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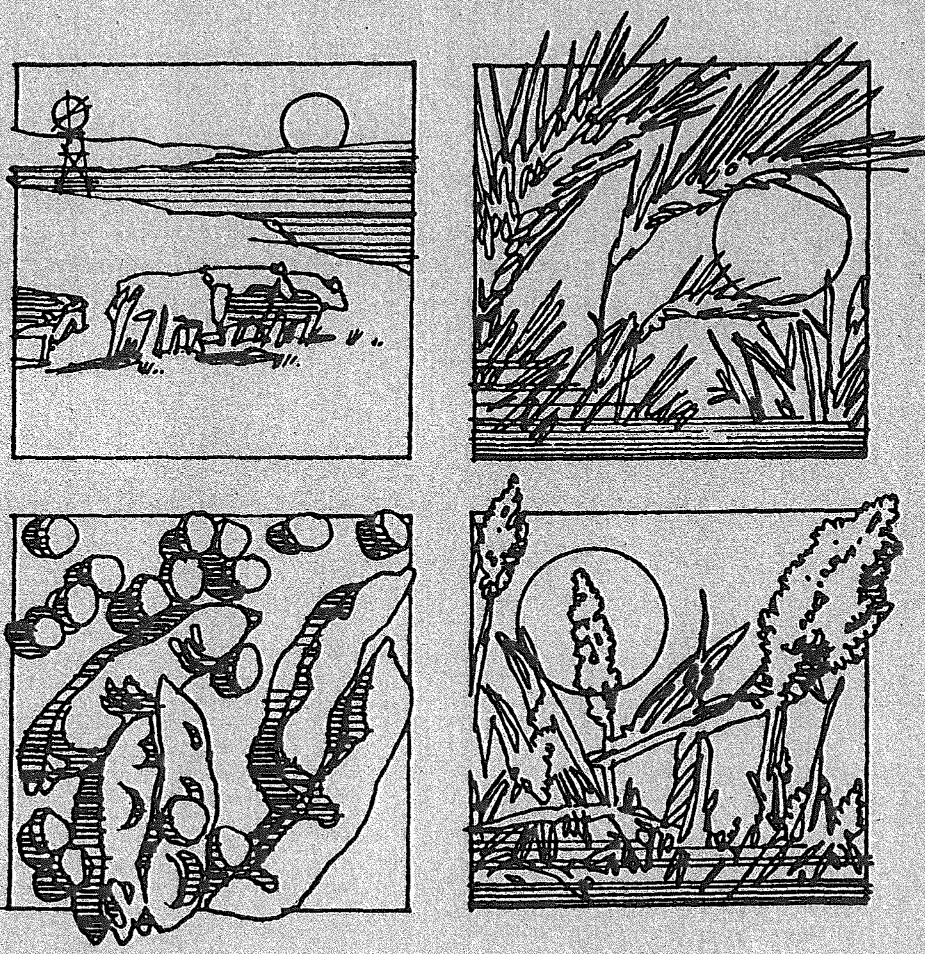
1989 AGRICULTURAL RESEARCH



Report of Progress 571

Agricultural Experiment Station

Kansas State University, Manhattan

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SOUTHEAST KANSAS BRANCH STATION

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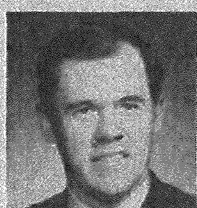

KEN KELLEY, Crops and Soils Agronomist, received a B.S. degree in Agricultural Education and a M.S. degree in Agronomy from Kansas State University. He has been a staff member since 1975. His research includes evaluation of herbicides, crop rotation systems, and intensive wheat management.

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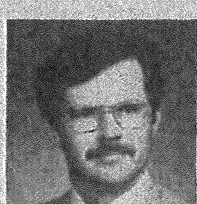

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SOYBEAN HULLS IN A FINISHING RATION FOR BEEF CATTLE

Kenneth P. Coffey and Lyle W. Lomas

Summary

Twenty steers and 14 heifers of mixed breeding were fed rations consisting of 75% energy concentrate, 20% corn silage, and 5% protein supplement on a dry matter basis. The energy concentrate for half of the cattle was ground grain sorghum (GS), whereas that for the other half was composed of 75% ground grain sorghum and 25% soybean hulls (SBH). Steers had a more desirable (P<.10) feed efficiency, lower (P<.01) dressing percentage, and lower (P<.01) cost of gain than heifers. Substitution of soybean hulls for 25% of the grain sorghum resulted in a lower dressing percentage (P<.01) and cost of gain (P<.05) without affecting rate of gain or feed efficiency.

Introduction

Soybean hulls are a high-fiber by-product from the manufacturing process of soybean meal. The fibrous fraction of soybean hulls is highly digestible, resulting in an acceptable feed value. Previous research reported that using soybean hulls as the sole energy source in a finishing ration reduced animal performance and efficiency. The purpose of this study was to determine if soybean hulls could replace 25% of the grain sorghum in a finishing ration without affecting animal performance.

Experimental Procedure

Twenty steers (avg. wt. 878 lb.) and 14 heifers (avg. wt. 798 lb.) of varied genotype were randomly allotted by weight within sex into two groups of 10 steers and two groups of 7 heifers. All cattle were vaccinated against clostridial organisms and dewormed with fenbendazole. Steers were implanted with Synovex-S and the heifers with zeranol. One group of each sex was offered a finishing ration consisting of 75% ground grain sorghum, 20% corn silage, and 5% protein supplement (Table 1) on a dry matter basis (M). The remaining group of each sex was offered the same ration except that 25% of the ground grain sorghum was replaced with soybean hulls on a dry weight basis (SBH). Cattle were fed the respective ration for 107 days, then slaughtered, and carcass data were collected.

Results

Cattle fed SBH tended (P>.10) to gain faster and consume more feed, but to convert feed less efficiently to gain than cattle fed GS (Table 2). However, due to the price differential of soybean hulls and grain sorghum ($80 vs. $87.50/ton, respectively), feed cost per unit of liveweight gain was less (P<.05) from cattle fed the diet with soybean hulls. Dressing percentage was lower (P<.01) from cattle fed SBH than from those fed GS. Other carcass characteristics were unaffected by dietary treatment (Table 3).

When steers and heifers were compared, steers had heavier initial (P<.01) and final (P<.05) weights, more desirable feed efficiencies (P<.10), and lower (P<.01) feed cost per unit of gain (Table 2). Steers tended (P>.10) to gain faster and consume more feed, also. Steers had heavier (P<.05) hot carcass weights and lower (P<.05) dressing percentages (Table 3). Other carcass characteristics were similar between steers and heifers.

These data indicate that soybean hulls may be included in a finishing ration for cattle at up to 25% of the energy source without adversely affecting cattle gain or feed efficiency. Therefore, the price differential between soybean hulls and grain sorghum should be the major consideration in deciding whether or not to use soybean hulls.

Table 1. Specifications of Feedlot Protein Supplement.

Item	Amount
Total crude protein (half natural, half from urea)	45 %
Calcium	5 %
Trace mineralized salt	5 %
Molasses	5 %
Monensin	500 g/ton
Vitamin A	20,000 IU/lb
Vitamin D	2000 IU/lb
Vitamin E	200 IU/lb

Table 2. Performance and Efficiency of Cattle Offered Finishing Rations Containing Grain Sorghum or Grain Sorghum with Soybean Hulls (107 days).

Item	Treatment		Sex	
	GS	GS + SBH	Heifers	Steers
Initial wt., lb.	838	838	798[b]	878[a]
Final wt., lb.	1121	1136	1070[d]	1186[c]
Gain, lb.	283	298	272	308
Daily gain, lb.	2.67	2.81	2.57	2.91
Daily dry matter intake, lb.	21.8	23.4	21.8	23.4
Daily feed DM/gain	8.26	8.43	8.57[e]	8.12[f]
Feed cost/ cwt gain	41.99[c]	41.46[d]	42.55[a]	40.91[b]

[a,b]Means within the same row and within either treatment or sex comparison with unlike superscripts differ (P<.01).
[c,d]Means within the same row and within either treatment or sex comparison with unlike superscripts differ (P<.05).
[e,f]Means within the same row and within either treatment or sex comparison with unlike superscripts differ (P<.10).

Table 3. Carcass Characteristics of Stocker Cattle Offered Finishing Rations Containing Grain Sorghum or Grain Sorghum with Soybean Hulls.

Item	Treatment		Sex	
	GS	GS + SBH	Heifers	Steers
Hot carcass wt., lb	691	696	663[d]	724[c]
Dressing %	61.7[a]	61.3[b]	62.0[c]	61.0[d]
Quality grade	10.6	10.2	10.8	10.0
Backfat, in.	.36	.36	.40	.33
Ribeye area, in^2	13.5	13.7	13.6	13.6
Yield grade	2.0	2.0	2.0	2.0

[a,b]Means within the same row and within either treatment or sex comparison with unlike superscripts differ (P<.01).
[c,d]Means within the same row and within either treatment or sex comparison with unlike superscripts differ (P<.05).

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INFLUENCE OF GRAZING DIFFERENT FESCUE VARIETIES ON SUBSEQUENT FEEDLOT PERFORMANCE OF STEERS

Kenneth P. Coffey, Joseph L. Moyer, and Lyle W. Lomas

Summary

A feedlot study was conducted to evaluate the effect of previous grazing on different fescue varieties on subsequent feedlot performance of steers. Forty, Angus x Hereford, crossbred steers were fed a common feedlot ration consisting of 79% ground grain sorghum, 15% corn silage, and 6% protein supplement on a dry matter basis for 125 days following a 208-day grazing period. The steers previously grazed either high-endophyte Kentucky 31 (HE), low-endophyte Kentucky 31 (LE), low-endophyte Missouri 96 (MO96), or HE interseeded with ladino clover (HE+LC). Steers that previously grazed LE and HE+LC were heavier (P<.01) at the initiation of the feedlot phase and produced heavier (P<.05) carcasses at the termination of the study, but gained at a slower (P<.05) rate than the steers that previously grazed HE or MO96. Steers that previously grazed HE had a more desirable (P<.10) feed efficiency than those that previously grazed LE or HE+LC. Final weights were similar (P>.10) among previous forage type. Therefore, cattle that previously grazed high-endophyte tall fescue appeared to compensate for lower pasture performance and to more efficiently convert feed to liveweight gain during the finishing phase.

Introduction

Tall fescue stands with plants that are infected with the endophytic fungus, Acremonium coenophialum, have been shown to adversely affect the performance of animals consuming this forage. The symptomology of tall fescue toxicity does not immediately disappear when the cattle are removed from the toxic fescue. However, the carryover effects of previously grazing tall fescue on subsequent feedlot performance are inconclusive. The data in this report represent the second year of a 3-year study that emphasizes the effects of grazing different fescue varieties on subsequent feedlot performance of cattle.

Experimental Procedure

Forty, Angus x Hereford, crossbred steers were allotted randomly by weight into eight replicates of five head each. The replicates were allotted randomly such that two replicates each were assigned to graze either high-endophyte Kentucky 31 (HE), low-endophyte Kentucky 31 (LE), low-endophyte Missouri 96 (MO96), or HE interseeded with ladino clover (HE+LC) for 209 days beginning on April 9, 1987. The cattle were not implanted and received no supplemental feed during the pasture phase. The cattle were weighed off of pasture on the mornings of November 3 and 4 to determine pasture ending weights and feedlot initial weights. The cattle were moved to the SEKES feedlot facility at Mound Valley, with previous pasture replicates maintained. All steers were implanted with Synovex-S, dewormed with levamisole, and vaccinated against clostridial infection. The cattle were fed a corn silage based ration initially. Grain level replaced corn silage until a final ration of 79% ground grain sorghum, 15% corn silage, and 6% protein supplement was being offered. The supplement contained monensin to provide 25 g/ton in the complete ration. The cattle were fed for 124 days, then slaughtered, and carcass data were collected.

Results

Steers that previously grazed HE+LC and LE entered the feedlot phase heavier (P<.01) than those that previously grazed HE and MO96 (Table 1). Final weights were similar, however, indicating that HE and MO96 cattle compensated for reduced pasture phase gains. Steers that previously grazed MO96 gained 47 lb more (P<.05) and those that previously grazed HE gained 82 lb more (P<.05) than those that previously grazed LE and HE+LC. Steers that previously grazed HE converted feed to gain more efficiently (P<.10) than those that previously grazed LE.

Steers that previously grazed HE+LC had greater (P<.05) backfat than those that previously grazed HE or MO96 (Table 2). Yield and quality grade were not affected by previous forage treatment. Over both pasture and feedlot phases, HE cattle gained 39 and 49 lb. less than HE+LC and LE cattle, respectively (Table 3).

These data indicate that although cattle grazed on tall fescue infected with A. coenophialum weigh less when placed in the feedlot, compensatory gain may occur. More efficient feed conversion to gain may accompany the faster rate of gain, such that feed cost per unit of gain may be lower.

Table 1. Effect of Previous Pasture Type on Feedlot Performance of Steers (209 days).

Item	HE	HE+LC	LE	MO96
Initial wt., lb.	704[b]	825[a]	834[a]	724[b]
Final wt., lb.	1160	1198	1208	1144
Gain, lb.	456[c]	374[d]	374[d]	421[c]
Daily gain, lb.	3.65[c]	2.99[d]	2.99[d]	3.37[c]
Daily DM intake, lb.	25.6	24.8	26.6	24.9
Daily feed DM/gain	7.06[g]	8.32[ef]	8.91[e]	7.41[fg]

[a,b]Forage type means within the same row with unlike superscripts differ ($P<.01$).
[c,d]Forage type means within the same row with unlike superscripts differ ($P<.05$).
[e,f,g]Forage type means within the same row with unlike superscripts differ ($P<.10$).

Table 2. Effect of Previous Pasture Type on Carcass Characteristics.

Item	HE	HE+LC	LE	MO96
Hot carcass wt., lb.	673[b]	710[a]	707[a]	668[b]
Dressing %	58.1	59.3	58.6	58.5
Quality grade	10.2	10.3	10.5	10.3
Backfat, in.	.40[b]	.51[a]	.46[ab]	.38[b]
Ribeye area, in^2	12.2	12.7	12.7	12.6
Yield grade	2.2	2.4	2.3	2.0

aMeans within the same row with unlike superscripts differ ($P<.05$).

Table 3. Effect of Pasture Type on Overall Steer Performance (April 9, 1987 - March 8, 1988).

Item	HE	HE+LC	LE	MO96
No. of steers	10	10	10	10
Initial wt., lb.	501	500	500	501
Final wt., lb.	1160	1198	1208	1144
Total gain, lb.	659	698	708	643
Daily gain, lb.	1.97	2.09	2.12	1.93

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FEEDLOT PERFORMANCE BY STEERS THAT PREVIOUSLY STRIP-GRAZED OR CONTINUOUSLY GRAZED TALL FESCUE OR TALL FESCUE INTERSEEDED WITH LADINO CLOVER

Kenneth P. Coffey, Joseph L. Moyer, and Lyle W. Lomas

Summary

Forty-six crossbred steers that previously strip-grazed (SG) or continuously grazed (CG) fescue (F) or fescue - ladino clover (FL) pastures were fed a finishing ration for 141 days to determine the effect of previous forage type and management on feedlot performance. Steers that previously grazed FL were heavier (P<.01) at the initiation of the feedlot phase. Other feedlot performance parameters were statistically similar (P>.10) between F and FL. Steers previously managed by CG were heavier at the initiation (P<.01) and termination (P<.10) of the feedlot phase. Gain and feed efficiency were not affected by previous management. Previous forage type had no effect on carcass characteristics, whereas previous management affected dressing percentage but had no effect on carcass quality or yield grades. Therefore, weight reductions incurred during the pasture phase by either strip-grazing or by grazing fescue were not compensated for during the feedlot phase of the study.

Introduction

The effect of previous management has been demonstrated to have a significant impact on feedlot performance. However, the repercussions of grazing tall fescue containing the endophytic fungus, *Acremonium coenophialum*, on subsequent feedlot performance are highly variable and may be notably affected by forage and cattle management. The purpose of this experiment was to evaluate the effects of grazing tall fescue and fescue - ladino clover forages in a continuous or strip-grazing system on subsequent feedlot performance of steers.

Experimental Procedure

Forty-eight Limousin crossbred steers were allotted randomly by weight into replicates of six head each. Each replicate was assigned randomly to a particular pasture containing either tall fescue (F) or tall fescue that was interseeded with ladino clover (FC). Approximately 65% of the fescue plants were infected with *A. coenophialum*. Pastures from both forage types were either continuously grazed (CG) or were grazed in a short-duration intensive manner (strip-grazing; SG) for 197 days beginning on April 21, 1987. The cattle were not implanted and received no supplemental grain during the pasture phase of the experiment. At the end of the 197-day pasture phase, the cattle were implanted with Synovex-S, vaccinated against clostridial infection, dewormed with levamisole, and placed in the SEKES feedlot facility near Mound Valley. Pasture replicates were maintained during the feedlot phase. The steers were offered a corn silage-based ration; a portion of which was replaced by ground grain sorghum until a final ration of 79% ground grain sorghum, 15% corn silage, and 6% protein supplement was achieved. The protein supplement contained monensin to maintain a 25 g/ton level in the complete ration. The steers were fed for 141 days, then slaughtered, and carcass data were collected.

Results

Steers that previously grazed F entered the phase weighing 44 lb. less (P<.01) than those that previously grazed FC (Table 1). Although statistically similar (P>.10), steers that previously grazed F tended to gain faster and more efficiently during the feedlot phase than FC but still averaged 39 lb. lighter at the time of slaughter. Steers that were managed by CG were 38 lb. heavier (P<.01) at the initiation of the feeding period and 52 lb heavier (P<.10) at the time of slaughter than those managed by SG. Steers previously CG tended to gain faster and more efficiently than those previously SG.

Previous forage type had little effect on carcass characteristics (Table 2), and previous management only affected dressing percentage (P<.10).

In a treatment comparison across the pasture and feedlot phases (Table 3), steer gain was improved by 6.5% by grazing pastures with ladino clover, whereas strip-grazing fescue and fescue - ladino clover pastures reduced total gain by 8.4% compared with continuously grazing similar pasture types.

In summary, managing cattle both by strip-grazing and by allowing them to graze monocultures of tall fescue resulted in lower animal weights at the initiation of the feedlot phase. These cattle failed to significantly compensate for reduced pasture performance and, therefore, maintained a lower body weight through the feedlot phase until slaughtered.

Table 1. Effect of Forage Type and Management on Subsequent Steer Feedlot Performance (197 days).

Item	Forage Type: Fescue	Forage Type: Fescue + Ladino	Management: Continuous	Management: Strip
No. Steers	22	24	23	23
Initial wt., lb.	726[b]	770[a]	767[a]	729[b]
Final wt., lb.	1147	1186	1193[c]	1141[d]
Total gain, lb.	422	417	426	412
Daily gain, lb.	2.97	2.93	3.00	2.90
Daily feed intake, lb.	24.7	25.4	25.4	24.7
Daily feed DM/gain	8.33	8.64	8.45	8.52

[a,b]Forage type or management means with different superscripts differ (P<.01).
[c,d]Forage type or management means with different superscripts differ (P<.10).

Table 2. Effect of Forage Type and Management on Subsequent Steer Carcass Characteristics.

Item	Forage Type: Fescue	Forage Type: Fescue + Ladino	Management: Continuous	Management: Strip
Hot carcass wt., lb.	709	720	716	713
Dressing %	61.8	60.8	60.1[c]	62.5[b]
Quality grade[a]	9.8	9.9	10.1	9.7
Backfat, in.	.28	.28	.30	.25
Ribeye area, in^2	14.0	14.2	13.8	14.4
Yield grade	1.4	1.4	1.6	1.2

[a]High select = 9, low choice = 10, etc.
[b,c]Management means within a row differ (P<.10).

Table 3. Effect of Forage Type and Management on Overall Steer Performance. (April 21, 1987 - March 24, 1988)

Item	Forage Type: Fescue	Forage Type: Fescue + Ladino	Management: Continuous	Management: Strip
No. of steers	22	24	23	23
Initial wt., lb.	562	563	562	563
Final wt., lb.	1147	1186	1193	1141
Total gain, lb.	585	623	631	578
Daily gain, lb.	1.73	1.84	1.86	1.71

EFFECT OF IMPLANT, COPPER BOLUS, AND SUMMER ROTATION TO BERMUDAGRASS ON PASTURE AND SUBSEQUENT FEEDLOT PERFORMANCE OF STEERS GRAZING HIGH-ENDOPHYTE TALL FESCUE INTERSEEDED WITH LADINO CLOVER[1,2]

Kenneth P. Coffey, Joseph L. Moyer, and Lyle W. Lomas

Summary

Sixty-two crossbred steers were used in a study to evaluate the effect of different management practices on pasture and subsequent feedlot performance by stocker steers grazing high-endophyte tall fescue interseeded with ladino clover. Management practices evaluated were the effect of implanting with Synovex-S, orally administering a bolus containing copper oxide needles, and summer rotation to bermudagrass. Rotation of the steers to bermudagrass lowered (P<.01) ending pasture weights and animal gain but did not affect gain/acre. Rotated cattle had lower (P<.10) hot carcass weights and feed efficiencies than continuously grazed cattle. Implanted cattle were heavier (P<.10) at the end of the grazing phase and produced more (P<.01) gain per animal and per acre during the pasture phase but gained less (P<.10) during the feedlot phase and had lower (P<.10) carcass quality grades. Cattle receiving boluses with copper oxide needles had lower (P<.05) carcass quality grades than cattle not receiving boluses. These data indicate that management practices that helped to improve gain during the pasture phase reduced feedlot performance, so that final weights were statistically similar across treatments.

Introduction

Performance of cattle grazing tall fescue containing the endophytic fungus, *Acremonium coenophialum*, has typically been suboptimal. Many treatments and management practices have been and are currently being tested to minimize the effects of *A. coenophialum* on cattle. In the present experiment, Synovex implant; copper oxide needles; and rotation of the cattle from fescue in the spring, to bermuda in the summer, then back to fescue in the fall were evaluated as treatments to help minimize performance reductions caused by the endophyte.

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[1]Implants and partial financial support provided by Syntex Animal Health, Inc., West Des Moines, IA.

[2]Copper boluses and fly tags provided by Cooper's Animal Health, Kansas City, MO.

Experimental Procedure

Sixty-two, Limousin, crossbred steers were used in an experiment to compare continuous grazing (CG) of tall fescue-ladino clover pastures vs. rotation of the cattle from fescue - ladino pastures in the spring and fall to bermudagrass in the summer (RG); implant with Synovex-S (I) vs. no implant (NI); and bolus with copper oxide needles (CO) vs. no copper (NCO). Approximately 70% of the fescue plants were infected with the endophytic fungus. The cattle were dewormed with fenbendazole and ear tagged with Tomahawk@ ear tags to control face flies. Continuously grazed cattle were divided into five replicates of five head and one replicate of six head, and each replicate was then placed on a specific 5-acre pasture for a 207-day grazing period. The remaining cattle were divided into one replicate of 15 head and one replicate of 16, head with each replicate assigned to a 5-acre pasture until May 27. On May 27, RG cattle were moved such that each replicate was assigned to one 5-acre bermudagrass pasture until September 15. On August 23, shortage of available forage necessitated the removal of nine RG cattle, leaving 12 head in each of the two replicates. At that time, the steers originally receiving an implant were reimplanted. Rotated cattle were returned to the fescue - ladino pastures on September 15 and grazed those pastures until November 8. All steers had ad libitum access to water and mineral supplement throughout the experiment.

On November 8, all cattle were dewormed with levamisole, implanted with Synovex-S, vaccinated against clostridial infection, then transported to the SEKES feedlot facility at Mound Valley. The steers were fed a silage-based ration, with levels of grain sorghum increased until a final ration of 75% ground grain sorghum, 15% corn silage, and 5% protein supplement on a dry matter basis was achieved. The steers were fed the finishing ration for 111 days, then slaughtered, and carcass data were collected.

Results

Rotation of the cattle to bermudagrass reduced ($P<.01$) ending pasture weight by 78 lb. and per animal gain by 80 lb (Table 1). However, gain/acre tended ($P>.10$) to be higher from RG. During the feedlot phase, RG cattle tended to gain more, so that final weights were statistically similar ($P>.10$) between CG and RG cattle (Table 2). Continuously grazed cattle produced heavier ($P<.10$) carcasses than RG, but other carcass characteristics were similar between CG and RG (Table 3). Rotationally grazed cattle converted feed to gain more efficiently ($P<.10$) than CG (Table 4).

Implanted cattle gained 17.1% more ($P<.01$) weight and were 34 lb. heavier ($P<.10$) at the end of the pasture phase than NI.

However, NI gained 32 lb. more than I during the finishing phase, so that final weights of the two groups were similar (Table 2). Cattle implanted during the pasture phase had lower (P<.10) carcass quality grades than NI (Table 3).

Administering boluses with copper oxide needles had no effect on pasture (Table 1) or feedlot performance (Table 2) or carcass characteristics (Table 3), with the exception of a reduction (P<.05) in carcass quality grade from CO vs. NCO steers.

These data indicate that removing the cattle from fescue - ladino pastures during the summer months and grazing them on bermudagrass did not help animal performance but actually hindered individual animal gains. The summer of 1988 was dry, so normal forage production was restricted during these months. Along with the excessive stocking rate imposed upon the rotated cattle, this caused a reduction in available forage, which is the most probable reason for the reduction in individual animal gain. The improvement in performance from Synovex was greater than normally expected. However, similar improvements have been shown with other implants in cattle grazing high-endophyte tall fescue. In the present experiment, feedlot performance appeared to be adversely affected by pasture performance. Treatments that improved pasture performance also improved feedlot performance, and treatments that reduced pasture performance resulted in improved feedlot performance.

Table 1. The Effect of Implant, Copper Oxide Needles, and Summer Rotation to Bermudagrass on Steer Grazing Performance (207 days).

Item	Management		Implant		Copper Oxide	
	CG	RG	I	NI	CO	NCO
No. Steers	31	31	31	31	31	31
Initial wt., lb.	641	643	642	642	642	642
End pasture wt., lb.	896[a]	818[b]	874[c]	840[d]	854	860
Gain, lb.	255[a]	175[b]	232[a]	198[b]	212	218
Gain/acre, lb.	255	295	314	267	285	296
Daily gain, lb.	1.23[a]	.85[b]	1.12[a]	.96[b]	1.02	1.05

[a,b]Means within the same main effect and row with unlike superscripts differ (P<.01).
[c,d]Means within the same main effect and row with unlike superscripts differ (P<.10).

Table 2. The Effect of Implant, Copper Oxide Needles, and Summer Rotation to Bermudagrass on Steer Feedlot Performance (207 days).

Item	Management		Implant		Copper Oxide	
	CG	RG	I	NI	CO	NCO
No. Steers	31	24	28	27	28	27
Initial wt., lb.	896[a]	818[b]	874[c]	840[d]	854	860
Final wt., lb.	1260	1216	1239	1237	1233	1243
Total gain, lb.	363	394	367[d]	391[c]	377	391
Daily gain, lb.	3.28	3.55	3.31[d]	3.52[c]	3.40	3.43

[a,b]Means within the same main effect and row with unlike superscripts differ (P<.01).
[c,d]Means within the same main effect and row with unlike superscripts differ (P<.10).

Table 3. The Effect of Implant, Copper Oxide Needles, and Summer Rotation to Bermudagrass on Steer Carcass Characteristics.

Item	Management		Implant		Copper Oxide	
	CG	RG	I	NI	CO	NCO
No. Steers	31	24	28	27	28	27
Hot carcass wt.,lb.	762[c]	722[d]	748	736	735	749
Backfat, in.	.38	.35	.37	.37	.34	.40
Ribeye area, in^2	14.3	14.0	14.3	14.0	14.0	14.3
Quality grade[e]	9.4	9.4	9.2[d]	9.7[c]	9.1[b]	9.7[a]
Yield grade	2.2	2.1	2.1	2.2	2.1	2.2

[a,b]Means within the same main effect and row with unlike superscripts differ (P<.05).
[c,d]Means within the same main effect and row with unlike superscripts differ (P<.10).
[e] 9 = high select; 10 = low choice; etc.

Table 4. The Effect of Summer Rotation to Bermudagrass on Feed Intake and Efficiency During the Subsequent Feedlot Phase (207 days).

Item	Continuous	Rotated
Daily feed intake, lb.	24.2	22.2
Daily feed DM/gain, lb	7.43[a]	6.25[b]

[a,b]Means in the same row with unlike superscripts differ (P<.10).

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

EFFECT OF COPPER OXIDE NEEDLES ON CATTLE GRAZING DIFFERENT FESCUE VARIETIES[1]

Kenneth P. Coffey, Joseph L. Moyer, and Lyle W. Lomas

Summary

Thirty, Angus x Hereford, crossbred steers were grazed on either high- endophyte Kentucky 31 tall fescue (HE), HE interseeded with ladino clover (HE+LC), or low-endophyte Missouri 96 tall fescue (MO96) for 222 days beginning on April 14. One half of the cattle on each treatment received boluses with 20 g copper oxide needles. Copper did not affect animal weights or gains on either of the three forage types. Cattle grazing MO96 were 77 lb. heavier (P<.10) than those grazing HE and 90 lb. heavier (P<.10) than those grazing HE+LC at the end of the study. High-endophyte fescue pastures containing ladino clover did not produce improved performance compared with high-endophyte fescue pastures without ladino clover,as was the case in the previous two years of this experiment.

Introduction

In the previous two years at SEKES, cattle grazing either Missouri 96 or high-endophyte fescue interseeded with ladino clover have gained more than those grazing high-endophyte fescue. This study represents the third and final year of an experiment designed to compare performance of cattle grazing either Kentucky 31 tall fescue stands, in which approximately 70% of the plants are infected with the endophytic fungus, Acremonium coenophialum; the same fescue interseeded with ladino clover; or a low-endophyte variety, Missouri 96.

Experimental Procedure

Thirty crossbred steers (Angus x Hereford) having an average initial weight of 550 lb. were allotted randomly by weight into six replicates of five head each. The replicates then were allotted randomly to graze one of six, 5-acre pastures of either Kentucky 31 tall fescue having approximately 70% of the plants infected with the endophytic fungus, Acremonium coenophialum

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[1]Copper oxide needles and fly tags provided by Cooper's Animal Health, Kansas City, MO.

(HE), HE interseeded with ladino clover (HE+LC), or Missouri 96 tall fescue having less than 10% of the plants infected with A. coenophialum (2 pastures of each forage type). Within each forage type, half of the cattle received boluses containing 20 g of copper oxide needles. All steers were dewormed with fenbendazole and were given a Tomahawk@ ear tag for face fly control. The steers grazed the respective pastures for 222 days beginning on April 14. At the end of the pasture phase, the cattle were placed in the SEKES feedlot facility to be finished to slaughter specifications.

Results

Boluses containing copper oxide needles had no effect on animal weights or animal gain. Steers grazing MO96 were heavier ($P<.10$) at the end of the study and tended ($P=.11$) to gain faster than those that grazed HE or HE+LC. Steers that grazed HE+LC tended to gain less than those that grazed HE. The reason for this is uncertain but can probably be attributed to limited summer rainfall during 1988. Ladino clover is more productive under wetter conditions and is not as drought tolerant as other legumes. Poor ladino production would also lead to poor fixation of nitrogen for the fescue and, therefore, poor fescue production. The HE+LC pastures probably had limited available forage during the latter days of the experiment, which could have resulted in reduced performance.

Table 1. The Effect of Copper Oxide Needles and Tall Fescue Variety on the Performance of Stocker Steers (222 days).

	Copper Bolus		Forage Type		
Item	Yes	No	HE	HE+LC	MO96
Initial wt., lb.	549	552	552	551	549
Final wt., lb.	787	798	771[b]	758[b]	848[a]
Total gain, lb.	239	246	220	208	299
Daily gain, lb.	1.07	1.10	.93	.98	1.34

[a,b]Forage type means with unlike superscripts differ ($P<.10$).

PERFORMANCE OF STOCKER STEERS OFFERED HIGH OR LOW ENDOPHYTE FESCUE HAY AND NO SUPPLEMENTAL COPPER OR COPPER FROM EITHER COPPER OXIDE OR COPPER PROTEINATE[1]

Kenneth P. Coffey, Joseph L. Moyer, and L.W. Lomas

Summary

Fifty-nine crossbred steers were fed diets of either high- (HE) or low- (LE) endophyte Kentucky 31 tall fescue hay and supplemented with 2 lb/head daily of one of three soybean-hull based supplements containing essential minerals and salt. The supplements contained either no copper (NC) or copper at a level to provide 108 mg/head daily from either copper oxide (COX) or copper proteinate (CPR). Steers offered the LE hay consumed more ($P<.01$) forage (lb. and % of body weight), converted consumed forage to gain more ($P<.01$) efficiently, and gained faster ($P<.01$) than those offered HE. Copper source had no effect on gain, intake, or efficiency but did appear to affect final ceruloplasmin levels. Therefore, feeding hay that contains _Acremonium coenophialum_ may reduce hay intake and cattle performance.

Introduction

Cattle consuming tall fescue containing _Acremonium coenophialum_ exhibit certain symptoms that mimic copper deficiency. Although many sources of copper are available to the cattle producer, these sources may differ greatly in their bioavailability. It has been postulated in recent years that chelation of copper with specific proteins (copper proteinate) would greatly enhance copper absorption and utilization by livestock. The purpose of this experiment was to compare the effects of copper oxide and copper proteinate with no supplemental copper on cattle consuming high- and low- endophyte fescue forage.

Experimental Procedure

Fifty-nine crossbred steers were allotted randomly by weight into 11 replicates of 5 head each and one replicate of 4 head. Six replicates were fed forage harvested from Kentucky 31 tall

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[1]Mineral package and feed analyses were provided by Prince Agri Products, Quincy, IL.

fescue fields in which approximately 65% of the plants were infected with A. coenophialum (HE), and six replicates were fed forage harvested from endophyte-free Kentucky 31 tall fescue fields (Table 1). The replicates assigned to each forage type were divided such that two replicates each would receive supplements containing either no copper (NC) or 108 mg/head daily from either copper oxide (COX) or copper proteinate (CPR). The supplements were formulated to provide the levels of essential minerals shown in Table 2 and blended in a soybean hull carrier.

The cattle were fed ad-libitum quantities of the respective hays for 58 days, beginning on July 27. All cattle were fed the NC supplement for the first 30 days, followed by 28 days of feeding the respective supplements containing no copper or copper from the respective copper sources. The steers were weighed on July 27 and August 26, following a 16 hour removal from feed and water to determine initial and final weights. Cattle were bled via jugular puncture prior to the initiation of feeding supplements with copper and again at the end of the study. Packed cell volume, or hematocrit, was determined on whole blood samples, and ceruloplasmin was determined on blood serum samples. Hematocrit values represent the volume of blood that is red blood cells and is used to access the degree of anemia encountered in the blood. Ceruloplasmin is a copper-related enzyme that is a very good indicator of blood copper levels.

Results

Presence of the endophytic fungus, A. coenophialum, in the tall fescue forage significantly reduced ($P<.01$) ending weight by 5.3%, total and daily gain by 44.6%, feed intake by 9.4% and 6.9% (lb. and % body weight, respectively), and the efficiency of feed conversion by 67.0%. Copper source had no effect ($P>.10$) on animal performance or feed intake.

A significant ($P<.05$) forage type x copper source interaction was detected for final ceruloplasmin levels. Therefore, all blood data are shown as the interactive means. No effect of either forage type or copper source was detected for initial or final hematocrit or change from initial to final hematocrit. Final ceruloplasmin levels were similar ($P>.10$) for the different copper supplements fed to cattle consuming LE. Within the steers fed HE, final ceruloplasmin levels were highest from those offered the supplement with CPR, lowest from those offered the supplement without copper (NC), and intermediate from those offered the supplement with COX. However, changes in ceruloplasmin levels from initial to final values did not significantly differ.

These data indicate that the presence of A. coenophialum in tall fescue hay may have a significant impact on cattle performance and forage intake. Although it is suspected from other studies that the endophyte level in fescue may affect the copper status of the cattle grazing the infected fescue, these factors could not be shown in the present experiment.

Table 1. Composition of High and Low Endophyte Fescue Hays and Soybean Hulls.

Item	High	Low	Soy Hulls
Crude protein, %	7.6	7.1	17.2
Neutral detergent fiber, %	62.0	59.1	-
Acid detergent fiber, %	38.6	38.3	40.8
Nitrate, ppm.	8	6	-
Calcium, %	.39	.44	1.04
Phosphorus, %	.18	.21	1.04
Potassium, %	2.0	2.1	.21
Magnesium, %	.20	.22	1.4
Cobalt, %	.0004	.0005	.29
Copper, %	.0008	.0007	.0007
Iron, %	.0472	.0123	.0005
Manganese, %	.0136	.0093	.0774
Zinc, %	.0043	.0065	.0047
Selenium, ppm	< 10	< 10	.0108
			< 10

Table 2. Amounts of Specific Elements Provided by 2 lb. of Supplement.

Element	Amount provided
Calcium	25 g
Phosphorus	15 g
Magnesium	15 g
Potassium	5 g
Sulfur	7.7 g
Iron	575 mg
Manganese	300 mg
Zinc	300 mg
Molybdenum	15 mg
Iodine	5 mg
Selenium	2.5 mg
Cobalt	.8 mg

Table 3. Performance and Feed Consumption by Steers Fed High- and Low-Endophyte Fescue Hay and Supplements Containing Different Copper Sources (58 days).

Item	Forage		Copper Source		
	HE	LE	COX	CPR	NC
No. Steers,	29	30	20	19	20
Initial wt., lb.	730	729	729	730	729
Final wt., lb.	786[b]	830[a]	806	813	805
Total gain, lb.	56[b]	101[a]	77	83	76
Daily gain, lb.	.97[b]	1.74[a]	1.33	1.43	1.31
Daily feed intake, lb.	16.3[b]	18.0[a]	17.1	17.3	17.1
Daily feed intake, % body weight	2.15[b]	2.31[a]	2.22	2.23	2.23
Daily feed/gain	17.2[a]	10.3[b]	14.5	12.4	14.4

[a,b]Forage type means with unlike superscripts differ (P<.01).

Table 4. Effect of Forage Type and Copper Source on Blood Hematocrit and Serum Ceruloplasmin Levels.

Item	High Endophyte			Low Endophyte		
	COX	CPR	NC	COX	CPR	NC
Initial hematocrit, %	36.3	38.1	35.4	37.8	37.1	37.8
Final hematocrit, %	37.3	37.7	35.7	37.4	37.6	37.3
Hematocrit change	1.0	-0.4	0.3	-0.35	0.5	-0.6
Initial ceruloplasmin, mg/dl	10.9	11.0	9.3	11.1	10.9	10.4
Final ceruloplasmin, mg/dl	11.8[b]	13.7[a]	9.9[c]	12.0[ab]	11.4[bc]	11.8[b]
Ceruloplasmin change	0.9	2.7	0.6	0.9	0.5	1.4

EFFECT OF CONTINUOUS ANTHELMINTIC TREATMENT WITH MORANTEL TARTRATE ON STOCKER STEER PERFORMANCE AND FECAL PARASITE COUNTS[1]

Kenneth P. Coffey, Joseph L. Moyer, and Lyle W. Lomas

Summary

Three experiments were conducted to evaluate continuous anthelmintic treatment of stocker steers with morantel tartrate. In Experiments 1 and 2, morantel tartrate was provided free choice in mineral mixtures to steers grazing smooth bromegrass. In Exp. 3, morantel tartrate was provided via sustained-release trilaminate orally administered to steers grazing bermudagrass pastures. Fecal parasite counts were low throughout each study, indicating only low levels of parasite infection. Therefore, effects of parasite treatment on animal performance were minimal.

Experimental Procedures

Exp. 1.

Sixty, Limousin, crossbred steers were allotted randomly by weight to one of 10 10-acre, smooth bromegrass pastures. Following a 2-week adaptation to a nonmedicated mineral mixture containing trace mineralized salt and dicalcium phosphate (C; Table 1), the cattle were offered ad-libitum access to one of four mineral mixtures shown in Table 1 for 56 days, beginning on November 10. The mineral mixtures consisted of the nonmedicated mineral mixture (C), C with 5.58 mg of the anthelmintic morantel tartrate per gram of mineral mixture (MT), C with 10% of the mineral replaced with dried cane molasses (CM), and CM with 5.58 mg morantel tartrate per gram of mineral mixture (CM-MT). Mineral mixtures were provided in covered "weather-vane" type mineral feeders. Fecal samples were collected from half of the steers at the beginning and end of the study, and fecal parasite egg counts were determined.

Exp. 2.

One hundred twenty crossbred steers were allotted randomly by weight into six lots of 10 head or four lots of 15 head each,

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[1]Morantel tartrate products and partial financial support were provided by Pfizer, Inc., Lee's Summit, MO.

with each group placed on one of ten 10-acre, smooth bromegrass pastures. All cattle were vaccinated against eight strains of Clostridial organisms, IBR, PI_3, BVD, and five strains of Leptospirosis, and implanted with Synovex-S. Three lots of 10 head and two lots of 15 head received morantel tartrate in a mineral mixture (MT; Table 1), while the remaining lots received no internal parasite treatment (C; Table 1). Mineral was offered ad libitum from covered "weather vane" type mineral feeders. Pastures were stocked with either 1.5 steer/acre from April 8 to June 24 for the early-intensive (EI) treatment or at 1.0 steers/acre from April 8 to September 1 for the season-long (SL) treatment. Fecal samples were collected from half of the steers on April 8, May 20, June 24, and September 1, and fecal nematode egg counts were determined.

Exp. 3.

Eighty mixed crossbred steers were allotted randomly by weight to one of eight lots of 10 head each. The lots were allotted randomly such that three lots received a single injection of levamisole (L), three lots received sustained-release trilaminate containing morantel tartrate (MSRT), and two lots received no deworming treatment (C). All cattle were vaccinated against eight strains of Clostridial organisms, IBR, PI_3, BVD, and 5 strains of Leptospirosis, and implanted with Synovex-S. Each lot was then allotted randomly to one of eight 5-acre bermudagrass pastures which they continuously grazed for 140 days from May 11 to September 29. Fecal samples were collected from the steers on May 11, August 3, and September 29 for fecal nematode count determination.

Results

Exp. 1.

Total gain and average daily gain were similar among groups of steers offered different mineral mixtures (Table 2). Fecal parasite counts were lower from cattle consuming mineral with morantel tartrate (MT and CM-MT) than from those consuming unmedicated mineral mixtures (C and CM). Consumption of CM was greatest ($P<.05$), followed by CM-MT, indicating an intake stimulation from the addition of molasses but an intake suppression from the addition of morantel tartrate in this type of mineral mixture. Consumption of MT also tended to be lower than that of C but differences were not statistically ($P<.10$) different. At these levels of consumption, average morantel tartrate ingestion was 128 and 335 mg daily from MT and CM-MT, respectively.

Exp. 2.

Steers grazing EI pastures were removed on June 24. At that time, steers grazing SL pastures were 15 lb heavier (P<.05) than EI steers (Table 2). The SL steers gained 33 lb during the grazing period between June 24 and September 1, such that those steers were 49 lb heavier (P<.05) on September 1 than EI steers had been on June 24.

Steers grazing EI pastures produced 95 lb more (P<.05) beef per acre by June 24 than steers on SL pastures (Table 3). Even though SL pastures were grazed 70 days longer, gain/acre on September 1 was still 62 lb greater (P<.05) from EI pastures.

Mineral consumption was similar (P>.10) between both main effects of deworming treatment and stocking rate.

Parasite treatment had no effect (P>.10) on animal performance, whether expressed on a per animal or per acre basis. This was possibly due to the relatively low nematode infestations observed throughout this study (Table 4). Statistical differences in nematode egg counts were detected (P<.10) between MT and C on May 20 and June 24, but the infestation in the C steers was still quite low. Morantel tartrate consumption ranged from 296 mg/head/day for week 1 to 494 mg/head/day for week 7 and was not affected by stocking rate.

Exp. 3.

No significant differences were detected for animal performance parameters (Table 5). Deworming cattle with levamisole numerically (P>.10) improved animal gain by 14.9%, whereas deworming with the MSRT numerically (P>.10) improved animal gain by 11.2%.

Fecal internal parasite egg counts were similar (P>.10) across all treatments on May 11 and August 3. On September 29, egg counts from cattle receiving levamisole were lower (P<.10) than those from of cattle receiving no parasite treatment. Egg counts from cattle receiving MSRT were similar (P>.10) to those from both levamisole and control groups.

These data indicate that parasite infestation in cattle during dry years such as 1988 may not be sufficient to adversely affect performance. However, the data give no indications of the expected response of cattle to deworming programs during years of adequate or above average rainfall.

Table 1. Formulation of Mineral Mixtures Offered to Stocker Steers Grazing Smooth Bromegrass in Exp. 1 and 2.

Ingredient	Treatment			
	C	MT	CM	CM-MT
	%			
Trace mineral salt	75.00	72.84	67.50	65.56
Dicalcium phosphate	25.00	24.28	22.50	21.85
Dried cane molasses			10.00	9.71
Rumatel 88 premix (88g morantel tartrate per lb.)		2.88		2.88

Table 2. Performance and Mineral Consumption by Steers Offered Mineral Mixtures with and without Morantel Tartrate or Dried Molasses (Exp. 1) (56 days).

Item	Treatment			
	C	MT	CM	CM-MT
Initial wt., lb.	555	553	556	560
Final wt., lb.	636	622	620	629
Total gain, lb.	81	69	65	69
Daily gain, lb.	1.46	1.23	1.16	1.24
Fecal parasite eggs/g				
November 10	25.5[c]	46.3[b]	101.5[a]	20.7[c]
January 5	92.0[a]	35.7[b]	93.0[a]	19.3[b]
Daily mineral consumption, g	35[c]	23[c]	143[a]	60[b]

[a,b,c]Means within a row with unlike superscripts differ ($P<.10$).

Table 3. Performance and Mineral Consumption by Steers Stocked at 1.0 or 1.5 Steers/acre and Offered a Control Mineral Mixture or One Containing Morantel Tartrate. (Exp. 2) (56 days)

Item	Treatment[a] MT	C	Stocking Rate 1.0	1.5
Cattle weights, lb				
April 8	569	571	570	570
June 24[b]	802	799	808	793
September 1[b]	818	816	842	793
Cattle gains, lb				
April 8 - June 24[c]	233	227	238	222
April 8 - Sept. 1[b]	249	245	271	222
Cattle gains, lb/acre				
April 8 - June 24[b]	289	282	238	333
April 8 - Sept. 1[b]	305	299	271	333
Mineral consumption				
April 8 - June 24	69.4	63.8	59.3	74.0

[a]MT = morantel tartrate; C = control.
[b]Stocking rate effects were statistically different (P<.01).
[c]Stocking rate effects were statistically different (P=.015).

Table 4. Nematode Eggs from Steers Stocked at 1.0 Or 1.5 Steers/acre and Offered a Control Mineral Mixture or One Containing Morantel Tartrate. (Exp. 2)

Stocking rate	1.0		1.5	
Treatment	C	MT	C	MT
Item				
April 8	.1	.1	.1	0.0
May 20	33.5[b]	14.9[c]	36.2[b]	8.6[c]
June 24	37.6[b]	5.6[c]	49.3[b]	3.6[c]
September 1	16.6	25.1		

[a]MT = morantel tartrate; C = control.
[b,c]Means within a row bearing unlike superscripts differ (P<.01).

Table 5. Performance of Stocker Cattle Dewormed with Levamisole or a Morantel Tartrate Sustained Release Trilaminate[a]. (56 days)

Item	Control	Levamisole	MSRT
Initial wt, lb.	584	584	585
Final wt., lb.	745	769	764
Gain, lb.	161	185	179
Gain, lb/day	1.14	1.31	1.27
Fecal parasite eggs/g			
May 11	203	61	77
August 3	30	14	18
September 29	51[a]	24[b]	47[ab]

[a,b]Means within the same row with unlike superscripts differ (P<.10).

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

ALFALFA VARIETY PERFORMANCE IN SOUTHEASTERN KANSAS

Joseph L. Moyer

Summary

Despite dry growing conditions in much of 1988, alfalfa yields were relatively high. Yields of the cultivar '630' were higher than those of any other cultivar in 1988, giving it the highest 3-year total production. 'Endure' and KS196 continued to perform well, whereas relative production of other varieties was less consistent.

Introduction

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

Experimental Procedure

The 15-line test was seeded (12 lb/acre) in April, 1986 at the Mound Valley Unit. Plots were sprayed with Lorsban (1.5 pt/acre) on April 19, 1988 to control a moderate but increasing weevil population. Five harvests were obtained in 1988, after plots were fertilized with 0-40-150 lb/acre of N-P_2O_5-K_2O on September 2, 1987.

Results

Forage yields for each of the five cuttings and total 1988 production are shown in Table 1. Yields were excellent in 1988, ranging from 7.22 to 8.92 tons/acre (12% moisture), despite periods of extreme drought. Good, uniform stands were maintained in 1988, with only minor infestations of crabgrass in the third and fourth cuttings. One cultivar, '630', produced more forage than any other in 1988, and 'Arrow' yielded significantly ($P<.05$) more than the two lowest-yielding cultivars, K82-21 and 'Riley'. 'Southern Special' and 'Endure' also outproduced K82-21 in 1988.

Total 3-year forage production (Table 2) of the top-yielding cultivar, 630, was significantly greater than production of 10 other cultivars in the test. Five high-yielding cultivars produced significantly more forage than the two that yielded least, K82-21 and Riley. Endure has performed well in all 3 years of the test; WL-320 and KS196 performed well in the first 2 years, but were average in production this year; K82-21 and 655 performed well only the first year of the test.

Table 1. 1988 Forage Yield of Alfalfa Varieties, Mound Valley Unit, SEK Station.

Source	Variety	Harvest Dates				
		5/9	6/15	7/14	8/22	11/2
		- - - - - tons/acre @ 12% moisture - - - - -				
USDA-KSU	KS196 EXP	3.26bcde[1]	1.19abcd	0.74a	1.14a	1.50b
Waterman-Loomis	WL-320	3.06def	1.21abcd	0.86a	1.15a	1.54ab
PAG Seeds	Endure	3.48bcd	1.16abcde	0.74a	1.05a	1.50b
Garst	636	3.58ab	1.03e	0.70a	1.04a	1.44b
Garst	630	3.91a	1.20abcd	0.86a	1.16a	1.78a
Waterman-Loomis	South. Spec.	3.20bcdef	1.23abcd	0.85a	1.10a	1.62ab
Cargill	EXP 339	3.14cdef	1.22abcd	0.75a	1.10a	1.48b
USDA-KSU	Riley	3.16bcdef	1.10de	0.66a	1.02a	1.35b
Agripro	Arrow	3.52bc	1.16abcde	0.72a	1.16a	1.51b
Agripro	Dart	3.25bcde	1.13bcde	0.83a	1.16a	1.52b
Asgrow/O's Gold	Eagle	3.10cdef	1.12cde	0.82a	1.16a	1.40b
Great Plains Res.	Cimarron	3.13cdef	1.28ab	0.84a	1.16a	1.38b
USDA-KSU	K82-21 EXP	2.79f	1.20abcd	0.77a	1.04a	1.43b
Garst	655	2.93ef	1.32a	0.81a	1.14a	1.53ab
USDA-KSU	Kanza	3.11cdef	1.27abc	0.79a	1.15a	1.40b
	Average	3.24	1.19	0.78	1.11	1.49
	LSD(.05)	0.37	0.14	NS	NS	NS

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

Table 2. 3-Year Forage Yield of Alfalfa Varieties, Mound Valley Unit, SEK Station.

Source	Variety	Year 1986	Year 1987	Year 1988	TOTAL
		- - - - tons/acre @ 12% moisture - - -			
USDA-KSU	KS196 EXP	3.86abc[1]	8.44a	7.82bcd	20.12ab
Waterman-Loomis	WL-320	3.78abc	8.10ab	7.83bcd	19.70abcde
PAG Seeds	Endure	4.07a	8.01ab	7.94bc	20.01abc
Garst	636	3.50c	7.88bc	7.78bcd	19.16bcde
Garst	630	3.64abc	7.88bc	8.92a	20.44a
Waterman-Loomis	Southern Special	3.96ab	7.84bc	7.99bc	19.78abcd
Cargill	EXP 339	3.56bc	7.83bc	7.69bcd	19.08bcde
USDA-KSU	Riley	3.72abc	7.70bc	7.29cd	18.71de
Agripro	Arrow	3.58bc	7.74bc	8.03b	19.35bcde
Agripro	Dart	3.72abc	7.65bc	7.92bcd	19.28bcde
Asgrow/O's Gold	Eagle	3.76abc	7.67bc	7.58bcd	19.00cde
Great Plains Res.	Cimarron	3.90abc	7.58bc	7.79bcd	19.26bcde
USDA-KSU	K82-21 EXP	4.04a	7.63bc	7.22d	18.90de
Garst	655	3.96ab	7.46c	7.73bcd	19.15bcde
USDA-KSU	Kanza	3.54bc	7.40c	7.72bcd	18.66e
	Average	3.77	7.79	7.81	19.38
	LSD(.05)	0.38	0.45	0.59	0.91

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

LESPEDEZA INTERSEEDING, LIME, AND P-K FERTILIZATION OF NATIVE GRASS MEADOW

Joseph L. Moyer

Summary

Forage production in 1988 was affected by dry June conditions, so treatment effects on yield were minor. No effects on forage crude protein content were found. The good late-summer grass and lespedeza regrowth may increase the likelihood of detecting legume effects in 1989.

Introduction

Hay production from native meadow has been increased by small amounts of nitrogen (N). However, returns from fertilization do not always cover the cost, and fertilization can encourage undesirable species. Since native hay is usually low in nutrients such as protein and minerals, legumes in the stand could add N for grass growth and improve overall forage quality. This study was established to determine whether lime and/or P-K fertilization would promote legume establishment, production, and native forage yield and quality.

Experimental Procedure

Lime was applied to designated plots on March 19, 1980 at 2400 lb ECC/acre. Fertilizer sufficient to provide 40 lb/acre each of P_2O_5 and K_2O was applied in April, 1980. Legumes were broadcast-seeded in 1981, but dry spring weather prevented stand establishment. In 1987 and 1988, the plot area was burned on April 9 and 7, respectively. Seeding was performed with a no-till plot seeder using a rate of 20 lb/acre on April 21 and 20 in 1987 and 1988, respectively. Common Korean lespedeza seed was obtained locally, and Ark S-100 seed was obtained from Dr. Beuselinck at the University of Missouri. Plots were harvested with a flail mower (3'x 20' strip) on June 29, 1988. Subsamples of the chopped forage were collected for moisture and crude protein determinations.

Results

Fertilization with P and K in 1980 had mixed effects on native grass forage production in 1988 (Table 1). Plots seeded with Ark S-100 that received no P-K fertilizer yielded significantly less than Ark S-100 plots that had received P and K. Plots seeded with Korean lespedeza appeared to follow the same trend, but unseeded plots did not. Liming increased yields only where P-K fertilizer was applied. No differences in forage crude protein content were detected among treatments.

The low amount of lespedeza produced early in 1988 was not sufficient to affect forage quality and also indicates that little N was fixed. Late-summer and early-fall regrowth of grass and legumes was not harvested, so the carryover effect may be greater in 1989 than in previous years. Thus, legumes will be seeded for another year to check for N-fixation effects.

Table 1. Forage Production and Crude Protein Content of Native Meadow with or without P-K Fertilization as Affected by Lime and Lespedeza Interseeding.

Treatment	Forage Production		Crude Protein	
	No P-K	0-40-40	No P-K	0-40-40
	- tons/A @ 12% moist.-		- - - - % - - - -	
<u>Legume Interseeding</u>				
None	1.39	1.28	5.1	4.7
Korean	1.26	1.37	4.7	4.8
Ark S-100	1.20	1.41	4.9	4.8
LSD(0.05)	0.16		NS	
<u>Lime</u>				
None	1.33	1.32	4.9	4.8
2400# E.C.C.	1.23	1.39	4.8	4.7
LSD(0.05)	0.13		NS	

FORAGE YIELDS OF TALL FESCUE VARIETIES IN SOUTHEASTERN KANSAS

Joseph L. Moyer

Summary

In the second harvest year of the test, 'Phyter' and 'MO 96' were the only cultivars that produced more first-cut forage than average at an earlier-than-average maturity. 'Kenhy' was higher in second-cut yield than all but Phyter and Ky 31. Total 1988 production was highest in Phyter, Kenhy, and Ky 31, and lowest in 'Stef'.

Introduction

Tall fescue is the most widely grown forage grass in southeastern Kansas. New and old cultivars were compared for agronomic adaptation and forage quality, since effects of variety chosen for a new seeding will be felt for as long as the stand exists.

Experimental Procedure

Plots were seeded on September 4, 1986 at 20 lb/acre at the Mound Valley Unit, ostensibly with seed free of <u>Acremonium coeniphialum</u> endophyte. Plots were 30 x 7.5 ft each, in four randomized complete blocks. Application of 120 lb N/acre was made on January 19, 1988, following fertilization with N-P-K in the previous fall. Plots were cut on May 9 and November 3, 1988. A subsample from each plot was collected for moisture determination.

Results

In the first cutting, 'Fawn' yielded significantly more than 'Stef', 'Johnstone', and 'Kenhy' (Table 1). Three cultivars that ranked highest in maturity (degree of heading) were three of the top four in first-cut yields. The exception was 'Phyter', which ranked third in yield, but was significantly less mature than 'Triumph', 'Forager', and Fawn. Kenhy and Stef appeared relatively late-maturing, and had lowest first-cut yields. By the second cutting, Kenhy was the highest-yielding, producing significantly more than three-fourths of the other cultivars. For the year, Phyter and Kenhy produced significantly more forage than Stef and Johnstone. Two years' production was significantly higher from Kenhy than from Stef, Johnstone, and 'Mozark'. Six cultivars yielded more than Johnstone, and it was the only cultivar that failed to exceed Stef in 2-year production.

Table 1. Second-year (1988) Forage Yield (@12% moisture) and Maturity and 2-Year Yield of Tall Fescue Varieties, Mound Valley Unit, Southeast Kansas Branch Experiment Station.

Variety	Cut 1		Forage Yield		
	Yield	Maturity Rating	Cut 2 (11/3)	1988 Total	2-Year Total
	tons/acre	(0-5)*	- - - - - tons/acre - - - - -		
Kenhy	2.84bcd	1.50e	3.16a	6.00a	14.86a
Mo-96	3.20ab	1.75e	2.22bc	5.42ab	14.30ab
Forager	3.49ab	4.75a	2.25bc	5.74ab	14.56ab
ISI-TTFL	3.20ab	4.00ab	2.08c	5.28abc	13.99abc
Phyter	3.38ab	2.25de	2.74ab	6.13a	14.64ab
Martin	3.28ab	3.00cd	2.36bc	5.64ab	14.08ab
Festorina	3.03abc	2.00e	2.59abc	5.62ab	14.06ab
Triumph	3.32ab	4.50ab	2.14bc	5.45ab	13.84abcd
Fawn	3.58a	4.25ab	2.16bc	5.74ab	13.82abcd
Ky-31	3.10abc	1.75e	2.64abc	5.74ab	13.77abcd
Johnstone	2.50cde	1.75e	2.28bc	4.78bcd	12.72cde
Mozark	3.27ab	3.75bc	2.36bc	5.63ab	13.38bcd
Stef	2.20e	1.50e	2.30bc	4.50cd	11.75e
Average	3.11	2.83	2.40	5.51	13.74
LSD($_{.05}$)	0.56	0.89	0.53	0.84	1.13

*Degree of heading, where 0 denotes none and 5=100% headed.

BIG BLUESTEM CULTIVAR EVALUATION

Joseph L. Moyer

Summary

Forage productivity and quality, seed production, and other adaptive traits were measured on four big bluestem cultivars. Forage production was similar among the entries, averaging about 1.9 tons/acre from two cuttings in 1988. Forage quality in terms of 1987 crude protein and neutral-detergent fiber (NDF) was also similar among cultivars. 'Pawnee' produced significantly less seed in 1988 than the other three cultivars.

Introduction

Warm-season, perennial grasses are needed to fill a production void left by cool-season grasses in certain forage systems. Reseeding improved varieties of certain native species, such as big bluestem, also could help fill the summer production "gap." This test compared old and new cultivars for several agronomic and adaptive traits.

Experimental Procedure

Big bluestem was seeded with a cone planter in 12-inch rows on June 20, 1985 at 12 lb PLS/acre in four randomized blocks. Stand counts, plant heights, and other seedling measurements were taken after the first growth season, the center rows were cut twice in 1986 and on June 29, 1987 for forage production, and culms from the outside rows were counted and threshed for estimation of seed production. In 1988, forage was harvested from the plots on June 28 and August 22, and seed was harvested on September 30.

Results

Forage yields, crude protein content, and neutral-detergent fiber (NDF) from the big bluestem cultivar test are shown in Table 1. 'Kaw' ranked highest in first-cut and total 1988 yield, but no differences were significant (P>.05). Crude protein and NDF contents did not vary in the cutting obtained in 1987. Seed production in 1988 was lower for 'Pawnee' than for the other big bluestem cultivars (Table 1). Stands after 4 years were similar for the cultivars, averaging 70% (data not shown).

Table 1. Big Bluestem Varieties: 1988 Forage and Seed Production and Crude Protein and IVDMD of 1987 Forage.

Entry	1988 Production			1987 Analyses	
	Forage				
	Cut 1	Cut 2	Seed	C.P.	IVDMD
	- - tons/a - -		lb/acre	- - - % - - -	
Rountree	1.08	0.79	143	5.20	55.7
Kaw	1.32	0.76	153	5.38	56.0
TO4237	1.22	0.66	145	5.15	55.9
Pawnee	1.14	0.75	106	5.45	56.6
LSD(0.05)	NS	NS	36	NS	NS
Average	1.19	0.74	137	5.29	56.1

EFFECTS OF FLUID FERTILIZER PLACEMENT AND TIMING ON TALL FESCUE AND BROMEGRASS YIELD

Joseph L. Moyer and Daniel W. Sweeney

Summary

Both fescue and bromegrass responded with increased forage yield to N fertilization at rates up to 150 lb/a. Split N application of 2/3 in fall and 1/3 in spring resulted in the highest 1988 yield for both species, even though timing did not affect yields in 1987. Knife applications tended to result in higher yields than broadcast applications, with dribble applications resulting in intermediate yield values.

Introduction

Several million acres of seeded cool-season grasses exist in eastern Kansas, mostly tall fescue and smooth bromegrass pastures. Much of the cool-season grass in southeastern Kansas has been in long-term production and continually fertilized by top-dressing. This study was initiated in 1986 to determine how yield of tall fescue and smooth bromegrass is affected by 1) timing of N application, 2) method of fluid N application as either broadcast, dribble, or knife at 4", and 3) N rates of 75 and 150 lb/a.

Experimental Procedure

Nitrogen fertilization timing schemes were 1) 100% of the N applied in the fall, 2) 100% of the N applied in the spring or split N applications consisting of 3) 67% of the N in fall and 33% of the N in spring, and 4) 33% of the N applied in fall and 67% of the N in spring. Target application dates were late Oct. or early Nov. for the fall UAN (urea-ammonium nitrate solution - 28% N) fertilization, whereas spring N applications were in mid-March. Dribble and knife spacings were 15 inches. Uniform broadcast applications of 39 lb P_2O_5/a and 77 lb K_2O/a were made each fall immediately preceeding N application. A 3 ft x 20 ft area was harvested in mid-May.

Results

Tall fescue or bromegrass yields were not affected by timing of N application in 1987 (Table 1). However, in 1988, fescue and bromegrass yields were affected by timing, with highest yields obtained with two-thirds of the N applied in the fall and one-third in the spring. Knife applications resulted in 0.28 to 0.71 ton/a higher yields than broadcast for fescue and bromegrass in both years. Knife applications also resulted in higher yield than dribble application for fescue, whereas dribble and knife applications for bromegrass were not significantly different in 1987. Increasing the N rate from 75 to 150 lb/a increased fescue and bromegrass yields by approximately 0.5 ton/a in 1987 and 1988. However, in both years, a 0.73 to 1.25 ton/a yield increase over the check was obtained when 75 lb N/a was applied. A three-way interaction of timing, method, and N rate for fescue yield in 1988 suggested, especially at the 150 lb N/a rate, that yield was increased by knife as compared to surface applications in systems including fall applications, whereas knifing in the spring did not increase yields above those with surface applications.

Table 1. Effect of Fluid N Rate, Placement and Time of Application on Tall Fescue and Smooth Bromegrass Yields.

Treatment	Yield @ 12% moisture			
	Fescue		Bromegrass	
	1987	1988	1987	1988
	------------ton/a-----------			
Timing				
100% of N in fall	2.36	2.93	2.42	3.58
67% of N in fall - 33% of N in spring	2.54	3.01	2.62	3.97
33% of N in fall - 67% of N in spring	2.46	2.77	2.59	3.56
100% of N in spring	2.43	2.55	2.71	3.61
LSD (0.05)	NS	0.23	NS	0.30
Method				
Broadcast	2.29	2.66	2.41	3.36
Dribble	2.43	2.76	2.65	3.61
Knife	2.62	3.02	2.69	4.07
LSD (0.05)	0.15	0.20	0.23	0.26
N Rate (lb/a)				
75	2.18	2.50	2.34	3.44
150	2.72	3.13	2.83	3.92
LSD (0.05)	0.12	0.16	0.19	0.21
Interaction(s)	NS	TxMxR	NS	NS
Check[1]	1.32	1.25	1.61	2.28

[1]Not included in the 4x3x2 factorial analyses.

EFFECTS OF SULFUR RATE, METHOD, AND SOURCE ON TALL FESCUE[2]

Daniel W. Sweeney and Joseph L. Moyer

Summary

Fluid S additions had little effect on tall fescue yield in 1988, however, some quality parameters were improved. Final fescue forage was approximately 1 ton/a more with knifing as compared to surface applications, although quality tended to decrease.

Introduction

Since sulfur is a necessary element for both plant and animal growth, sulfur fertilization not only may benefit forage growth but may improve animal performance. Tall fescue is one of the major forages in southeastern Kansas, as well as in other parts of the country. Thus, this research was initiated to evaluate the effect of fluid S rate, method of application, and source on yield and quality of tall fescue.

Experimental Procedure

The experiment was established in spring 1988 at an off-station site (Terry Green farm). Factors included 0 lb S/a compared with 15 and 30 lb S/a as ammonium sulfate and ammonium thiosulfate. Methods of application were broadcast, dribble, and knife. Spacing for dribble and knife applications was 15 inches. Nitrogen was balanced to 150 lb N/a with UAN. Uniform broadcast applications of 77 lb P_2O_5/a and 84 lb K_2O/a were made to all plots.

Approximately 3 weeks after fertilization, forage samples, termed intermediate harvests, were clipped from an 18" by 84" subplot (1 m^2) within each plot. Final forage production was harvested near full bloom from a 3' by 20' area.

[2] Research is partially supported by grant funding from the Fluid Fertilizer Foundation, Texas Sulphur Products Co., and The Sulphur Institute.

Results

Intermediate harvest yields were not affected by rate of sulfur, when applied as ammonium sulfate (Table 1). However, the application of 30 lb S/a as ammonium thiosulfate resulted in a 15% increase in early forage yield as compared to 15 lb S/a or no sulfur. Sulfur rate did not affect N concentration or NDF values in the intermediate harvest. However, the addition of S did increase S concentration in the plant.

Intermediate yields, N concentrations, and S concentrations tended to be lower with knife applications than with dribble or broadcast (Table 1). However, knife applications tended to increase NDF values when the S source was ammonium sulfate. Increased NDF values may be related to decreased digestibilty for animals.

Rate of sulfur application, regardless of source, did not significantly affect final yield (Table 2). Increasing S rate resulted in increased S concentrations in the final harvest. However, with ammonium thiosulfate, NDF values were significantly decreased with increasing S rate.

Knife applications resulted in approximately 1 ton/a higher yield than either broadcast or dribble regardless of S source (Table 2). However, S concentrations were lower and NDF values were higher with knife applications. Thus, even though yield was increased with knife applications, selected quality parameters declined.

Table 1. Effect of S Rate and Method of Application on Intermediate Forage Yield, N, S, and Neutral-detergent Fiber (NDF) Content of Tall Fescue Fertilized with Ammonium Sulfate (AS) and Ammonium Thiosulfate (ATS).

Treatment	Yield		N		S		NDF	
	AS	ATS	AS	ATS	AS	ATS	AS	ATS
	-- ton/a --		---- % ----		--- ppm ---		---- % ----	
Rate (lb/a)								
0	0.92	0.92	2.49	2.49	1630	1630	58.5	58.5
15	0.99	0.93	2.45	2.71	1840	2310	58.1	56.1
30	0.93	1.07	2.49	2.53	2010	2130	58.4	58.8
LSD (0.05)	NS	NS	NS	NS	NS	420	NS	NS
LSD (0.10)	NS	0.11	NS	NS	280	340	NS	NS
Method								
Broadcast	0.93	1.03	2.54	2.65	2020	2370	56.9	58.4
Dribble	1.08	1.00	2.59	2.60	2110	2170	57.0	56.5
Knife	0.83	0.89	2.31	2.47	1340	1530	61.1	58.5
LSD (0.05)	0.15	NS	0.23	NS	330	420	2.9	NS
RxM Interaction	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Effect of S Rate and Method of Application on Final Forage Yield, N, S, and Neutral-detergent Fiber (NDF) Content of Tall Fescue Fertilized with Ammonium Sulfate (AS) and Ammonium Thiosulfate (ATS).

Treatment	Yield		N		S		NDF	
	AS	ATS	AS	ATS	AS	ATS	AS	ATS
	-- ton/a --		---- % ----		--- ppm ---		---- % ----	
Rate (lb/a)								
0	3.94	3.94	1.63	1.63	1070	1070	67.6	67.6
15	3.72	3.86	1.73	1.67	1420	1430	66.7	66.0
30	3.88	3.71	1.74	1.74	1600	1680	67.2	64.5
LSD (0.05)	NS	NS	NS	NS	170	200	NS	1.5
Method								
Broadcast	3.61	3.59	1.70	1.67	1410	1570	65.7	64.4
Dribble	3.48	3.40	1.75	1.73	1480	1450	67.0	66.0
Knife	4.45	4.52	1.65	1.63	1190	1160	68.8	67.7
LSD (0.05)	0.33	0.30	NS	NS	170	200	1.7	1.5
RxM Interaction	NS	NS	NS	NS	NS	NS	NS	NS

EFFECT OF LEGUMES ON SUBSEQUENT GRAIN SORGHUM YIELD IN CONSERVATION TILLAGE SYSTEMS

Daniel W. Sweeney and Joseph L. Moyer

Summary

Previous legume crops increased grain sorghum yields at two sites in the first year after the legume (1987) but not in the second year (1988). Similarly, tillage affected yields in 1987 but not in 1988. In the first year after the legumes, N application rate did not affect yields; however, yields tended to increase with N rate in 1988.

Introduction

This study was initiated to evaluate the use of spring-seeded (red clover) and fall-seeded (hairy vetch) legumes in reduced and no-tillage systems on subsequent grain sorghum production. Nitrogen rates from 0 to 120 lb/a were applied in each system to estimate the N contribution from the legumes.

Experimental Procedure

The experiment was a split-split plot arrangement of a randomized complete block design with three replications. The whole plots were previous crop: red clover, hairy vetch, or grain sorghum. The first split was tillage system: reduced tillage or no tillage. The second split was N rates of 0, 30, 60, 90, and 120 lb/a. The experiment was conducted on two adjacent sites at the Parsons Field of the Southeast Kansas Branch Experiment Station. Site 1 had 24 lb available P per acre and 160 lb available K per acre, whereas Site 2 had 8 lb available P per acre and 120 lb available K per acre in the surface soil zone. Site 1 was plowed from native grass in spring 1979, whereas Site 2 was plowed from native grass in fall 1983. To establish the previous crop for subsequent grain sorghum production, red clover was planted on March 21, 1986, grain sorghum was planted on June 17, 1986, and hairy vetch was planted on September 10, 1986. No-till plots in the red clover and hairy vetch areas were sprayed with 1 qt/a of glyphosate and 3 pt/a of 2,4-D ester in May, 1987. No-till plots in the previous grain sorghum area were sprayed with 1 qt/a of glyphosate in May. Reduced tillage plots in all previous crop areas were offset disced with one pass in May. Nitrogen as UAN solution (28% N) was dribble applied in

June prior to planting at the rates listed above. Pioneer 8585 grain sorghum seed was planted in all areas at 62,000 seed/a. Plots were established in 1988 as in 1987.

Results

At Site 1, yields of grain sorghum following either red clover or hairy vetch were higher in 1987 than those of grain sorghum following grain sorghum (Table 1). At Site 2, the lower soil P and K fertility site, grain sorghum yields following hairy vetch were 11 bu/a higher than those following red clover; however, this difference was not significant. Both previous legume crop systems resulted in higher yield in 1987 than continuous grain sorghum. However, in 1988, grain sorghum yield was not significantly affected by previous legume crop. At Site 1, though not statistically significant, yields were more than 13 bu/a less with continuous grain sorghum than where legumes were grown in 1986-87. At both sites in 1987, reduced tillage resulted in more than 15 bu/a higher yields than no tillage; however, tillage did not affect grain sorghum yield in 1988. For the first grain sorghum crop to follow the legume systems (1987), nitrogen rate did not significantly affect yields at either site. In contrast, for the second grain sorghum crop to follow the legumes (1988), nitrogen rate tended to increase yields, with no interaction between previous crop and N application rate. Moisture stress in both years likely influenced yield potential in all systems.

Table 1. Effect of Previous Crop, Tillage, and N Rate on Grain Sorghum Yield at Two Sites at the Parsons Field in 1987 and 1988.

Treatment	Yield 1987 Site 1	Yield 1987 Site 2	Yield 1988 Site 1	Yield 1988 Site 2
	------------- bu/a		-------------	
Previous Crop				
Red clover	56.7	39.1	87.2	68.5
Hairy vetch	55.5	50.4	88.6	74.9
Grain Sorghum	27.9	21.9	73.9	69.8
LSD (0.05)	10.4	12.7	NS	NS
Tillage				
Reduced	59.3	45.5	83.3	72.6
No-tillage	34.1	28.8	83.1	69.5
LSD (0.05)	12.7	11.3	NS	NS
N rate (lb/a)				
0	45.0	35.0	77.3	68.7
30	43.9	34.8	80.5	67.1
60	47.3	39.3	81.1	71.5
90	48.2	37.9	86.8	73.3
120	49.1	38.7	90.3	74.6
LSD (0.05)	NS	NS	6.2	4.3
Interaction(s)	NS	NS	NS	NS

EFFECTS OF P AND K RATES AND FLUID FERTILIZER APPLICATION METHOD ON DRYLAND ALFALFA YIELD[1]

Daniel W. Sweeney, Joseph L. Moyer, and John L. Havlin[2]

Summary

Total alfalfa yield was increased by fluid P additions up to 120 lb P_2O_5/a; however, K additions only produced approximately 0.5 ton/a more forage at the first cutting. Preplant dribble and knife applications resulted in approximately 0.7 ton/a more total forage than broadcast.

Introduction

Alfalfa production in Kansas totals approximately 1 million acres. Efficient fertilizer use can result in large economic returns for alfalfa producers. Limited work has been done in Kansas concerning fertilizer options for alfalfa. Therefore, a study was initiated to determine how alfalfa yields are affected by P and K rates and method of fluid fertilizer application.

Experimental Procedure

An on-station site was planted in fall 1987. Background soil P and K levels in the surface 6" were 11 and 120 lb/a, respectively. The treatments were randomized in a complete block with four replications. Two separate analyses (experiments) were made. The first analysis compared liquid fertilizer P rates of 0, 40, 80, and 120 lb P_2O_5/a and K rates of 0, 80, and 160 lb K_2O/a when dribble applied. The second analysis compared broadcast, dribble, and knife (4-inch depth) application methods at P rates of 40 and 80 lb P_2O_5/a and K rates of 0 and 80 lb K_2O/a. Fertilizer applications were made preplant in fall 1987. Three cuttings were taken from a 3 x 20' area of each plot in 1988. A fourth, dormant cut was taken in late fall after fall fertilization in 1988, but is not included in these results.

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[1]Research is partially supported by grant funding from the Fluid Fertilizer Foundation.

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Results

Experiment 1

At the first cutting, significant yield increases were obtained with P and K rates up to 80 lb P_2O_5/a and 80 lb K_2O/a (Table 1). First cutting yields doubled with 80 lb P_2O_5/a as compared to no-P treatments. Though differences in mean yields were small, second and third cutting yields tended to increase with increasing P level, with the 120 lb P_2O_5/a rate resulting in the highest yield. Total yield of the three cuttings increased with increasing P rate. In contrast, except for the first cutting, K rate had no significant effect on alfalfa yield. The number of crowns/m^2 in this new stand was affected by the preplant fertilization. In April, stand count was increased by increasing P rate, with the most notable difference occurring with the first 40 lb P_2O_5/a that was applied. However, by November (after the fall fertilization), P or K rate did not affect plant stand.

Experiment 2

First and second cutting yields, as well as the total were affected by fluid fertilizer placement (Table 2). Dribble and knife applications resulted in more than 0.5 ton/a higher first cut yield than broadcast. Yields from the second and third cuttings were small; thus, final yields were approximately 0.7 ton/a higher with dribble and knifing as compared to broadcast. However, no difference was obtained between dribble and knife applications. First cut and total yields were increased by 80 as compared to 40 lb P_2O_5/a and 80 lb K_2O/a as compared to no K. Even though plant stand in April was not affected by the main effect of fertilization method, an increase in the April plant stand of 50 crowns/m^2 when 80 lb K_2O/a was knifed as compared to no K resulted in a method by K rate interaction (data not shown). However, after the fertilization in fall 1988, plant stand was significantly less with knife applications as compared to the surface application methods.

Table 1. Alfalfa Yield and Plant Stand in 1988 as Affected by P and K Rates of Dribble Applied Fluid Fertilizer.

Treatment	Yield @12% Moisture: Cuttings 1	2	3	Total	Plant Stand 4/5	11/7
	ton/a				crowns/m^2	
P_2O_5 (lb/a)						
0	1.59	0.53	0.73	2.93	189	145
40	2.95	0.64	0.88	4.46	256	170
80	3.46	0.57	0.92	4.95	264	160
120	3.74	0.75	1.06	5.57	290	156
LSD (0.05)	0.31	0.11	0.15	0.46	35	NS
K_2O (lb/a)						
0	2.67	0.63	0.88	4.33	245	159
80	3.11	0.61	0.89	4.55	272	165
160	3.02	0.63	0.90	4.51	232	149
LSD (0.05)	0.26	NS	NS	NS	31	NS
Interaction F Value	NS	NS	NS	NS	NS	NS

Table 2. Alfalfa Yield and Plant Stand in 1988 as Affected by Placement and P and K Rates of Fluid Fertilizer.

Treatment	Yield @12% Moisture: Cuttings 1	2	3	Total	Plant Stand 4/5	11/7
	---------- ton/a			-----------	crowns/m^2	
Placement						
Broadcast	2.57	0.53	0.81	3.90	260	172
Dribble	3.14	0.60	0.88	4.61	270	172
Knife	3.08	0.67	0.92	4.67	273	139
LSD (0.05)	0.27	0.09	NS	0.41	NS	15
P_2O_5 (lb/a)						
40	2.77	0.58	0.83	4.18	265	162
80	3.09	0.61	0.91	4.61	270	160
LSD (0.05)	0.22	NS	NS	0.34	NS	NS
K_2O (lb/a)						
0	2.75	0.60	0.82	4.17	259	158
80	3.11	0.60	0.92	4.62	276	164
LSD (0.05)	0.22	NS	NS	0.34	NS	NS
Interaction(s)	NS	MxP	NS	NS	MxK	NS

EFFECT OF PREVIOUS RESIDUE MANAGEMENT AND N RATE ON YIELDS IN A CONTINUOUS SMALL GRAIN - DOUBLECROP SOYBEAN ROTATION

Daniel W. Sweeney

Summary

The previous residue management for doublecrop soybeans affected subsequent wheat yield in 1988. Where soybeans were grown no-till, wheat yield and grain protein were reduced compared to where the previous residue was burned then disced. Doublecrop soybean yields were low in 1988; however, no tillage resulted in the highest yields.

Introduction

Doublecropping soybeans after wheat or other small grains, such as oats, is practiced by many producers in southeastern Kansas. Several options exist for dealing with straw residue from the previous small grain crop. The method of managing the residue may affect not only the doublecrop soybeans but also the following small grain crop. Wheat (or oat) residue that is not removed by burning or is not incorportated before planting soybeans may result in immobilization of N applied for the following small grain crop (usually wheat). Therefore, an additional objective of this study was to observe whether an increase in N rate, especially where doublecrop soybeans were grown with no tillage, could increase small grain yields.

Experimental Procedure

Three wheat residue management systems for doublecrop soybeans with three replications were established in spring 1983: no tillage, disc only, and burn then disc. After the 1983 soybean harvest, the entire area was disced, field cultivated, and planted to wheat. Before field cultivation, 6-24-24 was broadcast in all areas. In spring, urea was broadcast as a topdressing to all plots so that the total N rate was approximately 80 lb N/a. Wheat yield was determined in areas where the three residue management systems were imposed previously. In spring 1985, residue management plots were split, and two topdress N rates were applied for wheat. These two rates were added to give total yearly N applications of approximately 80 and 130 lb N/a. These residue management and total N rate treatments were continued through 1988.

Results

Wheat grown where soybeans were no-till doublecropped in 1987 yielded over 7 bu/a less than wheat in areas where 1987 wheat straw was burned, then disced before planting the doublecrop soybeans (Table 1). Increasing the N rate lowered wheat yield by 5 bu/a. No interaction between wheat residue management system and N rate was measured.

Wheat grain protein was reduced ($p<0.10$) in previous no-tillage areas as compared to areas that were burned, then disced for doublecrop soybeans (Table 1). In contrast to yield, grain protein was increased by the higher N rate.

Soybean yields were low in 1988 because of sparse rainfall (Table 1). No tillage resulted in the highest yields, whereas soybean yields in the burn system were less than 2 bu/a. Even though not measured, these yield differences were likely related to soil moisture, as evidenced by visual stress in the burn treatments. Residual N from applications to the wheat did not affect soybean yields.

Table 1. Wheat Yield and Protein Content and Soybean Yield in 1988 as Influenced by Previous Residue Management and N Application Rates.

Treatment	Wheat Yield	Wheat Grain Protein	Soybean Yield
	-bu/a-	-%-	-bu/a-
Wheat residue mgt.			
Burn, then disc	57.6	14.3	1.1
Disc only	53.0	13.1	2.9
No-tillage	49.9	12.1	6.3
LSD 0.05	4.8	NS	2.1
LSD 0.10	3.7	1.5	1.6
N Rate (lb/a)			
83	55.9	12.3	3.2
129	51.0	13.9	3.6
LSD 0.05	4.6	0.6	NS
Interaction	NS	NS	NS

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

Daniel W. Sweeney

Summary

In 1988, the sixth cropping year of a grain sorghum - soybean rotation, tillage systems or residual N fertilization did not affect soybean yields.

Introduction

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

Experimental Procedure

A split-plot design with four replications was initiated in 1983, with tillage systems as whole plots and N treatments as subplots. The three tillage systems were conventional, reduced, and no tillage. The conventional system consisted of chiseling, discing, and field cultivation. The reduced tillage system consisted of discing and field cultivation. Glyphosate was applied each year at 1.5 qt/a to the no-till areas. The four nitrogen treatments for the 1983, 1985, and 1987 grain sorghum were a) zero N applied, b) anhydrous ammonia knifed to a depth of 6 inches, c) broadcast urea-ammonium nitrate (UAN - 28% N) solution, and d) broadcast solid urea. N rates were 125 lb/a. Harvests were collected from each subplot for both grain sorghum and soybean crops, even though N fertilization was applied only to grain sorghum.

Results

No significant differences related to tillage or residual N fertilization were found for soybean yield in 1988 (data not shown). The test average yield was 21.7 bu/a.

SOIL COMPACTION EFFECTS ON SOYBEAN AND GRAIN SORGHUM AND SELECTED SOIL PROPERTIES[1]

Daniel W. Sweeney, James B. Sisson[2], and Mary Beth Kirkham[2]

Summary

In the first two years of this study, the soil compaction regimes used did not affect yields of either soybean or grain sorghum.

Introduction

Claypan soils are typical in southeastern Kansas. Though some variation occurs, these soils have approximately 1 ft of silt loam overlying 3 ft or more of silty clay. Therefore, mechanical operations that affect the top 12" of soil may significantly impact plant growth and crop production. Soil compaction is one possible consequence of tillage and harvesting operations. Thus, the objective of this experiment was to determine the long-term effect of selected compaction systems on soybean and grain sorghum growth and yield and on soil properties.

Experimental Procedure

The experiment was established at the Columbus Field of the Southeast Kansas Branch Experiment Station in 1987. Five compaction systems comprised the whole plots of a split-plot experimental design. The compaction regimes include 1) entire area compacted, 2) wheel track compaction, 3) wheel track compaction that has received a subsequent chisel operation, 4) wet disc operation, and 5) no intentional compaction. Subplots were two soybean varieties, Williams 82 and Bay, and one grain sorghum variety, Pioneer 8585. Plots were compacted in the spring each year by use of a four-wheel drive tractor with a total weight of 18,640 lb in 1987 and 20,140 lb in 1988. Double passes in the same track were made by the tractor. In addition, since the tire width was 20", side-by-side, double-passed tracks were used to

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[1] Research is partially supported by grant funding from the Kansas Soybean Commission.

[2]Dept. of Agronomy, KSU.

make a 40" compacted area. These tracks were made perpendicular to the subsequent row planting. The chisel operation for designated wheel track treatments was done perpendicular to the wheel tracks in April at a depth of 8" and on a spacing of 12". Wet disc operations were done in May. All plots, including those receiving no intentional compaction, were disced and field cultivated in June prior to planting. Soybeans and grain sorghum were planted in mid-June at approximately 140,000 and 66,000 seeds/a, respectively. Soybeans were fertilized with 153 lb/a of 6-24-24 applied as a side band with the planter. Grain sorghum was fertilized with a blend of 67 lb N/a as urea (46-0-0) and 145 lb/a of 6-24-24 applied as a side band with the planter.

Plots were harvested for yield. Yield components were determined from a sample taken from a 30 x 52" area within the plot. In addition, plant height at maturity, leaf area index, and dry weight were measured. Oxygen diffusion rates at 4" and gravimetric moisture content were measured in the soil.

Results

Even though visual symptoms were apparent by 1988, the compaction systems did not result in statistical differences in yield of soybeans or grain sorghum in 1987 or 1988 or in differences in most of the measured plant and soil parameters in 1987 (data not shown). This study will be continued to determine long-term effects of annual compaction schemes.

EFFECT OF TILLAGE SYSTEMS ON SOYBEAN YIELD[1]

Daniel W. Sweeney, James B. Sisson[2], and Mary Beth Kirkham[2]

Summary

Soybean yield was not significantly affected by tillage system when grown continuous. Soybean yields were affected by a tillage and cultivar interaction when grown in rotation with grain sorghum. At both sites, no tillage tended to result in lowest yields.

Introduction

Southeastern Kansas accounts for approximately one-third of soybean production in the state. Thus, much of Kansas soybean production occurs on claypan soils typical of the area. Though some variation occurs, claypan soils of southeastern Kansas have approximately 1 ft of silt loam overlying 3 ft or more of silty clay. Therefore, mechanical operations such as tillage that affect the top 12" of soil may significantly impact plant growth and crop production. The objective of this study was to determine the effect of six selected tillage systems on soybean yield in continuous monocrop and in rotation with grain sorghum.

Experimental Procedure

The experiment was established at the Mound Valley Field in 1988. Three areas were subdivided from a 9-acre field. The first area is for continuous soybeans, and the second and third areas will be in rotation with grain sorghum, so that soybean information will be collected one year from the second area and in the next year from the third area. The six planned tillage systems included spring plowing, late winter chiseling, spring chiseling, ridge-tillage, reduced tillage, and no tillage. Three cultivars (Williams 82 - Group III; Sparks - Group IV; Bay - Group V) were planted in each tillage system.

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[1] Research is partially supported by grant funding from the Kansas Soybean Commission.

[2]Dept. of Agronomy, KSU.

Results

Tillage system did not affect yields of continuous soybeans (Table 1); however, yields tended to be lower with notillage than with the other systems, whether grown continuously or in rotation with grain sorghum. However, when soybeans were grown in rotation, yields were influenced by an interaction between tillage system and cultivar. Yields were higher for Bay than Sparks, with Williams 82 having intermediate values at both sites. This study will be continued to determine long-term effects of tillage on soybean production.

Table 1. Effect of Selected Tillage Systems on Yield of Soybeans in 1988 Grown Continuously or in Rotation with Grain Sorghum

	Soybean Yield	
Treatment Means	Continuous Soybeans	In Rotation with Grain Sorghum
	----------- bu/a	--------------
Tillage		
Late Winter Chisel	20.4	22.5
Spring Chisel	20.8	23.5
Spring Plow	21.1	21.0
Ridge-tillage	21.6	21.6
Reduced	20.0	21.2
No-tillage	18.5	20.0
LSD (0.05)	NS	NS
Cultivar		
Williams 82	20.7	22.1
Sparks	19.2	20.1
Bay	21.3	22.8
LSD (0.05)	1.5	0.9
Interaction	NS	TxC

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EFFECT OF TIMING OF LIMITED IRRIGATION ON SOYBEANS PLANTED AT TWO DATES

Daniel W. Sweeney and George V. Granade

Summary

In 1987, limited irrigation did not significantly increase the yield of soybeans planted in early or late June. An interaction ($p<0.10$) suggested that during 1987, irrigation may have been more important for late-planted soybeans than for those planted in early June. In 1988, soybean yield was increased by as much as 25% by the addition of limited irrigation.

Introduction

Irrigation of soybeans is not extensive in southeastern Kansas. This is due partly to the lack of large irrigation sources. Limited irrigation, supplied by the substantial number of ponds in the area, could be used to help increase soybean yields. The objectives of this experiment were to determine the optimum reproductive growth stage for irrigation with a limited water supply and to determine if planting date affects soybean responses to irrigation.

Experimental Procedure

An experiment was established in 1987 to determine the effect of four irrigation schemes on yield of three soybean cultivars planted at two dates. The four irrigation schemes were no irrigation, 1" applied at the R1 growth stage (first bloom), 1" applied at the R4 growth stage (pod 0.75" long at one of four uppermost nodes), and 1" applied at R6 growth stage (full-sized green beans at one of the four uppermost nodes). The two planting dates were early and late June. The three soybean cultivars were Crawford, Douglas, and Sparks. All cultivars were seeded at approximately 146,000 seed/a. All areas were fertilized with 112 lb/a of 6-24-24 prior to planting.

Results

In 1987, soybean yield was not significantly affected by irrigation scheme, planting date, or cultivar selection (Table 1) and averaged 38.7 bu/a. An interaction between planting date and variety in 1987 showed that Sparks was little affected by planting date, whereas both Crawford and Douglas yielded approximately 2 to 3 bu/a less when planted in late June rather than in early June. In 1988, the planting date by variety interaction was due to the larger reduction in yield for Douglas planted at the later date than for the other two varieties. An interaction ($p<0.10$) between irrigation scheme and planting date in 1987 suggested that yields of the three cultivars were not affected by irrigation schemes when planted at the early date. However, when the three cultivars were planted in late June, they appeared to respond to the irrigation systems. Yields were increased by 3 to 6 bu/a when the soybeans received 1" of irrigation at the R1 and R6 reproductive growth stages, as compared to either no irrigation or irrigation at the R4 stage (data not shown). Even though rainfall occurred sporadically in 1987, the yields suggest that moisture stress periods were minimal. In contrast, yields were lower in 1988 and were likely influenced by dry conditions. Thus, soybean yields were 2.5 to 4.1 bu/a higher with than without irrigation in 1988. In addition, early June planting and Sparks soybeans resulted in higher yield than late planting and Crawford and Douglas varieties.

Table 1. Effect of Timing of Limited Irrigation on Yield of Soybean Planted at Two Dates in 1987 and 1988.

Treatment Means	Yield 1987	Yield 1988
	------ bu/a	------
Irrigation by growth stage		
None	36.8	16.4
R1	39.6	18.9
R4	38.3	20.0
R5	39.9	20.5
LSD (0.05)	NS	2.3
Planting Date		
Early June	39.4	20.1
Late June	37.9	17.9
LSD (0.05)	NS	1.6
Cultivar		
Crawford	38.9	18.1
Douglas	38.4	18.6
Sparks	38.7	20.2
LSD (0.05)	NS	0.9
Interaction(s)	P x C I x P (0.10)	P x C

PERFORMANCE TESTING OF SMALL GRAIN VARIETIES

George V. Granade and Ted Walter[1]

Summary

Winter wheat and barley were planted in early October, 1987, and spring oats and spring wheat were planted in early March, 1988. Winter wheat was harvested in June with an average yield of 71 bu per acre. Winter barley had an average yield of 89 bu per acre. The spring small grains were harvested in late June. Spring oat varieties, Ogle and Bates, had the highest yields. Yields of spring wheat were much lower than those of winter wheat. The spring wheats do not appear very promising because of the warm humid conditions in early spring in southeastern Kansas, which increase the potential for diseases.

Introduction

The small grain variety tests are conducted to help southeastern Kansas growers select varieties best adapted for the area. Complete results for these tests are available in Kansas Agric. Expt. Stn. Report of Progress 551 and Report of Progress 565. The small grains tested in 1988 included winter wheat, winter barley, spring oats, and spring wheat.

Experimental Procedure

Thirty-six winter wheat and five winter barley cultivars were planted on October 1, 1987, and eight spring oats and six spring wheat cultivars were planted on February 29, 1989. Seeding rates were 1,080,000 seeds per acre for wheat, 70 lb. per acre for barley, and 90 lb. per acre for the spring oats. All grains were fertilized with 75 lb. N per acre.

Winter Wheat Results

Average yield for all varieties tested was 71 bu/a, with Pioneer 2551, DeLange 7846, Terra SR 87, Bounty WH180001, Pioneer 2172, Chisholm, TAM 107, and AgriPro Thunderbird being the top yielders. The fall was very favorable for planting and

[1] Department of Agronomy, KSU.

establishing stands. The winter was cold, but the wheat was well established, so there was little, if any, winter kill. The spring was drier than normal, but rainfall was adequate to produce excellent yields. Yields of the some varieties may be found in Table 1.

Winter Barley Results

Barley yields ranged from 80 to 99 bu/a (Table 2). Lodging was a major problem for most varieties. Post produced the highest yield for 1988 and for the 2- and 3-year averages.

Spring Oats Results

Yields and yield components of spring oats are shown in Table 3. Average yield of the test was 35 bu per acre, and test weights averaged 28 lb per bushel. Yields ranged from 15 to 57 bu per acre, with Ogle being the highest yielding variety. Yields were lower than normal because of a cool spring and low rainfall for May and June.

Spring Wheat Results

Yields and yield components for spring wheat may be found in Table 4. The spring wheat test averaged 11 bu per acre, and the highest yielding cultivar was Yecora Rojo (16 bu per acre). Test weight ranged from 50 to 58 lb per bushel. The dry spring reduced yields for these wheats.

Table 1. Winter Wheat Yields of Selected Varieties, Parsons, 1988.

Brand	Variety	1988 Yield	Test Weight	Plant Height
		Bu/a	Lb/bu	In
Pioneer	2551 (S)	81	56.0	36
DeLange	7846	79	60.5	42
Terra	SR 87 (S)	79	59.0	44
Bounty	WH180001 Exp.	79	58.5	42
---	Chisholm	78	61.3	39
---	TAM 107	78	58.1	39
Pioneer	2172	78	59.6	35
AgriPro	Thunderbird	77	63.5	43
AgriPro	Mesa	75	64.1	36
Bounty	BH 122	75	58.7	40
---	Caldwell (S)	75	57.8	40
AgriPro	Abilene	74	62.7	35
---	Century	74	59.9	40
DeLange	7837	74	57.3	38
	Test mean	71	59.8	39
	$LSD_{0.05}$	4.7	1.8	1.5

Planted: October 1, 1987
Harvested: June 14, 1988
Fertilizer: 75 lb N/a on October 1, 1987

Table 2. Yield and Yield Components for Winter Barley, 1988.

Variety	Yield 1988	Yield 1987-88	Yield 1986-88	Plant Height	Lodging
	Bu/a	Bu/a	Bu/a	In	%
Dundy	85	71	70	38	95
Hitchcock	80	69	67	40	26
Kanby	95	77	69	41	69
Post	99	92	83	42	26
Schuyler	87	79	76	38	5
Test mean	89	78	73	40	44
$LSD_{0.05}$	8	16	12	1.6	39.5

Planted: October 1, 1987
Harvested: June 14, 1987
Fertilizer: 75 lb N/a on October 1, 1987

Table 3. Yield and Yield Components of Spring Oats, 1988.

Variety	Yield 1988	1987-88	1986-88	Plant Height	Stand
	Bu/a			In	%
Bates	45	44	60	27	93
Don	37	34	49	26	88
Kelly	15	--	--	27	74
Ogle	57	56	71	28	86
Starter	25	30	51	26	71
Larry	33	36	53	24	73
Test mean	35	36	53	26	81
$LSD_{0.05}$	8	5	5	1.0	14.9

Planted: February 29, 1988
Harvested: June 25, 1987
Fertilizer: 75 lb N/a on October 1, 1987

Table 4. Yield and Yield Components of Spring Wheat, 1988.

Variety	Yield 1988	1987-88	1986-88	Stand	Protein Content
	Bu/a			%	%
Anza	12	--	--	81	14
Guard	12	19	27	78	16
Marshall	13	25	--	81	16
Norseman	10	22	--	84	17
Olso	11	18	21	74	17
Phoenix	5	--	--	55	17
Yecora Rojo	16	--	--	78	15
Yolo	7	--	--	70	14
Test mean	11	21	23		
$LSD_{0.05}$	3	2	1		

Planted: February 29, 1988
Harvested: June 25, 1987
Fertilizer: 75 lb N/a on October 1, 1987

SOUTHEAST KANSAS BRANCH STATION
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CORN HYBRID PERFORMANCE TEST

George V. Granade and Ted Walter[1]

Summary

A corn performance test was planted in Montgomery County under irrigated and dryland conditions to determine the top corn hybrids in southeastern Kansas. Several hybrids have potential for this area with and without irrigation. Yields of the irrigation test were not as high as in previous years. Because of a problem with insects and birds, the dryland test was not harvested in 1988.

Introduction

Corn hybrids are grown in southeastern Kansas in both dryland and irrigated conditions. Determining which hybrids will perform best in this area is of prime importance to farmers with and without irrigation facilities.

Experimental Procedure

In 1988, 55 and 36 corn hybrids were planted in off-station tests under irrigation and dryland conditions, respectively. All corn was planted on April 24 in 30-inch rows in Montgomery County. The irrigated corn was watered on June 9, 10, 23, 24 and July 14, 15, and 28 with 1 inch of water on each day. The irrigated test was thinned to a population of 24,600 plants per acre, and the dryland test was thinned to 16,100 plants per acre on May 26. Corn from the irrigated test was harvested on September 1. Because of insect and bird problems, yields were not reported for the dryland test.

Results

May and June were drier than typically expected, thus, yields were lower than those of previous years. The irrigated test averaged 138 bu per acre, with a range of 110 to 175 bu per acre.

[1] Department of Agronomy, KSU.

Table 1 shows the yields and yield components of some of the highest yielding corn hybrids in the irrigated test. Complete results are compiled in Kansas Agric. Expt. Stn. Report of Progress 560.

Table 1. Irrigated Corn Hybrids Yields, Montgomery County, 1988

Brand	Hybrid	Yield 1988	Yield 2-yr.	Yield 3-yr.	Test Weight	Days to Silking
		------Bu/a------			Lb/bu	
Golden Acres	T-E 6994	175	170	171	57	66
Cargill	7990	156	157	---	55	68
Terra	TR363 Exp	154	---	---	56	70
Triumph	1650 FG	153	161	---	57	71
Growers	GSC 2333	153	---	---	55	68
Growers	GSC 2216	152	---	---	58	67
Bo-Jac	9310	151	---	---	56	70
Pioneer	3377	150	---	---	58	67
Garrison	SG 8215	149	---	---	57	67
Golden Acres	T-E 6951	149	---	---	58	67
Cargill	SX 352	148	155	---	57	67
Golden Acres	T-E 6988	148	151	151	56	68
Oro	150	148	152	---	58	68
Triumph	1595	148	152	156	59	67
Test Mean		138	147	151	57	69
$LSD_{0.05}$		22	---	---	1	2

Planted: April 24, 1988
Harvested: September 1, 1988
Fertilizer: 150 lb N/a; 60 lb P_2O_5/a; 40 lb K_2O/a. Applied before planting.
Herbicide: Eradicane Extra plus Atrazine.
Irrigation and Amounts: June 9, 10, 23, 24; July 14, 15, and 28 with 1 inch each day.

SOYBEAN VARIETY PERFORMANCE TEST

George V. Granade and William T. Schapaugh[1]

Summary

Soybean varieties from maturity groups III, IV, and V were planted in mid-June at the Columbus Field of the Southeast Kansas Branch Station. Weather conditions were not very favorable for good soybean growth during the early part of the growing season, but were better during July. Maturity group V soybean varieties continue to have the most consistent high yields for southeastern Kansas.

Introduction

Soybeans are an important crop for southeastern Kansas, which has approximately one-third of the state's acreage. Testing and developing varieties that are adapted to the area is of prime importance to local farmers.

Experimental Procedure

Soybean cultivars from maturity groups III, IV, and V were tested in 1988 at the Columbus Field. Soybeans were planted on June 20 in 30-inch rows with a John Deere Max-emerge planter equipped with cones.

Results

Rainfall was below normal for June with periods of heat stress, whereas July had above normal rainfall. Also, rainfall tended to increase late in the growing season, which benefited the late group IV and V entries. Yields for maturity group V soybeans averaged 28 bu per acre, whereas yields for the group III and IV soybean were slightly lower. Some of the more commonly grown varieties are listed in Table 1. Complete results are compiled in Kansas Agric. Expt. Stn. Report of Progress 564.

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[1] Department of Agronomy, KSU.

Table 1. Soybean Cultivar Yields, Columbus Field, 1987.

Brand	Variety	Maturity Group	1988 Yield	1987-88 Yield	1986-88 Yield
			Bu/a	Bu/a	Bu/a
Asgrow	A4393	III	24.3	----	----
-----	Harper	III	25.8	21.7	18.7
Merschman	Washington VI	III	25.9	22.4	----
----	Resnik	III	25.9	----	----
S Brand	S-57A	III	24.0	----	----
----	Sherman	III	25.9	21.7	18.0
Terra	Cycle	III	27.3	----	----
-----	Williams 82	III	26.8	23.9	20.7
-----	Zane	III	24.1	21.5	18.5
	Test mean		23.4		
	$LSD_{(0.05)}$		4.7		
Asgrow	A 4595	IV	18.0	20.0	17.8
----	Crawford	IV	22.7	23.3	20.5
DeLange	DS 455	IV	25.2	----	----
NeCo	1350	IV	25.9	27.6	25.5
Northrup King	S44-77	IV	29.2	----	----
Ohlde	O-4386	IV	26.7	25.8	24.0
Pioneer	9442	IV	26.1	----	----
----	Spencer	IV	22.5	21.8	----
----	Stafford	IV	28.5	----	----
Terra	Competitor	IV	24.6	24.3	----
	Test mean		22.3		
	$LSD_{(0.05)}$		4.3		
----	Bay	V	27.9	27.6	27.8
Coker	425	V	29.3	----	----
DeLange	DS 510	V	23.6	24.0	----
----	Essex	V	28.0	28.6	27.2
----	Hutcheson	V	30.9	29.7	31.1
----	K1130	V	28.5	28.4	----
----	K1133	V	28.2	29.2	----
Northrup King	S53-34	V	29.8	----	----
Ohlde	5126	V	27.0	----	----
----	Pershing	V	26.8	27.0	26.4
Pioneer	9531	V	28.9	----	----
	Test mean		27.5		
	$LSD_{(0.05)}$		NS		

Planted: June 20, 1987.
Herbicide: 0.33 lb Lexone DF/a + 1.5 pt Dual/a.

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MATURITY GROUP V AND VI SOYBEAN VARIETIES[1]

George V. Granade

Summary

Soybean varieties from maturity groups V and VI from private and public sources were planted in early June. Several maturity group V soybeans, which are not currently marketed in the area, have potential for southeastern Kansas. Maturity group VI soybeans yields were slightly less than those of group V soybeans.

Introduction

Many maturity group V soybean varieties are not currently grown in southeastern Kansas. Some private companies have not promoted these soybeans in the area. The possibility also exists that maturity group VI soybean varieties might be grown.

Experimental Procedure

Soybeans varieties from maturity group V and VI were obtained from public and private breeders. These were planted at the Columbus field on June 6 in 30-inch rows with eight viable seeds per foot in a linear row (139,000 seeds per acre). Lexone DF at the rate of 0.33 lb/a and Dual at the rate of 1.5 pt/a were applied after planting.

Results

Soybean yields ranged from 20 to 38 bu per acre, with Hartz 5164, a group V soybean, having the highest yield (Table 1). The highest yielder in group VI was Asgrow A6295, with 34 bu per acre. Lodging was a problem for several varieties (Table 1). Plant height ranged from 27 to 47 inches (Table 1). The taller varieties tended to lodge more than the shorter varieties.

[1]This research is supported by a grant from the Kansas Soybean Commission.

Table 1. Yield and Yield Components of Group V and VI Soybean Cultivars, 1988.

Brand	Soybean Cultivar	Maturity Group	1988 Yield	Plant Height	Maturity		Seed Size	Lodging Score[†]
			Bu/a	In.	Mon	Day	/lb	
Asgrow	A4906	V	24.2	34	9	27	4400	1
Asgrow	A5403	V	31.5	35	10	11	3480	2
Asgrow	A5474	V	31.4	39	10	11	3170	2
Asgrow	A5980	V	34.9	43	10	17	2730	3
---	Avery	V	25.9	47	9	30	3350	2
---	Bay	V	31.0	39	10	9	2900	2
Coker	425	V	31.2	30	10	1	3800	1
Coker	485	V	34.2	35	10	19	2570	2
Coker	Brand 6925	V	26.4	32	10	2	4050	1
Coker	Brand 6955	V	27.9	38	10	10	3590	2
Coker	Brand 6995	V	36.3	44	10	18	3410	3
Coker	RA 452	V	27.1	35	10	1	4280	1
---	Essex	V	28.9	27	9	28	4280	1
---	Forrest	V	30.3	39	10	16	3890	2
Hartz	5164	V	38.1	43	10	19	3250	3
Hartz	5171	V	37.7	42	10	20	3350	4
Hartz	5252	V	33.4	41	10	16	3410	2
Hartz	5370	V	33.7	43	10	16	3530	2
---	K1154	V	23.5	23	9	20	5040	1
---	K1155	V	28.3	41	10	1	3890	1
---	Pershing	V	30.6	26	9	29	5050	1
Riverside	RVS 477	V	20.0	45	9	30	4260	2
Riverside	RVS 499	V	26.2	38	9	30	3680	2
Riverside	RVS 577	V	31.3	40	10	18	3330	3
---	Toano	V	28.2	31	9	29	3620	1
Asgrow	A6242	VI	29.6	42	10	29	3150	3
Asgrow	A6295	VI	33.9	37	10	29	3250	2
---	Bradley	VI	28.4	33	10	18	4280	2
Coker	RA 606	VI	26.2	46	10	31	3110	3
---	Davis	VI	25.4	41	11	6	2910	2
Hartz	6130	VI	31.9	40	11	2	3100	2
Hartz	X 6200	VI	29.4	43	10	17	3600	2
---	Tracy M	VI	29.4	42	11	1	2900	4
Riverside	Cajun	VI	32.9	38	10	28	3020	3
Riverside	RVS 677	VI	30.7	44	11	3	2960	2
	$LSD_{0.05}$		5.5	4		6	593	1
	Test mean		29.9	38	10	13	3590	2
	C.V. (%)		11.4	6		1	10	26

[†]Score is on a scale of 1 to 5; 1 - almost all plants erect; 5 - almost all plants down.

Planted: June 6, 1988
Herbicide: .33 lb Lexone DF + 1.5 pt Dual/a
Soil Test: pH 7.7; P 64 lb/a; K 160 lb/a; sampled November, 1988

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

SOYBEAN CULTIVARS DOUBLECROPPED AFTER WHEAT IN DIFFERENT TILLAGE SYSTEMS IN SOUTHEASTERN KANSAS[1]

George V. Granade, Daniel W. Sweeney, and William T. Schapaugh[2]

Summary

Since doublecropping soybeans after wheat is a common practice in southeastern Kansas, a study was conducted to examine the response of soybean cultivars to selected doublecrop tillage systems. In late June, 1988, after harvesting 'TAM 107' wheat, 12 soybean cultivars representing three maturity groups were planted in three tillage systems. Soybean yields ranged from 1 to 11 bushels per acre, with Stafford and Northrup King S44-77 in the no-tillage system being the top yielders. A cultivar by tillage interaction suggests that yields of group III and IV soybeans were lowest in the burn system, whereas yields of group V soybeans were lowest with no tillage.

Introduction

Doublecropping of soybeans in southeastern Kansas is a common practice, when time and soil moisture are available. Selection of the best cultivar is usually based on results from the soybean performance report, which is for full-season soybeans. Several states have reported that these results can be used for doublecrop systems; however, other states have indicated that there are differences. A study was initiated to examine the response of different soybean cultivars after wheat in three different tillage systems.

Experimental Procedures

Wheat was planted in October, 1987, and harvested in late June, 1988. After wheat harvest, three tillage systems were established: a) burn (burn wheat stubble, disc several times); b) minimum tillage (disc twice with offset disc); and c) no tillage.

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[1] This research is supported by a grant from the Kansas Soybean Commission.

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Twelve soybean cultivars (four each from maturity groups III, IV, and V) were planted in 30-inch rows with a John Deere Max-Emerge planter modified with a cone. The study was planted in 1988 at the Parsons Field.

Soybeans were planted at a target population of 139,000 plants per acre (8 seeds per foot). Data collected were stand count, plant height, number of seeds per pound, and yield. Number of seed per pound was determined by the conversion of 100-seed weight.

Results

Yield and yield components are shown in Table 1. Yield, plant height, seed size, and plant population were significantly affected by an interaction of soybean cultivars with tillage systems. Yields were low because of scarce rainfall during the reproductive growth stages. Soybean cultivars in the burn system appeared to be stressed more than cultivars in either the minimum or no-tillage systems. This stress period tended to reduce the yields of the group III and IV soybeans more in the burn system than in the minimum or no-tillage systems. However, group V soybeans yields were higher in the burn and minimum systems than in the no-tillage system. The group V yields in the no-tillage system may have been reduced by a hail storm in mid-October. Seeds from the minimum and no-tillage systems tended to be larger than seeds from the burn system. Soybean cultivars were taller in the no-tillage system than in either the burn or minimum tillage systems. Increased soybean plant height in the no-tillage system may have been due to elongated nodes resulting from shading by standing wheat stubble. Plant stands in the burn system were significantly higher than those in either the minimum or no-tillage systems. Although plant stands of group III and IV soybean in the burn system were approximately twice as dense as stands in the no-tillage system, seeds from the no-tillage system were significantly larger than those from the burn system. This may have been due to a greater competition for soil moisture in the burn system or better conservation of moisture in the no-tillage system.

Table 1. Doublecropped Soybean Yields and Yield Components as Affected by Cultivar and Tillage Systems following Wheat, Parsons, 1988.

Soybean Cultivar	Maturity Group	Tillage System	Yield	Seed Size	Plant Height	Plant Population
			Bu/a	Seed/lb	In	Plant/a
Coker 393	III	Burn	2.0	4600	13	130,000
		Minimum	4.9	4110	15	66,600
		No-tillage	7.4	3290	23	67,500
Sherman	III	Burn	0.8	4370	12	123,700
		Minimum	3.4	5060	15	61,700
		No-tillage	5.2	3690	21	62,400
Williams 82	III	Burn	1.7	4470	14	110,600
		Minimum	4.2	3870	19	72,100
		No-tillage	8.5	3330	25	79,900
Zane	III	Burn	1.5	4250	13	102,600
		Minimum	6.4	3680	18	60,500
		No-tillage	5.1	2770	23	44,300
Dallas	IV	Burn	1.6	4470	14	95,600
		Minimum	7.0	3450	22	50,800
		No-tillage	6.3	3540	24	63,600
NK S44-77	IV	Burn	3.7	4130	15	108,900
		Minimum	6.3	3300	19	66,800
		No-tillage	10.2	3180	26	58,800
Pioneer 9442	IV	Burn	2.0	4030	13	114,200
		Minimum	7.2	3300	18	69,700
		No-tillage	4.2	3250	21	46,000
Stafford	IV	Burn	5.2	4440	17	133,600
		Minimum	8.0	4000	19	74,100
		No-tillage	11.1	3860	25	71,600
K 1130	V	Burn	5.2	4020	15	41,600
		Minimum	8.4	4160	17	31,000
		No-tillage	4.0	4060	18	14,500
K 1133	V	Burn	5.2	4320	17	89,300
		Minimum	8.8	3590	16	49,600
		No-tillage	3.4	3810	21	41,400
Pershing	V	Burn	7.5	4180	19	137,700
		Minimum	8.9	3930	20	88,600
		No-tillage	4.7	3980	22	73,600
Toano	V	Burn	7.1	3280	19	99,500
		Minimum	8.0	3460	20	61,500
		No-tillage	2.7	3700	24	42,600
19,170	$LSD_{0.05}$			4.3	631	4.0
	Test mean		5.5	3860	19	75,200

Planted: July 5, 1988
Herbicide: 1.5 pt Dual plus 0.33 lb Lexone DF per acre

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

PERFORMANCE OF EARLY MATURITY SOYBEANS IN SOUTHEASTERN KANSAS

George V. Granade

Summary

Thirty soybean cultivars from maturity groups 00, 0, and I were planted in late April in Southeastern Kansas. Despite drier than normal conditions in May and June, yields averaged 22 bu per acre. Two-year averages ranged from 10 to 33 bu per acre. Group I soybean cultivars had higher yields than either the group 0 or 00 soybean cultivars.

Introduction

Interest has increased in growing early soybeans, with wheat following them in the fall. Maturity group 00, 0, and I soybeans are normally grown in the northern part of the United States; however, the possibility exists of growing these soybeans in southeastern Kansas. The growing season will be shorter, and plant height will be reduced. The objective of this study was to examine yield potential of group 00, 0, and I soybeans.

Experimental Procedures

Thirty soybean cultivars from maturity groups 00, 0, and I were obtained and planted on 22 April on the Calvin Flaharty farm near McCune. Soybeans were drilled in 7-inch rows at the rate of 336,000 seeds per acre. Plant height, height to first pod, maturity, yield per acre, and number of seeds per pound were recorded. A composite seed sample from the four replications was analyzed for protein and oil content.

Results

Yields ranged from 7 to 30 bu per acre, with Jacques J-201, Pioneer 9181, and Pioneer 9202 being the top yielders (Table 1). All cultivars matured during late July to early August and were harvested in mid-August. Protein content ranged from 36 to 40 percent, whereas oil content ranged from 18 to 20 percent. Cultivars from maturity group I generally yielded higher than cultivars from maturity group 0 or 00.

Table 1. Yield and Yield Components of Short-Season Soybeans, McCune, 1988.

Brand	Cultivar	MG[1]	Yield 1988	Yield 1987-88	Maturity	Plant Height	Pod Height
			----Bu/a----		Mon day	In	In
Jacques	J-201	I	30.0	28.7	8 - 7	17.1	2.0
Pioneer	9181	I	28.6	27.9	8 - 8	16.5	2.6
Pioneer	9202	II	28.5	28.9	8 - 7	17.5	2.0
---	Weber 84	I	27.8	32.9	8 - 9	19.1	2.2
Northrup King	S23-12	II	27.8	--	8 - 8	19.8	2.3
Pioneer	9161	I	27.7	--	8 - 6	19.1	2.0
---	Hodgson 78	I	27.6	25.2	8 - 5	18.0	1.9
Hoegemeyer	150	I	27.4	--	8 - 5	18.5	2.2
Jacques	J-150	I	27.4	28.0	8 - 6	20.4	2.2
Asgrow	A1937	I	26.6	25.3	8 - 5	17.6	1.9
Hoegemeyer	208	II	26.5	--	8 - 9	20.5	2.8
Northrup King	S15-50	I	26.2	32.1	8 - 5	18.2	2.0
DeKalb	CX 187	I	25.2	--	8 - 5	17.6	1.9
Pioneer	1677	I	23.4	--	8 - 3	15.8	1.7
Merschman	Venus	I	23.0	22.5	8 - 5	17.1	2.1
---	Sibley	I	22.7	26.1	8 - 5	16.6	2.2
Northrup King	B 095	0	20.8	--	7 -31	16.9	1.7
Asgrow	A 1525	I	19.1	25.8	8 - 3	15.3	1.6
Northrup King	B 117	I	17.6	--	8 - 1	15.2	1.7
---	Dawson	0	6.2	18.3	7 -26	12.8	1.3
---	Dassel	0	14.9	15.7	7 -31	14.2	1.4
---	Evans	0	14.5	17.4	7 -31	14.6	1.3
---	Chico	00	11.4	13.0	7 -17	11.8	1.4
---	McCall	00	10.1	14.2	7 -16	11.4	1.4
---	Maple Ridge	00	6.9	10.3	7 -15	11.4	1.5
	$LSD_{0.05}$		5.1	8.0	2	1.8	0.6
	Test Mean		22.3	23.5	8 - 2	16.5	1.9

Planted: April 22, 1988
Harvested: August 15, 1988
Herbicide: 1.5 pt Pro 5 per acre

Table 2. Seed Size and Quality and Oil and Protein Content of Short-Season Soybeans, McCune, 1988.

Brand	Variety	Maturity Group	Seed Quality[1]	Seeds per Pound	Oil Content	Protein Content
					%	%
Jacques	J-201	I	3	3410	18.9	38.2
Pioneer	9181	I	4	2920	18.8	39.3
Pioneer	9202	II	3	3400	20.1	36.3
	Weber 84	I	3	3850	19.5	36.3
Northrup	S23-12	II	3	3230	20.4	36.9
King	9161	I	3	4010	18.9	37.9
Pioneer	Hodgson 78	I	4	3230	18.8	40.0
	150	I	3	3770	20.0	35.9
Hoegemeyer	J-150	I	3	3810	19.5	38.5
Jacques	A1937	I	4	3960	18.7	39.6
Asgrow	208	II	3	3720	19.9	37.3
Hoegemeyer	S15-50	I	4	4020	18.2	38.7
Northrup	CX187	I	4	3720	19.5	36.7
King	1677	I	4	3830	19.5	36.5
DeKalb	Venus	I	3	3610	19.7	36.8
Pioneer	Sibley	I	4	3480	19.1	38.5
Merschman	BO95	O	5	4390	18.6	37.1
	A1525	I	4	3980	18.4	39.6
Northrup	B117	I	4	4170	18.7	38.3
King	Dawson	O	4	4110	18.7	36.4
Asgrow	Dassel	O	4	3810	18.9	39.0
Northrup	Evans	O	4	4250	18.8	38.1
King	Chico	OO	4	5750	19.4	37.6
	McCall	OO	4	4540	19.0	38.1
	Maple Ridge	OO	5	4740	18.0	36.6

[1]Seed score rated on a scale of 1 to 5; 1 - very good; 2 - good; 3 - fair; 4 - poor; 5 - very poor.

SOUTHEAST KANSAS BRANCH STATION
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EFFECT OF PLANTING DATE ON EARLY MATURITY SOYBEANS[1]

George V. Granade

Summary

Soybeans from maturity groups OO, O, and I each were planted in early April, mid-April, and early May. Yield, seed quality and size, plant height, height to first pod, plant population, and maturity were measured. Soybeans from maturity group I planted in mid-April and early May had the highest yields in 1988. However, the two-year average indicated mid-April as the optimal planting date.

Introduction

Interest in early soybeans has increased in southeastern Kansas. However, the best time to plant these soybeans has not been determined. The objective of this study was to examine the effect of planting dates on yield and yield components of soybean cultivars from maturity groups OO, O, and I.

Experimental Procedures

Three soybean cultivars each were obtained from maturity groups OO, O, and I, and all were planted on April 8, April 22, and May 9 at the Parsons Field. Planting rate was 336,000 seeds per acre, using a 12 row, 7-inch plot grain drill. Yield, maturity, plant height, pod height, plant population, seed size, and seed quality were measured.

Results

Yield and yield components are shown in Tables 1 and 2. There were significant differences for yield, seed size, plant height, and maturity because of the interaction of soybean cultivar and planting date. Highest yield for Hodgson 78 was from the April 22 planting, whereas the other cultivars peaked from May 9 planting. Plant height of the soybean cultivars followed the same pattern as yield. Seed quality was poor for

[1]This research is supported by a grant from the Kansas Soybean Commission.

all cultivars, except Weber 84 and Hodgson 78. Seventy percent of the seeds planted emerged, regardless of cultivar or planting date.

Table 1. Yield Components and Yield of Soybeans from Maturity Groups OO, O, and I Planted at Three Different Dates, Parsons, 1988.

Soybean Cultivar	Maturity Group	Planting Date	Yield 1988	Yield 2-yr	Seed Quality	Seed Size	Maturity
		Mo Day	--Bu/a--		Score	/lb	Mo day
Chico	OO	April 8	6.5	12.8	4	5090	7 - 14
		April 22	11.2	15.3	4	4460	7 - 24
		May 9	17.4	23.7	4	4330	8 - 3
Maple Ridge	OO	April 8	4.0	8.6	5	4630	7 - 6
		April 22	11.3	13.5	5	5170	7 - 15
		May 9	18.4	19.2	4	4430	8 - 2
McCall	OO	April 8	3.5	12.6	4	3440	7 - 17
		April 22	13.2	22.6	4	3560	7 - 27
		May 9	22.5	27.9	4	4080	8 - 3
Dassel	O	April 8	5.7	10.2	4	3610	7 - 29
		April 22	19.1	20.1	4	3960	8 - 6
		May 9	25.4	26.2	4	4160	8 - 13
Dawson	O	April 8	5.2	16.3	4	4340	7 - 19
		April 22	15.9	25.7	4	3570	8 - 1
		May 9	23.0	23.4	4	4180	8 - 9
Evans	O	April 8	4.6	12.9	5	4260	7 - 21
		April 22	13.8	19.1	4	3920	7 - 30
		May 9	18.5	24.4	4	4390	8 - 9
Hodgson 78	I	April 8	8.2	17.1	4	3610	7 - 30
		April 22	25.6	31.8	3	3560	8 - 6
		May 9	25.1	28.6	4	3870	8 - 14
Sibley	I	April 8	6.1	14.2	4	3870	8 - 3
		April 22	18.5	25.9	4	3910	8 - 7
		May 9	19.5	24.5	4	4670	8 - 12
Weber 84	I	April 8	8.7	17.9	3	4770	8 - 1
		April 22	22.2	29.9	2	4130	8 - 7
		May 9	25.5	25.7	3	4760	8 - 14
	$LSD_{(0.05)}$		5.8	4.6	NS	701	4
Main Effects							
Chico	OO		11.6	17.3	4	4630	7 - 23
Maple Ridge	OO		11.2	13.8	5	4740	7 - 18
McCall	OO		13.1	21.0	4	3690	7 - 26
Dassel	O		16.7	18.8	4	3910	8 - 6
Dawson	O		14.7	21.8	4	4030	7 - 30
Evans	O		12.3	18.7	4	4190	7 - 31
Hodgson 78	I		19.7	25.8	4	3680	8 - 7
Sibley	I		14.7	21.6	4	4150	8 - 8
Weber 84	I		18.8	24.5	3	4560	8 - 7
		$LSD_{(0.05)}$	2.7	2.3	0.3	359	2
		April 9	5.8	13.6	4	4180	7 - 22
		April 24	16.8	22.7	4	4030	7 - 30
		May 11	21.7	24.9	4	4320	8 - 8
		$LSD_{(0.05)}$	4.5	2.9	NS	NS	3

Table 2. Plant Population, Plant Height, and Pod Height of Soybeans from Maturity Groups OO, O, and I Planted at Three Different Dates, 1988.

Soybean Cultivar	Maturity Group	Planting Date Mo Day	Plant Population Plants/a	Plant Height In	Pod Height In
Chico	OO	April 9	195,000	8.5	1.0
		April 24	188,000	10.0	1.4
		May 11	208,000	11.5	1.4
Maple Ridge	OO	April 9	308,000	9.2	1.1
		April 24	239,000	10.6	1.7
		May 11	236,000	13.4	1.8
McCall	OO	April 9	254,000	8.4	0.8
		April 24	242,000	11.8	1.7
		May 11	249,000	13.5	1.7
Dassel	O	April 9	250,000	8.5	1.7
		April 24	254,000	11.7	1.8
		May 11	230,000	16.8	1.5
Dawson	O	April 9	250,000	8.0	1.3
		April 24	242,000	12.2	1.8
		May 11	259,000	13.6	1.8
Evans	O	April 9	193,000	8.9	1.2
		April 24	236,000	11.7	1.8
		May 11	212,000	12.0	1.5
Hodgson 78	I	April 9	220,000	10.2	2.1
		April 24	243,000	14.9	1.7
		May 11	220,000	19.6	2.4
Sibley	I	April 9	268,000	10.4	1.8
		April 24	210,000	13.3	1.8
		May 11	228,000	16.1	1.9
Weber 84	I	April 9	234,000	11.4	2.0
		April 24	225,000	14.3	1.7
		May 11	236,000	19.8	2.0
		$LSD_{(0.05)}$	NS	2.3	NS
Main Effects					
Chico	OO		197,000	10.0	1.3
Maple Ridge	OO		261,000	11.1	1.5
McCall	OO		248,000	11.2	1.4
Dassel	O		245,000	12.3	1.7
Dawson	O		250,000	11.3	1.6
Evans	O		213,000	10.9	1.5
Hodgson 78	I		228,000	14.9	2.1
Sibley	I		235,000	13.3	1.8
Weber 84	I		232,000	15.2	1.9
		$LSD_{(0.05)}$	31,300	1.2	0.4
		April 9	241,000	9.3	1.4
		April 24	231,000	12.3	1.7
		May 11	231,000	15.1	1.8
		$LSD_{(0.05)}$	NS	1.4	NS

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

EARLY SOYBEANS COMPARED WITH FULL-SEASON SOYBEANS[1]

George V. Granade

Summary

Soybeans cultivars from maturity groups OO, O, I, III, IV, and V were planted in both mid-April and early June at the Parsons Field of the Southeast Kansas Experiment Station. Hodgson 78, planted on April 22, and Bay, planted on June 16, were the two highest yielding cultivars.

Introduction

Interest in planting early soybeans (maturity groups OO, O, and I) has increased, but questions have been asked about how they compare to full-season soybeans (maturity groups III, IV, and V). A study was initiated to examine how early soybeans yields and yield components compare to those of full-season soybeans.

Experimental Procedures

Soybean cultivars from maturity groups OO, O, I, III, IV, and V were obtained and planted at the Parsons Field of the Southeast Kansas Experiment Station. Soybeans were drilled in 7-inch rows at the rate of 336,000 seeds per acre on April 22 and planted in 30-inch rows at a rate of 139,000 seeds per acre on June 16. Date of first bloom, yield, maturity, plant height, pod height, seed size, and seed quality were determined.

Results

Yield and yield components are shown in Table 1. Yields ranged from 11 to 26 bu per acre. Hodgson 78, a group I soybean, planted in April had yields similar to Bay, a group V soybean, planted in June. Yields of the early soybeans (groups OO and O) were generally increased for the June planting because of rains in July, and yields of the full-season soybeans were slightly higher for the June planting.

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[1]This research is supported by a grant from the Kansas Soybean Commission.

Table 1. Yield and Yield Components of Selected Group 00, 0, I, III, IV, and V Soybeans Planted in April and June, Parsons, 1988.

Soybean Cultivar	Maturity Group	Date Planted[1] Mo	Date Planted[1] Day	Yield Bu/a	Seed Quality Score[2]	Seed Size Seed/lb	Maturity Mo	Maturity Day	Plant Height In	Pod Height In	First Bloom Mo	First Bloom Day
McCall	00	4	22	10.8	5	3770	7	31	11	2	5	2
Dawson	0	4	22	14.4	5	3730	8	2	11	1	5	5
Hodgson 78	I	4	22	26.0	4	3670	8	9	15	1	5	5
Weber 84	I	4	22	20.8	4	4410	8	10	14	2	5	4
Zane	III	4	22	20.6	3	3710	8	22	22	2	5	7
Crawford	IV	4	22	12.5	2	4510	9	13	27	3	5	25
Stafford	IV	4	22	18.3	2	4530	9	13	24	7	7	7
Bay	V	4	22	16.2	3	3040	10	24	29	7	7	7
										7	7	9
McCall	00	6	16	18.7	3	3810	8	31	22	3	7	13
Dawson	0	6	16	17.4	4	4560	8	30	19	2	7	15
Hodgson 78	I	6	16	19.7	3	3710	9	3	24	3	7	13
Weber 84	I	6	16	16.9	3	5100	9	4	23	2	7	14
Zane	III	6	16	21.1	3	3350	9	13	24	4	7	20
Crawford	IV	6	16	14.7	2	3090	9	29	28	5	7	23
Stafford	IV	6	16	21.0	2	3820	9	29	22	6	8	2
Bay	V	6	16	23.2	2	2850	10	26	30	6	8	7
	$LSD_{0.05}$			4.3	0.6	533		4	3	1		5
Main Effects												
McCall	00			14.7	4	3800	8	15	16	3	6	22
Dawson	0			15.9	4	4150	8	16	15	2	6	25
Hodgson 78	I			22.8	3	3690	8	22	19	2	6	24
Weber 84	I			18.8	3	4760	8	22	19	2	6	25
Zane	III			20.9	3	3530	9	2	23	4	7	7
Crawford	IV			13.6	2	3800	9	21	28	6	7	15
Stafford	IV			19.7	2	4180	9	21	23	7	7	20
Bay	V			19.7	2	2950	10	25	30	7	7	23
	$LSD_{0.05}$			2.8	0.4	401		3	2	1		3
		4	22	17.5	3	3920	8	27	19	4	6	19
		6	16	19.1	3	3790	9	17	24	4	7	21
	$LSD_{0.05}$			NS	NS	93		3	2	NS		3
	Test Means			18.3	3		9	6	22	4	7	5

[1] Soybeans planted in April were drilled in 7-inch rows at the rate of 336,000 seeds/a; June planted soybeans were planted in 30-inch rows at the rate of 139,000 seeds/a.

[2] Score rated on a scale of 1 to 5; 1 - very good; 2 - good; 3 - fair; 4 - poor; 5 - very poor.

Herbicide: 0.33 lb Lexone DF + 1.5 pt Dual/a on April 22 as preplant incorporated.

Fertilizer: Limed on February 29 at rate of 2 tons/a; no other fertilizer applied.

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

COMPARISON OF EARLY MATURING AND FULL-SEASON SOYBEANS: AN ECONOMIC ANALYSIS

Guido van der Hoeven[1], Robert O. Burton, Jr.[1], George V. Granade, and Allen M. Featherstone[1]

Summary

Economic analysis was based on biological data shown on pages 75-76 of this report. Soybeans from maturity groups 00 to V were planted in late April and mid-June at Parsons, Kansas. Budgeting to determine returns above variable costs was used for each cultivar and planting date. The returns ranged from $18.96 to $152.32 per acre for the April planting date and from $45.60 to $106.20 for the June planting date. Hodgson 78, a Group I soybean planted in April, had the highest returns.

Introduction

Diversification into early maturing soybeans could spread labor, machinery, crop management, and cash flow over a longer time period each year, enhancing returns and improving economic stability. Producers considering early maturing soybeans need information about their economic potential compared to traditional, full-season soybeans. This study summarizes returns above variable costs for early maturing and traditional soybeans on two planting dates.

Experimental Procedures

Budgeting was used to measure receipts minus variable costs (Table 1). Budgeted gross returns reflect differences in yields and soybean prices for different cultivars on different planting dates. Yields are reported on page 76 of this report. Assuming soybeans were sold at harvest, the soybean price in each budget was the average of weekly cash bids for country elevators in the Kansas City, KS area for the week harvested. These prices, reported in USDA's Grain and Feed Market News, indicated a price advantage for soybeans sold prior to the traditional fall harvest.

Budgets also reflect variable costs differences for the two planting dates. Soybeans planted in April were drilled in 7-inch rows and used more than twice as many seeds as soybeans planted in June, which were planted in 30-inch rows. Seed costs for maturity

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[1]Department of Agricultural Economics, KSU.

groups 00 through I were higher than seed costs for groups III through V because freight charges were added for seeds not normally sold in southeastern Kansas. Machinery operations for soybeans planted in April included field cultivation, herbicide spraying, planting with a drill, and combining. Machinery operations for soybeans planted in June included field cultivation, herbicide spraying, planting with a planter, row cultivating, and combining. Thus, machinery costs were greater for soybeans planted in June because an extra cultivation was used and because planting is more expensive then drilling. Since labor requirements were directly tied to machinery operations, soybeans planted in June required more labor.

Results and Discussion

Results indicate that production of early-maturing soybeans is a viable diversification option in southeastern Kansas (Table 2). Based on the two years of data available, the most profitable cultivar and planting date were Hodgson 78 (Group I) planted in April. The most profitable cultivar planted in June was Bay (Group V).

Because production of early-maturing soybeans is not a well established cultural practice in southeastern Kansas, questions remain about input requirements, variability, harvesting problems, and seed quality. Research has not been performed to determine optimal seeding and fertilization rates for early-maturing soybeans. The data available are not enough to measure variability over time. Diversification into early-maturing soybeans might reduce whole-farm income variability. Early-maturing soybeans are short and tend to pod closer to the ground; thus, farmers may have problems cutting low enough to get all the soybeans in the combine. However, opportunities to harvest early soybeans in August, when weather is typically dry, may be an advantage.

Appearance of early-maturing soybeans suggests poor seed quality. The authors know of two producers, who have not experienced dockage with early-maturing soybeans. However, if production of early-maturing soybeans increases significantly, dockage might occur.

Tillage operations and timing of the two soybean systems have implications for the effect of early-maturing soybeans on farm structure and the environment. April-planted, early-maturing soybeans require primary and secondary tillage performed in a narrow time period; but few machinery operations for other major crops are required during this time. Tillage operations for full-season soybeans, planted in June, are performed during a broader time frame. Primary tillage occurs in April and May and secondary tillage in June prior to planting. With a combination of early and traditional soybeans, more acres might be operated by smaller producers without increasing the machinery compliment. Similarly, larger producers might operate more acres. Thus, this technology could benefit farms of various sizes and would likely contribute to increased production of soybeans. Impacts on farm size will depend on the desires of individual producers and the opportunities available to them. The early canopy coverage of early-maturing soybeans during the rainy part of spring should reduce sheet and rill water movement over fields. Thus, soil erosion and herbicide and fertilizer runoff might be reduced.

Such potential impacts on farm structure and the environment may become important in southeastern Kansas, if research continues to indicate that production of early-maturing soybeans is a viable alternative.

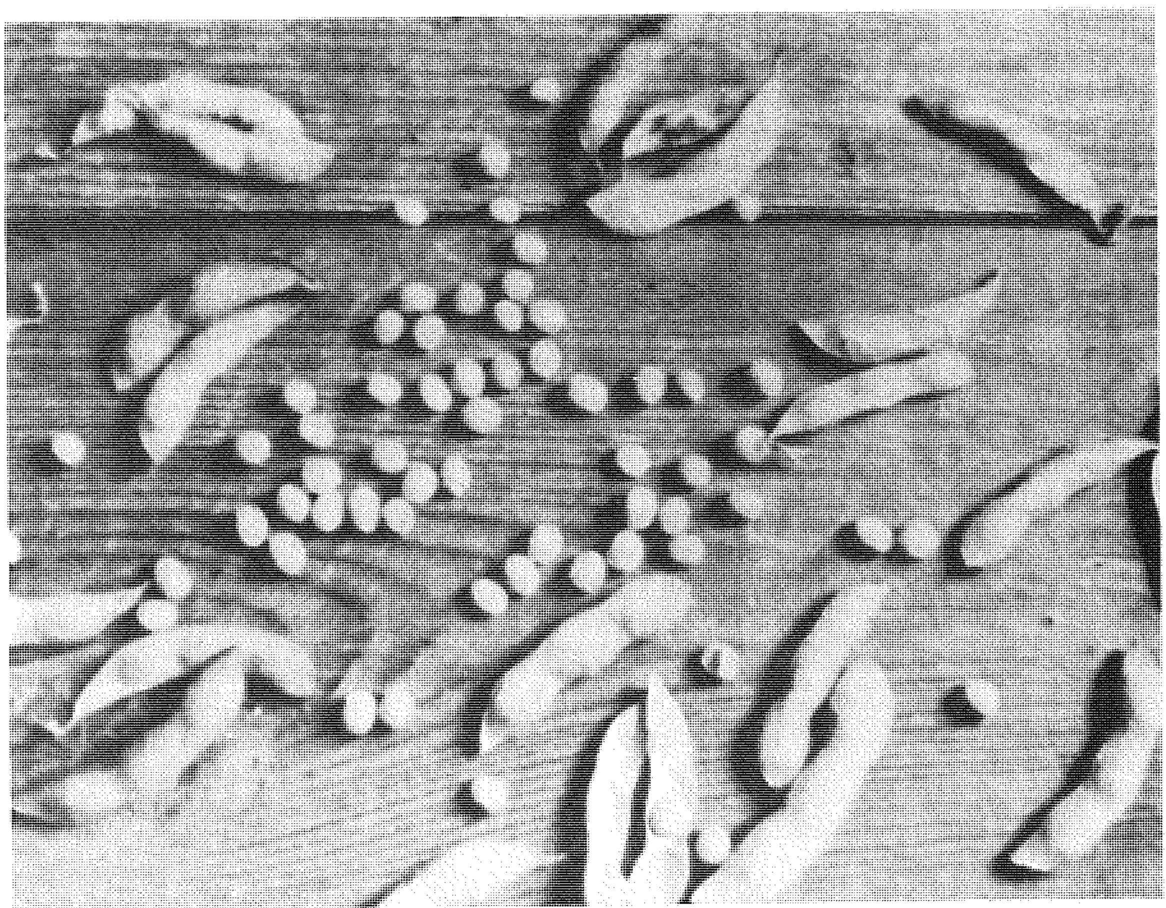

Table 1. Sample Budgets for Hodgson 78, a Group I Soybean Planted on April 22, and Bay, a Group V Soybean Planted on June 16, Parsons, Kansas, 1988[a].

		Hodgson 78			Bay		
	Unit	Price	Quantity per acre	Value or cost	Price	Quantity per acre	Value or cost
1. Gross Receipts from Production	Bu.	$ 8.66	26.00	$225.16	$ 7.51	23.20	$174.23
2. Variable costs							
Seed	Lb.	$ 0.16	87.27	$ 13.96	$ 0.14	36.10	$ 5.05
Phosphate	Lb.	$ 0.00	0.00	$ 0.00	$ 0.00	0.00	$ 0.00
Potash	Lb.	$ 0.00	0.00	$ 0.00	$ 0.00	0.00	$ 0.00
Lime	Ton	$10.00	2.00	$ 20.00	$10.00	2.00	$ 20.00
Herbicide				$ 15.75			$ 15.75
Insecticide				$ 0.00			$ 0.00
Labor	Hr.	$ 6.00	1.07	$ 6.42	$ 6.00	1.43	$ 8.58
Machinery				$ 12.58			$ 14.80
Interest on 1/2 of variable cost	Dol.	$ 0.12	34.36	$ 4.12	$ 0.12	32.09	$ 3.85
TOTAL VARIABLE COST				$ 72.84[b]			$ 68.04[b]
3. Income above variable cost				$152.32			$106.20

[a]Yields and input requirements are based on the experiment described on pp. 75-76 of this report. Soybean prices are based on the average of weekly cash bids for country elevators in the Kansas City, Kansas area from USDA's Grain and Feed Market News. Herbicide rates and prices are Dual @ 2pts/A $11.26 and Lexone DF @ 1/4 lbs/A $4.49. Machinery variable costs (fuel, lubrication, and repairs) are based on information from Fuller, Earl I and Mark F. McGuire, Minnesota Farm Machinery Economic Cost Estimates for 1988, Minnesota Extension Service, University of Minnesota, AG-FO-2308, revised 1988, with adjustments for southeastern Kansas. Machinery costs include charges for machinery operations used for crop production plus charges for a 400 bushel truck and a pickup truck. Acres per hour for the 400 bushel truck are based on soybean yields of 18 bushels per acre. Lower yields would increase acres per hour and decrease costs per acre. Higher yields would decrease acres per hour and increase costs per acre. Because adjustments in costs would be small, acres per hour and costs per acre are not adjusted for yield differences. Lime is applied every 3-5 years as needed and is charged to the budgets in the year applied. Wage rate is from Tierney, William I. and James R. Mintert, Prices for Forward Planning, KSU Farm Management Guide, MF-525, August 1988.

[b]This sum appears to be off by 1 cent because computer calculations are more accurate than calculations based on numbers rounded to the nearest penny.

Table 2. Incomes above Variable Costs for Soybeans of Different Maturity Groups Planted in April and June in Parsons, 1988, and Average of 1987 and 1988[a].

Soybean Cultivar	Maturity Group	April Planting 1988	April Planting 1987 - 1988[b]	June Planting 1988	June Planting 1987 - 1988[b]
McCall	00	$ 18.96	$ 71.98	$ 94.08	$ 68.00
Dawson	0	$ 49.56	$ 91.66	$ 84.67	$ 58.67
Hodgson 78	I	$152.32	$154.67	$102.79	$ 71.88
Weber 84	I	$100.22	$100.22	$ 78.40	$ 78.40
Zane	III	$104.53	$107.36	$103.14	$102.30
Crawford	IV	$ 31.39	$ 39.16	$ 45.60	$ 73.12
Stafford	IV	$ 78.89	$ 78.89	$ 94.29	$ 94.29
Bay	V	$ 50.68	$ 80.44	$106.20	$116.76
$LSD_{(0.05)}$		32.74	28.05	32.74	28.05

[a]Incomes are based on biological data shown on pp. 75-76 of this report.

[b]The 1987 incomes were converted to the 1988 price level before averaging, using the personal consumption portion of the implicit Gross National Product deflator, a factor of 1.049.

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

SHORT-SEASON CORN HYBRID POPULATION

George V. Granade and Gary Kilgore[1]

Summary

Fifteen corn hybrids were obtained and planted at two populations in Montgomery County. Because of a poor stand, all plots were thinned to approximately 16,000 plants per acre. Yields ranged from 74 to 110 bu per acre. DeKalb DK 535, Cargill 6127, and Golden Harvest EX 723 were the top yielding hybrids.

Introduction

Growing under dryland conditions may be critical for full-season corn, if rains do not come during the reproductive stage of growth. Corn that matures in 100 to 115 days planted at higher than normal population may have more potential than full-season corn. The objective of this study was to determine the best population for growing short-season corn.

Experimental Procedures

Fifteen corn hybrids were obtained, packaged, and planted on the Dale Springer farm on April 24. Plots were thinned to one population because of a problem with insects and birds. Corn was harvested from two 25-foot rows in early September. Mid-silk date, lodging, dropped ears, yield, and test weight were recorded.

Results

Corn yields and yield components are shown in Table 1. Yields averaged 95 bu per acre, with DeKalb DK 535, Cargill 6127, and Golden Harvest EX 723 being the top yielders. Test weights ranged from 58 to 60 lb per bushel. Lodging and ear drop were not problems for any hybrid. Population did vary with hybrid, and generally hybrids with higher populations had a higher yield.

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[1]Area Extension Agronomist, Southeast Kansas.

Table 1. Yield and Yield Components of Short-Season Corn, Montgomery Co., 1988.

Brand	Hybrid	1988 Yield	Test Weight	Plant Population	Days to Silking	Lodging	Ear Drop
		Bu/a	Lb/bu	Plants/a		%	%
Cargill	3327	74.1	60.4	13,400	64	0	0
Cargill	6127	107.7	59.4	15,500	65	0	0
DeKalb	DK535	109.6	58.6	16,400	66	1	0
Garst	8711	77.7	58.8	13,000	65	0	1
Garst	8808	90.3	57.6	16,700	63	1	1
Golden Harvest	EX 723	105.0	59.4	15,400	63	1	0
Golden Harvest	H-2343	88.8	57.9	14,600	62	2	2
Hoegemeyer	SX 2566	100.1	60.4	16,200	65	0	0
Hoegemeyer	X8019 Exp	95.1	59.7	15,300	65	0	0
Northrup King	N4350	99.0	57.6	16,700	63	0	0
Northrup King	S4474	89.7	59.2	16,100	65	1	0
Pioneer	3737	101.8	58.5	15,800	63	0	0
Pioneer	3779	100.5	59.5	16,600	63	0	0
Seed Tec	ST-5900	90.5	58.3	15,500	66	1	0
Seed Tec	ST-7446	92.3	58.8	15,500	64	0	0
	$LSD_{0.05}$	15.4	0.7	2,100	1		
	Test mean	94.5	58.9	15,500	64		

Planting date: April 24, 1988
Harvest date: August 31, 1988
Herbicide: 0.66 pt Eradicane Extra + 2.5 lb Atrazine 9.0 per acre
Fertilizer: 150 lb N/a; 60 lb P_2O_5/a; 40 lb K_2O/a applied before planting.

COMPARISON OF SAVED WHEAT SEED AND CERTIFIED WHEAT SEED

George V. Granade

Summary

Seed of three hard red winter wheat varieties, one hybrid hard red winter wheat, and one soft red winter wheat variety was cleaned and saved from the 1987 study. In the fall, both certified seed and cleaned 1-year and 2-year old, saved seed were drilled at the rate of 1,080,000 seeds per acre. In June, 1988, wheat yields were measured. Caldwell and Chisholm were the two highest yielding varieties. Certified seed of Bounty BH 205 yielded 15 and 20 percent higher than the 1-year and 2-year old saved seed of BH 205. However, 1-year old, saved seed of Chisholm gave significantly higher yield than the certified Chisholm seed.

Introduction

Seed saved from year to year, especially from hybrids, usually yields lower than certified seed. Corn seed that has been saved from the previous season yields lower and produces a lot of variation in plant height. It would seem that wheat hybrids would follow a similar pattern. A study was initiated to examine the effect of saving seeds compared to using certified seed of the same wheat varieties or hybrids.

Experimental Procedures

Three hard red winter wheat varieties (Arkan, Chisholm, and TAM 107), one hard red winter hybrid wheat (Bounty BH 205), and one soft red winter wheat (Caldwell) were first planted in the fall, 1985; seed was saved and planted again with certified seed in 1986 and 1987. Seed from 1987 was cleaned to remove any trash and light test weight seeds. Certified seed of the same wheat varieties was obtained in the fall, 1987. On September 25, cleaned 1-year and 2-year saved seed and certified seed were planted with a 8-foot plot grain drill (7-inch row spacing) at a rate of 1,080,000 seeds per acre. Wheat was harvested on June 15, 1988. At harvest, yield, test weight, protein content, and 1000-kernel weight were determined.

Results

Yield and yield components are shown in Table 1. Significant differences were found in yield for variety and the interaction of seed source with variety. Yields from cleaned, 1-year old, saved wheat seed generally were higher than those from the certified wheat seed. Caldwell and Chisholm were the highest yielding wheat varieties, and Bounty BH 205 and Arkan were the lowest. Yields from the cleaned, 1-year old, saved Chisholm seed were significantly higher than yields from the certified Chisholm seed. However, yield from certified Bounty BH 205 seed was 15 to 20 percent higher than that from 1-year or 2-year old, saved seed.

Test weight was significantly higher for Chisholm than for any other variety. Arkan, Bounty BH 205, and TAM 107 had the highest protein content. Chisholm produced the smallest seed, whereas Caldwell produced the largest seed.

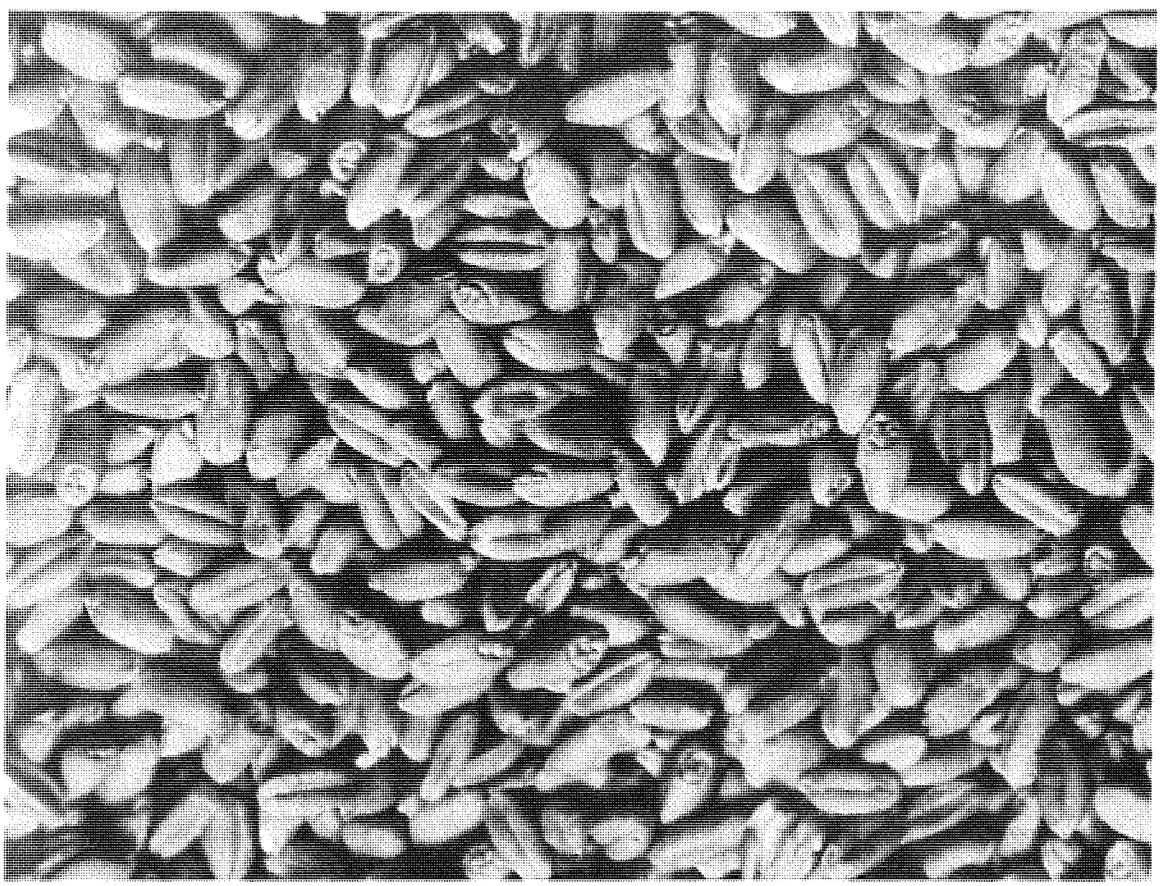

Table 1. Yield and Yield Components of Certified and Saved Wheat Seed, 1988.

Cultivar	Seed Source	1988 Yield	2 Yr Av. Yield	Test Weight	50% Heading	Plant Height	TKW[1]	Protein Content
		---bu/a----		lb/bu	Mo day	In	g	%
Arkan	Certified	67.7	58.7	58.1	5 - 6	43	22.4	13.4
Arkan	1 year[2]	72.5	62.4	58.2	5 - 4	42	23.4	12.7
Arkan	2 year	71.3	- -	58.8	5 - 5	43	22.6	12.6
Bounty BH 205	Certified	77.3	65.8	59.2	5 - 8	45	23.8	12.1
Bounty BH 205	1 year	67.2	59.7	57.6	5 - 9	47	25.1	12.7
Bounty BH 205	2 year	64.3	--	58.0	5 -10	46	23.6	12.6
Chisholm	Certified	73.8	67.9	60.0	5 - 5	41	24.2	11.8
Chisholm	1 year	81.4	72.4	60.8	5 - 5	41	25.3	11.0
Chisholm	2 year	78.7	--	60.3	5 - 5	40	26.2	11.4
TAM 107	Certified	72.3	62.2	55.5	5 - 3	41	24.9	12.6
TAM 107	1 year	75.7	66.4	55.0	5 - 3	42	24.7	12.5
TAM 107	2 year	75.1	--	55.7	5 - 3	42	25.1	12.3
Caldwell	Certified	77.9	72.2	55.6	5 - 5	42	20.5	11.9
Caldwell	1 year	81.3	70.6	56.4	5 - 6	42	20.7	11.8
Caldwell	2 year	76.2	--	56.3	5 - 6	42	20.7	12.0
	$LSD_{0.05}$	5.4	6.7	NS	NS	NS	NS	NS
Main Effects								
Arkan		70.5	60.5	58.3	5 - 5	43	22.8	12.9
Bounty BH 205		69.6	62.7	58.3	5 - 9	46	24.2	12.5
Chisholm		78.0	70.1	60.4	5 - 5	41	25.2	11.4
TAM 107		74.4	64.3	55.4	5 - 3	42	24.9	12.5
Caldwell		78.4	71.4	56.1	5 - 6	41	20.6	11.9
	$LSD_{0.05}$	3.1	3.8	1.2	1	1	1.5	0.4
	Certified	73.8	65.3	57.7	5 - 5	42	23.9	12.4
	1 year	75.6	66.3	57.6	5 - 5	42	24.9	12.2
	2 year	73.1	--	57.8	5 - 6	43	23.6	12.2
	$LSD_{0.05}$	NS	NS	NS	NS	NS	NS	NS

[1] TKW -- Thousand Kernel Weight.

[2] Seed is 1 or 2 years from certification; trash and light test weight seeds have been removed.

Date Planted: September 25, 1987

Date Harvested: June 15, 1988

PHOSPHORUS, POTASSIUM, AND CHLORIDE EFFECTS ON SELECTED DISEASES IN SIX WHEAT CULTIVARS IN SOUTHEASTERN KANSAS[1]

George V. Granade, William G. Willis[2], Merle G. Eversmeyer[2], Daniel W. Sweeney, David A. Whitney[3], and Larry C. Bonczkowski[3]

Summary

Wheat diseases destroy 10 to 25 percent of Kansas wheat yield and reduce the quality of harvested grain. A study was established in the fall of 1987 to examine the effects of P, K, Cl, and the P - K interaction with and without 'Tilt' on wheat diseases in six wheat cultivars. Yields were increased with each addition of P and K, whereas the incidence of leaf rust was decreased. Application of 'Tilt' fungicide increased yield, whereas it decreased the percent of leaf rust. Chloride decreased leaf rust and increased yields.

Introduction

In Kansas, wheat diseases destroy 10 to 25 percent of the wheat yield and reduce the quality of harvested grain. Depending on the year, the severity and incidence of the diseases change. Notable diseases for southeastern Kansas are leaf rust, speckle leaf blotch, and tan spot.

Addition of fertilizers have boosted yields, reduced lodging, and improved test weight. Research in the northwestern part of the United States also has indicated a decrease of disease incidence with certain fertilizer nutrients. Chloride has been shown to decrease take-all disease in wheat. The objectives of this study were (1) to examine the P, K, Cl, or the P - K interaction effects on the incidence of leaf rust, speckle leaf blotch, or tan spot in different wheat cultivars and (2) to determine whether fertility factors affect (a) plant nutrient concentrations, (b) protein content, (c) wheat yield, and (d) yield components.

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[1] Research is partially funded by a grant from the Foundation for Agronomic Research

[2]Department of Plant Pathology, KSU, Manhattan.

[3]Department of Agronomy, KSU, Manhattan.

Experimental Procedures

The study site was in soybeans for the previous three years and planted to wheat in the fall following soybean harvest. Eleven fertility levels were established with the soybean study and continued for the wheat study. Three P rates (0, 30, and 60 lb P_2O_5/a) were used in combination with three K rates (0, 40, and 80 lb K_2O/a). Two rates (0 and 64 lb/a) of Cl also were used. All fertilizers were broadcast by hand. Wheat cultivars planted were Agripro Thunderbird, Bounty BH 205, Caldwell, Karl, Newton, and TAM 107. At the boot growth stage, plots were split with one side receiving the fungicide 'Tilt'.

At the boot stage, 44 inches of one row of each plot was harvested for determination of dry matter production and nutrient concentration. Before harvest, the number of heads per area was counted, and 20 heads were selected randomly from each split plot to determine kernels per head. Plant height, yield, test weight, and 1000-kernel weight also were determined.

Results

The 1987 - 1988 growing season was very good for wheat, with overall yields averaging 72 bu/a. Yield, test weight, kernels per head, heads/m^2, disease rating for leaf rust, protein content, P uptake, K uptake, soil P, and soil K were significantly affected by the addition of P, K or the P - K interaction (Tables 1 and 2). Wheat yields were increased with each increment of P and K, but the highest yields were obtained with the addition of 60 lb of P_2O_5 and 40 lb of K_2O per acre (Table 1). Test weight was increased with each addition of K, whereas the addition of P decreased test weight. Applied P decreased the number of kernels per head, but increased the number of heads/m^2. Applied K decreased the number of kernels per head. Addition of K decreased the severity of leaf rust, whereas the addition of P had no effect. (Leaf rust was the major pathogen present in the 1987-1988 growing season.) Protein content was decreased with the addition of P_2O_5. Uptake of P was significantly affected by the interaction of applied P and K (Table 2). As P and K rates increased, the amount of P taken up by the plant increased. Soil P was increased with P fertilization, whereas soil K was decreased. Soil K was increased with K additions.

'Tilt', cultivar, and the interaction of 'Tilt' and cultivar significantly affected yield, test weight, kernels per head, heads per meter, disease rating of leaf rust, and protein content (Table 3). 'Tilt' increased yield, test weight, and the number of kernels per head and decreased the percent of leaf rust on the flag leaf. Caldwell and Bounty BH 205 were the highest yielding cultivars, and Karl had the highest test weight and protein content. Newton and TAM 107 had the highest incidence of leaf rust. 'Tilt' increased yield and test weight of Newton and TAM

107, but had no effect on yield and test weight of AgriPro Thunderbird, Bounty BH 205, Caldwell, and Karl. All cultivars had a decrease of leaf rust with 'Tilt'.

Yield, test weight, kernels per head, and protein content were significantly influenced by the interaction of P fertilization and cultivar (Table 4). Yield of all cultivars increased significantly with 30 lb P_2O_5/a. Test weight, kernels per head, and protein content decreased with each additional increment of P.

Yield, test weight, kernels per head, heads/m^2, disease rating for leaf rust, and protein content were significantly affected by the interaction of applied K and cultivar (Table 5). Even though yield tended to increase with 40 lb K_2O/a, only the yield of TAM 107 was significantly increased by K additions. Test weight, heads/m^2, and disease rating increased with K fertilization. Kernels per head, disease rating for leaf rust, and protein content decreased for some cultivars with the addition of K fertilizer.

Chloride and the Cl by cultivar interaction significantly affected yield, test weight, disease rating for leaf rust, Cl uptake, and soil Cl (Table 6). Yield, test weight, Cl uptake, and soil Cl were significantly increased with the addition of Cl. The incidence of leaf rust was decreased with the addition of Cl. TAM 107 yield was significantly increased with Cl, whereas the other cultivars (except AgriPro Thunderbird) were not significantly affected. Test weights of most cultivars were increased (significantly for TAM 107); however, that of Thunderbird remained unchanged.

Table 1. Effect of P and K Fertilization on Wheat, 1988.

Applied P_2O_5	K_2O	Yield	Test Weight	Disease Rating[1]	Kernels per Head	Heads per m^2	Protein Content
---lb/a---		bu/a	lb/bu	%			%
0	0	52.8	60.6	20	35.2	476	11.8
	40	57.3	61.4	20	33.1	509	11.7
	80	57.7	61.5	20	32.8	534	12.0
30	0	74.3	59.1	20	33.1	740	10.9
	40	80.8	60.2	15	32.2	734	10.6
	80	81.2	60.7	15	29.6	737	10.5
60	0	73.4	58.6	20	31.4	756	10.8
	40	85.0	60.4	15	28.4	721	10.5
	80	83.9	60.3	15	29.5	784	10.4
	LSD (.05)	2.1	0.5	3	NS	NS	NS
Main Effects							
0		55.9	61.1	20	33.7	506	11.8
30		78.7	60.0	20	31.6	737	10.6
60		80.8	59.8	20	29.8	754	10.6
	LSD (.05)	1.2	0.3	NS	1.2	40	0.2
	0	66.8	59.4	20	33.2	657	11.1
	40	74.4	60.6	15	31.2	654	10.9
	80	74.6	60.8	15	30.6	685	10.9
	LSD (.05)	1.2	0.3	2	1.2	NS	NS

[1] Disease rating was made on May 25, 1988 determining the percent of leaf rust on the flag leaf.

Table 2. Effect of Application Rates on P and K Uptake by Wheat and Soil P and K Levels, 1988.

Applied P_2O_5	Applied K_2O	Plant uptake P	Plant uptake K	Soil P	Soil K
---lb/a---		----lb/a----		----lb/a----	
0	0	4.6	50	11	96
	40	3.9	56	9	136
	80	4.3	71	12	198
30	0	9.4	56	27	97
	40	12.2	121	30	137
	80	12.8	162	27	184
60	0	13.7	76	59	98
	40	17.6	136	59	135
	80	17.9	165	58	173
	LSD (.05)	1.9	19	NS	NS
Main Effects					
0		4.3	59	11	143
30		11.5	113	28	139
60		16.4	125	59	135
	LSD (.05)	1.1	11	4	6
	0	9.3	60	32	97
	40	11.2	104	33	136
	80	11.7	133	32	185
	LSD (.05)	1.1	11	NS	6

Table 3. Effect of Cultivar and 'Tilt' Fungicide on Wheat Yield, Yield Components, Disease Rating, and Grain Protein Content.

Wheat Cultivar	'Tilt'	Yield	Test Weight	Disease Rating[1]	Kernels per Head	Heads per m^2	Protein Content
		bu/a	lb/bu	%			%
Thunderbird	No	71.1	62.2	10	29.0	645	11.0
	Yes	72.9	62.4	5	29.7	656	11.6
Bounty 205	No	76.6	60.0	15	34.2	646	11.4
	Yes	78.0	60.2	10	37.4	658	11.4
Caldwell	No	77.6	58.8	15	36.9	700	10.4
	Yes	79.3	58.9	10	36.8	671	10.2
Karl	No	69.0	61.4	15	27.3	713	11.6
	Yes	71.2	61.6	10	28.4	711	11.9
Newton	No	58.9	59.6	40	30.2	636	10.6
	Yes	67.5	60.7	20	32.1	644	10.7
TAM 107	No	65.2	58.1	50	28.2	655	10.7
	Yes	75.4	59.4	20	29.7	654	10.6
LSD (.05)		3.1	0.5	3	NS	NS	NS
Main Effects							
Thunderbird		72.0	62.3	5	29.4	650	11.3
Bounty 205		77.3	60.1	10	35.8	652	11.4
Caldwell		78.4	58.9	10	36.8	685	10.3
Karl		70.1	61.5	10	27.9	712	11.7
Newton		63.2	60.1	30	31.1	640	10.6
TAM 107		70.3	58.7	30	28.9	654	10.6
LSD (.05)		2.2	0.3	2	1.3	38	0.3
	No	69.7	60.0	25	31.0	666	11.0
	Yes	74.1	60.5	10	32.4	665	11.0
LSD (.05)		1.5	0.2	1	1.3	NS	NS

[1] Disease rating was made on May 25, 1988 determining the percent of leaf rust on the flag leaf.

Table 4. Effect of Wheat Cultivar and P Application Rate on Yield and Yield Components, 1988.

Wheat Cultivar	Applied P_2O_5	Yield	Test Weight	Kernels per Head	Protein Content
	lb/a	bu/a	lb/bu		%
Thunderbird	0	54.0	63.0	31.0	12.6
	30	80.3	62.0	29.8	10.8
	60	81.6	62.0	27.3	10.6
Bounty 205	0	61.5	60.9	36.4	12.4
	30	83.9	59.8	36.1	11.0
	60	86.4	59.6	34.9	10.8
Caldwell	0	64.0	60.2	41.7	10.7
	30	85.0	58.3	35.7	10.1
	60	86.3	58.1	33.1	10.0
Karl	0	52.7	62.3	28.2	12.8
	30	77.2	61.2	28.9	11.1
	60	80.3	60.9	26.5	11.2
Newton	0	50.7	60.4	34.8	11.2
	30	69.1	60.0	30.2	10.3
	60	69.9	59.9	28.5	10.3
TAM 107	0	52.1	59.6	29.7	11.2
	30	76.7	58.7	29.0	10.5
	60	80.0	58.2	28.3	10.3
LSD (.05)		13.8	1.9	2.5	0.5

Table 5. Effect of Cultivar and K Fertilization on Wheat Yield, Yield Components, Disease Rating, and Grain Protein Content.

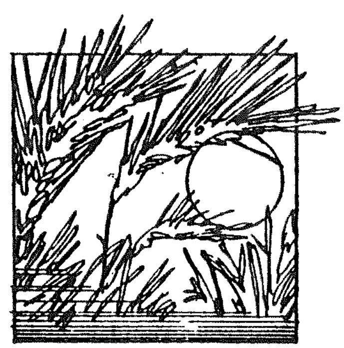
Wheat Cultivar	Applied K_2O	Yield	Test Weight	Disease Rating[1]	Kernels per Head	Heads per m^2	Protein Content
	lb/a	bu/a	lb/bu	%			%
Thunderbird	0	69.3	62.0	10	30.7	632	11.3
	40	73.6	62.4	5	29.5	632	11.3
	80	73.1	62.6	5	27.8	687	11.3
Bounty 205	0	69.2	59.5	15	37.6	603	11.5
	40	80.2	60.3	10	35.4	661	11.1
	80	82.5	60.6	10	34.4	691	11.6
Caldwell	0	72.4	57.8	15	38.5	733	10.6
	40	83.1	59.3	15	35.1	681	10.2
	80	79.8	59.5	10	36.8	642	10.1
Karl	0	68.9	60.9	20	29.1	681	11.7
	40	71.8	61.8	10	27.9	725	11.7
	80	69.6	61.7	10	26.6	730	11.7
Newton	0	59.9	59.5	35	32.7	619	10.6
	40	63.3	60.1	35	30.9	614	10.8
	80	66.5	60.8	30	29.9	687	10.5
TAM 107	0	61.2	57.0	40	30.7	676	11.2
	40	74.2	59.7	30	28.5	613	10.3
	80	76.1	59.6	30	27.6	674	10.5
LSD (.05)		13.8	1.9	4	NS	77	0.5

[1] Disease rating was made on May 25, 1988 determining the percent of leaf rust on the flag leaf.

Table 6. Cultivar and Cl Fertilization Effects on Wheat, 1988.

Wheat Cultivar	Applied Cl	Yield	Test Weight	Disease Rating[1]	Plant Uptake Cl	Soil Cl
	lb/a	bu/a	lb/bu		lb/a	lb/a
Thunderbird	0	82.0	62.0	5	15.8	13.7
	64	79.0	62.2	5	33.7	24.1
Bounty 205	0	82.0	59.1	15	13.5	12.8
	64	85.5	60.0	10	46.8	30.8
Caldwell	0	85.1	57.9	15	16.1	13.1
	64	86.1	58.1	10	51.9	32.1
Karl	0	78.3	60.7	15	13.7	12.3
	64	78.2	61.3	10	35.9	23.3
Newton	0	69.3	60.3	35	13.7	14.4
	64	69.8	60.4	30	52.0	32.4
TAM 107	0	77.2	56.5	35	14.7	13.1
	64	82.9	58.7	25	39.9	30.3
LSD (.05)		4.3	0.7	3	NS	3.8
Main effect						
	0	79.0	59.4	20	14.6	13.2
	64	80.3	60.1	15	43.4	28.8
LSD (.05)		NS	0.5	2	5.1	2.6

[1] Disease rating was made on May 25, 1988 determining the percent of leaf rust on the flag leaf.



SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

COMPARISON OF CONVENTIONAL AND INTENSIVE WHEAT MANAGEMENT SYSTEMS

Kenneth Kelley and George Granade

Summary

Nitrogen fertilizer and foliar fungicide effects were evaluated with selected winter cultivars at two sites in 1988. The optimum management system at the Parsons Unit consisted of a conventional fall N application followed by a foliar fungicide treatment in late spring. However, at the Columbus Unit, the intensive N system (fall + late winter) alone produced the highest grain yield.

Introduction

The objective of intensive cereal management is to produce winter wheat as efficiently as possible. Cultivar selection, time of N application, and use of foliar fungicide are important components in intensive wheat management systems. This research seeks to compare conventional and intensive wheat management systems for the climatic conditions in southeastern Kansas.

Experimental Procedure

In 1987 and 1988, 10 winter wheat cultivars were evaluated under conventional N management (75 lb N/a as a preplant, fall application) and an intensive N system (75 lb N/a applied in the fall + 50 lb N/a topdressed in late winter). Urea was the N source. The presence or absence of a foliar fungicide (Tilt) was evaluated in both N systems. Tilt was applied in late April at the rate of 4 oz/a. At the Parsons Unit, wheat followed wheat, and at the Columbus Unit, wheat followed soybeans in the rotation.

Results

At the Parsons Unit (Table 1), highest grain yield and test weight were obtained with a conventional fall N application + foliar fungicide; however, disease-susceptible cultivars showed the largest yield response to fungicide application. The fall +

late winter N application without fungicide significantly reduced both grain yield and test weight across all cultivars. Yield component data indicate that applying additional N in late wintermay be reducing the number of fertile tillers per plant, which would lower grain yield.

Effects of nitrogen and fungicide on wheat yield components also were evaluated at Parsons (Table 2). Applying additional N resulted in more kernels per head and reduced the individual kernel weight. However, the foliar fungicide had no effect on kernels per head, although individual kernel size was increased.

Plant tissue and grain samples were analyzed at the Parsons Unit (Table 3) for nitrogen concentrations to determine the effect of split-nitrogen application. The split-N application increased the N concentration in the plant and also increased grain protein. Arkan had the highest grain protein among wheat cultivars tested.

At the Columbus Unit, when wheat followed after soybeans (Table 4), the additional N application in late winter significantly increased the grain yield for selected varieties. Because foliar disease pressure was light in the spring of 1988, there was no response to foliar fungicide at this location.

This study will be continued in 1989 to further evaluate the optimum wheat management system for the climatic conditions of southeastern Kansas. Results at this point indicate that a foliar fungicide may be practical in some management systems and with specific wheat cultivars. Seed producers especially may be able to benefit from foliar fungicide applications, since they may be in a better position to recover the added fungicide expense through the sale of higher quality seed wheat. However, additional research is needed to determine the optimum nitrogen requirement for wheat grown in southeastern Kansas. Nitrogen is an essential nutrient for obtaining high winter wheat yield and for maximizing highest economic return, but it is not fully known how nitrogen fertility affects the foliar disease complex.

Table 1. Comparison of Winter Wheat Cultivars in Conventional and Intensive Management Systems, Parsons, 1988.

	Grain Yield					Test Weight				
	Fall - N		Fall + LW - N			Fall - N		Fall + LW - N		
Brand Cultivar	No Tilt	Tilt	No Tilt	Tilt	Avg.	No Tilt	Tilt	No Tilt	Tilt	Avg.
	---------- bu/A ----------					---------- lbs/Bu ----------				
Agripro Mesa	60.0	65.2	51.2	57.6	58.5	62.9	63.4	62.4	62.8	62.9
Agripro Victory	64.8	67.6	53.6	58.1	61.0	60.5	60.9	58.7	59.6	59.9
Arkan	58.4	62.2	47.7	52.2	55.1	61.1	61.2	60.1	60.6	60.8
Bounty 122	61.8	67.4	52.1	55.8	59.3	60.6	61.0	59.4	59.4	60.1
Caldwell	63.2	62.3	55.3	60.3	60.3	60.1	60.4	58.5	58.8	59.5
Century	55.8	72.0	56.1	59.8	60.9	59.3	60.0	58.2	59.1	59.1
Chisholm	63.3	76.2	59.2	68.0	66.7	61.6	62.6	61.4	62.1	61.9
McNair 1003	76.2	67.7	61.7	65.9	67.9	59.5	60.0	58.6	59.1	59.3
Pioneer 2157	61.4	65.0	51.7	58.1	59.0	63.0	62.9	61.9	62.4	62.5
Siouxland	49.4	54.9	48.8	48.7	50.4	61.2	61.6	60.3	61.1	61.1
Tam 107	63.0	68.7	59.0	68.4	64.8	59.5	60.8	58.0	59.9	59.5
(Means)	61.6	66.3	54.2	59.4		60.8	61.4	59.8	60.4	
LSD 0.05:										
Among management system means:					4.3					0.7
Among cultivar means averaged over management systems:					3.0					0.4
C.V. (%)					6.1					0.9

Planting date: Oct. 2, 1987
Previous crop: Wheat
Nitrogen fertilizer: Fall (75 lbs N/a, applied as preplant urea + starter N)
Late winter (50 lbs N/a, applied as urea on Feb. 29,1988
Fungicide application: Tilt, 4 fl. oz/a on April 25, 1988 (growth stage -8)

Table 2. Effects of Conventional and Intensive Management Systems on Wheat Yield Components, Parsons, 1988.

Brand Cultivar	Kernels / Head					1-000 Kernel Weight				
	Fall - N		Fall + LW - N			Fall - N		Fall + LW - N		
	No Tilt	Tilt	No Tilt	Tilt	Avg.	No Tilt	Tilt	No Tilt	Tilt	Avg.
						------------- gr -----------				
AP Mesa	25.0	26.5	27.4	29.1	27.0	24.9	26.4	23.3	24.5	24.8
AP Victory	30.0	30.3	31.5	33.6	31.3	24.8	27.8	25.5	26.3	26.1
Arkan	28.6	28.4	28.1	29.7	28.7	25.4	26.1	24.7	25.0	25.3
Bounty 122	30.7	33.0	35.3	36.8	34.0	27.6	29.6	26.5	28.2	28.0
Caldwell	33.1	32.3	33.6	36.8	34.0	23.8	23.4	21.4	20.6	22.3
Century	31.4	35.4	36.8	36.4	35.0	22.4	22.7	22.6	23.1	22.7
Chisholm	29.3	28.1	30.5	30.9	29.7	26.2	28.9	25.4	26.1	26.6
McNair 1003	33.5	33.5	39.3	38.3	36.2	28.0	29.6	28.2	28.4	28.6
Pioneer 2157	32.4	33.9	33.0	35.6	33.7	25.9	27.0	23.6	25.0	25.4
Siouxland	28.8	28.9	30.9	31.1	29.9	25.8	27.3	23.5	24.5	25.3
Tam 107	30.1	29.8	27.7	30.5	29.5	25.7	29.4	25.0	26.7	26.7
(Means)	30.3	30.9	32.2	33.5		25.5	27.1	24.5	25.3	
LSD 0.05:										
Between management system means:					0.9					1.0
Between variety means:					1.2					0.8
Between varieties for same management system:					2.3					1.5

Table 3. Effects of Conventional and Intensive Management Systems on Nitrogen Concentration in Flag Leaf and Grain, Parsons, 1988.

Brand Cultivar	Nitrogen Conc. - Flag Leaf: Fall - N, No Tilt	Fall - N, Tilt	Fall + LW - N, No Tilt	Fall + LW - N, Tilt	Avg.	Grain Protein: Fall - N, No Tilt	Fall - N, Tilt	Fall + LW - N, No Tilt	Fall + LW - N, Tilt	Avg.
	------------- %	------------				------------- %	------------			
AP Mesa	3.26	3.10	3.35	3.31	3.25	13.1	12.9	14.5	14.2	13.8
AP Victory	3.73	3.28	4.00	3.88	3.72	13.1	13.1	15.4	14.5	14.0
Arkan	3.63	3.47	3.73	3.68	3.63	13.7	13.5	15.3	15.2	14.4
Bounty 122	3.40	3.38	3.51	3.63	3.48	12.9	13.1	14.1	14.3	13.6
Caldwell	3.72	3.81	4.00	4.07	3.90	12.6	12.6	14.0	13.8	13.3
Century	3.46	3.43	3.82	3.69	3.60	13.3	13.2	14.2	14.0	13.7
Chisholm	3.31	3.00	3.39	3.44	3.29	12.3	11.9	13.3	13.3	12.7
McNair 1003	3.78	3.42	3.85	3.73	3.69	13.6	13.2	14.7	14.2	13.9
Pioneer 2157	3.35	3.33	3.53	3.50	3.43	12.7	12.8	14.4	14.4	13.6
Siouxland	4.10	3.31	4.15	4.02	3.89	13.6	12.5	14.9	14.6	13.9
Tam 107	3.47	3.31	3.60	3.59	3.49	13.3	12.7	14.6	13.6	13.6
(Means)	3.56	3.35	3.72	3.69		13.1	12.9	14.5	14.2	
LSD 0.05:										
Between management system means:					0.18					0.8
Between variety means:					0.13					0.4
Between varieties for same management system:					0.27					0.8

Table 4. Comparison of Winter Wheat Cultivars in Conventional and Intensive Management Systems, Columbus, 1988.

Brand Cultivar	Grain Yield: Fall - N: No Tilt	Grain Yield: Fall - N: Tilt	Grain Yield: Fall + LW - N: No Tilt	Grain Yield: Fall + LW - N: Tilt	Grain Yield: Avg.	Test Weight: Fall - N: No Tilt	Test Weight: Fall - N: Tilt	Test Weight: Fall + LW - N: No Tilt	Test Weight: Fall + LW - N: Tilt	Test Weight: Avg.
	bu/A					lbs/Bu				
AP Mesa	63.1	62.8	69.2	72.8	67.0	63.9	64.2	64.5	64.4	64.2
AP Thunderbird	62.9	60.4	61.9	65.2	62.6	63.3	63.9	64.1	64.2	63.9
AP Twain	64.9	60.8	66.5	67.7	65.0	63.5	63.2	63.6	63.9	63.5
Arkan	63.3	58.8	67.9	64.5	63.6	62.4	62.5	62.5	62.6	62.5
Caldwell	66.9	61.3	70.7	70.0	67.2	63.0	63.3	62.2	62.4	62.7
Century	58.1	63.2	66.7	67.4	63.8	62.9	63.4	62.0	62.2	62.6
Chisholm	71.3	63.3	78.4	75.2	72.1	62.4	62.2	62.7	63.1	62.6
Delange 7837	66.5	63.2	68.7	69.4	66.9	61.4	61.7	61.2	61.3	61.4
Pioneer 2551	63.6	61.1	71.7	75.7	68.0	61.3	61.6	61.2	61.2	61.3
Tam 107	67.1	63.1	64.0	67.3	65.4	61.4	61.9	60.2	60.9	61.1
(Means)	64.8	61.8	68.6	69.5		62.6	62.8	62.4	62.6	
LSD 0.05:										
Among management system means:					2.8					0.6
Among cultivar means:					2.4					0.2
C.V. (%)					4.5					0.4

Planting date: Oct. 22, 1987
Previous crop: soybeans
Nitrogen fertilizer: Fall (75 lbs N/a, applied as preplant urea + starter N)
Late winter (50 lbs N/a, applied as urea on Feb. 29,1988
Fungicide application: Tilt, 4 fl. oz/a on April 26, 1988 (growth stage-8).

EFFECTS OF PLANTING DATE AND FOLIAR FUNGICIDE ON WINTER WHEAT CULTIVARS

Kenneth Kelley and George Granade

Summary

The optimum planting date varied with individual cultivars, and the response to foliar fungicide also was dependent on the degree of disease resistance of individual cultivars. Yields ranged up to 21 bu/a higher with the foliar fungicide treatment.

Introduction

Wheat is planted over a wide range of planting dates in southeastern Kansas because of the varied cropping rotations in the area. More research is needed to determine if planting date has an effect on the occurrence of foliar leaf diseases and also to evaluate the effectiveness of a foliar fungicide in preventing leaf diseases using selected cultivars that differ in disease resistance.

Experimental Procedure

Ten winter wheat cultivars were planted on Sept. 25 and Oct. 16, 1987. A third planting date on Nov. 22 was destroyed because of poor stands. A foliar fungicide (Tilt) was applied at 4 oz/a at growth stage (GS) 8, which corresponds to flag leaf emergence.

Results

Wheat planted in September made good vegetative growth in early fall, but the lower leaves of all cultivars had a distinct yellow color that appeared to be associated with an environmental factor or disease complex. October-planted wheat did not grow as much vegetatively in the fall; however, the plants appeared much healthier. Grain yield was high for both September and October planting dates (Table 1) and did not appear to be affected by the early yellowing. The optimum planting date varied with individual cultivars. Response to the foliar fungicide also varied among cultivars. Century, Chisholm, and Tam 107 yielded significantly higher with the fungicide treatment. Both soft and hard wheat cultivars with a high degree of disease resistance did not show any yield benefit from the Tilt application.

Table 1. Response of Selected Winter Wheat Varieties to Foliar Fungicide Application at Two Different Planting Dates, Parsons, 1988.

Brand Variety	Grain Yield: Sept Plant No Tilt	Grain Yield: Sept Plant Tilt	Grain Yield: Oct Plant No Tilt	Grain Yield: Oct Plant Tilt	Grain Yield: Avg.	Grain Test Weight: Sept Plant No Tilt	Grain Test Weight: Sept Plant Tilt	Grain Test Weight: Oct Plant No Tilt	Grain Test Weight: Oct Plant Tilt	Grain Test Weight: Avg.
	---------- bu/A				-----------	----------- lbs/Bu				---------
Agripro Thunderbird	68.8	68.1	71.5	78.8	71.8	62.7	62.8	62.7	63.1	62.8
Arkan	65.8	64.4	67.2	75.5	68.2	60.6	61.4	60.6	60.8	60.9
Bounty 122	67.4	70.2	67.4	74.2	69.8	61.2	61.7	59.6	60.9	60.8
Caldwell	75.8	75.6	81.6	77.6	77.7	60.4	60.9	59.2	59.5	60.0
Century	70.9	80.7	71.3	76.2	74.8	59.7	60.0	58.3	59.5	59.4
Chisholm	73.4	80.1	80.0	90.4	81.0	62.0	62.3	61.7	62.3	62.1
Pioneer 2157	65.4	71.3	74.4	79.2	72.6	62.8	63.0	62.7	63.2	62.9
Pioneer 2551	85.8	88.6	79.6	78.7	83.2	58.5	58.6	56.8	57.4	57.8
Siouxland	64.2	65.1	67.3	76.2	68.2	61.7	62.2	61.4	61.8	61.8
Tam 107	70.2	81.8	64.1	85.1	75.3	60.0	61.1	58.0	60.3	59.9
(Means)	70.8	74.6	72.4	79.2		61.0	61.4	60.1	60.9	

LSD 0.05:	Yield	Test wt.
Planting date means:	NS	NS
Variety means (averaged over fungicide & planting date):	3.7 bu	0.3 lb
Fungicide means (variety & planting date combined):	3.1 bu	0.3 lb
Variety means for same planting date & fungicide:	7.4 bu	0.7 lb
Variety means for same fungicide (P.D. combined):	5.3 bu	0.5 lb
Planting date means for same or different fungicide and variety:	12.0 bu	1.1 lb
Fungicide means for same planting date & same or different variety:	8.2 bu	0.8 lb
C.V. (%)	6.2	0.7

Planting dates: Sept. 25 and Oct. 16, 1987
Fungicide rate: 4 fl. oz/A, applied at GS 9

COMPARISON OF FOLIAR FUNGICIDES FOR FOLIAR DISEASE CONTROL IN WINTER WHEAT

Kenneth Kelley

Summary

Comparisons of several foliar fungicides applied in late spring did not show any yield benefit when foliar disease pressure was very light because of the drier than normal climatic conditions in the spring of 1988.

Introduction

Foliar diseases have reduced both grain yield and grain quality the past 5 years in southeastern Kansas. Typically, leaf rust, septoria leaf spot, and powdery mildew have been the primary foliar leaf diseases that affect wheat. Previous research has shown that systemic fungicides, like Tilt and Bayleton, are effective in controlling certain leaf diseases during the critical grain filling stage. However, more information is needed under various climatic conditions to fully evaluate the use of foliar fungicides in eastern Kanasas.

Experimental Procedure

Four foliar fungicide treatments were compared in late April and early May across six wheat cultivars with various levels of disease resistance. Folicur, from Moybay, has not received federal clearance as a foliar fungicide as of this date.

Results

Grain yields (Table 1) were not affected by any of the foliar fungicide treatments at this site in 1988. Disease pressure was very light, which explains the lack of fungicide response. Of the selected cultivars compared, Chisholm was the top yielding.

Table 1. Comparison of Foliar Fungicide Applications with Selected Winter Wheat Cultivars, Parsons, 1988.

Brand Cultivar	Grain Yield — Foliar Fungicide					
	Bayleton	Dithane + Bayleton	Tilt	Folicur	Control	Avg.
	------------------ bu/A --------------------------					
Agripro Thunderbird	67.6	71.0	69.4	70.8	66.1	69.0
Caldwell	69.1	71.8	70.1	73.6	70.4	71.0
Century	68.8	66.9	70.1	71.9	64.6	68.4
Chisholm	78.8	73.1	80.9	77.7	77.1	77.5
Pioneer 2551	67.8	65.5	70.1	69.6	67.5	68.1
Tam 107	68.6	67.4	70.3	72.4	63.0	68.3
(Means)	70.1	69.3	71.8	72.7	68.1	

LSD 0.05:	
Fungicide treatments:	NS
Variety means:	3.1 bu/A
Fungicide x variety interaction:	NS
C.V. (%)	7.0

Planting date: Oct. 5, 1987
Fungicide application date:
Folicur & Tilt applied April 25, 1988 (growth stage 8)
Bayleton applied May 2, 1988 (growth stage 10)
Bayleton + Dithane applied on May 5, 1988 (growth stage 10.3)
Fungicide rate:
Bayleton - 4 oz/A (alone), 2 oz/A (tank-mix); Dithane - 2 lbs/A;
Folicur - 12 oz/A; Tilt - 4 oz/A;

CHEATGRASS CONTROL IN WINTER WHEAT

Kenneth Kelley

Summary

Tycor, an experimental wheat herbicide, gave excellent cheatgrass control and very little crop injury when fall-applied. When Tycor and Sencor were applied in late winter, cheatgrass control was satisfactory only at the higher application rate.

Introduction

Cheatgrass is a problem annual weed in many wheat fields where wheat has been grown continously or when wheat is planted on government set-aside land. Since wheat and cheatgrass are both in the grass family, herbicide control of cheat is difficult.

Experimental Procedure

Tycor and Sencor were applied both in late fall and late winter at the Parsons Unit to winter wheat that was densely populated with cheatgrass. Tycor has not received federal clearance as a wheat herbicide as of this date.

Results

Tycor applied in late November (Table 1) gave excellent cheatgrass control, whereas late winter applications provided only fair to good control, with the exception of the higher rate of Tycor. When Sencor was tank-mixed with Tycor in the fall, wheat injury was increased and wheat grain yield was reduced somewhat. However, the addition of Sencor to the tank-mix in late winter significantly increased cheat control.

Table 1. Comparison of Herbicides for Cheatgrass Control in Winter Wheat, Parsons Unit, 1988.

Herbicide	Rate	When Applied	Wheat Yield	Test Wt	Cheat Control	Crop Injury
	lb. a.i./A.		bu/A	lb/Bu	%	
Tycor	0.75	Fall	60.9	62.2	98	1.2
Tycor	1.00	Fall	65.2	62.0	98	1.3
Tycor + Sencor	1.00 + 0.125	Fall	52.1	62.2	98	1.8
Tycor	1.25	Fall	66.1	61.8	98	1.3
Sencor	0.375	Fall	55.0	62.3	98	2.5
Tycor + Sencor	1.00 + 0.125	Late winter	40.9	62.1	73	2.2
Tycor	1.00	Late winter	28.9	61.7	43	1.5
Tycor	1.25	Late winter	39.1	62.1	67	1.7
Tycor + Sencor	1.25 + 0.125	Late winter	33.2	62.3	75	2.2
Tycor	1.50	Late winter	31.1	61.8	57	1.8
Tycor + Sencor	1.50 + 0.125	Late winter	62.3	62.2	92	2.2
Sencor	0.50	Late winter	41.3	62.2	82	4.0
No Herbicide	---	----	12.8	59.2	0	1.0
LSD 0.05:			7.5	0.5	6	0.3
C.V. (%)			9.9	1.0	5	5

Variety: Tam 107, planted Oct. 5, 1987
Herbicide application dates:
Fall: Nov. 6, 1987 (Tycor); Nov. 23, 1987 (Sencor)
Late winter: Feb. 26, 1988
Rainfall after herbicide applications:
Fall: Nov. 8 = 0.35", 16 = 1.13", 17 = 0.30", 24 = 1.35", 25 = 1.05"
Late winter: Rained 2.15" within 6 days following herbicide treatment.
Crop injury rating: 1 = no injury and 10 = all plants dead.

EFFECTS OF CROPPING SEQUENCE ON SOYBEAN YIELDS[1]

Kenneth Kelley

Summary

When full-season soybeans follow grain sorghum, wheat, or a wheat-doublecrop rotation, soybean yield has not been affected significantly by the crop rotation. However, when soybeans follow soybeans, grain yield is reduced approximately 10%, even though the same amount of phosphorous and potassium fertilizer is applied to all crop rotations.

Introduction

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 double-cropping rotation with wheat. More information is needed to determine the long-term agronomic effects of cropping sequences on full-season soybeans.

Experimental Procedure

In 1979, four cropping rotations were initiated at the Columbus Field: 1) [wheat - doublecrop soybean] - soybeans, 2) wheat - fallow - soybeans, 3) grain sorghum - soybeans, and 4) continuous soybeans. Full-season soybean yields were compared across all four cropping systems in even-numbered years. Beginning in 1984, an identical study was started adjacent to the initial site so that full-season yield effects could also be compared in odd-numbered years. All rotations received the same amount of phosphorus and potassium fertilizer (80 lb/a), which was applied to the crop proceeding full-season soybeans.

Results

Soybean yield over the 7-year period is shown in Table 1. When soybeans follow grain sorghum, wheat, or a wheat-doublecrop rotation, grain yield has essentially been the same over the three rotations; however, when soybeans are grown on the same

[1]Research was supported by the Kansas Soybean Commission.

site, yield is reduced approximately 10%. Soil analyses reveal that the soil fertility level is nearly the same for all rotations, and the initial level has been maintained with the 80 lb/a application rate of phosphorus and potassium every 2 years.

Table 1. Effects of Cropping Sequences on Soybean Yield and Soil Nutrient Levels, Columbus Unit, 1988.

Cropping Sequence	Soy Yield		Soil Test Data					
			1980			1988		
	1988	7-yr.	pH	P	K	pH	P	K
	-- bu/A --			- lb/A -			- lb/A -	
Soybeans following Wheat - doublecrop Soy	31.3	24.0	7.1	39	150	7.0	40	150
Soybeans following Grain Sorghum	30.1	24.4	7.1	43	150	6.9	44	160
Soybeans following Wheat	32.8	25.2	7.2	40	135	7.1	35	130
Soybeans following Soybeans	25.2	21.8	7.2	40	135	7.2	46	135
LSD 0.05:	3.0	-	-	-	-	-	-	-

Soil test data represents the initial (1980) and current (1988) soil nutrient values. Phoshorous and potassium have been applied at the rate of 80 lbs/A for each nutrient to the crop preceeding full-season soybeans.

WHEAT AND SOYBEAN CROPPING SEQUENCES COMPARED

Kenneth Kelley

Summary

Over an 8-year period, comparisons between three wheat and soybean cropping systems indicate that doublecrop soybean yields can vary from a complete crop disaster to yields comparable to those of full-season soybeans. The long-term agronomic effects of double-cropping on subsequent crops that follow in the rotation are still being evaluated.

Introduction

In southeastern Kansas, producers often rotate wheat after soybean, or plant doublecrop soybeans following wheat harvest. Management practices of one crop, therefore, may affect the production of the next crop. The objectives of this study were to evaluate the effects of doublecropping and the risk factors associated with a particular cropping rotation.

Experimental Procedure

Beginning in 1981, three different wheat and soybean cropping rotations were established at the Parsons Field: 1) [wheat - doublecrop soybean], 2) [wheat - doublecrop soybean] - soybean, and 3) full-season soybean following 2 years of wheat. Wheat straw has been burned and then disced prior to planting doublecrop soybean. Soybean maturity has consisted of group IV and group V for doublecrop and full-season soybeans, respectively. When wheat has winter-killed or was not planted in the fall because of wet soil conditions, spring oats were planted in late winter.

Results

Soybean yields (Table 1) for the three crop rotations reflect the typical soil moisture variations that are commonly encountered in southeast Kansas during the summer growing season. Droughty soil conditions during August of 1988 affected doublecrop soybeans more than full-season soybeans.

In 1988, wheat yield (Table 2) also appeared to be affected by the previous crop rotation; however, more data are needed before any conclusions can be made regarding the effects of doublecropping on the wheat crop that follows in the rotation.

Table 1. Effects of Wheat and Soybean Cropping Sequences on Soybean Yield.

Crop Sequence	Soybean Yield 1981	1982	1983	1984	1985	1986	1987	1988	8-yr Avg.
	bu/A								
Wheat - doublecrop soy	18.7	23.6	17.9	2.1	33.2	19.9	19.5	9.1	18.0
Wheat - doublecrop soy full-season soy	18.0	23.0	16.9	2.0	31.6	17.6	19.3	8.4	17.1
Wheat - doublecrop soy full-season soy	25.8	24.3	15.5	11.1	32.6	21.2	35.4	22.7	23.6
Wheat - wheat full-season soy	25.7	24.9	14.5	12.8	32.1	23.9	42.6	25.1	25.2
LSD 0:05:	3.7	n.s.	n.s.	2.9	n.s.	3.8	2.5	1.5	----

Full-season and doublecrop soybeans planted on the same dates in 1982 & 1985.

Table 2. Effects of Wheat and Soybean Cropping Sequences on Wheat Yield, Parsons Unit, 1988.

Cropping Sequence	Grain Yield	Test Wt.	Grain N	TKW	Whole Plant N	Whole Plant P	Whole Plant K	Soil P	Soil K
	bu/A	lb/Bu	%	gr	%	%	%	lb/A	lb/A
[Wh - Soy]	49.5	58.8	2.00	24.6	1.58	0.204	1.56	51	193
[Wh - Soy] - Soy	52.6	60.7	1.59	27.4	1.04	0.165	1.37	34	177
Wh - Wh - Soy	60.5	61.7	1.68	27.0	1.01	0.170	1.40	47	193
Wh - Wh - Soy	61.6	59.2	1.97	24.9	1.44	0.171	1.49	52	193
LSD 0:05:	5.1	0.9	0.18	1.5	0.19	0.011	0.17	--	---
C.V. (%)	4.8	0.8	5.2	3.2	7.9	3.8	6.3	--	---

Variety: Arkan; planted Oct. 21, 1987.
Fertilizer: 70 lb N/A, 50 lb P_2O_5/A, and 50 lb K_2O/A.
Whole plant nutrient concentrations at flowering stage of wheat development.
Soil test values as of March, 1988.

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

ECONOMIC COMPARISONS OF WHEAT AND SOYBEAN CROPPING SEQUENCES

Robert O. Burton, Jr.[1] and Kenneth W. Kelley

Summary

Economic comparisons of three crop rotations were based on experimental data shown on p.109-110 of this report. Incomes based on 1988 yields favor a 3- year sequence of 2 years of wheat followed by full-season soybeans. Incomes based on 1988 wheat yields and average annual 1981-88 soybean yields favor a 1-year sequence of wheat followed by doublecrop soybeans.

Introduction

Farmers producing wheat and soybeans in southeastern Kansas select a cropping sequence in order to manage soil fertility, control weeds, and maximize income. An ongoing experiment at the Parsons Unit of the Southeast Kansas Branch Experiment Station provides biological data about alternative cropping sequences. The purpose of this study is to provide information about returns associated with these alternative sequences.

Experimental Procedures

Budgeting was used to calculate incomes above variable costs for each crop in three crop sequences (Table 1). Crop sequences included a 1-year sequence of wheat and doublecrop soybeans; a 2-year sequence of wheat, doublecrop soybeans, and full-season soybeans; and a 3-year sequence of 2 years of wheat followed by full-season soybeans. Output prices and seed costs were assumed to be the same for a given crop, regardless of when production occurred. Fertilizer prices were the same for all wheat, and interest rate was the same for all crops. No fertilizer was applied on soybeans. Yields and machinery operations differed according to the crop sequence (Table 2). For purposes of this study, labor was not included as a variable cost. Incomes above variable cost for each crop were added to provide total income

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for each sequence; these totals were then divided by the number of years required to complete a sequence to provide average annual incomes for each sequence. Incomes above variable costs were calculated based on 1988 yields for both wheat and soybeans and also based on 1988 yields for wheat and the average annual yields for soybeans for 1981 through 1988.

Results

Based on 1988 yields, the highest income above variable costs was obtained for the 3-year sequence consisting of 2 years of wheat followed by 1 year of full-season soybeans (Table 3). When average yields for soybeans were used, the highest income above variable cost was obtained for the 1-year sequence of wheat followed by doublecrop soybeans. In 1988, because of droughty soil conditions in August, doublecrop soybean yields were much more below normal than full-seasons soybean yields. These results indicate that on the average, doublecropping has been more profitable than singlecropping, when profit is measured by income above variable costs. But in a given year, such as 1988, income from crop rotations including doublecropping may be lower than income from crop rotations containing all full-season crops.

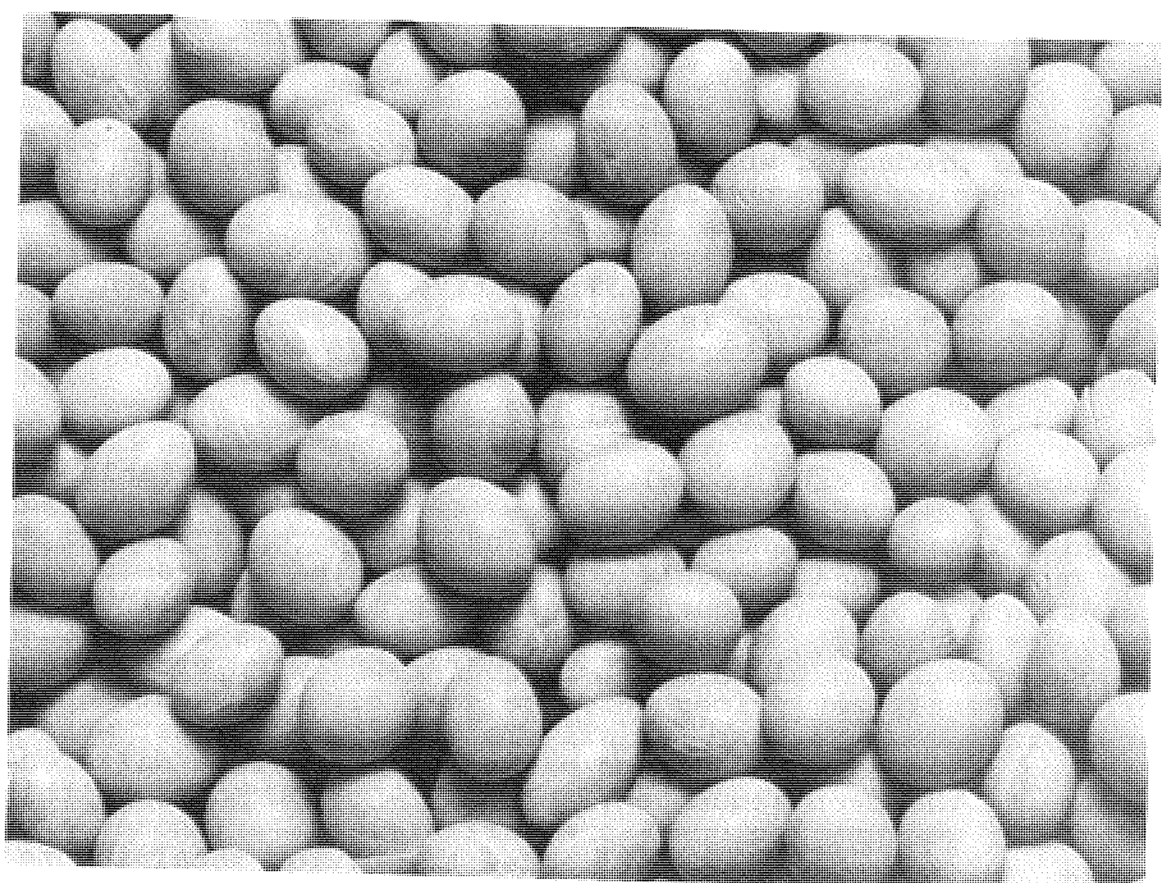

Table 1. Sample Budgets for Two-year Crop Sequence of Wheat, Doublecrop Soybeans, and Full-season Soybeans.

		Wheat			Doublecrop Soybeans			Full-season Soybeans		
	Unit	Price[a]	Quantity per Acre[b]	Value or Cost	Price[a]	Quantity per Acre[b]	Value or Cost	Price[a]	Quantity per Acre[b]	Value or Cost
1. Gross Receipts from Production	Bu.	$2.40	52.60	$126.24	$5.25	8.40	$44.10	$5.25	22.70	$119.18
2. Variable Costs										
Seed	Lbs.	0.10	75.00	7.50	0.15	60.00	9.00	0.15	60.00	9.00
Nitrogen	Lbs.	0.22	70.00	15.40	-	-	0.00	-	-	0.00
Phosphate	Lbs.	0.26	50.00	13.00	-	-	0.00	-	-	0.00
Potash	Lbs.	0.12	50.00	6.00	-	-	0.00	-	-	0.00
Herbicide				0.00			21.05			21.05
Machinery				15.31			13.43			17.14
Interest on 1/2 of variable cost	Dol.	0.12	28.61	3.43	0.12	21.74	2.61	0.12	23.60	2.83
Total Variable Cost				60.64			46.09			50.02
3. Income above variable costs				$65.60			($1.99)[c]			$69.16

[a] Prices and costs other than machinery costs are projections from Figurski, Leo and John R. Schlender, Soybean Production in Eastern Kansas and Continuous Cropped Winter Wheat in Eastern Kansas, KSU Farm Management Guides MF-570 and MF-572, revised August 1988. Machinery variable costs (fuel, lubrication, and repairs) are based on information from Fuller, Earl I and Mark F. McGuire, Minnesota Farm Machinery Economic Cost Estimates for 1988, Minnesota Extension Service, University of Minnesota, AG-FO-2308, revised 1988, with adjustments for southeastern Kansas.

[b] Yields, seed and fertilizer are 1988 data from Kenneth Kelley at the Southeast Kansas Branch Experiment Station.

[c] Parentheses indicate a negative number.

Table 2. Typical Average Machinery Operations per Acre Used in Budgets for Crops in Alternative Crop Sequences

Machinery Operations	Wheat Following Wheat	Wheat Following Doublecrop or Full-season Soybeans	Doublecrop Soybeans Following Wheat	Full-season Soybeans Following Wheat	Full-season Soybeans Following Doublecrop Soybeans
	-Number of Times over the Field-				
Burn Wheat Straw			1.00		
Moldboard Plow	0.50				
Chisel Plow				1.00	1.00
Disk	2.50	1.00	1.00	3.00	2.00
Fertilizer Buggy	1.00	1.00			
Field Cultivate	1.25	1.00			
Field Cultivate with Herbicide			1.00	1.00	1.00
Plant	1.00	1.00	1.00	1.00	1.00
Herbicide Application			0.50	0.50	0.50
Row Cultivate				0.50	0.50
Combine	1.00	1.00	1.00	1.00	1.00
	Acre/Truck Load-				
Medium Truck[a]	7.13	7.13	21.90	21.90	21.90
	Acres/Hour-				
Light Truck	3.50	3.50	3.50	3.50	3.50
	-Dollars/Acre-				
Machinery Variable Costs[b]	19.95	15.31	13.43	18.39	17.14

[a] Acres per truck load for a 400 bushel truck are based on yields of 18 bushels per acre for soybeans and 56 bushels per acre for wheat. Lower yields would increase acres per truckload and decrease costs per acre and vice versa. Because adjustments in costs would be small, acres per truck load and costs per acre are not adjusted for yield differences.

[b] Variable costs include fuel, lubrication, and repairs and $2.50 per acre rental charge for the fertilizer buggy.

Table 3. Incomes above Variable Costs for Alternative Cropping Sequences Containing Wheat, Doublecrop Soybeans, and/or Full-season Soybeans at Parsons, Kansas[a]

Crops and Crop Sequences[b]	Income above Variable Costs: 1988 Yields	Income above Variable Costs: 1988 Wheat and 1981-88 Average Soybean Yields
	-Dollars/Acre-	
[W-DCSB]		
W	58.16	58.16
DCSB	1.69	48.41
Annual Average[c]	59.85	106.57
[W-DCSB]-FSSB		
W	65.60	65.60
DCSB	(1.99)[d]	43.69
FSSB	69.16	73.88
Annual Average[c]	66.39	91.59
W-W-FSSB		
W Year 1	84.56	84.56
W Year 2	82.28	82.28
FSSB	80.43	80.95
Annual Average[c]	82.42	82.60

[a] Incomes are based on biological data shown in this report, p. 110.

[b] Abbreviations are as follows W = wheat; DCSB = doublecrop soybeans, FSSB = full-season soybeans. Brackets indicate wheat and doublecrop soybeans harvested the same year.

[c] Annual average income is the total income for the crop sequence divided by the number of years required to complete the sequence.

[d] Parentheses indicate a negative number.

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COMPARISONS OF TILLAGE METHODS FOR DOUBLECROP SOYBEANS AND SUBSEQUENT EFFECTS ON FULL-SEASON SOYBEANS

Kenneth Kelley

Summary

Four tillage methods (plow, burn - disc, disc, and burn - chisel - disc) have been compared for doublecrop soybean production to evaluate both the short- and long-term effects in a wheat and soybean cropping system. For the dry soil conditions in 1988, discing the wheat stubble and leaving the straw mulch on the soil surface conserved soil moisture and gave the highest yield.

Introduction

Producers in southeastern Kansas typically grow doublecrop soybeans after wheat, when soil moisture and time permit. Various tillage methods are used, depending to some degree on the type of equipment that is available. The primary goals of doublecropping are to plant soybeans as quickly as possible after wheat harvest and produce acceptable grain yields as economically as possible. However, the long-term effects from the doublecrop tillage methods have not been thoroughly evaluated for shallow, claypan soil conditions.

Experimental Procedure

Since 1982, four tillage methods have been compared for doublecrop soybeans after wheat harvest at the Columbus Field. Tillage methods are: 1) plow under stubble, 2) burn stubble and then disc, 3) disc stubble, and 4) burn stubble and then chisel. The tillage study is alternated each year between two different sites, so that the doublecrop tillage methods can be compared yearly when the cropping rotation is [wheat - doublecrop soybean] - full-season soybeans. All plots are chiseled in the spring following doublecrop soybeans. Fertilizer is applied only to the wheat crop.

Results

In 1988 when soil moisture was limited during August, highest doublecrop soybean yield (Table 1) was obtained by discing the wheat stubble and leaving the stubble on the soil surface to conserve soil moisture. However, over a 6-year period, plowing the stubble under has given the highest doublecrop soybean yield.

Table 1. Comparison of Doublecrop Tillage Methods, Columbus Unit.

Doublecrop Tillage Method	Doublecrop Soybean Yield						
	1982	1983	1985	1986	1987	1988	6-yr.
	bu/A						
Plow, disc, field cultiv.	26.1	25.2	32.9	20.2	18.7	14.6	23.0
Burn, disc, field cultiv.	25.8	24.2	32.1	14.7	9.8	10.5	19.5
Disc (2x)	26.6	23.2	30.3	15.2	12.8	19.2	21.2
No-till	26.3	20.5	24.7	---	---	---	---
Burn, chisel, disc, field cultiv.				15.3	14.4	14.3	---
LSD 0.05:	n.s.	3.6	4.9	1.3	2.8	3.0	---

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

Table 2. Effects of Doublecrop Tillage Method on Subsequent Yield of Full-Season Soybeans, Columbus Unit.

Doublecrop Tillage Method	Full-Season Soybean Yield				
	1985	1986	1987	1988	4-yr Avg.
	bu/A				
Plow, disc	32.1	25.8	30.7	26.3	28.7
Burn, disc	32.5	26.0	29.0	26.3	28.5
Disc	32.2	24.7	29.3	25.1	27.8
Burn, chisel, disc	33.3	25.7	30.8	25.7	28.9
LSD 0.05	n.s.	n.s.	n.s.	n.s.	n.s.

Cropping sequence is a [wheat - doublecrop soybean] - full season soybean rotation. All plots are chiseled in the spring, so the tillage method represents only the doublecrop tillage effect from the previous year. Doublecrop tillage methods have completed three complete cycles in the crop rotation cycle.

Table 3. Effects of Previous Doublecrop Soybean Tillage Methods on Winter Wheat Growth, Columbus Unit, 1988.

Doublecrop Tillage	Grain Yield	Test Wt.	1,000 Kernel Wt.	Grain N	Nutrient Conc. of Plant		
					N	P	K
	bu/A	lb/Bu	gr	%	--------	%	----------
Plow	60.8	62.0	33.5	1.38	0.70	0.141	1.18
Burn	57.6	61.9	33.4	1.30	0.68	0.147	1.12
Disc	60.6	61.7	33.3	1.31	0.69	0.133	1.03
Chisel	61.7	61.9	32.9	1.33	0.76	0.155	1.14
LSD 0:05:	n.s.	n.s.	n.s.	0.05	n.s.	n.s.	n.s.

Nutrient concentration of plant at flowering stage of wheat development.

Table 4. Effects of doublecrop tillage methods on soil properties of doublecrop soybeans, Columbus Unit, 1988.

Doublecrop Tillage	Soil Bulk Density	Soil Moisture		
		0-4"	4-8"	8-12"
	gr/cm3	------	% by volume	-------
Plow	1.56	9.2	10.9	15.9
Burn - Disc	1.58	7.6	9.7	13.9
Disc	1.62	10.3	13.5	21.2
Burn - Chisel	1.55	8.7	10.7	14.8
LSD 0.05:	n.s	1.4	1.8	n.s.

Soil bulk density represents a soil depth of 0-4".
Soil moisture measurements were taken at the early pod stage of soybean growth.

EFFECTS OF PHOSPHORUS AND POTASSIUM FERTILIZER ON SOYBEANS

Kenneth Kelley

Summary

Soybean yields were not significantly affected by preplant applications of phosphorus and potassium fertilizer at two locations in Cherokee County, where soils were testing medium in available phosphorus and low in exchangeable potassium and the previous crop was soybeans.

Introduction

Soybeans are considered poor responders to direct fertilizer applications. In southeast Kansas, soybeans are often grown in rotation with wheat or a row-crop, such as grain sorghum or corn. When grown in rotation with another crop, soybeans are seldom fertilized, since they can utilize the residual fertility from the previous crop. However, this research was initiated to determine if soybeans respond to direct fertilizer applications when following soybeans, which occurs quite often in southeastern Kansas.

Experimental Procedure

In the spring of 1988, fertilizer was applied to two locations in Cherokee County, where the previous crop was soybeans in 1987. At site 1 (Bill Shaffer farm), grain sorghum was grown in 1986, and at site 2 (Dee Shaffer farm), soybeans had been grown for the past 3 years and no fertilizer had been applied. Both locations tested medium in available P (26 and 40 lb/a) and low in exchangeable K (110 lb/a). The fertilizer treatments were incorportated with a field cultivator prior to soybean planting. Leaf samples were collected at the early pod-fill stage of soybean growth to determine P and K nutrient concentrations.

Results

Grain yield at both locations did not show a significant response to direct fertilizer application (Table 1). There was a trend toward higher yield with increasing rates of potassium at site 2, but this was not statistically significant. Leaf anaylses at this same site did show that higher potassium levels were present in the plant at the early pod-fill stage when fertilizer K rates were increased.

Table 1. Effects of Phosphorus and Potassium Fertility Applications on Soybeans, Cherokee County, 1988.

Fertilizer		Bill Shaffer Farm			Dee Shaffer Farm		
P	K	Leaf-P	Leaf-K	Yield	Leaf-P	Leaf-K	Yield
-- lb/A --		%	%	bu/A	%	%	bu/A
0	0	0.297	1.24	23.5	0.317	1.19	35.5
40	0	0.287	1.18	22.4	0.321	1.17	37.3
80	0	0.293	1.24	25.6	0.309	1.13	37.1
0	40	0.294	1.24	24.4	0.319	1.28	37.9
0	80	0.301	1.35	23.3	0.312	1.34	38.3
40	40	0.294	1.28	22.6	0.318	1.27	37.9
40	80	0.297	1.40	26.0	0.323	1.38	39.3
80	40	0.301	1.27	22.5	0.318	1.29	37.4
80	80	0.285	1.25	22.9	0.308	1.34	38.5
LSD 0.05		NS	NS	NS	NS	0.10	NS
C.V.(%)		3.1	8.0	8.0	2.6	4.7	5.3

Initial soil test data:

Site-1: pH = 6.8, avail. P = 26 lb/a, and exch. K = 110 lb/a

Site-2: pH = 6.7, avail. P = 40 lb/a, and exch. K = 110 lb/a

Leaf samples collected at the early pod-fill stage of growth.

COMPARISON OF SOYBEAN HERBICIDES FOR COCKLEBUR CONTROL IN NARROW AND WIDE ROW SPACINGS

Kenneth Kelley

Summary

Good to excellent cocklebur control was obtained both in narrow (7-inch) and wide (30-inch) row spacing in a 3-year study; however, postemergent herbicide applications were more consistent for weed control than preplant or preemergent treatments.

Introduction

Cocklebur is one of the major problem weeds in many soybean fields of southeastern Kansas. It is a strong competitor for available water, light, and nutrients. When cockleburs are allowed to compete with the soybean plant for the entire growing season, yields in many cases are reduced by 50% or more. The weeds also cause mechanical harvesting problems. The objectives of this research were to evaluate various herbicides and application methods both in narrow and wide row spacing and also to determine the added benefit of cultivation.

Experimental Procedure

Beginning in 1986, preplant incorporated, preemergent, and postemergent herbicides were compared in three management systems: 1) narrow rows (7-inch spacing), 2) 30-inch rows, and 3) 30-inch rows with one mechanical cultivation. Some herbicide treatments were not tested during all 3 years.

Results

A 3-year summary of soybean yield and cocklebur control for the herbicide treatments are shown in Tables 1, 2, and 3. Postemergent treatments gave the best and most consistent cocklebur control. Yields were highest in 2 out of 3 years for soybeans grown in 7-inch row spacing. In 30-inch rows, cultivation increased soybean yield by 3 to 5 bu/a. When cockleburs were controlled within 4 weeks of planting, soybean yield generally was not affected. However, after 4 weeks of cocklebur competition, soybean yield normally was reduced significantly.

Table 1. Effects of Herbicides and Row Spacings on Soybean Yield with Heavy Cocklebur Weed Competition, Southeast Ks. Branch Expt. Station.

Herbicide	Rate	When Applied	Row Spacing	Soybean Yield 1988	1987	1986
				---------	bu/A	---------
Canopy	0.5 lb	PPI	Narrow	30.7	---	35.2
			Wide	21.2	---	24.4
			Wide + Cultiv.	22.8	---	28.9
			(Avg)	(24.9)	---	(29.5)
Scepter	0.67 pt	PPI	Narrow	26.8	---	33.0
			Wide	19.9	---	27.1
			Wide + Cultiv.	20.3	---	29.5
			(Avg)	(22.3)	---	(29.9)
Canopy	0.5 lb	PRE	Narrow	31.7	25.3	35.8
			Wide	19.5	27.3	27.7
			Wide + Cultiv.	23.5	34.0	29.6
			(Avg)	(24.9)	(28.9)	(31.0)
Preview	0.5 lb	PRE	Narrow	31.0	28.8	---
			Wide	21.4	24.8	---
			Wide + Cultiv.	21.6	33.4	---
			(Avg)	(24.7)	(29.0)	---
Scepter	0.67 pt	PRE	Narrow	24.2	28.6	---
			Wide	19.8	29.4	---
			Wide + Cultiv.	22.2	29.7	---
			(Avg)	(22.1)	(29.2)	---
Basagran	1.00 pt	POST	Narrow	30.9	34.2	36.9
			Wide	22.2	29.5	25.4
			Wide + Cultiv.	26.4	34.1	32.7
			(Avg)	(26.5)	(32.6)	(31.7)
Classic	0.5 oz	POST	Narrow	32.3	26.1	28.5
			Wide	21.3	26.3	19.3
			Wide + Cultiv.	27.9	32.7	29.4
			(Avg)	(27.2)	(28.4)	(25.7)
Scepter	0.67 pt	POST	Narrow	30.4	28.5	31.3
			Wide	21.2	27.8	23.9
			Wide + Cultiv.	28.9	33.3	30.0
			(Avg)	(26.8)	(29.9)	(28.4)
Rescue	2.00 qt	L-POST	Narrow	24.9	20.9	28.8
			Wide	13.3	21.4	12.3
			Wide + Cultiv.	16.2	28.4	18.7
			(Avg)	(18.1)	(23.6)	(19.9)
Control	---	---	Narrow	9.0	14.0	14.1
			Wide	5.8	13.2	5.6
			Wide + Cultiv.	10.8	19.1	18.8
			(Avg)	(8.5)	(15.4)	(12.8)

Surfactant (0.25% v/v) or 28% N (1 qt/A) added to postemergent treatments.

Table 2. Effects of Herbicides and Row Spacings on Cocklebur Control in Soybeans, Southeast Ks. Branch Expt. Station.

Herbicide	Rate	When Applied	Row Spacing	Cocklebur Control 1988	1987	1986
				---------- % ---------		
Canopy	0.5 lb	PPI	Narrow	91	--	97
			Wide	84	--	85
			Wide + Cultiv.	95	--	98
Scepter	0.67 pt	PPI	Narrow	95	--	98
			Wide	91	--	90
			Wide + Cultiv.	97	--	98
Canopy	0.5 lb	PRE	Narrow	92	75	98
			Wide	83	80	87
			Wide + Cultiv.	94	87	98
Preview	0.5 lb	PRE	Narrow	93	75	--
			Wide	78	70	--
			Wide + Cultiv.	93	87	--
Scepter	0.67 pt	PRE	Narrow	90	92	--
			Wide	83	91	--
			Wide + Cultiv.	96	91	--
Basagran	1.00 pt	POST	Narrow	97	98	98
			Wide	97	93	96
			Wide + Cultiv.	98	88	97
Classic	0.50 oz	POST	Narrow	98	88	98
			Wide	97	85	98
			Wide + Cultiv.	98	94	98
Scepter	0.67 pt	POST	Narrow	98	98	98
			Wide	97	98	97
			Wide + Cultiv.	98	96	98
Rescue	2.00 qt	L-POST	Narrow	78	95	77
			Wide	67	98	65
			Wide + Cultiv.	83	98	83
Control	---	---	Narrow	20	20	25
			Wide	0	0	0
			Wide + Cultiv.	43	45	47

Surfactant (0.25% v/v) or 28% N (1 qt/A) added to postemergent treatments.

Table 3. Summary of Soybean Yield and Cocklebur Control, Columbus, 1986-88.

		Year 1988	1987	1986
		Yield - bu/A		
Means of herbicide treatments: (Control not included)	Narrow	29.2	27.5	32.8
	Wide	20.0	26.6	22.9
	Wide + Cultiv.	23.3	32.2	28.4
F-test significance:	Row Spacing	***	*	***
	Herbicice Trt	***	***	***
	Row x Herb Trt	***	***	***
C.V. (%):		5.4	4.9	6.1
LSD 0:05: (Among herbicide treatments)				
Comparing herbicides within same row spacing:		2.1	2.3	2.8
Comparing herbicides between row spacings:		2.3	4.2	2.9
		Cocklebur Control (%)		
Means of herbicide treatments: (Control not included)	Narrow	92	89	95
	Wide	86	88	88
	Wide + Cultiv.	95	92	96
F-test significance:	Row Spacing	**	*	*
	Herbicide Trt	***	***	***
	Row x Herb Trt	***	***	***
C.V. (%):		2.6	3.1	3.5
LSD 0.05: (Among herbicide treatments)				
Comparing herbicides within same row spacing:		4	5	5
Comparing herbicides between row spacings:		5	5	7
Date of soybean planting:		6/22	6/12	6/20
Date of herbicide applications:				
Shallow preplant (PPI)		6/22	----	6/20
Preemergent (PRE)		6/23	6/12	6/20
Postemergent - early (POST)		7/11	6/26	7/8
- late (L-POST)		7/26	7/20	7/24

Date of cultivation:
Approximately one week after postemergent herbicide application.

Row spacing:
Narrow: 7-inch spacing
Wide: 30-inch spacing

Soybean variety: Pershing (Group V Maturity)

ECONOMIC ANALYSIS OF ALTERNATIVE HERBICIDES AND PRODUCTION SYSTEMS FOR COCKLEBUR CONTROL IN SOYBEANS

Rachel C. Thuruthel[1], Robert O. Burton, Jr.[1], Kenneth W. Kelley, Guido van der Hoeven[1], and Allen M. Featherstone[1]

Summary

Cocklebur control was evaluated using alternative herbicides and application methods or no herbicide application, with narrow row spacings, wide row spacings, and wide row spacings with one cultivation. Budgeting was used to measure returns above variable costs based on biological data from p.121-124 of this report. Returns above variable costs ranged from $16.18 to $127.12 for narrow row spacings, from $2.31 to $80.81 for wide row spacings, and from $27.25 to $107.79 for wide row spacings with one cultivation. Results could differ for different years or locations. However, in 1988, the postemergent herbicide Classic used with narrow row spacings returned the highest income above variable costs.

Introduction

Farmers who need to control cocklebur in soybeans consider several different herbicides and production systems. This study measures returns and variable costs associated with six herbicides and three application methods that can be used with three production systems, narrow (7-inch) rows, wide (30-inch) rows, or wide rows with a cultivation to control weeds.

Experimental Procedure

Budgeting was used to measure receipts, variable costs, and income above variable costs (Table 1). A budget was prepared for each herbicide and application method for each of the three production systems. Soybean price, seed price, fertilizer rates and prices, and cost of Treflan to control grasses were the same for all budgets. Yields, herbicide costs, machinery costs, and interest costs differed for the different combinations of herbicide, application method, and production system. Machinery costs were based on machinery operations typical of Southeastern Kansas farms (Table 2). Based on the assumption that most farms

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in Southeastern Kansas rely primarily on family labor, costs of labor and management were not included.

Result and Discussion

In comparisons of individual herbicides, Basagran and Classic applied postemergent resulted in the two highest income levels with soybeans planted in wide rows or narrow rows (Table 3). When wide rows with a cultivation were used, Scepter applied postemergent had the highest income; Classic and Basagran applied postemergent had the second and the third highest income levels. Thus, postemergent herbicides resulted in the two highest income levels for all three production systems. Canopy and Preview applied preemergent with narrow row spacings also resulted in high income levels.

In comparisons of the production systems, the use of narrow rows resulted in the highest income levels for all herbicides. Cultivation was more profitable than no cultivation in 30-inch row soybean production.

This study focused on the effectiveness of selected herbicides, application methods, and production systems in 1988. Thus, issues such as herbicide carryover and possible detrimental impacts on human health and the environment were not addressed. Weather, soil, and other conditions that affect herbicide productivity vary. Since this study only considers results at Columbus, Kansas in 1988, producers should consider information from other years and other locations in selecting the appropriate weed control strategy for individual farms.

Table 1. Sample Budget: Soybean Production with Narrow Row Spacing and Cocklebur Control Using Classic (Postemergent).

Item	Unit	Price[a]	Quantity Per Acre[b]	Value or Cost
Gross Receipts From Production	Bu.	$5.25	32.30	$169.58
Variable Inputs				
Seed	Lb.	$0.15	60.00	$9.00
Phosphate	Lb.			$0.00
Potash	Lb.			$0.00
Treflan	Pt.	$3.33	1.50	$5.00
Classic +	Oz.	$20.30	0.50	$10.15
liq N	Qt.	$0.18	1.00	$0.18
Machinery	Dol.			$15.73
Interest on 1/2 of Variable Cost	Dol.	$0.12	20.03	$2.40
Total Variable Costs				$42.46
Income Above Variable Costs	Dol.			$127.12

[a] The cost of liq N is from U. S. Dept. of Agr., Agricultural Prices, Washington, D.C.: ASB NASS, Oct 31, 1988. Output price, seed price, interest rate, and price of fertilizer are from Figuriski and Schlender, Soybean Production in Eastern Kansas, KSU Farm Management Guide, MF-570, Dept. of Agr. Econ., Kansas State University, Revised Aug., 1988. Herbicide costs are from Nilson et al., "Chemical Weed Control for Field Crops, Pastures, Rangeland, and Noncropland, 1988." Rpt. of Progress 530, Agr. Exp. Sta., Kansas State University, Jan. 1988. Machinery operating costs (fuel, repairs, and lubrication) are based on information from Fuller, Earl I, and Mark F. McGuire, Minnesota Farm Machinery Economic Cost Estimates for 1988, Minnesota Extension Service, University of Minnesota, AG-FO-2308, revised 1988, with adjustments for southeastern Kansas.

[b] Yields, seed, and fertilizer are 1988 data from Kenneth Kelley at the Southeast Kansas Branch Experiment Station.

Table 2. Machinery Operations for Alternative Herbicide Application Methods and Production Systems for Cocklebur Control in Soybeans, 1988.

Machinery Operations	Shallow Preplant Incorporate and No Herbicide, Narrow Rows	Shallow Preplant Incorporate and No Herbicide, Wide Rows	Shallow Preplant Incorporate and No Herbicide, Wide Rows with Cultivation	Pre- and Post emergent, Narrow Rows	Pre- and Post emergent, Wide Rows	Pre-and Post emergent, Wide Rows with Cultivation
	---Number of Times Over the Field---					
Tandem Disk	2.00	2.00	2.00	2.00	2.00	2.00
Chisel Plow	1.00	1.00	1.00	1.00	1.00	1.00
Field Cultivate with Herbicide Application	1.00	1.00	1.00	1.00	1.00	1.00
Planter		1.00	1.00		1.00	1.00
Grain Drill	1.00			1.00		
Sprayer				1.00	1.00	1.00
Row Cultivator			1.00			1.00
Combine	1.00	1.00	1.00	1.00	1.00	1.00
	---Acres per Truck Load---					
Medium Truck[a]	21.90	21.90	21.90	21.90	21.90	21.90
	---Acres Per Hour---					
Light Truck	3.50	3.50	3.50	3.50	3.50	3.50
	---Dollars per Acre---					
Total Variable Costs[b]	15.31	16.30	17.53	15.73	16.73	17.96

[a] Acre/truck load for a 400 bu. truck are based on yields of 18 bu./acre for soybeans. Lower yields would increase the acres/truck load and decrease costs/acre and vice versa. Because adjustments in costs would be small, acres/truck load and costs/acre are not adjusted for yield differences.

[b] Variable costs include fuel, lubrication, and repairs.

Table 3. Income above Variable Costs for Alternative Strategies to Control Cocklebur in Soybeans[a]

Herbicide	Application[b] Rate	Method	Income above Variable Costs: Narrow Row	Wide Row	Wide Row with Cultivation
			----------------	$	----------------
Canopy	0.5 lb.	SPPI	113.95	67.03	74.09
Scepter	0.66 pt.	SPPI	95.80	62.50	63.30
Canopy	0.5 lb.	PRE	118.75	57.62	77.31
Preview	0.5 lb.	PRE	117.19	69.71	69.45
Scepter	0.66 pt.	PRE	81.70	61.52	72.81
Basagran[c]	1 pt.	POST	123.57	80.81	101.55
Classic[c]	0.5 oz.	POST	127.12	72.28	105.63
Scepter[c]	0.66 pt.	POST	114.05	68.67	107.79
Rescue[c]	2 qt.	POST	92.67	34.68	48.60
No Herbicide			16.18	2.31	27.25

[a] Incomes are based on biological data shown in this report, pp. 121-124.

[b] Abbreviations of herbicide application methods are SPPI for Shallow Preplant Incorporated, PRE for Preemergent, and POST for Postemergent.

[c] One quart of liquid nitrogen was applied with postemergent treatments.

COMPARISON OF SOYBEAN HERBICIDES AND TIME OF APPLICATION FOR COCKLEBUR CONTROL

Kenneth Kelley

Summary

Soybean herbicides applied postemergent gave the best cocklebur control and highest soybean yield in 1988. Drier soil conditions during May and early June evidently did not adequately activate preplant and especially preemergent herbicides for optimum cocklebur control.

Introduction

Determining the optimum time to apply broadleaf herbicides for problem weeds, such as cocklebur, is an important consideration for many soybean producers in southeastern Kansas. This research seeks to evaluate the effectiveness of broadleaf herbicides and determine the optimum time of application for cocklebur control.

Experimental Procedure

Various soybean herbicide tankmixes that are currently labeled for cocklebur control were compared at the Columbus Field on a site where cocklebur was the predominant weed competition. The soil type was a Parsons silt loam with 1.3% organic matter and a pH of 6.8.

Results

In 1988, the best cocklebur control and highest soybean yields were obtained with postemergent herbicide applications. Results are shown in Tables 1, 2, and 3. Preemergent herbicide applications provided only fair to good weed control, even though adequate rainfall occurred within 10 days of application. Cockleburs may have emerged before the preemergent herbicides were activated by rainfall. Scepter applied immediately prior to planting appeared to reduce soybean yield on some light-textured soils. However, when Scepter was applied several weeks ahead of planting, soybean injury appeared to be reduced. With moderate cocklebur competition, Pursuit provided significantly better weed control when applied postemergent rather than preplant or preemergent.

Table 1. Comparisons of Soybean Herbicides and Time of Application for Cocklebur Control, Columbus Unit, 1988.

Herbicide	Rate	When Applied	Soy Yield	Cocb Control	Crop Injury
	lb. a.i./A		bu/A	%	
Lasso + Scepter	2.0 + 0.125	EPP	17.2	97	1.4
Squadron	0.875	EPP	16.2	93	1.5
Tri-Scept	0.875	EPP	17.3	96	1.5
Prowl + Scepter	1.0 + 0.125	EPP + POST	18.2	98	1.1
Prowl + Pursuit	1.0 + 0.063	EPP + POST	19.6	98	1.1
Prowl + Scepter	1.0 + 0.125	EPP + PRE	16.1	87	1.4
Lasso + Scepter	2.0 + 0.125	Shal. PPI	15.7	95	1.5
Squadron	0.875	PPI	16.2	97	1.5
Tri-Scept	0.875	PPI	14.2	98	1.6
Lasso + Scepter	2.0 + 0.125	PRE	16.1	88	1.4
Squadron	0.875	PRE	15.3	95	1.5
Hand Weeded	-----	---	23.6	99	1.0
No Herbicide	-----	---	5.3	0	1.0
LSD 0.05:			3.8	4	0.2
C.V. (%)			13	3	8

All plots cultivated once.
Variety: Pershing, planted June 21, 1988.
Time of herbicide application: EPP (early preplant incorporated) = May 27; Shal. PPI (shallow preplant incorporated) & PRE (preemergent) = June 21; POST (postemergent) = July 11.
Crop injury rating: 1 = no injury and 10 = all plants dead.
Weed rating: July 20. Cocb = common cocklebur.
Soil type: Parsons silt loam, O.M. = 1.2%
Rainfall record: May 17 = 0.40", 22 = 0.75"; June 15 = 1.7", 30 = 2.7"; July 1 = 1.7", 6 = 0.2", 17-18 = 1.50", 22 = 0.33".

Table 2. Comparisons of Soybean Herbicides and Time of Application for Cocklebur Control, Columbus Unit, 1988.

Herbicide	Rate	When Applied	Soy Yield	Cocb Control	Crop Injury
	lb. a.i./A		bu/A	%	
Squadron	0.875	EPP	18.4	91	1.6
Treflan + Pursuit	0.75 + 0.063	EPP	19.0	63	1.1
Treflan + Canopy	0.75 + 0.33	EPP	19.0	84	1.5
Prowl + Scepter	0.75 + 0.125	EPP + POST	23.9	98	1.2
Treflan + Pursuit	0.75 + 0.063	EPP + POST	24.7	98	1.1
Treflan + Classic	0.75 + 0.008	EPP + POST	24.7	98	1.3
Squadron	0.875	PPI	16.2	93	1.7
Treflan + Pursuit	0.75 + 0.063	PPI	16.3	78	1.2
Treflan + Canopy	0.75 + 0.33	PPI	19.2	88	1.5
Lasso + Scepter	1.5 + 0.125	Shal. PPI	14.4	83	1.4
Lasso + Canopy	1.5 + 0.33	Shal. PPI	21.2	83	1.4
Lasso + Pursuit	1.5 + 0.063	Shal. PPI	14.8	60	1.1
No Herbicide	-----	---	5.5	0	1.0
LSD 0.05:			5.2	14	0.2
C.V. (%)			17	11	6

All plots cultivated once.
Variety: Pershing, planted June 21, 1988.
Time of herbicide application: EPP (early preplant incorporated) = May 27; Shal. PPI (shallow preplant incorporated), PPI, & PRE = June 21; POST (postemergent) = July 11.
Crop injury rating: 1 = no injury and 10 = all plants dead.
Weed rating: July 20.
Soil type: Parsons silt loam, O.M. = 1.2%
Rainfall record: May 17 = 0.40", 22 = 0.75"; June 15 = 1.7", 30 = 2.7"; July 1 = 1.7", 6 = 0.2", 17-18 = 1.50", 22 = 0.33".

Table 3. Comparisons of Soybean Herbicides and Time of Application for Cocklebur Control, Columbus Unit, 1988.

Herbicide	Rate	When Applied	Soy Yield	Cocb Control	Crop Injury
	lb. a.i./A		bu/A	%	
Sencor + Classic	0.3 + 0.008	PRE + POST	22.2	98	1.4
Lorox (+)	0.60	PRE	15.7	84	1.5
Sencor + Scepter	0.25 + 0.063	PRE	14.6	67	1.4
Preview	0.33	PRE	17.6	83	1.5
Canopy	0.33	PRE	17.9	90	1.7
Scepter	0.125	PRE	15.8	89	1.5
Pursuit	0.063	PRE	16.4	70	1.2
Basagran	0.50	POST	21.5	98	1.2
Classic	0.008	POST	20.5	98	1.2
Cobra + 2,4-DB	0.2 + 0.03	POST	21.0	98	5.0
Tackle + 2,4-DB	0.5 + 0.03	POST	19.7	95	3.0
Scepter	0.094	POST	19.9	98	1.1
No Herbicide	-----	---	8.8	0	1.0
LSD 0.05:			4.0	9	0.2
C.V. (%)			13	7	6

Dual applied preemergent to all plots for annual grass control.
All plots cultivated once.
Variety: Pershing, planted June 21, 1988.
Time of herbicide application: PRE (preemergent) = June 21;
POST (postemergent) = July 11.
Crop injury rating: 1 = no injury and 10 = all plants dead.
Weed rating: July 20.
Soil type: Parsons silt loam, O.M. = 1.2%
Rainfall record: June 15 = 1.7", 30 = 2.7"; July 1 = 1.7", 6 = 0.2", 17-18 = 1.50 ", 22 = 0.33".

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

COMPARISONS OF HERBICIDES AND APPLICATION METHODS FOR VELVETLEAF CONTROL IN SOYBEANS

Kenneth Kelley

Summary

Various application methods and herbicides were evaluated for velvetleaf control, and all treatments provided excellent broadleaf weed control in 1988.

Introduction

Velvetleaf has become a serious broadleaf weed problem in many fields of southeastern Kansas. When velvetleaf is present in a moderately heavy population and germinates at the same time as soybeans emerge, it competes with soybeans for available light and soil moisture and can reduce yields significantly.

Experimental Procedure

Preplant incorporated treatments were applied with a field cultivator prior to planting. Incorported and preemergent herbicides were applied on the same day that soybeans were planted. Postemergent herbicides were applied 3 weeks later when velvetleaf was in the 2- to 4-leaf stage of growth. Soil type was a Parsons silt loam with 1.3% organic matter and a pH of 6.8.

Results

Velvetleaf control was good to excellent for all herbicide comparisons in 1988 (Table 1). Lack of rainfall for 10 days after planting may have been the reason for the lower weed control with preemergent applications. However, timely rainfall and high humidity provided excellent climatic conditions for postemergent velvetleaf control. The addition of liquid 28% N fertilizer to postemergent treatments also improved velvetleaf control.

Table 1. Comparisons of Soybean Herbicides and Application Methods for Velvetleaf Control, Columbus Unit, 1988.

Herbicide	Rate	When Applied	Soy Yield	Vele Control	Crop Injury
	lb. a.i./A		bu/A	%	
Canopy	0.28	S. PPI	21.7	92	1.5
Preview	0.33	S. PPI	21.5	91	1.5
Command	0.75	S. PPI	21.4	98	1.0
Pursuit	0.063	S. PPI	20.9	95	1.5
Scepter + Command	0.125 + 0.125	S. PPI	21.1	93	1.6
Sencor	0.25 + 0.25	S. PPI + PRE	18.1	96	2.0
Canopy	0.28	PRE	22.3	89	1.6
Preview	0.33	PRE	23.2	92	1.6
Lorox (+)	0.60	PRE	21.6	88	1.5
Pursuit	0.063	PRE	20.2	95	1.6
Scepter	0.125	PRE	19.7	86	1.5
Basagran + Liq. N	0.5 + 1 gal	POST	22.5	98	1.3
Basagran + Crop Oil	0.5 + 1 qt	POST	23.5	98	2.4
Classic + Liq. N	0.008 + 1 gal	POST	21.4	98	1.2
Cobra + Liq. N	0.2 + 1 gal	POST	22.6	98	5.5
Pursuit + Liq. N	0.063 + 1 gal	POST	21.7	97	1.4
Tackle + Liq. N	0.5 + 1 gal	POST	23.6	98	2.8
No Herbicide	-----	----	11.7	0	1.0
LSD 0.05:			3.1	4	0.3
C.V. (%)			9	3	11

Dual applied preemergent to all plots for annual grass control.
Variety: Pershing, planted June 20, 1988.
Time of herbicide application: S. PPI (shallow preplant incorporated), PPI, and PRE (preemergent) = June 20; POST (postemergent) = July 11.
Crop injury rating: 1 = no injury and 10 = all plants dead.
Weed rating: July 20. Vele = velvetleaf.
Soil type: Parsons silt loam, O.M. = 1.2%
Rainfall record: June 15 = 1.7", 30 = 2.7"; July 1 = 1.7", 6 = 0.2"; 17-18 = 1.50", 22 = 0.33".

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

EFFECTS OF HERBICIDE APPLICATIONS ON SOYBEAN YIELD

Kenneth Kelley

Summary

Soybean herbicides and application methods were evaluated for annual weed control in 1988. In the absence of adequate weed competition, treatments also were evaluated for possible effects on soybean yield because of crop injury associated with a particular application method or herbicide.

Introduction

Annual grass and small-seeded broadleaf weeds can become serious problems for soybean producers in southeastern Kansas. When weeds compete for available light, water, and soil nutrients during the entire growing season, soybean yields are often reduced significantly. Crop rotations are helpful in breaking some weed cycles, but proper selection and application of herbicides are essential for obtaining optimum soybean yields in most fields.

Experimental Procedure

Preplant, preemergent, and postemergent soybean herbicides were compared at the Columbus Field. Soil type was a Parsons silt loam with 1.3% organic matter and a pH of 7.0. Weed competition was very light at this site in 1988 and consisted primarily of smooth pigweed.

Results

Comparisons for the various soybean herbicide tankmixes are shown in Tables 1, 2, and 3. In general, postemergent treatments provided the least crop injury, best weed control, and highest soybean yield in 1988. Some of the postemergent treatments, such as Cobra and Tackle, resulted in significant soybean leaf burning, but plants soon resumed normal growth, and yield was not affected. However, a slight yield reduction appears to be possible with some of the newer soybean herbicides, when they are applied preplant incorporated immediately prior to soybean planting. The exact reason for this yield reduction on light-textured soils is not fully known. More studies are planned to further investigate this problem.

Table 1. Comparisons of Preplant Soybean Herbicides for Weed Control, Columbus Unit, 1988.

Herbicide	Rate	When Applied	Soy Yield	Smpw Control	Crop Injury
	lb a.i./A		bu/A	%	
Squadron	0.875	PPI	18.6	98	1.7
Prowl + Pursuit	0.75 + 0.063	PPI	24.6	94	1.2
Treflan + Command	0.75 + 0.50	PPI	25.0	89	1.1
Salute	1.125	PPI	23.8	94	1.3
Sonalan + Canopy	0.75 + 0.28	PPI	21.9	95	1.5
Salute + Scepter	1.125 + 0.063	PPI	22.8	97	1.3
Turbo	2.0	Shal. PPI	24.6	93	1.3
Dual + Preview	1.5 + 0.33	Shal. PPI	23.2	97	1.3
Lasso + Scepter	1.5 + 0.125	Shal. PPI	22.1	98	1.6
Lasso + Canopy	1.5 + 0.28	Shal. PPI	21.5	96	1.5
Command + Preview	0.75 + 0.33	Shal. PPI	25.3	94	1.2
No Herbicide + Cult.	-----	---	23.9	90	1.0
LSD 0.05:			3.1	NS	0.2
C.V. (%)			8	5	9

All plots cultivated once.
Variety: Pershing, planted June 21, 1988.
Time of herbicide application: PPI (preplant incorporated), Shal. PPI (shallow preplant incorporated) & PRE (preemergent) = June 21, 1988.
Crop injury rating: 1 = no injury and 10 = all plants dead.
Weed rating: July 20. Smpw = smooth pigweed.
Soil type: Parsons silt loam, O.M. = 1.2%
Rainfall record: June 15 = 1.7", 30 = 2.7"; July 1 = 1.7", 6 = 0.2", 17-18 = 1.50", 22 = 0.33".

Table 2. Comparisons of Preemergent Soybean Herbicides for Weed Control, Columbus Unit, 1988.

Herbicide	Rate	When Applied	Soy Yield	Smpw Control	Crop Injury
	lb. a.i./A		bu/A	%	
Lasso + Canopy	1.5 + 0.28	PRE	21.6	97	1.6
Dual + Canopy	1.5 + 0.28	PRE	20.1	98	1.6
Dual + Preview	1.5 + 0.33	PRE	19.7	98	1.6
Lasso + Preview	1.5 + 0.33	PRE	21.2	98	1.5
Lasso + Sencor	1.5 + 0.30	PRE	23.8	98	1.3
Dual + Sencor + Scepter	1.5 + 0.25 + 0.063	PRE	18.9	91	1.5
Lasso + Scepter	1.5 + 0.125	PRE	19.0	98	1.7
Dual + Scepter	1.5 + 0.125	PRE	19.2	98	1.6
Lasso + Pursuit	1.5 + 0.063	PRE	20.8	95	1.5
Dual + Pursuit	1.5 + 0.063	PRE	20.2	98	1.4
Lasso + Lorox (+)	1.5 + 0.60	PRE	21.8	95	1.5
No Herbicide + Cultivation	-----	---	20.7	90	1.0
LSD 0.05			2.9	5	0.2
C.V. (%)			8	3	6

All plots cultivated once.
Variety: Pershing, planted June 21, 1988.
Time of herbicide application: PRE (preemergent) = June 21, 1988.
Crop injury rating: 1 = no injury and 10 = all plants dead.
Weed rating: July 20. Smpw = smooth pigweed.
Soil type: Parsons silt loam, O.M. 1.2%
Rainfall record: June 15 = 1.7", 30 = 2.7"; July 1 = 1.7", 6 = 0.2", 17-18 = 1.50", 22 = 0.33".

Table 3. Comparisons of Soybean Herbicides and Time of Application for Weed Control, Columbus Unit, 1988.

Herbicide	Rate	When Applied	Soy Yield	Smpw Control	Crop Injury
	lb a.i./A		bu/A	%	
Treflan + Classic	0.75 + 0.008	PPI + POST	27.5	98	1.3
Treflan + Pursuit	0.75 + 0.063	PPI + POST	27.1	98	1.2
Prowl + Scepter	0.75 + 0.125	PPI + POST	24.5	98	1.2
Command + Classic	0.75 + 0.008	S. PPI + POST	27.8	93	1.2
Command + Cobra	0.75 + 0.20	S. PPI + POST	28.1	98	2.7
Sonalan + Blazer	0.75 + 0.25	S. PPI + POST	26.6	98	1.9
Lasso + Basagran	2.0 + 0.5	S. PPI + POST	28.4	98	1.2
Lasso + Classic	2.0 + 0.008	S. PPI + POST	25.4	97	1.3
Dual + Pursuit	1.5 + 0.063	S. PPI + POST	25.8	98	1.3
Dual + Scepter	1.5 + 0.125	S. PPI + POST	24.4	97	1.4
Scepter + Tackle	0.125 + 0.5	S. PPI + POST	23.2	98	2.3
No herbicide + Cultiv.	-----	---	22.8	90	1.0
LSD 0.05:			3.5	2	0.3
C.V. (%)			8	3	9

All plots cultivated once.
Liquid 28% N applied at a rate of 1 qt/A for all postemergent treatments.
Variety: Pershing, planted June 21, 1988.
Time of herbicide application: S. PPI (shallow preplant incorporated) and PRE (preemergent) = June 21; POST (postemergent) = July 11.
Crop injury rating: 1 = no injury and 10 = all plants dead.
Weed rating: July 20. Smpw = smooth pigweed.
Soil type: Parsons silt loam, O.M. = 1.2%
Rainfall record: June 15 = 1.7", 30 = 2.7"; July 1 = 1.7", 6 = 0.2", 17-18 = 1.50", 22 = 0.33".

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

EFFECTS OF POSTEMERGENT SPRAY ADDITIVES FOR COCKLEBUR CONTROL

Kenneth Kelley

Summary

Four postemergent spray additives were evaluated with selected postemergent soybean herbicides to determine if cocklebur control would be affected. Since soil moisture and humidity were ideal for postemergent applications in 1988, no significant difference was found among the additives tested (surfactant, crop oil concentrate, liquid-N, or Dash).

Introduction

Postemergent soybean herbicides often are applied in southeastern Kansas to control broadleaf weeds. The effect of adding various spray additives to the herbicide tankmix is not fully known for certain broadleaf weed problems, such as cocklebur. Climatic conditions at the time of spraying also are known to have an effect on the performance of postemergent herbicides.

Experimental Procedure

Four, selected, postemergent soybean herbicides were compared with four different spray additives at the Columbus Field, where cocklebur was the predominant weed problem.

Results

Excellent cocklebur control was obtained with all herbicides and additives tested in 1988 (Table 1). It appears that the addition of a spray additive is not as important for cocklebur control as it might be for other broadleaf weeds, such as velvetleaf and pigweed. In addition, when weeds are somewhat drought stressed, the addition of a spray additive has significantly improved weed control in previous research trials, when pigweed was the predominant weed.

Table 1. Effects of Postemergent Herbicide Additives for Cocklebur Control, Columbus Unit, 1988.

Herbicide Additive	Rate	Soy Yield	Weed Control Cocb	Weed Control Tea	Crop Injury
	lb a.i./A	bu/A	---- % ----		
Basagran + Blazer	0.5 + 0.25	(19.7)	(98)	(98)	(2.8)
Surfactant (AG-98)	0.25 %	18.7	98	98	2.5
Crop Oil	1 %	19.4	98	98	3.0
Liq. 28% N	2 qt	21.5	98	98	2.5
Dash	1 %	19.3	98	98	3.0
Classic	0.008	(17.9)	(98)	(10)	(1.5)
Surfactant (AG-98)	0.25 %	16.9	98	10	1.4
Crop Oil	1 %	16.3	98	10	1.7
Liq. 28% N	2 qt	18.4	98	10	1.3
Dash	1 %	19.9	98	10	1.7
Cobra + 2,4-DB	0.2 + 0.03	(17.9)	(98)	(98)	(4.5)
Surfactant (AG-98)	0.25 %	16.6	98	98	4.0
Crop Oil	1 %	16.8	98	98	5.0
Liq. 28% N	2 qt	19.1	98	98	4.2
Dash	1 %	19.3	98	98	4.8
Pursuit	0.063	(19.5)	(98)	(18)	(1.2)
Surfactant (AG-98)	0.25 %	17.2	98	15	1.1
Crop Oil	1 %	18.0	98	20	1.3
Liq. 28% N	2 qt	20.4	98	20	1.1
Dash	1 %	22.5	98	20	1.4
No herbicide	---	8.3	0	0	1.0
LSD 0.05 (herbicide treatment):		NS	NS	5	0.1
C.V. (%)		15	-	5	5
Means of herbicide additives:					
Surfactant (AG-98)		17.3	98	-	2.3
Crop Oil		17.6	98	-	2.8
Liq. 28% N		19.8	98	-	2.3
Dash		20.2	98	-	2.7
LSD 0.05:		2.5	NS	-	0.2

All plots received Treflan for annual grass control.
Variety: Pershing, planted June 22.
Date of postemergent herbicide application: July 13, 1988
Crop injury rating: 1 = no injury and 10 = all plants dead.
Weed rating: August 1. Cocb = common cocklebur; Tea = teaweed.
Rainfall record: July 1 = 1.7", 6 = 0.2", 17-18 = 1.50", 22 = 0.33".

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

PERFORMANCE EVALUATION OF GRAIN SORGHUM HYBRIDS

Kenneth Kelley, George Granade, and Ted Walter[1]

Summary

Sixty-five grain sorghum hybrids were evaluated for agronomic performance. Average grain yield was 106 bu/a, with a range of 84 to 123 bu/a. Complete test results are compiled in the 1988 Kansas Sorghum Performance Tests, Report of Progress No. 562.

Introduction

Grain sorghum is an important feed crop in southeastern Kansas, especially on the shallow, upland soils where corn yields are often reduced because of the normally dry conditions during July, when corn is tasseling and filling grain. Performance tests provide farmers, extension workers, and private research and sales personnel with unbiased agronomic information on many sorghum hybrids marketed in Kansas.

Experimental Procedure

Sixty-five grain sorghum hybrids were evaluated in 1988 at the Parsons Field. Planting date was May 4, and harvest date was September 13.

Results

Dry topsoil conditions at the time of the early May planting resulted in uneven seed emergence, and initial stand counts of some hybrids were not at the desired 35,000 plants per acre level. However, thin stands compensated during the favorable growing season by producing more tillers per plant, and final yields did not appear to be affected by the initial standcount.

The test averaged 106 bu/a, with a range in yield from 84 to 123 bu/a. Moisture condition during early July was ideal for good grain development. Plots were harvested in mid-September before any severe plant lodging had occurred. Complete test results are compiled in the 1988 Kansas Sorghum Performance Test, Report of Progress No. 562, which is available in local county extension offices.

[1]Department of Agronomy

COMPARISONS OF GRAIN SORGHUM HERBICIDES FOR WEED CONTROL

Kenneth Kelley

Summary

Grain sorghum herbicides and different application methods were compared for annual grass and broadleaf weed control. Excellent weed control was obtained with all of the herbicide treatments in 1988.

Introduction

Grain sorghum is an important grain and feed crop for many producers in southeastern Kansas. It is often grown in rotation with wheat and soybeans, which helps in breaking up the weed cycle that often exists when a monocrop of continuous milo is grown. The use of safened seed treatment also has allowed producers a wider choice of herbicides with the ability to control a wider array of weed species. The objective of this research is to evaluate grain sorghum herbicides and various tankmixes for weed control and crop injury effects.

Experimental Procedure

Various grain sorghum herbicides, tankmixes, and application methods were evaluated at the Columbus Field in 1988. Preplant herbicide treatments were incorporated with a field cultivator equipped with a 3-bar tine-mulcher. Soil type was a Parsons silt loam, with 1.2 % organic matter and a pH of 6.8. Safened grain sorghum seed was planted on June 20.

Results

Weed control results and grain yields are shown in Table 1. Timely rainfall before and after planting resulted in optimum herbicide activation with nearly all treatments. Some post-emergent treatments resulted in rather moderate leaf burning or leaf rolling at the time of application, but final grain yield was not affected.

Table 1. Comparisons of Grain Sorghum Herbicides for Weed Control, Columbus Unit, 1988.

Herbicide	Rate	When Applied	Milo Yield	Bl Control	Gr Control	Crop Injury
	lb. a.i./A		bu/A	--%--		
AAtrex	1.5	PPI	100.6	99	80	1.6
Dual + Basagran	2.0 + 0.5	PPI + POST	108.9	96	98	1.2
Lasso + Basagran	2.5 + 0.5	PPI + POST	106.5	99	98	1.3
Bicep	2.7	PPI	105.7	98	98	1.4
Lasso + AAtrex	1.5 + 1.0	PPI	112.5	94	98	1.5
AAtrex	1.5	PRE	105.2	99	85	2.4
Dual + AAtrex + COC	2.0 + 2.0	PRE + POST	114.6	98	98	1.6
Lasso + AAtrex + COC	2.5 + 2.0	PRE + POST	110.5	99	98	1.5
Bicep	2.7	PRE	108.6	98	98	1.5
Lasso + AAtrex	1.5 + 1.0	PRE	107.2	95	98	1.3
Ramrod + AAtrex	3.0 + 1.25	PRE	108.6	99	98	1.4
Lasso + Buctril	1.5 + 0.25	PPI + POST	107.7	98	98	1.6
Lasso + 2,4-D amine	1.5 + 0.38	PPI + POST	106.7	98	98	5.7
Lasso + Banvel	1.5 + 0.25	PPI + POST	102.9	98	98	3.5
Lasso + Buctril + 2,4-D	1.5 + 0.25 + 0.25	PPI + POST	103.2	98	98	5.0
Dual + Buctril/atrazine	1.5 + 0.25 + 0.50	PPI + POST	109.0	98	98	1.6
Dual + AAtrex + Banvel	1.5 + 0.5 + 0.25	PPI + POST	105.7	98	98	4.3
Dual + AAtrex + Basagran	1.5 + 0.5 + 0.5	PPI + POST	112.3	98	98	1.1
Dual + AAtrex + COC	1.5 + 1.5	PPI + POST	105.2	98	98	1.3
Buctril/atrazine + Cult.	0.38 + 0.75	POST	100.5	98	80	2.0
AAtrex + COC + Cult.	2.0	POST	103.8	98	80	1.3
Hand Weeded	-----	---	100.9	95	90	1.0
No Herbicide	-----	---	62.6	0	0	1.0
LSD 0.05:			8.2	3	3	0.5
C.V. (%)			5	4	5	12

Hybrid: Garst 5511 (safened seed), planted June 20, 1988.
Date of herbicide applications: PPI and PRE = June 20; POST = July 6.
Weed rating: Aug 1. Bl = broadleaf weeds (smooth pigweed, cocklebur, annual morningglory) and Gr = grass specie (large crabgrass).
Crop injury rating: 1 = no injury and 10 = all plants dead.
Soil type: Parsons silt loam, O.M. = 1.3%
Rainfall record: June 15 = 1.7", 30 = 2.7"; July 1 = 1.7", 6 = 0.2", 17-18 = 1.50", 22 = 0.33".

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

ANNUAL SUMMARY FOR PARSONS, KANSAS IN 1988

L. Dean Bark[1]

The charts that follow show graphically the daily weather in Parsons during the last two years. Each chart has three smooth curves to represent the average weather conditions at Parsons based on 30 years of records from the Experiment Station files. The actual temperature and accumulated precipitation totals that occurred throughout 1987 and 1988 are plotted by the rough lines on these charts, so that the "weather" can be compared with the climatic averages.

Table 1 summarizes the monthly average values for weather conditions at the station. These values are also compared to the monthly normal values.

As indicated by the charts and table, the weather was cooler than normal in Parsons during 1988 with near-normal precipitation. However, precipitation was not evenly distributed throughout the year or throughout the area. This change from very wet to very dry periods contributed to many weather problems in southeastern Kansas. Fortunately, the area was not as severly affected by drought conditions as other areas of the state.

Daytime temperatures were cooler than normal for 6 of the 12 months in 1988. October was particularly cool, with a mean temperature over 8° below normal. The first 4 months were also quite cool, as was July.

Temperature extremes for the year ranged from 101°F on August 10th to -8°F on January 8th. Unlike 1987, when no temperatures below zero were recorded, there were 6 such days in 1988. There were 14 days during the year when temperatures dipped below 10°F. The last freeze occurred on March 30th; the first freeze in the fall did not occur until October 31st, giving a freeze-free period of 215 days.

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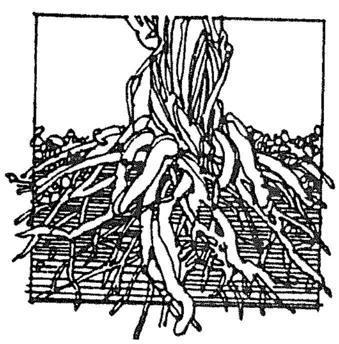
of Physics.

The precipitation total for the year was just about normal. However, the months of March, April, July, September, and November were quite wet,whereas May, June, August, and October were dry. Heavy rains produced flooding on the Neosho, Verdigris, and Marmaton rivers during the first week of April. Dry periods from mid-April through June and mid-July to mid-September produced moisture stress in growing crops. Crops and fieldwork also were affected by heavy rains during parts of the year. Twelve days during the year had rainfall totals exceeding 1 inch. Rainfall was very localized during 1988, and some places separated by only a few miles received widely different amounts. Even in southeastern Kansas, some crop production suffered from a lack of rainfall during the year.

The heavy rainfalls in southeastern Kansas during the year were produced by lines of strong thunderstorms moving through the area. These thunderstorms also produced damaging winds in the area during March, May, June, September, November, and December. Hail was reported in July, October, and November in several southeastern counties. The particularly severe storms on November 15th also produced a tornado in southern Neosho county.



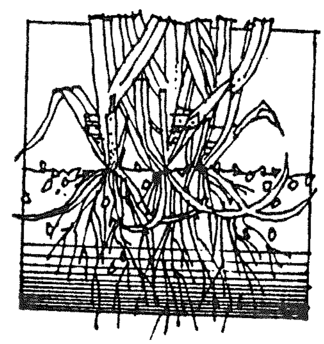


Table 1. ANNUAL WEATHER SUMMARY FOR PARSONS - 1988

1988 DATA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVG. MAX	37.3	44.2	55.8	66.3	79.8	90.6	88.5	92.2	84.3	63.9	59.0	48.2	67.6
AVG. MIN	18.3	21.7	32.8	41.6	55.1	62.8	68.7	68.3	56.9	42.3	34.7	25.2	44.1
MEAN	27.8	32.9	44.3	54.0	67.4	76.7	78.6	80.2	70.6	53.1	46.9	36.7	55.8
PRECIP	.49	.87	4.66	8.37	1.38	1.20	5.92	1.75	6.40	1.07	4.74	1.60	38.45
SNOW	6	4	4.5	0	0	0	0	0	0	0	2	0	16.5
HEAT DD	1154	930	642	339	34	2	0	6.5	14.5	375	544	878	4917
COOL DD	0	0	0	8.5	110	352	421	479	182	5.5	0	0	1557
DAYS WITH --													
RAIN	3	4	9	10	7	4	10	8	8	5	7	6	81
MIN <= 10	9	5	0	0	0	0	0	0	0	0	0	0	14
MAX >= 90	0	0	0	0	0	17	13	23	4	0	0	0	57
MIN <= 32	26	25	17	0	0	0	0	0	0	1	14	28	111

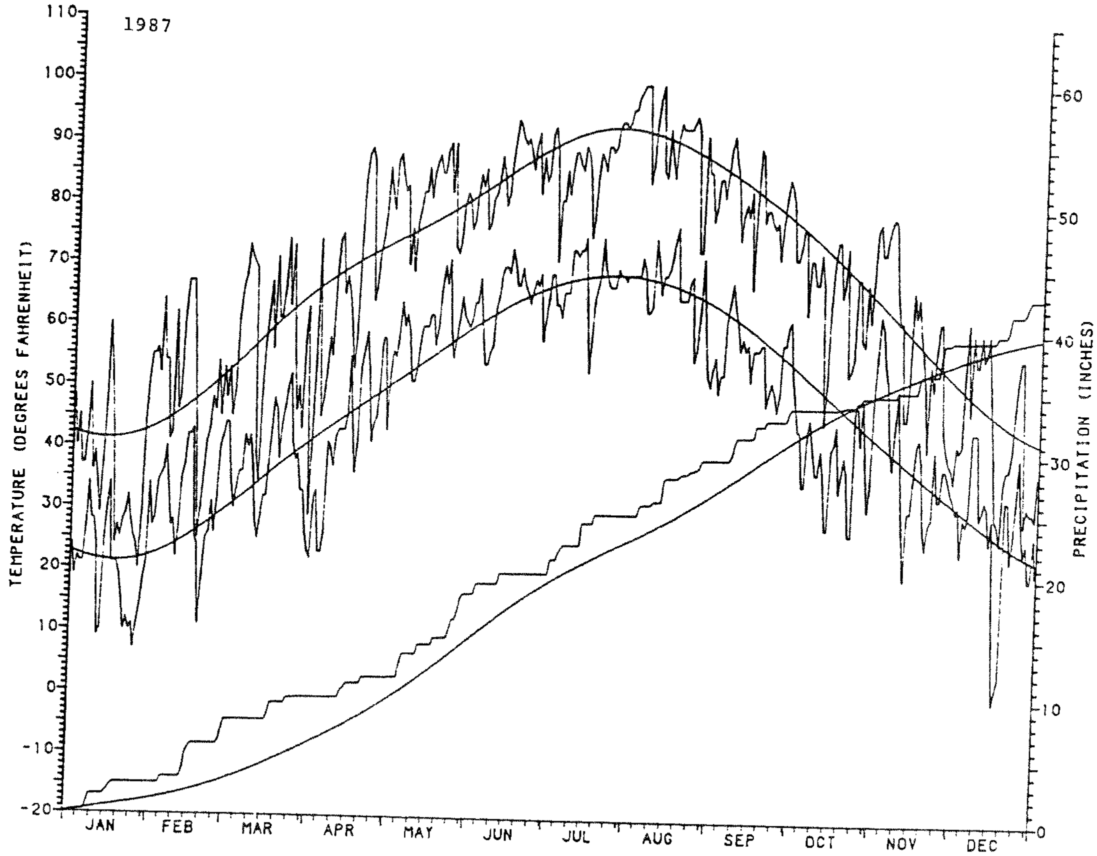
NORMAL VALUES (1951 -1980 Average)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVG. MAX	42.8	49.3	58.6	70.8	78.8	87.2	93.1	92.2	84.0	73.6	57.9	47.3	69.6
AVG. MIN	22.6	27.6	35.5	47.2	56.5	64.9	69.5	67.6	60.3	49.0	36.8	27.8	47.1
MEAN	32.7	38.5	47.1	59.0	67.7	76.1	81.3	79.9	72.1	61.3	47.4	37.6	58.4
PRECIP	1.22	1.34	2.98	3.72	5.18	4.80	3.65	3.43	4.53	3.47	2.54	1.65	38.51
SNOW	2	5	1.5	0	0	0	0	0	0	0	2	0	10.5
HEAT DD	1001	742	565	209	59	6	0	0	24	173	528	849	4156
COOL DD	0	0	10	29	143	339	505	462	237	58	0	0	1783

1988 DEPARTURES FROM NORMAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
AVG. MAX	-5.5	-5.1	-2.8	-4.5	1.0	3.4	-4.6	0.0	0.3	-9.7	1.1	0.9	-2.0
AVG. MIN	-4.3	-5.9	-2.7	-5.6	-1.4	-2.1	-0.8	0.7	-3.4	-6.7	-2.1	-2.6	-3.0
MEAN	-4.9	-5.6	-2.8	-5.0	-0.3	0.6	-2.7	0.3	-1.5	-8.2	-0.5	-0.9	-2.6
PRECIP	-.73	-.47	1.68	4.65	-3.8	-3.6	2.27	-1.7	1.87	-2.4	2.2	-.05	-.06
SNOW	4	-1	3	0	0	0	0	0	0	0	0	0	6
HEAT DD	153	188	76.5	130	-25	-4	0	6.5	-9.5	202	15.5	29	760.5
COOL DD	0	0	-10	-21.	-34.	13	-84	17	-56.	-53.	0	0	-226

DD=Degree Days


1987
TEMPERATURE (DEGREES FAHRENHEIT)
PRECIPITATION (INCHES)
JAN
FEB
MAR
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MAY
JUN
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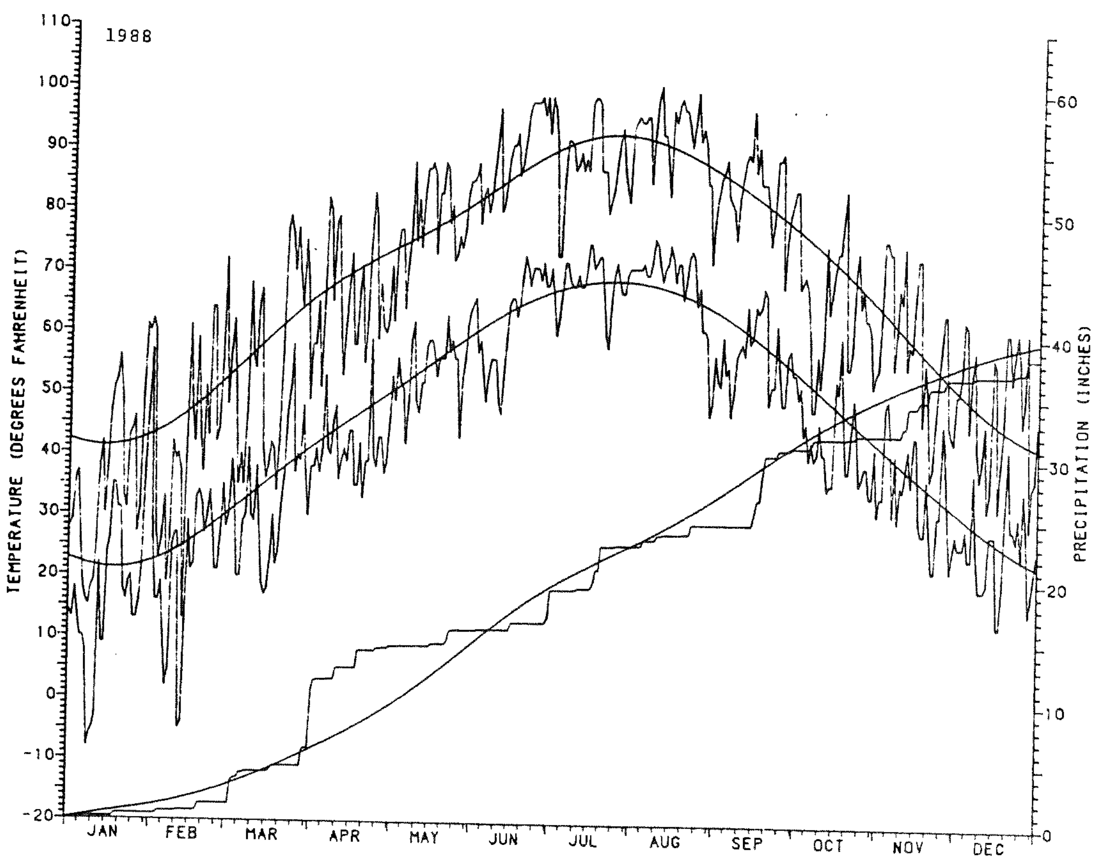
DEC


1988
TEMPERATURE (DEGREES FAHRENHEIT)
PRECIPITATION (INCHES)
JAN
FEB
MAR
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JUN
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SEP
OCT
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DEC

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IMC Pitman-Moore, Terre Haute, IN
International Seed, Inc., Halsey, OR
Jacob Hartz Seed Co., Stuggart, AR
Jacques Seed Co., Prescott, WI
Kansas Soybean Commission, Topeka, KS
Kerley Enterprises, Inc., Phoenix, AZ
Markley Seed Farms, Dennis, KS
Martin Farms, Columbus, KS
Mears Fertilizer Co., El Dorado, KS
Merschman Seeds, West Point, IA
Mobay Chemical Corp., Kansas City, MO
Monsanto Agricultural Products, St. Louis, MO
National Fertilizer Solutions Association, St. Louis, MO
Northern Farm and Garden, Inc., Bemidji, MN
Northrup King Seed Co., Richardson, TX
PAG Seeds, Minneapolis, MN
Parsons Chamber of Commerce, Parsons, KS
Alice M. Parscale, Monett, MO
Parsons Livestock Market, Parsons, KS
Pfizer, Inc., Lee's Summit, MO
Pioneer Hi-Bred International, Johnston, IA
Pioneer Hi-Bred International, Lincoln, NE
Potash-Phosphate Institute, Atlanta, GA
PPG Industries, Inc., Pittsburgh, PA
Prince Agri Products, Quincy, IL
R & F Farm Supply, Erie, KS
Rhone-Poulenc, Inc. Monmouth Junction, NJ
SCS Plant Materials Center, Manhattan, KS
Seedtec International, Hereford, TX
Sharp Bros. Seed Co., Healy, KS
Dee Shaffer, Columbus, KS
Dale Springer, Independence, KS
Star Seed, Beloit, KS
Stauffer Seed, Phillips, NE
Stine Seed Farm, Inc., Adel, IA
Syntex Agribusiness, Inc., Des Moines, IA
Taylor-Evans Seed Co., Tulia, TX
Terra Internationa, Inc., Champaign, IL
Texas Sulphur Products Co., Borger, TX
The Sulphur Institute, Washington, D.C.
Triumph Seed Co., Ralls, TX
Van der Have Oregon, Inc., Albany, OR
Ted Wary, Columbus, KS
W-L Research, Inc., Highland, MD

NOTE

Trade names are used to identify products. No endorsements are intended, nor is any criticism implied of similar products not mentioned.

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