AGRICULTURAL RESEARCH 2009

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SOUTHEAST AGRICULTURAL RESEARCH CENTER

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Supplementation of Grazing Stocker Cattle with Distillers Grains

L. W. Lomas and J. L. Moyer

Summary

A total of 108 steers grazing smooth bromegrass pastures in 2005, 2006, and 2007 and 120 steers grazing bermudagrass pastures in 2006, 2007, and 2008 were used to evaluate the effects of supplementation with dried distillers grains (DDG) at 0.5 or 1.0% of body weight daily on available forage, grazing gains, subsequent finishing gains, and carcass characteristics. Supplementation with DDG resulted in significantly higher ($P<0.05$) grazing gains and gain per acre than feeding no supplement but had no effect ($P>0.05$) on forage availability. Supplementation with 1.0% DDG resulted in higher ($P<0.05$) grazing gains and gain per acre than supplementation with 0.5% DDG. Supplementation during the grazing phase had no effect ($P>0.05$) on finishing gains or feed efficiency of steers that grazed bermudagrass. However, steers that received no supplement while grazing bromegrass had greater ($P<0.05$) finishing gains than those supplemented with 1% DDG and were more ($P<0.05$) efficient in converting feed to gain than steers supplemented with DDG during the grazing phase. Finishing gain, slaughter weight, hot carcass weight, yield grade, and overall gain were not different ($P>0.05$) between steers supplemented with 0.5 or 1.0% DDG while grazing bromegrass pastures. Steers supplemented with 1.0% DDG while grazing bermudagrass had greater final slaughter weight, hot carcass weight, backfat thickness, and overall gain than those that received no grazing supplement. Unsupplemented steers and those that received 0.5% DDG had similar ($P>0.05$) finishing performance, carcass traits, and overall gains.

Introduction

Distillers grains are a by-product of the ethanol industry. Ethanol production from feed grains is a rapidly growing industry that is making a major contribution to the American agricultural economy. Total ethanol production in the United States has nearly quadrupled in the past 10 years and is expected to increase even more in the future. Currently, Kansas has 10 operating dry mill ethanol plants that have a combined production capacity of more than 329 million gallons of ethanol annually, and additional plants are in various stages of planning. Current ethanol production in Kansas creates a market for more than 116 million bushels of corn and sorghum and yields more than 1 million tons of DDG annually. With further growth of the ethanol industry, availability of this coproduct likely will increase, and cost likely will decrease. Therefore, efficient, cost-effective uses of this feedstuff need to be identified. The value of distillers grains as a supplement for grazing cattle also needs to be determined.

Currently, more than 80% of distillers grains are being fed to ruminants, but they also are used in swine and poultry diets. Distillers grains commonly are included in diets of dairy and finishing cattle at 20 to 30% of diet dry matter. A limiting factor in feeding large amounts of distillers grains is the environmental effect of excess nitrogen and phosphorus. A South Dakota study revealed that protein was in excess of requirements when distillers grains were included at 30% of the diet dry matter in cows producing either

53 or 66 lb/day of milk. Care also must be taken to balance diets containing distillers grains to avoid overfeeding phosphorus and sulfur.

Forage-based livestock production is a vital component of the Kansas economy. Kansas has more than 18 million acres of pastureland and ranks sixth in the United States in the number of beef cows, with more than 1.5 million head. Cash receipts from cattle production in Kansas exceeded $6.25 billion in 2006. Forages account for 80% of the feed units consumed by beef cattle and, therefore, represent an extremely important resource to the industry. Increasing the proportion of feed that is harvested directly by grazing cattle and balancing their diets with low-cost supplements such as distillers grains could improve sustainability and profitability of the beef cattle industry in Kansas and create additional demand for corn and sorghum coproducts.

Productivity of forage-livestock systems is limited by seasonality of forage growth. Energy and protein content of cool-season grasses can decline as much as 30 and 60% from vegetative stage to maturity, respectively. Livestock growth rates and reproductive performance generally decline in response to these seasonal changes in forage availability and quality unless diets are supplemented with additional nutrients. Depending on price, use of supplemental feeds may be a cost-effective risk management strategy if amounts and/or nutritional quality of forages are inadequate. Because of the expansion of the grain processing industries, coproducts like distillers grains or gluten feed can be purchased at a price that is competitive with corn on a net energy basis and, with further growth of the industry, likely will be less expensive in the future. Because the coproducts generally have high concentrations of protein and phosphorus, their composition complements mature forages that are typically deficient in these nutrients.

Experimental Procedures

Thirty-six steers of predominately Angus breeding were weighed on two consecutive days, stratified by weight, and randomly allotted to nine 5-acre smooth bromegrass pastures on Apr. 5, 2005 (437 lb), Apr. 11, 2006 (484 lb), and Apr. 3, 2007 (497 lb). Three pastures of steers were randomly assigned to one of three supplementation treatments (three replicates per treatment) and were grazed for 196 days, 161 days, and 182 days in 2005, 2006, and 2007, respectively. Supplementation treatments were 0, 0.5, and 1.0% of body weight of DDG per head daily. Pastures were assigned to the same treatment during all 3 years. Pastures were fertilized with 100-40-40 lb/a N-P_2O_5-K_2O_5 on Mar. 5, 2005, Mar. 6, 2006, and Mar. 8, 2007. Pastures were stocked with 0.8 steers per acre and grazed continuously until Oct. 18, 2005 (196 days), Sept. 19, 2006 (161 days), and Oct. 2, 2007 (182 days), when steers were weighed on two consecutive days and grazing was terminated.

Forty mixed black yearling steers were weighed on two consecutive days, stratified by weight, and randomly allotted to eight 5-acre 'Hardie' bermudagrass pastures on June 1, 2006 (749 lb), May 22, 2007 (734 lb), and June 4, 2008 (812 lb). Supplementation treatments were 0, 0.5, and 1.0% of body weight of DDG per head daily. There were two replicates of the 0 level and three replicates each of the 0.5 and 1.0% levels. Pastures were fertilized with 100-30-30 lb/a N-P_2O_5-K_2O_5 on June 1, 2006, and June 6, 2007, 100 lb/a N on July 7, 2006, and 50 lb/a N on July 16, 2007, and 150-30-30 lb/a N-P_2O_5-K_2O_5 on July 2, 2008. Pastures were stocked with one steer per acre and grazed continuously until Sept. 6, 2006 (89 days), Sept. 11, 2007 (112 days), and Sept. 17, 2008 (105 days), 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, 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 distillers grain 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 the respective forage being grazed. In 2005, one steer was removed from the study for reasons unrelated to experimental treatment.

After the grazing period, cattle were shipped to a finishing facility, implanted with Synovex S, and fed a diet of 80% ground milo (whole-shelled corn in 2008), 15% corn silage, and 5% supplement (dry matter basis). Steers that grazed smooth bromegrass pastures in 2005, 2006, and 2007 were fed a finishing diet for 126, 126, and 119 days, respectively. Steers that grazed bermudagrass pastures in 2006, 2007, and 2008 were fed a finishing diet for 85, 112, and 86 days, respectively. All cattle were slaughtered in a commercial facility at the end of the finishing period, and carcass data were collected.

Results and Discussion

Available forage for the smooth bromegrass pastures during the grazing phase is pooled across treatments and presented by date and year in Figure 1 because supplementation with DDG had no effect ($P>0.05$) on quantity of forage available for grazing. In general, the quantity of available forage closely mirrored the level of rainfall. Quantity of available bromegrass forage varied by sampling date as expected. In 2005 and 2006, available forage was lowest in early April, increased with each successive sampling date to its highest level in June, and gradually declined as the grazing season progressed. In 2007, available forage reached its highest level in late April, declined in May because of an armyworm invasion, increased in June and July because of timely rainfall, and then declined gradually as the grazing season progressed. Average available forage was approximately 2,400 lb/a less in 2006 than in 2005, reflecting the lower level of precipitation in 2006, and 540 lb/a less in 2006 than in 2007 despite an armyworm invasion. Feeding DDG either caused a reduction in forage intake that our forage measurement technique was not sensitive enough to detect or improved forage digestibility sufficiently enough to increase forage intake and offset any substitution effects.

Grazing and subsequent finishing performance of steers supplemented with DDG while grazing smooth bromegrass in 2005, 2006, and 2007 are pooled across years and presented by supplementation treatment in Table 1. Steers supplemented with 0.5 or 1.0% DDG during the grazing phase had 39 or 50% higher ($P<0.05$) weight gain, daily gain, and steer gain per acre, respectively, than those that received no supplement. Steers supplemented with 0.5 or 1.0% DDG had 105 or 132 lb higher ($P<0.05$) total weight gain, 0.58 or 0.73 lb higher ($P<0.05$) daily gain, and 84 or 105 lb higher ($P<0.05$) gain per acre, respectively, than those that received no supplementation. Supplementation of grazing steers with 1.0% DDG resulted in 7% higher ($P<0.05$) weight gain (27 lb), daily gain (0.15 lb), and gain per acre (27 lb), than supplementation with 0.5% DDG. Steers supplemented with DDG at 0.5 or 1.0% of body weight per head daily consumed a total of 607 or 1,211 lb of DDG, respectively, during the 180-day grazing period. Average consumption of DDG was 3.4 or 6.7 lb/head daily for steers supplemented with 0.5 or 1.0% DDG per head daily, respectively. Steers supplemented with 0.5 or 1.0% DDG per head daily required 5.9 or 10.0 lb of DDG for each additional pound of body weight gained during the grazing phase.

Steers supplemented with 0.5 or 1.0% DDG during the grazing phase were heavier ($P<0.05$) at slaughter, had higher ($P<0.05$) hot carcass weights and higher ($P<0.05$) numerical yield grades, but required more ($P<0.05$) feed per unit of gain than those that received no supplement. Steers that received no supplement during the grazing phase had higher ($P<0.05$) finishing gains than those supplemented with 1.0% DDG. Finishing gains of steers supplemented with 0.5% DDG were not different ($P>0.05$) from those of steers that received no supplement or 1.0% DDG. Supplementation with DDG during the grazing phase had no effect ($P<0.05$) on finishing feed intake, backfat, marbling score, or percentage of carcasses grading Choice. Steers supplemented with 0.5 or 1.0% DDG had 82 or 91 lb higher ($P<0.05$) overall gain and 0.27 or 0.29 lb higher ($P<0.05$) daily gain, respectively, than those that received no supplement while grazing. Most of the difference in overall gain observed was achieved during the grazing phase and carried through the finishing phase.

Available forage during the grazing phase is pooled across treatments and presented by date and year for the bermudagrass pastures in Figure 2 because supplementation with DDG had no effect ($P>0.05$) on quantity of forage available for grazing. Available forage was highest in 2008 and lowest in 2006, which followed the same trend as rainfall. Available forage tended to reach maximum level each year in mid-August. Grazing and finishing performance of steers supplemented with DDG while grazing bermudagrass pastures in 2006, 2007, and 2008 are pooled and presented by supplementation treatment in Table 2. Steers supplemented with 0.5 or 1.0% DDG during the grazing phase had 21 or 54% higher ($P<0.05$) weight gain, daily gain, and steer gain per acre, respectively, than those that received no supplement. Steers supplemented with 0.5 or 1.0% DDG had 35 or 88 lb higher ($P<0.05$) total weight gain, 0.33 or 0.84 lb higher ($P<0.05$) daily gain, and 35 or 88 lb higher ($P<0.05$) gain per acre, respectively, than those that received no supplementation. Supplementation of grazing steers with 1.0% DDG resulted in 27% higher ($P<0.05$) weight gain (53 lb), daily gain (0.51 lb), and gain per acre (53 lb) than supplementation with 0.5% DDG. Steers supplemented with DDG at 0.5 or 1.0% of body weight per head daily consumed a total of 439 or 895 lb of DDG, respectively, during the 96-day grazing period. Average consumption of DDG was 4.3 or 8.8 lb/head daily for steers supplemented with 0.5 or 1.0% DDG per head daily, respectively. Consumption of DDG for each additional pound of body weight gain averaged 12.5 or 10.2 lb for steers supplemented with 0.5 or 1.0% DDG, respectively, during the 3 years of the study. Supplement conversion was likely not efficient enough to make supplementation of cattle grazing bermudagrass with DDG economically feasible. This may be partially due to these cattle being heavier and having a lower protein requirement that was being met by the bermudagrass forage alone.

Supplementation with DDG during the grazing phase had no effect ($P>0.05$) on finishing gain, daily gain, dry matter intake, or feed:gain. Steers supplemented with 1.0% DDG while grazing were heavier ($P<0.05$) at the end of the finishing phase and had higher ($P<0.05$) hot carcass weights and greater ($P<0.05$) backfat thickness than steers that received no supplement. Ribeye area, yield grade, marbling score, and percentage of carcasses grading Choice were not different ($P>0.05$) between supplementation treatments. Steers supplemented with 1.0% DDG had 58 lb higher ($P<0.05$) overall gain and 0.28 lb higher ($P<0.05$) daily gain than those that received no supplement while grazing. Overall performance of cattle supplemented with 0.5 or 1.0% DDG was not different ($P>0.05$).

Under the conditions of this study, supplementation of stocker cattle grazing smooth bromegrass pasture with DDG at 0.5% of body weight daily resulted in more efficient supplement conversion and, therefore, a greater potential return on dollars invested in DDG than supplementation at the 1.0% level. Supplementation of stocker cattle grazing bermudagrass pastures with DDG appeared to be less beneficial than supplementation of cattle grazing smooth bromegrass pastures.

Table 1. Effect of supplementing steers grazing smooth bromegrass pastures with dried distillers grains (DDG) on grazing and subsequent finishing performance, Southeast Agricultural Research Center, 2005, 2006, and 2007

	Level of DDG (% body weight/head per day)		
Item	0	0.5	1.0
Grazing phase (180 days)			
No. of head	35	36	36
Initial weight, lb	472	473	473
Final weight, lb	738^{a}	844^{b}	871^{c}
Gain, lb	266^{a}	371^{b}	398^{c}
Daily gain, lb	1.48^{a}	2.06^{b}	2.21^{c}
Gain/acre, lb	213^{a}	297^{b}	318^{c}
Total DDG consumption, lb/head	0	607	1211
Average DDG consumption, lb/head/day	0	3.4	6.7
DDG, lb/additional gain	–	5.9	10.0
Finishing phase (124 days)			
Beginning weight, lb	738^{a}	844^{b}	871^{c}
Ending weight, lb	1214^{a}	1297^{b}	1305^{b}
Gain, lb	476^{a}	454^{ab}	435^{b}
Daily gain, lb	3.85^{a}	3.67^{ab}	3.51^{b}
Daily dry matter intake, lb	25.8	26.5	26.8
Feed:Gain	6.73^{a}	7.22^{b}	7.63^{b}
Hot carcass weight, lb	727^{a}	783^{b}	795^{b}
Dressing percentage, %	60^{a}	60^{ab}	61^{b}
Backfat, in.	0.49	0.53	0.53
Ribeye area, square in.	13.1	13.0	13.1
Yield grade	2.7^{a}	3.0^{b}	3.1^{b}
Marbling score[1]	SM^{26}	SM^{40}	SM^{54}
Percent choice, %	69	69	72
Overall performance (Grazing plus finishing; 304 days)			
Gain, lb	742^{a}	824^{b}	833^{b}
Daily gain, lb	2.45^{a}	2.72^{b}	2.74^{b}

[1] SM = small.

[abc] Within rows, means without a common superscript differ ($P<0.05$).

Table 2. Effect of supplementing steers grazing bermudagrass pastures with dried distillers grains (DDG) on grazing and subsequent finishing performance, Southeast Agricultural Research Center, 2006, 2007, and 2008

	Level of DDG (% body weight/head per day)		
Item	0	0.5	1.0
Grazing phase (102 days)			
No. of head	30	45	45
Initial weight, lb	765	765	765
Final weight, lb	928[a]	963[b]	1016[c]
Gain, lb	163[a]	198[b]	251[c]
Daily gain, lb	1.64[a]	1.97[b]	2.48[c]
Gain/acre, lb	163[a]	198[b]	251[c]
Total DDG consumption, lb/head	0	439	895
Average DDG consumption, lb/head/day	0	4.3	8.8
DDG, lb/additional gain	–	12.5	10.2
Finishing phase (94 days)			
Beginning weight, lb	928[a]	963[b]	1016[c]
Ending weight, lb	1324[a]	1345[ab]	1381[b]
Gain, lb	395	382	365
Daily gain, lb	4.21	4.05	3.86
Daily dry matter intake, lb	26.3	25.8	25.7
Feed:Gain	6.29	6.38	6.73
Hot carcass weight, lb	780[a]	803[ab]	814[b]
Dressing percentage, %	59	60	59
Backfat, in.	0.35[a]	0.39[ab]	0.41[b]
Ribeye area, square in.	12.4	12.8	12.9
Yield grade	2.9	2.9	3.0
Marbling score[1]	SM^{39}	SM^{56}	SM^{70}
Percent choice, %	70	64	67
Overall performance (Grazing plus finishing; 196 days)			
Gain, lb	558[a]	580[ab]	616[b]
Daily gain, lb	2.86[a]	2.97[ab]	3.14[b]

[1] SM = small.

[abc] Within rows, means without a common superscript differ ($P<0.05$)

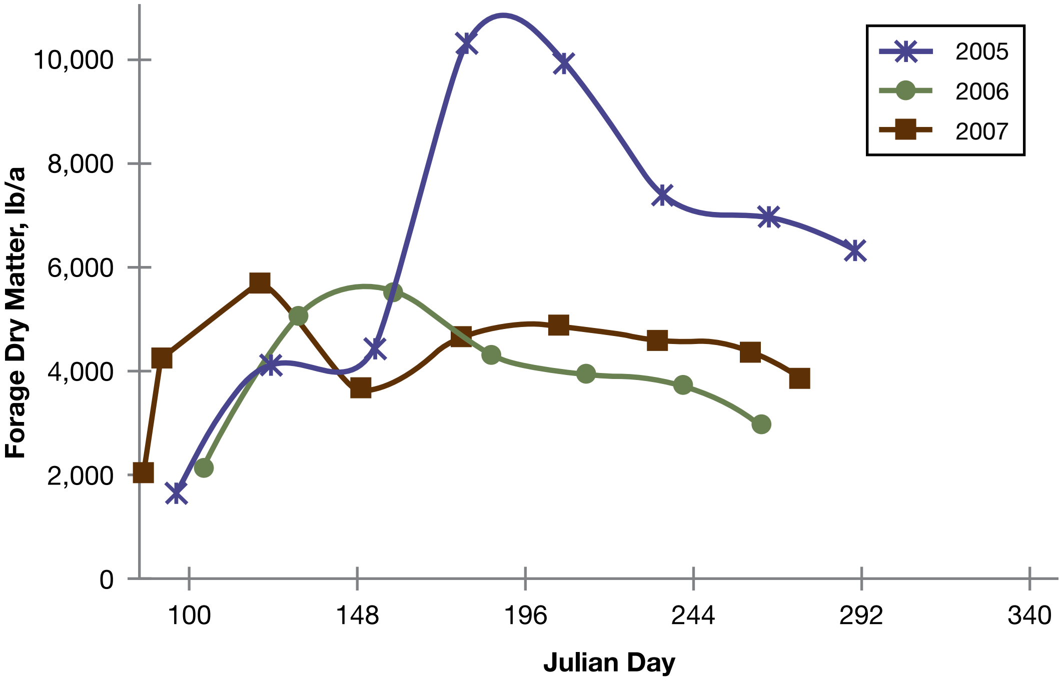

Figure 1. Available forage of smooth bromegrass pastures, Southeast Agricultural Research Center, 2005, 2006, and 2007.

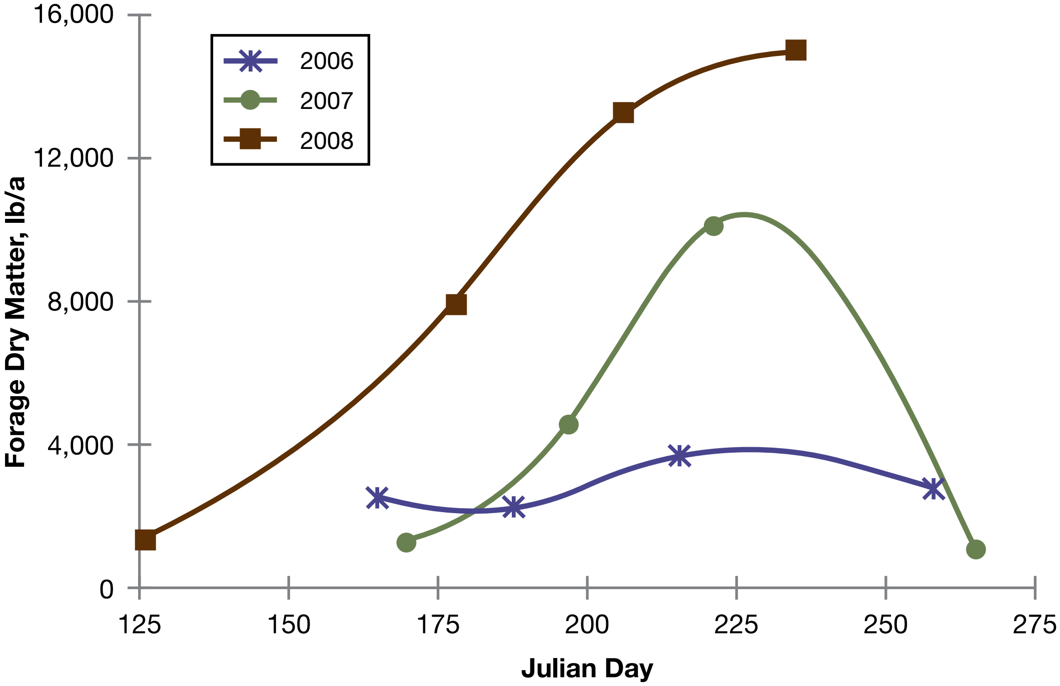

Figure 2. Available forage of bermudagrass pastures, Southeast Agricultural Research Center, 2006, 2007, and 2008.

Distillers Grains Supplementation Strategy for Grazing Stocker Cattle

L. W. Lomas and J. L. Moyer

Summary

Thirty-six 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. Supplementation treatments evaluated were no supplement, dried distillers grains (DDG) at 0.5% of body weight per head daily during the entire grazing phase, or 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 ($P<0.05$) between the two DDG supplementation treatments. Supplementation during the grazing phase had no effect ($P>0.05$) on finishing performance, carcass characteristics, or overall performance.

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 coproducts 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 economics perspective. This research was conducted to evaluate DDG supplementation strategies that might potentially 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 (450 lb) of predominately Angus breeding were weighed on two consecutive days, stratified by weight, and randomly allotted to nine 5-acre smooth bromegrass pastures on Apr. 9, 2008. Three pastures of steers were randomly assigned to one of three supplementation treatments (three replicates per treatment) and were grazed for 140 days. Supplementation treatments were no supplement, DDG at 0.5% of body weight per head daily, or no DDG during the first 56 days of grazing then DDG at 0.5% of body weight per head daily for the remaining 140 days of the grazing phase. Pastures were fertilized with 100 lb/a N on Feb. 29, 2008. Pastures were stocked with 0.8 steers per acre and grazed continuously until Oct. 22, 2008, 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 distillers grain 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, and fed a diet of 80% whole-shelled corn, 15% corn silage, and 5% supplement (dry matter basis) for 112 days. 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 Table 1. Supplementation with DDG had no effect (P>0.05) on quantity of forage available for grazing. Average available forage for all treatments was high (greater than 9,000 lb/a of dry matter), likely because of significantly greater than average rainfall in 2008.

Steers supplemented with 0.5% DDG during the entire grazing season or only during the latter part of the grazing season had 31 or 23% greater (P<0.05) weight gain, daily gain, and steer gain per acre, respectively, than those that received no supplement. Steers supplemented with 0.5% DDG throughout the grazing season or only during the latter part had 100 or 75 lb greater (P<0.05) total weight gain, 0.51 or 0.38 lb greater (P<0.05) daily gain, and 80 or 60 lb greater (P<0.05) gain per acre, respectively, than those that received no supplementation. Grazing weight gain, daily gain, and gain per acre 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 196-day grazing season consumed a total of 651 lb of DDG, whereas steers supplemented only during the latter 140 days of the grazing season consumed 496 lb of DDG. Average consumption of DDG was 3.3 or 3.5 lb/head daily for steers supplemented the entire grazing season or only during the last 140 days, respectively. Steers supplemented with DDG during the entire grazing season or only during the latter part consumed 6.5 or 6.6 lb of DDG for each additional pound of body weight gained during the grazing phase above steers that received no supplement.

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) was not different (P>0.05) between supplementation treatments.

Under the conditions of this study, supplementation of stocker cattle grazing smooth bromegrass pasture with DDG at 0.5% of body weight during the entire grazing season or only during the latter part of the grazing season would likely have been profitable if the cattle had been marketed as feeder cattle at the end of the grazing phase. Delaying supplementation until early June would have reduced labor requirements for the first 56 days of the grazing phase, when cattle received no supplement, but resulted in similar grazing gains. If ownership of the cattle was to be retained through slaughter, there was no advantage to supplementation with DDG during the grazing phase in the current study. This is contrary to previous research in which stocker cattle supplemented with DDG during the grazing phase maintained their weight advantage through slaughter.

Table 1. Effect 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	772[a]	871[b]	846[b]
Gain, lb	321[a]	421[b]	396[b]
Daily gain, lb	1.64[a]	2.15[b]	2.02[b]
Gain/acre, lb	257[a]	337[b]	317[b]
Total DDG consumption, lb/head	0	651	496
Average DDG consumption, lb/head/day	0	3.3	3.5
DDG, lb/additional gain	–	6.5	6.6
Average available smooth bromegrass forage, lb of dry matter/acre	9264	9020	9240
Finishing phase (112 days)			
Beginning weight, lb	772[a]	871[b]	846[b]
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, square in.	11.1	11.6	11.5
Yield grade	3.2	2.9	2.8
Marbling score[2]	MT^{75}	MT^{45}	MT^{40}
Percent 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] MT = modest.

[abc] Within rows, means without a common superscript differ ($P<0.05$).

Evaluation of Forage Production and Grazing Performance of Steers Grazing Tall Fescue Cultivars with the Novel Endophyte

L. W. Lomas and J. L. Moyer

Summary

A total of 288 mixed black steers were used to evaluate the effect of tall fescue cultivar on grazing gains, forage production, and stand persistence in 2004, 2005, 2006, and 2007. Cultivars evaluated were high-endophyte Kentucky 31, low-endophyte Kentucky 31, ArkPlus, and MaxQ. Pastures with low-endophyte Kentucky 31, ArkPlus, or MaxQ produced higher ($P<0.05$) steer grazing gains and more ($P<0.05$) gain per acre than high-endophyte Kentucky 31. Steer live weight gain and gain per acre were similar ($P>0.05$) among pastures with low-endophyte Kentucky 31, ArkPlus, or MaxQ. There was no difference ($P>0.05$) in available forage dry matter between varieties in 2004. However, in 2005, 2006, 2007, and 2008, high-endophyte Kentucky 31 pastures had greater ($P<0.05$) available forage than low-endophyte Kentucky 31 ArkPlus, and MaxQ pastures.

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 grazing animal performance than endophyte-infected fescue, endophyte-free fescue is less persistent under grazing and more susceptible to stand loss from drought stress. In situations 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 incorporating legumes into existing pastures. Adding legumes can improve nutritive quality of fescue pastures, increase gains of grazing livestock, and reduce nitrogen fertilizer rates.

During the past few years, new tall fescue cultivars have been developed that have a “novel” endophyte that provides vigor to the fescue plant but does not have the negative effect on performance of grazing livestock. Objectives of this study were to evaluate grazing and subsequent finishing performance of stocker steers, forage availability, and stand persistence of two of these new cultivars and compare them with high- and low-endophyte Kentucky 31 tall fescue.

Experimental Procedures

Sixty-four mixed black steers in 2004, 2005, and 2006 and 48 mixed black steers in 2007 and 2008 were weighed on two consecutive days and allotted to 16 five-acre pastures (12 pastures in 2008) of high-endophyte Kentucky 31, low-endophyte Kentucky 31, ArkPlus, or MaxQ tall fescue (four replications per cultivar in 2004, 2005, 2006, and 2007 and 3 replications in 2008) on Mar. 18, 2004 (513 lb), Mar. 24, 2005 (501 lb), Mar. 29, 2006 (568 lb), Apr. 10, 2007 (626 lb), and Apr. 2, 2008 (575 lb). All pastures were seeded in the fall of 2002 and harvested for hay in 2003. All pastures were fertilized with 80 lb/a N and P_2O_5 and K_2O as required by soil test on Jan. 15, 2004, and with 80 lb/a N on Feb. 2, 2005, Jan. 19, 2006, Mar. 7, 2007, and Mar. 11, 2008, and with 40-40-30 lb/a N-P_2O_5-K_2O on Sept. 3, 2004, Sept. 13, 2005, Sept. 11, 2006, and Sept. 4, 2007, and with 20 lb/a N and P_2O_5 and K_2O as required by soil test on Oct. 17, 2008.

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.

Cattle were weighed every 28 days, and forage availability was measured approximately every 28 days with a disk meter calibrated for tall fescue. In both 2006 and 2008, two steers were removed from the study for reasons unrelated to experimental treatment. Pastures were grazed continuously until Nov. 30, 2004 (257 days), Dec. 6, 2005 (257 days), Aug. 15, 2006 (139 days), Nov. 20, 2007 (224 days), and Nov. 26, 2008 (236 days), when steers were weighed on two consecutive days and grazing was terminated. Drought stress reduced the length of the grazing season in 2006. Pastures were stocked with four steers per pasture in 2004, 2005, 2006, and 2008 and three steers per pasture in 2007 because of stand reduction that occurred following the drought in 2006.

After the grazing period, cattle were moved to a finishing facility, implanted with Synovex S, and fed a diet of 80% ground milo (whole-shelled corn in 2008), 15% corn silage, and 5% supplement (dry matter basis). Cattle grazed in 2006 were reimplanted with Synovex S on day 84 of the finishing period. Cattle grazed during 2004, 2005, 2007, and 2008 were fed a finishing diet for 112, 112, 100, and 98 days, respectively. Steers grazed during 2006 on low-endophyte Kentucky 31, ArkPlus, or MaxQ were fed a finishing diet for 142 days, and steers that grazed high-endophyte Kentucky 31 were fed a finishing diet for 168 days. All steers were slaughtered in a commercial facility, and carcass data were collected.

Results and Discussion

Average available forage dry matter of each cultivar is presented by year in Table 1. There was no difference ($P>0.05$) among cultivars for average available forage for the 2004 grazing season. However, high-endophyte Kentucky 31 pastures had greater ($P<0.05$) average available forage than low-endophyte Kentucky 31, ArkPlus, or MaxQ pastures in 2005, 2006, 2007, and 2008. MaxQ pastures had greater ($P<0.05$) average available forage dry matter than low-endophyte Kentucky 31, ArkPlus, or MaxQ pastures in 2005. However, average available forage was similar ($P>0.05$) among low-endophyte Kentucky 31, ArkPlus, and MaxQ in 2006, 2007, and 2008.

Grazing and subsequent finishing performance averaged across years is presented by cultivar in Table 2. Steers that grazed pastures of low-endophyte Kentucky 31, MaxQ, or ArkPlus gained significantly more ($P<0.05$) and produced more ($P<0.05$) gain per acre than those that grazed high-endophyte Kentucky 31 pastures. Gains of cattle that grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ were similar ($P>0.05$). Daily gains of steers grazing pastures with high-endophyte Kentucky 31, low-endophyte Kentucky 31, ArkPlus, and MaxQ were 1.06, 1.63, 1.65, and 1.74 lb/head daily, respectively. Gains per acre from pastures with high-endophyte Kentucky 31, low-endophyte Kentucky 31, ArkPlus, and MaxQ were 181, 271, 276, and 288 lb/a, respectively. In general, low-endophyte Kentucky 31, ArkPlus, or MaxQ pastures had less ($P<0.05$) available forage dry matter and produced greater ($P<0.05$) steer gains than high-endophyte Kentucky 31 pastures that had greater ($P<0.05$) available forage dry matter. This could indicate that the lower available dry matter was the result of greater forage intake by grazing steers, which resulted in higher gains and/or less vigor of the fescue cultivar.

Steers that previously grazed high-endophyte Kentucky 31 had lower ($P<0.05$) final finishing weights and lower ($P<0.05$) hot carcass weights than steers that grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ. Final live weights and hot carcass weights were similar ($P>0.05$) for steers that grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ. However, steers that grazed high-endophyte Kentucky 31, low-endophyte Kentucky 31, or ArkPlus had higher ($P<0.05$) finishing daily gains than those that grazed MaxQ. Steers that had previously grazed high-endophyte Kentucky 31 required less ($P<0.05$) feed per unit of gain during the finishing phase than those that had grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ. Steers that grazed low-endophyte Kentucky 31 or ArkPlus were more ($P<0.05$) efficient in converting feed to gain than those that grazed MaxQ. Feed:Gain was similar ($P>0.05$) for steers that had grazed low-endophyte Kentucky 31 or ArkPlus.

Steers that grazed ArkPlus had greater ($P<0.05$) ribeye area than those that grazed high-endophyte Kentucky 31. This was likely partially due to the lower ($P<0.05$) hot carcass weight of steers that grazed high-endophyte Kentucky 31. Fat thickness, yield grade, marbling score, and percentage of carcasses grading Choice were not different ($P>0.05$) between grazing treatments.

Overall gain and daily gain of steers that grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ were greater ($P<0.05$) than those of steers that grazed high-endophyte Kentucky 31. Overall gain and daily gain of steers that grazed low-endophyte Kentucky 31, ArkPlus, or MaxQ were similar ($P>0.05$).

Cattle grazing ArkPlus or MaxQ tall fescue, new varieties with the novel endophyte, appear to have gains similar to those of cattle grazing low-endophyte Kentucky 31 and significantly greater than those of cattle grazing high-endophyte Kentucky 31 tall fescue.

Table 1. Effect of cultivar on season average available forage of tall fescue pastures, Southeast Agricultural Research Center, 2004, 2005, 2006, 2007, and 2008

	Tall fescue cultivar			
Year	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	ArkPlus	MaxQ
	---lb/a dry matter---			
2004	2868	2599	2676	2850
2005	2412^{a}	2133^{c}	2132^{c}	2257^{b}
2006	1756^{a}	1180^{b}	985^{b}	1175^{b}
2007	2094^{a}	1809^{b}	1801^{b}	1750^{b}
2008	4867^{a}	4459^{b}	4526^{b}	4403^{b}

^{abc} Within rows, means without a common superscript differ ($P<0.05$).

Table 2. Effect of cultivar on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2004, 2005, 2006, 2007, and 2008

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	ArkPlus	MaxQ
Grazing phase (223 days)				
No. of head	70	72	70	72
Initial weight, lb	556	557	557	557
Ending weight, lb	796^{a}	917^{b}	923^{b}	938^{b}
Gain, lb	240^{a}	360^{b}	366^{b}	382^{b}
Daily gain, lb	1.06^{a}	1.63^{b}	1.65^{b}	1.74^{b}
Gain/acre, lb	181^{a}	271^{b}	276^{b}	288^{b}
Finishing phase				
No. of days	118	113	113	113
Beginning weight, lb	796^{a}	917^{b}	924^{b}	938^{b}
Ending weight, lb	1283^{a}	1366^{b}	1374^{b}	1364^{b}
Gain, lb	487^{a}	449^{b}	449^{b}	425^{c}
Daily gain, lb	4.17^{a}	3.99^{a}	3.99^{a}	3.77^{b}
Daily dry matter intake, lb	27.1	27.9	27.7	27.7
Feed:Gain	6.61^{a}	7.14^{b}	7.04^{b}	7.51^{c}
Hot carcass weight, lb	756^{a}	809^{b}	814^{b}	812^{b}
Dressing percentage, %	59^{a}	59^{a}	59^{a}	60^{b}
Backfat, in.	0.41	0.45	0.45	0.44
Ribeye area, square in.	11.9^{a}	12.1^{ab}	12.3^{b}	12.1^{ab}
Yield grade	2.8	3.1	3.0	3.0
Marbling score[1]	SM^{76}	SM^{63}	SM^{72}	SM^{74}
Percent choice, %	79	82	80	88
Overall performance (Grazing plus finishing)				
No. of days	341	336	336	336
Gain, lb	727^{a}	809^{b}	817^{b}	807^{b}
Daily gain, lb	2.14^{a}	2.43^{b}	2.45^{b}	2.43^{b}

[1] SM = small

^{abc} Within rows, means without a common superscript differ ($P<0.05$).

Evaluation of Tall Fescue Cultivars

J. L. Moyer

Summary

Spring 2008 yields of the 2003 trial were higher for FA 120 and 'Ky 31' LE than for 'AU Triumph' and 'Select'. Fall production of AU Triumph and Ky 31 LE was higher than 18 other entries. Total 2008 production was higher for FA 111, FA 2860, and Ky 31 LE than for 'Jesup MaxQ'. Total 2007-2008 production of Ky 31 LE was greater than 19 other cultivars, whereas 5-year production of FTF-24 was greater than 9 other cultivars.

Introduction

Tall fescue (*Festuca arundinacea* Schreb.) is the most widely grown forage grass in southeast 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 also are 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

All trials were seeded at the Mound Valley Unit of the Southeast Agricultural Research Center in 10-in. rows on Parsons silt loam soil. Plots (30 × 5 ft) were arranged in four randomized complete blocks. Tests were seeded with 19 lb/a of pure, live seed on Sept. 17, 2003.

Fertilizer to supply 120 lb/a nitrogen (N) was applied to all plots on Mar. 12, 2008, and 60 lb/a N was applied on September 18. Harvest was performed on a 3-ft-wide and 15- to 20-ft long strip from each plot cut to a 3-in. height with a flail-type harvester after all plots were headed (May 21, 2008). Regrowth that occurred primarily in fall was harvested on Jan. 7, 2009. A forage subsample was collected and dried at 140 °F for moisture determination, and forage was removed from the rest of the plot at the same height.

Results and Discussion

Spring 2008 forage yield of entries in the 2003 trial was greater ($P<0.05$) for FA 120 than for AU Triumph, Select, and FA 2850 (Table 1). KY 31 LE had greater spring yield than AU Triumph. For fall production, AU Triumph and Ky 31 LE yields were higher than 18 other entries, FTF-24 yield was higher than 12 other entries, and 'ArkPlus' and Jesup MaxQ yields were lower than 12 other entries. Total 2008 production was higher for FA 111, FA 2860, and Ky 31 LE than for Jesup MaxQ.

The droughty year of 2006 resulted in extremely low fescue yields (Table 2) and may have affected fescue stands. Because 2007 and 2008 had abundant moisture, yields from those years should reflect productivity of the remaining plants. Total 2007-2008 production (Table 1) for Ky 31 LE was greater than 19 other cultivars. FTF-24 production was greater than 7 other cultivars. Ky 31 LE, FTF-24, and FA 2860 yielded more than FA 2845 and Jesup MaxQ.

Total cumulative yield from 2004 to 2008 (5 years) was greater for FTF-24 than for 9 other cultivars (Table 2). FTF-24 has had the highest cumulative yield since the test began, but the entry that was originally low-endophyte Ky 31 has dramatically increased in rank in the past 2 years.

Table 1. Forage yield of tall fescue cultivars, Southeast Agricultural Research Center, Mound Valley Unit, 2008, 2007, and 2-year total

Cultivar	Cut 1	Cut 2	2008 total	2007	2-year
	-----------------------	ton/a at 12% moisture	-----------------------		
FTF-24	2.91	2.19	5.10	5.80	10.90
FTF-25	2.87	2.02	4.89	5.20	10.10
AU Triumph	2.67	2.34	5.01	4.95	9.96
Stockman	2.98	2.00	4.98	5.32	10.30
Tuscany II	3.16	1.94	5.09	5.45	10.54
Montendre	2.89	1.86	4.75	5.06	9.80
ArkPlus[1]	3.02	1.68	4.69	5.40	10.10
Jesup MaxQ[1]	2.87	1.72	4.58	5.11	9.69
Select	2.76	2.03	4.78	5.18	9.96
Enhance	2.85	1.89	4.74	5.09	9.83
FA 111	3.09	2.15	5.25	4.84	10.09
FA 117	3.09	1.85	4.94	5.25	10.20
FA 120	3.20	1.87	5.07	5.03	10.10
FA 121	3.02	2.10	5.11	5.16	10.27
FA 2845	3.06	1.81	4.86	4.78	9.64
FA 2846	3.07	2.01	5.08	5.38	10.46
FA 2847	3.00	1.91	4.91	5.27	10.17
FA 2848	3.03	2.08	5.11	5.13	10.23
FA 2849	3.05	1.87	4.92	5.12	10.04
FA 2850	2.77	2.05	4.82	5.41	10.23
FA 2860	3.06	2.18	5.24	5.35	10.59
FA 2861	3.05	1.79	4.84	5.09	9.92
Ky 31 HE[2]	3.19	1.90	5.08	5.47	10.55
Ky 31 LE[2]	2.89	2.33	5.22	6.06	11.27
Average	2.98	1.98	4.96	5.25	10.20
LSD (0.05)	0.40	0.25	0.54	0.55	0.71

[1] Contains proprietary novel endophyte.

[2] LE = low-endophyte seed (originally < 2% infected); HE = high-endophyte seed (80% infected).

Table 2. Forage yield of tall fescue cultivars in previous years and 5-year total, Southeast Agricultural Research Center, Mound Valley Unit

Cultivar	2004	2005	2006	5-year total
	------------------	ton/a at 12% moisture	------------------	
FTF-24	5.11	4.63	1.36	22.00
FTF-25	4.80	4.61	1.25	20.76
AU Triumph	4.15	4.20	1.30	19.60
Stockman	4.85	4.28	1.24	20.67
Tuscany II	4.57	4.41	1.22	20.74
Montendre	4.13	4.20	1.15	19.28
ArkPlus[1]	4.83	4.13	1.30	20.35
Jesup MaxQ[1]	4.80	4.18	1.14	19.81
Select	4.34	3.72	1.18	19.21
Enhance	4.19	4.10	1.02	19.14
FA 111	4.37	3.84	1.16	19.45
FA 117	4.94	4.39	1.29	20.82
FA 120	4.48	4.29	1.24	20.12
FA 121	4.85	4.43	1.22	20.77
FA 2845	4.30	3.92	1.16	19.02
FA 2846	4.44	3.94	1.08	19.92
FA 2847	4.75	4.36	1.18	20.46
FA 2848	4.46	4.32	1.17	20.17
FA 2849	4.46	3.94	1.11	19.55
FA 2850	4.65	4.28	1.18	20.33
FA 2860	4.61	4.05	1.05	20.30
FA 2861	4.91	4.08	1.16	20.07
Ky 31 HE[2]	4.62	4.10	1.38	20.66
Ky 31 LE[2]	4.40	4.04	1.09	20.79
Average	4.58	4.18	1.19	20.22
LSD (0.05)	0.82	0.47	0.14	1.43

[1] Contains proprietary novel endophyte.

[2] LE = low-endophyte seed (originally < 2% infected); HE = high-endophyte seed (80% infected).

Forage Production of Seeded Bermudagrass Cultivars

J. L. Moyer

Summary

Yields from three cuttings in 2008 were higher for ‘SG 19’ than for eight other entries. Six seeded types yielded more than ‘Midland 99’, a sprigged type included as a check cultivar.

Introduction

Bermudagrass can be a high-producing, warm-season perennial forage for eastern Kansas when not affected by winterkill. Producers in southeast Kansas have profited from the use of winter-hardy varieties that produced more than common bermudas. Seeded types may offer cost savings or other advantages in marginal areas. Further developments in bermudagrass breeding should be monitored to speed adoption of improved, cold-hardy types.

Experimental Procedures

Thirteen bermudagrass entries were seeded at 8 lb/a of pure, live seed for hulled seed or 5 lb/a for hulless seed at the Mound Valley Unit of the Southeast Agricultural Research Center on June 21, 2005, and Midland 99 plugs were planted 2 weeks later. In 2008, plots were fertilized on April 15 with 165-50-60 lb/a N-P_2O_5-K_2O and on July 15 with 60 lb/a N as ammonium nitrate.

Plots were cut July 14, August 18, and October 13, and subsamples were collected from the 20 × 3 ft harvested strips to determine moisture content of forage.

Results and Discussion

Rainfall each month of the 2008 growing season was greater than the 30-year average. More than 45 in. were received in April through September, which is greater than the average annual precipitation and 17 in. above average for the period. The first cutting was delayed by wet weather, such that forage dry matter averaged 37%, compared with 28% in the second cutting. The late first cutting accounted for 47% of the seasonal total. It was also unusual that late-season yield (after August 18) amounted to 27% of the total.

First-cut yield was higher for SG 19 and ‘Sungrazer’ than for 10 of the other 12 cultivars (Table 1). A group of eight cultivars produced more than 3.5 ton/a in the first cutting, which was significantly greater than yields of the other six cultivars.

Second-cut yield of Midland 99 was greater than that of the other cultivars (Table 1). Yield of SG 19 for Cut 2 was greater than that of three other cultivars. Yields from the third cutting were relatively uniform, with a range of less than 0.6 ton/a. The high-yielding cultivar ‘Jackpot’ produced more than only three other cultivars.

Total-season yield for 2008 was higher for SG 19 than for eight other entries. SG 19 and Sungrazer yielded more than six cultivars, including Midland 99, a sprigged type included as a check cultivar. In fact, six seeded types yielded more than Midland 99 in 2008.

Yield totals have been obtained for two post-seeding years, 2006 and 2008. The 2-year total yield of SG 19 was greater than that of 9 of the other 13 cultivars. 'Cherokee', 'CIS-CD-4', and 'Riata' produced less than eight of the other cultivars.

Table 1. Forage yield in 2008 and 2-year total yields (2006 and 2008) for bermudagrass seeded in 2005, Southeast Agricultural Research Center, Mound Valley Unit

		2008 forage yield				2-year
Source	Entry	7/14	8/18	10/13	Total	total
		---------- ton/a at 12% moisture----------				
K-F Seeds	KF 888	3.70	1.65	1.93	7.28	10.81
K-F Seeds	KF 194	3.92	1.48	1.71	7.11	11.09
K-F Seeds	KF 111	3.78	1.68	1.75	7.21	12.08
K-F Seeds	KF 222	3.51	1.57	1.88	6.96	10.57
K-F Seeds	SG 19	4.54	1.76	1.88	8.19	12.39
Genetic Seed & Chemical	Sungrazer	4.48	1.67	1.65	7.80	12.03
Genetic Seed & Chemical	Sungrazer I	3.90	1.58	1.82	7.30	11.16
Genetic Seed & Chemical	Sungrazer Plus	3.60	1.70	1.88	7.18	10.74
Nixa Hardware & Seed	Cherokee	2.08	1.41	1.46	4.94	8.01
Genetic Seed & Chemical	Jackpot	1.81	1.75	1.98	5.54	9.74
Oklahoma State University	Wrangler	1.94	1.62	1.41	4.96	9.78
Oklahoma State University	Midland 99[1]	1.95	2.37	1.81	6.13	10.98
Johnston Seed	Riata	1.69	1.39	1.61	4.68	9.27
DLF International Seeds	CIS-CD 4	1.67	1.45	1.86	4.98	8.94
Average		3.04	1.65	1.76	6.45	10.54
LSD (0.05)		0.64	0.29	0.36	1.04	1.37

[1] Sprigged cultivar.

Winter Annual Crops for Forage

J. L. Moyer, V. Martin[1], and B. Kindiger[2]

Summary

Early-cut total cereal forage yields, which simulate grazing, were usually highest for one or more of the rye cultivars. A single late cutting in 2007 produced best yields from two triticale cultivars, whereas in two harvests of reproductive growth in 2008, 'Maton' and 'Elbon' ryes and 'Bess' wheat gave higher yields than four other entries.

Of the dicotyledonous species tested, hairy vetch (Figure 1) production was most consistent. 'Wichita' canola produced relatively higher in early spring, whereas field pea production was later.

Introduction

Pastures in eastern Kansas consist mainly of cool-season grasses that produce mostly in spring and early summer. Stockpiled forages can be used in fall and early winter, but grazing is usually lacking in late winter and early spring. A complementary system that uses annuals for late-winter grazing would provide high-quality forage when quality of stockpiled forages is low. Designing such a system requires basic information about growth and development of winter annual species. The objective of this research was to evaluate the adaptability, yield, and quality of winter annual forages at this site for use in complementary forage systems.

Experimental Procedures

Winter annual cereals and other crops were planted in blocks with three replications. Cereals were planted at the rate of 100 lb/a of pure, live seed, brassicas at 5 lb/a, and legumes and ryegrass at 30 lb/a. Plots (10 × 30 ft) were planted on Sept. 19, 2006, and Sept. 18, 2007, in 10-in. rows. Fertilizer was applied preplant at 20-50-60 lb/a N-P_2O_5-K_2O. Additional nitrogen (60 lb/a) was applied Mar. 8, 2007, and Mar. 12, 2008.

Plots were harvested from either side of each plot on an early-cut or late-cut schedule with a 3 × 20-ft flail cutter. Early-cut strips were cut to simulate grazing when growth of most plots produced a harvestable amount (4 to 6 in.) and soil conditions permitted. Late-cut strips were cut near physiological maturity in 2007 and after cereal stem initiation and again after physiological maturity (hard dough) in 2008. Subsamples of forage were collected at each harvest for moisture and crude protein determination.

Results and Discussion

Winter Cereals

In the early-cut harvest of 2007, rye cultivars produced more ($P<0.05$) than other winter cereals in the first harvest (Table 1), whereas barley produced less than five other cultivars. In the other early-cut harvest, 'Post 90' barley produced more forage than all other

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entries. Total production from early-cut harvests was higher from barley and the two ryes than from all of the wheat cultivars except 'Danby' (Table 1).

Late-cut 2007 forage yield was higher for the triticale cultivars than for the wheat cultivars and 'Oklon' rye. In addition, Post 90 barley and Elbon rye yielded more than 'Trego' and 'Overley' wheats (Table 1).

In the first 2008 early-cut harvest, Overley wheat produced more than the other winter cereals (Table 2), whereas 'Karl 92' produced less. Post 90 barley produced more forage than the triticales and two of the rye cultivars. In the second early-cut harvest, all rye cultivars produced more forage than six other entries, whereas Post 90 produced less than all but two other cultivars (Table 2).

In the third early-cut harvest, 'Boreal' triticale produced more than the other winter cereals, and all triticales produced more than three of the four rye cultivars (Table 2). However, total production from early-cut harvests was higher from Maton rye than from all cultivars except Elbon rye and Overley wheat. Karl 92 produced less forage than all other cultivars, and the triticales and barley produced less than Maton and Elbon (Table 2).

Yield from the first harvest of late-cut 2008 forage was higher for all rye cultivars than for the other eight cultivars (Table 2). Conversely, Karl 92 wheat and Boreal triticale yielded less than the other entries. In the other late-cut harvest, Danby and Bess wheats yielded more than the barley, rye, and hard wheat cultivars. The three triticale cultivars also yielded more than Post 90 barley, Karl 92 wheat, and 'Chason' and Maton ryes. Total production from late-cut harvests was higher from Maton, Elbon, and Bess than from Karl 92, Post 90, Boreal, and Overley.

Total forage yield from the early-cut harvests averaged 62 and 70% of yield from late-cut harvests in 2007 and 2008, respectively. In the early-cut system, about half of the production occurred by the first week of April each year. In 2007, rye production was most pronounced before the first cutting, whereas Post 90 barley produced relatively more in the later period, a pattern consistent with previous studies. In 2008, however, Overley and Post production appeared earlier than rye production, which was most pronounced between April 7 and May 5. Triticale production seemed more prominent later in the harvest period. Generally, rye forage production seemed most consistent for early pasture production.

The late-cut harvests generally demonstrated the later growth of triticales compared with the ryes. In 2007, triticales generally had better production than wheats, whereas in 2008, ryes yielded more than wheats.

Other Winter Annuals

Of the six dicotyledonous forages tested in 2006-2007, Wichita canola produced more spring forage in the first early-cut harvest and in the late harvest than the other species (Table 1). Hairy vetch produced as much forage as Wichita in the second early-cut harvest and for the total of the early-cut harvests. Field pea forage yield was numerically but not significantly ($P<0.05$) less than that of canola or hairy vetch in the second early-cut harvest or of hairy vetch in the other harvests. In 2007-2008 (Table 3), only the late-cut harvest was measured. First-cut yield was higher for 'Passerel Plus' ryegrass than for field pea and hairy vetch. Canola and hairy vetch also yielded more than field pea. Second-cut yield was greater for ryegrass than for field pea and hairy vetch but was nonexistent for canola. Total late-cut yield was greatest for ryegrass and similar for the other three forages. Besides ryegrass, Wichita canola (a brassica) and hairy vetch (a legume) appear to be promising spring forages. Annual ryegrass forage production seemed later and somewhat less than that of cereals.

Table 1. Forage yield from winter annual species, Southeast Agricultural Research Center, Mound Valley Unit, 2007

		Early cut (vegetative)			Late cut
Species	Cultivar	Cut 1 (4/9)	Cut 2 (5/23)	Total	(5/23)
		-------------ton/a at 12% moisture-------------			
Cereals					
Wheat, hard red	Overley	1.18	0.90	2.08	3.73
	Karl 92	1.36	0.89	2.25	4.03
Wheat, hard white	Danby	1.17	1.51	2.68	4.07
	Trego	1.34	0.99	2.33	3.57
Wheat, soft red	Bess	1.08	1.40	2.47	3.90
Triticale	Boreal	1.25	1.45	2.70	4.78
	Windrift	1.26	1.31	2.57	5.19
	Pika	1.44	1.28	2.71	5.09
Barley	Post 90	0.84	2.37	3.21	4.49
Rye[1]	Elbon	2.15	0.97	3.12	4.61
	Oklon	2.27	1.10	3.38	4.11
Average		1.39	1.29	2.68	4.35
LSD (0.05)		0.46	0.73	0.62	0.64
Other forages[2]					
Canola	Wichita	0.66	1.42	2.08	3.46
Rapeseed	Bonar	0.09	0.08	0.17	0.05
Field pea	Winkowitsch	0.02	0.87	0.88	0.52
Hairy vetch		0	1.54	1.54	1.32
Average		0.19	0.98	1.17	1.34
LSD (0.05)		0.17	0.99	0.90	1.04

[1] Yield of late-cut Maton rye strips was intermediate between yields of the other rye cultivars.

[2] 'Purpletop' turnip and 'Yucchi' arrowleaf clover were also grown but did not produce a significant amount of spring forage.

Table 2. Forage production from winter cereals, Southeast Agricultural Research Center, Mound Valley Unit, 2008

		Early cut (vegetative)					Late cut		
Species	Cultivar	Cut 1 (1/23)	Cut 2 (4/7)	Cut 3 (5/5)	Total	Crude protein (5/5)	Cut 1 (4/7)	Cut 2 (6/12)	Total
		---------------ton/a at 12% moisture---------------				%	------- ton/a at 12% moisture-------		
Wheat, hard red	Overley	2.34	1.32	0.58	4.25	17.4	3.61	1.79	5.40
	Karl 92	0.66	1.77	0.53	2.96	18.6	2.60	1.45	4.05
Wheat, hard white	Danby	1.96	1.38	0.65	3.98	13.0	3.38	2.60	5.98
Wheat, soft red	Bess	1.93	1.40	0.54	3.87	17.3	3.61	2.51	6.12
Triticale	Boreal	1.24	1.30	0.95	3.49	13.6	2.72	2.16	4.89
	Windrift	1.21	1.69	0.68	3.58	13.3	3.40	2.41	5.81
	Pika	1.78	1.44	0.63	3.85	14.1	3.36	2.30	5.66
Barley	Post 90	2.08	1.11	0.65	3.84	13.9	3.43	0.82	4.25
Rye	Chason	1.79	1.89	0.33	4.02	18.0	4.48	1.12	5.60
	Elbon	1.82	1.95	0.50	4.27	16.0	4.48	1.69	6.17
	Oklon	1.95	1.34	0.31	3.49	11.6	4.39	1.53	5.92
	Maton	2.05	2.03	0.34	3.80	15.5	4.81	1.49	6.30
Average		1.73	1.60	0.56	3.87	15.2	3.69	1.82	5.51
LSD (0.05)		0.25	0.21	0.19	0.41	3.4	0.39	0.64	0.69

Table 3. Forage yield from winter annual species, Southeast Agricultural Research Center, Mound Valley Unit, 2008

Species[1]	Cultivar	Cut 1 (4/7)	Cut 2 (6/12)	Total
		------------ton/a at 12% moisture------------		
Canola	Wichita	1.41	0	1.41
Field pea	Winkowitsch	0.36	1.89	2.24
Hairy vetch		0.94	1.33	2.27
Ryegrass	Passerel Plus	1.63	3.17	4.80
Average		1.08	1.60	2.68
LSD (0.05)		0.51	0.81	1.15

[1] Purpletop turnip was also grown but did not produce a significant amount of spring forage.

Figure 1. Hairy vetch, *Vicia villosa* Roth ssp. *varia* (Host) Corb.
Photo by G. A. Cooper, courtesy of Smithsonian Institution; obtained from USDA-NRCS PLANTS Database.

Nitrogen Fertilization of Bermudagrass

J. L. Moyer and K. W. Kelley

Summary

Bermudagrass forage yield response to nitrogen (N) fertilization was measured for rates up to 300 lb/a N in 2006 and 2008. Total yield of bermudagrass cultivar 'Midland 99' from two cuttings was higher in 2006 than in 2008, reaching an optimum at about 250 lb/a N. In 2008, yield was still increasing linearly at 300 lb/a. Nutrisphere applied at the higher rates in 2008 had no effect on yield.

Introduction

Bermudagrass can be a high-producing, warm-season perennial forage for hay or pasture in eastern Kansas when sufficient N is applied. Newer, high-yielding cultivars may have different N responses than older varieties, so optimum rates of N need to be determined for newer cultivars.

Split applications of N are generally recommended for bermudagrass. However, use of N stabilizers may make single applications more efficient. Nutrisphere, a urease inhibitor, may preserve N for uptake throughout the summer.

Experimental Procedures

Established Midland 99 bermudagrass plots received one of six rates (0, 60, 120, 180, 240, and 300 lb/a) of N as urea on Apr. 12, 2006, and May 23, 2008. In 2008, some urea was treated with Nutrisphere and applied to additional plots at 240 and 300 lb/a N. Plots were 20 × 6 ft in 2006, and 40 × 6 ft in 2008, arranged in randomized complete blocks with four replications each year.

Plots were harvested on June 21 and Aug. 16, 2006, and June 25 and Aug. 18, 2008 from 3-ft strips of varying length; subsamples were collected to determine moisture content of forage.

Results and Discussion

In 2006, first-cut yield was higher for each 60-lb increment of N applied up to the 180 lb/a rate (Table 1). Second-cut yield was higher for the 300 lb/a rate than for the 120 through 240 lb/a rates, which were, in turn, higher than the check and 60 lb/a rate. Trends of total yield reflected those of the second cutting, in that yield responses continued to occur up to the highest N rates.

In 2008, first-cut yield was higher for each of the first two 60-lb increments of N applied (Table 1). However, yield from the 180 lb/a rate was not significantly (P=0.05) greater than yield from the 120 lb/a rate, and none of the higher rates increased yield beyond that achieved with the 180 lb/a rate. Second-cut yield was not increased compared with the check by the first two 60-lb increments of N applied but was increased by the 180 and 240 lb/a rates. The 300 lb/a rate resulted in a further yield increase compared with the lower rates. Total 2008 yield was higher for each 60-lb increment of N applied up to the 180 lb/a rate. Yield from the 240 lb/a rate with Nutrisphere was significantly higher than yield from the 180 lb/a rate of urea alone. This was the only case in which Nutrisphere resulted in a significant yield difference. The 300 lb/a rate resulted in a further yield increase compared with the lower rates, regardless of whether Nutrisphere was added (Table 1).

Rainfall in the 3-month growing season of 2006 was about 80% of normal, whereas rainfall in the 2008 growing season was 155% of the 30-year average. In April through September of 2008, more than 42 in. of rainfall were received; this is near the average annual precipitation and 15 in. above average for the period. This hindered efficient use of applied N and contributed to the lower yield in 2008 compared with the drier year of 2006 (Table 1).

Table 1. Forage yield in 2006, 2008, and total annual yields for Midland 99 bermudagrass, Southeast Agricultural Research Center, Columbus Unit

	2006			2008		
Nitrogen rate	Cut 1	Cut 2	Total	Cut 1	Cut 2	Total
lb/a	ton/a at 12% moisture					
0	0.95	0.39	1.34	0.90	0.55	1.45
60	2.37	0.47	2.83	1.96	0.74	2.69
120	4.28	0.98	5.26	2.78	0.90	3.68
180	4.86	0.97	5.83	3.12	1.44	4.55
240	5.03	1.39	6.42	3.35	1.56	4.91
300	5.08	1.92	7.00	3.33	2.73	6.06
240 + Nutrisphere	–	–	–	3.39	1.82	5.21
300 + Nutrisphere	–	–	–	3.41	2.47	5.88
Average	3.76	1.02	4.78	2.78	1.53	4.30
LSD (0.05)	0.60	0.44	0.88	0.37	0.42	0.49

Biomass Production of Switchgrass Lines

J. L. Moyer and C. Christensen[1]

Summary

Biomass production for the seeding year of 2007 was higher for experimental lines 56 and 60 than for the other eight entries in this study. In both years and for the 2-year total, experimental line 58 and 'Cave-in-Rock' produced less than the other entries.

Introduction

Switchgrass is a perennial grass that is native to the prairies of North America. It has been identified by the U.S. Department of Energy as a preferred dedicated energy crop. Because switchgrass has been subjected to less intense breeding efforts than most commodity crops, rapid and significant improvements can be made through advanced plant breeding and biotechnology. This study was established to compare standard cultivars with advanced lines for adaptation in eastern Kansas and to test the biomass for suitability as a bioenergy crop.

Experimental Procedures

Ten switchgrass entries obtained from Ceres, Inc. were seeded at 5 lb/a of pure, live seed in 20-in. rows at the Mound Valley Unit of the Southeast Agricultural Research Center on May 21, 2007. Seed was planted no-till after a wheat-soybean double crop, then sprayed with 1 qt/a glyphosate (0.75 lb a.e./gal). Plots (20 × 10 ft) were arranged in a randomized complete block with six replications. On June 21, stands were rated as good to excellent. Plots were sprayed on June 25 with 0.1 oz/a (60 DF) metsulfuron + 1 lb a.i./a 2,4-D amine + 1 lb a.i./a atrazine.

Two rows (40 in.) for a length of 14 ft/plot were harvested at a 2.5-in. height on November 27. Biomass was subsampled for moisture content and chemical constituents, and the residual was burned that winter. In 2008, plots were sprayed for weed control with 1 qt/a S-metolachlor (1.9 lb a.e./gal). They were fertilized on April 15 with 50-40-60 lb/a N-P_2O_5-K_2O and again on May 15 with 50 lb/a N as ammonium nitrate. Plots were harvested on November 25 as described previously from two 13-ft-long rows, and the residual was cut and removed.

Results and Discussion

Conditions for establishment were excellent in 2007, with wetter-than-normal precipitation and cooler temperatures. The 14.73 in. of precipitation received in June was more than 9 in. above the 30-year average, and July precipitation was 1.8 in. above average. In the 2008 growing season, rainfall each month was greater than the 30-year average. In April through September, more than 45 in. were received, which is greater than the average annual precipitation and 17 in. above average for the period.

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[1] Product Manager, Ceres, Inc., Thousand Oaks, CA

First-year (2007) yield was higher ($P<0.05$) for experimental lines 56 and 60 than for the other eight entries (Table 1). Experimental line 58, Cave-in-Rock, and 'Kanlow' produced less than the four highest-yielding entries.

In 2008, experimental line 59 produced more than five other entries (Table 1). Cave-in-Rock and experimental line 58 produced less than the other eight entries in this study. Kanlow and 'Alamo' produced amounts similar to six other entries in the "high-yield" group. Total 2-year production was higher for members of that same "high-yield" group than for experimental line 58 and Cave-in-Rock.

Table 1. Biomass production in 2007 and 2008 for switchgrass seeded in 2007, Southeast Agricultural Research Center, Mound Valley Unit

Entry	Status	2007	2008	Total
		-------------------	lb/a dry matter	-------------------
54	Experimental	6440	14150	20590
55	Experimental	6930	13760	20685
56	Experimental	8380	13280	21660
57	Experimental	6400	13820	20220
58	Experimental	4120	9630	13760
59	Experimental	6310	15760	22070
60	Experimental	8220	14180	22395
Cave-in-Rock	Variety	4740	9270	14020
Alamo	Variety	6950	14455	21400
Kanlow	Variety	5660	14540	20196
Average		6415	13284	19700
LSD (0.05)		1240	1690	2350

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

Overall in 2008, adding nitrogen (N) increased wheat yields, but the advantage of knifing compared with broadcast and dribble placement was apparent only in no-till. Double-crop soybean yields were slightly decreased with no-till but were unaffected by the residual from N placement treatments.

Introduction

Many crop rotation systems are used in southeast Kansas. This experiment is designed to determine the long-term effect 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) continues in the same areas as 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-numbered years is 125 lb/a. The N rate of 120 lb/a for wheat is split as 60 lb/a applied preplant as broadcast, dribble, or knifed UAN. All plots except for the controls are top-dressed in the spring with broadcast UAN at 60 lb/a N.

Results and Discussion

In 2008, adding fertilizer N, in general, doubled wheat yields compared with the no-N controls (Figure 1). Wheat yield was affected by a tillage and N placement interaction. With conventional and reduced tillage, there were no differences in yield due to placement method. In no-till, knife application of fertilizer N resulted in nearly 50% greater yield than broadcast or dribble applications but did not fully compensate for yield reduction with no-till. Although double-crop soybean yields were not affected by the residual effect of N placement or an interaction of N placement with tillage (data not shown), no-till soybean yield was 3 to 4 bu/a less than yields with conventional or reduced tillage (Figure 2).

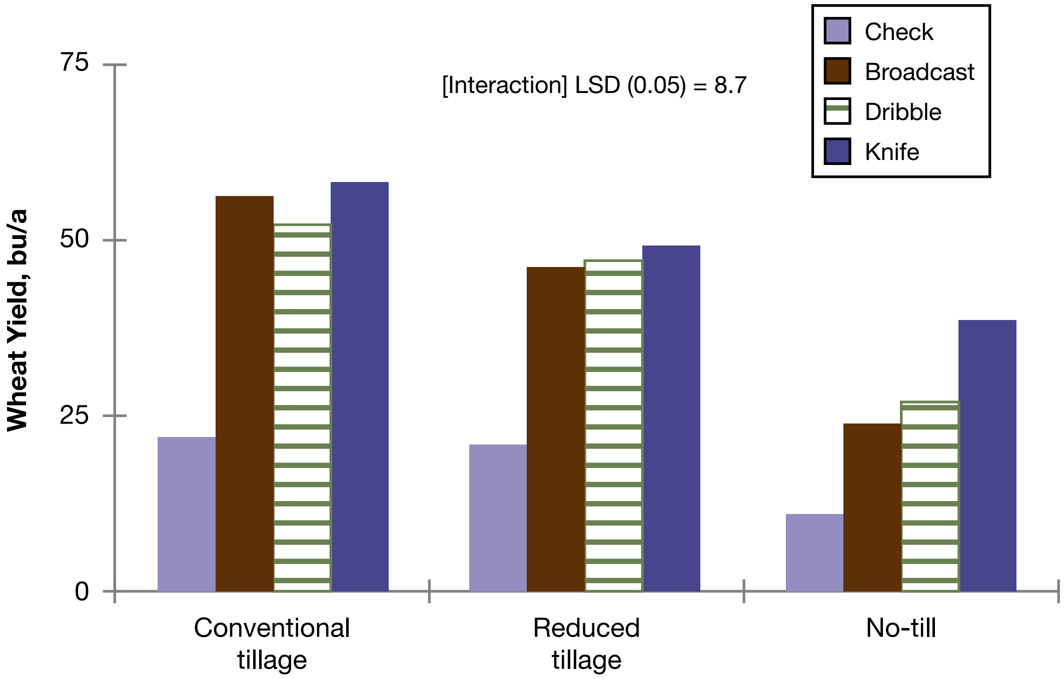
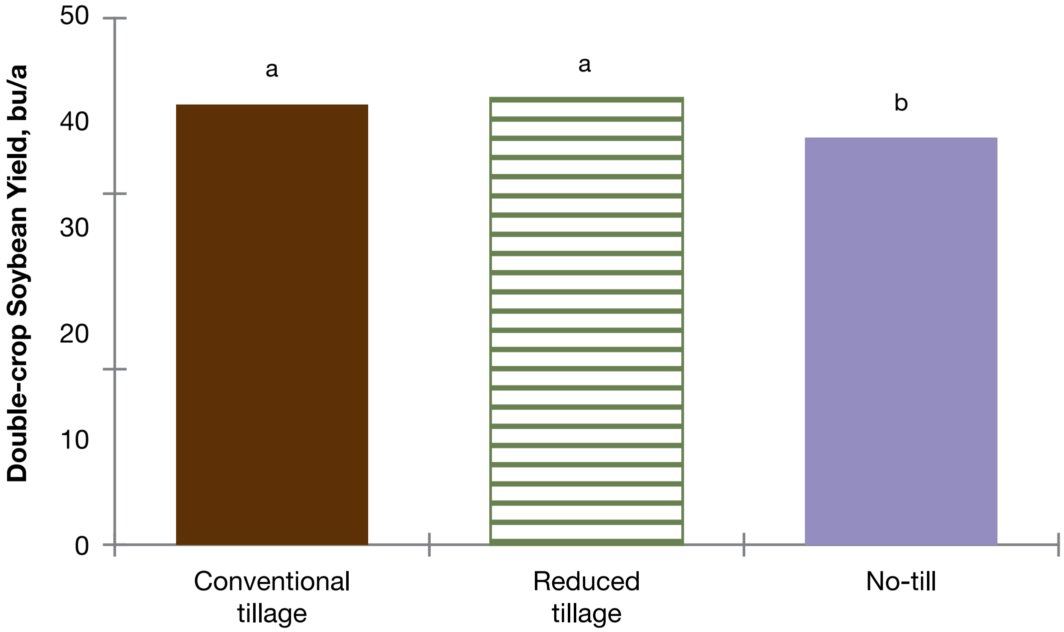


Figure 1. Effect of tillage and nitrogen placement on wheat yield, Southeast Agricultural Research Center, 2008.



Bars with the same letter are not statistically different at $P<0.05$ according to the LSD test.

Figure 2. Effect of tillage on soybean yield planted as a double crop after wheat, Southeast Agricultural Research Center, 2008.

Effect of Nitrogen and Phosphorus Starters on Short-Season Corn Grown in Conservation-Tillage Systems

D. W. Sweeney, D. B. Mengel[1], and K. W. Kelley

Summary

Overall corn yields in 2008 averaged near 150 bu/a. Corn yields were not improved by use of starters. Even though early corn growth appeared to be improved with the highest phosphorus (P) rate in the starter, this effect did not persist by the reproductive stages of growth.

Introduction

Corn acreage has increased in southeast Kansas in recent years because of the introduction of short-season cultivars that enable producers to plant in the upland, claypan soils typical of the area. Short-season hybrids reach reproductive stages earlier than full-season hybrids and thus may partially avoid midsummer droughts, which are often severe on these claypan soils that have limited plant-available moisture storage.

Optimum corn production results from proper management of soil fertility, tillage, and other practices. However, ideal soil fertility and other management options have not been well defined for short-season corn production in southeast Kansas. Reducing tillage has the potential to reduce soil and nutrient losses to the environment, and maintaining proper plant nutrition is critical for crop production. Starter fertilizers have been used to improve early plant growth in no-till or reduced-tillage systems, and this often translates to additional yield. However, data are limited regarding the effect of starter fertilization on yield of short-season corn grown on the claypan soils found in areas of the eastern Great Plains. The objective of this study was to determine the effect of nitrogen (N) and P rates in starter fertilizers on short-season corn planted with reduced tillage or no-till.

Experimental Procedures

The experiment was conducted in 2008 at the Kansas State University Southeast Agricultural Research Center at Parsons, KS. The soil was a Parsons silt loam with a claypan subsoil. Selected background soil chemical analyses in the 0- to 6-in. depth were pH 6.5 (1:1 soil:water), 5 ppm P (Bray-1), 65 ppm K (1 M $NH_4C_2H_3O_2$ extract), 5.3 ppm NH_4-N, 6.4 ppm NO_3-N, and 2.8% organic matter. The experimental design was a split-plot arrangement of a randomized complete block with three replications. The whole plots were tillage system (reduced tillage and no-till), and subplots were starter N-P combinations. Nine of the subplots were starter fertilizer combinations in which N rates were 20, 40, and 60 lb/a and P rates were 0, 25, and 50 lb/acre P_2O_5. In addition, there were two reference subplot treatments: a no-starter treatment (all N and P applied preplant) and a control with no N or P. All plots except the no N-P control were balanced to receive a total of 120 lb/a N and 50 lb/a P_2O_5. The N and P fertilizer sources were 28-0-0 and

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[1] KSU Dept. of Agronomy, Manhattan, KS

10-34-0 fluids. All plots received 60 lb/a K_2O as solid KCl broadcast preplant. Pioneer 35F37 Roundup Ready corn was planted at 25,000 seeds per acre on Apr. 16, 2008. Starter solutions were applied 2 × 2 with the planter. Grain was harvested for yield on Sept. 19, 2008, with a small-plot combine equipped with a corn head.

Results and Discussion

Although rainfall was variable, environmental conditions were more favorable than in the past 2 years, resulting in overall corn yields in 2008 near 150 bu/a. However, corn yields were not improved by use of starters in 2008. Average corn yield with starters was 8 bu/a less than with all N and P fertilizer applied prior to planting (Table 1). This yield difference appeared to be due to a greater number of kernels per ear in the treatment with all N and P prior to planting. Even though early growth appeared to be improved with the highest P rate in the starter, this effect did not persist by the reproductive stages of growth (Table 2). A rate of 40 lb/a N in the starter resulted in greater dry matter production at R1 compared with 20 lb/a N, but this effect was not apparent at any other growth stage. At the R4 (dough) growth stage, dry matter production was not significantly affected by any treatment including the control.

Table 1. Effect of conservation-tillage systems and nitrogen and phosphorus starter rates on yield and yield components of short-season corn, Southeast Agricultural Research Center, 2008

Treatments	Yield	Population	Kernel weight	Kernels/ear
	bu/a	plants/a	mg	
Tillage[1]				
Reduced	153	27700	284	589
No-till	146	28500	281	577
LSD (0.05)	NS	NS	NS	NS
Starter N Rate, lb/a				
20	147	28100	286	580
40	153	28000	281	595
60	149	28200	282	577
LSD (0.05)	NS	NS	NS	NS
Starter P_2O_5 rate, lb/a				
0	153	28100	284	581
25	150	27500	284	583
50	147	28600	280	588
LSD (0.05)	NS	NS	NS	NS
All N-P preplant	158	28200	285	601
Control (No N or P)	140	28100	278	533

[1] Means for tillage include all treatments.

Table 2. Effect of conservation-tillage systems and nitrogen and phosphorus starter rates on corn dry matter accumulation at the V6, V12, R1 (silk), and R4 (dough) growth stages, Southeast Agricultural Research Center, 2008

Treatments	V6	V12	R1	R4
	---------- lb/a	----------	----------	----------
Tillage[1]				
Reduced	480	3750	6230	12900
No-till	490	3610	6150	13300
LSD (0.05)	NS	NS	NS	NS
Starter N Rate, lb/a				
20	490	3520	5930	12900
40	530	3780	6720	13300
60	520	3820	6370	13300
LSD (0.05)	NS	NS	490	NS
Starter P_2O_5 rate, lb/a				
0	490	3720	6370	13500
25	470	3490	6100	12800
50	590	3930	6560	13200
LSD (0.05)	60	330†	NS	NS
All N-P preplant	450	4000	5860	13700
Control (No N or P)	270	3060	5150	12000

[1] Means for tillage include all treatments.

† Significant at the 0.10 probability level.

Effects of Population, Planting Date, and Timing of Supplemental Irrigation on Sweet Corn

D. W. Sweeney and M. B. Kirkham[1]

Summary

In 2008, irrigation applied at both the VT and R2 growth stages increased total fresh weight but not number of ears or individual ear weight. Earlier planting increased total ears, total fresh weight, and individual ear weight. Knife application increased total sweet corn fresh weight, but nitrogen (N) placement had no effect on number of ears or individual ear weight.

Introduction

Sweet corn is a possible value-added, alternative crop for producers in southeast Kansas. Corn responds to irrigation, and timing of water deficits can affect yield components. Even though large irrigation sources, such as aquifers, are lacking in southeast Kansas, supplemental irrigation could be supplied from the substantial number of small lakes and ponds in the area. However, there is a lack of information on effects of irrigation management, N placement, and planting date on performance of sweet corn, which may hinder producers' adoption of this crop.

Experimental Procedures

The experiment was established on a Parsons silt loam in spring 2008 as a split-plot arrangement of a randomized complete block with three replications. The whole plots included two planting dates (targets of late April and mid-May) and four irrigation schemes: (1) no irrigation, (2) 1.5 in. at VT (tassel), (3) 1.5 in. at R2 (blister), and (4) 1.5 in. at both VT and R2. Subplots were three N treatments consisting of no N and 100 lb/a N applied broadcast or as a subsurface band (knife) at 4 in. Sweet corn was planted on Apr. 22 and May 19, 2008. Sweet corn from the first planting date was picked on July 14 and 18, and corn from the second planting date was picked on Aug. 1 and 6, 2008.

Results and Discussion

The total number of ears was 15% greater from sweet corn planted in April than sweet corn planted in May (Table 1), and there was a similar difference in individual ear weight. As a result, total fresh weight was more than 30% greater for sweet corn planted in April than in May. Limited irrigation applied at both the VT and R2 growth stages resulted in more than 10% greater total fresh weight than no irrigation or irrigation at only one growth stage. Irrigation did not increase number of ears per acre or individual ear weight. Nitrogen placement did not affect number of ears or individual ear weight, but knifing increased total fresh weight by about 10% above broadcast N or no N fertilizer. The minimal response to fertilizer N may be a result of the plot area being fallowed the previous year.

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[1] KSU Dept. of Agronomy, Manhattan, KS

Table 1. Effects of planting date, irrigation scheme, and nitrogen placement on sweet corn, Southeast Agricultural Research Center, 2008

Treatment	Total ears	Total fresh weight	Individual ear weight
	ears/a	ton/a	g/ear
Planting date			
Date 1	17100	6.08	323
Date 2	14900	4.54	278
LSD (0.05)	1000	0.29	13
Irrigation scheme			
None	15600	5.07	293
VT (1.5 in.)	15500	5.17	303
R2 (1.5 in.)	15900	5.17	296
VT-R2 (1.5 in. at each)	17000	5.81	310
LSD (0.10)	NS	0.41	NS
N Placement			
None	15800	5.20	297
Broadcast	15500	5.19	301
Knife	16600	5.54	303
LSD (0.05)	NS	0.28[†]	NS
Interactions	NS	NS	NS

[†] Significant at the 0.10 probability level. NS = Not significant.

Effects of Tillage on Full-Season Soybean Yield

K. W. Kelley and D. W. Sweeney

Summary

Long-term effects of tillage method (conventional and no-till) on full-season soybean yield are being evaluated at the Parsons and Columbus Units. Soybean yields have been more affected by tillage at the Columbus Unit, which has a longer cropping history than the Parsons Unit.

Introduction

In southeast Kansas, full-season soybean often is rotated with other crops, such as corn and grain sorghum, to diversify cropping systems. Soybean was typically planted with conventional tillage (chisel – disk – field cultivate), but improved equipment technology has made no-till planting more feasible. This research evaluates the long-term effects of tillage method on yield of full-season soybean grown in rotation with corn or grain sorghum.

Experimental Procedures

From 1995 through 2002, a 3-year crop rotation was evaluated at both the Columbus and Parsons Units. The rotation consisted of (corn and grain sorghum)/soybean/(wheat and double-crop soybean), and tillage effects on full-season soybean yield were evaluated every 3 years. Tillage treatments were: (1) all crops planted with conventional tillage (CT), (2) all crops planted with no-till (NT), and (3) alternate CT and NT systems. Beginning in 2003, the 3-year rotation was changed to a 2-year rotation that consisted of soybean following grain sorghum. Since then, tillage effects on soybean yield have been evaluated each year at both the Columbus and Parsons Units.

Results and Discussion

Effects of tillage method on full-season soybean yield are shown in Table 1. At the Columbus Unit, soybean yields were greater with CT than with NT during the first two cropping cycles. In recent years, however, soybean yields with continuous NT have been equal to or greater than yields with CT. But soybean yields for NT following CT have been significantly lower than yields for continuous NT or continuous CT. Tillage has had less effect on soybean yields at the Parsons Unit, except for the last two cropping years. The Columbus Unit has a significantly longer cropping history than the Parsons Unit, which may be affecting tillage responses.

Table 1. Effects of tillage systems on full-season soybean yield, Southeast Agricultural Research Center, 1996 to 2008

	Full-season soybean yield									
Tillage system[1]	1996	1999	2002	2003	2004	2005	2006	2007	2008	avg.
	bu/a									
Columbus Unit										
NT only	48.4	18.1	27.0	35.7	46.1	30.8	35.8	50.1	54.7	38.5
NT following CT	46.0	14.2	26.0	29.3	38.4	23.7	29.8	43.3	50.1	33.4
CT only	53.9	20.3	23.4	35.8	43.2	29.3	27.9	45.4	51.4	36.7
CT following NT	54.4	20.0	26.5	36.9	40.3	25.9	28.3	44.3	49.1	36.2
LSD (0.05)	4.9	1.3	1.4	2.0	3.7	1.7	2.3	2.8	3.2	2.6
Parsons Unit										
NT only	45.3	15.8	32.4	34.9	42.4	30.8	–	35.0	46.9	35.4
NT following CT	43.7	14.9	32.1	33.5	42.2	27.1	–	32.0	47.1	34.1
CT only	45.2	15.5	27.9	30.8	45.1	29.4	–	32.2	45.8	34.0
CT following NT	45.8	16.0	29.6	35.1	43.8	29.4	–	33.6	46.6	35.0
LSD (0.05)	NS	NS	3.9	2.8	NS	1.9	–	2.1	NS	NS

Effects of previous crop (corn and grain sorghum) on soybean yield were nonsignificant (NS) for the first phase of the study from 1996 through 2002; thus, yields were averaged over both previous crops. From 2003 to 2008, the previous crop before soybean was grain sorghum. Drought conditions in 2006 prevented any meaningful yield data at the Parsons Unit.

[1] NT = no-till; CT = conventional tillage (disk-chisel-disk-field cultivate).

Effects of Nitrogen Fertilizer Rate and Time of Application on Corn and Grain Sorghum Yields

K. W. Kelley and D. W. Sweeney

Summary

Effects of various rates of fertilizer nitrogen (N) applied preplant or side-dressed have been evaluated with corn and grain sorghum in southeast Kansas since 2005. Averaged over 3 years, fertilizer N rate has influenced both corn and grain sorghum yields more than time of N application when these crops follow double-crop soybean in a 2-year cropping rotation.

Introduction

Because of recent increases in N fertilizer prices, producers are looking to reduce production costs for feed-grain crops, such as corn and grain sorghum. There is renewed interest in applying some of the fertilizer N requirement after the crop has emerged, referred to as side-dressing. Some research has shown that a subsurface application of banded N after the crop has emerged results in more efficient N use and often increases net return. In southeast Kansas, excessive spring rainfall also increases the potential for greater N loss where fertilizer N is applied preplant.

Experimental Procedures

Studies were established at the Columbus Unit of the Southeast Agricultural Research Center in 2005 to evaluate effects of time and rate of N fertilizer application on both corn and grain sorghum. Fertilizer (28% liquid N) treatments consisted of different N rates applied preplant or side-dressed. Preplant N fertilizer was subsurface applied before planting on 15-in. centers at a depth of 4 to 6 in. Side-dress N also was subsurface applied between 30-in. rows. All plots received 30 lb/a N preplant as 18-46-0. In 2008, corn was planted in late April and grain sorghum near May 20. Side-dress N was applied June 18 for both crops. The previous crop was double-crop soybean.

Results and Discussion

Corn and grain sorghum yield responses to fertilizer N for 2008 and 3-year averages are shown in Table 1. In the spring of 2008, above-normal rainfall (28 in.) occurred during the 3-month period from April through June. Even though soil moisture was excessive during early spring, water did not pond on the soil surface. Corn yields in 2008 showed no increase above the 120 lb/a N rate, but 3-year corn yield averages were greater for the 150 lb/a N rate. Corn yields responded more to rate than time of fertilizer N application. Under conditions in this study, in which denitrification N loses were likely small, corn yields were greater when fertilizer N was applied preplant than when it was side-dressed, although grain yield differences were not large over the 3-year period.

Similar to corn, grain sorghum yields generally increased with increasing N rates, although 3-year average yields showed the 120 lb/a N rate was most efficient. Time of fertilizer N application did not have a significant effect on grain sorghum yields.

Table 1. Effects of nitrogen fertilizer rate and time of application on corn and grain sorghum yields, Southeast Agricultural Research Center, Columbus Unit

Rate of fertilizer N[1]		Grain yield			
		Corn		Grain sorghum	
Preplant	Side-dress	2008	3-year avg.	2008	3-year avg.
---------lb/a---------		---------bu/a---------			
30	0	77.2	77.8	70.2	88.4
60	0	89.6	92.0	94.8	108.7
90	0	111.8	111.1	110.4	118.1
120	0	129.6	122.0	121.8	130.2
150	0	130.4	128.5	133.1	132.0
30	30	84.2	89.1	97.5	109.5
30	60	103.3	107.3	110.0	121.3
30	90	116.7	118.7	121.7	132.6
30	120	113.4	126.6	130.1	135.0
LSD (0.05)		6.4	6.1	4.4	6.4

[1] 30 lb/a N applied as 18-46-0 to all treatments.

Effects of Phosphorus and Potassium Fertilizer Rate and Time of Application in a Wheat Double-Cropping System

K. W. Kelley and D. W. Sweeney

Summary

Neither rate nor timing of phosphorus (P) and potassium (K) fertilizer application significantly affected grain yields of grain sorghum, wheat, and double-crop soybean during initial stages of this long-term study.

Introduction

Timing and rate of fertilizer P and K application are important crop production management decisions. In southeast Kansas, producers often plant wheat following harvest of a feed-grain crop, such as grain sorghum or corn, and then plant double-crop soybean after wheat, giving three crops in 2 years. In these multiple-crop systems, producers typically apply fertilizer P and K only to the feed-grain and wheat crops. Because fertilizer costs are increasing, this research seeks to determine direct and residual effects of rate and timing of P and K fertilizer application on grain yields in a double-cropping system.

Experimental Procedures

This study was established in 2004 at the Columbus Unit of the Southeast Agricultural Research Center. Crop rotation consists of grain sorghum/(wheat – double-crop soybean), giving three crops in a 2-year period. Grain sorghum is planted with conventional tillage, and wheat and double-crop soybean are planted with no-till. Different P and K fertilizer rates are applied preplant to the grain sorghum crop only or to both the grain sorghum and wheat crops. Initial soil test values before study establishment were 23 ppm Bray-1 P and 160 ppm exchangeable K for the 0- to 6-in. soil depth. Soil has been sampled each year since study establishment for nutrient availability following the double-crop soybean harvest.

Results and Discussion

Effects of various P and K fertilizer treatments on grain sorghum, wheat, and double-crop soybean yields are shown in Table 1. Fertilizer treatments have affected grain yields very little during initial years of study establishment. The nonsignificant yield response was not unexpected because initial soil test values indicated soil P and K values were sufficient for expected yield goals.

Nutrient removal in harvested grain for 100 bu/a grain sorghum, 50 bu/a wheat, and 25 bu/a double-crop soybean is 87 lb/a P_2O_5 and 72 lb/a K_2O. Thus, this study will continue for several cropping cycles to monitor residual effects of P and K fertilizer treatments on grain yields and soil nutrient concentrations of P and K.

Table 1. Effects of phosphorus and potassium fertilizer rate and time of application on grain yield in a double-cropping system, Southeast Agricultural Research Center, Columbus Unit

Fertilizer rate						Grain yield		
Grain sorghum			Wheat					
N	P_2O_5	K_2O	N	P_2O_5	K_2O	Grain sorghum	Wheat	Soybean
lb/a						bu/a		
120	0	0	120	0	0	88	42	31
120	45	45	120	45	45	91	46	32
120	90	90	120	0	0	94	44	32
120	60	60	120	60	60	93	46	32
120	120	120	120	0	0	94	46	31
120	75	75	120	75	75	94	46	32
LSD (0.05)						NS	NS	NS

2-year crop rotation: grain sorghum/(wheat – double-crop soybean).

Initial soil test values before study establishment were 23 ppm Bray-1 P and 160 ppm exchangeable K for the 0- to 6-in. soil depth.

Grain yields represent averages from 2005 through 2008, except no grain yields were reported for wheat in 2007 because of early April freeze damage.

Effect of Soil pH on Crop Yield

K. W. Kelley

Summary

Grain yields of grain sorghum, soybean, and wheat increased as soil acidity decreased with lime application. This study has completed five cropping cycles.

Introduction

In southeast Kansas, nearly all topsoils are naturally acidic (pH less than 7.0). Agricultural limestone is applied to correct soil acidity and improve nutrient availability, but applying too much lime can result in alkaline soil conditions (pH greater than 7.0), which also reduces nutrient availability and increases persistence of some herbicides. This research evaluated crop yield responses to different soil pH levels.

Experimental Procedures

Beginning in 1989, five soil pH levels ranging from 5.5 to 7.5 were established on a native grass site at the Parsons Unit of the Southeast Agricultural Research Center in a 3-year crop rotation: grain sorghum/soybean/(wheat – double-crop soybean). Soil samples (0- to 6-in. depth) have been taken yearly to assess soil pH values. In the fall of 2008, soil samples also were collected at three different depths (0 to 3 in., 3 to 6 in., and 6 to 12 in.) to determine the influence of lime application on soil pH.

Results and Discussion

Grain yield responses for the various soil pH treatments after five complete crop rotations are shown in Table 1. Yields of all crops increased as soil acidity decreased, although yield response to pH was generally low for wheat. Yields were greatest when soil pH was near the neutral range of 7.0. Soil data will be summarized following analysis of soil results taken after the fall harvest in 2008.

Table 1. Effects of soil pH on crop yields, Southeast Agricultural Research Center, Parsons Unit, 5-year averages

	Grain yield[1]			
Soil pH[2]	Grain sorghum	Full-season soybean	Double-crop soybean	Winter wheat
	---bu/a---			
5.4	82.3	30.7	22.7	41.8
6.0	87.8	32.4	26.0	43.0
6.3	92.8	35.2	26.8	44.1
7.0	95.7	35.7	28.3	45.1
7.3	95.3	36.4	27.5	44.4
	4.0	1.5	1.5	1.8

[1] Grain yields represent 5-year averages.

[2] Average soil pH from 2005 through 2007 (0- to 6-in. depth).

Soybean Foliar Fungicide Trial

J. H. Long, D. Jardine[1], and E. DeWolf[1]

Summary

Eight fungicide treatments were applied at the Parsons Unit on full-season soybean to evaluate their control of soybean rust (*Phakopsora pachyrhizi*). These plots were evaluated for grain yield and other agronomic characteristics throughout the summer of 2008. Soybean rust did not infect plants during 2008, but other diseases did, including Septoria brown spot. These diseases had strong visual effects on plants but did not affect grain yields. Grain yields ranged from 53 to 58 bu/a for all treatments, whereas the untreated check averaged 55 bu/a.

Introduction

Soybean rust is a new disease that is capable of causing severe grain yield loss. It can completely defoliate a soybean plant in just a few weeks. This disease spread from South America to the United States in 2004 and has infected most major soybean-producing areas in the United States. There are no known resistant varieties, so disease management through fungicide application is the only reliable remedy for this disease. Many fungicide treatments are available to manage soybean rust, but little is known regarding their effectiveness in Kansas. Treatments were determined by contacting retail outlets that sell soybean fungicides and determining treatments available to the farming public. This study established best management practices for control of this quick-acting disease and determined if fungicides should be applied at predetermined growth stages to protect the crop

Experimental Procedures

Soybean variety NK S52U3 was planted into good moisture at the Parsons Unit of the Southeast Agricultural Research Center. The soil is a Parsons silt loam. Soil was conventionally tilled, and soybean was planted with John Deere 7000 planter units on June 21, 2008, at 10 seeds per foot of row. Dual II Magnum herbicide was applied preemergence at the rate of 1 pint/a. Roundup WeatherMax at 22 oz/a was sprayed after planting to control weeds. Fungicide applications were then applied at three growth stages with a 10-ft-wide boom sprayer using a 20 gal/a mixture. Harvest occurred Nov. 8, 2008.

Results and Discussion

Most foliar fungicide treatments were applied at the R3 growth stage of soybean (beginning to pod), which is early in the reproductive stages of the soybean plant. One treatment was applied very early at R1 (first bloom), and another was applied late at R5 (pod fill). Soybean rust was not present in these plots in 2008, yet several diseases occurred in the season. Grain yield of the untreated check was equal to that of fungicide treatments (Table 1). Grain yields ranged from 53 to 58 bu/a. Fungicide treatment also had little effect on grain yield components. Folicure at R3 yielded less than several top treatments

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[1] KSU Dept. of Plant Pathology, Manhattan, KS

including Headline at R3, Quadris at R3, and Quilt at both R5 and multiple treatments. Leaf bronzing did occur with Folicure, but the exact cause of the yield reduction is unknown.

Table 1. Foliar fungicide effects on soybean grain yields, Parsons, 2007 and 2008

Treatment	Rate	Soybean growth stage at application	Grain yield 2007	Grain yield 2008	Grain yield 2-year avg.
			-----------------	bu/a	-----------------
Folicure	4	R3	34	53	43.5
Domark	5.5	R3	33	55	44.0
Headline	12	R3	–	57	–
Quadris	12.3	R3	36	58	47.0
Quilt	14	R1	34	56	45.0
Quilt	14	R3	36	56	46.0
Quilt	14	R5	33	58	45.5
Quilt	14	R1, R3, R5	–	57	–
Check - None	–	–	35	55	45.0
LSD (0.05)			NS	4	

Foliar Fungicide Application on Full-Season and Double-Crop Soybean

J. H. Long, D. Jardine[1], and E. DeWolf[1]

Summary

Eight fungicide timing treatments were applied at the Parsons Unit on full-season and double-crop soybean (late-planted) to evaluate their control of soybean rust (*Phakopsora pachyrhizi*). These plots were evaluated for grain yield and other agronomic characteristics throughout the summer of 2008. Soybean rust did not affect yields. Grain yields ranged from 34.7 to 51.2 bu/a.

Introduction

Soybean rust is a new disease that is capable of causing severe grain yield loss. It can completely defoliate a soybean plant in just a few weeks. This disease spread from South America to the United States in 2004 and has infected most major soybean-producing areas in the United States. There are no known resistant varieties, so disease management through fungicide application is the only reliable remedy for this disease. The time of fungicide application depends on two factors. It is important to determine when the disease arrives from the southern region of the United States via wind-borne spores, and the growth stage of soybean in surrounding fields determines how vulnerable the crop is to the disease. Growth stages of the crop are influenced by the maturity grouping of the variety and planting time of the variety being grown. Many soybean fields in southeast Kansas are planted late in the growing season and thus may be more susceptible to disease development. This study also helped determine the effect of soybean maturity group and planting date on disease development as well as the effect of the disease on soybean grain yield in 2008.

Experimental Procedures

Two soybean varieties (Asgrow 3802 and Asgrow 5605) were planted on June 17 and June 29 at 10 seeds per foot of row. Conventional tillage was used for early planted soybean, and late-planted soybean was planted without tillage. Dual II Magnum herbicide was applied preemergence at the rate of 1 pint/a. Plants emerged to form an excellent stand. All varieties were glyphosate tolerant, and Roundup WeatherMax herbicide at 22 oz/a was applied postemergence. The soybean was harvested on Nov. 8, 2008.

Results and Discussion

Fungicide had mixed effects on soybean grain yield or yield components in 2008 (Table 1). Early planted Asgrow 5605 with Headline fungicide yielded more than Asgrow 5605 without fungicide. Fungicide-treated soybean had more pods than untreated soybean. Early planted Asgrow 5605 outyielded early planted Asgrow 3802 by producing more pods, whereas late-planted Asgrow 5602 yielded the same as Asgrow 3802 yet

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[1] KSU Dept. of Plant Pathology, Manhattan, KS

had more pods and fewer seeds per pod. Yields ranged from 34.7 to 51.2 bu/a during 2008. The maturity group V soybean yielded more than the maturity group III variety both years when planted early.

Table 1. Foliar fungicide effects on grain yields and yield components of early and late-planted soybean, Parsons, 2007 and 2008

		Growth stage	Grain yield		2008 yield components	
Variety	Fungicide[1]	at application	2007	2008	Pods	Seed
			-------bu/a------		no./ft	no./pod
Early planted						
Asgrow 3802	Yes	Early R4	34.9	35.3	261	1.9
Asgrow 3802	No	Early R4	34.3	34.7	237	2.0
Asgrow 5605	Yes	Early R4	42.2	51.2	379	1.9
Asgrow 5605	No	Early R4	43.2	45.3	336	2.1
LSD (0.05)			5.5	5.6	40	NS
Late planted						
Asgrow 3802	Yes	Early R4	–	44.8	203	2.4
Asgrow 3802	No	Early R4	–	41.3	216	2.5
Asgrow 5605	Yes	Early R4	–	43.1	294	2.2
Asgrow 5605	No	Early R4	–	42.1	267	1.9
LSD (0.05)			NS	NS	46	0.2

[1] Headline fungicide applied at 8 oz/a.

Effect of Plant Population and Hybrid Maturity on Corn Grain Yield in Southeast Kansas

J. H. Long

Summary

Corn hybrids DeKalb 50-44 and DeKalb 62-99 were planted at Parsons, Pittsburg, and Columbus, KS, in plant population studies during 2008. DeKalb 50-44 is a 100-day relative maturity hybrid, and DeKalb 62-99 is a 112-day relative maturity hybrid. Weather conditions were very wet in 2008 at Parsons and Columbus and affected grain yields. Still, final populations of 23,000 on early maturity hybrids yielded at or near 100 bu/a at both Parsons and Columbus. Grain yields ranged from 65 to 100 bu/a at both locations.

Introduction

Short-season corn has rapidly become a major crop in southeast Kansas. Crop acreage has grown from fewer than 50,000 to nearly 350,000 acres in the last 25 years, with most of the acreage increase in the last 10 years. This increase in acreage has been influenced by the release of well-adapted, high-yielding corn hybrids. Newer hybrids are short to silk with extended grain fill periods but are 5 to 7 days longer in maturity than current 105-day hybrids. Longer-maturity hybrids outyield shorter-maturity hybrids when moisture is not a limiting factor.

Experimental Procedures

DeKalb 50-44 and DeKalb 62-99 were planted at two locations, Parsons and Columbus, during 2008. Original stands were thinned back to four different final stands. Final stands were 18,000, 23,000, 28,000, and 33,000 plants per acre. During 2008, Parsons was planted on April 21, and Columbus was planted on May 5. All locations followed a previous crop of soybean. Prior to planting, fields were field cultivated. Following planting, Dual II Magnum herbicide was applied preemergence to help control weeds. Fertilizer was applied following soil test recommendations for corn. Grain was harvested in August and September at both locations. Yield was determined at 15.5% moisture.

Results and Discussion

The summer of 2008 began very wet and delayed planting. Both locations were considered late, but the Columbus location was planted in May, which is very late for southeast Kansas. Stands were adequate for the required population; however, some plots were lost to water and considered missing. There was a 3-week dry period during the last 2 weeks of July and first week of August, which is considered normal for this part of Kansas. No differences were seen with 18,000 plants per acre. The short-season DeKalb 50-44 outyielded the full-season DeKalb 62-99, with final populations of 23,000 and 28,000 plants per acre having yields of 93 to 100 bu/a (Figure 1). Although DeKalb 62-99 silked relatively early, the extended grain fill pushed maturity into the hot, dry period of July and August. The short-season hybrid that silked during June and reached dent by the middle of July was best for southeast Kansas in 2008. Tests will be continued during 2009 and 2010.

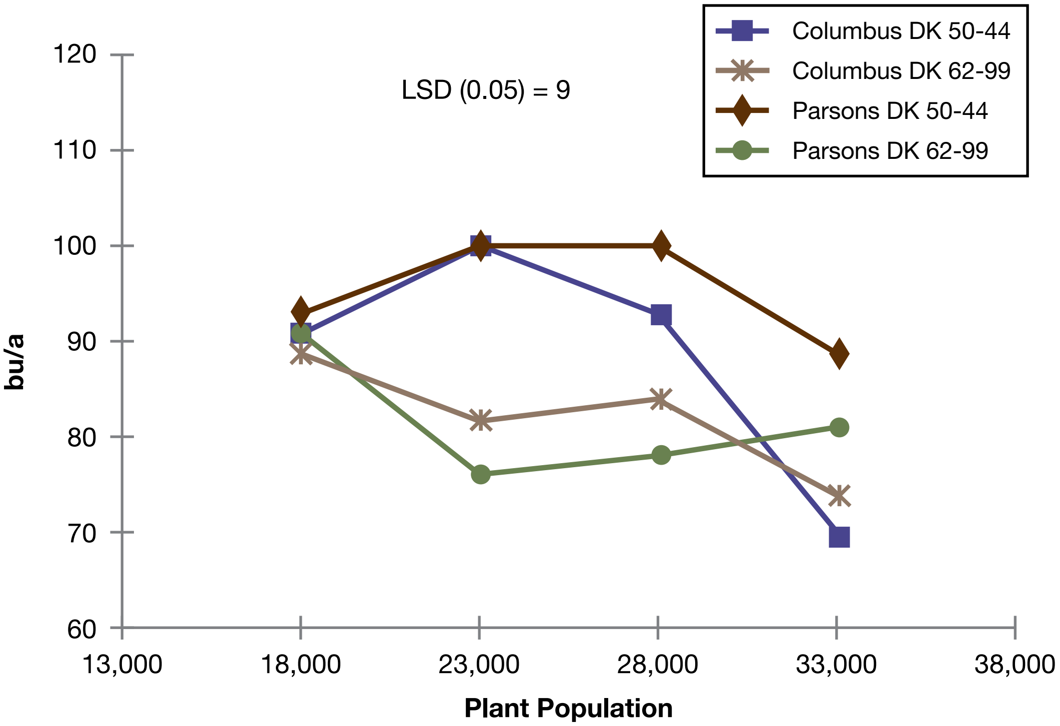

Figure 1. Effect of plant population and hybrid on corn grain yield in southeast Kansas, 2008.

Corn Fungicide Effectiveness in Southeast Kansas for 2008

J. H. Long

Summary

Corn fungicide studies were conducted at three locations in southeast Kansas during 2008: Parsons, Columbus, and Coffeyville. Hybrid DeKalb 50-44 was planted at each location, and then three treatments were used at silk to evaluate fungicide effectiveness on foliar diseases. Early planted corn had higher grain yields and showed no effect of fungicide use on grain yields. Late-planted corn had lower grain yields but showed some positive effects from foliar fungicide use. Grain yields ranged from 101 to 138 bu/a for all treatments.

Introduction

Use of foliar fungicides on corn is not generally a recommended practice when corn is planted on time and matures before the threat of disease has developed. However, many producers would use fungicides, especially if high grain prices warranted. A study was begun in 2008 to evaluate the effectiveness of foliar fungicides on corn in southeast Kansas.

Experimental Procedures

Hybrid DeKalb 50-44 (100-day relative maturity) was planted at Columbus, Parsons, and Coffeyville during 2008. Corn was planted on March 27 and April 21 at Parsons, April 23 at Coffeyville, and May 1 at Columbus. Soil at all locations was a Parsons silt loam. Soil was conventionally tilled, and corn was planted with John Deere finger pick-up units dropping 27,500 seeds per acre. Dual II Magnum herbicide was applied preemergence at the rate of 1 pint/a at both Columbus and Parsons. Fertility included 150 lb of nitrogen applied both as broadcast urea and side-dressed as urea ammonium nitrate. Fungicide applications were then applied at silk with a 10-ft-wide boom sprayer using a 20 gal/a mixture. Harvest was conducted with a Gleaner K2 combine outfitted with a HarvestMaster grain gauge weighing system.

Results and Discussion

Foliar fungicides had little effect on grain yield at Parsons (Table 1). Seed was planted at or near optimum time, and little disease was seen during the season. Grain yields were greater than 130 bu/a. However, at Columbus, where planting was very late, and Coffeyville, where foliar diseases can be a problem with later planting, fungicide treatments were effective in preserving grain yields. Grain yields increased by at least 10 bu/a at both locations. More information needs to be gathered to determine any long-term trends for foliar fungicide use; however, data from 2008 indicate that late-planted corn can benefit from fungicide use if disease is present.

Table 1. 2008 corn fungicide trials, Southeast Agricultural Research Center[1]

		Headline rate (oz/a)		
Location	Plant date	0	6	9
Parsons 1	Mar. 27	133	134	137
Parsons 2	Apr. 21	137	135	138
Coffeyville	Apr. 23	108	–	118
Columbus	May 1	101	108	112
LSD (0.05) treatment × location		10		

[1] Hybrid DeKalb 50-44; sprayed at silk.

Planting Date, Plant Population, and Drying Agent Effects on Late-Planted Sunflower in Southeast Kansas

J. H. Long

Summary

Sunflower was planted at five populations on three dates during July and August. Prior to harvest, three drying treatments were sprayed to hasten grain in-the-shell drydown to levels that would permit earlier combining of the crop. Grain yield and other agronomic characteristics were collected during the summer of 2008. Results indicate that July-planted sunflower gave greatest yields and that final plant stands of 15,000 and 20,000 plants per acre were best. Results were affected by excessive wind and rain from remnants of late-summer hurricanes, and final rainfall totals for 2008 were nearly 20 in. above normal.

Introduction

Sunflower has been grown as a catch crop in eastern Kansas for many years. It has never been grown on more than a few thousand acres per county in this part of the state, but sunflower has great potential as a crop if management practices can be developed to enable greater grain yield. Little is known about the effect of late planting dates (following wheat harvest) and plant populations needed in southeast Kansas, so a study was conducted to determine these important practices.

Experimental Procedures

Sunflower hybrid Pioneer 63M91 was planted into good moisture at the Parsons Unit of the Southeast Agricultural Research Center. The soil is a Parsons silt loam. Because of very high rainfall, soil was conventionally tilled to dry the ground before planting. Sunflower was planted with John Deere planter units on July 3, July 15, and Aug. 4, 2008, according to planting populations needed. Each population was overplanted then thinned to final stands of 15,000, 20,000, 25,000, 30,000, or 35,000 plants per acre. Trifluralin herbicide was applied preemergence at the rate of 1 pint/a. Roundup WeatherMax or Kixor was sprayed late in the season at growth stage R9 to evaluate their use as drying agents to facilitate earlier harvest. Harvest occurred October 2 for the July 3 planting, October 28 for the July 15 planting, and November 21 for the August 4 planting date.

Results and Discussion

Grain yields were affected by planting date and plant population (Figure 1). July 3 planting of sunflower at 20,000 plants final stand and July 15 planting at 15,000 plants final stand both had seed yields greater than 1,500 lb/a. The August 3 planting generally yielded less than the July plantings but still gave 1,076 lb/a when 15,000 plants per acre were used. Yield decreased as population increased. The drydown treatments of Roundup and Kixor were effective in drying the plants to harvestable levels, and seed yields were nearly 10% greater than those in sunflower with no drydown treatment. One possible explanation is that quicker drydown of the head held seed tighter and did not allow shattering to occur. Further study is needed to provide more reliable data, especially on final stands. High winds and heavy rain caused more lodging in high populations and resulted in very low yields in 2008.

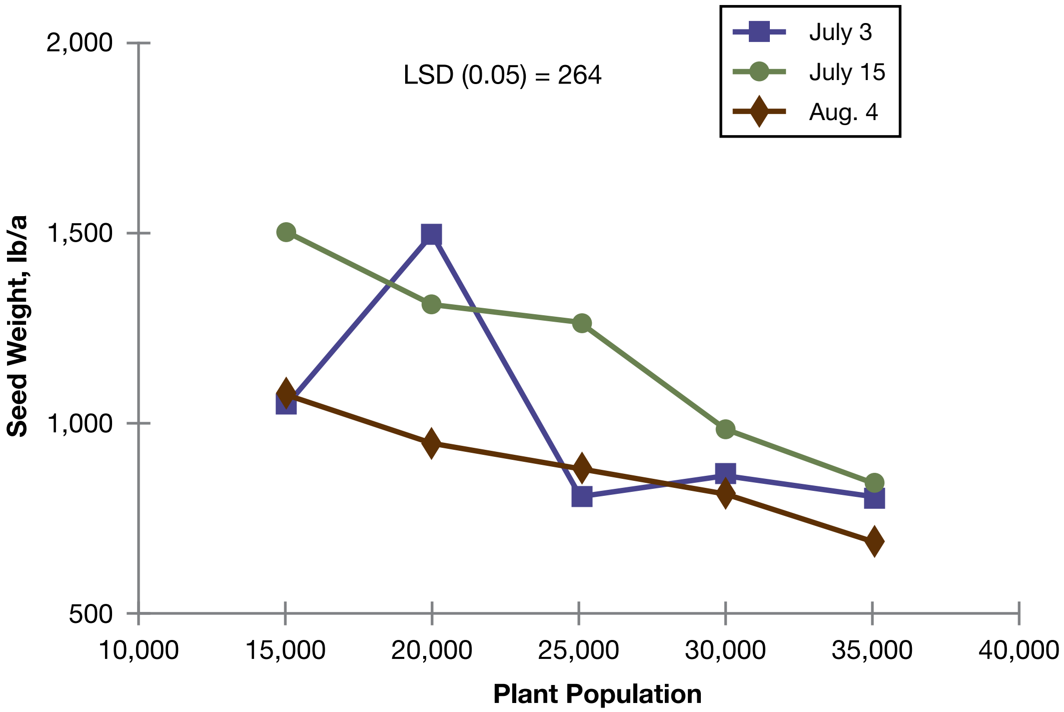

Figure 1. Effect of plant population on sunflower seed yield with three planting dates in southeast Kansas, 2008.

Annual Summary of Weather Data for Parsons, KS

M. Knapp[1]

2008 Data

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
Avg. max	44.1	43.0	56.9	63.5	75.3	84.4	90.1	85.9	77.4	68.2	56.6	44.1	65.8
Avg. min	22.1	22.8	32.4	41.2	54.0	65.1	68.4	66.4	57.2	44.1	34.4	21.5	44.1
Avg. mean	33.1	32.9	44.6	52.3	64.6	74.8	79.2	76.1	67.3	56.1	45.5	32.8	55.0
Precip.	0.64	2.83	4.49	7.8	9.65	12.85	3.39	4.79	6.80	3.32	3.44	2.18	62.14
Snow	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.2
Heat DD[1]	990	931	632	392	96	0	0	0	44	295	586	998	4962
Cool DD[1]	0	0	0	12	84	293	441	346	112	21	1	0	1308
Rain days	4	10	8	10	14	15	7	8	9	6	5	7	103
Min < 10	5	0	0	0	0	0	0	0	0	0	0	5	10
Min < 32	26	26	15	3	0	0	0	0	0	4	13	26	113
Max > 90	0	0	0	0	0	1	16	6	1	0	0	0	24

Normal values (1971-2000)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
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[1]	1079	800	590	295	95	6	0	3	51	229	594	942	4684
Cool DD[1]	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.	Ann.
Avg. max	3.9	-4.2	-0.3	-3.6	-0.7	-0.6	-1.0	-4.1	-3.6	-2.3	1.1	-0.3	-1.3
Avg. min	1.9	-2.8	-2.4	-2.9	-0.4	1.7	0.1	0.4	-0.8	-2.2	-0.5	-3.3	-1.0
Avg. mean	2.9	-3.5	-1.4	-3.3	-0.6	0.5	-0.5	-1.9	-2.2	-2.3	0.3	-1.8	-1.1
Precip.	-0.73	1.05	1.12	3.94	4.26	8.03	-0.44	1.37	1.87	-0.72	0.15	0.15	20.05
Snow	-2.0	-1.8	-1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.0	1.0	-6.3
Heat DD	-89	131	42	97	1	-6	0	-3	-8	66	-8	56	278
Cool DD	0	0	0	-2	-17	10	-15	-61	-76	-4	1	0	-163

[1] 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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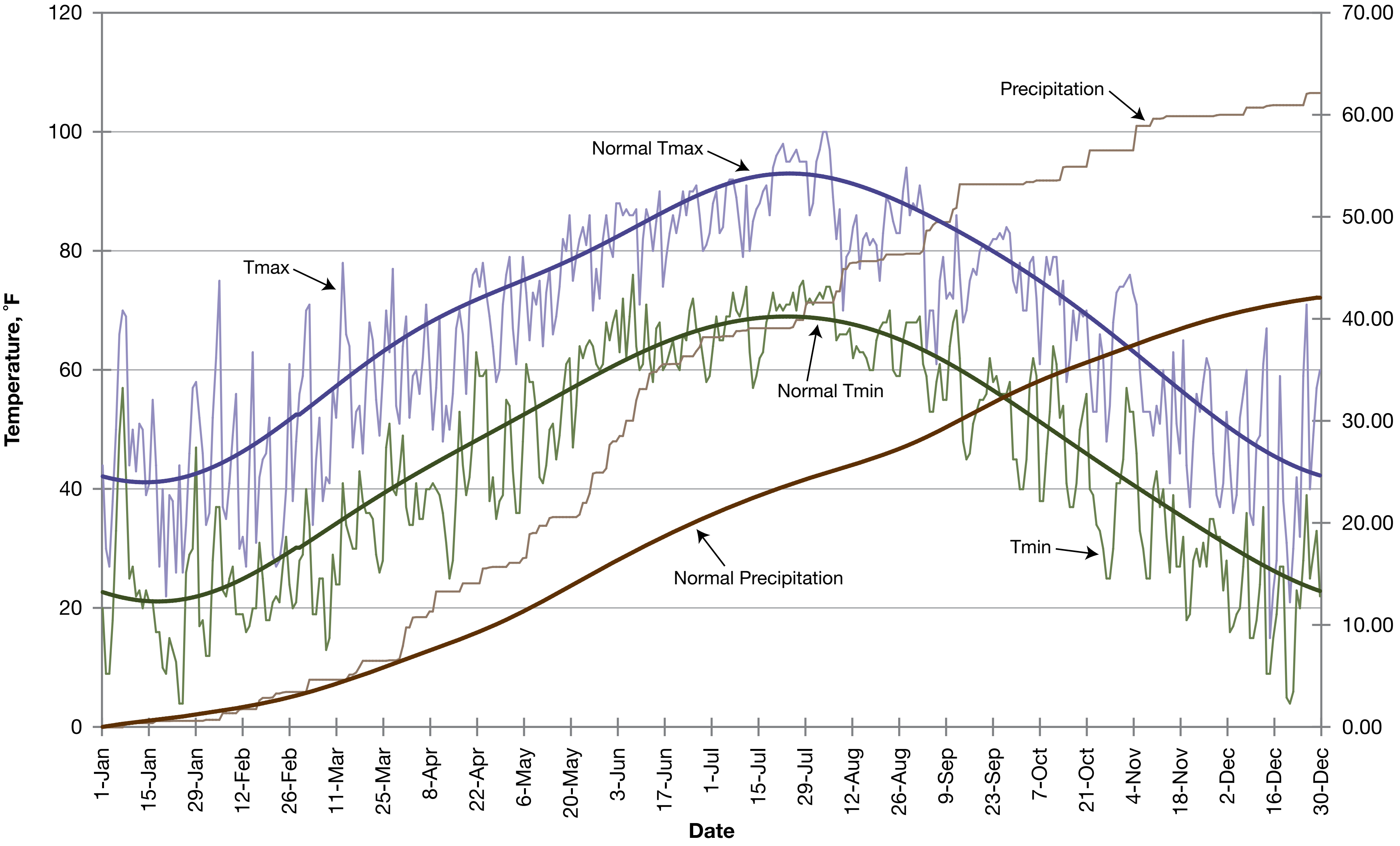
[1] Kansas State Climatologist, KSU Dept. of Agronomy, Manhattan, KS

Weather Summary for Parsons, KS – 2008



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- Larry Ellis, Agricultural Technician
- TaLana Erikson, Animal Science Technician II
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Ceres, Inc., Thousand Oaks, CA

Coffeyville Feed & Farm Supply, Coffeyville, KS

Coffeyville Livestock Market, Coffeyville, KS

Commercial Bank, Parsons, KS

DeLange Seed Co., Girard, KS

DLF International, Tangent, OR

Dow AgroSciences LLC, Indianapolis, IN

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Ft. Dodge Animal Health, Overland Park, KS

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Kansas Sunflower Commission, Rossville, KS

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Emmet and Virginia Terril, Catoosa, OK

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