Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 8 *Southeast Agricultural Research Center Reports (2014 and earlier)*

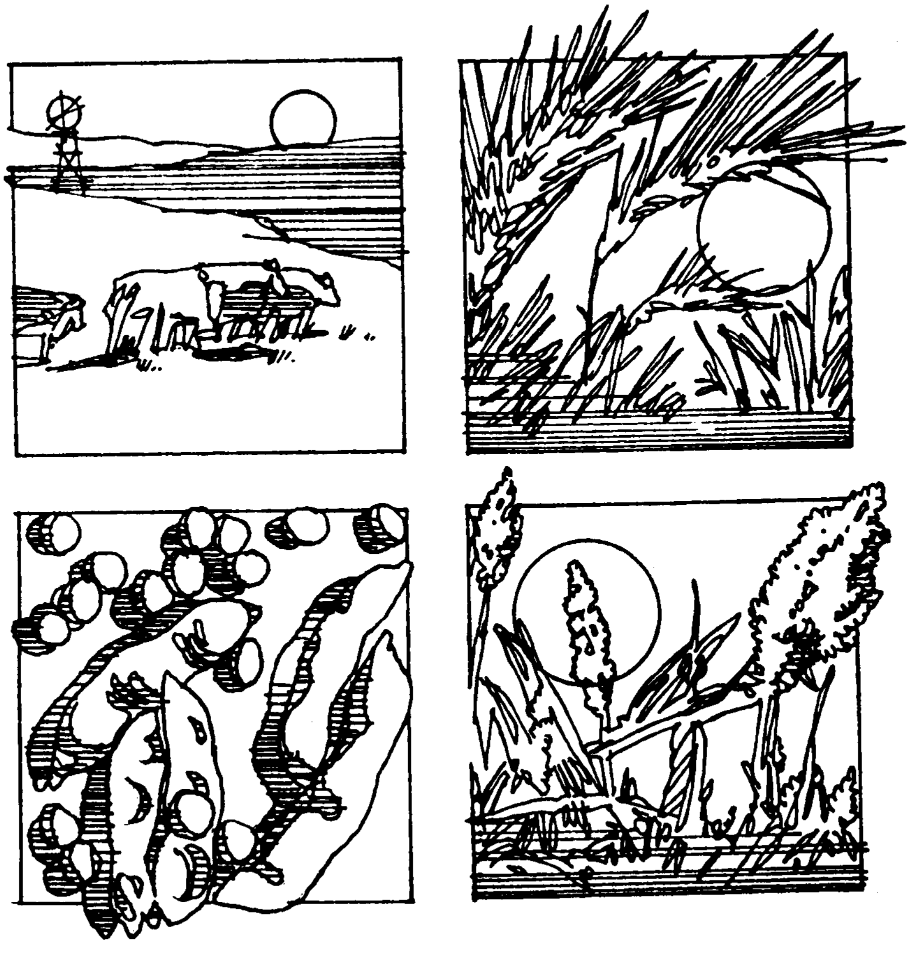
Article 23

1991

1991 Agricultural Research Southeast Agricultural Research Center

Kansas State University. Agricultural Experiment Station and Cooperative Extension Service

1991 AGRICULTURAL RESEARCH



Report of Progress 628

Agricultural Experiment Station

Kansas State University, Manhattan

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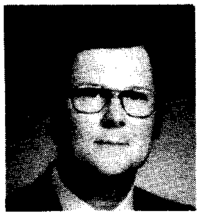
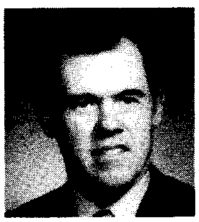
SOUTHEAST KANSAS BRANCH STATION

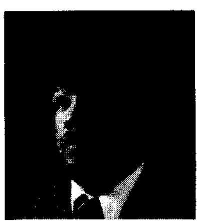


LYLE LOMAS, Station Head, received B.S. and M.S. degrees in Animal Husbandry from the University of Missouri and a Ph.D. degree in Animal Husbandry from Michigan State University. He provides leadership for research and is responsible for Station' administration. Lyle joined the staff in 1979 as Animal Scientist. His research interests are beef cattle nutrition, production, and management.

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



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



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

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

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

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Contribution No. 91-445-S from the Kansas Agricultural Experiment Station.

EFFICACY OF LAIDLOMYCIN PROPIONATE FOR IMPROVING WEIGHT GAIN OF GROWING CATTLE ON PASTURE[1]

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

Summary

Eighty mixed-breed steers were blocked by weight into two replicates, then allotted in a random stratified manner to receive a control supplement of 1 lb ground grain sorghum or 25, 50, or 75 mg/hd/d of laidlomycin propionate (LP) in a 1 lb ground grain sorghum carrier. The steers in each replicate were rotated at 14-d intervals through four smooth bromegrass pastures for 119 d beginning on April 24. Laidlomycin propionate tended ($P>.10$) to improve animal gain by 3.7, 9.0, and 10.5 % for 25, 50 and 75 mg/hd/d, respectively. Amount of shrink incurred following a 16-h removal from feed and water was not affected by ionophore level. It appears that LP has the potential to improve gains from grazing cattle. However, the magnitude of improvement is directly related to LP level.

Introduction

Ionophores have been used in recent years to alter rumen fermentation such that feed efficiency is improved in feedlot cattle and rate of gain is improved in grazing cattle. Laidlomycin propionate is one of a group of second-generation ionophores used to alter rumen fermentation but at a much lower effective dose than was needed with first-generation ionophores. The efficacy of laidlomycin propionate in improving feedlot performance has been proven. However, data concerning the effective dosage of LP for improving grazing performance are limited.

Experimental Procedure

Eighty, mixed-breed steers were divided into light- and heavy-weight replicates, then allotted in a random stratified manner into four lots of 10 head each. The steers received vaccinations against IBR, PI_3, BVD, vibriosis, leptospirosis (5 strains), blackleg (8-way), pinkeye, and BRSV and were treated with levamisole to control internal parasites. Each lot of steers was allotted randomly to receive a control supplement of 1 lb. of ground grain sorghum or one containing 25, 50, or 75 mg/hd/d of laidlomycin propionate blended in a 1 lb. ground grain sorghum carrier. The lots were then allotted randomly to one of four smooth bromegrass pastures blocked by replication.

The lots of steers were rotated through the four pastures at 14-d intervals to minimize the effect of pasture variation. Weights measured on the mornings of April 24 and August 21 were used as beginning and ending weights, respectively, to calculate steer gains during the experiment. These weights were measured following a 16-h removal from pasture and water. The steers were also weighed on the afternoon of August 20 so that the effects of LP on 16-h shrinkage could be determined.

Water and mineral supplement were provided ad-libitum to all animals throughout the study.

Results and Discussion

None of the performance parameters measures were statistically different between different levels of laidlomycin propionate (Table 1). However, there was a tendency

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[1]Appreciation is expressed to Syntex Animal Health, Inc., Palo Alto, CA for financial assistance and donation of laidlomycin propionate.

for increased weight gain with increasing levels. Weight gains were numerically increased by 3.7, 9.0, and 10.5% with 25, 50 and 75 mg/hd/d laidlomycin propionate, respectively. No apparent effect on live weight shrink was observed. Therefore, although no statistical improvements were observed, there appears to be a tendency for improved weight gain by supplementing with laidlomycin propionate. Other studies have validated this fact.

Table 1. Weight Gain and Shrink by Steers Offered Different Levels of Laidlomycin Propionate while Grazing Smooth Bromegrass Pastures[a].

Item	Control	Laidlomycin propionate, mg/hd/d		
		25	50	75
Cattle weights, lb				
Apr. 24 (shrunk)	645.7	645.6	641.3	643.9
Aug. 20 (full)	858.3	867.3	864.2	874.4
Aug. 21 (shrunk)	796.0	801.4	805.2	810.0
Cattle gain, lb Apr. 24-Aug. 21				
Total gain	150.3	155.8	163.9	166.1
Daily gain	1.26	1.31	1.38	1.40
16-h shrinkage, %	7.26	7.60	6.81	7.37

[a]Orthogonal contrasts for linear and quadratic effects and control vs. 25, 50 and 75 mg/hd/d were not significant (P<.10) for any variable.

PERFORMANCE AND FORAGE INTAKE BY STOCKER CATTLE GRAZING RYE IN MONOCULTURE OR NO-TILL DRILLED INTO BERMUDAGRASS SOD

Kenneth P. Coffey and Joseph L. Moyer

Summary

Two experiments were conducted to evaluate the potential of no-till drilling of cereal rye into bermudagrass sod to extend the bermudagrass grazing season in Southeast Kansas. In experiment 1, a 2-year study was conducted to compare performance by stocker heifers (1989) and steers (1990) grazing cereal rye in monoculture (MR) followed by grazing bermudagrass in monoculture (MB) with that of cattle grazing bermudagrass pastures no-till drilled with cereal rye (R/B). During the rye grazing phase in 1989, cattle grazing R/B gained more (P<.10) but had fewer animal grazing days/acre than those grazing MR, so that gain/acre was similar between treatments. During the bermuda grazing phase of 1989, cattle grazing MB gained more (P<.10) but had fewer animal grazing days/acre than those grazing R/B, so that gain/acre was again similar between treatments. In 1990, cattle grazing R/B tended (P<.20) to gain more per animal and per acre during the rye grazing phase and similarly during the bermuda grazing phase compared to those grazing MR and MB. In experiment 2, forage intake was greater (P<.01) and rumen organic matter fill and rumen retention time were lower (P<.05 and .10, respectively) for rumen-fistulated heifers grazing MR than for heifers grazing R/B. Therefore, no-till drilling of rye in bermudagrass sod offers the potential to extend the grazing season and provide more total cattle production from bermudagrass acreage.

Introduction

Bermudagrass is a productive forage species for southeastern Kansas when intensively managed but is dormant for much of the year. Annual species often invade the dormant sward, but their productivity is sporadic and short-lived. Annual rye is a crop that has been used in the southeastern U.S. to lengthen the bermudagrass grazing season. Concerns exist that the bermudagrass sward may be damaged by fall drilling operations or by spring competition from rye. These experiments were designed to compare spring and summer performance and spring forage intake of stocker cattle grazing rye that was no-till drilled in bermudagrass pastures versus stocker cattle grazing rye or bermudagrass in monoculture.

Experimental Procedure

Experiment 1

Eight 5-acre pastures of 'Hardie' bermudagrass and two adjacent 5-acre tilled pastures were used. Six bermudagrass and two clean-tilled pastures were seeded with 100 lb/acre of 'Bonel' rye in late September of each year (R/B and MR, respectively); two bermudagrass pastures were left in monoculture (MB). Bermudagrass-containing pastures received annual P and K applications of 26 and 66 lb/acre, whereas MR pastures received annual applications of 17 and 33 lb of P and K, respectively. In 1988, 60 lb N/acre as urea was applied to all R/B and MR at seeding, but another 40 lb/acre of N was needed by R/B pastures in November to overcome apparent N immobilization. In 1989, 50 lb N/acre was fall-applied to MR near seeding time and to R/B on October 19. All bermudagrass-containing pastures received 150 lb N/acre on about June 1 of each year.

In 1989, stocker heifers (avg. wt.=492 lb.) were weighed on April 4 and 5 without prior removal from a common tall fescue pasture. The heifers were randomly allotted by weight into eight groups of 12 head each, then randomly allotted to one of six experimental R/B and two experimental MR pastures. All heifers were dewormed and vaccinated according to routine procedures. They grazed rye until June 2, then grazed bermudagrass from June 2 until September 7. Put-and-take heifers were used as needed to control forage availability.

In 1990, stocker steers were weighed on 3 April following a 16-h removal from feed and water, then allotted in a random stratified manner into eight groups of eight head each. Smaller groups were chosen so that fistulated heifers could be used as put-and-take animals to determine forage intake in experiment 2. The groups were then randomly allotted to one of six experimental R/B and two experimental MR pastures. All steers were dewormed, implanted, and vaccinated according to routine procedures and grazed rye until May 14. Bermudagrass grazing began on June 21 and ended on August 30. All cattle weights were shrunk weights. Put-and-take steers were used during both the rye and bermudagrass grazing periods to control forage availability.

Available forage was estimated during rye grazing in April using disk meter readings (9/pasture) calibrated for rye. Bermudagrass ground cover was estimated visually (3 sites/pasture) on June 22, 1990.

Experiment 2

Ten rumen-fistulated heifers were randomly allotted to either one R/B or one MR pasture on March 26, 1990. Fecal samples were collected for 5 days following a 21-day adaptation to pasture and a 10-day period for fecal chromium concentrations to equilibrate after receiving a sustained-release chromic oxide bolus.   On the 5th day of fecal collections, heifers were allowed to graze following total rumen evacuation. Grazed forage samples were then removed from the rumen and used to determine dietary forage quality and in vitro digestibility. Fecal chromium concentrations along with in vitro digestibilities were used to estimate forage intake. Rumen fill was measured directly and rumen turnover rate was determined by dividing rate of indigestible acid-detergent fiber (IADF) intake by rumen IADF fill.

Results and Discussion

Performance data are shown by year (Table 1) because of year effects and year by treatment interactions for a number of variables. In 1989, cattle grazing R/B gained faster (P<.10) during the rye phase and slower (P<.10) during the bermudagrass phase, so that total gain was similar (P>.10) to that of cattle grazing MR and MB. Animal grazing days were greater (P<.01) for MR during the rye phase and for R/B during the bermudagrass phase. Because grazing on MR and MB occurred on separate pastures and grazing on R/B occurred on the same pastures, average grazing days per acre and average gain per acre were 2 times higher from R/B than the combination of MR and MB. In 1990, performance was similar between treatments during both phases. Animal grazing days during the bermudagrass grazing phase were greater (P<.10) from MB than R/B. Much of this may be attributed to a higher degree of winterkill on R/B compared with MB pastures. However, unusually high rates of winterkill were reported in Oklahoma and Arkansas, as well as Kansas. Average grazing days and average gain per acre again were greater from R/B than the combination of MR and MB.

Available April forage (Table 2) averaged 83% greater (P<.01) in MR than R/B pastures across years. The rye stand in bermudagrass was visually more uneven and variable than in monoculture.

Total cattle gains across both rye and bermudagrass grazing phases were similar in both years, although cattle grazing R/B tended (P<.20) to gain more than cattle grazing MR/MB during the 1990 grazing season (Table 3). When the number of animal grazing days and gain per acre were expressed on a basis of the land area utilized in the total grazing season, both variables were higher (P<.01) from R/B.

Experiment 2

Forage intake (lb/day and % of body weight) was greater (P<.01) and rumen retention time was lower (P<.05) for heifers grazing MR than R/B. Forage consumed by heifers grazing MR was more (P<.01) digestible and had higher (P<.05) fiber content but lower (P<.01) lignin content than forage consumed by heifers grazing R/B.

Therefore, the forage consumed by heifers grazing MR was of higher quality. The failure of agreement for intake and performance data is perplexing but may be related to stocking density. During grazing of MR, weather was a key issue. Initiation of grazing was determined by ground moisture. Early grazing on MR was conducted at a lower stocking rate to prevent excessive forage damage by trampling the forage into mud. Therefore, once the ground became dry enough to support more cattle, forage growth dictated adding greater numbers of cattle to control the available forage. This led to large differentials in stocking densities (animals/acre) between MR and R/B. It is possible that the greater density of animals per unit of land area caused greater social and behavioral interactions, which adversely affected animal performance.

In summary, drilling rye into bermudagrass sod offers the potential to increase the productivity of bermudagrass pastures. Grazing of cool-season annuals in Southeast Kansas is highly dependent upon weather conditions. The bermudagrass sod base for the cool-season annuals provides greater security that the annuals can be grazed. However, potential damage to the bermudagrass stand is a concern that needs to be addressed in future studies.

Table 1. Performance Traits of Stocker Cattle on a Monocultured Rye and Bermudagrass System (MR/MB) vs. Rye Interseeded into Bermudagrass Pasture (R/B) in Experiment 1.

	1989		1990	
	MR/MB	R/B	MR/MB	R/B
Rye Phase				
Initial wt., lb.	491	493	488	488
Final wt., lb.	560[b]	581[a]	557	584
Gain, lb.	69[b]	88[a]	68	97
Daily gain, lb.	1.18[b]	1.52[a]	1.67	2.35
Grazing days/acre	177[c]	140[d]	100	86
Gain/acre	205	212	165	195
Bermuda Phase				
Initial wt., lb.	560[b]	581[a]	617	642
Final wt., lb.	669	671	702	742
Gain, lb.	109[a]	90[b]	86	100
Daily gain, lb.	1.12[a]	.93[b]	1.22	1.42
Grazing days/acre	194[d]	230[c]	174[a]	140[b]
Gain/acre	218	213	213	195

[a,b]Means within a row and year differ (P<.10).
[c,d]Means within a row and year differ (P<.01).

Table 2. Spring Forage Availability in Monoculture Rye (MR) and Rye Interseeded into Bermudagrass Pasture (R/B) in Experiment 1.

Date	MR	R/B
April 6, 1989	3020[a]	1850[b]
April 3, 1990	2270[a]	1330[b]
April 23, 1990	2580[a]	1120[b]

[a,b]Means within a row differ (P<.01).

Table 3. Overall Performance Traits of Stocker Cattle Pastured on a Monocultured Rye and Bermudagrass System (MR/MB) vs. Interseeded Rye-Bermudagrass (R/B) in Experiment 1.

Trait	1989		1990	
	MR/MB	R/B	MR/MB	R/B
Total gain, lb	178	178	154	196
Daily gain, lb.	1.15	1.15	1.39	1.77
Avg. grazing days/acre	186[b]	369[b]	137[d]	225[c]
Avg. gain/acre	214[b]	428[a]	190[b]	389[a]

[a,b]Means within a row and year differ (P<.01).
[c,d]Means within a row and year differ (P<.05).

Table 4. Organic Matter (OM) Intake, Gut Fill, and Quality of Forage Consumed by Heifers Grazing Monoculture Rye (MR) vs. Rye Interseeded into Bermudagrass Pasture (R/B) in Experiment 2.

Item	MR	R/B
Organic matter intake, lb/day	17.0[a]	10.9[b]
Organic matter intake, % of body wt.	2.1[a]	1.3[b]
Fresh fill, lb.	67.5	72.8
Rumen retention time, h	13.1[d]	20.5[c]
Quality		
In vitro organic matter digestion, %	76.4[a]	66.7[b]
In vitro organic matter digestion, %/h	8.3	7.5
Crude protein, %	10.9	11.3
Neutral detergent fiber, %	62.7[c]	59.3[d]
Acid detergent fiber, %	33.6[a]	30.9[b]
Acid detergent lignin, %	3.5[b]	4.6[a]

[a,b]Means within a row differ (P<.01).
[c,d]Means within a row differ (P<.05).

EFFECT OF IMPLANT AND COPPER OXIDE NEEDLES ON GRAZING AND SUBSEQUENT FEEDLOT PERFORMANCE AND BLOOD PARAMETERS OF STEERS GRAZING ACREMONIUM COENOPHIALUM-INFECTED TALL FESCUE PASTURES[1]

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

Summary

Forty mixed-breed steers grazing Acremonium coenophialum infected (70% of the plants infected) tall fescue pastures were used in an experiment to evaluate the effects of progesterone-estradiol implant and copper oxide needles on grazing and subsequent feedlot performance and selected blood parameters. The steers were allotted randomly by weight, so that 20 steers received no implant (NI) and 20 received a progesterone-estradiol implant on May 17 (I). Within NI and I groups, half of the cattle received no additional copper (NCu) and half received 20 g of copper oxide needles (Cu) in a bolus. The steers grazed fescue pastures for 177 days, then were placed in a feedlot for 145 days. Daily gain was similar among treatment combinations during both the grazing and feedlot phases. Feed conversion tended (P=.12) to be lower for NI. Carcass characteristics were not affected by pasture phase treatments. Steers receiving Cu had higher serum copper and ceruloplasmin but lower zinc than the NCu group. Therefore, pasture treatments did not appear to affect total animal performance. Copper oxide needles did prevent seasonal decline in serum copper levels, which might have affected animal performance if additional stresses had been imposed.

Introduction

Previous work in Southeast Kansas and other states has eluded to declining blood copper levels in cattle grazing tall fescue pastures. However, the effects of these declining levels on grazing and subsequent feedlot performance, including feed efficiency are uncertain. Also, zeranol has been shown to have dramatic effects on increasing grazing performance and serum prolactin levels of cattle grazing endophyte-infected tall fescue, but the effects of a progesterone-estradiol implant on these parameters have not been established. Therefore, the objectives of this experiment were to evaluate the direct effects of copper oxide needles and progesterone-estradiol implant on grazing performance and selected blood parameters and their subsequent effects on feedlot performance.

Experimental Procedure

Forty mixed-breed steers were weighed directly from pasture on the mornings of May 16 and 17, then randomly allotted by weight so that 20 received a progesterone-estradiol implant (I) and 20 received no implant (NI). Within each implant treatment group, half of the steers received 20 g of copper oxide needles in polyethylene capsules (Cu) and the remaining half received no copper oxide needles (NCu). The cattle received routine vaccination and deworming treatments. All steers were allowed to graze as a group between May 17 and November 9 and had free-choice access to water and a trace mineralized salt-dicalcium phosphate mineral supplement that contained .04 ppm of copper. Blood samples were collected via jugular puncture on May 17 and November 9 and analyzed for hematocrit and serum copper, zinc, ceruloplasmin, and prolactin.

Following the 145-d grazing phase, the steers were placed in the SEKES feedlot

[1]Appreciation is expressed to the following: Syntex Animal Health, West Des Moines, IA for implants; Coopers Animal Health, Kansas City, MO for providing copper oxide needles; Pittman-Moore, Inc., Mundelein, IL for providing dicalcium phosphate; Prince Agri Products, Quincy, IL for providing trace mineral package.

facility at Mound Valley and offered a ration containing 80% ground milo, 15% corn silage, and 5% protein supplement on a dry matter basis. The steers were randomly divided to provide two replicates per previous treatment combination so that the effects of previous treatment on feed consumption and efficiency could be determined. All steers were implanted twice with progesterone-estradiol and received 25 g monensin per ton of diet dry matter during the 145-day feeding period. At the end of the feedlot phase of the study, all steers were slaughtered at the IBP slaughter plant in Emporia, KS, and carcass data were collected following a 24-hour chill.

Results and Discussion

No differences were detected in animal performance during the grazing phase of the experiment (Table 1). However, all gains were extremely low. A rule of thumb is that cattle must be gaining at a rate of 1 lb/day to show a response to implanting. In this study, the gains were well below that level.

Likewise, no differences were detected in animal gain during the feedlot phase. This is probably a direct result of similar pasture phase performance, because compensatory gain potential was similar across treatments. However, NI steers showed a tendency ($P<.15$) to more efficiently convert feed to gain, and thereby, have a reduced feed cost per pound of gain.

Hot carcass weight, ribeye area, backfat, and USDA quality grades were similar among treatments. An implant by copper interaction was detected ($P<.10$) for USDA yield grades. Within NI, Cu steers had higher yield grades ($P<.10$) than NCu steers, whereas no differences between Cu and NCu were apparent within I steers. However, no differences were detected when yield grade was actually calculated from carcass measurements. Therefore, this parameter may not be of great importance.

Packed cell volume (Table 3) was initially higher ($P<.05$) in I than NI but was similar at the end of the study. Therefore, these differences were probably due simply to random allotment of the cattle. Initial serum ceruloplasmin, copper, and zinc were similar across treatments. However, at the end of the study, Cu steers had higher ($P<.01$) serum ceruloplasmin and copper but lower ($P<.05$) serum zinc levels than NCu steers. Serum ceruloplasmin levels declined 47% in NCu steers and only 27% in Cu steers during the study. Serum copper levels actually increased ($P<.01$) in both Cu and NCu during the study. It is uncertain why serum copper levels increased, but ceruloplasmin is generally accepted as a better indicator of copper status of the animal than serum copper levels. Therefore, these cattle were progressing toward copper deficiency, as illustrated by declining ceruloplasmin levels, and supplemental copper oxide needles helped reduce the rate of decline.

In summary, cattle grazing *A. coenophialum*-infected tall fescue performed poorly during the pasture phase and during the feedlot phase as well, compared to previous studies. Implanting with a progesterone-estradiol implant, or orally dosing the steers with boluses of copper oxide needles did not offset the gain reduction associated with grazing infected fescue. Pasture treatments also did not have an effect on subsequent feedlot gain, but implanting cattle during the growing phase tended to increase subsequent feedlot feed to gain ratio. Maintaining a higher copper status could have benefitted the grazing cattle by contributing to a more enhanced immune system, if they had been challenged with additional stresses.

Table 1. Effect of Pasture Phase Treatment with Implants or Copper Oxide Needles on Grazing and Subsequent Feedlot Performance by Steers Grazing A. coenophialum-infected fescue pastures.

Item	Implant		Supplemental copper	
	Implant	No Implant	Copper Needles	No Copper Needles
Grazing Phase				
Initial wt, lb.	625	625	624	625
Final wt., lb.	683	672	678	677
Grazing gain, lb.	58	47	54	52
Daily gain, lb.	.33	.27	.31	.30
Feedlot Phase				
Initial wt., lb.	683	672	678	677
Final wt., lb.	1100	1119	1105	1113
Feedlot gain, lb.	417	447	427	436
Daily gain, lb.	2.88	3.08	2.95	3.01
Dry matter intake, lb/d	23.4	22.1	22.5	23.0
Dry matter/gain	8.2[a]	7.2[b]	7.6	7.7
Cost/cwt. gain., $[c]	42.30[a]	37.20[b]	39.50	40.00

[a,b]Means within a row were different at the P=.12 level of probability.
[c]Costs represent actual feed cost marked up 10% to cover miscellaneous expenses.

Table 2. Effect of Implant and/or Copper Oxide Needles on Subsequent Carcass Characteristics.

Characteristic	Implant: Implant	Implant: No Implant	Supplemental copper: Copper Needles	Supplemental copper: No Copper Needles
Dressing Percentage	59.2	59.4	59.7	58.9
Hot carcass wt, lb.	652	665	660	657
Backfat, in.	.36	.32	.38	.31
Ribeye area, in^2	12.0	12.7	12.3	12.3
USDA quality grade	9.7	9.6	9.7	9.5
USDA yield grade	1.9	1.7	1.9	1.7
Calculated yield grade	2.7	2.4	2.6	2.4

[a] 9 = Select$^+$; 10 = Choice$^-$.

Table 3. Effect of Implant and/or Copper Oxide Needles on Blood Parameters of Steers Grazing A. coenophialum-infected Tall Fescue Pastures.

Blood parameter	Implant: Implant	Implant: No Implant	Supplemental copper: Copper Needles	Supplemental copper: No Copper Needles
May 17				
Hematocrit,%	37.8[a]	33.9[b]	35.6	36.1
Ceruloplasmin, mg/dl	16.7	16.8	16.9	16.6
Serum copper, ppm.	.78	.80	.79	.78
Serum zinc, ppm.	.61	.63	.65	.60
Serum prolactin, ng/ml	84.5	125.1	119.1	90.5
November 9				
Hematocrit,%	35.3	35.2	36.0	34.5
Ceruloplasmin, mg/dl	10.7	10.5	12.4[c]	8.8[d]
Serum copper, ppm.	1.06	1.09	1.17[c]	.98[d]
Serum zinc, ppm.	.70	.70	.67[b]	.73[a]
Serum prolactin, ng/ml	.5	.4	.5	.4

[a,b]Means within a row and main effect differ (P<.05).
[c,d]Means within a row and main effect differ (P<.10).

EFFECT OF LADINO CLOVER INTERSEEDING, GRAIN SUPPLEMENTATION, AND LENGTH OF GRAZING SEASON ON GRAZING AND SUBSEQUENT FEEDLOT PERFORMANCE OF STEERS GRAZING ACREMONIUM COENOPHIALUM-INFECTED TALL FESCUE PASTURES

Kenneth P. Coffey, Joseph L. Moyer, Lyle W. Lomas, and Frank K. Brazle[1]

Summary

One hundred mixed-breed steers grazed Acremonium coenophialum-infected fescue with (FL) and without (F) ladino clover for 56 (EI) or 155 (FS) days beginning on April 25. Half of the cattle assigned to each forage type were offered ground grain sorghum (GS) and the other half were not (NoGS). All steers were placed in a feedlot at the end of the grazing period and finished on a high concentrate ration. Length of grazing season had the greatest impact on performance parameters measured. Steers that grazed FS tended (P<.20) to have higher pasture gains but had lower (P<.05) pasture daily gains than those that grazed EI. Steers that grazed FS had heavier (P<.10) initial feedlot weights, tended (P<.20) to have heavier final feedlot weights, gained faster (P<.05) during the feedlot period, and higher (P<.10) USDA quality grades than steers that grazed EI. Those steers also had lower feed cost per head (P<.05) and per pound of feedlot gain (P<.10). Therefore, cattle grazing tall fescue pastures may be affected by the time of year when they are placed in the feedlot.

Introduction

Cattle grazing tall fescue infected with the endophytic fungus A. coenophialum generally perform poorly, particularly during the summer months. Tall fescue quality and yield peak during the late spring. Stocking rates may be increased to better utilize this burst of growth and quality, but grazing season must be reduced if stocking rate is increased. Ergovaline levels are suspected to peak in May, necessitating dilution of the spring forage with legumes or grain. This experiment was conducted to evaluate early-intensive (EI) vs. full-season (FS) stocking, ladino clover interseeding, and supplemental grain sorghum on grazing and subsequent feedlot performance by steers grazing tall fescue pastures.

Experimental Procedure

Following routine vaccination and deworming, 100 mixed-breed steers were randomly allotted by weight into 16 groups of five head each. Two groups each then were randomly assigned to one of eight 5-acre fescue (F) or fescue-ladino clover (FL) pastures on April 25. The cattle grazing two pastures of each forage type were offered grain sorghum at a level of .25% of body weight (GS), and the cattle grazing the remaining pastures received no supplement (NoGS). The level of grain sorghum was increased to .5% of body weight on July 18 and maintained throughout the grazing phase. One group of five head was removed from each pasture on June 20 and placed in the feedlot facility at Mound Valley. The remaining groups of five head on each pasture were allowed to graze until September 27, then placed in the feedlot. Forage availability became limiting on two of the four FL pastures, and steers were removed on July 18 and placed on a mixed bermudagrass-fescue pasture until September 27.

All cattle were offered a diet of 80% ground grain sorghum, 15% corn silage, and 5% protein supplement with monensin on a dry matter basis during the feedlot period. Attempts were made to feed both EI and FS cattle to a common backfat endpoint. Beginning and ending pasture and feedlot weights were measured following a 16-hour removal from feed or pasture and water.

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[1]Extension Livestock Specialist, Southeast Area Extension Office, Chanute, KS.

Results and Discussion

Neither interseeded ladino clover nor supplemental grain sorghum significantly (P<.20) affected grazing or feedlot performance, although steers grazing FL tended to gain 14% more than those grazing F and steers offered GS tended to gain 18% more than those offered NoGS (Table 1).

Length of grazing season had the most substantial effect on animal performance. Steers grazing for 155 days (FS) tended (P<.20) to gain more during the pasture phase than those grazing for 56 days (EI). However, they gained only 21 lb. more in 99 days, or .21 lb/day.

Steers that grazed FS were 44 lb. heavier (P<.10) at the start of the feedlot period, tended (P=.16) to be 34 lb. heavier at the end of the feeding period, and gained at a rate of .4 lb/d faster than EI steers. We should note that differences in final pasture weight and initial feedlot weight were due to the early removal of some of the FL steers from pasture. Their weight change during the period between removal and subsequent placement in the feedlot was not considered in data calculations.

Feed costs per head and per lb. of gain were higher (.05 and .10, respectively) for EI steers than for FS steers. This was due to seasonality of grain sorghum prices.

Hot carcass weights were heavier (P<.10) and ribeye area was larger (P<.10) from FL than F steers (Table 2). Other carcass characteristics were similar between the two groups. Supplemental grain sorghum during the grazing phase had no effect on subsequent carcass characteristics. Backfat and yield grades were similar between EI and FS steers, but quality grade was higher (P<.10) from FS than EI, even though EI steers were fed for 22 days longer than FS (181 vs. 159 days).

In summary, grazing steers on tall fescue for a longer period may benefit them from the standpoint of reduced feed cost and faster daily gain when they are placed in the feedlot. However, ending pasture and feedlot weights may not be significantly different because of low rates of summer gain.

Table 1. Effect of Forage Type, Grain Supplementation, and Grazing Management on Grazing and Feedlot Performance by Steers.

	Forage		Grain		Grazing season	
Item	Fescue + Ladino	Fescue	Control	Milo	Early Intens.	Full Season
Pasture phase						
Initial wt, lb.	581	581	580	581	581	580
Final wt, lb.	676	662	662	676	660	679
Gain, lb.	95	83	82	97	79	100
Daily gain, lb.	1.21	.98	1.06	1.13	1.39[a]	.80[b]
Feedlot phase						
Initial wt., lb.	699	664	677	687	660[d]	704[c]
Final wt., lb.	1281	1243	1260	1264	1245	1279
Gain, lb.	582	579	584	578	585	576
Daily gain, lb.	3.53	3.51	3.54	3.50	3.32[b]	3.72[a]
DM intake, lb./head	4162	4221	4214	4168	4250	4132
Feed efficiency	7.2	7.3	7.2	7.2	7.3	7.2
Feed cost, $/head	223.70	226.80	226.33	224.13	236.45[a]	214.00[b]
Feed cost, $/lb of gain	.38	.39	.39	.39	.40[a]	.37[b]

[a,b]Means within a main effect differ (P<.05).
[c,d]Means within a main effect differ (P<.10).

Table 2. Effect of Previous Pasture Treatment on Subsequent Carcass Characteristics.

Characteristic	Forage		Grain		Grazing season	
	Fescue + Ladino	Fescue	Control	Milo	Early Intens.	Full Season
Hot carcass wt., lb.	804[a]	778[b]	786	795	784	798
Dressing %	62.8	62.6	62.4	62.9	63.0	62.3
Backfat, in.	.42	.45	.43	.45	.45	.43
Ribeye area, in^2	14.2[a]	13.4[b]	13.7	13.9	14.1	13.5
USDA quality grade[c]	10.7[b]	11.0[a]	10.8	10.9	10.5	11.2
USDA yield grade	1.9	2.2	2.2	1.9	2.0	2.0

[a,b]Means within a main effect differ (P<.10).
[c]9=Select$^+$; 10=Choice$^-$.

PASTURE AND SUBSEQUENT FEEDLOT PERFORMANCE BY STEERS GRAZING ACREMONIUM COENOPHIALUM-INFECTED TALL FESCUE AND OFFERED DIFFERENT LEVELS OF GROUND GRAIN SORGHUM

Kenneth P. Coffey, A.S. Freeman[1], Joseph L. Moyer, and Lyle W. Lomas

Summary

Sixty-three yearling, crossbred steers grazing Acremonium coenophialum-infected tall fescue were assigned to a control or were offered supplemental grain sorghum (GS) at levels of .25 or .50% of body weight to evaluate effects on grazing and subsequent feedlot performance. Pasture phase gains increased as the level of GS increased. Supplementation during the pasture phase did not affect (P>.10) feedlot dry matter intake or gain. Steers receiving GS at .25% of body weight were more (P<.10) efficient during the feedlot phase than control steers or those receiving GS at .5% of body weight. Steers receiving GS at .5% of body weight were less (P<.10) efficient than those receiving no GS. Steers receiving GS during the pasture phase had higher (P<.10) backfat and yield grades than those receiving no GS. Therefore, offering ground grain sorghum to steers grazing endophyte-infected fescue pastures improved pasture gain without substantially affecting subsequent feedlot performance.

Introduction

Various management practices have been applied to reduce the toxic effects of endophyte-infected fescue. Grain sorghum has been used to improve rate of gain of grazing cattle. In many instances, cattle offered supplemental grain while grazing exhibit reduced performance and efficiency during a subsequent feedlot period. It is well documented that supplemental grain reduces forage intake. Offering grain supplements to cattle grazing endophyte-infected fescue should dilute the toxic effects of tall fescue which should have a dramatic effect on animal performance, but subsequent effects on feedlot performance remain unknown. This study was conducted to evaluate the effects of supplementation with different levels of ground grain sorghum on pasture and subsequent feedlot performance by steers grazing endophyte-infected tall fescue pastures.

Experimental Procedure

Ninety crossbred yearling steers that had been vaccinated previously against IBR, BVD, PI_3, five strains of leptospirosis, and seven clostridial strains were co-mingled for 7 days on a mixed pasture of endophyte-free fescue, bromegrass, and native grass. Initial full weights were measured on May 8 and 9, when they were randomly allotted by weight into nine lots of seven head each. Steers were vaccinated against pinkeye and BRSV, dewormed with levamisole, and received an insecticide ear tag to control flies at that time. The steers were then transported to one of nine 5-acre A. coenophialum-infected tall fescue pastures (70% of the plants infected), where they grazed until July 3. Pastures were randomly allotted such that steers grazing each of the nine pastures were assigned to a control or were offered ground grain sorghum (GS) at levels of .25 and .5% of body weight daily (three pastures each). The remaining 27 head were used to control excess forage production on the experimental pastures. Water and mineral blocks containing monensin were provided free-choice. Grain levels were adjusted according to interim weights measured on May 29 and June 20.

All steers were weighed on the morning of July 3 and moved to the previously grazed mixed-grass pasture for a 7-day period to equalize gut fill. Final pasture weights were measured on July 9 and 10, and the cattle were transported overnight to

[1]Southwest Research - Extension Center.

the Southwest Research - Extension Center, Garden City, KS for the feedlot phase of the trial. The steers were fed a high concentrate ration until November 19. The cattle then were slaughtered at the Finney Co. IBP plant, and carcass data were collected following a 24-h chill.

Results and Discussion

Pasture gain tended to increase with increasing grain level (Table 1). Steers offered GS at .5% of body weight gained more (P<.10) than those offered no GS. Gains by steers offered GS at .25% of body weight were intermediate between the control and GS at .5%. Efficiency of conversion of pasture supplement increased with level; conversion for steers offered GS at .25% of body weight was 6.2 lb GS per pound of additional gain, whereas conversion for steers offered GS at .5% of body weight was 5.1 lb GS per pound of additional gain. Furthermore, the additional GS between that offered at .25 and .5% of body weight was converted at a rate of 1 lb. of gain for each 4.4 lb. of GS.

Pasture grain level did not affect feedlot gain or dry matter intake but did affect feed efficiency. Steers offered GS at .25% of body weight had the lowest (P<.10) feed conversion followed by those offered no GS. Steers offered GS at .5% of body weight had the highest (P<.10) feed conversion ratio.

Steers offered both amounts of GS during the pasture phase had higher backfat (P<.10) and yield grades (P<.05). Other carcass characteristics were not affected by previous pasture GS level.

Therefore, supplementation with ground grain sorghum, particularly at the level of .25% of body weight, may have a positive effect on pasture performance without substantially affecting feedlot performance.

Table 1. Effect of Grain Level during the Pasture Phase on Grazing and Subsequent Feedlot Performance by Steers Grazing A. coenophialum-infected Tall Fescue Pastures.

Item	Control	Grain level, % of body weight .25	.5
		lb	
Pasture phase			
Initial wt.	743	738	740
Final wt.	776[b]	788[b]	815[a]
Pasture gain	33[b]	50[ab]	75[a]
Daily gain	.53[b]	.81[ab]	1.21[a]
Grain consumption	0[c]	105[b]	215[a]
Feedlot phase			
Initial wt.	716	731	756
Final wt.	1236	1263	1276
Gain	520	532	520
Daily gain	3.94	4.03	3.94
Dry matter intake	22.6	22.6	23.5
Feed efficiency	5.74[b]	5.61[c]	5.96[a]
Combined total			
Total gain	553	582	595
Daily gain	2.53	2.72	2.75
Concentrate intake	20.5	21.0	22.4
Concentrate $/cwt gain	27.67	27.09	28.35

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

Table 2. Effect of Grain Level During the Pasture Phase on Subsequent Carcass Characteristics by Steers Previously Grazing A. coenophialum-infected Tall Fescue Pastures.

Characteristic	Control	Grain level, % of body weight .25	.5
Hot carcass wt. lb.	748	763	780
Dressing %	62.9	62.8	63.6
Ribeye area, in^2	13.1	12.4	12.9
Backfat, in.	.39[b]	.47[a]	.49[a]
USDA yield grade	2.7[d]	3.2[c]	3.1[c]
USDA quality grade[e]	10.0	10.1	9.9

[a,b]Means within a row differ (P<.10).
[c,d]Means within a row differ (P<.05).
[e] 9= Select$^+$; 10 = Choice$^-$.

YIELD, QUALITY, AND ANIMAL PREFERENCE FOR SILAGES MADE FROM WHOLE-PLANT SOYBEANS[1]

Kenneth P. Coffey, George V. Granade[2], and J.L. Moyer

Summary

Stafford (Group IV) and Bay (Group V) soybeans were harvested at the R2, R4, and R6 growth stages to determine the effects of variety, growth stage, and bacterial inoculant on yield, quality, and acceptability to ruminants of silages made from whole-plant soybeans. Silage dry matter yields in 1988 and 1989 from Bay soybeans harvested at the R2 and R6 growth stages were greater ($P<.10$) than those of the corresponding growth stages of Stafford soybeans. Both variety and growth stage had substantial effects on silage quality and preference by sheep.

Introduction

Soybeans have been ensiled with different cereal grains to increase the protein content of the silage. In order to ensure uniform silage, soybeans and cereal grains must be planted in some arrangement of alternate rows, which severely limits the flexibility of the cropping system. Another alternative for improving the dietary protein content of cereal grain silages for cattle feed is to simply supplement the silage with protein. However, supplemental protein is generally expensive. The objectives of this experiment were to determine 1) if whole plant soybeans could be ensiled to produce an acceptable feedstuff for ruminant livestock, 2) the optimum maturity group and growth stage at which to harvest soybeans to produce the most acceptable silage, and 3) if adding a bacterial inoculant would affect the quality of silages made from soybeans harvested at different growth stages and maturity groups.

Experimental Procedure

Soybean varieties selected to represent Group IV (Stafford) and V (Bay) maturity groups were planted in 30-inch rows at a rate of 139,000 seeds per acre in 1988 and 1989. Whole plants were harvested with a flail chopper at the R2 (full bloom), R4 (empty pods 3/4 inches long at the 10th node), and R6 (pods filled but no leaf senescence) growth stages and packed into 5-gallon plastic buckets lined with plastic trash can liners. Four replicates of each maturity group - growth stage combination were inoculated with a lactobacillus inoculant prior to packing into the buckets (I) and four replicates were not treated with the inoculant (NI). The silages were ensiled for a minimum of 42 days prior to opening.

Silage acceptability and preference by ruminants was determined in the following manner. Three yearling wethers (1988) and three ewe lambs (1989) were housed in individual pens with water and mineral provided free-choice. The sheep were adapted to soybean silage by offering them Bay R4 silage for 10 days. During the following 13-day period, sheep were given a choice of four different silages daily that were selected from the 12 different soybean silage combinations (2 varieties, 3 growth stages, and 2 inoculant treatments) and corn silage. Which four of the 13 silages would be offered any particular day were determined by stipulating that each silage type must be offered along with each other silage type one day during the study. The

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[1]Appreciation is expressed to Chr. Hansen's Laboratory, Inc., Milwaukee, WI for providing silage inoculant.

[2]Former Crop Variety Development Agronomist.

silages were fed at a level such that any one of the four silages could comprise only 50% of the daily, estimated, dry matter intake.

Results and Discussion

The variety by growth stage interaction was significant (P<.05) for yield variables in both 1988 and 1989 (Table 1). In both years, fresh yield and dry matter yield per acre were greater (P<.05) from Bay soybeans harvested at the R2 and R6 than from Stafford soybeans harvested at those same growth stages. Fresh and dry matter yields of R4 soybeans were similar between varieties.

Silage made from Stafford soybeans had higher quality than that made from Bay soybeans, because crude protein was higher and lignin lower in 1988 and crude protein was higher and fiber and lignin lower in 1989. Silage quality generally declined with plant maturity, and lactobacillus inoculant did not affect silage quality.

Sheep preferred corn silage to the soybean silages in both years, as illustrated by their consumption of more than 90% of the corn silage dry matter offered. On the days when corn silage was offered, the sheep consumed approximately 50% of their total dry matter intake from the corn silage. Again, 50% of the total dry matter intake of any one silage was established as a maximum intake level to force consumption and preference decisions on less desirable silages. Inoculation of silages did not alter sheep preference for the silages in either year. In 1988, silage consumption as a % of the dry matter offered was greater (P<.05) from Stafford R6 and Bay R4 and R6 silages than the other silages. Sheep tended to consume a lower proportion of Bay R2 and Stafford R4 silage dry matter. Bay and Stafford R6 silage consumption comprised a greater (P<.05) portion of the daily dry matter intake than consumption of the other silages. In 1989, sheep generally consumed less (P<.05) of the R4 silages than of the R2 and R6 silages as a percentage of offered dry matter and as a percentage of total diet dry matter.

In summary, whole plant silages made from soybeans contained high levels of crude protein and moderate levels of fiber and lignin, indicating that they may be a viable feed source for ruminants. When presented with a choice between corn and soybean silage, sheep chose corn silage. However, on days when only soybean silage was offered, the sheep consumed 3% of body weight in dry matter, indicating that consumption would be acceptable.

Table 1. Effect of Variety and Growth Stage on Soybean Silage Dry Matter and Yield.

	Bay			Stafford		
Item	R2	R4	R6	R2	R4	R6
1988						
Ton/acre fresh	7.4[c]	8.7[b]	9.6[a]	6.0[d]	8.8[ab]	8.5[b]
% Dry Matter	22.4[d]	29.4[c]	36.7[a]	21.4[e]	28.7[c]	31.5[b]
Ton/acre dry matter	1.7[c]	2.6[b]	3.5[a]	1.3[d]	2.5[b]	2.8[b]
1989						
Ton/acre fresh	7.9[d]	10.2[c]	13.1[a]	6.4[e]	11.0[bc]	11.7[b]
% Dry Matter	23.1[b]	23.4[b]	26.3[a]	21.4[c]	21.2[c]	25.8[a]
Ton/acre dry matter	1.8[d]	2.4[c]	3.5[a]	1.4[e]	2.3[c]	3.0[b]

[a,b,c,d,e]Means within a row differ (P<.05).

Table 2. Effect of Soybean Variety, Growth Stage, and Bacterial Inoculant on Silage Quality of Whole-Plant Soybeans.

Item	Variety		Growth stage			Inoculant	
	Bay	Staf.	R2	R4	R6	Yes	No
1988				%			
Crude protein	16.6[b]	17.4[a]	18.9[a]	16.4[b]	15.7[c]	16.9	17.1
NDF	48.3	49.2	47.8[b]	51.0[a]	47.3[b]	48.5	48.9
ADF	37.3	38.1	38.2[a]	39.5[a]	35.4[b]	37.5	37.9
Lignin	7.4[a]	6.8[b]	6.3[b]	7.5[a]	7.4[a]	7.0	7.2
Phosphorus	.27[b]	.29[a]	.29[a]	.29[a]	.26[b]	.27	.29
1989							
Crude protein	18.8[b]	20.3[a]	20.3[a]	19.6[ab]	18.9[b]	19.5	19.7
NDF	39.7[a]	38.3[b]	35.8[b]	40.1[a]	41.2[a]	39.3	38.8
ADF	28.3[a]	27.3[b]	26.1[c]	27.9[b]	29.5[a]	28.0	27.6
Lignin	6.7[a]	6.0[b]	5.5[c]	6.4[b]	7.1[a]	6.4	6.3
Phosphorus	.25	.51	.38	.28	.49	.40	.37

[a,b,c]Means within a row and main effect differ (P<.05).

Table 3. Animal Preference for Corn Silage and Inoculated or Non-inoculated Soybean Silages Made from Two Soybean Varieties Harvested at Three Growth Stages.

Year	Silage	Bay			Stafford		
		R2	R4	R6	R2	R4	R6
		Dry matter consumption as a % ----- of the silage dry matter offered from each silage -----					
1988	Inoc	44.4[d]	57.9[bcd]	72.4[b]	50.4[cd]	44.4[d]	72.9[b]
	No Inoc	46.3[d]	56.4[bcd]	66.9[bc]	55.9[bcd]	44.8[d]	69.6[b]
	Corn silage			99.6[a]			
		Dry matter consumption as a % ----- of total dry matter intake -----					
	Inoc	15.3[c]	20.7[c]	38.0[b]	15.8[c]	14.2[c]	30.1[b]
	No Inoc	13.5[c]	21.1[c]	34.6[b]	18.1[c]	18.1[c]	33.0[b]
	Corn silage			51.9[a]			
		Dry matter consumption as a % ----- of the silage dry matter offered from each silage -----					
1989	Inoc	58.2[b]	35.9[de]	58.2[bc]	60.2[bc]	34.6[de]	69.5[b]
	No Inoc	69.5[b]	34.6[e]	56.8[bcd]	66.1[b]	39.7[cde]	63.3[b]
	Corn silage			92.9[a]			
		Dry matter consumption as a % ----- of total dry matter intake -----					
	Inoc	23.2[bcd]	15.3[cd]	27.5[b]	23.1[bcd]	13.2[d]	31.7[b]
	No Inoc	27.7[b]	15.8[cd]	27.6[b]	23.8[bc]	15.8[cd]	28.2[b]
	Corn silage			52.1[a]			

[a,b,c,d,e]Means within a year and category with unlike superscripts differ (P<.05).

GRAZING OF DIFERENT TYPES OF FESCUE PASTURE AND SUBSEQUENT FEEDLOT PERFORMANCE: AN ECONOMIC ANALYSIS

Robert O. Burton, Jr.[1], Patrick T. Berends[1], Kenneth P. Coffey, Lyle W. Lomas, and Joseph L. Moyer

Summary

Steers weighing approximately 500 lb were grazed in a 3-year experiment on endophyte-infected Kentucky 31 fescue, endophyte-infected Kentucky 31 fescue interseeded with ladino clover, and endophyte-free Missouri 96 fescue. The cattle were then finished in a feedlot. Budgeting of returns above variable costs was used to measure the relative profitability of the systems. Results indicate that for the grazing phase, Missouri 96 was most profitable in 2 out of 3 years. But because of plentiful rainfall in 1987, Kentucky 31 with ladino clover was most profitable on the average. The feedlot phase showed the importance of compensatory gain for the cattle that had grazed the endophyte-infected fescue. For the feedlot phase, cattle that had grazed Kentucky 31 were most profitable on the average and for 2 out of 3 years. For the overall program, including both the grazing and feedlot phase, Kentucky 31 with ladino clover was most profitable in all 3 years.

Introduction

Large areas of fescue pasture in Southeastern Kansas are infected with an endophytic fungus that can cause poor pasture performance. However, the possibility exists for compensatory gains in the feedlot. In a 3-year experiment at the Southeast Branch Experiment Station, three alternative grazing systems were considered. These were endophyte-infected Kentucky 31 fescue, endophyte-infected Kentucky 31 fescue interseeded with ladino clover, and endophyte-free Missouri 96 fescue. Steers grazing in these three systems were finished to evaluate subsequent feedlot performance. The purpose of this study is to provide information about the relative profitability of the alternative grazing systems and subsequent feedlot performance.

Experimental Procedure

Income above variable costs was used to measure the profitability of the alternative systems (Tables 1 and 2). Thus, fixed cost for inputs such as land, buildings, machinery, and equipment were assumed to be the same for all three systems.

Budgets were prepared based on recent or current prices and on agronomic and animal performance data for 1986, 1987, 1988 and the 3-year average. For the endophyte-infected Kentucky 31 fescue, one set of budgets was prepared with a price discount for the cattle at the end of the grazing season and one set without a price discount. The possibility exists that cattle grazing on endophyte-infected fescue might bring a price premium, but this was not

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[1]Department of Agricultural Economics, KSU.

budgeted. Major differences between the costs of the three systems are as follows. 1) Establishment costs were included for Missouri 96. This is based on the assumption that a producer needs to decide whether to replace endophyte-infected fescue with endophyte-free fescue. 2) For the grazing of Kentucky 31 with ladino clover, the costs of interseeding clover every 2 years were included. 3) Kentucky 31 with ladino clover was assumed to use smaller amounts of nitrogen fertilizer.

Results and Discussion

In the grazing phase of the study, Missouri 96 was most profitable in 2 out of 3 years (Table 3). However, because of plentiful rainfall in 1987, Kentucky 31 with Ladino clover was most profitable on the average. Endophyte-infected Kentucky 31 had the lowest returns for all 3 years. This indicates that producers who have endophyte-infected fescue and who do not retain ownership beyond the grazing phase should consider grazing alternatives.

Results from the finishing phase indicate large impacts of compensatory gain. For 2 out of 3 years and on the average, steers that had grazed the endophyte-infected fescue were most profitable in the feedlot phase. In 1988, steers that had grazed Kentucky 31 with ladino clover were most profitable.

For the overall program, including both the grazing and the feedlot phase, steers that had grazed Kentucky 31 with ladino clover were most profitable in all 3 years.

In the budgets, we assumed that cattle coming off the pasture received the same price per hundredweight for all systems. However, in many cases, cattle that have grazed endophyte-infected fescue might appear unhealthy and receive a price discount. Therefore, a budget analysis was performed with the price of the cattle coming off endophyte-infected fescue reduced by $4.65 per hundredweight. As expected, discounting the price of steers that had grazed endophyte-infected fescue decreased returns in the grazing phase and increased returns in the finishing phase.

Table 1. Per Acre Returns above Variable Costs for Steers Grazed on Endophyte-infected KY 31 Fescue, Endophyte-infected KY 31 Fescue plus Ladino Clover, and Endophyte-free Missouri 96 Fescue.[a]

			KY31 No Discount		KY31/Ladino		MO96	
Item	Unit	Price	Quantity	Value	Quantity	Value	Quantity	Value
Purchased Stock	Cwt.	103.00	5.25	540.75	5.21	536.63	5.21	536.63
Pasture Maintenance								
Fall Nitrogen	Lbs.	0.23	50.00	11.50	-----		50.00	11.50
Phosphorus	Lbs.	0.22	17.00	3.74	17.00	3.40	17.00	3.74
Potassium	Lbs.	0.13	33.00	4.29	33.00	4.29	33.00	4.29
Spring Nitrogen	Lbs.	0.23	80.00	18.40	16.00	3.68	80.00	18.40
Seed	Lbs	1.00	-----		2.00	2.00	-----	
Labor	Hrs.	6.00	1.80	10.80	1.80	10.80	1.80	10.80
Machinery	Dol.	0.37	2.00	0.74	1.00	0.37	2.00	0.74
Establishment Costs[b]	Dol.	9.18	-----		-----		1.00	9.18
Animal Costs								
Vitamins and Minerals	Lbs.	0.03	30.00	0.90	30.00	0.90	30.00	0.90
Labor	Hrs.	6.00	1.05	6.30	1.05	6.30	1.05	6.30
Medical Expenses	Head	8.40	1.00	8.40	1.00	8.40	1.00	8.40
Repairs	Dol.	1.40	1.00	1.40	1.00	1.40	1.00	1.40
Utilities, Fuel, and Oil	Dol.	2.10	1.00	2.10	1.00	2.10	1.00	2.10
Miscellaneous	Dol.	varies	1.00	2.51	1.00	2.59	1.00	3.43
Interest on Cattle 1/2 Variable Costs	Dol.	varies	1.00	45.47	1.00	44.03	1.00	45.54
TOTAL VARIABLE COSTS				657.30		627.23		663.35
Returns - Livestock Sold	Cwt.	varies	7.13	614.89	7.52	648.52	7.64	658.87
RETURNS ABOVE VARIABLE COSTS				-56.88		21.29		-4.48

[a] Budgets are based on the average of three years (1986-88) of agronomic and animal performance data from the Southeast Kansas Branch Experiment Station and on recent or current prices. Prices for chemicals, feed, labor, and cattle are from Tierney and Mintert, Prices for Forward Planning, KSU Farm Management Guide MF-525, revised August 1990. Costs for machinery (fuel, lube, and repairs) are based on Fuller, Lazars, and Nordquist, Minnesota Farm Machinery Economic Cost Estimates For 1990, Minnesota Extension Service AG-FO-2308, revised 1990. Costs for medical expenses, repairs (building and equipment), and utilities, fuel, and oil are based on Langemeier and Barnaby, Grazing Yearling Beef, KSU Farm Management Guide, MF-591, revised October 1990. Miscellaneous costs are 10% of variable costs, less purchased cattle and interest. An interest rate of 12% was used. Returns for livestock include a death loss adjustment of 2%. Labor hour estimates are based on Langemeier, Labor Standards for Forward Planning, KSU Farm Management Guide MF-670, revised September 1987. Marketing costs are not included in the calculation of returns. An operator selling grazed cattle to a feedlot may need to include marketing costs.

[b] Establishment costs of $181.50 per acre minus $105.00 worth of hay sold in the year of establishment were allocated to the annual budget using the capitalization equation and an interest rate of 12%. Establishment costs were based on custom rates for seed preparation and harvesting. Rates are from Kansas Custom Rates 1990, Kansas Agricultural Statistics, Kansas Board of Agriculture, 1990.

Table 2. Per Head Returns for Steers, Finished in a Feedlot in Southeast Kansas, after Grazing Endophyte-infected Kentucky 31 Fescue, Endophyte-infected Kentucky 31 Fescue Interseeded with Ladino Clover, or Endophyte-free Missouri 96 Fescue.[a]

			KY31 No Discount		KY31/Ladino		MO96	
Item	Unit	Price	Quantity	Value	Quantity	Value	Quantity	Value
Purchased Stock	Cwt.	varies	7.13	602.34	7.52	648.52	7.64	658.87
Corn Silage	Ton	25.00	0.98	24.62	1.03	25.67	1.00	24.93
Grain Sorghum	Ton	54.00	1.30	70.14	1.35	73.13	1.32	71.04
Protein Supplement with Vitamins and Minerals	Ton	267.41	0.09	22.79	0.09	23.76	0.09	23.08
Labor	Hrs.	6.00	0.4	2.40	0.4	2.40	0.4	2.40
Medical Expenses	Dol.	5.00	1	5.00	1	5.00	1	5.00
Utilities, Fuel, and Oil	Dol.	3.25	1	3.25	1	3.25	1	3.25
Repairs	Dol.	4.00	1	4.00	1	4.00	1	4.00
Miscellaneous	Dol.	varies	1	13.22	1	13.72	1	13.37
Interest on Cattle and 1/2 Variable Costs	Dol.	varies	1	30.29	1	31.90	1	32.27
TOTAL VARIABLE COSTS				790.60		831.34		838.21
Returns								
Livestock Sold	Cwt.	varies	11.74	898.46	11.79	913.02	11.81	903.82
RETURNS ABOVE VARIABLE COSTS				107.86		81.67		65.61
TOTAL RETURNS ABOVE VARIABLE COSTS (Grazing + Feedlot)				65.45		102.97		61.13

[a] Budgets are based on the average of three years (1986-88) of agronomic and animal performance data from the Southeast Kansas Branch Experiment Station and on current prices, except the costs of protein supplement with vitamins and minerals are the three-year average paid by the researchers. Prices for labor, cattle, corn silage, and grain sorghum are from Tierney and Mintert, Prices for Forward Planning, KSU Farm Management Guide MF-525, revised August 1990. Medical expenses, repairs (includes building and equipment), and utilities, fuel, and oil are based on Langemeier and Barnaby, Finishing Beef, KSU Farm Management Guide MF-592, revised October 1990. Miscellaneous costs are 10% of variable costs less purchased cattle and interest. An interest rate of 12% is used. The selling price for finished cattle includes a price differential for select and choice carcass grades and a 1% death loss adjustment. Labor hours estimates are based on Langemeier, Labor Standards for Forward Planning, KSU Farm Management Guide MF-670, revised September 1987. Marketing costs are not included in the calculation of returns.

Table 3. Summary of Returns above Variable Costs for Three Grazing Alternatives and Subsequent Feedlot Performance.[a]

Situation	KY/31 Discount[b]	KY/31 No Discount	KY31/Ladino	MO96
	. . . .$/head.	. . . .	. . . .	. . . .
Grazing				
1986	(127)	(98)	(40)	(33)
1987	(50)	(18)	115	(11)
1988	(38)	(2)	(3)	40
3 Yr. Ave.	(75)	(42)	21	(4)
Finishing				
1986	176	146	112	76
1987	143	110	37	78
1988	111	73	98	46
3 Yr. Ave.	142	108	82	66
Grazing + Finishing				
1986	--	48	72	33
1987	--	92	152	67
1988	--	71	96	86
3 Yr. Ave.	--	65	103	61

[a] The three grazing alternatives are endophyte-infected Kentucky 31 fescue, endophyte-infected Kentucky 31 fescue interseeded with Ladino clover, and endophyte-free Missouri 96 fescue. Marketing costs are not included in the calculation of returns. An operator selling grazed cattle to a feedlot may need to include marketing costs.

[b] Cattle that have grazed endophyte-infected fescue may appear unhealthy and therefore, receive a price discount. The $4.65 per hundredweight discount is the discount on stale cattle from Mintert, Brazle, Schroeder, and Grunewald, Factors Affecting Auction Prices of Feeder Cattle, Cooperative Extension Service C-697, September 1988.

ALFALFA VARIETY PERFORMANCE IN SOUTHEASTERN KANSAS

Joseph L. Moyer

Summary

Alfalfa yields for 1990 reflect only three cuttings because of stand depletion. Yield of the cultivar 'Arrow' was highest in 1990, and it also had one of the best remaining stands. 'WL-320', 'Endure', and 636 were also in the high-yielding group. In 5-year average production, 630, WL-320, KS196, 'Endure', and 'Southern Special' were significantly greater than the four lowest-yielding cultivars.

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 fifth growing season of this test was the last for yield determination.

Experimental Procedure

The 15-line test was seeded (12 lb/acre) in April, 1986 at the Mound Valley Unit. Plots were fertilized with 20-50-200 lb/acre of N-P_2O_5-K_2O on 22 March, 1990. Three harvests were obtained in 1990, and stands were visually estimated.

Results and Discussion

Forage yields for each of the three cuttings and total 1990 production are shown in Table 1. Yields declined in 1990, partly because the wet May conditions (175% of average) resulted in stand depletion. Three of the four highest-yielding cultivars also ranked among the top four in stand ratings, whereas the seven lowest-yielding cultivars also had the poorest stands (Table 1). The four highest-yielding cultivars produced significantly more forage than five low-yielding cultivars in 1990. The first group consisted of Arrow, WL-320, Endure, and 636, whereas the latter included 'Riley', 655, 'Cimarron', K82-21, and 'Kanza'. Arrow produced the highest yields of the test in both cuts 1 and 2; Endure and 630 had high yields in cut 1, whereas 636 amd WL-320 had highest yields in cut 2.

Average 5-year forage production (Table 2) of the top-yielding cultivar, 630, was significantly greater than production of six other cultivars. Three high-yielding cultivars produced more forage than the four that yielded least. WL-320 has performed well except in 1988; 'Endure' was generally a consistent performer, along with KS196; K82-21 and 655 yielded adequately in the first 2 years of the test, but fell behind other cultivars thereafter.

Table 1. 1990 Forage Yields and Stand Ratings of the 1986 Alfalfa Variety Test, Mound Valley Unit, SEK Station.

Source	Variety	Forage Yield: Harvest Dates: 5/2	6/22	7/26	Total	Stand Ratings, 6/22
		- - tons/acre @ 12% moisture - -				- % -
USDA-KSU	KS196 EXP	1.60ab[1]	1.00bcde	0.58ab	3.18bcd	35bcde
Waterman-Loomis	WL-320	1.69ab	1.25ab	0.61ab	3.55ab	55abc
PAG Seeds	Endure	1.85a	1.15abcd	0.54ab	3.54ab	35bcde
Garst	636	1.65ab	1.30ab	0.56ab	3.51ab	60a
Garst	630	1.80a	0.98bcde	0.57ab	3.36abc	40abcd
Waterman-Loomis	South. Spec	1.46b	0.90cdef	0.70a	3.06bcde	28de
Cargill	EXP 339	1.65ab	1.20abc	0.54ab	3.39abc	40abcd
USDA-KSU	Riley	1.41b	0.59g	0.59ab	2.59e	15e
Agripro	Arrow	1.90a	1.41a	0.52ab	3.82a	60a
Agripro	Dart	1.66ab	1.22ab	0.56ab	3.45abc	58ab
Asgrow/O's Gold	Eagle	1.60ab	0.86defg	0.61ab	3.06bcde	32cde
Great Plains Res.	Cimarron	1.44b	0.70efg	0.61ab	2.75de	20de
USDA-KSU	K82-21 EXP	1.44b	0.86defg	0.55ab	2.85de	28de
Garst	655	1.46b	0.64fg	0.50b	2.60e	20de
USDA-KSU	Kanza	1.65ab	0.74efg	0.58ab	2.97cde	30de
	Average	1.62	0.99	0.58	3.18	37
	LSD(.05)	0.28	0.27	NS	0.44	21

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

Table 2. 5-Year Average Forage Yields of Alfalfa Varieties, Mound Valley Unit, SEK Station.

Source	Variety	Year 1986	1987	1988	1989	1990	5-Yr. Avg.
		- - - - tons/acre @ 12% moisture - - -					
Garst	630	3.64abc	7.88bc	8.92a	8.61ab	3.36abc	6.48a
Waterman-Loomis	WL-320	3.78abc	8.10ab	7.83bcd	8.82a	3.55ab	6.42a
USDA-KSU	KS196 EXP	3.86abc[1]	8.44a	7.82bcd	8.33abc	3.18bcd	6.33ab
PAG Seeds	Endure	4.07a	8.01ab	7.94bc	8.39abc	3.54ab	6.39a
Waterman-Loomis	South Spec	3.96ab	7.84bc	7.99bc	8.37abc	3.06bcde	6.24ab
Garst	636	3.50c	7.88bc	7.78bcd	8.43ab	3.51ab	6.22ab
Agripro	Arrow	3.58bc	7.74bc	8.03b	8.22abc	3.82a	6.28ab
Cargill	EXP 339	3.56bc	7.83bc	7.69bcd	8.38abc	3.39abc	6.17abc
Agripro	Dart	3.72abc	7.65bc	7.92bcd	8.58ab	3.45abc	6.17abc
Great Plains Res	Cimarron	3.90abc	7.58bc	7.79bcd	8.04bcd	2.75de	6.01bcd
Asgrow/O's Gold	Eagle	3.76abc	7.67bc	7.58bcd	8.18bc	3.06bcde	6.05bcd
Garst	655	3.96ab	7.46c	7.73bcd	7.35e	2.60e	5.82d
USDA-KSU	Kanza	3.54bc	7.40c	7.72bcd	7.79cde	2.97cde	5.88cd
USDA-KSU	K82-21 EXP	4.04a	7.63bc	7.22d	7.42e	2.85de	5.84d
USDA-KSU	Riley	3.72abc	7.70bc	7.29cd	7.53de	2.59e	5.77d
	Average	3.77	7.79	7.81	8.16	3.18	6.14
	LSD(.05)	0.38	0.45	0.59	0.53	0.44	0.29

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

LESPEDEZA INTERSEEDING, LIME APPLICATION, AND P-K FERTILIZER ON NATIVE GRASS MEADOW

Joseph L. Moyer

Summary

Forage production in 1987-89 was increased an average of 8% by fertilization with 0-40-40 in 1980, but not by lime. The low amount of lespedeza produced in seeded plots of either cultivar did not affect forage yield or quality in any of the 3 years, even with lime and fertilization.

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. Because 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 19 March, 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, 1988, and 1989, the plot area was burned on 9, 7, and 13 April, respectively. Seeding was performed with a no-till plot seeder using a rate of 20 lb/acre on 21 April in 1987 and 1989 and on 20 April in 1988. Common Korean lespedeza seed was obtained locally, and Ark S-100 (since released as 'Marion') seed was obtained from Dr. Beuselinck at the University of Missouri. In 1987 and 1989, one m^2 was clipped from the center of each plot for determination of botanical composition and dry matter production (1987 only). In 1988 and 1989, a flail mower was used to harvest a 3'x 20' strip from each plot. Subsamples were collected each year for moisture and crude protein determinations. Sampling dates were 13 July, 29 June, and 28 June in 1987, 1988, and 1989, respectively.

Results and Discussion

Fertilization with P and K in 1980 increased yield of native grass forage in each of the 3 years and the 3-year average (Table 1). Liming had no effect on forage yield nor did interseeding common Korean or Marion lespedeza. The percentage of lespedeza in 1987 and 1989 forage was increased by the seeding treatment equally in both cultivars, but never amounted to more than 4.3% (124 lb DM $acre^{-1}$). Other forbs (weeds) accounted for more than twice the dry matter of lespedeza in the forage in 1989.

The low amount of lespedeza produced during the 3 years was not sufficient to affect forage quality, as indicated by forage crude protein (Table 1). Because no direct or cumulative effects of lespedeza interseeding were measured, there was no appreciable amount of fixed N residual in the soil. Thus, neither lespedeza improved native meadow forage production, even with the addition of lime and/or P-K fertilizer.

Table 1. Three-year Average Forage Yield (12% Moisture) and Crude Protein Content from Native Meadow with or without P-K Fertilization, as Affected by Lime and Lespedeza Interseeding.

Treatment	Yield	Crude Protein
	tons/A	- % -
Legume Interseeding		
None	1.59	4.9
Korean	1.65	5.0
Marion	1.64	5.0
LSD(0.05)	NS	NS
Lime		
None	1.63	
5.0		
2400# E.C.C.	1.62	5.0
LSD(0.05)	NS	NS
Fertilizer		
None	1.56	5.0
0-40-40	1.69	5.0
LSD(O.05)	0.09	NS

FORAGE YIELDS OF TALL FESCUE VARIETIES IN SOUTHEASTERN KANSAS

Joseph L. Moyer

Summary

In the fourth harvest year of the test, 'Phyter' and 'Mo-96' yielded more first-cut forage than 'Triumph', 'Cajun', and 'Stef'. For the year, Phyter produced more forage than Stef and Triumph under hay management. Under a 7-clip system, however, Triumph produced more than Stef and Phyter. Over the 4 years of the test, Phyter and 'Festorina' yielded more than Stef and 'Johnstone'.

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, because effects of a variety chosen for a new seeding will be apparent for as long as the stand exists.

Experimental Procedure

Plots were seeded on 4 September, 1986 at 20 lb/acre at the Mound Valley Unit, ostensibly with seed free of *Acremonium coenophialum* endophyte. Plots were 30 x 7.5 ft each, in four randomized complete blocks. Application of 160-50-57 lb/acre of N-P_2O_5-K_2O was made on 22 March, 1990, followed by fertilization with 60 N on 7 September, 1990. Plots 15'x 3' were cut on 29 May and 19 November, 1990. A subsample from each plot was collected for moisture, fiber, crude protein, and *in vitro* digestibility determinations. A 10'x 7.5' subplot of each plot was measured with a disk meter for yield estimation before those harvests, plus an additional five clippings.

Results and Discussion

'Forager', 'Fawn', Triumph, and 'Mozark' headed significantly earlier than six other cultivars in 1990 (Table 1). Stef, Mo-96, and Johnstone headed significantly later than eight other cultivars.

Wet April weather delayed the first forage harvest in 1990. Phyter and Mo-96 yielded significantly more than Stef, and Phyter also outyielded Triumph (Table 1). Dry summer and early fall conditions did not enable a second cutting until November, and it averaged two-thirds of the yield of cut 1. In the second cutting, Mozark, Festorina, and eight other cultivars yielded significantly more than Stef. For the year, Phyter produced more than Stef. Three-year average production was significantly higher from Phyter than from Stef, Johnstone, and Triumph.

Intensive clipping altered the relative productivity of the cultivars. Triumph and nine other cultivars produced more under intensive clipping than Stef, and Triumph also out-produced Phyter (Table 1).

Forage quality parameters are listed in Table 2. Crude protein content in the first cutting did not differ significantly among cultivars, but ranged from 9.9 for Fawn to 11.7% for Stef. Fall (second-cut) forage was significantly higher in Stef and Mo-96 than in Cajun, and Stef was also higher in protein than Fawn.

Fiber contents (ADF and NDF) in cut 1 were lowest in Cajun and highest in Ky-31 and Kenhy (Table 2). Phyter was also lower in fiber contents than Ky-31. ADF contents of Triumph, Fawn, and Forager were lower than those of Ky-31 and Kenhy.

Digestibilities (IVDMD) of both cuttings are shown in Table 2. In cut 1, digestility of Stef and Johnstone were higher than those of Forager, Martin, and Ky-31. Also, Phyter was higher than Forager and Martin. In cut 2 forage, Johnstone was more digestible than Mozark.

Table 1. Heading Date and Forage Yield (@12% moisture) of Tall Fescue Varieties for 1990, Mound Valley Unit, Southeast Kansas Branch Experiment Station.

Variety	Heading Date[1]	Forage Yield: Cut 1 (5/29)	Cut 2 (11/19)	Total	Clip[2]	3-Year Average
		- - - - - - - - - - - - tons/acre - - - - - - - - - - - -				
Kenhy	121.0cde	4.39abc[3]	2.85a	7.24abc	4.48ab	6.96abc
Mo-96	125.5b	4.56ab	2.69ab	7.26abc	4.46ab	6.97abc
Forager	116.2h	4.15abc	2.85a	7.00abc	4.46ab	6.93abc
Cajun	118.0fgh	3.93bc	2.95a	6.88abc	4.59ab	6.77abc
Phyter	119.5defg	4.83a	2.99a	7.82a	4.18bc	7.30a
Martin	118.2efgh	4.12abc	2.88a	7.00abc	4.32abc	7.01ab
Festorina	120.0def	4.24abc	3.11a	7.35abc	5.21ab	7.01ab
Triumph	116.8gh	3.68c	2.88a	6.56bc	5.30a	6.60bc
Fawn	116.8gh	4.06abc	2.92a	6.97abc	4.85ab	6.71abc
Ky-31	121.5cd	4.38abc	2.83a	7.20abc	4.87ab	6.80abc
Johnstone	123.0bc	4.21abc	2.70ab	6.91abc	5.14ab	6.32cd
Mozark	117.0gh	4.37abc	3.23a	7.69ab	5.20ab	6.86abc
Stef	128.2a	3.94bc	2.21b	6.15c	3.39c	5.83d
Average	120.1	4.22	2.85	7.08	4.65	6.69
LSD(.05)	2.6	0.73	0.54	1.04	0.93	0.57

[1]Julian day when heads first appeared. (Day 120=30 April).
[2]Sum of disk meter yield estimates taken prior to each of seven clippings.
[3]Means within a column followed by the same letter are not significantly ($P \leq .05$) different, according to Duncan's test.

Table 2. Crude Protein, Fiber Contents, and IVDMD of Tall Fescue Varieties for 1990, Mound Valley Unit, Southeast Kansas Branch Experiment Station.

Variety	Crude Protein		Fiber Content Cut 1		IVDMD	
	Cut 1	Cut 2	NDF	ADF	Cut 1	Cut 2
	%					
Kenhy	11.0a	12.1abc	63.4ab[2]	36.4ab	59.4abcd	61.8ab
Mo-96	11.2a	12.6ab	62.2abc	35.4abcd	59.0abcd	61.7ab
Forager	11.0a	12.5abc	62.4abc	34.2cde	56.3d	60.0ab
Cajun	11.1a	11.1c	60.0c	33.1e	59.2abcd	60.1ab
Phyter	11.6a	12.5abc	61.3bc	34.4bcde	60.2abc	58.8ab
Martin	10.7a	11.6abc	63.1ab	35.8abc	56.7d	61.9ab
Festorina	11.3a	12.4abc	62.4abc	35.0abcde	58.5bcd	61.8ab
Triumph	11.0a	12.1abc	62.1abc	33.5de	58.2bcd	59.3ab
Fawn	9.9a	11.3bc	61.8abc	33.9cde	58.7bcd	59.2ab
Ky-31	10.8a	12.1abc	64.1a	37.0a	57.4cd	61.3ab
Johnstone	10.9a	12.5abc	62.2abc	35.0abcde	61.2ab	63.2a
Mozark	10.8a	11.7abc	62.7ab	35.7abc	56.3d	58.0b
Stef	11.7a	12.9a	61.9abc	35.0bcde	62.0a	59.6ab
Average	11.1	12.2	62.3	35.0	58.7	60.5
LSD(.05)	NS	NS	2.1	1.7	2.7	NS

[1]Means within a column followed by the same letter are not significantly (P≤.05) different, according to Duncan's test.

WINTER ANNUAL LEGUMES AND GRASSES FOR GROUND COVER AND FORAGE IN SOUTHEASTERN KANSAS

James H. Long[1] and Joseph L. Moyer

Summary

Six legumes planted for use as winter annuals and two winter grass crops were compared for their performance as cover crops and for forage production in the fall of 1989 and the early spring of 1990 at the Mound Valley field. Late fall sampling indicated that several legumes gave 90+ % ground cover by November. Winter survival played a key role in both ground cover and forage production of the legumes in the following spring; field peas and crimson clover having less forage and percent ground cover than when sampled before the winter. Of the legumes, hairy vetch produced the greatest forage by the first week of May and was the only legume to provide consistent early spring growth.

Introduction

The use of crops, especially legumes, for ground cover and for their nitrogen contribution has been revived during the last 5 years. Although they are used similarly to the old "cover crops" and "green manures" of the early 20th century their use has taken on new meaning with government programs and environmental concerns. The objective of this study was to compare selected available legumes for their potential use as winter/spring cover crops, forage, and green manure in Southeastern Kansas.

Experimental Procedure

Six legumes, including hairy vetch, black medic, crimson clover, winter peas, sweet clover (a biennial), and arrowleaf clover, and two small grains, winter wheat and rye, were planted on August 27, 1989 at Mound Valley. Plots were sampled on November 22, 1989; March 27, 1990; April 8, 1990; April 24, 1990; and May 8, 1990 for forage production, plant height, and plant canopy density. Gravimetric soil moisture measurements from 0 - 6 inches were collected at the April and May sample dates while percent ground cover measurements were collected on November 22, 1989 and May 8, 1990 samplings. Winter survival was recorded at the March 27, 1990 sampling.

[1] Department of Agronomy, KSU.

Results and Discussion

The wheat and rye gave adequate ground cover and early spring growth for use as cover crops (Table 1). Both crops were killed with a postemerge herbicide on April 4, 1990 because they were in the 'boot' stage and had reached the maximum growth allowable for a cover crop. The only legume to give adequate early growth was hairy vetch, and it was somewhat slower than the small grains (Table 1). The winter peas and crimson clover suffered winter damage after good fall growth which affected their early spring growth (Table 1). The other legumes grew very slowly during the spring and showed significant growth by the April 24 and May 8, 1990 samplings. This late growth pattern may make such species unacceptable as cover crops in Southeast Kansas.

Table 1. Growth and selected ground cover characteristics of winter annual legumes and grasses.

Crop	Winter Survival	Ground Cover	Height	Dry Matter	Canopy Density	Soil Moisture
	-percent-	-percent-	--in--	-lb/a-	-lb/a/in-	-percent-
	-------------------------November 22, 1989-----------------					
Winter peas	---	86.5	4.9	1102	248	---[a]
Sweet clover	---	90.3	1.9	319	164	---
Hairy vetch	---	97.5	2.4	1406	583	---
Black medic	---	87.0	1.7	364	212	---
Crimson clover	---	93.0	3.4	1278	376	---
Arrowleaf clover	---	92.2	1.9	441	209	---
Winter wheat	---	90.7	9.0	1710	194	---
Rye	---	99.0	9.1	2508	279	---
L.S.D.(0.05)	---	9.8	1.2	478	119	---
	-------------------------March 27, 1990--------------------					
Winter peas	35.0	---[b]	2.9	173	69	---
Sweet clover	100.0	---	2.6	518	203	---
Hairy vetch	100.0	---	4.9	1879	396	---
Black Medic	100.0	---	1.3	499	392	---
Crimson clover	32.7	---	2.5	441	185	---
Arrowleaf clover	95.9	---	1.1	403	377	---
Winter wheat	57.1	---	10.9	2109	194	---
Rye	68.6	---	15.6	2377	155	---
L.S.D. (0.05)	57.2	---	0.9	425	84	---

Table 1 Continued.

Crop	Winter Survival	Ground Cover	Height	Dry Matter	Canopy Density	Soil Moisture
	-percent-	-percent-	--in--	-lb/a-	-lb/a/in-	-percent-
	------------------------April 8, 1990---------------------					
Winter peas	---	---	2.6	192	74	31
Sweet clover	---	---	3.2	422	134	30
Hairy vetch	---	---	7.9	2186	293	30
Black Medic	---	---	1.6	307	216	31
Crimson clover	---	---	3.1	384	102	29
Arrowleaf clover	---	---	1.6	115	75	33
Winter wheat	---	---	---[c]	---	---	--
Rye	---	---	---[d]	---	---	38
L.S.D. (0.05)	---	---	1.0	438	133	NS
	-----------------------April 24, 1990--------------------					
Winter peas	---	---	5.3	96	15	23
Sweet clover	---	---	7.8	1361	177	25
Hairy vetch	---	---	12.1	2723	226	23
Black medic	---	---	2.8	1189	452	19
Crimson clover	---	---	8.7	1150	132	23
Arrowleaf clover	---	---	4.3	460	109	22
Winter Wheat	---	---	---	---	---	---
Rye	---	---	---	---	---	---
L.S.D. (0.05)	---	---	1.9	428	133	NS
	----------------------May 8, 1990----------------------					
Winter peas	---	15.0	9.0	336	48	22
Sweet clover	---	100.0	20.3	2530	126	23
Hairy vetch	---	100.0	19.5	4429	229	21
Black medic	---	100.0	5.2	1496	300	23
Crimson clover	---	88.5	14.1	1510	104	24
Arrowleaf clover	---	91.5	6.9	844	148	22
Winter wheat	---	81.5	---	---	---	--
Rye	---	94.5	---	---	---	30
L.S.D. (0.05)	---	15.1	2.6	772	82	NS

[a] Soil moistures taken during the April and May samplings.
[b] Cover readings taken in November, 1989 and May, 1990 only.
[c] Wheat killed April 4, 1990 and no further readings taken.
[d] Rye killed April 4, 1990 and only soil moisture taken in April and May.

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

Daniel W. Sweeney and Joseph L. Moyer

Summary

Split fall-spring applications of N tended to result in higher tall fescue and smooth bromegrass yields than one N application in the fall. Knifing resulted in higher fescue yield than broadcast applications; however, placement method had no effect on bromegrass yields.

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 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, and spring N applications were made 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 preceding N application. A 3 ft x 20 ft area was harvested in mid-May.

Results and Discussion

Tall fescue and bromegrass yields were affected by timing of N application in 1990 (Table 1). The highest bromegrass yield was obtained with two-thirds of the N applied in the fall and one-third in the spring, and lowest yield resulted when all N was applied in the fall, although differences were less than 0.5 ton/a. For fescue, both split N applications resulted in an average yield of 2.00 ton/a, but fescue yield was approximately 18% less with single fall or spring applications. Knife N applications resulted in 1more than a 20% increase in fescue yield compared to broadcast or dribble. Placement did not significantly affect bromegrass yields in 1990. Increasing the N rate from 75 to 150 lb/a increased fescue and bromegrass yields by approximately 44%. However, yield was increased by more than 1 ton/a, compared to the check, when 75 lb N/a was applied.

Table 1. Effect of Fluid N Rate and Placement and Time of Application on Tall Fescue and Smooth Bromegrass Yields in 1990.

Treatment	Yield @ 12% moisture	
	Fescue	Bromegrass
	------ ton/a -------	
Timing		
100% of N in fall	1.63	2.52
67% of N in fall - 33% of N in spring	2.00	2.96
33% of N in fall - 67% of N in spring	2.00	2.63
100% of N in spring	1.65	2.60
LSD (0.05)	0.18	0.30
Method		
Broadcast	1.73	2.61
Dribble	1.64	2.61
Knife	2.10	2.81
LSD (0.05)	0.15	NS
N Rate (lb/a)		
75	1.49	2.19
150	2.15	3.16
LSD (0.05)	0.12	0.21
Interaction(s)	NS	NS
Check[1]	0.33	0.94

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

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, the major response appeared to be due to the first 40 lb of P_2O_5/a. First-cutting alfalfa yield was increased by 80 lb K_2O/a, but no further increase occurred with a higher K rate. Fluid fertilizer placement did not affect alfalfa yield in 1990.

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. Fertilizer solutions were also applied in fall 1988 and 1989. Cuttings were taken from a 3 x 20' area of each plot.

Results and Discussion

Experiment 1

At the first cutting in 1990, significant yield increases were obtained with P and K rates up to 120 lb P_2O_5/a and 80 lb K_2O/a (Table 1). First cutting yields increased approximately 60% with 120 lb P_2O_5/a as compared to no-P treatments. Second and third cutting yields were small, partly because of apparent stand reductions caused by wet spring weather, and thus, P additions had minimal effect. Phosphorus additions increased total yield by 0.50 to 0.81 ton/a above the check. The addition of 80 lb K_2O/a resulted in

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

[2]Department of Agronomy, KSU.

significant increases in yield for only the first cutting and the total; however, a further increase to 160 lb K_2O/a did not result in additional increases in yield.

Experiment 2

Yield of individual cuttings and total yield were not significantly affected by fluid fertilizer placement in 1990 (data not shown). One interaction of method with K applications for the second cutting suggested that knifing of K may result in a higher yield response than broadcasting or dribbling K fertilizer (data not shown).

Table 1. Alfalfa Yield in 1990 as Affected by P and K Rates of Dribble Applied Fluid Fertilizer.

	Yield @12% Moisture				
	Cutting				
Treatment	1	2	3	4	Total
	ton/a				
P_2O_5 (lb/a)					
0	1.03	0.93	0.76	0.46	3.18
40	1.39	1.09	0.74	0.39	3.61
80	1.46	0.96	0.87	0.41	3.70
120	1.60	0.94	0.99	0.44	3.97
LSD (0.05)	0.14	NS	0.15	NS	0.30
K_2O (lb/a)					
0	1.27	0.93	0.79	0.41	3.40
80	1.41	1.02	0.83	0.42	3.68
160	1.44	0.99	0.90	0.44	3.76
LSD (0.05)	0.12	NS	NS	NS	0.26
Interaction	NS	NS	NS	NS	NS

EFFECTS OF SULFUR RATE, METHOD, AND SOURCE ON TALL FESCUE[1]

Daniel W. Sweeney and Joseph L. Moyer

Summary

Although differences were small, yield was increased by ammonium thiosulfate fertilization as compared to ammonium sulfate, but was decreased when the S fertilization rate was increased from 15 to 30 lb/a. Yield was increased by more than 30% at both sites by knife fertilizer applications as compared to broadcast.

Introduction

Because sulfur is a necessary element for both plants and animals, 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

Site 1 was established in spring 1988 at an off-station location (Terry Green farm), and Site 2 was established in spring 1989 at a second off-station location (Callander farm). Factors included a no S check compared with 15 and 30 lb S/a as ammonium sulfate (AS) and ammonium thiosulfate (ATS) as fluid sources. 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 in each year. In mid-May, final forage production was harvested near full bloom at both sites.

Results and Discussion

At both sites in 1990, ATS resulted in approximately 10% higher spring fescue forage yield than obtained with AS (Table 1). However, yield was reduced 0.3 to 0.5 ton/a by increasing the S application rate from 15 to 30 lb S/a. At both sites, yield was affected by fertilizer placement in the order: knife > dribble > broadcast. Yield was affected by an S source by S rate interaction at both sites (data not shown), because of a sharper reduction in yield at 30 lb S/a with AS than with ATS. At Site 2, additional interactions suggested that placement may be important in the response of tall fescue to S source and rate (data not shown). Yield response of tall fescue was lower to AS than to ATS when broadcast and dribbled, but both S sources resulted in similar yield when knifed. At 15 lb S/a, yield was higher with knifing and dribble applications than with broadcasting. However, the apparent decrease in yield at 30 lb S/a resulted in smaller yield differences with placement.

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[1] Research was partially supported by grant funding from the Fluid Fertilizer Foundation; Kerley Ag, Inc.; The Sulphur Institute; and Allied-Signal, Inc.

In addition to yield data shown in Table 1, several measures of quality were made in 1990. Several parameters such as N and S content, N:S ratios, and *in vitro* dry matter digestibilities were found to be affected by S source, rate, and placement (data not shown).

Table 1. Effect of S Source, S Rate, and Method of Application on Spring Tall Fescue Yield at Two Sites in 1990.

Treatment Means	Yield	
	Site 1	Site 2
	---- ton/a ----	
S Source (S)		
AS	2.33	2.19
ATS	2.57	2.37
LSD (0.05)	0.17	0.15
S Rate (R)		
lb/a		
15	2.65	2.44
30	2.25	2.12
LSD (0.05)	0.17	0.15
Method (M)		
Broadcast	2.11	1.97
Dribble	2.45	2.24
Knife	2.79	2.64
LSD (0.05)	0.21	0.19
Interaction(s):	SxR	SxR SxM RxM

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

Daniel W. Sweeney

Summary

In 1990, the eighth 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, 1987, and 1989 grain sorghum were a) no N check, b) anhydrous ammonia knifed to a depth of 6 inches, c) broadcast urea-ammonium nitrate (UAN - 28% N) solution, and d) broadcast solid urea. N rates were 125 lb/a. Harvests were collected from each subplot for both grain sorghum (odd years) and soybean (even years) crops, even though N fertilization was applied only to grain sorghum.

Results and Discussion

No significant differences related to tillage or residual N fertilization were found for soybean yield in 1990 (data not shown). The test average yield was 11.3 bu/a.

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

Daniel W. Sweeney

Summary

In general, doublecrop soybean yields were low from 1983 to 1990, with no well-defined trend in response to wheat straw residue management. However, wheat (or oat) yields often were lower where the previous doublecrop soybeans were planted no-till as compared to burn and disc or discing only. Increased N rates for wheat had minimal effect on wheat or soybean yields.

Introduction

Doublecropping of 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 incorporated 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 83 lb N/a. Wheat yield was determined in areas where the three residue management systems had been 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 83 and 129 lb N/a. These residue management and total N rate treatments were continued through 1990, except in 1986 and 1987, when oats were planted in the spring because of wet conditions in the fall.

Results and Discussion

In general, yields of doublecrop soybeans were low during the 8 years of this study (Table 1), rarely exceeding 15 bu/a. The disc only treatment tended to give higher yields in years where residue management resulted in significant differences. No tillage tended to result in lower or no yields, partly because of weed pressure. In 1987 and 1989, the residual N that was applied to the previous wheat crop resulted in higher soybean yield in the burn then disc treatment and in the disc only treatment. However, yield was not increased by residual N in the no-tillage plots (interaction data not shown).

In general, the previous residue management used for doublecrop soybeans affected the subsequent wheat or oat crops (Table 2). Small grain yields were up to 20 bu/a less where soybeans were doublecropped no-till in the previous year. Often, yield differences were small between the burn then disc treatment and the disc only treatment. Averaged across residue management systems, increasing the N rate resulted in an increase in small grain yield only in 1990. However, oat yields in 1987 were affected by an interaction between residue management system and N rate. Increasing N rate lowered oat yields in areas where doublecrop soybeans had been planted no-till, whereas increasing N rate increased oat yields where the residue management had been either burn then disc or disc only.

Table 1. Soybean Yield as Influenced by Small Grain Residue Management and Residual N Application Rates.

Treatment Means	Soybean Yield							
	1983	1984	1985	1986	1987	1988	1989	1990
	bu/a							
Small grain residue mgmt.								
Burn then disc	7	-	15	10	13	1	11	8
Disc only	4	-	21	12	17	3	10	12
No-tillage	6	-	0	9	13	6	0	3
LSD 0.05	NS	-	2	NS	3	2	6	4
N Rate (lb/a)								
83	-	-	12	10	13	3	5	7
129	-	-	13	12	15	4	10	9
LSD 0.05	-	-	NS	NS	1	NS	2	NS
Interaction	-	-	NS	NS	*	NS	**	NS

Table 2. Wheat Yield in 1984, 1985, 1988, 1989, and 1990 and Oat Yield in 1986 and 1987 as Influenced by Previous Small Grain Residue Management and N Application Rates.

Treatment Means	Small Grain Yield						
	1984	1985	1986	1987	1988	1989	1990
	bu/a						
Previous residue mgmt.							
Burn, then disc	63	59	79	51	58	40	18
Disc only	59	55	85	49	53	45	12
No-tillage	43	48	64	42	50	33	7
LSD 0.05	13	8	6	NS	5	NS	6
N Rate (lb/a)							
83	-	53	77	47	56	38	10
129	-	55	75	47	51	40	14
LSD 0.05	-	NS	NS	NS	5	NS	3
Interaction	-	NS	NS	*	NS	NS	NS

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

Daniel W. Sweeney and George V. Granade[1]

Summary

In 1987 and 1989, yield appeared to be increased with limited irrigation for late June-planted soybeans, but not for early June plantings. In 1988 and 1990, average soybean yield was increased by 15 to 60% 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 irrigation schemes on yield of three soybean cultivars planted at two dates. The four schemes were a no-irrigation check, 1" applied at the R1-R2 growth stage (first to full 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 and Discussion

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 ($p<0.10$) between irrigation scheme and planting date in 1987 suggested that yields of the three cultivars planted at the early date were not affected by irrigation. 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-R2 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 suggested 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

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[1] Former Crop Variety Development Agronomist.

irrigation than without in 1988. In 1989, an interaction similar to that in 1987 between irrigation scheme and planting date was observed. Yield tended to be unaffected by irrigation at the early planting date; however, yields from the late planting date were increased by approximately 7 to 11 bu/a (data not shown). In 1990, moisture stress reduced yields; however, irrigation at the R6 growth stage increased yields by more than 6 bu/a. Four-year average yields suggested that 1" of irrigation at the R6 growth stage results in approximately 4.5 bu/a higher soybean yield than no supplemental irrigation.

An interaction between planting date and cultivar in 1987 (Table 1) 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 cultivar interaction was due to the larger reduction in yield for Douglas than for the other two cultivars planted at the later date and to early June planting of Sparks soybeans resulting in higher yield than late planting of Crawford and Douglas cultivars. In 1989, the interaction was due to lower yields at the early date for Sparks than for Crawford or Douglas, whereas all cultivars yielded approximately the same when planted at the later date. In 1989, the differences between planting dates were not significant, although Sparks tended to yield approximately 5 bu/a less than Crawford and Douglas. In 1990, at the early date, Sparks yielded 3-5 bu/a more than Crawford or Douglas, whereas at the later date, Douglas yielded 3-4 bu/a less than Crawford or Sparks.

Table 1. Effect of Timing of Limited Irrigation on Yield of Soybean Planted at Two Dates in 1987-1990.

Treatment Means	Yield				
	1987	1988	1989	1990	4-Yr. Avg.
	bu/a				
Irrigation by growth stage					
None	36.8	16.4	25.0	10.1	22.1
R2	39.6	18.9	29.4	12.2	25.0
R4	38.3	20.0	28.5	12.6	24.9
R6	39.9	20.5	29.8	16.3	26.6
LSD (0.05)	NS	2.3	NS	2.6	
Planting Date					
Early June	39.4	20.1	29.8	14.6	26.0
Late June	37.9	17.9	26.6	11.0	23.4
LSD (0.05)	NS	1.6	NS	1.9	
Cultivar					
Crawford	38.9	18.1	30.2	12.7	25.0
Douglas	38.4	18.6	29.1	11.3	24.4
Sparks	38.7	20.2	25.2	14.4	24.6
LSD (0.05)	NS	0.9	1.6	1.1	
Interaction(s)	PxC IxP	PxC	PxC IxP	PxC	

PHOSPHORUS, POTASSIUM, AND CHLORIDE EFFECTS ON YIELD AND DISEASE OF SIX WHEAT CULTIVARS IN SOUTHEASTERN KANSAS[1]

D.W. Sweeney, G.V. Granade[2], M.G. Eversmeyer[3], D.A. Whitney[4], and William G. Willis[3]

Summary

Even though overall yields were low, P additions increased wheat yields, probably because of increased heads per area. K fertilization slightly reduced leaf rust, but did not increase yields in 1990. Cultivars appeared to respond differently to P fertilization. Although all cultivars tended to respond to fungicide treatment, susceptible cultivars appeared to benefit more than cultivars that are less susceptible to diseases. Chloride additions had minimal effect on the wheat grown in the 1989-1990 crop year.

Introduction

In Kansas, wheat diseases often reduce yield and quality of harvested grain. In addition to boosting yields, reducing lodging, and improving test weight, research in the northwestern United States has suggested that certain fertilizer nutrients may reduce disease incidence. Thus, the objectives of this study were to 1) examine the effects of P, K, Cl, or the P-K interaction on wheat disease of selected cultivars and 2) determine the effect of fertility on wheat yield and yield components.

Experimental Procedure

The study site (a Parson silt loam soil) was in soybeans from 1985 to 1987 and planted to wheat in the fall of 1987 and 1988. 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) in combination with three K rates (0, 40, and 80 lb K_2O/a) were compared. Two rates (0 and 64 lb/a) of Cl were also included. 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. Before harvest, the number of heads per area was counted, and 20 heads were randomly selected from each split plot to determine kernels per head. Kernel weight was also determined.

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

[2] Former Crop Variety Development Agronomist.

[3] Department of Plant Pathology.

[4] Department of Agronomy, KSU.

Results and Discussion

The 1989-1990 growing season was not as favorable for wheat as those of previous years, with yields averaging approximately 25 bu/a. High precipitation amounts in the spring (e.g., May rainfall exceeding 11 inches) likely depressed the 1990 yields. Leaf rust was the predominate leaf disease in 1990, with negligible amounts of speckled leaf blotch or tan spot.

Wheat yield was increased above that obtained with no P by the addition of 30 lb P_2O_5/a (Table 1). However, increasing the P rate to 60 lb P_2O_5/a did not further increase yield. Yield components were also affected by P additions. Increasing the P application to the highest rate appeared to lower the average kernel weight and the number of kernels/head. In contrast, increasing P fertilization increased the number of heads/m^2. Test weight and leaf rust were not affected by P fertilization. Potassium fertilization did not affect yield, kernels/head, or heads/m^2 but tended to increase kernel weight, test weight, and reduce leaf rust. Yield, heads/m^2, and test weight were affected by an interaction of P and K rates of fertilization. Yield, head/m^2, and test weight tended to be increased by the application of 40 lb K_2O/a with no P as compared to either no K or 80 lb K_2O/a. However, with 60 lb P_2O_5/a, fertilization with 40 lb K_2O/a reduced the response as compared to that from no K or 80 lb K_2O/a.

Yield, kernel weight, kernels/head, test weight, and leaf rust were affected by an interaction between P application rate and cultivar (Table 2). Bounty 205, Caldwell, and Thunderbird yields were increased by P addition. Kernel weight of Bounty 205 and Newton increased by 12 and 8%, respectively, by fertilization with 30 P_2O_5/a. Kernels/head of every cultivar decreased with P fertilization, however the reduction was up to 30% with Bounty 205 and Caldwell. Although the response was moderate, P fertilization tended to reduce leaf rust on Bounty 205 but appeared to increase leaf rust on TAM 107.

The use of the fungicide Tilt tended to increase yields of all wheat cultivars, but the increase was significant for Newton, TAM 107, and Thunderbird (Table 3). The yield increase appeared to be primarily related to kernel weight increases, because the kernels/head and heads/m^2 were not affected by either the main effect of the fungicide or the interaction between cultivar and fungicide. Tilt also appeared to improve test weight, especially for Newton, TAM 107, and Thunderbird. Tilt decreased leaf rust for all cultivars; however, the largest reduction in leaf rust was for the susceptible cultivars, Newton and TAM 107.

Perhaps because of overall depressed yields, wheat yield was not affected by Cl or a Cl by K interaction (Table 4). Chloride addition did not affect yield components, test weight, or leaf rust in 1990. The Cl by K interaction only affected leaf rust. Though unexplained, Cl addition reduced leaf rust without K; however, with K, leaf rust increased.

Table 1. Effect of P and K Fertilization on Wheat Yield, Yield Components, and Leaf Rust in 1990.

Fertilization P_2O_5	K_2O	Yield	Kernel Weight	Kernels/ Head	Heads/ m^2	Test Weight	Leaf Rust[1]
		bu/a	mg			lb/bu	%
0	0	19.6	23.0	25.5	390	52.9	25
0	40	24.2	23.9	25.9	452	54.4	25
0	80	20.2	24.6	23.4	383	54.8	20
30	0	24.8	23.1	22.8	480	53.2	30
30	40	25.7	23.9	21.7	491	54.2	20
30	80	25.4	24.7	22.4	525	54.3	20
60	0	26.3	22.9	18.9	553	53.1	25
60	40	19.6	22.1	17.2	489	52.2	15
60	80	27.5	23.9	18.4	582	54.7	20
	LSD (0.05)[2]	3.8	NS	NS	56	1.2	NS
Main Effects:							
0		21.3	23.8	24.9	408	54.0	20
30		25.3	23.9	22.3	499	53.9	20
60		24.5	23.0	18.2	541	53.3	20
	LSD (0.05)	2.2	0.8	1.3	32	NS	NS
	0	23.6	23.0	22.4	474	53.0	25
	40	23.2	23.3	21.6	477	53.6	20
	80	24.3	24.4	21.4	497	54.6	20
	LSD (0.05)	NS	0.8	NS	NS	0.7	5

[1] Disease rating was made on May 29, 1990 to determine the percent of leaf rust on the flag leaf.
[2] Calculated from the interaction of main effects, not from a single factor analysis.

Table 2. Effect of P Application on Yield, Yield Components, and Leaf Rust of Six Wheat Cultivars in 1990.

Wheat Cultivar	Applied P_2O_5	Yield	Kernel Weight	Kernels/ Head	Heads/ m^2	Test Weight	Leaf Rust[1]
		bu/a	mg			lb/bu	%
Bounty 205	0	25.6	24.1	29.3	398	54.2	20
	30	33.4	27.1	24.7	488	56.0	10
	60	32.9	25.7	21.2	533	55.9	10
Caldwell	0	23.0	22.0	30.2	421	54.4	5
	30	26.8	21.8	25.0	534	54.1	10
	60	24.9	20.6	21.1	533	52.1	5
Karl	0	21.1	24.4	19.7	466	55.2	25
	30	24.8	22.9	19.4	548	53.5	25
	60	21.8	21.1	15.5	588	52.1	20
Newton	0	20.6	21.7	28.3	440	52.6	40
	30	23.1	23.5	22.9	485	54.3	40
	60	20.7	23.4	16.6	568	54.4	40
TAM 107	0	21.0	26.3	20.5	354	53.2	35
	30	19.6	23.3	20.1	485	50.3	45
	60	20.0	22.9	17.3	474	49.5	40
Thunderbird	0	16.7	24.5	21.5	371	54.6	10
	30	24.1	24.8	21.9	452	55.4	5
	60	26.4	24.2	17.3	553	55.8	10
LSD (0.05)[2]		3.8	1.3	2.5	NS	1.2	7

[1] Disease rating was made on May 29, 1990 to determine the percent of leaf rust on the flag leaf.
[2] Calculated from the interaction of main effects, not from a single factor analysis.

Table 3. Effect of the Fungicide Tilt on Yield, Yield Components, and Leaf Rust of Six Wheat Cultivars in 1990.

Wheat Cultivar	Fungicide 'Tilt'	Yield	Kernel Weight	Kernels/ Head	Heads/ m^2	Test Weight	Leaf Rust[1]
		bu/a	mg			lb/bu	%
Bounty 205	No	29.7	25.1	24.7	456	54.9	15
	Yes	31.5	26.2	25.4	491	55.8	10
Caldwell	No	24.2	21.3	25.7	495	53.2	10
	Yes	25.6	21.7	25.1	497	53.9	5
Karl	No	22.2	22.6	17.9	516	53.5	25
	Yes	23.0	23.0	18.4	551	53.6	15
Newton	No	17.7	21.0	22.3	487	52.1	45
	Yes	25.3	24.7	22.9	509	55.4	30
TAM 107	No	18.4	23.1	19.6	423	50.2	45
	Yes	22.1	25.3	19.0	452	51.7	30
Thunderbird	No	20.1	23.5	19.7	455	54.4	10
	Yes	24.7	25.4	20.8	463	56.2	5
LSD (0.05)[2]		3.0	1.0	NS	NS	0.9	5

[1] Disease rating was made on May 29, 1990 to determine the percent of leaf rust on the flag leaf.
[2] Calculated from interaction of main effects, not single factor analysis.

Table 4. Effect of K and Cl on Wheat Yield, Yield Components, and Leaf Rust in 1990.

Fertilization K_2O	Cl	Yield	Kernel Weight	Kernels/ Head	Heads/ m^2	Test Weight	Leaf Rust[1]
		bu/a	mg			lb/bu	%
0	0	26.3	22.9	18.9	553	53.1	25
0	64	22.6	22.6	18.9	525	52.9	15
80	0	26.7	24.7	16.8	567	55.0	15
80	64	27.5	23.9	18.4	582	54.7	20
	LSD (0.05)[2]	NS	NS	NS	NS	NS	5
Main Effects:							
0		24.5	22.8	18.9	539	53.0	20
80		27.1	24.3	17.6	574	54.8	15
	LSD (0.05)	NS	0.9	NS	35	1.1	NS
	0	26.5	23.8	17.9	560	54.0	20
	64	25.0	23.3	18.6	553	53.8	20
	LSD (0.05)	NS	NS	NS	NS	NS	NS

[1] Disease rating was made on May 29, 1990 to determine the percent of leaf rust on the flag leaf.
[2] Calculated from interaction of main effects, not single factor analysis.

EARLY-MATURING SOYBEANS COMPARED WITH FULL-SEASON SOYBEANS[1]

Daniel W. Sweeney and George V. Granade[2]

Summary

Soybeans cultivars from maturity groups OO, O, I, III, IV, and V were planted in both late April and early June in two row spacings and at two seeding rates at the Parsons Field of the Southeast Kansas Experiment Station. For the two years, 1989 and 1990, yields tended to be highest with Maturity Group I and III soybeans. Interactions in both years suggest that optimum planting date and row spacing selections may vary with cultivar.

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 yields of early soybeans compare to those of full-season soybeans when planted in April or June at two seeding rates and two row spacings.

Experimental Procedure

Soybean cultivars from maturity groups OO, O, I, III, IV, and V were planted at the Parsons Field of the Southeast Kansas Experiment Station. Soybeans were sowed in 7- and 30-inch rows at the rate of 139,000 and 336,000 seeds per acre in late April and mid June.

Results and Discussion

In 1989, the overall highest yields were with Weber 84, Hodgson 78, and Zane (Table 1). However, in April the highest yielding cultivars were Weber 84, Stafford, and Zane, but in June the three highest yields were obtained with Hodgson 78, Dawson, and Weber 84. Yield was affected by a planting date by cultivar interaction, because most cultivars yielded more in June except for Stafford and Weber 84. Zane tended to yield approximately the same regardless of planting date. In addition, most cultivars tended to have higher yield when drilled in 7" rows, except for soybeans of the later maturity groups, Crawford, Stafford, and Bay.

In 1990, the overall highest yields were with Zane, Hodgson 78, and Weber 84 (Table 1). However, in April, the highest yielding cultivars were Zane, Stafford, and Crawford, but in June, the highest yields were obtained with Hodgson 78, Zane, and Weber 84. Early maturing cultivars, OO, O, and I,

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[1] Research was partially supported by a grant from the Kansas Soybean Commission.

[2] Former Crop Variety Development Agronomist.

showed increased yield when planted in June, but the Maturity Group III, IV, and V cultivars tended to yield more when planted in April. In general, the earlier-maturing soybeans from Maturity Groups OO, O, I, and III tended to yield more when drilled in 7" rows as compared to 30" row spacings.

Table 1. Yield of Selected Group OO, O, I, III, IV, and V Soybeans Planted in April and June at Parsons in 1989 and 1990.

Soybean Cultivar	Maturity Group	Row Spacing	Seeding Rate	Month Planted	Yield 1989	Yield 1990	Yield 2-yr
		In.	Seeds/a		-----Bu/a-----		
McCall	OO	7	139,000	April	19.6	11.4	15.5
			336,000	April	21.6	11.4	16.5
		30	139,000	April	13.5	6.0	9.8
			336,000	April	11.1	8.3	9.7
Dawson	O	7	139,000	April	20.8	15.8	18.3
			336,000	April	25.4	19.5	22.5
		30	139,000	April	23.9	12.7	18.3
			336,000	April	14.0	11.2	12.6
Hodgson 78	I	7	139,000	April	27.6	19.5	23.6
			336,000	April	31.5	24.3	27.9
		30	139,000	April	25.7	13.5	19.6
			336,000	April	19.5	19.6	19.6
Weber 84	I	7	139,000	April	36.5	20.1	28.3
			336,000	April	34.0	22.4	28.2
		30	139,000	April	31.9	16.9	24.4
			336,000	April	30.0	19.3	24.7
Zane	III	7	139,000	April	35.1	33.3	34.2
			336,000	April	32.3	34.6	33.5
		30	139,000	April	32.0	25.2	28.6
			336,000	April	13.9	30.2	22.1
Crawford	IV	7	139,000	April	21.1	25.0	23.1
			336,000	April	18.2	25.7	22.0
		30	139,000	April	22.3	23.1	22.7
			336,000	April	14.9	25.7	20.3
Stafford	IV	7	139,000	April	30.6	25.8	28.2
			336,000	April	23.2	25.4	24.3
		30	139,000	April	32.5	26.8	29.7
			336,000	April	31.3	24.1	27.7
Bay	V	7	139,000	April	11.8	14.8	13.3
			336,000	April	15.2	17.6	16.4
		30	139,000	April	14.6	17.6	16.1
			336,000	April	9.4	19.5	14.5

Table 1. Continued

Soybean Cultivar	Maturity Group	Row Spacing	Seeding Rate	Month Planted	Yield 1989	1990	2-yr
		In.	Seeds/a		-----Bu/a-----		
McCall	OO	7	139,000	June	31.2	20.5	25.9
			336,000	June	26.7	28.7	27.7
		30	139,000	June	21.4	21.9	21.7
			336,000	June	25.2	22.3	23.8
Dawson	O	7	139,000	June	32.0	20.3	26.2
			336,000	June	33.5	23.9	28.7
		30	139,000	June	25.2	16.2	20.7
			336,000	June	28.3	23.6	26.0
Hodgson 78	I	7	139,000	June	34.1	20.9	27.5
			336,000	June	36.3	30.0	33.2
		30	139,000	June	28.8	24.3	26.6
			336,000	June	30.8	28.8	29.8
Weber 84	I	7	139,000	June	35.3	24.4	29.9
			336,000	June	28.6	25.9	27.3
		30	139,000	June	29.1	24.4	26.8
			336,000	June	25.6	24.9	25.3
Zane	III	7	139,000	June	34.6	20.2	27.4
			336,000	June	33.1	28.3	30.7
		30	139,000	June	25.2	24.6	24.9
			336,000	June	19.2	29.4	24.3
Crawford	IV	7	139,000	June	27.4	7.2	17.3
			336,000	June	20.8	8.9	14.9
		30	139,000	June	23.3	10.6	17.0
			336,000	June	22.7	11.3	17.0
Stafford	IV	7	139,000	June	29.6	9.8	19.7
			336,000	June	17.9	6.7	12.3
		30	139,000	June	24.9	15.3	20.1
			336,000	June	17.8	11.6	14.7
Bay	V	7	139,000	June	18.1	11.3	14.7
			336,000	June	9.7	9.8	9.8
		30	139,000	June	19.8	9.0	14.4
			336,000	June	11.5	9.3	10.4
			LSD (0.05)[1]		9.9	5.8	

[1] LSD is calculated from a single factor analysis, not the interaction of the main effects (cultivar, row spacing, seeding rate, and planting date).

COMPARISON OF EARLY-MATURING AND FULL-SEASON SOYBEANS: AN ECONOMIC ANALYSIS[1]

Robert O. Burton, Jr.[2], William P. Casey[2], Daniel W. Sweeney, Allen M. Featherstone[2] and George V. Granade[3]

Summary

Economic analysis was based on agronomic data shown in the article on page 58. Soybeans from maturity groups 00 to V were planted in late April and mid-June using two row spacings and two seeding rates at Parsons, Kansas. Budgeting to determine returns above variable costs was used for each cultivar and planting date. Group III soybeans exhibited the highest returns. These high returns were associated with April planting, 7-inch rows, and either 139,000 or 336,000 seeds per acre. Group I soybeans also exhibited relatively high 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 based upon two planting dates, two row spacings, and two seeding rates.

Experimental Procedure

Budgeting was used to measure receipts minus variable costs (Table 1). Two sets of budgets were prepared; one based on 1990 yields and prices and one based on 1989-90 average yields and 1986-90 average prices. Gross returns reflect differences in yields and soybean prices for different cultivars on different harvest dates. Yields are reported in the previous article of this report. Soybean prices are for the month of harvest from Kansas Agricultural Statistics, Topeka, Kansas. Over the last 5 years, soybeans sold prior to the traditional fall harvest have had a price advantage.

Budgets also reflect differences in variable costs for the two planting dates, row spacings, and seeding rates. Each soybean cultivar was planted in April and June, drilled in 7-inch rows and 30-inch rows, and seeded at 139,000 and 336,000 seeds per acre. Seed costs for maturity groups 00 through I were slightly higher than seed costs for groups III through V, because of a $0.02 per pound shipping charge. Early-maturing soybeans seeds are typically not

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[1]This research was partially funded by the Kansas Soybean Commission.

[2]Department of Agricultural Economics, KSU.

[3]Formerly Crop Variety Development Agronomist.

available in southeastern Kansas. Machinery operations for soybeans drilled in 7-inch rows included field cultivation, herbicide application, sowing with a drill, and harvesting. Machinery operations for soybeans planted in 30-inch rows included field cultivation, herbicide application, planting, row cultivation, and harvesting. Machinery costs were higher for soybeans planted in 30-inch rows because of higher planting costs and a row cultivation. Labor requirements were directly tied to machinery operations. Costs in all budgets were based on the 1990 sources footnoted in Table 1.

Results and Discussion

For both yield and price situations considered, group III soybeans exhibited the highest returns when drilled in 7-inch rows in April (Table 2). Based on 1990 yields and soybean prices, Zane, the group III soybean, had per acre returns above variable costs of $142 at the lower seeding rate and $143 at the higher seeding rate.

When 2-year average yields and 5-year average soybean prices were used, Zane had returns of $164 at the lower seeding rate and $151 at the higher seeding rate. Weber 84, a group I soybean, had per acre returns of $137 and $126 when drilled in April at the higher and lower seeding rate, respectively. Relatively large returns for soybeans planted in June were shown by Hodgson 78, group I, ($144) when drilled at the high seeding rate: Weber 84 ($137) when drilled at the lower seeding rate, and Zane ($129) when drilled at the high seeding rate.

Because production of early-maturing soybeans is not a well established cultural practice in southeastern Kansas, questions remain about input requirements, variability, profitability, harvesting problems, and seed quality. Research has not been performed to determine optimal fertilization rates for early-maturing soybeans. The number of years of data available is not enough to measure long-term variability. Last year's progress report, based on up to 3 years of data for some cultivars, showed group I soybeans to be most profitable. 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. Appearance of early-maturing soybeans suggests poor seed quality. If production of early-maturing soybeans increases significantly, dockage might occur. However, opportunities to harvest early soybeans in August, when weather is typically dry, may be an advantage and could allow for more timely field preparation for wheat. Diversification into early-maturing soybeans might reduce variability of whole-farm income.

Table 1. Sample Budgets Illustrating Two Row Spacings, Two Seeding Rates, and Two Planting Dates for Weber 84, a Group I Soybean, Parsons, Kansas, 1990[a].

		7" Rows, 139,000 Seeds, Planted in April			30" Rows, 336,000 Seeds, Planted in June		
	Unit	Price	Quantity per acre	Value or cost	Price	Quantity per acre	Value or cost
1. Gross Receipts from Production	Bu.	$ 6.20	20.07	$124.43	$ 5.87	24.93	$146.34
2. Variable costs							
Seed	Lb.	$ 0.18	36.10	$ 6.50	$ 0.18	87.27	$ 15.71
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
Herbicide				$ 22.55			$ 22.55
Insecticide				$ 0.00			$ 0.00
Labor	Hr.	$ 6.00	1.00	$ 6.00	$ 6.00	1.35	$ 8.10
Machinery				$ 14.21			$ 16.53
Interest on ½ of variable cost	Dol.	$ 0.12	24.63	$ 2.96	$ 0.12	31.44	$ 3.77
TOTAL VARIABLE COST				$ 52.21			$ 66.66
3. Income above variable cost				$ 72.22			$ 79.68

[a]Yields and input requirements are based on the experiment in the previous article. Soybean prices are for the month of harvest based on data from Kansas Agricultural Statistics. Herbicide rates and prices are Dual @ 2 pts/A $16.18 and Lexone DF @ l/4 lbs/A $6.38. 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 1990", Minnesota Extension Service, University of Minnesota, AG-FO-2308, revised 1990, 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 20.09 bu/a for 7 inch row spacing and 18.98 bu/a for 30 inch row spacing. 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. Wage and interest rate are from Tierney, William I, Jr. and James R. Mintert, "Prices for Forward Planning," KSU Farm Management Guide, MF-525, Revised September 1990.

Table 2. Incomes above Variable Costs of Selected Group 00, 0, I, III, IV and V Soybeans Planted in April and June, Parsons, Kansas, 1990

Soybean Cultivar	Maturity Group	Row Spacing	Seeding Rate	Month Planted	Incomes Above Variable Costs: 1990 Yield[a] and Price[b]	Incomes Above Variable Costs: 2-yr. Yield[a] 5-yr. Price[b]
		In.	Seed/a		$/a	
McCall	00	7	139,000	April	15.99	49.99
			336,000	April	8.89	48.34
		30	139,000	April	(19.70)[c]	8.23
			336,000	April	(15.02)[c]	(1.77)[c]
Dawson	0	7	139,000	April	44.40	68.60
			336,000	April	55.22	84.29
		30	139,000	April	20.50	63.91
			336,000	April	(0.74)[c]	13.91
Hodgson 78	I	7	139,000	April	66.97	103.47
			336,000	April	87.28	121.93
		30	139,000	April	25.08	72.40
			336,000	April	50.97	63.83
Weber 84	I	7	139,000	April	72.22	136.73
			336,000	April	76.72	126.30
		30	139,000	April	47.88	106.09
			336,000	April	53.18	94.40
Zane	III	7	139,000	April	142.26	163.75
			336,000	April	142.80	151.18
		30	139,000	April	91.61	124.52
			336,000	April	107.03	71.02
Crawford	IV	7	139,000	April	90.91	90.63
			336,000	April	86.11	75.09
		30	139,000	April	75.31	83.70
			336,000	April	81.25	60.14
Stafford	IV	7	139,000	April	95.52	122.36
			336,000	April	84.57	89.65
		30	139,000	April	96.36	71.38
			336,000	April	72.49	105.91
Bay	V	7	139,000	April	31.63	29.86
			336,000	April	40.19	40.99
		30	139,000	April	44.01	43.04
			336,000	April	46.31	24.29
McCall	00	7	139,000	June	67.95	111.06
			336,000	June	106.49	113.09
		30	139,000	June	71.83	80.02
			336,000	June	64.24	83.44
Dawson	0	7	139,000	June	65.59	111.62
			336,000	June	74.79	115.80
		30	139,000	June	36.84	72.49
			336,000	June	68.35	95.59

Table 2 (cont.). Incomes above Variable Costs of Selected Group 00, 0, I, III, IV and V Soybeans Planted in April and June, Parsons, Kansas, 1990.

Soybean Cultivar	Maturity Group	Row Spacing	Seeding Rate	Month Planted	Incomes Above Variable Costs: 1990 Yield[a] and Price[b]	Incomes Above Variable Costs: 2-yr. Yield[a] 5-yr. Price[b]
		In.	Seed/a		$/a	
Hodgson 78	I	7	139,000	June	68.94	120.06
			336,000	June	110.42	143.83
		30	139,000	June	84.04	109.27
			336,000	June	98.87	118.07
Weber 84	I	7	139,000	June	91.19	136.53
			336,000	June	90.23	110.34
		30	139,000	June	86.51	112.26
			336,000	June	79.68	93.01
Zane	III	7	139,000	June	63.32	117.24
			336,000	June	100.90	128.99
		30	139,000	June	84.01	97.34
			336,000	June	102.47	84.88
Crawford	IV	7	139,000	June	(10.31)[c]	55.21
			336,000	June	(9.49)[c]	31.35
		30	139,000	June	4.35	48.37
			336,000	June	(0.51)	39.91
Stafford	IV	7	139,000	June	4.54	70.05
			336,000	June	(22.17)[c]	15.55
		30	139,000	June	30.75	67.59
			336,000	June	1.02	25.65
Bay	V	7	139,000	June	12.68	39.01
			336,000	June	(4.54)[c]	(0.16)[c]
		30	139,000	June	(4.75)[c]	32.66
			336,000	June	(11.89)[c]	(0.75)[c]

[a]Yields are shown in the previous article.

[b]The 1990 prices are for the month of harvest based on data from Kansas Agricultural Statistics. The 5-year price is based on 1986-90 prices for the average month of harvest from Kansas Agricultural Statistics. The personal consumption expenditure portion of the implicit Gross National Product deflator was used to update the 1986-89 prices to a 1990 price level before averaging.

[c]Parentheses indicate a negative number.

EFFECTS OF PLANTING DATE AND FOLIAR FUNGICIDE ON WINTER WHEAT

Kenneth Kelley

Summary

Wheat planted in late September was severely infected with barley yellow dwarf virus (BYDV) disease in 1990, and grain yield was reduced significantly compared with later planting dates. Applying a foliar fungicide (Tilt) did not control BYDV, but did increase grain yield of disease-susceptible varieties by an average of 5 bu/A.

Introduction

Wheat is often planted over a wide range of dates in southeastern Kansas because of the varied cropping rotations. Wheat following wheat is planted in late September and early October, whereas wheat following soybeans is typically planted from mid-October through early November. This research seeks to determine how planting date affects the incidence of foliar wheat diseases for disease-susceptible and -resistant cultivars.

Experimental Procedure

Six winter wheat cultivars were planted at four different planting dates (Sept. 28, Oct 13, Oct 27, and Nov. 9). Cultivars were selected for various foliar disease resistances: 1) resistant soft wheat cultivars (Caldwell and Pioneer 2551), 2) susceptible hard wheat cultivars (Chisholm and Tam 107), and 3) resistant hard wheat cultivars (2163 and Karl). Cultivars were seeded at the recommended rate for each planting date (850,000 seeds/A for late Sept., 1,050,000 seeds/A for mid-Oct., and 1,250,000 seeds/A for late Oct. and early Nov.). Tilt, a systemic foliar fungicide, was applied at 4 oz/A to half of the plot area for each planting date when the wheat was at Feekes growth stage 8 (flag leaf just visible from the boot). Grain yield and yield components were measured. BYDV disease ratings were made by Dr. Robert Bowden, KSU Extension Plant Pathologist.

Results and Discussion

Yield and test weight (Table 1) were significantly reduced when wheat was planted in late September compared with later planting dates. Yield losses were mainly attributed to the BYDV disease, although a late spring freeze also caused considerable stem damage and subsequent lodging to early maturing cultivars (Chisholm and Tam 107). BYDV is spread by aphids, which evidently infected the early planted wheat during fall growth. Systemic fungicides, such as Tilt, are not effective in preventing BYDV. Likewise, there are no known cultivars that have any resistance to BYDV.

Leaf rust was not a major foliar disease problem in 1990, because rust spores did not infect wheat until after heading. However, Tilt increased yield by an average of 5 bu/A over all planting dates for disease-susceptible cultivars (Chisholm and Tam 107). In addition, grain yield of Pioneer 2551, a soft wheat cultivar with good disease resistance, also showed a significant yield response to Tilt.

Grain protein (Table 2) was not significantly affected by planting date. Karl produced the highest grain protein levels, whereas Caldwell, a soft wheat, had the lowest. Grain protein was increased slightly, although significantly, from the application of Tilt.

Analysis of grain yield components (Tables 2 and 3) showed that cultivars compensated in various ways to produce grain. Because of the environmental conditions in 1990, wheat planted in late October and early November had the highest individual kernel weight and also had more kernels per head. Tilt increased kernel weight for nearly all cultivars, but did not affect kernels per head. BYDV had a significant effect on tiller development for September-planted Chisholm and Tam 107 cultivars; this was reflected in the low number of heads per square meter. The late October planting had the lowest number of heads per unit area; however, heavy rainfall occurred after planting and affected seed emergence.

Planting date influenced heading date (Table 4), but some cultivars appeared to be affected more than others. A 6-week delay in planting affected heading date by only 1 week or less. Differences in heading date because of planting date were probably due to the fact that some cultivars mature according to day-length, whereas others mature faster with higher temperatures.

In 1991, this study has been planted at both the Parsons and Columbus units so that planting date effects can be evaluated over more environmental conditions.

Table 1. Effects of Planting Dates and Foliar Fungicide on Wheat Yield and Test Weight of Selected Varieties, Parsons, 1990.

Planting date Variety	Grain Yield Fungicide No	 Yes	 Avg.	Test Weight Fungicide No	 Yes	 Avg.
	--------- bu/A	---------		--------- lb/Bu	-------	
Late September						
Caldwell	30.3	34.2	32.3	55.1	56.0	55.6
Chisholm	7.9	16.0	12.0	51.0	52.8	51.9
Karl	21.2	29.3	25.3	53.9	55.1	54.5
2163	30.0	32.6	31.3	54.4	55.4	54.9
Pioneer 2551	26.5	29.3	27.9	51.8	54.3	53.1
Tam 107	7.5	16.1	11.8	47.4	52.1	49.8
(Avg.)	20.6	26.3	23.4	52.3	54.3	53.3
Mid-October						
Caldwell	29.9	30.2	30.1	53.2	54.3	53.7
Chisholm	19.7	27.7	23.7	52.1	54.2	53.2
Karl	27.5	28.7	28.1	54.1	53.5	53.8
2163	27.8	34.2	31.0	52.9	54.1	53.5
Pioneer 2551	31.3	40.2	35.7	50.8	51.3	51.1
Tam 107	22.3	29.8	26.1	50.7	52.2	51.4
(Avg.)	26.4	31.8	29.1	52.3	53.3	52.8
Late October						
Caldwell	30.0	30.4	30.2	54.0	53.7	53.9
Chisholm	29.6	35.1	32.4	54.5	55.2	54.9
Karl	32.6	35.1	33.8	55.6	55.5	55.6
2163	33.3	41.1	37.2	53.8	54.4	54.1
Pioneer 2551	33.6	40.5	37.1	51.3	51.8	51.6
Tam 107	38.3	40.7	39.5	54.4	54.7	54.5
(Avg.)	32.9	37.1	35.0	53.9	54.2	54.1
Early November						
Caldwell	34.1	34.9	34.5	54.4	55.8	55.1
Chisholm	36.6	43.6	40.1	55.7	57.5	56.6
Karl	38.6	39.4	39.0	57.2	57.2	57.2
2163	46.8	47.1	47.0	55.2	56.0	55.6
Pioneer 2551	42.1	45.4	43.8	52.7	52.9	52.8
Tam 107	44.1	47.5	45.8	55.0	55.7	55.3
(Avg.)	40.4	43.0	41.7	55.0	55.9	55.5
Mean:	30.1	34.6	32.3	53.4	54.4	53.9
LSD 0.05:						
Variety means for same DOP:			2.3			1.0
Variety means for same DOP & FUNG:			3.2			1.3
Variety means for same FUNG:			1.6			0.7

Table 2. Effects of Planting Date and Foliar Fungicide on Grain Protein and Thousand Kernel Weight of Selected Varieties, Parsons, 1990.

Planting date / Variety	Grain Protein — Fungicide No	Grain Protein — Fungicide Yes	Avg.	1-000 Kernel Wt. — Fungicide No	1-000 Kernel Wt. — Fungicide Yes	Avg.
	---------- % -----------			------- gr./1000 ------		
Late September						
Caldwell	13.2	13.7	13.4	22.1	22.6	22.4
Chisholm	14.2	14.1	14.2	19.7	20.8	20.2
Karl	15.1	15.8	15.5	21.6	23.0	22.3
2163	14.3	14.3	14.3	22.8	24.6	23.7
Pioneer 2551	14.7	14.6	14.6	21.5	23.4	22.4
Tam 107	15.2	14.8	15.0	20.6	22.6	21.6
(Avg.)	14.5	14.6	14.5	21.4	22.8	22.1
Mid-October						
Caldwell	13.0	13.3	13.1	22.8	22.7	22.8
Chisholm	13.5	13.6	13.6	21.9	23.7	22.8
Karl	15.5	15.5	15.5	24.0	23.9	24.0
2163	14.0	14.3	14.1	25.2	26.1	25.6
Pioneer 2551	14.5	14.8	14.6	24.1	25.3	24.7
Tam 107	14.5	14.4	14.5	23.6	26.1	24.9
(Avg.)	14.2	14.3	14.2	23.6	24.6	24.1
Late October						
Caldwell	13.4	13.5	13.5	22.0	21.6	21.8
Chisholm	14.3	14.5	14.4	26.9	29.9	28.4
Karl	16.1	16.6	16.4	26.1	27.1	26.6
2163	13.9	14.4	14.2	24.7	26.2	25.5
Pioneer 2551	14.8	15.2	15.0	23.0	22.5	22.8
Tam 107	14.5	14.6	14.6	28.4	30.2	29.3
(Avg.)	14.5	14.8	14.7	25.2	26.3	25.7
Early November						
Caldwell	13.5	13.1	13.3	20.3	22.3	21.3
Chisholm	14.4	14.7	14.5	26.8	29.9	28.4
Karl	16.7	16.9	16.8	27.5	26.8	27.2
2163	14.0	14.4	14.2	23.7	25.8	24.8
Pioneer 2551	14.7	15.0	14.9	22.8	23.6	23.2
Tam 107	14.3	15.0	14.6	28.7	29.3	29.0
(Avg.)	14.6	14.8	14.7	25.0	26.3	25.6
Mean:	14.4	14.6	14.5	23.8	25.0	24.4
LSD 0.05:						
Variety means for same DOP:			0.4			0.8
Variety means for same DOP & FUNG:			0.6			1.2
Variety means for same FUNG:			0.3			0.6

Table 3. Effects of Planting Date and Foliar Fungicide on Wheat Yield Components, Parsons, 1990.

Planting date Variety	Kernels/head Fungicide No	 Yes	 Avg.	Heads/meter2 Fungicide No	 Yes	 Avg.
Late September						
Caldwell	20.5	22.7	21.6	527	548	538
Chisholm	21.3	22.9	22.1	165	260	213
Karl	16.6	20.2	18.4	430	466	448
2163	19.7	21.5	20.6	553	541	547
Pioneer 2551	26.0	27.4	26.7	379	404	392
Tam 107	14.1	17.1	15.6	243	371	307
(Avg.)	19.7	22.0	20.8	383	432	407
Mid-October						
Caldwell	22.8	24.5	23.6	494	433	463
Chisholm	23.0	21.7	22.4	329	421	375
Karl	22.1	19.6	20.9	434	434	434
2163	25.0	23.3	24.2	389	478	434
Pioneer 2551	29.5	32.2	30.9	366	418	392
Tam 107	23.3	23.1	23.2	348	423	386
(Avg.)	24.3	24.1	24.2	394	434	414
Late October						
Caldwell	27.8	29.2	28.5	347	312	329
Chisholm	23.3	23.6	23.5	310	373	341
Karl	23.0	21.6	22.3	368	395	382
2163	27.9	29.8	28.9	357	359	358
Pioneer 2551	32.7	32.5	32.6	361	382	372
Tam 107	22.5	23.0	22.8	411	434	422
(Avg.)	26.2	26.6	26.4	359	376	367
Early November						
Caldwell	30.9	27.1	29.0	382	430	406
Chisholm	22.9	23.6	23.3	388	417	403
Karl	18.9	19.7	19.3	502	444	473
2163	28.0	27.3	27.7	466	453	459
Pioneer 2551	33.2	31.4	32.3	404	431	418
Tam 107	21.8	22.1	21.9	500	546	523
(Avg.)	25.9	25.2	25.6	440	453	447
Mean:	24.0	24.5	24.3	394	424	409
LSD 0.05:						
Variety means for same DOP:			2.1			44
Variety means for same DOP & FUNG:			3.0			63
Variety means for same FUNG:			1.5			31

Table 4. Effects of Planting Date on Heading Date of Selected Winter Wheat Varieties, Parsons, 1990.

Brand Variety	Planting Date: Late Sept.	Mid-Oct.	Late Oct.	Early Nov.
Caldwell	May 8	May 9	May 14	May 15
Chisholm	May 6	May 7	May 10	May 11
Karl	May 6	May 7	May 10	May 11
2163	May 8	May 9	May 11	May 12
Pioneer 2551	May 9	May 11	May 15	May 16

Table 5. Statistical Significance of Wheat Planting Date and Foliar Fungicide Use for Selected Winter Wheat Varieties, Parsons, 1990.

	F - Test Significance					
Variable	Yield	TW	Protein	TKW	Ker/hd	Hds/m2
	-------------- statistical probability level ----------					
Date of planting	***	***	NS	***	***	**
Foliar fungicide	***	***	**	***	NS	**
DOP * Fung	NS	10%	NS	NS	*	NS
Variety	***	***	***	***	***	***
DOP x Var	***	***	***	***	***	***
Fung x Var	***	**	NS	***	NS	***
DOP x Fung x Var	**	10%	NS	**	NS	10%
C.V. (%):	6.1	1.5	2.5	3.0	7.6	9.4

*, **, *** Significant at the 0.05, 0.01, and 0.001 probability levels, respectively.

COMPARISON OF CONVENTIONAL AND INTENSIVE WHEAT MANAGEMENT SYSTEMS

Kenneth Kelley

Summary

Conventional and intensive wheat management systems were compared at two locations in 1990. Wheat yields in both management systems were below normal because of high rainfall amounts during May and June, which resulted in water-logged soil conditions when wheat was trying to fill. Yield of disease-susceptible cultivars and some resistant cultivars was significantly higher when a foliar fungicide (Tilt) was applied in late April. Applying 50 lb/A of N in late winter in addition to the conventional fall application of 75 lb N/A reduced yield for all cultivars at Parsons but increased yield at Columbus.

Introduction

The objective of intensive wheat management is to produce wheat as efficiently as possible using high-yielding cultivars, applying N fertilizer at two or more times during the growing season to optimize yield and quality, and using a foliar fungicide to control leaf diseases. This research seeks to compare conventional and intensive management systems for the climatic conditions in southeastern Kansas.

Experimental Procedure

Beginning in 1987, 10 winter wheat cultivars have been evaluated under conventional N management (75 lb N/A as a preplant, fall application) and an intensive N management system (75 lb N/A applied in the fall + 50 lb N/A topdressed in late winter). Urea was the fertilizer source. The presence or absence of a foliar fungicide (Tilt) was evaluated in both N systems. Tilt was applied in late April at 4 oz/A. In 1990, studies were located at the Parsons and Columbus Units.

Results and Discussion

In 1990, wheat yields were below normal for nearly all of southeastern Kansas because of high rainfall amounts during May and June when wheat was in the reproductive growth stage. At the Columbus Unit, rainfall during May amounted to nearly 13 inches, and 9 inches fell during June. Slightly lower rainfall amounts were recorded at Parsons. Even though wet conditions prevailed during late spring, leaf rust did not develop until after the wheat had already headed. Several cultivars developed head blight symptoms after the rainfall subsided and bright sunshine prevailed.

Grain yield (Tables 1 and 7) of several cultivars (Agripro Victory, AGSECO 7846, Chisholm, and Tam 107) was increased significantly with a Tilt fungicide application. Tilt also improved grain yield of some disease-resistant cultivars, such as Pioneer 2551 and Karl. Other disease-resistant cultivars, such as Caldwell and 2163, showed very little yield response to Tilt.

Test weight (Tables 2 and 8) response to conventional and intensive management practices generally followed the same trend as grain yield responses. Even though some cultivars did not show a positive yield response to Tilt, all cultivars had a higher test weight.

Tilt did not have a significant effect on grain protein at either location in 1990. However, topdressing an additional 50 lb N/A in late winter significantly increased grain protein for all cultivars at both locations (Tables 3 and 9).

Flag leaves were collected at the flowering stage of wheat development and analyzed for N concentration (Tables 3 and 9). The late winter N application increased flag leaf N concentration for all cultivars, which indicated that the plants had adsorbed the additional N applied. However, Tilt did not significantly increase the flag leaf N concentration.

Plant lodging (Tables 4 and 10) was significantly increased when higher N rates were applied with the intensive management system, particularly at the the Columbus Unit. The Tilt application decreased lodging somewhat at the Parsons Unit but had no effect at Columbus. In European countries where intensive management systems are commonly used, a growth regulator is used to reduce plant height and subsequent lodging problems. However, previous research has shown that the use of a growth regulator is generally impractical in most situations in eastern Kansas.

Analyses of yield components (Tables 5,6,11,12) showed that intensive management practices produced varied responses at Parsons and Columbus. At Parsons, additional N increased kernels per head, but individual kernel weight and number of heads per square meter were decreased. With some cultivars, higher N rates may reduce spring tiller development. However, at the Columbus location, additional N had no effect on kernels per head, decreased individual kernel weight, and increased the number of heads per square meter. Tilt increased individual kernel weight for all cultivars.

Table 1. Effects of Conventional and Intensive Wheat Management Systems on Grain Yield of Winter Wheat, Parsons, 1990.

Brand Variety	Grain Yield: Fall - N: No Fung.	Fung.	Avg.	Fall + Late Winter N: No Fung.	Fung.	Avg.	Mean
	---------------------- bu/A					----------------------	
Agripro Thunderbird	39.3	45.0	42.2	30.7	38.9	34.8	38.5
Agripro Victory	36.2	43.6	39.9	24.2	38.9	31.5	35.7
AGSECO 7846	35.8	46.1	41.0	30.6	40.7	35.6	38.3
Arkan	22.8	28.2	25.5	17.9	24.5	21.2	23.4
Caldwell	41.4	43.4	42.4	39.7	39.4	39.5	41.0
Chisholm	39.3	46.6	43.0	33.1	43.2	38.1	40.5
Karl	38.0	40.2	39.1	32.9	39.4	36.1	37.6
2163	47.2	47.5	47.3	39.0	42.5	40.7	44.0
Pioneer 2551	49.0	55.0	52.0	48.4	50.9	49.7	50.9
Tam 107	32.6	40.3	36.5	28.6	37.5	33.1	34.8
(Mean):	38.2	43.6	40.9	32.5	39.6	36.0	----
LSD 0.05:							
Among management system means (Time of N and Fungicide):						2.3	
Among varieties within same management system:						4.3	
Among varieties for different management system:						5.2	
F-test significance:							
Time of N			***				
Fungicide			***				
Time of N x Fungicide			NS				
Variety			***				
Time of N x Variety			10%				
Fungicide x Varity			***				
Time of N x Fungicide x Variety			NS				
C.V. (%)			6.9				

Fall N = 75 lb N/A applied preplant incorporated as urea.
Late winter N = 50 lb N/A applied as a topdress (urea).
Foliar fungicide = Tilt applied at 4 oz/A at growth stage 8.
Wheat followed soybeans in the rotation.
Planting date: October 17, 1989.

Table 2. Effects of Conventional and Intensive Wheat Management Systems on Test Weight of Winter Wheat, Parsons, 1990.

Brand Variety	Test Weight: Fall - N: No Fung.	Fung.	Avg.	Fall + Late Winter N: No Fung.	Fung.	Avg.	Mean
	lb/Bu						
Agripro Thunderbird	57.9	58.5	58.2	57.3	58.6	58.0	58.1
Agripro Victory	53.7	56.3	55.0	52.6	55.4	54.0	54.5
AGSECO 7846	55.4	56.4	55.9	53.0	55.4	54.2	55.1
Arkan	52.7	53.7	53.2	51.6	53.8	52.7	53.0
Caldwell	54.8	54.7	54.8	54.2	54.4	54.3	54.5
Chisholm	55.2	56.2	55.7	53.4	55.2	54.3	55.0
Karl	55.1	56.2	55.7	54.4	55.2	54.8	55.2
2163	54.4	54.3	54.3	52.9	53.3	53.1	53.7
Pioneer 2551	54.6	54.7	54.7	52.9	54.2	53.6	54.1
Tam 107	53.1	54.0	53.5	50.3	52.9	51.6	52.6
(Mean):	54.7	55.5	55.1	53.3	54.8	54.1	----

LSD 0.05:

Among management system means (Time of N and Fungicide):	0.8
Among varieties within same management system:	1.0
Among varieties for different management system:	1.4

F-test significance:

Time of N	*
Fungicide	**
Time of N x Fungicide	NS
Variety	***
Time of N x Variety	*
Fungicide x Variety	***
Time of N x Fungicide x Variety	NS
C.V. (%)	1.1

Table 3. Effects of Conventional and Intensive Wheat Management Systems on Grain Protein and Flag Leaf N Concentration, Parsons, 1990.

Brand Variety	Grain Protein Time of N F	Grain Protein Time of N F + LW	Grain Protein Avg.	Flag Leaf N Conc. Time of N F	Flag Leaf N Conc. Time of N F + LW	Flag Leaf N Conc. Avg.
	--------- % ----------			--------- % ----------		
Agripro Thunderbird	13.1	13.5	13.3	2.87	2.94	2.91
Agripro Victory	12.6	13.3	12.9	2.71	2.85	2.78
AGSECO 7846	12.7	13.4	13.1	2.55	2.75	2.65
Arkan	13.2	13.6	13.4	2.63	2.83	2.73
Caldwell	12.9	13.6	13.3	2.86	2.95	2.90
Chisholm	12.3	13.3	12.8	2.58	2.75	2.67
Karl	13.1	14.1	13.6	2.47	2.67	2.57
2163	12.3	13.6	12.9	2.89	3.05	2.97
Pioneer 2551	12.6	13.6	13.1	2.71	2.96	2.83
Tam 107	12.5	13.1	12.8	2.72	2.77	2.74
(Mean):	12.7	13.5	----	2.70	2.85	----
<u>LSD 0.05</u>:						
Among management system means:			0.4			0.07
<u>F-test significane</u>:						
Time of N			**			***
Fungicide			NS			10%
Time of N x Fungicide			NS			10%
Variety			NS			***
Time of N x Variety			NS			NS
Fungicide x Variety			NS			NS
Time of N x Fungicide x Variety			NS			NS
C.V. (%)			6.4			6.3

Table 4. Effects of Conventional and Intensive Wheat Management Systems on Plant Height, Plant Lodging, and Maturity, Parsons, 1990.

Brand Variety	Ht.	Lodging Time N F	F+LW	Avg.	Heading Date
	In.	------- % ------			
Agripro Thunderbird	36	2	6	4	May 9
Agripro Victory	36	2	7	4	May 12
AGSECO 7846	34	26	41	33	May 7
Arkan	32	4	16	10	May 5
Caldwell	37	2	4	3	May 8
Chisholm	33	10	35	23	May 5
Karl	31	3	17	10	May 5
2163	34	0	3	1	May 8
Pioneer 2551	35	2	3	3	May 9
Tam 107	33	9	47	28	May 4
(Mean):	--	6	18	--	-----

LSD 0.05:
Among varieties for same management system: 7

F-test significance:	Ht.	Lodging
Time of N	NS	***
Fungicide	NS	*
Time of N x Fungicide	NS	NS
Variety	***	***
Time of N x Variety	NS	***
Fungicide x Variety	NS	NS
Time of N x Fungicide x Variety	NS	NS
C.V. (%)	2.9	75

Table 5. Effects of Conventional and Intensive Wheat Management Systems on Thousand Kernel Weight of Winter Wheat, Parsons, 1990.

Brand Variety	1-000 Kernel Weight: Fall - N: No Fung.	Fung.	Avg.	Fall + Late Winter N: No Fung.	Fung.	Avg.	Mean
	gr/1000						
Agripro Thunderbird	27.0	25.7	26.4	21.8	24.3	23.1	24.7
Agripro Victory	21.3	25.5	23.4	17.3	21.8	19.5	21.5
AGSECO 7846	18.2	18.8	18.5	17.0	18.7	17.8	18.2
Arkan	15.4	18.3	16.8	15.1	17.7	16.4	16.6
Caldwell	20.1	19.3	19.7	18.0	17.7	17.9	18.8
Chisholm	21.6	26.6	24.1	19.4	23.6	21.5	22.8
Karl	23.1	27.1	25.1	19.3	21.2	20.3	22.7
2163	22.9	20.9	21.9	20.2	20.0	20.1	21.0
Pioneer 2551	25.1	24.9	25.0	18.2	22.5	20.3	22.7
Tam 107	21.2	21.4	21.3	20.6	22.3	21.4	21.4
(Mean):	21.6	22.8	22.2	18.7	21.0	19.8	----

LSD 0.05:

Among management system means (Time of N and Fungicide):	0.8
Among varieties within same management system:	1.5
Among varieties for different management system:	1.8

F-test significance:

Time of N	***
Fungicide	***
Time of N x Fungicide	NS
Variety	***
Time of N x Variety	***
Fungicide x Variety	***
Time of N x Fungicide x Variety	***
C.V. (%)	4.5

Table 6. Effects of Conventional and Intensive Wheat Management Systems on Wheat Yield Components, Parsons, 1990.

Brand Variety	Kernels / Head Time N F	F + LW	Avg.	Head Density Time N F	F + LW	Avg.
				----- Hds/M2 -----		
Agripro Thunderbird	23.3	22.2	22.7	466	458	462
Agripro Victory	22.3	24.3	23.3	519	443	481
AGSECO 7846	26.1	28.6	27.4	577	471	524
Arkan	19.3	18.2	18.7	532	477	504
Caldwell	27.4	27.1	27.3	538	554	546
Chisholm	23.8	23.0	23.4	513	522	517
Karl	19.1	20.9	20.0	555	581	568
2163	25.0	26.3	25.6	591	521	556
Pioneer 2551	26.2	31.3	28.8	543	533	538
Tam 107	22.3	22.1	22.2	521	470	495
(Mean):	23.5	24.4	----	535	503	---
LSD 0.05:						
Among management system means:			0.5			25
Among varieties for same management:			2.3			66
Among varieties for different management:			2.3			73
F-test significance:						
Time of N			***			*
Fungicide			NS			*
Time of N x Fungicide			10%			NS
Variety			***			***
Time of N x Variety			***			***
Fungicide x Variety			*			**
Time of N x Fungicide x Variety			10%			***
C.V. (%)			6.0			7.8

Table 7. Effects of Conventional and Intensive Wheat Management Systems on Grain Yield of Winter Wheat, Columbus, 1990.

Brand Variety	Grain Yield: Fall - N: No Fung.	Fung.	Avg.	Fall + Late Winter N: No Fung.	Fung.	Avg.	Mean
	bu/A						
Agripro Thunderbird	43.3	45.1	43.7	36.1	43.9	40.0	41.9
Agripro Victory	36.7	45.8	41.3	36.1	45.0	40.6	40.9
AGSECO 7846	29.9	40.6	35.3	34.9	44.0	39.4	37.3
Arkan	28.4	36.8	32.6	29.3	36.4	32.9	32.7
Caldwell	48.9	53.8	51.3	50.7	54.6	52.7	52.0
Chisholm	35.7	41.9	38.8	40.4	46.2	43.3	41.1
Karl	44.5	44.4	44.5	42.8	44.8	43.8	44.1
2163	45.0	49.0	47.0	50.9	52.0	51.5	49.2
Pioneer 2551	43.6	49.0	46.3	49.9	60.4	55.1	50.8
Tam 107	39.8	46.7	43.3	39.2	49.0	44.1	43.7
(Mean):	39.5	45.3	42.4	41.0	47.6	44.3	----

LSD 0.05:	
Among manangement system means (Time of N & Fungicide):	1.6
Among varieties within same management system:	5.8
Among varieties for different management system:	5.9
F-test significance:	
Time of N	*
Fungicide	***
Time of N x Fungicide	NS
Variety	***
Time of N x Variety	**
Fungicide x Variety	*
Time of N x Fungicide x Variety	NS
C.V. (%)	8.2

Fall N = 75 lb N/A applied preplant incorporated as urea.
Late winter N = 50 lb N/A applied as a topdress (urea).
Foliar fungicide = Tilt applied at 4 oz/A at growth stage 8.
Wheat following wheat in the rotation.
Planting date: October 13, 1989.

Table 8. Effects of Conventional and Intensive Wheat Management Systems on Test Weight of Winter Wheat, Columbus, 1990.

	Test Weight						
	Fall - N			Fall + Late Winter N			
Brand Variety	No Fung.	Fung.	Avg.	No Fung.	Fung.	Avg.	Mean
	---------------------- lb/Bu ----------------------						
Agripro Thunderbird	57.2	57.6	57.4	56.4	57.2	56.8	57.1
Agripro Victory	53.8	55.1	54.5	51.8	54.7	53.2	53.9
AGSECO 7846	54.8	56.4	55.6	53.5	55.3	54.4	55.0
Arkan	53.7	54.5	54.1	51.5	54.0	52.8	53.4
Caldwell	55.2	56.0	55.6	54.3	55.8	55.1	55.3
Chisholm	55.1	56.5	55.8	53.6	55.3	54.5	55.1
Karl	56.4	56.8	56.6	55.6	56.4	56.0	56.3
2163	54.4	56.0	55.2	54.5	54.5	54.5	54.8
Pioneer 2551	53.7	55.4	54.5	53.6	54.6	54.1	54.3
Tam 107	53.3	54.9	54.1	53.1	54.3	53.7	53.9
(Mean):	54.7	55.9	55.3	53.8	55.2	54.5	----

LSD 0.05:	
Among management system means (Time of N & Fungicide):	1.2
Among varieties within same management system:	1.1
Among varieties for different management system:	2.0

F-test significance:	
Time of N	NS
Fungicide	*
Time of N x Fungicide	NS
Varity	***
Time of N x Variety	NS
Fungicide x Variety	10%
Time of N x Fungicide x Variety	10%
C.V. (%)	1.2

Table 9. Effects of Conventional and Intensive Wheat Management Systems on Grain Protein and Flag Leaf N Concentration, Columbus, 1990.

Brand Variety	Grain Protein Time of N F	Grain Protein Time of N F + LW	Grain Protein Avg.	Flag Leaf N Conc. Time of N F	Flag Leaf N Conc. Time of N F + LW	Flag Leaf N Conc. Avg.
	--------- %	----------		--------- %	----------	
Agripro Thunderbird	10.1	11.3	10.7	2.42	2.88	2.65
Agripro Victory	9.3	10.3	9.8	2.27	2.80	2.53
AGSECO 7846	8.9	10.4	9.7	2.19	2.64	2.41
Arkan	10.6	11.3	10.9	2.09	2.69	2.39
Caldwell	8.2	9.3	8.7	2.59	2.94	2.76
Chisholm	9.0	9.9	9.4	2.14	2.56	2.35
Karl	9.6	10.6	10.1	2.16	2.50	2.33
2163	9.0	10.2	9.6	2.51	2.85	2.68
Pioneer 2551	8.6	9.2	8.9	2.33	2.59	2.46
Tam 107	9.5	10.3	9.9	2.27	2.59	2.43
(Mean):	9.3	10.3	---	2.30	2.70	----
LSD 0.05:						
Among management system means:			0.7			0.15
Among varieties for same management:			0.6			0.23
Among varieties for different management:			1.1			0.30
F-test significance:						
Time of N			*			***
Fungicide			NS			NS
Time of N x Fungicide			NS			NS
Variety			***			***
Time of N x Variety			NS			NS
Fungicide x Variety			NS			NS
Time of N x Fungicide x Variety			NS			NS
C.V. (%)			3.7			5.6

Table 10. Effects of Conventional and Intensive Wheat Management Systems on Plant Lodging and Maturity, Columbus, 1990.

Brand Variety	Lodging: Time of N: F	Lodging: Time of N: F + LW	Lodging: Avg.	Heading Date
	--------	%	-------	
Agripro Thunderbird	47	88	68	May 7
Agripro Victory	24	50	37	May 12
AGSECO 7846	36	82	59	May 5
Arkan	33	83	58	May 3
Caldwell	22	67	44	May 6
Chisholm	17	78	47	May 3
Karl	31	82	56	May 4
2163	13	40	27	May 6
Pioneer 2551	9	43	26	May 8
Tam 107	39	87	63	May 2
(Mean):	27	70	---	-----
LSD 0.05:				
Among management systems means:			8	
Among varieties within same management:			21	
Among varieties for different management:			23	
F-test significance:				
Time of N			***	
Fungicide			NS	
Time of N x Fungicide			NS	
Variety			***	
Time of N x Variety			*	
Fungicide x Variety			NS	
Time of N x Fungicide x Variety			NS	
C.V. (%)			27	

Table 11. Effects of Conventional and Intensive Wheat Management Systems on Thousand Kernel Weight of Winter Wheat, Columbus, 1990.

Brand Variety	1000 Kernel Weight: Fall - N, No Fung.	Fall - N, Fung.	Fall - N, Avg.	Fall + Late Winter N, No Fung.	Fall + Late Winter N, Fung.	Fall + Late Winter N, Avg.	Mean
	----------	----------	----------	gr/1000	----------	----------	
Agripro Thunderbird	25.4	25.3	25.3	22.5	23.4	23.0	24.2
Agripro Victory	23.9	27.9	25.9	21.5	24.0	22.8	24.3
AGSECO 7846	20.6	22.5	21.5	17.6	21.2	19.4	20.5
Arkan	19.2	21.0	20.1	17.8	20.0	18.9	19.5
Caldwell	24.2	24.3	24.2	23.3	22.6	23.0	23.6
Chisholm	23.0	25.8	24.4	20.4	23.0	21.7	23.1
Karl	22.1	24.7	23.4	22.1	23.0	22.5	23.0
2163	23.9	26.8	25.4	22.8	23.4	23.1	24.2
Pioneer 2551	24.0	25.6	24.8	24.0	22.9	24.0	24.4
Tam 107	25.0	26.7	25.8	23.6	26.5	25.1	25.5
(Mean):	23.1	25.1	24.1	21.6	23.1	22.3	----

LSD 0.05:

Among management system means (Time of N & Fungicide):	0.8
Among varieties within same management system:	1.3
Among varieties for different management system:	1.6

F-test significance:

Time of N	**
Fungicide	**
Time of N x Fungicide	NS
Variety	***
Time of N x Variety	***
Fungicide x Variety	***
Time of N x Fungicide x Variety	*
C.V. (%)	3.3

Table 12. Effects of Conventional and Intensive Wheat Management Systems on Grain Yield Components, Columbus, 1990.

Brand Variety	Kernels / Head Time of N F	Kernels / Head Time of N F + LW	Kernels / Head Avg.	Head Density Time of N F	Head Density Time of N F + LW	Head Density Avg.
				----- Hds/M2 -----		
Agripro Thunderbird	24.2	23.2	23.7	492	504	498
Agripro Victory	24.4	24.6	24.5	440	532	486
AGSECO 7846	29.7	30.4	30.0	423	478	451
Arkan	22.9	23.0	22.9	468	454	461
Caldwell	30.3	29.2	29.7	525	568	547
Chisholm	26.2	28.6	27.4	390	425	407
Karl	25.8	23.2	24.5	482	550	516
2163	26.2	26.9	26.5	498	518	508
Pioneer 2551	32.0	31.5	31.8	382	479	430
Tam 107	25.7	26.0	25.8	464	437	451
(Mean):	26.7	26.7	----	456	495	---
LSD 0.05:						
Among management system means:			NS			20
Among varieties for same management system:			2.4			68
Among varieties for different management:			2.4			70
F-test significance:						
Time of N			NS			**
Fungicide			NS			*
Time of N x Fungicide			10%			NS
Variety			***			***
Time of N x Variety			*			**
Fungicide x Variety			**			NS
Time of N x Fungicide x Variety			*			*
C.V. (%)			5.6			8.7

WHEAT AND SOYBEAN CROPPING SEQUENCES COMPARED[1]

Kenneth Kelley

Summary

Three different wheat and soybean crop rotations have been compared over a 10-year period. Double-crop soybean yield has averaged nearly 5 bu/A less than that of full-season soybeans, although yield has varied considerably over the period. In rotations involving full-season soybeans, yield has been significantly higher when soybeans were planted after wheat that had been summer-fallowed rather than double-cropped soybeans. Wheat yield has been the lowest in the continuous wheat - double-crop rotation.

Introduction

In southeastern Kansas, producers often rotate wheat after soybeans or plant double-crop soybeans following wheat harvest. Management practices of one crop, therefore, may affect the production of the subsequent crop. The objectives of this study were to evaluate the agronomic effects of double-cropping systems and to determine the risk factors over a long-term period.

Experimental Procedure

Beginning in 1981, three different wheat and soybean cropping rotations were established at the Parsons Unit: 1) [wheat - double-crop soybean], 2) [wheat - double-crop soybean] - soybean, and 3) full-season soybean following wheat. Prior to 1988, soybean varieties were selected from maturity groups IV and V for double-crop and full-season soybeans, respectively. Beginning in 1988, maturity groups I, III, IV, and V were compared in rotation No. 2. Group I maturity was planted in 7-inch row spacing, whereas the other maturity groups were planted in 30-inch row spacing. In 1986 and 1987, spring oats had to be planted rather than wheat because wet fall conditions prevented the wheat from being planted or it was winter-killed. Fertilizer (70 lb N/A, 50 lb P205/A, and 50 lb K20/A) was applied only to the wheat crop. For double-crop soybeans, wheat straw has been disced or burned and disced prior to planting.

Since 1988, Group I soybeans have been planted in early May (except for 1990), whereas Groups III, IV, and V normally have been planted in mid-June. Double-crop soybeans have been planted in late June or early July. Prior to 1988, wheat was not planted until all soybeans had been harvested, regardless of rotation. However, since 1988, wheat has been planted after a particular soybean maturity group has been harvested. Wheat following wheat or maturity group I soybean has been planted in early October.

Results and Discussion

Table 1 shows the yearly soybean yields for the three different wheat and soybean rotations over the past 10 years. Double-crop soybean yield has averaged nearly 5 bu/A less than that of full-season soybeans, but the variation from year to year has been significant. Highest full-season soybean yield has been when soybeans were planted after summer-fallowed wheat rather than double-crop soybeans. In double-crop

[1] This research was funded by the Kansas Soybean Commission.

soybean rotations, there has been no significant difference in yield between double cropping every year compared to every other year.

Soybean maturity effects on full-season and double-crop soybean yield are shown in Tables 3 and 4. In full-season soybean comparisons, Group I soybeans have produced the highest yield for the past 3 years, but seed quality has been very poor. Group I soybeans are maturing during the hottest period of the summer, which results in heat stress and subsequent seed damage. In double-crop comparisons, Group IV maturity has produced the highest yield.

Wheat yield as affected by the different crop rotations is shown in Table 2. Yield differences have been more pronounced since wheat has been planted at different dates according to the particular rotation scheme. More data are needed on the effects of soybean maturity and crop rotation on wheat yield, but in the continuous double-crop rotation, wheat yield often has been significantly lower.

Table 1. Effects of Wheat and Soybean Cropping Systems on Soybean Yield, Parsons Unit.

Crop Rotation	Soybean Yield 1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	10-yr Avg.
	bu/A										
Wh-DC Soy	18.7	23.6	17.9	2.1	33.2	19.9	19.5	9.1	27.6	22.1	19.4
Wh-DC Soy FS Soy	18.0	23.0	16.9	2.0	31.6	17.5	19.3	8.4	28.0	23.9	18.9
Wh-DC Soy FS Soy	25.8	24.3	15.5	11.1	32.6	21.2	35.4	22.7	28.3	19.6	23.6
Wh-Wh-FS Soy	25.7	24.9	14.5	12.8	32.1	23.9	42.6	25.1	29.8	22.0	25.3
LSD 0.05:	3.7	NS	NS	2.9	NS	3.8	2.5	1.5	1.7	1.2	----

DC = Double-crop soybeans; FS = Full-season soybeans.
Full-season and doublecrop soybeans were planted on the same dates in 1982, 1985, and 1989.

Table 2. Comparison of Wheat and Spring Oat Yield among Wheat and Soybean Crop Rotations, Parsons Unit.

Crop Rotation	1981	1982	Wheat & Spring Oat (*) Yield 1983	1984	1985	1986 *	1987 *	1988	1989	1990	7-yr Avg.
	bu/A										
Wh -DC Soy	47.6	58.9	48.4	51.4	---	87.8	58.8	49.5	50.3	30.4	48.1
Wh -DC Soy FS Soy	50.0	55.4	53.4	55.1	---	86.2	57.7	52.6	64.8	29.5	51.5
Wh-Wh-Soy	49.9	52.1	51.6	55.0	---	88.3	60.0	60.5	64.3	33.4	52.4
Wh-Wh-Soy	52.1	51.6	51.9	54.6	---	84.5	58.0	61.6	68.6	23.7	52.0
LSD 0.05:	NS				---			5.1	5.8	5.1	

In 1985, wheat drowned by wet weather; too late to plant oats.

Table 3. Comparison of Soybean Maturity Groups in a Full-Season Soybean Crop Rotation, Parsons Unit.

Variety	Maturity Group	Full-Season Soybean Yield 1988	1989	1990	3-yr avg.
		---------------- bu/A	------------------		
Weber 84	I	31.8	31.5	22.0	28.4
Flyer	III	24.0	30.8	14.5	23.1
Stafford	IV	26.9	28.8	16.0	23.9
Hutcheson	V	22.7	28.3	19.6	23.5
LSD 0.05:		1.5	1.7	----	----

Rotation is [Wheat - doublecrop soybean] - full-season soybean.

Table 4. Comparison of Soybean Maturity Groups in a Double-crop Soybean Crop Rotation, Parsons Unit.

Variety	Maturity Group	Double-crop Soybean Yield 1988	1989	1990	3-yr avg.
		---------------- bu/A	------------------		
Weber 84	I	2.0	28.7	10.9	13.9
Flyer	III	2.2	28.9	16.6	15.9
Stafford	IV	8.4	28.0	23.9	20.1
Essex	V	6.5	22.8	20.7	16.7
LSD 0.05:		1.5	1.7	----	----

Rotation is [Wheat - doublecrop soybean] - full-season soybean.

ECONOMIC COMPARISONS OF WHEAT AND SOYBEAN CROPPING SEQUENCES[1]

William P. Casey[2], Robert O. Burton, Jr.[2] and Kenneth Kelley

Summary

Economic comparisons of three crop rotations were based on budgeting and on experimental data shown in the article on page 86. Income based on 1990 yields and prices or average yields and prices favored a 1-year sequence of wheat followed by double-crop soybeans. Four soybean maturity groups were considered in the 2-year rotation containing wheat, double-crop soybeans, and full-season soybeans. Group I full-season soybeans were more profitable than soybeans in traditional maturity groups, whereas the budget analysis for double-crop soybeans favored group IV soybeans.

Introduction

Farmers producing wheat and soybeans in southeastern Kansas select a cropping sequence that enables them 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 was to provide information about economic returns associated with these alternative sequences.

Experimental Procedure

Budgeting was used to calculate income 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, double-crop soybeans, and full-season soybeans; and a 3-year sequence of 2 years of wheat followed by full-season soybeans. Output prices were for the month of harvest, July for wheat; October for soybean maturity groups III, IV, and V; and August for soybean maturity group I. Seed costs for maturity group I were actual costs plus a shipping charge. Other soybean seed costs were from a seed distributor in southeastern Kansas. 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 included as a variable cost. Incomes above variable cost for each crop were added to provide total income 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 1990 yields and prices for both wheat and soybeans and also based on average yields and prices over several years--1988-90 yields for wheat, 1981-

[1]This research was partially funded by the Kansas Soybean Commission.

[2]Department of Agricultural Economics, KSU.

90 yields for soybeans, and 1986-90 prices. The 1986-89 prices were converted to a 1990 price level before averaging.

Results and Discussion

Results indicate that double cropping wheat and soybeans every year is most profitable and that no double cropping is least profitable (Table 3). Comparisons of 1990 results with results based on average data indicate that returns associated with wheat were unusually low in 1990. Although both 1990 and average data favor double cropping, this result will not hold every year. For example, in a previous progress report, budgeting based on 1988 yields and projected prices showed double cropping every year to be least profitable and no double cropping to be most profitable. Moreover, some producers will not have adequate labor and machinery to double crop every year, especially when weather limits the number of days on which machinery operations may be performed during harvest and planting seasons.

One strategy for managing labor and machinery constraints during critical seasons is to use early maturing soybeans. From 1988 to 1990, four maturity groups were considered in the 2-year rotation containing wheat, double-crop soybeans, and full-season soybeans (see previous report). In this experiment, group I soybeans were drilled in 7-inch rows at 90 lb of seed per acre. Budgeted costs of Group I soybean seeds were 18 cents per lb plus a 2 cents per lb shipping charge. Group III, IV, and V soybeans were planted in 30-inch rows with per acre seeding rates of 50 lb for groups I and IV and 35 lb for group V. Costs of group III, IV, and V soybean seeds were 16 cents per lb, based on a $9.75 price per bushel obtained from a seed distributor in Southeastern Kansas. Thus, budgeted seed costs were $8.00 per acre for group III and IV soybeans and $18.00 per acre for group I. Soybeans harvested prior to the traditional harvest season typically have a price advantage; therefore early harvest favors the full-season group I soybeans that cost more to plant. For full-season soybeans, group I had the highest returns (Table 4). For double-crop soybeans, group IV had the highest returns (Table 5).

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

Item	Unit	Wheat			Double-crop Soybeans			Full-season Soybeans		
		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.	$2.82	29.50	$83.19	$5.69	23.90	$135.99	$5.69	19.60	$111.52
2. Variable Costs										
Seed	Lbs.	0.10	75.00	7.50	0.16	50.00	7.92	0.16	35.00	5.54
Nitrogen	Lbs.	0.23	70.00	16.10	-	-	0.00	-	-	0.00
Phosphate	Lbs.	0.22	50.00	11.00	-	-	0.00	-	-	0.00
Potash	Lbs.	0.13	50.00	6.50	-	-	0.00	-	-	0.00
Herbicide		-	-	0.00	-	-	23.95	-	-	23.95
Labor	Hrs.	6.00	1.16	6.96	6.00	1.24	7.44	6.00	1.45	8.70
Machinery				13.46			15.15			17.00
Interest on ½ of variable cost	Dol.	0.12	30.76	3.69	0.12	27.25	3.27	0.12	27.60	3.31
Total Variable Cost				65.98			57.73			58.50
3. Income above variable costs				17.98			78.26			53.02

[a]Wheat and soybean prices are for the month of harvest from Kansas Agricultural Statistics, Topeka, Kansas. Input costs other than machinery and soybean seed costs are projections from Fausett, Marvin 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 September 1990. Machinery variable costs (fuel, lubrication, and repairs) and labor requirements are based on information from Fuller, Earl I and Mark F. McGuire, Minnesota Farm Machinery Economic Cost Estimates for 1990, Minnesota Extension Service, University of Minnesota, AG-FO-2308, revised 1990, with adjustments for Southeastern Kansas. Soybean seed costs are from a seed distributor in Southeastern Kansas.

[b]Yields, seed, and fertilizer are 1990 data from Kenneth Kelley at the Southeast Kansas Branch Experiment Station.

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

Machinery Operations	Wheat Following Wheat	Wheat Following Double-crop or Full-season Soybeans	Double-crop Soybeans Following Wheat	Full-season Soybeans Following Wheat	Full-season Soybeans Following Double-crop 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[a]	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[b]	16.88	11.98	16.74	18.18	20.41
	-Acres/hour-				
Light Truck	3.50	3.50	3.50	3.50	3.50
	-Dollars/Acre-				
Machinery Variable Costs[c]	18.34	13.60	15.15	18.45	15.92

[a]Group I soybeans are planted with a grain drill and therefore have machinery variable costs about $1.00 less than soybeans planted with a planter.
[b]Acres per truck load for a 400 bushel truck are based on yields of each crop in each rotation. Lower yields would increase acres per truckload and decrease costs per acre and vice versa. Thus, truck costs for the same crop in a different sequence will differ because of different yields.
[c]Variable costs include fuel, lubrication, and repairs and $3.00 per acre rental charge for the fertilizer buggy.

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

Crops and Crop Sequences[b]	Incomes above Variable Costs[d]: 1990 Yields and Output Prices[e]	Incomes above Variable Costs[d]: 1988-1990 Average Wheat and 1981-1990 Average Soybean Yields, 1986-1990 Average Output Prices[f]
	-Dollars/Acre-	
[W-DCSB]		
W	20.49	68.01
DCSB	67.58	63.45
Annual Average[c]	88.07	131.46
[W-DCSB]-FSSB		
W	17.98	85.74
DCSB	78.26	60.37
FSSB	53.02	86.93
Annual Average[c]	74.63	116.52
W-W-FSSB		
W Year 1	28.77	96.94
W Year 2	(4.32)	84.96
FSSB	64.38	63.64
Annual Average[c]	29.61	81.85

[a] Incomes are based on agronomic data shown in the previous article of this report.

[b] Abbreviations are as follows W = wheat; DCSB = double-crop 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] Input costs are based on the same price level for all budgets. See Table 1 for sources.

[e] Source of 1990 wheat and soybean prices for the month of harvest is Kansas Agricultural Statistics, Topeka, KS.

[f] Source of average 1986-90 prices for the month of harvest is Kansas Agricultural Statistics. Prices were updated to a 1990 price level using the personal consumption expenditure (PCE) portion of the implicit GNP price deflator before averaging.

Table 4. Incomes above Variable Costs for Soybean Maturity Groups: Full-Season Soybeans in a 3-Year Rotation, Parsons, Kansas[a].

Variety	Maturity Group	1990 Soybean Price[b] 1990 Yield[c]	1990 Soybean Price[b] 3-yr. Avg. Yield[c]	5-yr. Avg. Soybean Price[b] 1990 Yield[c]	5-yr. Avg. Soybean Price[b] 3-yr. Avg. Yield[c]
Weber 84	I	66.66	106.34	77.14	119.86
Flyer	III	23.37	72.30	30.14	83.10
Stafford	IV	31.99	76.94	39.47	88.11
Hutcheson	V	54.99	77.18	64.15	88.17

[a]Rotation is [wheat-doublecrop soybeans] - full-season soybeans

[b]Prices are for the 1990 month of harvest, August for group I and October for groups III, IV, and V. Prices for 1986-89 were updated to a 1990 price level to calculate a 5-year average. The personal consumption expenditure portion of the implicit GNP price deflator was used to update prices.

[c]Yields are shown in the previous article of this report.

Table 5. Incomes above Variable Costs for Soybean Maturity Groups: Double-crop Soybeans in a 3-Year Rotation, Parsons, Kansas[a].

Variety	Maturity Group	1990 Soybean Price[b] 1990 Yield[c]	1990 Soybean Price[b] 3-yr. Avg. Yield[c]	5-yr. Avg. Soybean Price[b] 1990 Yield[c]	5-yr. Avg. Soybean Price[b] 3-yr. Avg. Yield[c]
Weber 84	I	(6.39)	10.68	(1.30)	17.17
Flyer	III	36.64	32.66	44.40	40.09
Stafford	IV	78.18	56.56	89.35	65.95
Hutcheson	V	62.51	39.75	72.19	47.56

[a]Rotation is [wheat-double-crop soybeans] - full-season soybeans

[b]Prices are for the 1990 month of harvest, October for groups I, III, IV, and V. Prices for 1986-89 were updated to a 1990 price level to calculate a five-year average. The personal consumption expenditure portion of the implicit GNP price deflator was used to update prices.

[c]Yields are shown in the previous article of this report.

EFFECTS OF CROPPING SEQUENCE ON SOYBEAN YIELDS[1]

Kenneth Kelley

Summary

Comparisons of full-season soybeans in four different crop rotations showed that yield has been slightly higher when they follow a wheat - lespedeza rotation than when they follow grain sorghum or double-crop soybeans. Soybeans following soybeans has produced the lowest yield. Since 1989, soybean cyst nematode effects on soybean yield have been evaluated in one of the continuous soybean rotations.

Introduction

Soybeans are a major crop for 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. With the recent introduction of soybean cyst nematodes to the area, more information is needed to determine how crop rotation can be used to manage around the nematode problem.

Experimental Procedure

In 1979, four cropping systems were initiated at the Columbus Unit: 1) [wheat - double-crop soybean] - soybeans, 2) wheat - fallow - soybeans (lespedeza was added to the wheat beginning in 1988), 3) grain sorghum - soybeans, and 4) continuous soybeans. Full-season soybeans were compared across all rotations in even-numbered years. Beginning in 1984, an identical study was started adjacent to the initial site so that full-season soybeans 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 preceeding full-season soybeans. Maturity Group 5 soybeans have been planted in the full-season rotation.

Results and Discussion

Soybean yields from the initial study that was started in 1979 are shown in Table 1. Soybean cyst nematodes have not been found at this site. Since 1988, soybean yield has been slightly higher when soybeans followed the wheat - lespedeza rotation. Soybeans following grain sorghum or double-crop soybeans produced nearly the same yield. For the 6-year average, yield has been reduced nearly 10% when soybeans follow soybeans; however, this trend did not occur in 1990.

Soybean yields from the study that was started in 1984 are shown in Table 2. At this site, soybean cyst nematodes were detected in 1989. Yield was reduced nearly 25% where nematodes were present in the continuous soybean rotation in 1989. Full-season soybeans will be grown at that site in 1991 to further evaluate the movement of cyst nematodes. In 1990, cyst nematodes were also detected in the wheat - double-crop soybean rotation. Future research plans are to evaluate resistant and susceptible soybean cultivars within the nematode-infected plot areas.

[1] This research was funded by the KS Soybean Commission.

Table 1. Effects of Long-term Crop Rotations on Soybean Yield in the Absence of Soybean Cyst Nematodes, Columbus Unit.

Crop Rotation	1980	1982	1984	1986	1988 (*)	1990 (*)	6-yr avg.
	bu/A						
Soybean following Wheat - double-crop soy	12.6	28.0	11.8	21.9	31.3	22.4	21.3
Soybean following Grain sorghum	13.3	30.4	10.8	23.6	30.1	23.4	21.9
Soybean following Wheat-lespedeza (*)	12.8	31.9	12.0	23.9	32.8	24.9	23.1
Soybean following Soybean	10.3	27.2	12.1	21.8	25.2	22.4	19.8
LSD 0.05:	1.0	3.0	NS	1.8	3.0	NS	---

(*) - Lespedeza was included in the rotation beginning in 1988.

Table 2. Effects of Long-term Crop Rotations on Soybean Yield in the Presence of Soybean Cyst Nematodes, Columbus Unit.

Crop Rotation	1985	1987	1989 (*)	3-yr avg.
	bu/A			
Soybean following Wheat - double-crop soy	31.9	30.7	27.0	29.9
Soybean following Grain sorghum	30.9	31.5	27.5	30.0
Soybean following Wheat-lespedeza (*)	29.5	33.2	33.4	32.0
Soybean following Soybean	27.9	28.2	20.7	25.6
LSD 0.05:	3.2	3.8	4.5	---

Cyst nematode was detected in the continuous soy rotation in 1989 (Table 2).
(*) - Lespedeza was included in the rotation beginning in 1988.

SOUTHEAST KANSAS BRANCH STATION
KANSAS STATE UNIVERSITY

COMPARISONS OF TILLAGE METHODS FOR DOUBLECROP SOYBEANS AND SUBSEQUENT EFFECTS ON FULL-SEASON SOYBEANS[1]

Kenneth Kelley

Summary

Comparisons among four tillage methods for double-crop soybeans showed that plowing under the wheat stubble gave the highest yield over an 8-year period. Full-season soybeans that follow in the rotation have not been significantly affected by any of the double-crop tillage methods.

Introduction

Producers in southeastern Kansas typically grow double-crop soybeans after wheat, when soil moisture and time permit. Various tillage methods are used, depending partly on the type of equipment that is available. The primary goals of double cropping 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 double-crop tillage methods have not been thoroughly evaluated for shallow, claypan soils.

Experimental Procedure

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

Results and Discussion

In 1990, double-crop soybean yield was the highest where the wheat stubble was plowed under (Table 1). This has also held true for the 8-year average yield; however, during some years, other tillage methods produced higher yield than plowing.

The subsequent effect of double-crop tillage methods on full-season soybean yield is shown in Table 2. The previous double-crop tillage method

[1] This research was funded by the KS Soybean Commission.

Table 1. Comparison of Double-crop Tillage Methods on Soybean Yield, Columbus Unit.

Doublecrop Tillage	Soybean Yield 1982	1983	1985	1986	1987	1988	1989	1990	8-yr. Avg.
	bu/A								
Plow	26.1	25.2	32.9	20.2	18.7	14.6	27.9	20.8	23.3
Burn - disc	25.8	24.2	32.1	14.7	9.8	10.5	23.3	18.3	19.8
Disc	26.6	23.2	30.3	15.2	12.8	19.2	22.6	15.8	20.7
No-till	26.3	20.5	24.7	----	----	----	----	----	----
Chisel-disc	----	----	----	15.3	14.4	14.3	22.1	16.3	----
LSD 0.05:	NS	3.6	4.9	1.3	2.8	3.0	1.2	2.0	----

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

Table 2. Effects of Double-crop Tillage Method on Subsequent Yield of Full-Season Soybean, Columbus Unit.

Doublecrop Tillage Method	Full-Season Soybean Yield 1985	1986	1987	1988	1989	1990	6-yr Avg.
	bu/A						
Plow - disc	32.1	25.8	30.7	26.3	34.1	18.6	27.9
Burn - disc	32.5	26.0	29.0	26.3	33.0	16.2	27.2
Disc	32.2	24.7	29.3	25.1	31.8	15.3	26.4
Chisel - disc	33.3	25.7	30.8	25.7	32.7	16.0	27.4
LSD 0.05:	NS	NS	NS	NS	NS	1.5	----

Cropping sequence is [wheat - double-crop soybean] - full-season soybean. All plots are chiseled in the spring, so the tillage method represents only the double-crop tillage effect from the previous year.

COMPARISON OF SHORT-SEASON CORN HYBRIDS

Kenneth Kelley and Gary Kilgore[1]

Summary

Twenty-two, short-season, corn hybrids were compared at two plant populations. Because of the dry and hot weather during July and August, grain yield potential was reduced significantly in 1990, with an average yield of 67 bu/A. Corn yield averaged 5 bu/A higher where hybrids were planted at 16,500 plants per acre compared with a higher population of 22,500 plants per acre.

Introduction

In recent years, producer interest in growing short-season corn has increased significantly in southeastern Kansas. Because corn is planted in April and harvested in September, it has the advantage of spreading out a producer's work-load requirement. If corn can tassel prior to July 4, it has a good chance of producing 80 to 100 bu/A yields, which makes it competitive with grain sorghum and soybeans for economic returns.

Experimental Procedure

Twenty-two, short-season, corn hybrids were planted at two plant populations (16,500 and 22,500 plants/A) on the Parsons Field on April 17. Plots were hand-thinned to the desired plant populations. Corn followed soybeans in the rotation, and fertilizer rate was 100 lb N/A, 60 lb P205/A, and 60 lb K20/A. Plots were machine harvested on September 5, and yields were corrected to 15.5% moisture content.

Results and Discussion

Corn yield and yield components are shown in Table 1. Although planting date was delayed somewhat because of wet soil conditions in April, initial corn growth was good. However, a hail storm occurred in May when corn was about 12 inches tall and destroyed early leaf growth. But corn resumed normal growth shortly after the hail storm.

DeKalb 584 was the high yielding corn hybrid. Grain yield of nearly all hybrids averaged 5 bu/A higher when planted at the lower plant population of 16,500 plants/A compared with the higher population of 22,500 plants/A. Because of the hot and dry weather experienced in August, many of the corn hybrids had barren ears at the high plant population.

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[1] SE Ks. Area Extension Agronomist

Table 1. Comparison of Early Maturing Corn Hybrids at Two Plant Populations, Southeast Kansas Branch Experiment Station, Parsons - 1990.

Brand	Hybrid	Plant Popul.	Corr. Yield	Harv. Moist	Test Wt.	Actual Popul.	Ear #	Silk Date
			bu/A	%	lb/Bu	Plants	Ear/Pl	
Asgrow	RX 578	Low	70.2	11.3	60.3	15944	0.89	7-4
		High	53.9	12.6	60.0	22130	0.66	7-4
Asgrow	RX 626	Low	65.2	11.7	60.1	15770	0.88	7-3
		High	43.9	12.4	60.0	22740	0.50	7-4
Cargill	5327	Low	56.1	12.0	59.5	16031	0.89	7-4
		High	45.7	12.4	59.7	22740	0.59	7-5
Cargill	6127	Low	79.6	13.1	60.8	15857	0.95	7-6
		High	76.8	13.8	60.6	22479	0.79	7-5
DeKalb	535	Low	76.5	11.1	59.9	16031	1.10	7-4
		High	73.8	11.8	60.3	23001	0.85	7-4
DeKalb	584	Low	88.9	12.9	60.3	15770	1.05	7-4
		High	90.5	12.7	60.5	23001	0.95	7-4
Garst	0882	Low	65.4	10.3	59.6	15857	1.04	7-2
		High	62.4	10.7	60.4	22740	0.86	7-3
Garst	8599	Low	81.2	12.0	59.5	15596	1.03	7-4
		High	87.2	11.9	59.6	22914	0.92	7-4
Hoegemeyer	2594	Low	64.4	13.3	62.0	15683	0.95	7-3
		High	52.3	13.9	61.7	21956	0.72	7-4
Hoegemeyer	2617	Low	69.1	11.2	60.0	15857	0.86	7-4
		High	58.6	12.4	60.4	22827	0.64	7-4
Jacques	4900	Low	75.0	11.0	61.1	15944	1.04	7-3
		High	74.5	11.4	61.2	22566	0.91	7-2
Jacques	5700	Low	75.6	11.1	60.5	15857	0.99	7-4
		High	79.9	12.0	60.6	22827	0.91	7-4
Northrup King	4350	Low	62.5	10.6	59.7	15944	0.99	7-2
		High	59.8	10.3	59.1	22653	0.88	7-1
Northrup King	6330	Low	61.8	15.7	58.8	15857	0.86	7-5
		High	58.7	15.9	59.0	22827	0.63	7-7

Table 1. (Continued).

Brand	Hybrid	Plant Popul.	Corr. Yield	Harv. Moist.	Test Wt.	Actual Popul.	Ear #	Silk Date
			bu/A	%	lb/Bu	Plants	Ear/Pl	
Oro	902	Low	73.1	11.4	61.6	15857	1.03	7-2
		High	67.5	11.2	60.7	21259	0.93	7-4
Oro	903	Low	64.2	11.8	60.3	15944	0.91	7-3
		High	54.3	12.3	60.3	22914	0.65	7-4
Pioneer	3467	Low	59.3	15.0	60.0	15508	0.99	7-4
		High	58.4	15.3	59.6	22217	0.76	7-7
Pioneer	3737	Low	82.6	10.6	60.5	16031	1.04	7-3
		High	71.4	11.1	60.5	22653	0.84	7-3
Rob-See-Co	H-2343	Low	63.3	11.5	58.9	15770	0.89	7-3
		High	62.3	11.4	59.7	22566	0.83	7-2
Rob-See-Co	H-2404	Low	78.4	12.2	61.0	16031	1.05	7-2
		High	73.4	11.9	60.8	23001	0.93	7-3
Cargill*	7877	Low	67.7	17.3	57.3	15944	0.92	7-8
		High	55.0	17.4	57.1	22826	0.75	7-10
Pioneer*	3379	Low	57.3	15.7	59.5	15857	0.92	7-8
		High	64.3	16.7	58.3	22827	0.76	7-8
LSD: 0.05			9.5	0.5	0.6	548	0.07	0.7
C.V. (%)			14.3	3.8	0.9	3	8.00	18
Means:								
		Low	69.9	12.4	60.0	15861	0.97	7-4
		High	64.8	12.8	60.0	22621	0.78	7-4
LSD 0.05			NS	0.2	NS	407	0.09	NS
F-test significance:								
Population			NS	**	NS	***	***	NS
Hybrid			***	***	***	NS	***	***
Population x Hybrid			NS	*	NS	NS	***	***

Planted April 17, 1990 and harvested Sept. 5, 1990.
Low population = 16,500 plants/A; high population = 22,500 plants/A.
Yields corrected to 15.5% moisture.
(*) Cargill 7877 and Pioneer 3379 are full-season hybrids.
Rainfall (in.): April (2.23), May (11.37), June (3.16), July (2.07), Aug. (2.20).

PERFORMANCE OF EARLY MATURING SOYBEANS

Kenneth Kelley

Summary

Grain yield and seed quality of early-maturing Group I soybean cultivars were significantly reduced by the late planting date and high temperatures experienced during August when plants were in the critical reproductive stage of plant growth. Grain yield averaged 15 to 20 bu/A.

Introduction

Early-maturing Group I soybeans are typically grown in more northern climates where day-length is longer and temperatures are cooler than those in the midwest. However, some interest has been shown in to determining if Group I soybeans could be grown in southeastern Kansas to possibly spread out producer work-load, because they could be planted in late April and harvested in August. This would also allow more time in the fall for a producer to prepare soybean land for wheat planting in October.

Experimental Procedure

Fourteen Group I soybean cultivars were planted at the Parsons Field in 1990. Planting date was delayed until June 5 because of the wet weather experienced in late April and during May. Cultivars were planted in 7-inch row spacing at the rate of 336,000 seeds per acre.

Results and Discussion

Agronomic results are shown in Table 1; grain yield averaged 15 to 20 bu/A. Seed quality was very poor for all cultivars. Although poor seed quality has been a problem for the Group I maturing soybean cultivars in previous research studies, it was compounded in 1990 because of the late planting date. Cultivars were filling seed pods in late July and early August when soil moisture was low and air temperatures were above normal.

Table 1. Comparison of Early Maturing Soybean Cultivars,
Southeast Ks. Branch Expt. Station, Parsons, Ks, 1990.

Brand Cultivar	Yield	Seed Wt.	Ht.	Maturity
	bu/A	gr/100	cm	
Hardin	18.0	11.1	32	8-30
Hodgson	20.2	12.6	34	8-28
NK 1550	18.5	12.0	32	8-30
NK 1990	21.4	14.6	32	8-31
Pioneer 9161	17.6	12.2	33	8-31
Pioneer 9181	15.1	14.6	30	9-1
Pioneer 9191	13.0	14.4	30	9-2
Pioneer 9202	18.3	13.0	33	8-31
Sibley	16.8	13.1	32	8-27
Stine 1070	16.6	13.4	28	8-29
Terra Flag	17.3	13.4	34	8-31
Terra Runner	15.6	13.0	30	8-29
Terra Runner II	18.5	14.6	35	9-1
Weber 84	19.7	11.5	33	9-1
LSD 0:05	2.9	1.4	--	---
C.V. (%)	9.8	6.3	--	---

Planting date: June 5, 1990 (7-inch row spacing).
Seeding rate: 336,000 seeds/acre.
Harvest date: Sept. 4, 1990.
Herbicide: Squadron (3 pt/a).
Seed quality was poor for all cultivars tested. Seed color was distinctly greenish and shriveled because of heat stress during the reproductive stage of growth.

CROP VARIETY PERFORMANCE TESTS

Kenneth Kelley, William Schapaugh,[1] and Kraig Roozeboom[1]

Summary

Average grain yields for the various crop performance tests were as follows: wheat - 23 bu/A; spring oats - 50 bu/A; corn - 89 bu/A; grain sorghum - 78 bu/A; and soybeans - 19 bu/A (Group III), 15 bu/A (Group IV), and 22 bu/A (Group V).

Introduction

Crop variety performance tests are conducted throughout the state of Kansas to determine area of cultivar or hybrid adaption. Results are of prime interest to area producers, seed company representatives, and ag extension personnel.

Experimental Procedure

Wheat: Planted on October 4, 1989 at 1,000,000 seeds/A. Fertilizer was applied at 75 lb N/A, 75 lb P205/A, and 75 lb K20/A.

Spring Oats: Planted on April 4, 1990 at 96 lbs/A. Fertilizer was applied at 60 lb N/A, 50 lb P205/A, and 50 lb K20/A.

Corn: Planted on April 17, 1990 and thinned to 16,000 plants/A. Fertilizer was applied at 100 lb N/A, 60 lb P205/A, and 60 lb K20/A.

Grain Sorghum: Planted on June 12, 1990 and thinned to 6" between plants. Fertilizer was applied at 115 lb N/A, 60 lb K20/A, and 60 lb K20/A.

Soybean: Planted on June 19, 1990. No fertilizer was applied.

Results and Discussion

Agronomic results of the various crop variety performance tests are compiled in the following Kansas Agric. Expt. Stn. Reports of Progress: wheat (No. 605), spring oats (No. 619), corn (No. 614), grain sorghum (No. 617), and soybeans (No. 621). These are available from your county extension office or Distribution Center, Umberger Hall, Kansas State University, Manhattan, Ks. 66506.

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[1] Department of Agronomy, KSU

[1] Department of Agronomy, KSU

SOYBEAN HERBICIDE RESEARCH

Kenneth Kelley

Summary

Various soybean herbicide treatments and application methods were compared for weed control. Wet weather during May and June prevented the application of preplant soil herbicides in 1990. Then dry soil conditions prevailed after the early July planting date and resulted in poor weed control for most preemergent herbicide applications. For the soil and climatic conditions of 1990, the best broadleaf weed control was achieved with postemergent herbicides.

Introduction

Soybeans occupy a large percentage of the crop acreage in southeastern Kansas. Herbicide research studies are conducted to compare herbicide performance and application methods for annual broadleaf and grassy weed control in soybeans.

Experimental Procedure

Soybean herbicide trials were conducted at the Columbus Field in 1990. Soybeans were grown in 30-inch row spacing. Planting was delayed until early July because of wet soil conditions in May and June. Major weed competition in most studies was from cocklebur, although velvetleaf, smooth pigweed, and crabgrass were present in some instances.

Results and Discussion

Weed control and soybean yield results for the various soybean herbicide studies are shown in Tables 1 through 7. Excellent cocklebur control was achieved with postemergent applications of Classic, Scepter, Pursuit, and Basagran. Pinnacle by itself did not give acceptable cocklebur control. Cobra was effective on cockleburs less than 6" in height but gave only partial control of cocklebur of larger size.

Lack of rainfall after planting resulted in poor herbicide performance for the preemergent applications (Table 2). Some preplant incorporated herbicide treatments (Table 3) also resulted in poor weed control because of cloddy soil conditions when the herbicides were incorporated.

Select, a new postemergent herbicide for annual and perennial grass control in soybeans, was compared in several tank-mixes with Basagran, Cobra, and Classic (Table 4). Crabgrass control was reduced when Select was tank-mixed with Basagran or a Basagan + Cobra tank-mix.

Herbicide tank-mix combinations of Cobra with Basagran and Classic were also evaluated with several spray additive treatments (Table 5). Crop injury was most severe when crop oil was added to the Cobra tank-mixes, but soybean plants resumed normal growth soon after the herbicide application, and yield was not affected. The addition of 2,4-DB to the Cobra + Basagran tank-mix did not improve cocklebur control.

Good velvetleaf control was obtained with several preplant and postemergent herbicides (Table 6). Canopy and Pursuit, applied preplant incorporated, both gave excellent velvetleaf control. Basagran, Pinnacle, and Pursuit gave good postemergent control of velvetleaf.

Several soybean herbicides were compared at full and reduced rates for cocklebur control (Table 7). Effective cocklebur control was achieved with reduced postemergent herbicide rates when supplemented with one cultivation. More research studies are planned in 1991 to further evaluate reduced postemergent herbicide applications.

Table 1. Comparison of Soybean Herbicides and Application Methods for Weed Control, Columbus Unit, 1990.

Herbicide	Rate	When Applied	Yield	Cocklebur Control	Crop Injury
	lb. a.i./A		bu/A	%	
Prowl +	0.75	PPI	26.3	100	2.1
Classic	0.010	POST			
Prowl +	0.75	PPI	25.6	100	1.8
Classic	0.004	POST			
Prowl +	0.75	PPI	21.8	25	2.3
Pinnacle	0.004	POST			
Prowl +	0.75	PPI	23.8	100	2.5
Classic + Pinnacle	0.004 + 0.004	POST			
Prowl +	0.75	PPI	26.0	100	1.7
Pinnacle + Scepter	0.004 + 0.063	POST			
Prowl +	0.75	PPI	25.9	100	1.3
Scepter	0.125	POST			
Prowl +	0.75	PPI	26.2	95	1.4
Scepter O.T.	0.312	POST			
Squadron +	0.875	PPI	26.3	100	1.6
Pursuit	0.063	POST			
Squadron +	0.875	PPI	26.5	100	1.3
Scepter	0.063	POST			
Squadron +	0.875	PPI	23.9	88	2.3
Pinnacle	0.004	POST			
Pursuit (+) +	0.91	PPI	26.7	100	1.3
Scepter	0.063	POST			
No Herbicide	---	---	15.5	0	1.0
LSD 0.05:			3.0	4	0.3

AG-98 surfactact added to postemergent treatments at the rate of 0.25%, except for Pinnacle treatments, which received 0.125%. Liquid 28% N also added to postemergent applications at the rate of 1 qt/A.
Planted July 3; Variety = Stafford; Row spacing = 30 inches.
Date of herbicide application: PPI = July 3; POST = July 30.
Rainfall (inches): July 11 = 0.50, July 22 = 0.50; Aug. 21 = 1.10.
Crop injury rating: 1 = no injury, 10 = all plants dead.

Table 2. Comparison of Soybean Herbicides and Application Methods for Weed Control, Columbus Unit, 1990.

Herbicide	Rate	Yield	Cocklebur Control	Crop Injury
	Oz. a.i./A	bu/A	#	
Preemergenent application:				
Canopy	3.75	18.6	10	1.0
Canopy	4.50	21.0	13	1.0
Canopy	5.25	18.4	10	1.0
Preemergenent + postemergent application:				
Canopy + Classic	3.75 + 0.165	22.4	95	2.2
Canopy + Classic	4.50 + 0.165	21.2	100	2.0
Canopy + Classic	5.25 + 0.063	20.9	100	1.8
Canopy + Pinnacle	3.75 + 0.063	17.4	35	2.2
Canopy + Pinnacle	4.50 + 0.063	17.6	43	2.0
Canopy + Pinnacle	5.25 + 0.063	20.3	52	2.2
Canopy + Classic + Pinnacle	3.75 + 0.063 + 0.063	19.2	95	2.3
Canopy + Classic + Pinnacle	4.50 + 0.063 + 0.063	19.1	98	2.5
Canopy + Classic + Pinnacle	5.25 + 0.063 + 0.063	18.7	100	2.5
No Herbicide	---	9.5	0	1.0
LSD 0.05:		3.0	23	0.2

Dual applied preemergent to all plots at the rate of 1.5 pt/A.
AG-98 surfactant was added to all Pinnacle postemergent treatments at the 0.125 % rate and 0.25% for the Classic treatments. Liquid 28% N was also added to all postemergent treatments at the rate of 1 qt/A.
Date planted: July 3; variety = Stafford; row spacing = 30 inches.
Date of herbicide applications: PRE = July 3; POST = July 30.
Rainfall (inches): July 11 = 0.50, July 22 = 0.50, Aug. 21 = 1.10
Weed species: Cocklebur (moderate population).
Crop injury rating: 1 = no injury, 10 = all plants dead.

Table 3. Comparison of Soybean Herbicides and Application Methods for Weed Control, Columbus Unit, 1990.

Herbicide	Rate	When Applied	Yield	Weed Control B-leaf	Weed Control Gr
	lb. a.i./A		bu/A	-- % --	
Command + Scepter + Sencor	0.25 + 0.063 + 0.188	PPI	22.5	83	83
Command + Canopy	0.25 + 0.188	PPI	21.9	48	83
Command + Canopy	0.50 + 0.188	PPI	23.0	50	97
Salute + Canopy	1.13 + 0.14	PPI	21.7	43	98
Salute + Command	1.13 + 0.25	PPI	20.2	43	97
Salute + Scepter	1.13 + 0.063	PPI	19.3	48	100
Salute +	1.13	PPI	23.3	90	98
Basagran	0.5	POST			
Treflan + Sencor	0.75 + 0.25	PPI	20.8	60	95
Sencor	0.25	PRE			
Turbo + Scepter	2.25 + 0.063	PRE	19.5	58	92
Lasso + Lorox (+)	1.5 + 0.525	PRE	19.2	38	83
Cultivation only	---	---	16.4	43	77
No Herbicide	---	---	9.5	0	0
LSD 0.05:			6.9	45	15

Date of planting = July 3; variety = Stafford.
Weed species: B-leaf = cocklebur, Gr = crabgrass.
Date of herbicide application: PPI = July 3, PRE = July 4, POST = July 30.
Rainfall (in.): July 11 = 0.50, July 22 = 0.50, Aug. 21 = 1.10.

Table 4. Comparison of Postemergent Soybean Herbicides for Weed Control, Columbus Unit, 1990.

Herbicide	Rate	Yield	Weed Control Coc	Weed Control Gr	Crop Injury
	lb. a.i./A	bu/A	---- %	---	
Select + Basagran + Crop Oil	0.094 + 0.75 1 qt.	20.0	100	58	2.0
Select + Basagran + Crop Oil	0.125 + 0.75 1 qt.	21.6	90	48	1.9
Select + Basagran + Cobra Crop Oil	0.094 + 0.5 + 0.15 1 pt.	19.8	93	42	3.5
Select + Classic + Crop Oil	0.094 + 0.008 1 pt.	19.2	100	83	2.3
Select + Classic + Crop Oil	0.125 + 0.008 1 pt.	21.9	100	95	2.4
Select + Classic + Cobra Crop Oil	0.094 + 0.006 + 0.15 1 pt.	20.8	93	80	3.2
Select + Cobra + Crop Oil	0.094 + 0.2 1 pt.	21.1	82	77	3.5
Select + Cobra + Crop Oil	0.125 + 0.2 1 pt.	21.1	85	82	3.5
Assure + Cobra + Crop Oil	0.09 + 0.2 1 pt.	20.4	90	81	3.5
Fusilade + Cobra + Crop Oil	0.18 + 0.2 1 pt.	22.2	85	83	3.5
Select + Crop Oil	0.094 + 1 qt.	13.9	0	93	1.0
No Herbicide	---	14.7	0	0	1.0
LSD 0.05:		3.8	9	27	0.2

Date of planting = July 3; variety = Stafford.
Date of postemergent herbicide application: July 30.
Weed species: Cocklebur and crabgrass.
Crop injury rating: 1= no injury, 10 = complete kill.
Rainfall (in.): July 11 = 0.50, July 22 = 0.50, Aug. 21 = 1.10.

Table 5. Comparison of Postemergent Soybean Herbicides for Weed Control, Columbus Unit, 1990.

Herbicide	Rate	Yield	Cocklebur Control	Crop Injury
	lb. a.i./A	bu/A	%	
Cobra + Basagran + 2,4-DB + AG-98	0.15 + 0.5 2 oz. + 0.25%	20.5	95	2.8
Cobra + Basagran + Crop Oil	0.15 + 0.5 1 pt.	20.4	98	3.5
Cobra + 2,4-DB + AG-98	0.2 2 oz. + 0.25%	19.3	85	2.9
Cobra + Classic + 2,4-DB + AG-98	0.15 + 0.006 2 oz. + 0.25%	20.4	100	2.8
Cobra + Classic + AG-98	0.15 + 0.006 0.25%	22.1	100	2.2
Cobra + Crop Oil	0.2 1 pt.	20.0	80	3.5
Cobra + Basagran + Crop Oil	0.125 + 0.75 1 pt.	22.6	95	3.5
Cobra + Classic + AG-98	0.125 + 0.008 0.25%	21.6	100	2.3
Cobra + Pinnacle + AG-98	0.125 + 0.004 0.25%	19.4	80	2.4
Cultivation Only	---	12.8	60	1.0
No Herbicide	---	8.4	0	1.0
LSD 0.05:		3.7	5	0.4

Date of planting: July 3; Variety = Stafford.
Date of herbicide application: July 30.
Crop injury rating: 1 = no injury and 10 = complete kill.
Rainfall (in.): July 11 = 0.5, July 22 = 0.5, Aug. 21 = 1.10
Weed species: Common cocklebur (moderate weed pressure).

Table 6. Comparisons of Soybean Herbicides and Application Methods for Velvetleaf Control, Columbus Unit, 1990.

Herbicide Application Method	Rate	Yield	Weed Control
	lb a.i./A	bu/A	%
<u>Preplant Incorporated</u>:			
Treflan + Canopy	0.75 + 0.28	15.5	97
Pursuit (+)	0.91	17.7	88
Squadron	0.87	14.8	82
Salute + Scepter	1.13 + 0.62	19.4	85
<u>Shallow Preplant Incorporated</u>:			
Freedon + Scepter	0.94 + 0.094	16.6	68
Lasso + Canopy	1.5 + 0.28	14.6	83
Lasso + Pursuit	1.5 + 0.063	17.7	82
<u>Preemergence</u>:			
Turbo + Scepter	2.0 + 0.062	16.0	23
Lasso + Canopy	1.5 + 0.28	18.0	50
Dual + Pursuit	1.5 + 0.063	15.7	60
<u>Preplant Incorporated + Postemergence</u>:			
Commence + Basagran	1.31 + 0.5	17.5	98
Prowl + Pursuit	0.75 + 0.063	17.6	100
Treflan + Cobra + Basagran	0.75 + 0.15 + 0.5	16.5	95
Treflan + Classic + Pinnacle	0.75 + 0.004 + 0.004	16.1	85
Cultivation Only	---	12.3	53
No Herbicide	---	8.8	0
LSD 0.05:		4.7	19
C.V. (%):		17.0	15

Planted July 2, 1990; Variety = Stafford; Row Spacing = 30 inch.
Date of herbicide applications: PPI, Shallow PPI, and PRE = July 2.
Postemergence = Aug. 1.
Weed species: Velvetleaf (light to moderate infestation).
Soil pH = 6.8; soil type = Parsons silt loam, 1.4% O.M.
Rainfall (in.): July 11 = 0.50, July 22 = 0.50.

Table 7. Comparison of Soybean Herbicides and Application Methods on Weed Control, Columbus Unit, 1990.

Herbicide	Rate	Cultiv.	Yield	Cocklebur Control
	lb. a.i./A		bu/A	%
<u>Preplant incorporated</u>:				
Prowl + Scepter	0.75 + 0.125	No	8.3	37
Prowl + Scepter	0.5 + 0.994	Yes	13.3	63
Treflan + Canopy	0.75 + 0.28	No	11.2	32
Treflan + Canopy	0.5 + 0.188	Yes	10.8	60
<u>Preemergent</u>:				
Dual + Scepter	1.5 + 0.125	No	7.7	27
Dual + Scepter	1.0 + 0.094	Yes	9.2	53
Lasso + Canopy	1.5 + 0.28	No	12.3	47
Lasso + Canopy	1.0 + 0.188	Yes	14.1	63
<u>Preplant incorporated + postemergent</u>:				
Treflan + Basagran	0.75 + 0.75	No	16.2	88
Treflan + Basagran + 2,4-DB	0.5 + 0.5 + 0.003	Yes	14.4	75
Prowl + Scepter	0.75 + 0.063	No	13.3	80
Prowl + Scepter	0.5 + 0.063 + 0.003	Yes	14.1	88
<u>Preeemergent + postemergent</u>:				
Lasso + Classic	1.5 + 0.008	No	11.6	97
Lasso + Classic + 2,4-DB	1.0 + 0.004 + 0.003	Yes	10.8	92
Cultivation only	---	--	10.6	48
No Herbicide	---	--	4.4	0
LSD 0.05:			4.5	31

Date of planting = July 3; variety = Stafford.
Date of herbicide application: PPI = July 3, PRE = July 4, POST = July 30.
Weed species: cocklebur (heavy population).
Rainfall (in.): July 11 = 0.50, July 22 = 0.50, Aug. 21 = 1.10.

Annual Weather Summary for Parsons - 1990

1990 DATA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
AVG. MAX	52.2	51.9	54.8	65.5	71.3	85.9	90.0	89.3	86.9	68.3	64.3	41.7	68.5
AVG. MIN	28.3	28.5	38.4	42.6	53.0	66.6	67.8	66.5	60.4	42.9	41.1	22.4	46.5
MEAN	40.2	40.2	46.6	54.0	62.1	76.3	78.9	77.9	73.7	55.6	52.7	32.0	57.5
PRECIP	2.41	3.14	6.61	2.23	11.4	3.16	2.07	2.2	3.63	1.18	2.45	1.56	42.01
SNOW	0	3	5	0	0	0	0	0	0	0	0	1.5	9.5
HEAT DD*	769	695	580	348	135	2	2	0	21	312	379	1022	4262
COOL DD*	0	0	9	19	46	340	432	401	281	21	9	0	1556
RAIN DAYS	4	7	15	12	18	12	8	6	6	8	8	8	112
MIN <= 10	0	0	0	0	0	0	0	0	0	0	0	5	5
MAX >= 90	0	0	0	0	0	9	17	15	12	0	0	0	53
MIN <= 32	25	0	0	0	0	9	17	15	12	0	0	0	53

NORMAL VALUES (1951 - 1980 Average)

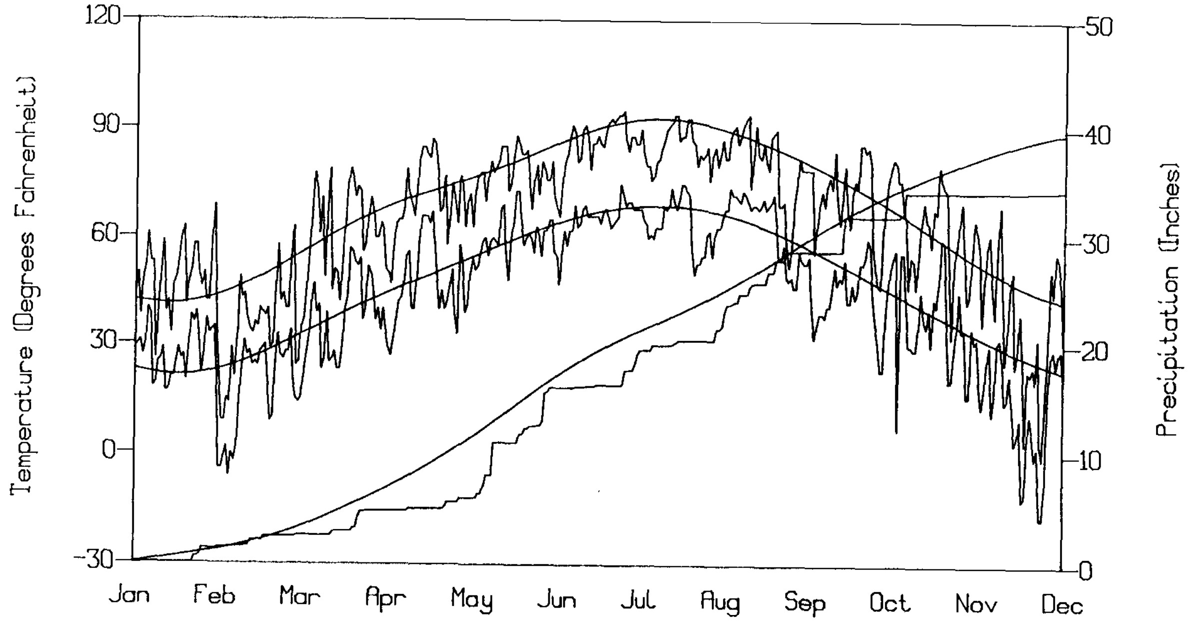
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
AVG. MAX	42.8	49.3	58.6	70.8	78.8	87.2	93.1	92.2	84.0	73.6	57.9	47.3	69.6
AVG. MIN	22.6	27.6	35.5	47.2	56.5	64.9	69.5	67.6	60.3	49.0	36.8	27.8	47.1
MEAN	32.7	38.5	47.1	59.0	67.7	76.1	81.3	79.9	72.1	61.3	47.4	37.6	58.4
PRECIP	1.22	1.34	2.98	3.72	5.18	4.80	3.65	3.43	4.53	3.47	2.54	1.65	38.51
SNOW	2	3	1.5	0	0	0	0	0	0	0	2	0	8.5
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

1990 DEPARTURE FROM NORMALS

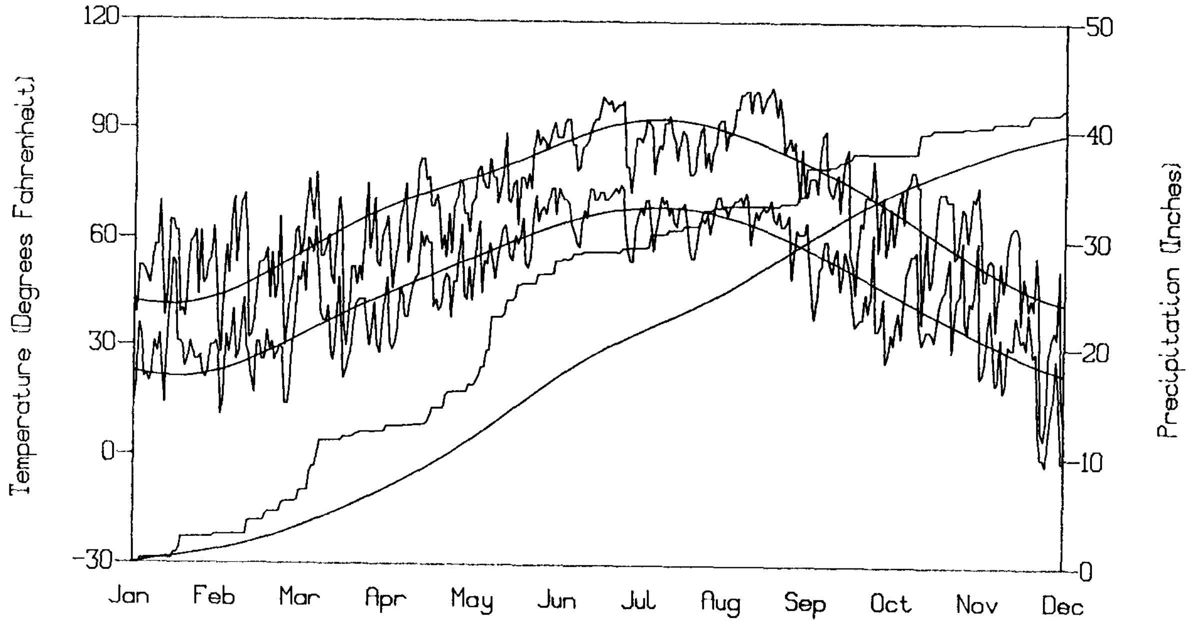
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
AVG. MAX	9.4	2.6	-3.8	-5.3	-7.5	-1.3	-3.1	-2.9	2.9	-5.3	6.4	-5.6	-1.1
AVG. MIN	5.7	.9	2.9	-4.6	-3.5	1.7	-1.7	-1.1	.1	-6.1	4.3	-5.4	-.6
MEAN	7.5	1.7	-.5	-5.0	-5.6	.2	-2.4	-2.0	1.6	-5.7	5.3	-5.6	-.9
PRECIP	1.19	1.8	3.63	-1.5	6.19	-1.6	-1.6	-1.2	-.9	-2.3	-.09	-.09	3.5
SNOW	-2	0	3.5	0	0	0	0	0	0	0	-2	1.5	1
HEAT DD*	-233	-47	15	139	76	-4	2	0	-3	139	-150	173	106
COOL DD*	0	0	-2	-11	-97	1	-73	-61	44	-38	9	0	-228

*DD=Degree Days

Weather Summary for Parsons, 1989



Weather Summary for Parsons, 1990



STATION PERSONNEL

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Mildred Beck	Office Assistant II
Larry Buffington	Custodial Worker
TaLana Erikson	Agric. Lab Technician II
Marla Sexton	Accountant I
Kenneth Coffey	Animal Scientist Beef Cattle Research
Fredrick Black	Animal Caretaker I
Larry Ellis	Animal Caretaker I
Terry Green	Animal Caretaker I
Ronald McNickle	Animal Caretaker II
Robert Middleton	Animal Caretaker III
James Long	Agronomist, Crop Varietal Development
Joyce Erikson	Farmer I
Charles Middleton	Farmer II
Kenneth Kelley	Agronomist, Crops and Soils
Michael Dean	Farmer II
Bobbie Hite	Farmer III
Joseph Moyer	Agronomist, Forage Crops
Mike Cramer	Farmer II
Kenneth McNickle	Farmer II
Daniel Sweeney	Agronomist, Soil and Water Management
Robert Black	Farmer III
David Kerley	Farmer I

Agricultural Experiment Station, Kansas State University, Manhattan 66506

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