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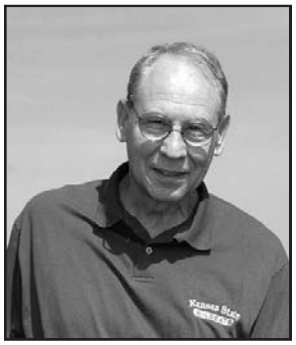

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Effects of Frequency of Dried Distillers Grains Supplementation on Gains of Heifers Grazing Smooth Bromegrass Pastures

L.W. Lomas and J.L. Moyer

Summary
A total of 90 heifer calves grazing smooth bromegrass pastures were used to compare daily supplementation of dried distillers grains (DDG) to supplementation with an equivalent amount of DDG three days per week (Monday, Wednesday, and Friday) in 2009, 2010, and 2011. The rate of DDG fed was based on the equivalent of 0.5% of body weight per head daily. Daily gains and DDG intake of heifers fed daily or three days per week were similar ($P > 0.05$) in all three years.

Introduction
Distillers grains, a by-product of the ethanol industry, have tremendous potential as an economical and nutritious supplement for grazing cattle. Distillers grains contain a high concentration of protein (25% to 30%) with more than two-thirds escaping degradation in the rumen, which makes it an excellent supplement for younger cattle. Previous research at this location on DDG supplementation of stocker cattle grazing smooth bromegrass has shown DDG at 0.5% body weight per head daily to be the most efficacious level from the perspectives of both animal performance and economics, but many producers would prefer not to supplement their cattle on a daily basis to save labor and reduce costs. This research was conducted to compare daily supplementation of grazing stocker cattle with DDG at 0.5% body weight with an equivalent amount of DDG supplemented three days per week (Monday, Wednesday, and Friday).

Experimental Procedures
Thirty heifer calves were weighed on two consecutive days each year, stratified by weight, and randomly allotted to six five-acre smooth bromegrass pastures on April 7, 2009 (420 lb), March 30, 2010 (422 lb), and April 5, 2011 (406 lb). Three pastures of heifers were randomly assigned to one of two supplementation treatments (three replicates per treatment) and grazed for 192 days, 168 days, and 169 days in 2009, 2010, and 2011, respectively. Supplementation treatments were DDG at 0.5% body weight per head daily or an equivalent amount of DDG fed three days per week (Monday, Wednesday, and Friday). Pastures were fertilized with 100 lb/a nitrogen (N), P_2O_5, and K_2O as required by soil test on February 10, 2009; February 19, 2010; and April 6, 2011. Pastures were stocked with 1 heifer/a and grazed continuously until October 16, 2009 (192 days); Sept. 13, 2010 (168 days); and Sept. 21, 2011 (169 days) when heifers were weighed on two consecutive days and grazing was terminated.

Cattle in each pasture were group-fed DDG in meal form in bunks on a daily basis, and pasture was the experimental unit. No implants or feed additives were used. Weight gain was the primary measurement. Cattle were weighed every 28 days; quantity of DDG fed was adjusted at that time. Cattle were treated for internal and external parasites before being turned out to pasture and later vaccinated for protection from pinkeye. Heifers had free access to commercial mineral blocks that contained 12% calcium, 12% phosphorus, and 12% salt. One heifer was removed from the study in 2009 and 2011 for reasons unrelated to experimental treatment.

Results and Discussion

Cattle gains and DDG intake are presented in Tables 1, 2, and 3 for 2009, 2010, and 2011, respectively. Gains and DDG intake of heifers that were supplemented three times per week were similar ($P > 0.05$) to those of heifers that were supplemented daily all three years. In 2009, daily gain and gain/a were 1.89 and 362 lb, respectively, for heifers supplemented daily and 1.87 and 359 lb, respectively, for heifers supplemented three times per week. Total DDG consumption and average daily DDG consumption were 561 and 2.9 lb, respectively, for heifers supplemented daily and 566 and 3.0 lb, respectively, for heifers supplemented three times per week. Heifers supplemented three times per week were fed an average of 6.9 lb per feeding.

In 2010, daily gain and gain/a were 1.75 and 294 lb, respectively, for heifers supplemented daily and 1.76 and 295 lb, respectively, for heifers supplemented three times per week. Total DDG consumption and average daily DDG consumption were 485 and 2.9 lb, respectively, for heifers supplemented daily and 478 and 2.8 lb, respectively, for heifers supplemented three times per week. Heifers supplemented three times per week were fed an average of 6.5 lb per feeding.

In 2011, daily gain and gain/a were 1.84 and 311 lb, respectively, for heifers supplemented daily and 1.82 and 307 lb, respectively, for heifers supplemented three times per week. Total DDG consumption and average daily DDG consumption were 477 and 2.8 lb, respectively, for heifers supplemented daily and 470 and 2.8 lb, respectively, for heifers supplemented three times per week. Heifers supplemented three times per week were fed an average of 6.5 lb per feeding.

Stocker cattle can be fed DDG three times per week rather than daily without adverse effects on performance, but producers should use caution when feeding greater than the equivalent of 0.5% per head daily fewer than seven days per week to avoid potential sulfur toxicity problems.

Table 1. Effects of frequency of dried distillers grains (DDG) supplementation on gains of heifer calves grazing smooth bromegrass pastures, Southeast Agricultural Research Center, 2009

	Supplementation frequency	
Item	Daily	Three times per week
No. of days	192	192
No. of head	14	15
Initial weight, lb	420	420
Final weight, lb	782	779
Gain, lb	362	359
Daily gain, lb	1.89	1.87
Gain/a, lb	362	359
Total DDG consumption, lb/head	561	566
Average DDG consumption, lb/head per day	2.9	3.0

Table 2. Effects of frequency of dried distillers grains (DDG) supplementation on gains of heifer calves grazing smooth bromegrass pastures, Southeast Agricultural Research Center, 2010

	Supplementation frequency	
Item	Daily	Three times per week
No. of days	168	168
No. of head	15	15
Initial weight, lb	422	422
Final weight, lb	716	717
Gain, lb	294	295
Daily gain, lb	1.75	1.76
Gain/a, lb	294	295
Total DDG consumption, lb/head	485	478
Average DDG consumption, lb/head per day	2.9	2.8

Table 3. Effects of frequency of dried distillers grains (DDG) supplementation on gains of heifer calves grazing smooth bromegrass pastures, Southeast Agricultural Research Center, 2011

	Supplementation frequency	
Item	Daily	Three times per week
No. of days	169	169
No. of head	14	15
Initial weight, lb	409	403
Final weight, lb	720	710
Gain, lb	311	307
Daily gain, lb	1.84	1.82
Gain/a, lb	311	307
Total DDG consumption, lb/head	477	470
Average DDG consumption, lb/head per day	2.8	2.8

Distillers Grains Supplementation Strategy for Grazing Stocker Cattle

L.W. Lomas and J.L. Moyer

Summary

A total of 144 steers grazing smooth bromegrass pastures were used to evaluate the effects of distillers grains supplementation strategy on available forage, grazing gains, subsequent finishing gains, and carcass characteristics in 2008, 2009, 2010, and 2011. Supplementation treatments evaluated were no supplement, dried distillers grains (DDG) at 0.5% of body weight per head daily during the entire grazing phase, and no supplementation during the first 56 days and DDG at 0.5% of body weight per head daily during the remainder of the grazing phase.

Supplementation with DDG during the entire grazing phase or only during the latter part of the grazing phase resulted in higher ($P < 0.05$) grazing gains than feeding no supplement. Supplementation treatment had no effect ($P > 0.05$) on available forage during the grazing phase. Grazing performance and supplement conversion efficiency were not different ($P > 0.05$); however, compared with steers supplemented during the entire grazing phase, those on the delayed supplementation treatment consumed 155, 142, 128, and 132 lb less DDG in 2008, 2009, 2010, and 2011, respectively, but had similar gains. Supplementation during the grazing phase had no effect ($P > 0.05$) on finishing performance in 2008, 2010, or 2011. In 2009, steers that received no supplementation during the grazing phase had greater ($P < 0.05$) finishing gains than those that were supplemented during the entire grazing phase and lower ($P < 0.05$) feed:gain ratios than steers that were supplemented with DDG while grazing. Steers supplemented with DDG in 2010 had greater ($P > 0.05$) overall gains than those that received no supplement during the grazing phase.

Introduction

Distillers grains are a by-product of the ethanol industry and have tremendous potential as an economical and nutritious supplement for grazing cattle. Because the co-products generally have high concentrations of protein and phosphorus, their nutrient composition complements that of mature forages, which are typically deficient in these nutrients. Previous research at this location evaluating DDG supplementation of stocker cattle grazing smooth bromegrass has shown DDG at 0.5% of body weight per head daily to be the most efficacious level from both an animal performance and economic perspective. This research was conducted to evaluate DDG supplementation strategies that might increase the efficiency of supplement conversion by delaying supplementation until later in the grazing season, when forage quality starts to decline.

Experimental Procedures

Thirty-six steers of predominately Angus breeding were weighed on two consecutive days, stratified by weight, and randomly allotted to nine five-acre smooth bromegrass pastures on April 9, 2008 (450 lb); April 3, 2009 (467 lb); March 30, 2010 (448 lb); and April 5, 2011 (468 lb). Three pastures of steers were randomly assigned to one of three supplementation treatments (three replicates per treatment) and were grazed for 196 days, 221 days, 224 days, and 199 days in 2008, 2009, 2010, and 2011, respectively. Supplementation treatments were no supplement, DDG at 0.5% of body weight per head daily, and no DDG during the first 56 days of grazing then DDG at 0.5% of body weight per head daily for the remainder of the grazing phase (140 days, 165 days, 168 days, and 143 days in 2008, 2009, 2010, and 2011, respectively). Pastures were fertilized with 100 lb/a N on February 29, 2008; February 10, 2009; February 18, 2010; and April 6, 2011. Pastures were stocked with 0.8 steers/a and grazed continuously until October 22, 2008; November 10, 2009; November 9, 2010; and October 21, 2011, when steers were weighed on two consecutive days and grazing was terminated.

Cattle in each pasture were group-fed DDG in meal form on a daily basis in metal feed bunks, and pasture was the experimental unit. No implants or feed additives were used during the grazing phase. Weight gain was the primary measurement. Cattle were weighed every 28 days; quantity of DDG fed was adjusted at that time. Cattle were treated for internal and external parasites before being turned out to pasture and later were vaccinated for protection from pinkeye. Cattle had free access to commercial mineral blocks that contained 12% calcium, 12% phosphorous, and 12% salt.

Forage availability was measured approximately every 28 days with a disk meter calibrated for smooth bromegrass.

After the grazing period, cattle were shipped to a finishing facility, implanted with Synovex S (Pfizer Animal Health, Madison, NJ), and fed a diet of 80% whole-shelled corn, 15% corn silage, and 5% supplement (dry matter basis) for 112 days in 2008 and 2009, for 100 days in 2010, and for 110 days in 2011. All cattle were slaughtered in a commercial facility at the end of the finishing period, and carcass data were collected.

Results and Discussion

Average available forage for the smooth bromegrass pastures during the grazing phase and grazing and subsequent finishing performance of grazing steers are presented by supplementation treatment in Tables 1, 2, 3, and 4 for 2008, 2009, 2010, and 2011, respectively. Supplementation with DDG had no effect ($P > 0.05$) on quantity of forage available for grazing in any year; however, average available forage for all treatments was higher in 2008 than in any of the other years.

Steers supplemented with 0.5% DDG during the entire grazing season or only during the latter part of the grazing season had greater ($P < 0.05$) weight gain, daily gain, and steer gain/a during each year than those that received no supplement. Supplementation with either system resulted in an average of 0.5 lb greater average daily gain over those that received no supplement. Grazing weight gain, daily gain, and gain/a were not different ($P > 0.05$) between steers that were supplemented with 0.5% DDG during the entire grazing season or only during the latter part of the season. Steers supplemented with DDG at 0.5% of body weight per head daily during the entire grazing season consumed 155, 142, 128, and 132 lb more DDG in 2008, 2009, 2010, and 2011, respectively, than those that were supplemented only during the latter part of the grazing season. In general, steers supplemented with DDG only during the latter part of the grazing season consumed approximately 20% less DDG but had grazing gains similar ($P > 0.05$) to those supplemented during the entire grazing season.

In 2008, supplementation during the grazing phase had no effect ($P > 0.05$) on finishing weight gain, feed intake, feed:gain, hot carcass weight, backfat, ribeye area, yield grade, or marbling score. Overall performance (grazing plus finishing) did not differ ($P > 0.05$) between supplementation treatments.

In 2009, steers that received no supplement during the grazing phase had greater ($P < 0.05$) finishing gains than those that were supplemented with DDG during the entire grazing season; lower ($P < 0.05$) final live weight, hot carcass weight, and overall gain than those that received DDG only during the latter part of the grazing season; and lower ($P < 0.05$) feed:gain ratios, dressing percentage, and ribeye areas than steers that received either DDG supplementation treatment. Feed intake, backfat, yield grade, marbling score, and percentage of carcasses grading choice or higher did not differ ($P > 0.05$) between supplementation treatments.

In 2010, supplementation during the grazing phase had no effect ($P > 0.05$) on finishing gains, dry matter intake, or feed:gain, but steers supplemented with DDG during the grazing phase had greater ($P < 0.05$) final live weight, hot carcass weight, and overall daily gain than those that received no supplement during the grazing phase.

In 2011, supplementation during the grazing phase had no effect ($P > 0.05$) on finishing gains, feed:gain, or carcass characteristics. Steers that received no supplementation during the grazing phase had lower ($P < 0.05$) final live weight, hot carcass weight, finishing feed intake, and overall live weight gain than those that were supplemented during the grazing phase.

Under the conditions of this study, supplementation of stocker cattle grazing smooth bromegrass pasture with DDG at 0.5% of body weight only during the latter part of the grazing season would likely have been the most profitable treatment if the cattle had been marketed as feeder cattle at the end of the grazing phase. Delaying supplementation until early June reduced labor requirements for the first 56 days of the grazing phase, when cattle received no supplement, but resulted in grazing gains similar to those supplemented during the entire grazing phase. In 2008, DDG supplementation during the grazing phase carried no advantage if ownership of the cattle was retained through slaughter. In 2009, 2010, and 2011, however, stocker cattle that were supplemented with DDG during the grazing phase maintained their weight advantage through slaughter.

Table 1. Effects of dried distillers grains (DDG) supplementation strategy on available smooth bromegrass forage and grazing and subsequent finishing performance of steers grazing smooth bromegrass pastures, Southeast Agricultural Research Center, 2008

	Level of DDG (% body weight/head per day)		
Item	0	0.5	0.5 delayed[1]
Grazing phase (196 days)			
No. of head	12	12	12
Initial weight, lb	450	450	450
Final weight, lb	772a	871b	846b
Gain, lb	321a	421b	396b
Daily gain, lb	1.64a	2.15b	2.02b
Gain/a, lb	257a	337b	317b
Total DDG consumption, lb/head	0	651	496
Average DDG consumption, lb/head per day	0	3.3	3.5
DDG, lb/additional gain	---	6.5	6.6
Average available smooth bromegrass forage, lb dry matter/a	9,264	9,020	9,240
Finishing phase (112 days)			
Beginning weight, lb	772a	871b	846b
Ending weight, lb	1306	1369	1357
Gain, lb	535	498	511
Daily gain, lb	4.77	4.44	4.56
Daily dry matter intake, lb	26.0	25.8	25.7
Feed:gain	5.46	5.83	5.64
Hot carcass weight, lb	764	821	813
Dressing percentage	58	60	60
Backfat, in.	0.43	0.45	0.41
Ribeye area, sq. in.	11.1	11.6	11.5
Yield grade	3.2	2.9	2.8
Marbling score[2]	675	645	640
Percentage USDA grade choice	100	100	100
Overall performance (grazing plus finishing; 308 days)			
Gain, lb	856	918	907
Daily gain, lb	2.78	2.98	2.94

[1] Steers were supplemented with DDG only during the last 140 days of the grazing phase.

[2] 600 = modest, 700 = moderate.

Means within a row followed by the same letter are not significantly different ($P < 0.05$).

Table 2. Effects of dried distillers grains (DDG) supplementation strategy on available smooth bromegrass forage and grazing and subsequent finishing performance of steers grazing smooth bromegrass pastures, Southeast Agricultural Research Center, 2009

	Level of DDG (% body weight/head per day)		
Item	0	0.5	0.5 delayed[1]
Grazing phase (221 days)			
No. of head	12	12	12
Initial weight, lb	467	467	467
Final weight, lb	792a	927b	922b
Gain, lb	325a	460b	454b
Daily gain, lb	1.47a	2.08b	2.06b
Gain/a, lb	260a	368b	364b
Total DDG consumption, lb/head	0	773	631
Average DDG consumption, lb/head per day	0	3.5	2.9
DDG, lb/additional gain	---	5.7	4.9
Average available smooth bromegrass forage, lb dry matter/a	5,109	5,110	5,212
Finishing phase (112 days)			
Beginning weight, lb	792a	927b	922b
Ending weight, lb	1230a	1280ab	1304b
Gain, lb	438a	353b	383ab
Daily gain, lb	3.91a	3.15b	3.42ab
Daily dry matter intake, lb	23.9	23.7	24.7
Feed:gain	6.13a	7.56b	7.25b
Hot carcass weight, lb	734a	781ab	799b
Dressing percentage	60a	61b	61b
Backfat, in.	0.36	0.36	0.41
Ribeye area, sq. in.	10.8a	11.9b	11.8b
Yield grade	2.8	2.7	2.9
Marbling score[2]	629	638	670
Percentage USDA grade choice	92	92	100
Overall performance (grazing plus finishing; 333 days)			
Gain, lb	763a	813ab	838b
Daily gain, lb	2.29a	2.44ab	2.52b

[1] Steers were supplemented with DDG only during the last 165 days of the grazing phase.

[2] 600 = modest, 700 = moderate.

Means within a row followed by the same letter are not significantly different ($P < 0.05$).

Table 3. Effects of dried distillers grains (DDG) supplementation strategy on available smooth bromegrass forage and grazing and subsequent finishing performance of steers grazing smooth bromegrass pastures, Southeast Agricultural Research Center, 2010

	Level of DDG (% body weight/head per day)		
Item	0	0.5	0.5 delayed[1]
Grazing phase (224 days)			
No. of head	12	12	12
Initial weight, lb	448	448	448
Final weight, lb	791a	880b	894b
Gain, lb	343a	431b	446b
Daily gain, lb	1.53a	1.93b	1.99b
Gain/a, lb	275a	345b	357b
Total DDG consumption, lb/head	0	758	630
Average DDG consumption, lb/head per day	0	3.4	2.8
DDG, lb/additional gain	---	8.6	6.1
Average available smooth bromegrass forage, lb dry matter/a	6,382	6,364	6,477
Finishing phase (100 days)			
Beginning weight, lb	791a	880b	894b
Ending weight, lb	1228a	1319b	1318b
Gain, lb	436	439	424
Daily gain, lb	4.36	4.39	4.24
Daily dry matter intake, lb	23.6	26.1	24.7
Feed:gain	5.41	5.94	5.82
Hot carcass weight, lb	725a	772b	779b
Dressing percentage	59.1	58.5	59.1
Backfat, in.	0.34	0.35	0.41
Ribeye area, sq. in.	11.0	11.3	11.7
Yield grade	2.7	2.8	2.9
Marbling score[2]	565	600	610
Percentage USDA grade choice	100	92	100
Overall performance (grazing plus finishing; 324 days)			
Gain, lb	780a	871b	870b
Daily gain, lb	2.41a	2.69b	2.69b

[1] Steers were supplemented with DDG only during the last 168 days of the grazing phase.
[2] 500 = small, 600 = modest, 700 = moderate.
Means within a row followed by the same letter are not significantly different ($P < 0.05$).

Table 4. Effects of dried distillers grains (DDG) supplementation strategy on available smooth bromegrass forage and grazing and subsequent finishing performance of steers grazing smooth bromegrass pastures, Southeast Agricultural Research Center, 2011

	Level of DDG (% body weight/head per day)		
Item	0	0.5	0.5 delayed[1]
Grazing phase (199 days)			
No. of head	12	12	12
Initial weight, lb	468	468	468
Final weight, lb	725a	814b	833b
Gain, lb	257a	346b	365b
Daily gain, lb	1.29a	1.74b	1.83b
Gain/a, lb	206a	277b	292b
Total DDG consumption, lb/head	0	658	526
Average DDG consumption, lb/head per day	0	3.3	2.6
DDG, lb/additional gain	---	7.4	4.9
Average available smooth bromegrass forage, lb dry matter/a	5,203	5,273	5,236
Finishing phase (110 days)			
Beginning weight, lb	725a	814b	833b
Ending weight, lb	1250a	1325b	1349b
Gain, lb	525	511	516
Daily gain, lb	4.77	4.64	4.69
Daily dry matter intake, lb	25.2a	26.7b	26.6b
Feed:gain	5.28	5.76	5.67
Hot carcass weight, lb	731a	780ab	788b
Dressing percentage	58.5	58.9	58.5
Backfat, in.	0.39	0.41	0.40
Ribeye area, sq. in.	11.6	11.7	12.4
Yield grade	2.8	2.8	2.5
Marbling score[2]	653	605	636
Percentage USDA grade choice	100	92	92
Overall performance (grazing plus finishing; 309 days)			
Gain, lb	782a	857ab	881b
Daily gain, lb	2.53a	2.77ab	2.85b

[1] Steers were supplemented with DDG only during the last 168 days of the grazing phase.
[2] 600 = modest, 700 = moderate.
Means within a row followed by the same letter are not significantly different ($P < 0.05$).

Effects of Various Forage Systems on Grazing and Subsequent Finishing Performance

L.W. Lomas and J.L. Moyer

Summary

A total of 80 mixed black yearling steers were used to compare grazing and subsequent finishing performance from pastures with 'MaxQ' tall fescue, a wheat-bermudagrass double-crop system, or a wheat-crabgrass double-crop system in 2010 and 2011. Daily gains of steers that grazed 'MaxQ' tall fescue, wheat-bermudagrass, or wheat-crabgrass were similar ($P > 0.05$) in 2010, but daily gains of steers that grazed wheat-bermudagrass or wheat-crabgrass were greater ($P > 0.05$) than those that grazed 'MaxQ' tall fescue in 2011. Finishing gains were similar ($P > 0.05$) among forage systems in 2010. In 2011, finishing gains of steers that grazed MaxQ tall fescue were greater ($P < 0.05$) than those that grazed wheat-bermudagrass.

Introduction

'MaxQ' tall fescue, a wheat-bermudagrass double-crop system, and a wheat-crabgrass double-crop system have been three of the most promising grazing systems evaluated at the Southeast Agricultural Research Center in the past 20 years, but these systems have never been compared directly in the same study. The objective of this study was to compare grazing and subsequent finishing performance of stocker steers that grazed these three systems.

Experimental Procedures

Forty mixed black yearling steers were weighed on two consecutive days each year and allotted on April 6, 2010 (633 lb), and March 23, 2011 (607 lb), to three four-acre pastures of 'Midland 99' bermudagrass and three four-acre pastures of 'Red River' crabgrass that had previously been no-till seeded with approximately 120 lb/a of 'Fuller' hard red winter wheat on September 30, 2009, and September 22, 2010, and four four-acre established pastures of 'MaxQ' tall fescue (four steers/pasture). All pastures were fertilized with 80-40-40 lb/a of N-P_2O_5-K_2O on March 3, 2010, and January 27, 2011. Bermudagrass and crabgrass pastures received an additional 46 lb/a of nitrogen (N) on May 28, 2010, and June 10, 2011. Fescue pastures received an additional 46 lb/a of N on August 31, 2010, and September 15, 2011. An additional 5 lb/a of crabgrass seed was broadcast on crabgrass pastures on April 8, 2011.

Pasture was the experimental unit. No implants or feed additives were used. Weight gain was the primary measurement. Cattle were weighed every 28 days, and forage availability was measured approximately every 28 days with a disk meter calibrated for wheat, bermudagrass, crabgrass, or tall fescue. Cattle were treated for internal and external parasites before being turned out to pasture and later were vaccinated for protection from pinkeye. Steers had free access to commercial mineral blocks that contained 12% calcium, 12% phosphorus, and 12% salt. Wheat-bermudagrass and wheat-crabgrass pastures were grazed continuously until September 14, 2010 (161 days), and September 7, 2011 (168 days), and fescue pastures were grazed continuously until

November 9, 2010 (217 days), and October 21, 2011 (212 days), when steers were weighed on two consecutive days and grazing was terminated.

After the grazing period, cattle were moved to a finishing facility, implanted with Synovex-S (Pfizer Animal Health, Madison, NJ), and fed a diet of 80% whole-shelled corn, 15% corn silage, and 5% supplement (dry matter basis). Finishing diets were fed for 94 days (wheat-bermudagrass and wheat-crabgrass) or 100 days (fescue) in 2010 and 98 days (wheat-bermudagrass and wheat-crabgrass) or 96 days (fescue) in 2011. All steers were slaughtered in a commercial facility, and carcass data were collected.

Results and Discussion

Grazing and subsequent finishing performance of steers that grazed 'MaxQ' tall fescue, a wheat-bermudagrass double-crop system, or a wheat-crabgrass double-crop system are presented in Tables 1 and 2 for 2010 and 2011, respectively. Daily gains of steers that grazed 'MaxQ' tall fescue, wheat-bermudagrass, or wheat-crabgrass were similar ($P > 0.05$) in 2010, but total grazing gain and gain/a were greater ($P < 0.05$) for 'MaxQ' tall fescue than wheat-bermudagrass or wheat-crabgrass because steers grazed 'MaxQ' tall fescue for more days. Gain/a for 'MaxQ' fescue, wheat-bermudagrss, and wheat-crabgrass were 362, 286, and 258 lb/a, respectively. 'MaxQ' tall fescue pastures had greater ($P < 0.05$) average available forage dry matter than wheat-bermudagrass or wheat-crabgrass. Grazing treatment in 2010 had no effect ($P > 0.05$) on subsequent finishing gains. Steers that grazed 'MaxQ' were heavier ($P < 0.05$) at the end of the grazing phase, maintained their weight advantage through the finishing phase, and had greater ($P < 0.05$) hot carcass weight than those that grazed wheat-bermudagrass or wheat-crabgrass pastures. Steers that previously grazed wheat-bermudagrass or wheat-crabgrass had lower ($P < 0.05$) feed:gain than those that had grazed 'MaxQ'.

In 2011, daily gains, total gain, and gain/a for wheat-bermudagrass or wheat-crabgrass were greater ($P < 0.05$) than 'MaxQ'fescue. Gain/a for 'MaxQ' fescue, wheat-bermudagrss, and wheat-crabgrass were 307, 347, and 376 lb/a, respectively. 'MaxQ' tall fescue pastures had greater ($P < 0.05$) average available forage dry matter than wheat-bermudagrass or wheat-crabgrass. Steers that grazed 'MaxQ' had greater ($P < 0.05$) finishing gain than those that grazed wheat-bermudagrass and lower ($P < 0.05$) feed:gain than those that grazed wheat-bermudagrass or wheat-crabgrass. Carcass weight was similar ($P > 0.05$) among treatments.

Hotter, drier weather during the summer of 2011 likely provided more favorable growing conditions for bermudagrass and crabgrass than for fescue, which was reflected in greater ($P < 0.05$) gains by cattle grazing those pastures. Lack of precipitation also reduced the length of the grazing season for 'MaxQ' fescue pastures in 2011, which resulted in less fall grazing and lower gain/a than was observed for those pastures in 2010.

Table 1. Effects of forage system on grazing and subsequent performance of stocker steers, Southeast Agricultural Research Center, 2010

	Forage system		
Item	'MaxQ' fescue	Wheat-bermudagrass	Wheat-crabgrass
Grazing phase			
No. of days	217	161	161
No. of head	16	12	12
Initial weight, lb	633	633	633
Ending weight, lb	995a	919b	891b
Gain, lb	362a	286b	258b
Daily gain, lb	1.67	1.78	1.60
Gain/a, lb	362a	286b	258b
Average available forage dry matter, lb/a	6214a	3497b	3174c
Finishing phase			
No. of days	100	94	94
Beginning weight, lb	995a	919b	891b
Ending weight, lb	1367a	1281b	1273b
Gain, lb	372	361	382
Daily gain, lb	3.72	3.84	4.07
Daily dry matter intake, lb	27.3a	24.6b	25.2b
Feed:gain	7.35a	6.42b	6.22b
Hot carcass weight, lb	847a	794b	790b
Backfat, in.	0.43	0.38	0.35
Ribeye area, sq. in.	12.5	12.5	12.2
Yield grade	2.8	2.5	2.5
Marbling score[1]	649	590	592
Percentage USDA Choice grade	100	92	83
Overall performance (grazing plus finishing)			
No. of days	317	255	255
Gain, lb	734a	648b	640b
Daily gain, lb	2.32a	2.54b	2.51ab

[1] 500 = small, 600 = modest, 700 = moderate.

Means within a row followed by the same letter do not differ ($P < 0.05$).

Table 2. Effects of forage system on grazing and subsequent performance of stocker steers, Southeast Agricultural Research Center, 2011

	Forage system		
Item	'MaxQ' fescue	Wheat-bermudagrass	Wheat-crabgrass
Grazing phase			
No. of days	212	168	168
No. of head	16	12	12
Initial weight, lb	607	607	607
Ending weight, lb	914a	954b	982b
Gain, lb	307a	347b	376b
Daily gain, lb	1.45a	2.07b	2.24b
Gain/a, lb	307a	347b	376b
Average available forage dry matter, lb/a	5983a	4172b	3904c
Finishing phase			
No. of days	96	98	98
Beginning weight, lb	914a	954b	982b
Ending weight, lb	1355	1344	1385
Gain, lb	442a	389b	403ab
Daily gain, lb	4.60a	3.97b	4.11ab
Daily dry matter intake, lb	27.9	28.0	29.3
Feed:gain	6.09a	7.07b	7.13b
Hot carcass weight, lb	841	833	859
Backfat, in.	0.41	041	0.44
Ribeye area, sq. in.	12.9	13.0	13.3
Yield grade	2.6	2.7	2.8
Marbling score[1]	619	640	612
Percentage USDA Choice grade	100	92	92
Overall performance (grazing plus finishing)			
No. of days	308	266	266
Gain, lb	749	737	779
Daily gain, lb	2.43a	2.77b	2.93b

[1] 600 = modest, 700 = moderate.

Means within a row followed by the same letter do not differ ($P < 0.05$).

Effects of Cultivar and Distillers Grains Supplementation on Grazing and Subsequent Finishing Performance of Stocker Steers Grazing Tall Fescue Pasture

L.W. Lomas and J.L. Moyer

Summary

Two hundred sixteen yearling steers grazing tall fescue pastures were used to evaluate the effects of fescue cultivar and dried distillers grains (DDG) supplementation during the grazing phase on available forage, grazing gains, subsequent finishing gains, and carcass characteristics. Fescue cultivars evaluated were high-endophyte 'Kentucky 31,' low-endophyte 'Kentucky 31,' 'HM4,' and 'MaxQ.' Steers were either fed no supplement or supplemented with DDG at 1.0% body weight per head daily in 2009 or 0.75% of body weight per head daily in 2010 and 2011 while grazing. Steers that grazed pastures of low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' gained significantly more ($P < 0.05$) and produced more ($P < 0.05$) gain/a than those that grazed high-endophyte 'Kentucky 31' pastures. Gains of cattle that grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' were similar ($P > 0.05$). Subsequent finishing gains were similar ($P > 0.05$) among fescue cultivars in 2009; however, steers that previously grazed high-endophyte 'Kentucky 31' had greater ($P > 0.05$) finishing gains that those that had grazed 'HM4' or 'MaxQ' in 2010 and greater ($P < 0.05$) finishing gains than those that grazed low-endophyte 'Kentucky 31' or 'HM4' in 2011. Supplementation of grazing steers with DDG supported a higher stocking rate and resulted in greater ($P < 0.05$) grazing gains, gain/a, hot carcass weights, ribeye area, and overall gains and reduced the amount of fertilizer needed by providing approximately 60 lb/a, 50 lb/a, and 50 lb/a of nitrogen (N) in 2009, 2010, and 2011, respectively, primarily from urine of grazing cattle.

Introduction

Tall fescue, the most widely adapted cool-season perennial grass in the United States, is grown on approximately 66 million acres. Although tall fescue is well adapted in the eastern half of the country between the temperate North and mild South, presence of a fungal endophyte results in poor performance of grazing livestock, especially during the summer. Until recently, producers with high-endophyte tall fescue pastures had two primary options for improving grazing livestock performance. One option was to destroy existing stands and replace them with endophyte-free fescue or other forages. Although it supports greater animal performance than endophyte-infected fescue, endophyte-free fescue has been shown to be less persistent under grazing pressure and more susceptible to stand loss from drought stress. In locations where high-endophyte tall fescue must be grown, the other option was for producers to adopt management strategies that reduce the negative effects of the endophyte on grazing animals, such as diluting the effects of the endophyte by incorporating legumes into existing pastures or providing supplemental feed. In recent years, new tall fescue cultivars have been developed with a novel endophyte that provides vigor to the fescue plant but does not have a negative effect on performance of grazing livestock.

Growth in the ethanol industry has resulted in increased availability of distillers grains, which have been shown to be an excellent feedstuff for supplementing grazing cattle because of their high protein and phosphorus content. Distillers grains contain approximately 4% to 5% N, and cattle consuming them excrete a high percentage of this N in their urine and feces; therefore, feeding DDG to grazing cattle will provide N to the pastures. Objectives of this study were to (1) evaluate two of these new cultivars in terms of forage availability, stand persistence, and grazing and subsequent finishing performance of stocker steers and compare them with high- and low-endophyte 'Kentucky 31' tall fescue; (2) evaluate DDG supplementation of cattle grazing these pastures; and (3) determine the contribution of DDG as a nitrogen fertilizer source.

Experimental Procedures

Seventy-two mixed black yearling steers were weighed on two consecutive days and allotted to 16 five-acre established pastures of high-endophyte 'Kentucky 31,' low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' tall fescue (four replications per cultivar) on March 26, 2009 (569 lb), March 24, 2010 (550 lb), and March 23, 2011 (536 lb). 'HM4' and 'MaxQ' are cultivars that have the novel endophyte. Four steers were assigned to two pastures of each cultivar and received no supplementation, and five steers were assigned to two pastures of each cultivar and supplemented with DDG at 1.0% or 0.75% body weight per head daily during the grazing phase in 2009 or 2010 and 2011, respectively. All pastures were fertilized with 80 lb/a N and P_2O_5 and K_2O as required by soil test on February 5, 2009; February 10, 2010; and January 27, 2011. Pastures with steers that received no supplement were fertilized with 60 lb/a N on September 16, 2009, and 46 lb/a N on August 30, 2010 and September 15, 2011. This was calculated to be approximately the same amount of N from DDG that was excreted on pastures by supplemented steers during the entire grazing season.

Cattle in each pasture were group-fed DDG in meal form in bunks on a daily basis, and pasture was the experimental unit. No implants or feed additives were used. Weight gain was the primary measurement. Cattle were weighed every 28 days; quantity of DDG fed was adjusted at that time. Forage availability was measured approximately every 28 days with a disk meter calibrated for tall fescue. Cattle were treated for internal and external parasites before being turned out to pasture and later vaccinated for protection from pinkeye. Steers had free access to commercial mineral blocks that contained 12% calcium, 12% phosphorus, and 12% salt. In 2009, two steers were removed from the study for reasons unrelated to experimental treatment. Pastures were grazed continuously until October 13, 2009 (201 days); November 3, 2010 (224 days); and October 19, 2011 (210 days), when steers were weighed on two consecutive days and grazing was terminated.

After the grazing period, cattle were moved to a finishing facility, implanted with Synovex-S (Pfizer Animal Health, Madison, NJ), and fed a diet of 80% whole-shelled corn, 15% corn silage, and 5% supplement (dry matter basis). Cattle that received no supplement or were supplemented with DDG while grazing were fed a finishing diet for 119 or 99 days and for 112 or 98 days, respectively, in 2009 and 2011, and for 106 days in 2010. All steers were slaughtered in a commercial facility, and carcass data were collected.

Results and Discussion

Because no significant interactions occurred ($P > 0.05$) between cultivar and supplementation treatment, grazing and subsequent finishing performance are pooled across supplementation treatment and presented by tall fescue cultivar in Tables 1, 2, and 3 for 2009, 2010, and 2011, respectively, and by supplementation treatment in Tables 4, 5, and 6 for 2009, 2010, and 2011, respectively.

During all three years, steers that grazed pastures of low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' gained significantly more ($P < 0.05$) and produced more ($P < 0.05$) gain/a than those that grazed high-endophyte 'Kentucky 31' pastures (Tables 1, 2, and 3). Gains of cattle that grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' were similar ($P > 0.05$). Daily gains of steers grazing pastures with high-endophyte 'Kentucky 31,' low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' were 1.70, 2.35, 2.25, and 2.33 lb/head, respectively, in 2009; 1.56, 1.91, 1.97, and 2.04 lb/head, respectively, in 2010; and 1.47, 2.00, 1.96, and 1.95 lb/head, respectively, in 2011. Gain/a from pastures with high-endophyte 'Kentucky 31,' low-endophyte 'Kentucky 31,' 'HM4,' and 'MaxQ' were 318, 438, 415, and 428 lb/a, respectively, in 2009; 322, 390, 400, and 416 lb/a, respectively, in 2010; and 288, 385, 377, and 378 lb/a, respectively, in 2011.

In 2009, subsequent finishing gains and feed efficiency were similar ($P > 0.05$) among fescue cultivars (Table 1). Steers that previously grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' maintained their weight advantage through the finishing phase and had greater ($P < 0.05$) final finishing weights, hot carcass weights, overall gains, and overall daily gains than those that previously grazed high-endophyte 'Kentucky 31.' Final finishing weights, hot carcass weights, overall gains, and overall daily gains were similar ($P > 0.05$) among steers that previously grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ.' Backfat thickness and percentage of carcasses grading choice or higher were similar ($P > 0.05$) among fescue cultivars.

In 2010, steers that previously grazed high-endophyte 'Kentucky 31' had greater ($P < 0.05$) finishing gains than those that had grazed 'HM4' or 'MaxQ,' finishing gains similar ($P > 0.05$) to those that grazed low-endophyte 'Kentucky 31,' lower ($P < 0.05$) hot carcass weight than those that grazed 'MaxQ,' hot carcass weight similar ($P > 0.05$) to those that grazed low-endophyte 'Kentucky 31' or 'HM4,' and less ($P < 0.05$) fat thickness than those that grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' (Table 2). Feed:gain and percentage of carcasses grading choice or higher were similar ($P > 0.05$) among fescue cultivars. Overall gain of steers that grazed high-endophyte 'Kentucky 31' was greater ($P < 0.05$) than that of steers that grazed low-endophyte 'Kentucky 31' or 'MaxQ' and similar ($P > 0.05$) to that of steers that grazed 'HM4.'

In 2011, steers that previously grazed high-endophyte 'Kentucky 31' had greater ($P < 0.05$) finishing gains and lower ($P < 0.05$) feed:gain than those that had grazed low-endophyte 'Kentucky 31' or 'HM4' and lower ($P < 0.05$) hot carcass weight and smaller ($P < 0.05$) ribeye area than those that grazed 'MaxQ' (Table 3). Hot carcass weight, ribeye area, and overall gain and daily gain were similar ($P < 0.05$) between steers that grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ.' Steers that previously grazed high-endophyte 'Kentucky 31' had lower ($P < 0.05$) overall gain and daily gain than steers that grazed 'HM4' or 'MaxQ.'

Steers supplemented with DDG gained significantly more ($P < 0.05$) and produced more ($P < 0.05$) gain/a than those that received no supplement while grazing (Tables 4,5, and 6). Grazing gains and gain/a of steers that received no supplement and those that were supplemented with DDG were 1.71 and 2.61 lb/head daily and 343 and 525 lb/a, respectively, in 2009; 1.62 and 2.12 lb/head daily and 363 and 475 lb/a, respectively, in 2010; and 1.46 and 2.23 lb/head daily and 246 and 469 lb/a, respectively, in 2011. Supplemented steers consumed an average of 7.8, 6.0, and 5.9 lb of DDG/head daily during the grazing phase in 2009, 2010, and 2011, respectively. Each additional pound of gain obtained from pastures with supplemented steers required 6.5, 7.2, and 5.6 lb of DDG in 2009, 2010, and 2011, respectively. Steers that were supplemented during the grazing phase had greater ($P < 0.05$) final finishing weights, hot carcass weights, overall gain, and overall daily gain than those that received no supplement while grazing during all three years. Daily gain, feed efficiency, yield grade, marbling score, and percentage of carcasses grading choice or higher were similar ($P > 0.05$) between supplementation treatments in 2009; however, in 2010 and 2011, steers supplemented with DDG while grazing had lower ($P < 0.05$) finishing gains than those that received no supplement while grazing.

Average available forage dry matter is presented for each fescue cultivar and supplementation treatment combination for 2009, 2010, and 2011 in Tables 7, 8, and 9, respectively. A significant interaction occurred ($P < 0.05$) between cultivar and supplementation treatment during all three years. Within each variety, there was no difference ($P > 0.05$) in average available forage dry matter between pastures stocked with 0.8 steer/a that received no supplement and those stocked with 1.0 steer/a and supplemented with DDG at 1.0% body weight per head daily in 2009 (Table 7). Average available forage dry matter was similar ($P > 0.05$) between supplementation treatments and pastures with supplemented steers stocked at a heavier rate, which indicates that pastures were responding to the N that was being returned to the soil from steers consuming DDG, or cattle supplemented with DDG were consuming less forage, or both. High-endophyte 'Kentucky 31' pastures with or without DDG supplementation had greater ($P < 0.05$) average available forage dry matter than 'MaxQ' pastures without supplementation. No other differences in average available forage dry matter were observed.

In 2010, no difference occurred ($P > 0.05$) in average available forage dry matter within variety for high-endophyte 'Kentucky 31,' low-endophyte 'Kentucky 31,' or 'HM4' pastures stocked with 0.8 steer/a that received no supplement and those stocked with 1.0 steer/a and supplemented with DDG at 0.75% body weight per head daily (Table 8); however, 'MaxQ' pastures that were stocked at the heavier rate and grazed by steers supplemented with DDG had greater ($P < 0.05$) average available forage dry matter than those stocked at a lighter rate and grazed by steers that received no supplement. High-endophyte 'Kentucky 31' pastures had greater ($P < 0.05$) average available dry matter than low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' pastures stocked with 0.8 steer/a that received no supplement.

In 2011, no difference occurred ($P > 0.05$) in average available forage dry matter within variety for low-endophyte 'Kentucky 31,' or 'HM4' pastures stocked with 0.8 steer/a that received no supplement and those stocked with 1.0 steer/a and supplemented with DDG at 0.75% body weight per head daily (Table 9), but 'MaxQ' pastures that were stocked at the heavier rate and grazed by steers supplemented with DDG had greater ($P < 0.05$) average available forage dry matter than those stocked at a lighter rate and grazed by steers that received no supplement. High-endophyte 'Kentucky 31' pastures that were stocked at the heavier rate and grazed by steers supplemented with DDG had lower ($P < 0.05$) average available forage dry matter than those stocked at a lighter rate. High-endophyte 'Kentucky 31' pastures had greater ($P < 0.05$) average available dry matter than low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' pastures stocked with 0.8 steer/a that received no supplement.

Grazing gains and overall gains of steers that grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' were similar ($P > 0.05$) and significantly greater ($P < 0.05$) than those of steers that grazed high-endophyte 'Kentucky 31.' Supplementation of grazing steers with DDG resulted in greater ($P < 0.05$) grazing gains, supported a higher stocking rate, resulted in greater ($P < 0.05$) gain/a, and reduced the amount of fertilizer needed by providing approximately 50 to 60 lb of N/a. Producers seeking to maximize production from fescue pastures should consider using one of the new fescue varieties with the novel endophyte in combination with DDG supplementation.

Table 1. Effects of cultivar on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2009

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (201 days)				
No. of head	17	18	17	18
Initial weight, lb	571	569	566	569
Ending weight, lb	913a	1042b	1019b	1038b
Gain, lb	342a	473b	453b	468b
Daily gain, lb	1.70a	2.35b	2.25b	2.33b
Gain/a, lb	318a	438b	415b	428b
Finishing phase (109 days)				
Beginning weight, lb	913a	1042b	1019b	1038b
Ending weight, lb	1285a	1381b	1366b	1376b
Gain, lb	372	339	347	338
Daily gain, lb	3.41	3.11	3.20	3.10
Daily dry matter intake, lb	24.4	24.1	24.1	24.9
Feed:gain	7.18	7.81	7.57	8.11
Hot carcass weight, lb	759a	820b	810b	811b
Backfat, in.	0.43	0.43	0.44	0.47
Ribeye area, sq. in.	11.9a	11.9a	12.5b	11.7a
Yield grade[1]	2.6a	3.0b	2.8a	3.0b
Marbling score[2]	601a	646ab	672bc	717c
Percentage USDA grade choice	95	100	95	100
Overall performance (grazing plus finishing) (310 days)				
Gain, lb	714a	812b	800b	807b
Daily gain, lb	2.31a	2.63b	2.59b	2.61b

[1] USDA (1987).

[2] 600 = modest, 700 = moderate, 800 = slightly abundant.

Means within a row followed by the same letter do not differ ($P < 0.05$).

Table 2. Effects of cultivar on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2010

Item	Tall fescue cultivar			
	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (224 days)				
No. of head	18	18	18	18
Initial weight, lb	550	550	550	550
Ending weight, lb	899a	978b	990b	1007b
Gain, lb	349a	428b	441b	457b
Daily gain, lb	1.56a	1.91b	1.97b	2.04b
Gain/a, lb	322a	390b	400b	416b
Finishing phase (106 days)				
Beginning weight, lb	899a	978b	990b	1007b
Ending weight, lb	1386a	1432b	1419b	1449b
Gain, lb	486a	454ab	429b	442b
Daily gain, lb	4.59a	4.28ab	4.04b	4.17b
Daily dry matter intake, lb	25.8	26.0	25.7	26.0
Feed:gain	5.63	6.10	6.37	6.24
Hot carcass weight, lb	812a	849ab	840ab	861b
Dressing percentage	58.6	59.3	59.2	59.4
Backfat, in.	0.37a	0.48b	0.44b	0.45b
Ribeye area, sq. in.	12.0	12.2	12.2	12.4
Yield grade[1]	2.7	2.9	2.8	2.8
Marbling score[2]	660ab	676a	630b	648ab
Percentage USDA grade choice	100	94	94	100
Overall performance (grazing plus finishing) (330 days)				
Gain, lb	836a	882b	869ab	899b
Daily gain, lb	2.53a	2.67b	2.63ab	2.72b

[1] USDA (1987).

[2] 600 = modest, 700 = moderate.

Means within a row followed by the same letter do not differ ($P < 0.05$).

Table 3. Effects of cultivar on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2011

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (210 days)				
No. of head	18	18	18	18
Initial weight, lb	536	536	536	536
Ending weight, lb	845a	956b	947b	946b
Gain, lb	310a	420b	411b	410b
Daily gain, lb	1.47a	2.00b	1.96b	1.95b
Gain/a, lb	288a	385b	377b	378b
Finishing phase (105 days)				
Beginning weight, lb	845a	956b	947b	946b
Ending weight, lb	1310a	1369ab	1374ab	1401b
Gain, lb	465a	412b	427bc	455ac
Daily gain, lb	4.42a	3.93b	4.05bc	4.33ac
Daily dry matter intake, lb	27.0ab	27.2ab	26.7a	27.8b
Feed:gain	6.12a	6.94b	6.62bc	6.43ac
Hot carcass weight, lb	812a	849ab	852ab	869b
Dressing percentage	59.9ab	59.5b	60.4a	60.5a
Backfat, in.	0.39a	0.46ab	0.45ab	0.50b
Ribeye area, sq. in.	12.7a	13.0ab	13.1ab	13.3b
Yield grade[1]	2.5	2.8	2.8	2.8
Marbling score[2]	646ab	620a	687b	654ab
Percentage USDA grade choice	100	100	100	100
Overall performance (grazing plus finishing) (315 days)				
Gain, lb	774a	833ab	839b	865b
Daily gain, lb	2.46a	2.65ab	2.66b	2.75b

[1] USDA (1987).
[2] 600 = modest, 700 = moderate.
Means within a row followed by the same letter do not differ ($P < 0.05$).

Table 4. Effects of dried distillers grains (DDG) supplementation on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2009

	DDG level (% body weight/head per day)	
Item	0	1.0
Grazing phase (201 days)		
No. of head	30	40
Initial weight, lb	569	569
Ending weight, lb	911a	1095b
Gain, lb	343a	525b
Daily gain, lb	1.71a	2.61b
Gain/a, lb	274a	525b
Total DDG consumption, lb/head	---	1628
Average DDG consumption, lb/head per day	---	7.8
DDG, lb/additional gain, lb	---	6.5
Finishing phase		
No. of days	119	99
Beginning weight, lb	911a	1095b
Ending weight, lb	1289a	1415b
Gain, lb	378a	320b
Daily gain, lb	3.17	3.23
Daily dry matter intake, lb	24.6	24.2
Feed:gain	7.80	7.54
Hot carcass weight, lb	768a	832b
Dressing percentage	59.6	58.8
Backfat, in.	0.43	0.45
Ribeye area, sq. in.	11.7a	12.3b
Yield grade	2.8	2.9
Marbling score[1]	638	680
Percentage USDA grade choice	100	95
Overall performance (grazing plus finishing)		
No. of days	320	300
Gain, lb	721a	846b
Daily gain, lb	2.25a	2.82b

[1] 600 = modest, 700 = moderate.
Means within a row followed by the same letter do not differ ($P < 0.05$).

Table 5. Effects of dried distillers grains (DDG) supplementation on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2010

	DDG level (% body weight/head per day)	
Item	0	0.75
Grazing phase (224 days)		
No. of head	32	40
Initial weight, lb	550	550
Ending weight, lb	912a	1025b
Gain, lb	363a	475b
Daily gain, lb	1.62a	2.12b
Gain/a, lb	290a	475b
Total DDG consumption, lb/head	---	1335
Average DDG consumption, lb/head per day	---	6.0
DDG, lb/additional gain, lb	---	7.2
Finishing phase (106 days)		
Beginning weight, lb	912a	1025b
Ending weight, lb	1378a	1464b
Gain, lb	466a	439b
Daily gain, lb	4.40a	4.15b
Daily dry matter intake, lb	26.2	25.6
Feed:gain	5.99	6.18
Hot carcass weight, lb	806a	875b
Dressing percentage	58.5a	59.7b
Backfat, in.	0.39a	0.47b
Ribeye area, sq. in.	12.1	12.2
Yield grade	2.6	3.0
Marbling score[1]	638a	669b
Percentage USDA grade choice	94	100
Overall performance (grazing plus finishing) (330 days)		
Gain, lb	829a	914b
Daily gain, lb	2.51a	2.77b

[1] 600 = modest, 700 = moderate.

Means within a row followed by the same letter do not differ ($P < 0.05$).

Table 6. Effects of dried distillers grains (DDG) supplementation on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2011

	DDG level (% body weight/head per day)	
Item	0	0.75
Grazing phase (210 days)		
No. of head	32	40
Initial weight, lb	536	536
Ending weight, lb	843a	1005b
Gain, lb	307a	469b
Daily gain, lb	1.46a	2.23b
Gain/a, lb	246a	469b
Total DDG consumption, lb/head	---	1240
Average DDG consumption, lb/head per day	---	5.9
DDG, lb/additional gain, lb	---	5.6
Finishing phase		
No. of days	112	98
Beginning weight, lb	943a	1005b
Ending weight, lb	1324a	1403b
Gain, lb	481a	498b
Daily gain, lb	4.30a	4.07b
Daily dry matter intake, lb	27.3	27.1
Feed:gain	6.38	6.68
Hot carcass weight, lb	821a	870b
Backfat, in.	0.46	0.44
Ribeye area, sq. in.	12.7a	13.3b
Yield grade	2.8	2.6
Marbling score[1]	644	659
Percentage USDA grade choice	100	100
Overall performance (grazing plus finishing)		
No. of days	322	308
Gain, lb	788a	867b
Daily gain, lb	2.45a	2.82b

[1] 600 = modest, 700 = moderate.
Means within a row followed by the same letter do not differ ($P < 0.05$).

Table 7. Effects of tall fescue cultivar and dried distillers grains (DDG) supplementation on average available forage dry matter, Southeast Agricultural Research Center, 2009

	DDG level (% body weight/head per day)	
Tall fescue cultivar	0	1.0
	--------------------- lb/a ---------------------	
High-endophyte Kentucky 31	5,593a	5,564a
Low-endophyte Kentucky 31	5,135ab	5,052ab
HM4	5,193ab	5,146ab
MaxQ	4,762b	5,527ab

Means followed by the same letter do not differ ($P < 0.05$).

Table 8. Effects of tall fescue cultivar and dried distillers grains (DDG) supplementation on average available forage dry matter, Southeast Agricultural Research Center, 2010

	DDG level (% body weight/head per day)	
Tall fescue cultivar	0	0.75
	--------------------- lb/a ---------------------	
High-endophyte Kentucky 31	6,553a	6,253ab
Low-endophyte Kentucky 31	5,791cd	5,675cd
HM4	5,884cd	5,617d
MaxQ	5,668d	5,984bc

Means followed by the same letter do not differ ($P < 0.05$).

Table 9. Effects of tall fescue cultivar and dried distillers grains (DDG) supplementation on average available forage dry matter, Southeast Agricultural Research Center, 2011

	DDG level (% body weight/head per day)	
Tall fescue cultivar	0	0.75
	--------------------- lb/a ---------------------	
High-endophyte Kentucky 31	5,313a	4,861b
Low-endophyte Kentucky 31	4,426c	4,439c
HM4	4,535c	4,468c
MaxQ	4,486c	4,939b

Means followed by the same letter do not differ ($P < 0.05$).

Using Legumes in Wheat-Bermudagrass Pastures

J.L. Moyer and L.W. Lomas

Summary
Using legumes in lieu of 100 lb/a of nitrogen (N) for wheat-bermudagrass pastures previously has maintained spring and summer cow gains. A winter legume could further increase N available for summer bermudagrass production, so hairy vetch as well as wheat were interseeded in fall to supplement summer clover production. Although forage production and estimated forage crude protein increased in legume pasture, photosensitivity to hairy vetch developed in three of the 16 cows that grazed these pastures. Otherwise, cow performance was similar between the two treatments.

Introduction
Bermudagrass is a productive forage species when intensively managed, but it has periods of dormancy and requires proper management to maintain forage quality. Bermudagrass also requires adequate N fertilizer to optimize forage yield and quality. Interseeding wheat or other small grains can lengthen the grazing season, but this requires additional N fertilization. Legumes in the bermudagrass sward could improve forage quality and reduce fertilizer usage, but legumes are difficult to establish and maintain with the competitive grass. Clovers can maintain summer survival once established in bermudagrass sod and may be productive enough to substitute for some N fertilization. Including a winter annual legume with wheat could produce more N and forage crude protein. This study was designed to compare dry cow performance on a wheat-bermudagrass pasture system that included spring and summer legume with a single 50 lb/a N application (Legumes) vs. wheat-bermudagrass with additional N applications of 100 lb/a and no legumes (Nitrogen).

Experimental Procedures
Eight 5-acre 'Hardie' bermudagrass pastures that were interseeded with wheat at the Mound Valley Unit of the Southeast Agricultural Research Center (Parsons silt loam soil) were assigned to Legume or Nitrogen treatments in a completely randomized design with four replications.

All pastures were interseeded (no-till) with 'Fuller' wheat (90 lb/a) into the bermudagrass sod on September 20 and 21, 2010, immediately after the four designated pastures were interseeded with hairy vetch (20 lb/a). White clover was abundant in legume pastures throughout the previous summer, so no additional seeding was deemed necessary. Pastures that received no legumes (Nitrogen) were fertilized with 50 lb/a N as urea each on January 26 and May 6, 2011. All pastures received 50-30-30 of N-P_2O_5-K_2O on July 1.

Thirty-two pregnant fall-calving cows of predominantly Angus breeding were weighed on consecutive days and assigned randomly by weight to pastures on March 31. On May 26, one cow from each of two legume pastures showed symptoms of photosensitivity, presumably from grazing the abundant hairy vetch, and were removed. A cow from a third legume pasture was removed June 10 for the same reason. Legume pastures were clipped with a rotary mower to 3- to 4-in. height about June 1 to terminate hairy vetch growth. Three cows replaced those removed on June 15, and all cows grazed until August 18 (140 days), when they were weighed on consecutive days and removed prior to calving.

Available forage and forage crude protein (CP), as estimated by the normalized difference vegetation index (NDVI), were monitored monthly during grazing with an automated rising plate meter and Greenseeker (Trimble, Sunnyvale, CA) instrument, respectively.

Results and Discussion

Average available forage was higher ($P < 0.05$) for the Legume than the Nitrogen system for two of the mid-season sampling times (Figure 1). Estimated CP concentration was higher in pastures with Legume vs. Nitrogen treatments prior to clipping the hairy vetch, but CP for the Nitrogen system was higher in July, after N fertilizer was applied. This was probably related to reduced clover production due to droughty conditions.

Cow gains during the season were similar for the Legume and Nitrogen systems (Table 1, $P > 0.10$), averaging 2.2 lb/head per day. The difference in cow gain per acre apparently was not affected by the slight reduction in animal grazing days when sensitized cows were removed.

Hollis and van de Merwe (see “Hairy Vetch Toxicity,” MF-2948, 2010; available at http://www.ksre.ksu.edu/library/lvstk2/mf2948.pdf) have described the risks and symptoms of toxicity that can occur when hairy vetch is grazed by older cattle, perhaps cumulatively. Despite the benefit that occurred from such a system on those pastures from 2000 to 2002, the risk of developing photosensitivity will prevent further trials with hairy vetch.

Table 1. Performance of cows grazing wheat-bermudagrass pastures interseeded with wheat and fertilized with nitrogen or interseeded with legumes, Mound Valley Unit, Southeast Agricultural Research Center, 2011

	Management system[1]	
Item	Nitrogen[2]	Legumes
No. of cows	16	16[3]
No. of days	140	140
Stocking rate, cows/a	0.8	0.8[3]
Cow initial weight, lb	1207	1210
Cow final weight, lb	1512	1521
Cow gain, lb	305	311
Cow daily gain, lb	2.18	2.22
Cow gain, lb/a	244	249

[1] None of the means within a row were significantly different at $P < 0.05$.
[2] Fertilized with 50 lb/a of N in February and May; both treatments received 50 lb N/a on July 1.
[3] One cow from each of two reps was removed on May 26 due to vetch toxicity. Another was removed on June 10. All three cows were replaced on June 15.

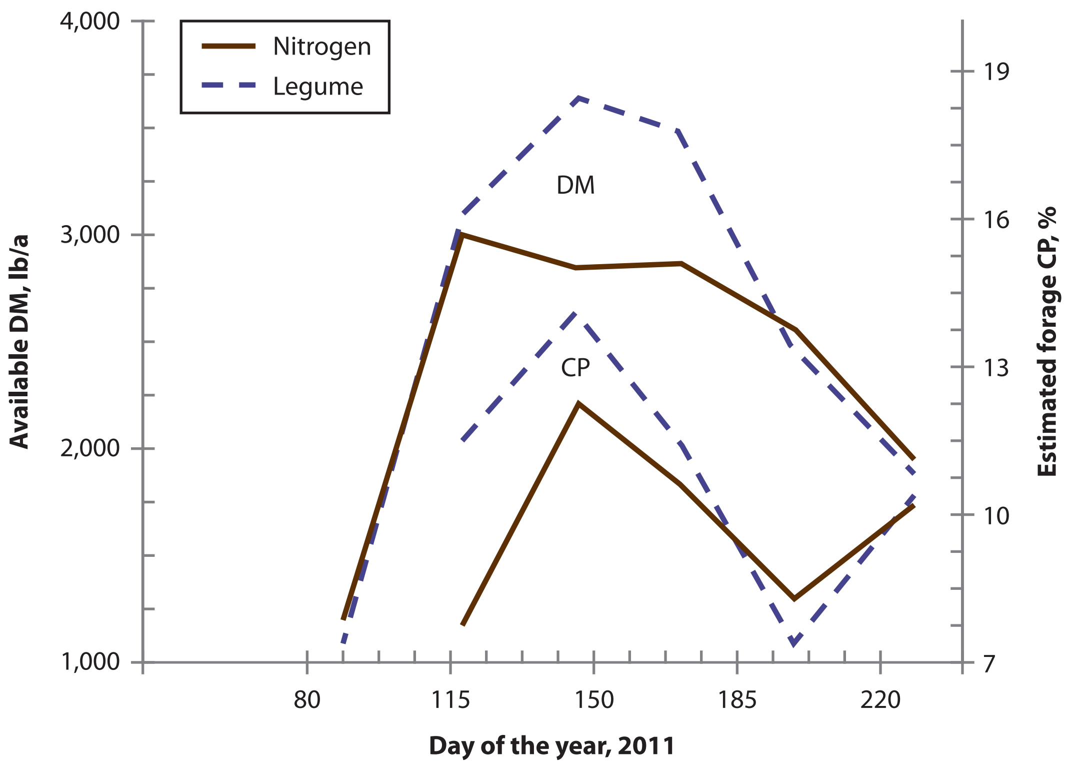


Figure 1. Available forage dry matter (DM) and estimated crude protein (CP) concentration during the grazing season in wheat-bermudagrass pastures fertilized with nitrogen or interseeded with legumes, Mound Valley Unit, Southeast Agricultural Research Center, 2011.

Alfalfa Variety Performance in Southeastern Kansas[1]

J.L. Moyer

Summary
A 16-line alfalfa test was seeded in 2010 and cut four times in 2011. Total 2011 yields from 'FSG639ST,' 'Ameristand 403T+,' and 'Vernal' were greater ($P < 0.05$) than yields from four other cultivars. Two-year production from 'FSG639ST' was greater than seven other entries.

Introduction
Alfalfa can be an important feed and cash crop on some soils in southeastern Kansas. The worth of a particular variety is determined by many factors including pest resistance, adaptability, longevity under specific conditions, and productivity.

Experimental Procedures
A 16-line alfalfa test with four replications was seeded (15 lb/a) on April 12, 2010, at the Mound Valley Unit of the Southeast Agricultural Research Center (Parsons silt loam). Plots were fertilized with 20-50-200 lb/a N-P_2O_5-K_2O each year. In 2011, harvests were taken on May 9, June 13, July 12, and August 23. Although some damage from late-summer infestations of blister beetles was noted, no pesticides were applied in 2011.

Results and Discussion
Dry growing conditions in June and July reduced yields, particularly after the second cutting. After the late-August cutting, regrowth was insufficient for an after-frost cutting.

First-cut yields (at 10% bloom) were significantly greater ($P < 0.05$) for 'Perry,' 'Vernal,' and 'Ameristand 403T+' than for seven other entries (Table 1). Second-cut yields were greater for 'FSG639ST' than for nine other entries. Although third- and fourth-cut yields were small because of drought, third-cut yield of 'FSG639ST' was greater than yields from eight other entries.

Total 2011 yield for 'FSG639ST,' 'AmeriStand 403T+,' and 'Vernal' was greater than yields from five other entries. Seven entries had higher 2010 yield than 'DKA50-18,' 'DG 4210,' and '6552.' Total yield for the two years was higher for 'FSG639ST' than for seven other entries.

[1] Statewide alfalfa performance tests results can be found at http://www.agronomy.ksu.edu/extension/p.aspx?tabid=91.

Table 1. Forage yields (tons/a at 12% moisture) for 2011, and 2-year total for the alfalfa variety test, Mound Valley Unit

		2011					
Source	Entry	May 9	June 13	July 12	August 23	Total	2-year total
		Tons/a, 12% moisture					
America's Alfalfa	AmeriStand 403T+	2.74	1.77	0.42	0.73	5.65	9.51
America's Alfalfa	AmeriStand 407TQ	2.58	1.77	0.50	0.74	5.58	9.61
America's Alfalfa	Archer III	2.31	1.61	0.45	0.67	5.03	8.75
Allied	FSG505 Bt	2.56	1.72	0.50	0.74	5.52	9.36
Allied	FSG408DP Bt	2.55	1.66	0.45	0.64	5.29	9.47
Allied	FSG639ST Bt	2.58	1.86	0.57	0.67	5.67	9.92
CPS	DG 4210	2.14	1.71	0.47	0.67	5.00	8.52
Farm Science Genetics	FSG 528SF	2.57	1.67	0.52	0.73	5.48	9.13
Garst Seed	6552	2.23	1.61	0.45	0.71	5.00	8.63
Monsanto Seed	DKA50-18	2.18	1.60	0.45	0.67	4.90	8.25
Syngenta	6422Q	2.21	1.83	0.50	0.69	5.24	8.99
W-L Research	WL 343 HQ	2.38	1.67	0.51	0.69	5.25	8.60
W-L Research	WL 363 HQ	2.23	1.68	0.50	0.72	5.13	9.10
Kansas AES[1] and USDA	Kanza	2.48	1.74	0.55	0.74	5.50	9.69
Nebraska AES and USDA	Perry	2.83	1.62	0.34	0.72	5.50	9.59
Wisconsin AES and USDA	Vernal	2.78	1.68	0.47	0.71	5.63	9.50
Average		2.46	1.70	0.48	0.70	5.33	9.16
LSD (0.05)		0.30	0.16	0.08	NS	0.49	0.80

[1] Agricultural Experiment Station.

Evaluation of Tall Fescue Cultivars

Joseph L. Moyer

Summary
Spring 2011 hay yields for the 2010 trial were higher for 'Martin 2–647' than for 13 of the 18 other entries. Later season production was greater for 'AGRFA-179' and 'AU Triumph' than for 'BAR FA80DH' and 'BAROptima Plus E34.' Total 2011 hay production was higher for 'Martin 2–647' than for 10 other entries. Total clipped forage removed was greater for 'PennTF01' than for 'BAR FA80DH' and for 'BAROptima Plus E34.'

Introduction
Tall fescue (*Lolium arundinacium* Schreb.) is the most widely grown forage grass in southeastern Kansas. Its tolerance to extremes in climate and soils of the region is partly attributable to its association with a fungal endophyte, *Neotyphodium coenophialum*; however, most ubiquitous endophytes are also responsible for production of substances toxic to some herbivores, including cattle, sheep, and horses. Endophytes that purportedly lack toxins but augment plant vigor have been identified and inserted into tall fescue cultivars adapted to the United States. These cultivars, and others that are fungus-free or contain a ubiquitous endophyte, are included in this test.

Experimental Procedures
The trial was seeded at the Mound Valley Unit of the Southeast Agricultural Research Center in 10-in. rows on Parsons silt loam soil. Plots were 50 ft by 5 ft and were arranged in four randomized complete blocks. They were fertilized preplant with 20-50-60 lb/a of N-P_2O_5-K_2O and seeded with 20 lb/a of pure, live seed on September 22, 2010. Spring nitrogen (N) (60 lb/a) was applied on March 17, 2011. Fall growth was supplemented with 50 lb/a of N on August 31.

To simulate grazing, half of each 50-ft plot was clipped to ≤2 in. on April 8, April 14, May 4, May 31, September 27, and December 6 with a rotary mower after some growth (>4 in.) was attained. The other half was left to harvest for hay yield. Prior to clipping, we estimated the amount removed from two plate meter readings per plot.

Harvest was performed on a 3-ft-wide and 15- to 20-ft-long strip from the remainder of each plot. A flail-type harvester was used to cut a 3-in. height after all plots had bloomed (May 31, 2011). Regrowth that occurred primarily in fall was harvested on December 8, 2011. After each harvest, forage was removed from the rest of the plot at the same height. A forage subsample was collected from each plot and dried at 140°F for moisture determination, then ground to pass a 1-mm screen for forage analysis.

Results and Discussion
Spring 2011 forage yield of entries was greater ($P < 0.05$) for 'Martin 2–647' than for 13 of the other 17 entries (Table 1). 'PennTF01' yielded more than seven of the other entries, whereas 'AGRFA-111' produced less forage than 11 higher-yielding entries.

Forage production during the rest of the season (May 31 through December 8) was greater for 'AGRFA-179' and 'AU Triumph' than for 'BAR FA80DH' and 'BAR-Optima Plus E34.'

Total 2011 production was higher for 'Martin 2–647' than for 13 of the other entries, eight of which were the same as for spring yields. 'Penn TF01' yielded more than 10 of the other entries, whereas 'AGRFA-111' again produced the least amount of forage, less than eight other entries. Total clipped forage removed (Table 1) was greater for 'PennTF01' than for 'BARFa80DH' and 'BAROptima Plus E34.'

Crude protein concentration was higher in spring-cut forage for 'AGRFA-111' than for six other entries (Table 1). 'PennTF01' had lower forage crude protein than 10 other entries. 'Bariane' bloomed later than 12 other entries. Conversely, average bloom dates for 'Drover' and 'AU Triumph' were earlier than those of all other entries, but we found no correlation ($P > 0.05$) between bloom date and any yield parameters in this test.

Table 1. Forage Yield, First-Cut Crude Protein (CP), and Bloom Date of Tall Fescue Cultivars Seeded in 2010, Mound Valley Unit

	Forage yield					
Cultivar	May 31	Dec. 8	2011 total	Clipped[1]	CP	Bloom date
	----------- Tons/a, 12% moisture -----------				--- % ---	(Julian)
BarOptima PLUS E34	3.86	0.47	4.33	2.22	8.5	139
Bar Elite	3.41	0.66	4.08	2.54	9.8	142
Bardurum	3.59	0.68	4.26	2.64	9.6	142
Drover	3.46	0.66	4.12	2.64	8.1	129
BAR FA 70DH	3.86	0.53	4.39	2.61	9.5	141
BAR FA 80DH	3.83	0.40	4.22	2.13	9.3	139
Bariane	3.38	0.59	3.97	2.36	9.6	144
DuraMax GOLD	4.03	0.66	4.68	2.60	8.5	136
Martin 2 647	4.32	0.55	4.86	2.81	8.4	137
AGRFA 111	3.27	0.64	3.91	2.39	10.3	140
AGRFA 177	3.78	0.64	4.43	2.55	9.1	140
AGRFA 178	3.77	0.56	4.32	2.44	8.7	140
AGRFA 179	3.45	0.73	4.18	2.30	9.1	141
Jesup MaxQ	3.99	0.57	4.56	2.67	9.2	137
PennTF01	4.17	0.62	4.79	2.87	7.0	140
AU Triumph	3.58	0.69	4.27	2.40	8.0	131
Ky 31 HE	4.08	0.66	4.74	2.84	9.0	140
Ky 31 LE	3.79	0.58	4.37	2.52	9.8	138
Average	3.75	0.60	4.36	2.53	9.0	138[2]
LSD (0.05)	0.42	0.22	0.43	0.65	1.8	4

[1] Sum of six clippings during the season, with yield estimated from disk meter readings.
[2] Average bloom date, Julian day 138, was May 18.

Establishing Legumes in Tall Fescue

J.L. Moyer

Summary
Legume interseeding trials in tall fescue were performed in 2010 and 2011 to test two methods of grass suppression and pest control on seedling establishment.

Introduction
Legumes have shown several advantages in grass pastures. Because they can incorporate atmospheric nitrogen (N), less N fertilizer is required. Legumes also generally increase forage nutritive value over grass alone, and their summer-oriented production tends to provide a more uniform seasonal distribution of forage than cool-season grass alone. Despite the benefits of pasture legumes, managers have not widely used legumes because of problems assuring legume establishment and persistence. Difficulties of establishment have been attributed to poor seedling vigor in a grass stand, disease, insect damage, heat and drought stress, winter heaving, and poor survival under continuous grazing. This study was designed to determine the effects of grass suppression and pest management on establishment of several legumes.

Experimental Procedures
Legume species were separately interseeded into endophyte-infected tall fescue at the Mound Valley Unit in four replicated, randomized strips. Seeding dates for the experiment were April 20, 2010, and April 18, 2011, at the rates listed in Table 1. These rates vary primarily according to seed size, such that smaller-seeded species are seeded at a lower rate. The seeded strips were split into sub-subplots to determine the effects of pesticide and grass suppression on legume establishment, as described in Table 2. In 2010, legume seedling counts were made on May 18 and June 1 and 17, corresponding to 28, 42, and 58 days after planting (DAP), respectively. In 2011, seedling counts were made on May 10, June 7, and July 7, corresponding to 22, 50, and 80 DAP, respectively.

Results and Discussion
Pesticide treatments had no effect on legume seedling density in either 2010 or 2011 (data not shown). Grass suppression by clipping increased legume seedling density at the latest count in 2010 (Table 3), but glyphosate treatment had no significant benefit, and neither approach had an effect in 2011.

Red clover seedling density was higher than that of the other legumes, except lespedeza, at 28 and 42 DAP in 2010 (Table 4); however, by June 17, red clover density was higher than density of only white clover. Korean lespedeza, an annual legume, had greater seedling density than white clover and birdsfoot trefoil at each count in 2010, and was also higher than red clover density at the last count, but it was not included in 2011.

In 2011, seedling density was higher for red clover than for all other species until 80 DAP (Table 5). At 80 DAP, birdsfoot trefoil had a similar density, which was higher than those of alfalfa and white clover. All species appeared to decline in seedling density by the latest seedling count in both years.

Species comparisons may be indicative of establishment success, but must be interpreted along with other factors. Populations that could result in productive stands vary according to species' growth habits. For example, red clover, a biennial with an upright, bunch-type growth habit, may require a higher population to be acceptable than white clover, a perennial that can propagate itself vegetatively by stolons.

Table 1. Legumes and rates (pure, live seed) that were interseeded into endophyte-infected tall fescue in 2010 and 2011, Mound Valley Unit, Southeast Agricultural Research Center

Legume	Species	Cultivar	Seeding rate
			lb/a
Alfalfa	*Medicago sativa*	Stampede	15
Red clover	*Trifolium pretense*	Cinnamon Plus	15
Birdsfoot trefoil	*Lotus corniculatus*	Norcen	8
White (ladino) clover	*Trifolium repens*	Pinnacle	4
Korean lespedeza[1]	*Lespedeza stipulacea*	Common	15

[1] Seeded in 2010 only.

Table 2. Pesticide protection and fescue suppression treatments to enhance legume establishment into endophyte-infected tall fescue in 2010 and 2011, Mound Valley Unit, Southeast Agricultural Research Center

Treatment	Material	Application date	Rate
Pesticide	*Fungicide*		
	Apron Maxx	Seed treatment	
	Headline foliar spray	May 21, 2010, and May 24, 2011	9 oz/a
	Insecticide		
	Cruiser	Seed treatment	
	Lorsban foliar spray	May 21, 2010, and May 24, 2011	24 oz/a
Fescue suppression	Glyphosate	April 8, 2010, and April 11, 2011	2.7 oz a.i./a
	Clipping	April 9 and 29 and May 24, 2010; April 11 and May 17, 2011	- - -

Table 3. Legume seedling density in tall fescue in 2010 as affected by grass suppression treatments

	Days after planting		
Treatment	28	42	58
	---------------------------- Seedlings/ft^2 ----------------------------		
No suppression	19.3	19.5	12.6
Clipping	22.0	25.4	19.4
Glyphosate	20.2	19.9	15.6
LSD (0.05)	NS	NS	5.2

Table 4. Seedling density of legumes interseeded into tall fescue in 2010

	Days after planting		
Legume	28	42	58
	---------------------------- Seedlings/ft^2 ----------------------------		
Alfalfa	19.3	20.0	12.7
Red clover	27.2	28.3	16.4
Birdsfoot trefoil	13.7	15.1	13.2
White (ladino) clover	14.2	13.0	8.7
Korean lespedeza[1]	28.3	31.7	28.3
LSD (0.05)	4.0	5.1	4.5

[1] Seeded in 2010 only.

Table 5. Seedling density of legumes interseeded into tall fescue in 2011

	Days after planting		
Legume	22	50	80
	---------------------------- Seedlings/ft^2 ----------------------------		
Alfalfa	17.9	8.6	4.2
Red clover	27.4	18.3	9.1
Birdsfoot trefoil	18.6	13.1	11.9
White (ladino) clover	20.8	10.8	3.3
LSD (0.05)	3.6	2.6	4.8

Tillage and Nitrogen Placement Effects on Yields in a Short-Season Corn/Wheat/Double-Crop Soybean Rotation

D.W. Sweeney and K.W. Kelley

Summary
In 2011, hot and dry conditions resulted in very low overall corn yields. Nitrogen (N) placement method did not affect corn yields. Adding N increased yields in the reduced and no-till systems, but not in the conventional tillage system.

Introduction
Many crop rotation systems are used in southeastern Kansas. This experiment is designed to determine the long-term effects of selected tillage and N fertilizer placement options on yields of short-season corn, wheat, and double-crop soybean in rotation.

Experimental Procedures
A split-plot design with four replications was initiated in 1983 with tillage system as the whole plot and N treatment as the subplot. In 2005, the rotation was changed to begin a short-season corn/wheat/double-crop soybean sequence. Use of three tillage systems (conventional, reduced, and no-till) continued in the same areas used during the previous 22 years. The conventional system consists of chiseling, disking, and field cultivation. Chiseling occurs in the fall preceding corn or wheat crops. The reduced-tillage system consists of disking and field cultivation prior to planting. Glyphosate (Roundup) is applied to the no-till areas. The four N treatments for the crop are: no N (control), broadcast urea-ammonium nitrate (UAN; 28% N) solution, dribble UAN solution, and knife UAN solution at 4 in. deep. The N rate for the corn crop grown in odd years is 125 lb/a. Corn was planted on April 12, 2011.

Results and Discussion
In 2011, hot and dry conditions resulted in very low corn yields of less than 35 bu/a for any treatment (Figure 1). Broadcast, dribble, and knife application of N fertilizer produced similar yields that were more than 60% greater than with the no-N control in reduced and no-till systems. However, in the conventional tillage system where corn yield was less than 24 bu/a, N fertilization, regardless of application method, did not result in yield greater than that obtained with the no-N control.

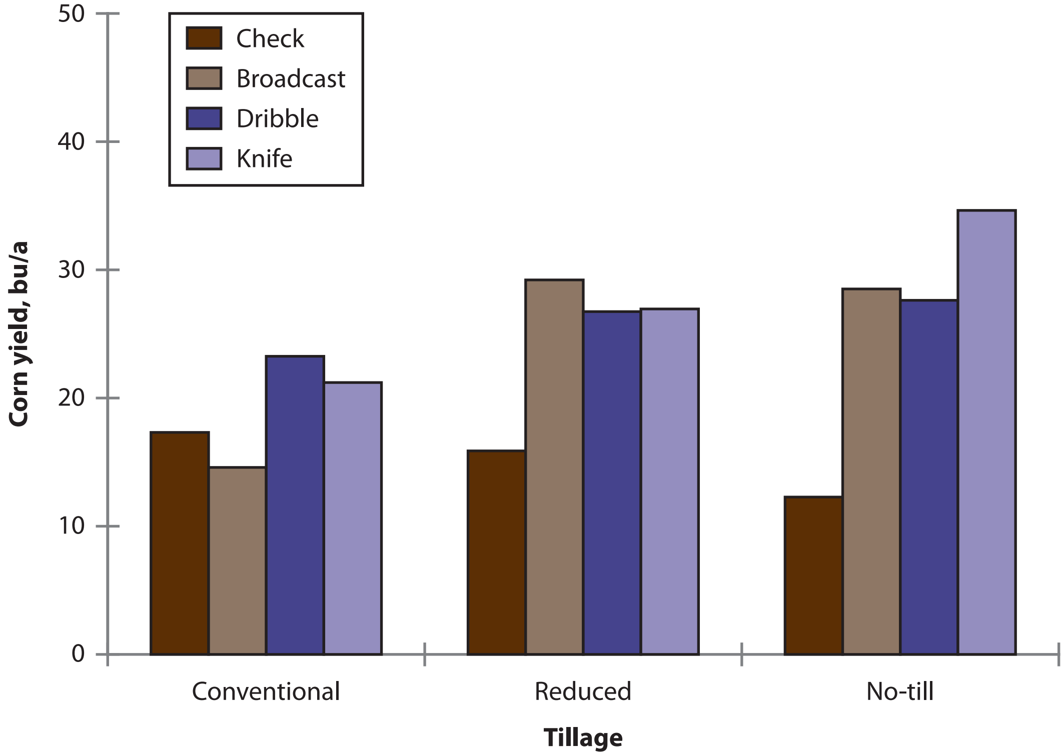


Figure 1. Effect of tillage and nitrogen placement on short-season corn yield in 2011.

Seeding Rates and Fertilizer Placement to Improve Strip-Till and No-Till Corn[1]

D.W. Sweeney and K.W. Kelley

Summary
In 2011, hot and dry conditions resulted in very low corn yields. Under these stressful environmental conditions, corn yield was reduced with increasing seeding rate, was increased by subsurface band (knife) applications, and was not affected by tillage system.

Introduction
Use of conservation tillage systems is promoted because of environmental concerns. In the claypan soils of southeastern Kansas, crops grown with no-till may yield less than crops grown in systems involving some tillage operation, often because of reduced plant emergence. Strip tillage provides a tilled seed-bed zone where early spring soil temperatures might be greater than those in no-till soils. But like no-till, strip tillage leaves residues intact between the rows as a conservation measure. Optimizing seeding rates for different tillage systems should improve corn stands and yields.

Experimental Procedures
In 2011, the experiment was conducted at the Mound Valley Unit (Site 1) and the Parsons Unit (Site 2) of the Southeast Agricultural Research Center. The experimental design was a split-plot arrangement of a randomized complete block with three replications. The whole plots were three tillage systems: conventional, strip tillage, and no-till. Conventional tillage consisted of chisel and disk operations in the spring. Strip tillage was done with a strip-till unit in the spring prior to planting. The subplots were a 5 × 2 factorial combination of five seed planting rates (18,000, 22,000, 26,000, 30,000, and 34,000 seeds/a) and two fertilizer placement methods: surface band (dribble) on 30-in. centers near the row and subsurface band (knife) at 4 in. deep. At the Mound Valley site, N and P nutrients were supplied as 28% urea ammonium nitrate and ammonium polyphosphate (10-34-0) applied at 125 lb/a N and 40 lb/a P_2O_5. Based on initial soil tests, at the Parsons site only N was applied by the two placement methods. Corn was planted at Site 1 on April 13, 2011, and at Site 2 on April 12, 2011.

Results and Discussion
In 2011, hot and dry conditions resulted in very low corn yields of less than 36 bu/a with any treatment at either location. Stressful environmental conditions resulted in yield reductions of 50 to 100% as seeding rate increased from 18,000 to 34,000 seeds/a at the two sites (Figure 1), but yield did not respond significantly to different tillage systems (data not shown). Even though overall yields were low, knife application resulted in more than 10% greater corn yield than dribble application at both sites (Figure 2). At the lower yielding site (Site 1), this response to knife placement was mainly evident in the no-till system.

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

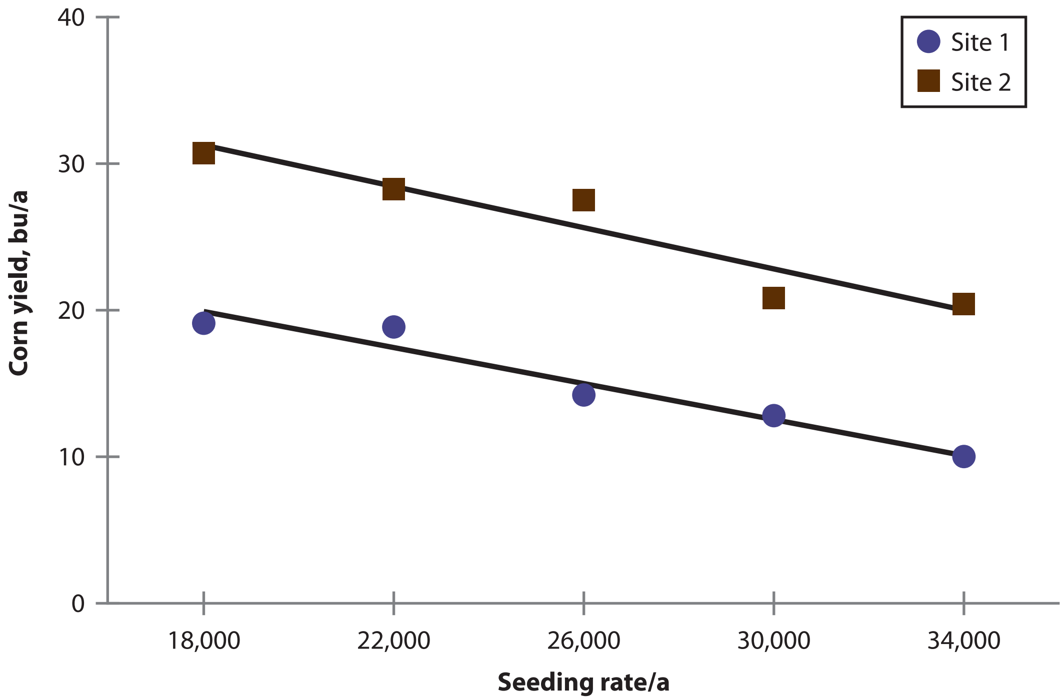


Figure 1. Effect of seeding rate on corn yield in 2011 at Site 1 (Mound Valley) and Site 2 (Parsons).

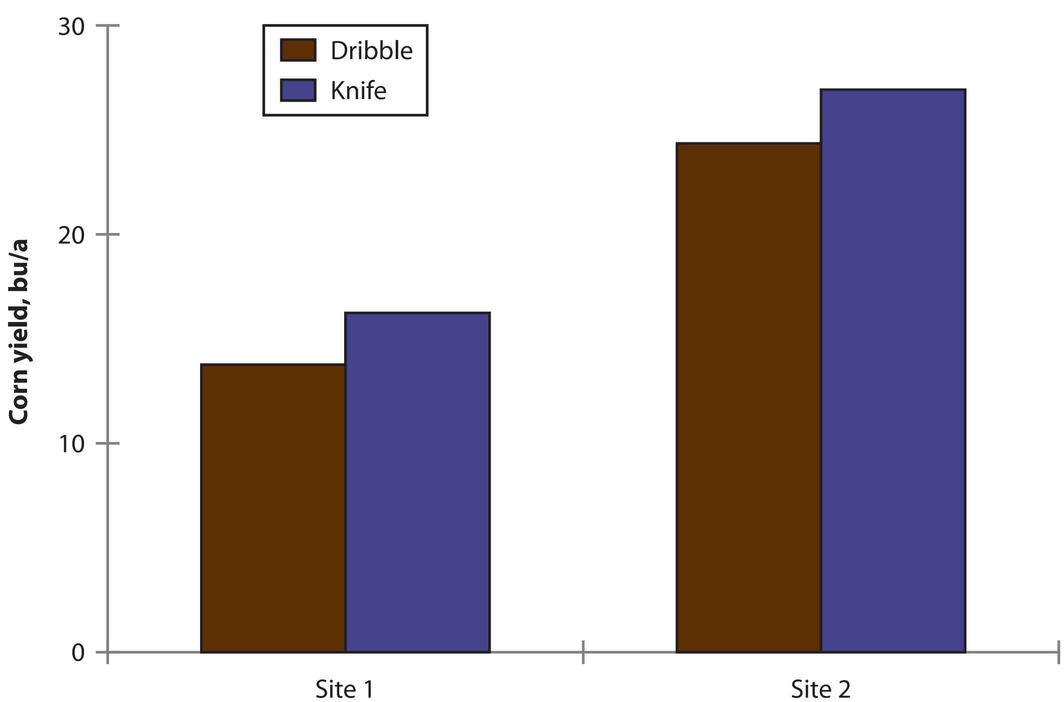


Figure 2. Effect of fluid fertilizer placement on corn yield in 2011 at Site 1 (Mound Valley) and Site 2 (Parsons). At each site, the placement methods are significantly different at the 0.05 probability level.

Effect of K, Cl, and N on Short-Season Corn, Wheat, and Double-Crop Sunflower Grown on Claypan Soil

D.W. Sweeney, D.J. Jardine[1], and K.W. Kelley

Summary
In 2011, wheat and double-crop sunflower were little affected by potassium (K) or chloride (Cl) fertilization. Increased nitrogen (N) rate increased wheat yield, heads/a, and dry matter production, but slightly decreased seed weight. Measured wheat and sunflower diseases were unaffected by K, Cl, and N fertilization.

Introduction
Corn acreage has been on the rise in southeastern Kansas in recent years because of the introduction of short-season cultivars that enable producers to partially avoid midsummer droughts that are often severe on the upland, claypan soils typical of the area. In addition, producing a crop after wheat and in rotation with corn potentially provides producers an increase in revenue by growing three crops in two years. Recent interest and developments in oil-type sunflower provide an alternative to soybeans for growers to double-crop after wheat. All crops in this corn-wheat-double-crop sunflower rotation require adequate fertilization with N to obtain optimum yields. Also, these crops are potentially affected by diseases that affect the leaf and stalk structures and may reduce yields. Potassium and chloride fertilization of crops often has been found to reduce disease pressure, but how N, K, and Cl interact to affect disease suppression and crop production have not been well defined, especially for corn, wheat, and double-crop sunflower in a two-year rotation on a claypan soil in southeastern Kansas.

Experimental Procedures
The experiment was conducted in 2010 and 2011 at the Southeast Agricultural Research Center of Kansas State University at Parsons, KS. The soil was a Parsons silt loam with a claypan subsoil. For background soil samples taken in spring 2010 at the 0- to 6-in. depth, selected soil chemical analyses were 6.4 pH (1:1 soil:water), 64 ppm K (1 M $NH_4C_2H_3O_2$ extract), 3.1 ppm NH_4-N, 4.0 ppm NO_3-N, 2.1 ppm Cl, and 2.5% organic matter. The experimental design was a split plot with three replications. The whole plots were a 2 × 2 factorial of K and Cl fertilization. The K and Cl rates were 0 and 50 lb K_2O/a and 0 and 40 lb Cl/a for each crop. Potassium and chloride fertilizer sources used to achieve these four fertility whole plots were potassium chloride, potassium sulfate, and calcium chloride and were spread using a small, handheld broadcast unit. The N rate subplots for wheat and double-crop sunflower were 0, 40, 80, and 120 lb/a surface band–applied as urea ammonium nitrate (UAN) solution for each crop. In addition to K, Cl, and N treatments, all plots received uniform applications of P at 40 lb P_2O_5/a for wheat and 30 lb P_2O_5/a for sunflower applied with a drop spreader. Fertilizers were incorporated by disking prior to planting. Jagger wheat was planted on October 15, 2010, at 90 lb/a and grain was harvested for yield on June 17, 2011. At the soft dough stage (Zadok's 85), visual estimate of disease incidence (percentage of

[1] Kansas State University Department of Plant Pathology.

the number of flag leaves affected by leaf rust) and dry matter production (whole plant samples) were determined. Mycogen 8N510 sunflower was planted at 20,000 seeds/a on June 30, 2011, and was harvested on Oct 17, 2011. At R6 growth stage, dry matter production was determined. At R7 growth stage, incidence of *Rhizopus* head rot was determined from the visual percentage of infected heads in the harvest rows.

Results and Discussion

In 2011, wheat yield and yield components were unaffected by the main effects of K or Cl fertilization. Chloride fertilization without K slightly decreased seed weight (data not shown), but had no effect on yield or other yield components. Increasing N rate from 0 to 120 lb/a increased wheat yield, heads/a, and dry matter production at the soft dough stage, but slightly decreased seed weight (Figure 1). Incidence of leaf rust was unaffected by K, Cl, N, or any interactions (data not shown). Following the wheat crop, average yield of double-crop sunflower in 2011 was low at 650 lb/a, likely because of hot and dry conditions and because approximately 50% of the sunflower heads were affected by *Rhizopus* head rot. Sunflower yield, yield components, and head rot disease incidence were unaffected by K, Cl, N, or their interactions (data not shown). Even though K fertilization increased dry matter production at the R6 growth stage by 40%, the poor growing conditions may have masked any subsequent effect on yield.

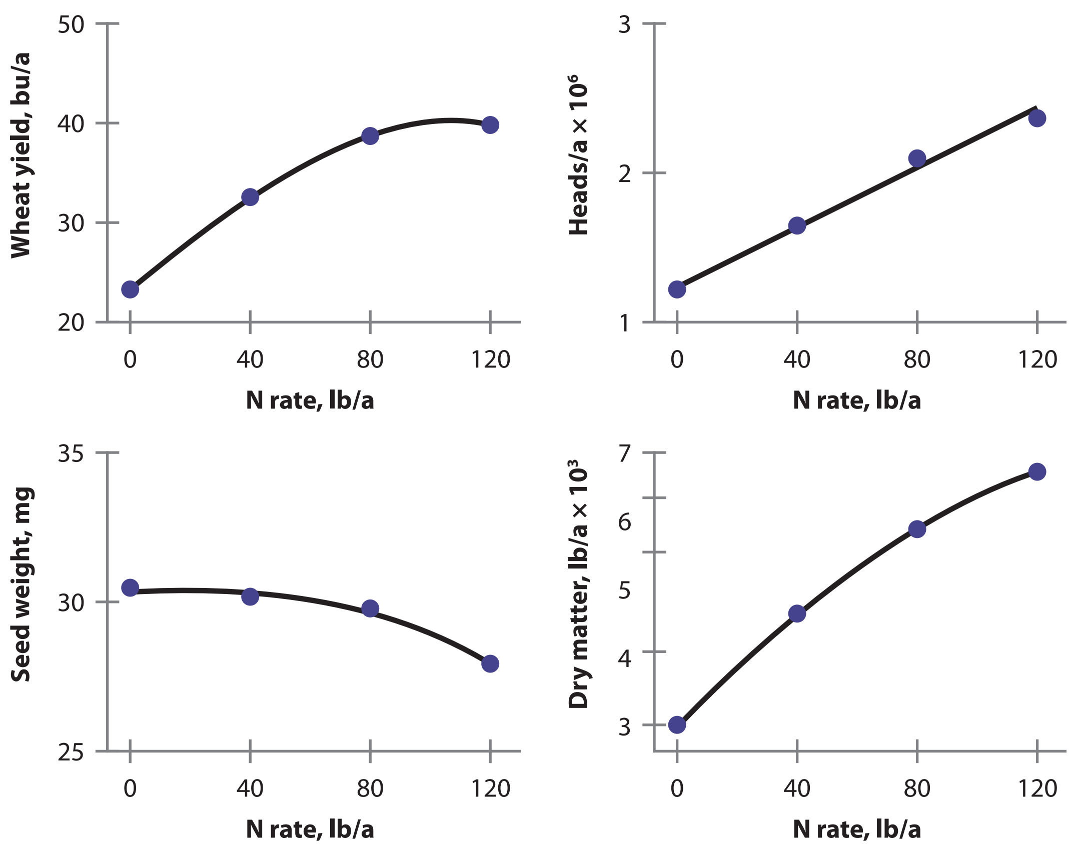
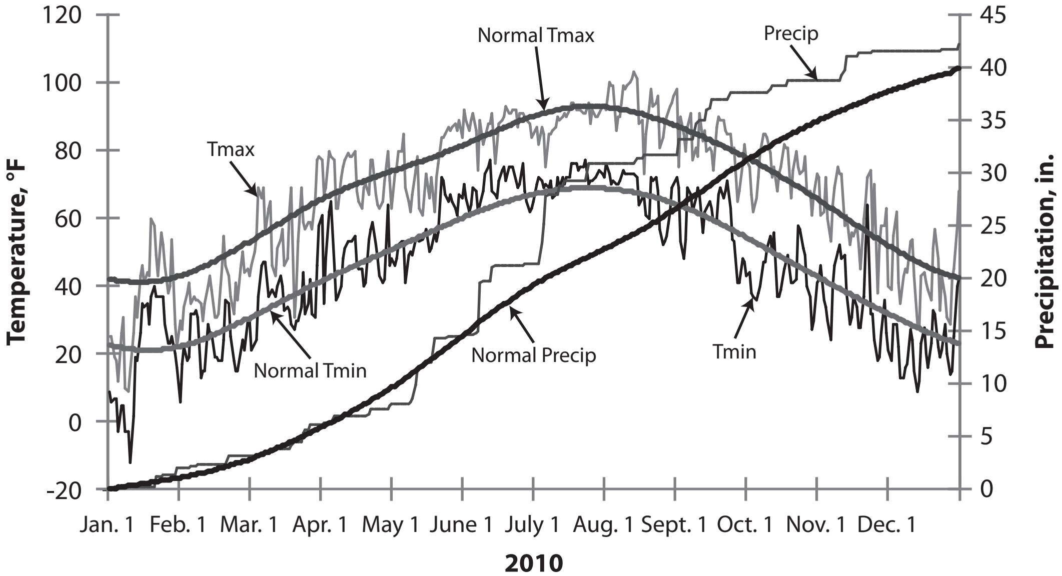
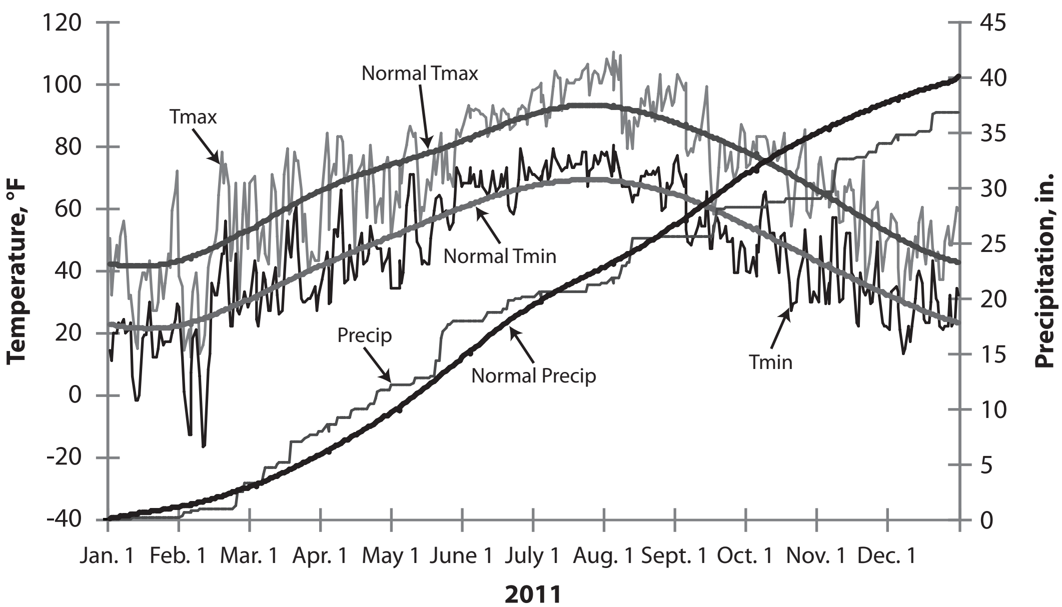


Figure 1. Wheat yield, heads/a, seed weight, and soft dough growth stage dry matter production as affected by nitrogen (N) rate in 2011.

Annual Summary of Weather Data for Parsons

M. Knapp[1]





[1] Kansas State Climatologist, Kansas State University Department of Agronomy, Manhattan.

2011 data

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Avg. max	39.7	43.0	56.7	68.8	72.5	89.5	99.1	95.2	80.9	73.9	58.7	47.5	68.8
Avg. min	17.3	19.9	35.6	44.2	53.0	67.9	73.3	69.5	53.5	43.6	36.4	27.1	45.1
Avg. mean	28.5	31.4	46.1	56.5	62.8	78.7	86.2	82.4	67.2	58.7	47.5	37.3	57.0
Precip.	0.18	3.07	4.37	4.1	6.28	2.11	1.22	4.16	2.79	0.70	4.96	2.83	36.74
Snow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	0.0
Heat DD*	1132	940	593	270	172	0	0	0	67	231	524	859	4786
Cool DD*	0	0	8	15	103	411	657	539	134	37	0	0	1903
Rain days	2	9	11	12	11	8	5	6	4	2	7	8	85
Min <10	4	8	0	0	0	0	0	0	0	0	0	0	12
Min <32	31	19	14	2	0	0	0	0	0	6	12	21	105
Max >90	0	0	0	0	0	13	28	22	6	0	0	0	69

Normal values (1971–2000)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Avg. max	40.2	47.2	57.2	67.1	76.0	85.0	91.1	90.0	81.0	70.5	55.5	44.4	67.1
Avg. min	20.2	25.6	34.8	44.1	54.4	63.4	68.3	66.0	58.0	46.3	34.9	24.8	45.1
Avg. mean	30.2	36.4	46.0	55.6	65.2	74.2	79.7	78.0	69.5	58.4	45.2	34.6	56.1
Precip.	1.37	1.78	3.37	3.82	5.39	4.82	3.83	3.42	4.93	4.04	3.29	2.03	42.09
Snow	2.0	3.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	0.0	8.5
Heat DD	1079	800	590	295	95	6	0	3	51	229	594	942	4684
Cool DD	0	0	0	13	101	283	456	406	187	24	0	0	1470

Departure from normal

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Avg. max	-0.5	-4.2	-0.5	1.7	-3.5	4.5	8.0	5.2	-0.1	3.4	3.2	3.1	1.7
Avg. min	-2.9	-5.7	0.8	0.1	-1.4	4.5	5.0	3.5	-4.5	-2.7	1.5	2.3	0.0
Avg. mean	-1.7	-5.0	0.1	0.9	-2.4	4.5	6.5	4.4	-2.3	0.3	2.3	2.7	0.9
Precip.	-1.19	1.29	1	0.25	0.89	-2.71	-2.61	0.74	-2.14	-3.34	1.67	0.8	-5.35
Snow	-2.0	-3.0	-1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2	0.0	-8.5
Heat DD	53	140	3	-26	77	-6	0	-3	16	2	-70	-84	102
Cool DD	0	0	8	2	2	128	201	133	-54	13	0	0	433

* Daily values were computed from mean temperatures. Each degree that a day's mean is below (or above) 65°F is counted for one heating (or cooling) degree day.

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