed control in soybeans has not been evaluated fully in southeastern Kansas.

Procedure: In 1981 soybeans were planted where wheat had been grown previously. Half of the plot area was chiseled and the other half plowed. Four treatments involving incorporated herbicides were compared on both plowed and chiseled plots.

Results: Soybean yields were about 3 bushels more per acre on plowed plots with incorporated herbicides than chiseled plots. Weed control, however, was equally good for the two tillage methods. Results are shown in Table 28.

Plots that were cultivated produced the highest yields on both the plowed and chiseled areas, even though no herbicide has been applied. Evidently, the cultivation aided water infiltration and improved aeration of the root system.

Conclusion: More research is needed on herbicide and tillage interactions before firm conclusions can be reached.

Table 28. Effects of primary tillage methods (chisel and plow) on controlled weeds in soybean plots where herbicides were incorporated, Columbus Field, 1981.

		PLOW			CHISEL		
Herbicide 1/	Rate a.i./a	Weed control, % Lacg 2/	Smpw 3/	Yield, bu/a	Weed control, % Lacg 2/	Smpw 3/	Yield, bu/a
Lasso + Lexone	2.0 + .25	90	90	39.3	90	90	36.7
Dual + Lexone	1.5 + .25	90	90	38.8	90	90	35.0
Treflan + Lexone	.75 + .38	90	90	39.0	90	90	37.0
Prowl + Lexone	.75 + .38	90	90	40.4	90	90	36.8
Control (cultivated)	- - -	90	85	41.8	90	85	40.5
LSD .05				N.S.			N.S.

1/ Herbicide treatments incorporated with a field cultivator prior to planting.

2/ Lacg = Large crabgrass.

3/ Smpw = Smooth pigweed.

Postemerge Soybean Herbicides Evaluated for Controlling Velvetleaf, Cocklebur, and Annual Morningglory

Broadleaf weeds such as velvetleaf, cocklebur, and annual morningglory are difficult to control in many soybean fields of southeastern Kansas. In many cases, postemergent herbicides are the best method of control.

Procedure: In 1981 postemergent soybean herbicides were applied at three locations in Cherokee county where velvetleaf, cocklebur, and annual morningglory were problems weeds.

Results: Weed control of broadleaf weeds in 1981 is summarized here.

Cocklebur: Basagran and Blazer were equally effective in controlling cockleburs. Adding crop oil with Basagran treatments did not improve the control. When weeds were less than 6 inches tall applying Basagran at 1.5 pints per acre was as effective as applying it at the 1 quart rate. Adding 2, 4-DB (2 oz/a) with Blazer (applied at 1 qt/a) did not improve cocklebur control. Dyanap applied at 3 quarts per acre gave good control, although soybean plants showed leaf burning. Applying tank-mixes of Basagran and Blazer at various rates did not control cocklebur any better than did applying those herbicides individually.

Velvetleaf: Basagran applied 1.5 pints per acre, controlled velvetleaf weeds best when they were less than 3 inches tall. Blazer applied at 1 qt/a gave about 85% control. Adding X-77 surfactant with Tackle (applied at 1 qt/a) improved velvetleaf control.

Annual morningglory: Ivyleaf morningglory was effectively controlled with Blazer, Basagran, or Dyanap when the weeds were no larger than the 2-leaf stage. Once the morningglory started to vine, herbicides did not give effective control.

Conclusions: Large-seeded broadleaf weeds can be controlled in many soybean fields; however, herbicide selection, proper rate, and time of application are critical factors in determining the degree of weed control.

Experimental Postemergent Soybean Herbicides Evaluated for Controlling Rhizome and Seedling Johnsongrass

Johnsongrass is a major weed problem for many soybean producers in southeastern Kansas. Methods of control recently introduced include several experimental postemergent herbicides for control of rhizome johnsongrass.

Procedure: In 1981 four experimental postemergent soybean herbicides (Fusilade, Poast, Vistar, and Dowco 453) were evaluated in Cherokee and Labette counties for controlling rhizome johnsongrass when 12 to 24 inches tall.

Results: Nearly all experimental herbicides evaluated in 1981 excellently controlled rhizome johnsongrass. With soil moisture adequate and humidity high, spray conditions were ideal. Vistar, which is a growth regulator, gave only 50 to 60% control, whereas Fusilade, Poast, and Dowco 453 gave about 95% control. Vistar resulted in some leaf curling of the soybean plants, but the other treatments showed no crop injury.

Conclusions: Although the herbicides evaluated do not have full-label clearance for farm use, apparently they have potential for effectively controlling rhizome johnsongrass when applied postemergent at the proper stage of grass development.

Herbicide Evaluated for Controlling Weeds in Soybeans Planted No-till in Wheat Stubble

It is common practice to plant soybeans after wheat harvest in southeastern Kansas; planting soybeans in wheat stubble with a no-till planter, however, 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, except that Dowco 453, was applied postemergent when crabgrass and volunteer wheat were 4 to 8 inches tall.

Results: Dry soil conditions in September reduced yields. (Complete results are shown in Table 29.) After wheat harvest, excellent burn-down of existing weeds was obtained with Paraquat. In the absence of Paraquat, adding 2,4-D amine to the herbicide treatments gave good pigweed control; however, crabgrass and volunteer wheat are a problem later in the season. Because of that grass problem, Dowco 453, an experimental postemergent herbicide, was applied and control was excellent.

Surflan controlled volunteer wheat better than did either Lasso or Dual.

Conclusions: Overall, weed control was quite good where soybeans were planted no-till in wheat stubble, but herbicide cost per acre was high. More research is needed before firm recommendations can be made.

Table 29. Evaluating herbicides for use on soybeans planted no-till in wheat stubble, Columbus Field, 1981.

Herbicide treatments	Rate, a. i./a	Yield, bu/a	Weed control, % Initial burn-down 1/				
			Gr	Br	Lacg 2/ Vowh	Smpw 3/	Crop injury
Paraquat + Lasso + Modown	.5 + 2.0 + 2.0	13.9	98	98	75	90	0
Paraquat + Dual + Modown	.5 + 1.5 + 2.0	14.1	98	98	75	90	0
Paraquat + Surflan + Modown	.5 + 1.0 + 2.0	14.5	98	98	90	90	0
Paraquat + Lasso + Lorox	.5 + 2.0 + .75	13.7	98	98	75	90	0
Paraquat + Dual + Lorox	.5 + 1.5 + .75	14.0	98	98	75	90	0
Paraquat + Surflan + Lorox	.5 + 1.0 + .75	14.4	98	98	90	90	0
2, 4-D + Lasso + Sencor	.25 + 2.0 + .25	9.5	20	98	75	90	0
2, 4-D + Dual + Sencor	.25 + 1.5 + .25	9.1	20	98	75	90	0
2, 4-D + Surflan + Sencor	.25 + 1.0 + .25	10.8	20	98	90	90	0
2, 4-D + Lorox + Dowco 453 4/	.5 + .5 + .06	8.2	25	98	25/65 5/	90	0
2, 4-D + Lorox + Dowco 453 4/	.5 + .75 + .12	11.8	30	98	25/90	90	0
2, 4-D + Loro + Dowco 453 4/	.5 + 1.0 + .25	11.3	30	98	25/95	90	0
2, 4-D + Sencor + Dowco 453 4/	.25 + .25 + .12	11.5	20	98	25/90 5/	90	0
2, 4-D + Sencor + Dowco 453 4/	.5 + .38 + .25	11.9	20	98	25/95	90	0
Weedy check	- - -	1.2	0	0	0	0	0
Treatment LSD .05	- - -	2.8	-	-	-	-	-

1/ Weed species present initially: smooth pigweed, crabgrass, and volunteer wheat.

2/ Lacg = Large crabgrass; Vowh = volunteer wheat.

3/ Smpw = Smooth pigweed.

4/ Dowco 453 = applied as a postemergent spray when crabgrass and volunteer wheat were 4 to 8 inches tall.

5/ First set of numbers represent Lorox or Sencor preemergent grass control; second set, Dowco 453 postemergent grass control.

Effects of Burning and Herbicide Treatment on Soybeans Planted No-till in Wheat Stubble

Surflan can now be applied to wheat after it has tillerd fully and before it reaches the jointing stage, at which time soybeans are to be planted. This practice, however, has not been evaluated in southeastern Kansas.

Procedure: Surflan was applied to winter wheat in March at 1.25 qt/a after it had fully tillered and in June at 1.0 qt/a after soybeans had been planted no-till in the wheat stubble.

Surflan also was applied to some areas after the wheat stubble had been burned to see what effect the charcoal residue would have on herbicide control.

Results: Doublecrop soybeans yielded nearly 30 bushels per acre where Surflan had been applied in March or June (Table 30).

Where wheat stubble had been burned, soybean yields were reduced dramatically, because of the severe potassium deficiency developed by the burning. That evidently was because of the dry top soil resulting from the burning, which made potassium unavailable to the plant.

Conclusion: Preliminary results indicate that pigweed can be controlled by applying Surflan to wheat in March and doublecropping soybeans planted no-till. We observed that burning the wheat straw and then planting soybeans no-till resulted in severely depressed yields.

Table 30. Effects of burning and herbicide treatment on yields of soybeans planted no-till in wheat stubble.

Time of Surflan application	Rate a.i./a	Wheat-stubble condition	Soybean yield, bu/a	Pigweed control, %
March	1.25	- - -	34	90
June	1.00	Not burned	32	90
June	1.00	Burned	10	90
Control		Not burned	15	0
Control		Burned	7	0
Treatment LSD .05			5	--

BEEF CATTLE RESEARCH

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Alfalfa Hay Compared with Grain as Creep Feed for Fall Calves

Creep feeding usually results in 40 to 80 lb of additional weight per calf at weaning time. In recent years creep feeding has declined in popularity because of high feed costs, low feeder-calf prices, cattle being backgrounded and sold as yearlings rather than at weaning, research showing decreased milk production of heifers creep-fed high-energy rations as calves, and fleshy calves being sold at a discount. Despite those drawbacks, creep feeding of calves can be profitable, especially for fall calves and those born to cows that are poor milkers or are 2 or more than 9 years old, and if pasture conditions are poor. Disadvantages of creep-fed calves making poorer milking cows and being discounted at the market as a result of flesh can be overcome by feeding a creep ration lower in energy than traditional creep rations. That can be done by adding high-quality roughage or increasing the proportion of grains, such as oats, that are higher in protein and lower in energy than corn. 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.

Procedure: Twenty-two fall-dropped Angus x Hereford, and Simmental x Angus calves (10 steers and 12 heifers) were equally divided by weight, sex, and breed on November 18, 1980. One group was creep-fed ground alfalfa (19.7% crude protein on 100 % DM basis), the other, 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 April 20, 1981, when they were approximately 7 months old.

Results: Calves that were creep-fed alfalfa hay gained 2.23 lb per day, while those fed grain had an average daily gain of 2.45 lb (Table 31). Although the grain-fed calves gained 9.9% (33 lb) more than did the calves creep-fed alfalfa hay, the difference was not statistically significant (P >.05). Average daily consumption of alfalfa hay and grain was 5.01 and 5.62 lb, respectively.

Conclusions: Alfalfa hay is an alternative creep feed that can compete favorably with a grain creep with respect to animal performance. Current market conditions favor alfalfa over grain as a creep ration.

Table 31. Alfalfa hay compared with grain as creep ration (153 days).

Item	Alfalfa	Grain
No. of calves	11	11
Initial wt., lb.	156	158
Final wt., lb.	498	533
Total gain, lb.	342	375
Average daily gain, lb	2.23	2.45
Average daily creep feed intake, lb [1]	5.01	5.62

[1] As-fed basis.

Crop Residues for Wintering Gestating Beef Cows

Crop residues, an alternative feedstuff for wintering the beef cow, usually are more nutrient deficient than good-quality hay; therefore, when fed, some type of supplementation usually is required. Because crop residues are most widely used only when hay or other feed is in short supply -- often following a dry summer like that of 1981 --, many cattlemen are not aware of their relative feeding value. In 1981 we compared hay made from drought-stricken milo and wheat straw probed with a liquid supplement with prairie hay as roughages for wintering gestating beef cows.

Procedure: Twenty-eight gestating beef cows were divided into two groups of nine head each and one group of 10. These cattle were grazed on fescue pasture from October 29, 1980, until February 6, 1981 (100 days), and each group received one of the following roughages *ad libitum* via big round bales fed in round, slant-bar-feeders: prairie hay, drought-sticken milo or wheat straw probed with 10% by weight of a 32% crude protein liquid supplement (22% CPE from NPN). All cattle had free access to a mixture of equal parts of steamed bone meal and trace-mineralized salt. Initial and final weights were taken after a 16-hour shrink from feed and water.

Results: Cows fed prairie hay gained 26.0% (35 lb) more (P <.05) and 75.5% (71 lb) more (P <.01) than did those fed milo hay and probed wheat straw, respectively (Table 32). Feeding milo hay resulted in 39.4% (36 lb) more gain than did feeding probed wheat straw. Average daily intakes of prairie hay, milo hay, and wheat straw were 14.5, 13.0, and 9.7 lb per head, respectively.

Conclusions: Gestating beef cows wintered on drought-stricken milo hay and wheat straw probed with a liquid supplement gained 79.4% and 57.0%, respectively, as much as did those wintered on prairie hay.

Table 32. Performance of beef cows fed crop residues.

Item	Prairie hay	Milo hay	Probed straw
No. of cows	9	10	9
Initial wt., lb.	877	868	882
Final wt., lb.	1043	999	977
Total gain, lb.	166	131	95
Average daily gain, lb.	$1.65^{a,b}$	$1.31^{b,d,e}$	$.94^{c,e}$
Average daily intake, lb.	14.5	13.0	9.7

^{a,b,c} Values in the same row with different superscripts differ significantly (P <.05).

^{d,e} Values in the same row different superscripts differ significantly (P <.01).

Effect of Ralgro[1] and COMPUDOSE[2] on Performance of Grazing Steers

Growth-promoting implants usually result in an 8 to 15% faster gain in growing and finishing cattle. Synovex and Ralgro, the only implants currently approved for beef cattle, cannot be used within 60 and 65 days, respectively, of slaughter. Because both implants have an effective life of about 100 days, reimplanting is necessary for maximum benefits.

COMPUDOSE is a silicone rubber implant that releases estradiol-17β (a naturally occurring hormone) at a controlled rate. COMPUDOSE was cleared for use by the Food and Drug Administration on March 12, 1982. Because it does contain a naturally occurring hormone, COMPUDOSE is approved for use without a required withdrawal period.

Procedure: On April 2, 1980, eighty-one Charolais steers averaging 539 lb were allotted this: 27 to 1) control - no implant; 27 to 2) 36 mg of Ralgro; and 27 to 3) COMPUDOSE -- a removable silicone rubber implant (4.76 mm x 3.0 cm) containing estradiol-17β. Implants were placed subcutaneously in the median surface of the ear at the beginning of the trial, and at no other time was any additional anabolic treatment given. Each COMPUDOSE - implanted steer was checked every 28 days to determine implant losses, and were reimplanted if necessary. The steers were observed daily for abnormal behavior, such as "buller" steers. Cattle were grazed in three separate bromegrass pastures, with all treatments represented equally when pastures became short. Initial and final weights were the average of non-shrunk individual weights taken on consecutive days. The study was terminated October 22, 1980.

Results: During the 202-day grazing study, steers implanted with COMPUDOSE gained 11.4% more ($P < .01$) and Ralgro-implanted steers gained 8.5% more ($P < .05$) than controls (Table 33). The gain difference between the two implants was not significant ($P > .20$).

Early in the study, several cattle lost COMPUDOSE implants. In most cases, if implants were retained for the first 28 days, they remained for the entire 202 days. At the end of the test, 74% of the original COMPUDOSE implants remained in place.

Average calculated estradiol-17β release from the COMPUDOSE implant was 49μg per day.

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

[2]COMPUDOSE is the trademark name for the estradiol implant produced by Elanco Products Co., Division of Eli Lilly Co., Indianapolis, IN 42606. Implants and partial financial assistance provided by Eli Lilly Co.

The incidence of "buller" steers or other mounting activity was similar among treatments.

Conclusions: COMPUDOSE (an estradiol removable implant) increased steer gains during 202 days of grazing by 11.4%; Ralgro implants (once at the beginning of the study) increased gain 8.5%. Steer performance on the two implants was statistically similar.

Table 33. Effect of implants on steer performance (202 days).

Item	Implant treatment		
	Control	Ralgro	COMPUDOSE
No. of steers	27	27	26
Initial wt., lb.	539	536	540
Final wt., lb	894	922	937
Total gain, lb.	$355^{a,c}$	$386^{b,c,d}$	$397^{b,d}$
Average daily gain, lb	$1.76^{a,c}$	$1.91^{b,c,d}$	$1.96^{b,d}$

^{a,b}Values in the same row with different superscripts differ significantly (P <.05).

^{c,d}Values in the same row with different superscripts differ significantly (P <.01).

Effect of Bovatec[1] on Performance of Grazing Steers

Previous research has shown Bovatec to be effective in increasing rate of gain and improving feed efficiency in feedlot cattle. Based on limited research, Bovatec also is effective in increasing rate of gain in grazing cattle. We evaluated two levels of Bovatec in a grazing study. Bovatec is currently not approved as a feed additive for beef cattle by the Food and Drug Administration.

Procedure: Seventy-two Simmental steers averaging 645 lb, all from one ranch, were randomly allotted by weight to nine, 10-acre bromegrass pastures on June 24, 1981; each pasture contain eight steers. These were the treatments, each treatment replicated three times: 1) Control; 2) 100 mg of Bovatec per head daily; and 3) 200 mg of Bovatec per head daily.

All cattle received 3 lb of dry, rolled milo per head for the first 84 days and 5 lb for the last 28 days. Cattle on Bovatec received the additive daily mixed with the rolled milo.

All cattle had free access to a mixture of equal parts of steamed bone meal and trace-mineralized salt. They were provided fly control by dust bags.

Steers were weighed every 28 days. Initial and final weights were taken after a 16-hour shrink off feed and water. The study was terminated after 112 days (October 14, 1981).

Results: During this 112-day grazing study, steers feed 100 mg of Bovatec per head daily gained 16.4% ($P<.05$) more, and those fed 200 mg, 23.9% ($P<.01$) more, than did control steers (Table 34). There was no statistically significant difference ($P>.20$) between Bovatec levels. Bovatec caused no palatability problems.

Conclusions: Steers fed 100 mg and those fed 200 mg of Bovatec[1] per head daily while grazing bromegrass for 112 days gained 16.4% and 23.9% faster, respectively, than did controls.

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[1]Bovatec is the trademark name for lasalocid sodium produced by Hoffmann-LaRoche, Inc., Nutley, N.J. 07110. Feed additive and partial financial assistance were provided by Hoffmann-LaRoche, Inc.

Table 34. Effect of Bovatec on steer performance - 112 days.

Item	Level of Bovatec (mg/head/day) 0	100	200
No. of steers	24	24	24
Initial wt., lb.	644	639	642
Final wt., lb.	794	813	827
Total gain, lb.	150[a,c]	174[b,c,d]	185[b,d]
Average daily gain, lb.	1.34[a,c]	1.56[b,c,d]	1.66[b,d]

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

[c,d]Values in the same row with different superscripts differ significantly ($P < .01$).

Effect of Protein Supplementation Method on Performance of Calves Wintered on Wheat Straw

Large acreages of wheat are grown in Kansas, and as a result a large quantity of wheat straw is available as feed for beef cattle. Various methods of providing supplemental protein are available. However, little is known about the relative merit of each with respect to economics and animal performance. Liquid supplement fed in a lick tank or probed into the bale and protein blocks were evaluated as protein supplementation methods in the following study.

Procedure: Sixty-six steer calves weighing an average of 477 lb were equally divided into three groups and were wintered on big, round bales of wheat straw in dry lots for 141 days. Cattle rations were supplemented with protein from a 32% crude protein, liquid supplement (22% CPE from NPN) fed in a lick tank or probed into bales at 10% of bale weight, or were supplemented with a 37% crude protein block (16.2% CPE from NPN). At the start of the study, all cattle were implanted with Ralgro, and they received 200 mg of Rumensin per head daily. All cattle received rolled milo at the rate of 3 lb per head daily for the first 64 days and 5 lb per head daily for the remainder of the study. All cattle had free access to a mineral mixture of equal parts of steamed bone meal and trace-mineralized salt. Initial and final weights were taken after a 16-hr shrink from feed and water.

Results: Cattle fed rations supplemented with protein blocks gained 44.4% (35 lb) more (P <.01) than did those fed liquid supplement from a lick tank and 111.6% (66 lb) more P <.01) than did those fed the supplement probed into bales.

Bales probed with liquid supplement resulted in poorest performance, primarily because of the low level of supplemental protein intake. It is probably physically impossible for a big, round bale to retain enough 32% liquid supplement to meet the protein requirement of 500-lb steers. In this study liquid supplement was injected into the bales with what was expected to be maximum level without any seepage.

Differences in performance between cattle fed liquid supplement in a lick tank and that of those fed protein blocks can be attributed to the higher levels of energy and natural protein found in blocks. Cattle on these two treatments had similar supplemental protein intakes, but cattle fed the blocks gained 44.4% more (P <.01). Intakes of straw were similar for all treatments.

Conclusions: Steer calves fed wheat straw supplemented with protein blocks gained more than did those fed liquid supplement in a lick tank or probed in bales.

Table 35. Effect of supplemental protein method on steer performance (141 days).

	Source of supplemental protein		
Item	Lick tank	Probed bales	Protein block
No. of steers	22	22	22
Initial wt, lb	479	476	477
Final wt, lb	572	538	605
Total gain, lb	93[a]	62[b]	128[c]
Average daily gain, lb	.63[a]	.43[b]	.91[c]
Daily protein supplement intake, lb	2.0	.89	1.72
Daily supplemental protein intake, lb	.64	.33	.63
Daily straw intake, lb	8	8	8

[a,b,c]Values on the same line with different superscripts differ significantly (P <.01).

Effect of Bovatec[1] and Ralgro[2] Implants on Performance of Finishing Steers

Bovatec, the trade name of lasalocid sodium, is a feed additive similar to Rumensin. Both antibiotics were used as poultry coccidiostats before their use for cattle. Both can alter the proportion of rumen volatile fatty acids toward more propionate and less acetate. Although not currently approved, Bovatec is expected to be cleared for feedlot cattle by the Food and Drug Administration in early 1982. The approved dosage is expected to be 10 to 30 grams per ton of ration dry matter.

Procedure: Eighty-four Simmental steers averaging 832 lb were randomly allotted by weight to 12 pens of seven head each. Treatments were 1) control (neither Bovatec or Ralgro); 2) Bovatec only (45 gm per ton dry ration); 3) Ralgro only (36 mg implant); amd 4) Bovatec and Ralgro combined. Each treatment was replicated in three pens. The study began March 11, 1980, using 30% concentrate and 70% corn silage (dry basis); daily thereafter, we increased the concentrate and decreased the silage by 5% until 80% concentrate and 20% corn silage was reached. Initially steers were weighed after a 16-hour shrink off feed and water; final weights were taken after 16 hours without feed. The trial was terminated July 1,1980. Cattle were slaughtered July 16, 1980 and individual carcass data were collected.

Results: During the 112-day finishing study, gains with and without Bovatec were similar (Table 36). Feeding Bovatec decreased feed intake 17.4% (P = .002) and improved feed efficiency 17.7% (P = .0001). In this study, as opposed to other studies, cattle fed Bovatec also had smaller ribeye area (P=.0001), more internal fat (P = .0051), and a higher yield grade (P = .0002) Bovatec generally has had no effect on carcass composition.

Ralgro implants increased steer gain (Table 36) 12.0% (P = .0001) and improved feed efficiency 6.9% (P = .0276) with no effect on feed intake. Implanted cattle also had less internal fat (P = .0360). Effects of Bovatec and Ralgro on feed efficiency were additive.

Conclusions: Cattle fed Bovatec consumed 17.4% less feed and were 17.7% more efficient than were controls, with no effect on gain. Ralgro implants improved gain 12% and feed efficiency 6.9% with no effect on feed intake. Effects of Bovatec and Ralgro combined on feed efficiency were additive.

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[1]Bovatec is the trademark name for lasalocid sodium produced by Hoffmann-LaRoche, Inc., Nutley, N. J. 07110. Feed additive and partial financial assistance were provided by Hoffmann-LaRoche, Inc.

[2]Ralgro is the trademark name for zernol implants produced by International Minerals and Chemical Corp., Terre Haute, IN 47808. Implants and partial financial assistance were provided by IMC.

Table 36. Effect of Bovatec and Ralgro on feedlot performance (112 days).

Item	Effect of Bovatec			Effect of Ralgro		
	No Bovatec	Bovatec, 45g/ton	Statistical significance[a]	No Ralgro	36 mg of Ralgro	Statistical significance
No. of steers	42	42	- - -	42	42	- - -
Initial wt., lb.	831.5	833.5	- - -	831.7	833.3	- - -
Final wt., lb.	1243.8	1248.5	- - -	1222.2	1270.0	- - -
Gain, lb	412.3	415.0	N.S.	390.5	436.7	.0001
ADG, lb.	3.68	3.71	N.S.	3.49	3.90	.0001
Daily DM intake, lb.	27.68	22.89	.002	24.76	25.78	N.S.[a]
Feed/gain	7.52	6.19	.0001	7.10	6.61	.0276
Fat thickness, in.	.28	.29	N.S.	.28	.29	N.S.[a]
REA, sq. in.	14.9	13.9	.0001	14.3	14.6	N.S.[a]
KPH fat, %	2.5	2.7	.0051	2.7	2.5	.0360
Marbling score[b]	5.9	5.9	N.S.	6.1	5.7	N.S.[a]
Quality grade[c]	10.9	10.7	N.S.	11.0	10.5	N.S.[a]
Yield grade	1.9	2.3	.0002	2.2	2.0	N.S.[a]

[a] N.S. = Not statistically different (P >.05).

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

[c] Quality grade: Ch^- = 10; Ch° = 11.

Evaluation of an NPN/Calcium Sulfate Product[a] and Addition of Shelled Corn to Drought Damaged Corn at Ensiling on Finishing Steer Performance

Initial work with a gypsum granular product (U. S. Gypsum Co.), using *in vitro* techniques, has indicated that gypsum product containing ration was more digestible than soybean meal or urea control rations. Pelleting of the rations containing gypsum product resulted in higher protein synthesis and a slower release of NH_3-N, compared with the urea control. A slow-release urea compound should be useful in reducing toxicity and might enhance acceptability of supplement and urea utilization.

Research has shown that the feed value of drought-damaged corn is 80-95% that of normal silage. Severity of drought damage, however, is highly variable and feeding value may vary widely by year and location. Therefore, it is difficult for cattlemen to decide how to harvest the drought-stressed corn crop.

In the current finishing study we evaluated 1) the gypsum granular product against soybean meal and urea in a practical feedlot diet and 2) adding shelled corn at time of ensiling to drought-stressed corn silage.

Procedure: Sixty Angus x Hereford yearling steers, initially weighing 815 lb each, were randomly allotted to 12 feedlot pens (five to a pen) on September 10, 1980. A 3 x 2 factorial design with three protein treatments (soybean meal, urea, and gypsum product) and two silages (no added corn and shelled corn added to ensiling) was used. Corn chopped for silage was severely drought stressed and was practically devoid of grain because few stalks had formed ears. The control silage was made from drought-stressed corn (no shelled corn). Six bushels of dry, shelled corn were added per ton on an as-harvested basis (32% dry matter) at the time of ensiling to this same material to make silage with added corn.

All steers were implanted initially with 36 mg of Ralgro and were fed a diet containing 69.2% whole-shelled corn, 20.0% corn silage, and 10.8% supplement on a dry matter basis. All rations were formulated to contain 12.0% crude protein, .38% calcium, and .37% phosphorus on a dry matter basis, 30 g of Rumensin per ton of dry matter, and 1200 IU of supplemental vitamin A and 120 IU of vitamin D_3 per lb of DM.

Cattle were confined in lots 66 ft x 112 ft with 20-ft linear fenceline bunks and access to automatic waterers. The pens had no cover or wind protection. Cattle were fed once daily a quantity that would allow for *ad libitum* consumption based on intake the previous day. Feed bunks were cleaned before the morning feeding and refused feed was weighed and discarded. Cattle were weighed individually every 28 days. Initial and final weights were taken after a 16-hour shrink from feed and water.

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[a]NPN/Calcium Sulfate and partical financial assistance provided by United States Gypsum Co., Des Plaines, Illinois 60016.

The study was terminated on December 27, 1980, and the cattle were slaughtered on December 29, 1980, at the Iowa Beef Processors plant in Emporia, Kansas. Individual carcass data were collected for each steer.

Results: Steer performance for each of the six treatment combinations is recorded in Table 37; performance is listed by protein treatment in Table 38 with silage treatments pooled within each protein treatment. The only traits that approached being significantly affected by protein treatment were average daily gain (P = .17) and kidney, pelvic, and heart fat (P = .20). Steers supplemented with the gypsum product gained 6.5% faster (P <.10) than steers supplemented with soybean meal. However, there was no significant difference (P >.20) in performance of steers supplemented with urea and those supplemented with soybean meal or gypsum product. Significant silage x protein treatment interactions existed for marbling score (P = .08) and quality grade (P = .02). Steer performance is listed by silage treatment in Table 39 with protein treatments pooled within each silage treatment. Adding shelled corn at ensiling resulted in 5.9% higher daily gain (P = .04), 11.7% less feed required per unit gain (P = .12) and larger ribeye area (P = .04) than was obtained by feeding silage to which no corn had been added. Steers receiving the added corn silage also had a slightly lower yield grade (P = .20).

Conclusions: Gypsum product resulted in 6.5% (P <.10) and 3.4% (P >.20) higher gains than the soybean meal and urea controls, respectively. There were no significant differences in any of the other traits evaluated with respect to protein treatment. Cattle receiving drought-stressed corn silage to which shelled corn had been added at the time of ensiling gained 5.9% faster (P = .04) and required 11.7% less feed per unit gain (P = .12) than did steers that received the control silage.

Table 37. Effect of protein treatment and addition of corn at ensiling on steer performance (108 days).

Item	Type of silage					
	No added corn			Added corn		
	Soybean meal	Urea	Gypsum product	Soybean meal	Urea	Gypsum product
No. of steers	10	10	10	10	10	10
Initial wt, lb	816	814	814	817	809	823
Final wt, lb	1205	1211	1229	1227	1235	1259
Average daily gain, lb	3.60	3.68	3.84	3.80	3.94	4.04
Daily dry matter intake, lb	25.1	25.4	21.6	21.8	21.8	24.1
Feed/gain	6.96	6.90	5.62	5.75	5.50	5.95
Dressing percent	59.7	60.0	59.1	60.0	59.0	59.4
Fat thickness, in	.45	.51	.50	.45	.48	.51
Ribeye area, sq in	13.0	12.9	12.7	13.3	13.0	14.0
KPH fat, %	3.0	3.2	3.0	3.0	3.2	3.3
Yield grade	2.8	3.1	3.0	2.8	2.9	2.8
Marbling score[a]	5.0	5.3	4.6	5.1	4.8	5.3
Quality grade[b]	9.5	10.5	9.2	9.9	9.4	10.2

[a]Marbling score: Slight = 4; small = 5; modest = 6.

[b]Quality grade: High good = 9; low choice = 10; average choice = 11.

Table 38. Effect of protein treatment on steer performance (108 days).

Item	Protein treatment: Soybean meal	Urea	Gypsum product	Level of statistical significance
No. of steers	20	20	20	- - -
Initial wt, lb	816	812	818	NS[a]
Final wt, lb	1216	1223	1244	NS[a]
Average daily gain, lb	3.70[b]	3.81[b,c]	3.94[c]	P = .17
Daily dry matter intake, lb	23.5	23.6	22.8	NS[a]
Feed/gain	6.35	6.20	5.79	NS[a]
Dressing percent	59.9	59.5	59.2	NS[a]
Fat thickness, in	.45	.49	.50	NS[a]
Ribeye area, sq in	13.2	12.9	13.3	NS[a]
KPH fat, %	3.0[b]	3.2[b]	3.1[b]	P = .20
Yield grade	2.8	3.0	2.9	NS[a]
Marbling score[d]	5.0	5.0	5.0	Interaction[e]
Quality grade[f]	9.7	10.0	9.7	Interaction[g]

[a]NS = not statistically significant (P >.20).

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

[d]Marbling score: Small = 5.

[e]There was a significant silage x protein treatment interaction. (P = .08) for marbling score.

[f]Quality grade: High good = 9; low choice = 10.

[g]There was a significant silage x protein interaction (P = .02) for quality grade.

Table 39. Effect of addition of shelled corn to drought-stressed corn silage at ensiling on steer performance (108 days).

Item	Type of silage		Level of statistical significance
	No added corn	Added corn	
No. of steers	30	30	- - -
Initial wt, lb	814	816	NS[a]
Final wt, lb	1215	1240	NS[a]
Average daily gain, lb	3.71	3.93	P = .04
Daily dry matter intake, lb	24.0	22.6	NS[a]
Feed/gain	6.49	5.73	P = .12
Dressing percent	59.6	59.5	NS[a]
Fat thickness, in	.49	.48	NS[a]
Ribeye area, sq in	12.9	13.4	P = .04
KPH fat, %	3.1	3.2	NS[a]
Yield grade	3.0	2.8	P = .20
Marbling score[b]	5.0	5.1	Interaction[c]
Quality grade[d]	9.7	9.8	Interaction[e]

[a]NS = not statistical significant (P >.20).

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

[c]There was a significant silage x protein treatment interaction (P = .08).

[d]Quality grade: High good = 9; low choice = 10

[e]There was a significant silage x protein interaction (P = .02) for quality grade.

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