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

L. W. Lomas
Kansas State University, llomas@ksu.edu

J. L. Moyer
Kansas State University, jmoyer@ksu.edu

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

L.W. Lomas and J.L. Moyer

Summary

Four hundred thirty-two yearling steers grazing tall fescue pastures were used to evaluate the effects of fescue cultivar and dried distillers grains (DDG) supplementation during the grazing phase on available forage, grazing gains, subsequent finishing gains, and carcass characteristics. Fescue cultivars evaluated were high-endophyte 'Kentucky 31' and low-endophyte 'Kentucky 31,' 'HM4,' and 'MaxQ.' Steers were either fed no supplement or were supplemented with DDG at 1.0% body weight per head daily in 2009 or 0.75% of body weight per head daily in 2010, 2011, 2012, 2013, and 2014 while grazing. Steers that grazed pastures of low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' gained significantly more ($P < 0.05$) and produced more ($P < 0.05$) gain/a than those that grazed high-endophyte 'Kentucky 31' pastures. Gains of cattle that grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' were similar ($P > 0.05$). Subsequent finishing gains were similar ($P > 0.05$) among fescue cultivars in 2009, 2012, 2013, and 2014; however, steers that previously grazed high-endophyte 'Kentucky 31' had greater ($P > 0.05$) finishing gains than those that had grazed 'HM4' or 'MaxQ' in 2010 and greater ($P < 0.05$) finishing gains than those that grazed low-endophyte 'Kentucky 31' or 'HM4' in 2011. Supplementation of grazing steers with DDG supported a higher stocking rate and resulted in greater ($P < 0.05$) grazing gain, gain/a, and overall daily gain and reduced the amount of fertilizer needed by providing approximately 60 lb/a, 50 lb/a, 50 lb/a, 30 lb/a, 40 lb/a, and 40 lb/a of nitrogen (N) in 2009, 2010, 2011, 2012, 2013, and 2014, respectively, primarily from urine of grazing cattle.

Introduction

Tall fescue, the most widely adapted cool-season perennial grass in the United States, is grown on approximately 66 million acres. Although tall fescue is well adapted in the eastern half of the country between the temperate North and mild South, presence of a fungal endophyte results in poor performance of grazing livestock, especially during the summer. Until recently, producers with high-endophyte tall fescue pastures had two primary options for improving grazing livestock performance. One option was to destroy existing stands and replace them with endophyte-free fescue or other forages. Although it supports greater animal performance than endophyte-infected fescue, endophyte-free fescue has been shown to be less persistent under grazing pressure and

more susceptible to stand loss from drought stress. In locations where high-endophyte tall fescue must be grown, the other option was for producers to adopt management strategies that reduce the negative effects of the endophyte on grazing animals, such as diluting the effects of the endophyte by incorporating legumes into existing pastures or providing supplemental feed. In recent years, new tall fescue cultivars have been developed with a non-toxic endophyte that provides vigor to the fescue plant without negatively affecting performance of grazing livestock.

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

Experimental Procedures

Seventy-two mixed black yearling steers were weighed on two consecutive days and allotted to 16 5-acre established pastures of high-endophyte 'Kentucky 31' or low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' tall fescue (four replications per cultivar) on March 26, 2009 (569 lb average weight); March 24, 2010 (550 lb); March 23, 2011 (536 lb); March 22, 2012 (550 lb); April 4, 2013 (600 lb); and April 1, 2014 (546 lb). 'HM4' and 'MaxQ' are cultivars that have a non-toxic endophyte. Four steers were assigned to two pastures of each cultivar and received no supplementation, and five steers were assigned to two pastures of each cultivar and supplemented with DDG at 1.0% in 2009 or 0.75% body weight per head daily during the grazing phase in 2010, 2011, 2012, 2013, and 2014. All pastures were fertilized with 80 lb/a N and P_2O_5 and K_2O as required by soil test on February 5, 2009; February 10, 2010; and January 27, 2011; 90 lb/a N on January 25, 2012; 85 lb/a N on February 5, 2013; and 74 lb/a N on February 13, 2014. Pastures with steers that received no supplement were fertilized with 60 lb/a N on September 16, 2009; 46 lb/a N on August 30, 2010 and September 15, 2011; 30 lb/a N on August 10, 2012; and 46 lb/a N on September 19, 2013 and September 15, 2014. This was calculated to be approximately the same amount of N from DDG that was excreted on pastures by supplemented steers during the entire grazing season.

Cattle in each pasture were group-fed DDG in meal form in bunks on a daily basis, and pasture was the experimental unit. No implants or feed additives were used. Weight gain was the primary measurement. Cattle were weighed every 28 days; quantity of DDG fed was adjusted at that time. Forage availability was measured approximately every 28 days with a disk meter calibrated for tall fescue. Cattle were treated for internal and external parasites before being turned out to pasture and later vaccinated for protection from pinkeye. Steers had free access to commercial mineral blocks that contained 12% calcium, 12% phosphorus, and 12% salt. Two steers in 2009, one steer in 2012, and two steers in 2013 were removed from the study for reasons unrelated to

experimental treatment. Pastures were grazed continuously until October 13, 2009 (201 days); November 3, 2010 (224 days); October 19, 2011 (210 days); August 21, 2012 (152 days); October 17, 2013 (196 days); and October 14, 2014 (196 days) for all pastures except one replicate of low-endophyte 'Kentucky 31,' where grazing was terminated on September 17, 2014 (169 days), when steers were weighed on two consecutive days and grazing was terminated.

After the grazing period, cattle were moved to a finishing facility, implanted with Synovex-S (Zoetis, Madison, NJ), and fed a diet of 80% whole-shelled corn, 15% corn silage, and 5% supplement (dry matter basis). Cattle that received no supplement or were supplemented with DDG while grazing were fed a finishing diet for 119 or 99 days, for 112 or 98 days, for 116 or 102 days, and for 120 or 106 days, respectively, in 2009, 2011, 2013, and 2014; for 106 days in 2010; and for 113 days in 2012. All steers were slaughtered in a commercial facility, and carcass data were collected.

Results and Discussion

Grazing and subsequent finishing performance are pooled across supplementation treatment and presented by tall fescue cultivar in Tables 1, 2, 3, 4, 5, and 6 for 2009, 2010, 2011, 2012, 2013, and 2014, respectively, and by supplementation treatment in Tables 7, 8, 9, 10, 11, and 12 for 2009, 2010, 2011, 2012, 2013, and 2014, respectively. No significant interactions were detected ($P > 0.05$) between cultivar and supplementation treatment in 2009, 2010, 2011, 2012, and 2014; however, a significant cultivar × supplement treatment interaction ($P < 0.05$) was detected in 2013 for grazing ending weight, pasture gain, pasture daily gain, feed:gain, and ribeye area.

During all years, steers that grazed pastures of low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' gained significantly more ($P < 0.05$) and produced more ($P < 0.05$) gain/a than those that grazed high-endophyte 'Kentucky 31' pastures (Tables 1, 2, 3, 4, 5, and 6). Gains of cattle that grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' were similar ($P > 0.05$). Daily gains of steers grazing pastures with high-endophyte 'Kentucky 31,' low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' were 1.70, 2.35, 2.25, and 2.33 lb/head, respectively, in 2009; 1.56, 1.91, 1.97, and 2.04 lb/head, respectively, in 2010; 1.47, 2.00, 1.96, and 1.95 lb/head, respectively, in 2011; 1.00, 1.93, 2.06, and 2.04 lb/head, respectively, in 2012; 1.29, 1.84, 1.89, and 1.93 lb/head, respectively, in 2013; and 1.52, 2.25, 2.23, and 2.04 lb/head, respectively, in 2014. Gain/a from pastures with high-endophyte 'Kentucky 31,' low-endophyte 'Kentucky 31,' 'HM4,' and 'MaxQ' were 318, 438, 415, and 428 lb/a, respectively, in 2009; 322, 390, 400, and 416 lb/a, respectively, in 2010; 288, 385, 377, and 378 lb/a, respectively, in 2011; 145, 271, 288, and 286 lb/a, respectively, in 2012; 237, 328, 339, and 346 lb/a, respectively, in 2013; and 274, 385, 398, and 367 lb/a, respectively, in 2014. In 2013, steers that grazed 'MaxQ' supplemented with DDG had higher ($P < 0.05$) grazing gain and higher ($P < 0.05$) gain/a than those that grazed low-endophyte 'Kentucky 31' supplemented with DDG. Supplementation of steers that grazed high-endophyte 'Kentucky 31' with DDG resulted in grazing performance similar ($P > 0.05$) to those that grazed low-endophyte 'Kentucky 31,' 'HM4,' and 'MaxQ' with no supplementation.

In 2009, subsequent finishing gains and feed efficiency were similar ($P > 0.05$) among fescue cultivars (Table 1). Steers that previously grazed low-endophyte 'Kentucky 31,'

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

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

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

In 2012, subsequent finishing gains were similar ($P > 0.05$) among fescue cultivars (Table 4), but steers that previously grazed high-endophyte 'Kentucky 31' had lower ($P < 0.05$) feed intake, lower ($P < 0.05$) feed:gain, lower ($P < 0.05$) hot carcass weight, lower ($P < 0.05$) overall gain, and lower ($P < 0.05$) overall daily gain than those that had grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' (Table 4).

In 2013, subsequent finishing gains were similar ($P > 0.05$) among fescue cultivars (Table 5), but steers that previously grazed high-endophyte 'Kentucky 31' had lower ($P < 0.05$) hot carcass weight, lower ($P < 0.05$) overall gain, and lower ($P < 0.05$) overall daily gain than those that had grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' and smaller ($P < 0.05$) ribeye area than those that grazed 'MaxQ.' Supplementation treatment had no effect ($P > 0.05$) on feed:gain of steers that grazed 'HM4' pastures. Unsupplemented steers that grazed 'MaxQ' and low-endophyte 'Kentucky 31' pastures produced carcasses with greater ($P < 0.05$) ribeye area than any of the other treatment combinations.

In 2014, subsequent finishing gains were similar ($P > 0.05$) among fescue cultivars (Table 6), but steers that previously grazed high-endophyte 'Kentucky 31' had lower ($P < 0.05$) ending finishing weight, lower ($P < 0.05$) hot carcass weight, lower ($P < 0.05$) overall gain, and lower ($P < 0.05$) overall daily gain than those that had

grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ'. Steers that had previously grazed high-endophyte 'Kentucky 31' had smaller ($P < 0.05$) ribeye area than those that grazed 'MaxQ' and lower ($P < 0.05$) marbling scores than those that grazed low-endophyte 'Kentucky 31.'

Steers supplemented with DDG gained significantly more ($P < 0.05$) and produced more ($P < 0.05$) gain/a than those that received no supplement while grazing (Tables 7, 8, 9, 10, 11, and 12). Grazing gains and gain/a of steers that received no supplement and those that were supplemented with DDG were 1.71 and 2.61 lb/head daily and 343 and 525 lb/a, respectively, in 2009; 1.62 and 2.12 lb/head daily and 363 and 475 lb/a, respectively, in 2010; 1.46 and 2.23 lb/head daily and 246 and 469 lb/a, respectively, in 2011; 1.31 and 2.20 lb/head daily and 160 and 334 lb/a, respectively, in 2012; 1.43 and 2.05 lb/head daily and 224 and 401 lb/a, respectively, in 2013; and 1.68 and 2.33 lb/head daily and 264 and 448 lb/a, respectively, in 2014. Supplemented steers consumed an average of 7.8, 6.0, 5.9, 5.5, 6.1, and 5.9 lb of DDG/head daily during the grazing phase in 2009, 2010, 2011, 2012, 2013, and 2014, respectively. Each additional pound of gain obtained from pastures with supplemented steers required 6.5, 7.2, 5.6, 4.8, 6.7, and 6.3 lb of DDG in 2009, 2010, 2011, 2012, 2013, and 2014, respectively. Steers that were supplemented during the grazing phase had greater ($P < 0.05$) final finishing weights, hot carcass weights, overall gain, and overall daily gain than those that received no supplement while grazing during 2009, 2010, 2011, and 2012. However, in 2013 and 2014, steers not supplemented while grazing were fed a finishing diet 14 days longer than those that were supplemented and final finishing weights, hot carcass weights, and overall gain were similar ($P > 0.05$). Daily gain, feed efficiency, yield grade, marbling score, and percentage of carcasses grading choice or higher were similar ($P > 0.05$) between supplementation treatments in 2009; however, in 2010, 2011, 2012, 2013, and 2014, steers supplemented with DDG while grazing had lower ($P < 0.05$) finishing gains than those that received no supplement while grazing. In 2012, 2013, and 2014, steers that received no supplement while grazing had lower ($P < 0.05$) feed:gain ratios than those that received supplement.

Average available forage dry matter (DM) is presented for each fescue cultivar and supplementation treatment combination for 2009, 2010, 2011, 2012, 2013, and 2014 in Tables 13, 14, 15, 16, 17, and 18, respectively. A significant interaction occurred ($P < 0.05$) between cultivar and supplementation treatment during all six years. Within each variety, there was no difference ($P > 0.05$) in average available forage DM between pastures stocked with 0.8 steer/a that received no supplement and those stocked with 1.0 steer/a and supplemented with DDG at 1.0% body weight per head daily in 2009 (Table 13). Average available forage DM was similar ($P > 0.05$) between supplementation treatments and pastures, with supplemented steers stocked at a heavier rate, which indicates that pastures were responding to the N that was being returned to the soil from steers consuming DDG, cattle supplemented with DDG were consuming less forage, or both. High-endophyte 'Kentucky 31' pastures with or without DDG supplementation had greater ($P < 0.05$) average available forage DM than 'MaxQ' pastures without supplementation. No other differences in average available forage DM were observed.

In 2010, no difference occurred ($P > 0.05$) in average available forage DM within variety for high-endophyte 'Kentucky 31,' low-endophyte 'Kentucky 31,' or 'HM4' pastures stocked with 0.8 steer/a that received no supplement and those stocked with 1.0 steer/a and supplemented with DDG at 0.75% body weight per head daily (Table 14); however, 'MaxQ' pastures that were stocked at the heavier rate and grazed by steers supplemented with DDG had greater ($P < 0.05$) average available forage DM than those stocked at a lighter rate and grazed by steers that received no supplement. High-endophyte 'Kentucky 31' pastures had greater ($P < 0.05$) average available DM than low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' pastures stocked with 0.8 steer/a that received no supplement.

In 2011, no difference occurred ($P > 0.05$) in average available forage DM within variety for low-endophyte 'Kentucky 31' or 'HM4' pastures stocked with 0.8 steer/a that received no supplement and those stocked with 1.0 steer/a and supplemented with DDG at 0.75% body weight per head daily (Table 15), but 'MaxQ' pastures that were stocked at the heavier rate and grazed by steers supplemented with DDG had greater ($P < 0.05$) average available forage DM than those stocked at a lighter rate and grazed by steers that received no supplement. High-endophyte 'Kentucky 31' pastures that were stocked at the heavier rate and grazed by steers supplemented with DDG had lower ($P < 0.05$) average available forage DM than those stocked at a lighter rate. High-endophyte 'Kentucky 31' pastures had greater ($P < 0.05$) average available DM than low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' pastures stocked with 0.8 steer/a that received no supplement.

In 2012, a cultivar × date interaction occurred, with similar peak available DM on April 18 ($P > 0.05$) but lower available DM for 'MaxQ' and 'HM4' ($P < 0.05$) at the end of the grazing phase on August 17. No difference occurred ($P > 0.05$) in average available forage DM within variety for low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' pastures stocked with 0.8 steer/a that received no supplement and those stocked with 1.0 steer/a and supplemented with DDG at 0.75% body weight per head daily (Table 16); however, high-endophyte 'Kentucky 31' pastures that were stocked at the heavier rate and grazed by steers supplemented with DDG had lower ($P < 0.05$) average available forage DM than those stocked at a lighter rate in both 2011 and 2012. This result suggests that supplementation with DDG increased forage intake and utilization by cattle grazing these pastures. High-endophyte 'Kentucky 31' pastures had greater ($P < 0.05$) average available DM than low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' pastures within each stocking rate and supplementation level in 2012.

In 2013, a cultivar × date interaction occurred, with all cultivars having similar ($P > 0.05$) available DM at the beginning of the grazing season. On April 30, low-endophyte 'Kentucky 31' had less ($P < 0.05$) available DM than the other three cultivars. Available DM peaked on June 3 then declined as the grazing season progressed. On June 3, high-endophyte 'Kentucky 31' had more ($P < 0.05$) available DM than the other three cultivars, and 'MaxQ' had less ($P < 0.05$) available DM than 'HM4.' By July 31, high-endophyte 'Kentucky 31' had more ($P < 0.05$) and 'MaxQ' less ($P < 0.05$) available DM than the other cultivars, a relationship that persisted throughout the remain-

der of the grazing season. No difference occurred ($P > 0.05$) in average available forage DM within variety for low-endophyte 'Kentucky 31' pastures stocked with 0.8 steer/a that received no supplement and those stocked with 1.0 steer/a and supplemented with DDG at 0.75% body weight per head daily (Table 17); however, high-endophyte 'Kentucky 31,' 'HM4,' and 'MaxQ' pastures that were stocked at the heavier rate and grazed by steers supplemented with DDG had lower ($P < 0.05$) average available forage DM than those stocked at a lighter rate without supplement. This result suggests that supplementation with DDG increased forage intake and utilization by cattle grazing these pastures and/or DDG level was not high enough to substitute for the forage consumed by the additional steer. High-endophyte 'Kentucky 31' pastures had greater ($P < 0.05$) average available DM than low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' pastures within each stocking rate and supplementation level in 2013.

In 2014, high-endophyte 'Kentucky 31' had more available DM than the other cultivars throughout the season, with no difference among the other three cultivars. On April 7, the initial date, available DM was the lowest for the entire season, whereas the highest available DM did not occur until June 25. This was because of the unusually dry spring followed by abundant rain in June. A cultivar × supplementation/stocking rate interaction occurred in 2014, because average available forage DM was similar for the cultivars, except in 'MaxQ' pastures (Table 18). The unsupplemented 'MaxQ' pastures had less available DM than those where supplement was fed, despite being stocked at a lower rate.

Grazing gains and overall gains of steers that grazed low-endophyte 'Kentucky 31,' 'HM4,' or 'MaxQ' were similar ($P > 0.05$) and significantly greater ($P < 0.05$) than those of steers that grazed high-endophyte 'Kentucky 31.' Supplementation of grazing steers with DDG resulted in greater ($P < 0.05$) grazing gains, supported a higher stocking rate, resulted in greater ($P < 0.05$) gain/a, and reduced the amount of fertilizer needed by providing approximately 30 to 60 lb of N/a. Producers seeking to maximize production from fescue pastures should consider using one of the new fescue varieties with the non-toxic endophyte in combination with DDG supplementation.

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

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (201 days)				
No. of head	17	18	17	18
Initial weight, lb	571	569	566	569
Ending weight, lb	913a	1,042b	1,019b	1,038b
Gain, lb	342a	473b	453b	468b
Daily gain, lb	1.70a	2.35b	2.25b	2.33b
Gain/a, lb	318a	438b	415b	428b
Finishing phase (109 days)				
Beginning weight, lb	913a	1,042b	1,019b	1,038b
Ending weight, lb	1,285a	1,381b	1,366b	1,376b
Gain, lb	372	339	347	338
Daily gain, lb	3.41	3.11	3.20	3.10
Daily dry matter intake, lb	24.4	24.1	24.1	24.9
Feed:gain	7.18	7.81	7.57	8.11
Hot carcass weight, lb	759a	820b	810b	811b
Backfat, in.	0.43	0.43	0.44	0.47
Ribeye area, sq. in.	11.9a	11.9a	12.5b	11.7a
Yield grade[1]	2.6a	3.0b	2.8a	3.0b
Marbling score[2]	601a	646ab	672bc	717c
Percentage USDA grade choice	95	100	95	100
Overall performance (grazing plus finishing) (310 days)				
Gain, lb	714a	812b	800b	807b
Daily gain, lb	2.31a	2.63b	2.59b	2.61b

[1] USDA (1987).
[2] 600 = modest, 700 = moderate, 800 = slightly abundant.
Means within a row followed by the same letter do not differ ($P < 0.05$).

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

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (224 days)				
No. of head	18	18	18	18
Initial weight, lb	550	550	550	550
Ending weight, lb	899a	978b	990b	1,007b
Gain, lb	349a	428b	441b	457b
Daily gain, lb	1.56a	1.91b	1.97b	2.04b
Gain/a, lb	322a	390b	400b	416b
Finishing phase (106 days)				
Beginning weight, lb	899a	978b	990b	1,007b
Ending weight, lb	1,386a	1,432b	1,419b	1,449b
Gain, lb	486a	454ab	429b	442b
Daily gain, lb	4.59a	4.28ab	4.04b	4.17b
Daily dry matter intake, lb	25.8	26.0	25.7	26.0
Feed:gain	5.63	6.10	6.37	6.24
Hot carcass weight, lb	812a	849ab	840ab	861b
Dressing percentage	58.6	59.3	59.2	59.4
Backfat, in.	0.37a	0.48b	0.44b	0.45b
Ribeye area, sq. in.	12.0	12.2	12.2	12.4
Yield grade[1]	2.7	2.9	2.8	2.8
Marbling score[2]	660ab	676a	630b	648ab
Percentage USDA grade choice	100	94	94	100
Overall performance (grazing plus finishing) (330 days)				
Gain, lb	836a	882b	869ab	899b
Daily gain, lb	2.53a	2.67b	2.63ab	2.72b

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

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

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (210 days)				
No. of head	18	18	18	18
Initial weight, lb	536	536	536	536
Ending weight, lb	845a	956b	947b	946b
Gain, lb	310a	420b	411b	410b
Daily gain, lb	1.47a	2.00b	1.96b	1.95b
Gain/a, lb	288a	385b	377b	378b
Finishing phase (105 days)				
Beginning weight, lb	845a	956b	947b	946b
Ending weight, lb	1,310a	1,369ab	1,374ab	1,401b
Gain, lb	465a	412b	427bc	455ac
Daily gain, lb	4.42a	3.93b	4.05bc	4.33ac
Daily dry matter intake, lb	27.0ab	27.2ab	26.7a	27.8b
Feed:gain	6.12a	6.94b	6.62bc	6.43ac
Hot carcass weight, lb	812a	849ab	852ab	869b
Dressing percentage	59.9ab	59.5b	60.4a	60.5a
Backfat, in.	0.39a	0.46ab	0.45ab	0.50b
Ribeye area, sq. in.	12.7a	13.0ab	13.1ab	13.3b
Yield grade[1]	2.5	2.8	2.8	2.8
Marbling score[2]	646ab	620a	687b	654ab
Percentage USDA grade choice	100	100	100	100
Overall performance (grazing plus finishing) (315 days)				
Gain, lb	774a	833ab	839b	865b
Daily gain, lb	2.46a	2.65ab	2.66b	2.75b

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

Table 4. Effects of cultivar on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2012

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (152 days)				
No. of head	18	18	17	18
Initial weight, lb	550	550	548	550
Ending weight, lb	702a	843b	861b	859b
Gain, lb	152a	293b	313b	310b
Daily gain, lb	1.00a	1.93b	2.06b	2.04b
Gain/a, lb	145a	271b	288b	286b
Finishing phase (113 days)				
Beginning weight, lb	702a	843b	861b	859b
Ending weight, lb	1,249a	1,384b	1,408b	1,415b
Gain, lb	547	541	547	556
Daily gain, lb	4.84	4.79	4.84	4.92
Daily dry matter intake, lb	24.8a	27.2b	28.0b	28.6b
Feed:gain	5.13a	5.67b	5.79b	5.85b
Hot carcass weight, lb	774a	858b	873b	877b
Backfat, in.	0.45a	0.52b	0.49ab	0.48ab
Ribeye area, sq. in.	12.2a	12.9ab	13.4b	13.1b
Yield grade[1]	2.7	3.0	2.8	2.9
Marbling score[2]	577a	591a	657b	619ab
Percentage USDA grade choice	95	88	100	100
Overall performance (grazing plus finishing) (265 days)				
Gain, lb	699a	835b	860b	865b
Daily gain, lb	2.64a	3.15b	3.25b	3.27b

[1] USDA (1987).
[2] 500 = small, 600 = modest, 700 = moderate.
Means within a row followed by the same letter do not differ ($P < 0.05$).

Table 5. Effects of cultivar on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2013

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (196 days)				
No. of head	17	17	18	18
Initial weight, lb	601	601	599	599
Ending weight, lb*	855a	961b	970b	977b
Gain, lb*	254a	360b	371b	378b
Daily gain, lb*	1.29a	1.84b	1.89b	1.93b
Gain/a, lb	237a	328b	339b	346b
Finishing phase (109 days)				
Beginning weight, lb	855a	961b	970b	977b
Ending weight, lb	1,351a	1,447b	1,448b	1,486b
Gain, lb	496	486	479	509
Daily gain, lb	4.52	4.44	4.39	4.65
Daily dry matter intake, lb	25.8	26.2	25.6	27.0
Feed:gain*	5.79	5.95	5.83	5.86
Hot carcass weight, lb	838a	897b	898b	921b
Backfat, in.	0.49	0.53	0.51	0.53
Ribeye area, sq. in.*	12.1a	12.8ab	12.5ab	13.2b
Yield grade[1]	2.9	2.7	3.0	2.8
Marbling score[2]	648	667	661	649
Percentage USDA grade choice	92	95	100	94
Overall performance (grazing plus finishing) (305 days)				
Gain, lb	750a	846b	850b	887b
Daily gain, lb	2.46a	2.78b	2.79b	2.91b

*Cultivar × DDG supplementation interaction ($P < 0.05$).
[1]USDA (1987).
[2]500 = small, 600 = modest, 700 = moderate.
Means within a row followed by the same letter do not differ ($P < 0.05$).

Table 6. Effects of cultivar on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2014

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase				
No. of days	196	189	196	196
No. of head	18	18	18	18
Initial weight, lb	546	546	546	546
Ending weight, lb	844a	969b	983b	946b
Gain, lb	297a	423b	437b	399b
Daily gain, lb	1.52a	2.25b	2.23b	2.04c
Gain/a, lb	274a	385b	398b	367b
Finishing phase (106 days)				
Beginning weight, lb	844a	969b	983b	946b
Ending weight, lb	1,304a	1,428bc	1,455c	1,382b
Gain, lb	460	459	473	436
Daily gain, lb	4.05	4.06	4.17	3.85
Daily dry matter intake, lb	25.4	26.7	26.3	26.1
Feed:gain	6.29	6.60	6.34	6.78
Hot carcass weight, lb	808a	886bc	902c	857b
Backfat, in.	0.51	0.58	0.54	0.57
Ribeye area, sq. in.	12.2a	12.7ab	13.2ab	13.3b
Yield grade[1]	2.7	3.0	2.8	2.6
Marbling score[2]	697a	743b	717ab	731ab
Percentage USDA grade choice	100	100	100	100
Overall performance (grazing plus finishing)				
No. of days	302	295	302	302
Gain, lb	757a	882bc	909c	835b
Daily gain, lb	2.45a	2.93b	2.94b	2.71c

[1] USDA (1987).
[2] 600 = modest, 700 = moderate, 800 = slightly abundant.
Means within a row followed by the same letter do not differ ($P < 0.05$).

Table 7. Effects of dried distillers grains (DDG) supplementation on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2009

	DDG level (% body weight/head per day)	
Item	0	1.0
Grazing phase (201 days)		
No. of head	30	40
Initial weight, lb	569	569
Ending weight, lb	911a	1,095b
Gain, lb	343a	525b
Daily gain, lb	1.71a	2.61b
Gain/a, lb	274a	525b
Total DDG consumption, lb/head	---	1628
Average DDG consumption, lb/head per day	---	7.8
DDG, lb/additional gain, lb	---	6.5
Finishing phase		
No. of days	119	99
Beginning weight, lb	911a	1,095b
Ending weight, lb	1,289a	1,415b
Gain, lb	378a	320b
Daily gain, lb	3.17	3.23
Daily dry matter intake, lb	24.6	24.2
Feed:gain	7.80	7.54
Hot carcass weight, lb	768a	832b
Dressing percentage	59.6	58.8
Backfat, in.	0.43	0.45
Ribeye area, sq. in.	11.7a	12.3b
Yield grade	2.8	2.9
Marbling score[1]	638	680
Percentage USDA grade choice	100	95
Overall performance (grazing plus finishing)		
No. of days	320	300
Gain, lb	721a	846b
Daily gain, lb	2.25a	2.82b

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

Table 8. Effects of dried distillers grains (DDG) supplementation on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2010

	DDG level (% body weight/head per day)	
Item	0	0.75
Grazing phase (224 days)		
No. of head	32	40
Initial weight, lb	550	550
Ending weight, lb	912a	1,025b
Gain, lb	363a	475b
Daily gain, lb	1.62a	2.12b
Gain/a, lb	290a	475b
Total DDG consumption, lb/head	---	1335
Average DDG consumption, lb/head per day	---	6.0
DDG, lb/additional gain, lb	---	7.2
Finishing phase (106 days)		
Beginning weight, lb	912a	1,025b
Ending weight, lb	1,378a	1,464b
Gain, lb	466a	439b
Daily gain, lb	4.40a	4.15b
Daily dry matter intake, lb	26.2	25.6
Feed:gain	5.99	6.18
Hot carcass weight, lb	806a	875b
Dressing percentage	58.5a	59.7b
Backfat, in.	0.39a	0.47b
Ribeye area, sq. in.	12.1	12.2
Yield grade	2.6	3.0
Marbling score[1]	638a	669b
Percentage USDA grade choice	94	100
Overall performance (grazing plus finishing) (330 days)		
Gain, lb	829a	914b
Daily gain, lb	2.51a	2.77b

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

Table 9. Effects of dried distillers grains (DDG) supplementation on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2011

	DDG level (% body weight/head per day)	
Item	0	0.75
Grazing phase (210 days)		
No. of head	32	40
Initial weight, lb	536	536
Ending weight, lb	843a	1,005b
Gain, lb	307a	469b
Daily gain, lb	1.46a	2.23b
Gain/a, lb	246a	469b
Total DDG consumption, lb/head	---	1240
Average DDG consumption, lb/head per day	---	5.9
DDG, lb/additional gain, lb	---	5.6
Finishing phase		
No. of days	112	98
Beginning weight, lb	843a	1,005b
Ending weight, lb	1,324a	1,403b
Gain, lb	481a	498b
Daily gain, lb	4.30a	4.07b
Daily dry matter intake, lb	27.3	27.1
Feed:gain	6.38	6.68
Hot carcass weight, lb	821a	870b
Backfat, in.	0.46	0.44
Ribeye area, sq. in.	12.7a	13.3b
Yield grade	2.8	2.6
Marbling score[1]	644	659
Percentage USDA grade choice	100	100
Overall performance (grazing plus finishing)		
No. of days	322	308
Gain, lb	788a	867b
Daily gain, lb	2.45a	2.82b

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

Table 10. Effects of dried distillers grains (DDG) supplementation on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2012

	DDG level (% body weight/head per day)	
Item	0	0.75
Grazing phase (152 days)		
No. of head	31	40
Initial weight, lb	549	550
Ending weight, lb	748a	884b
Gain, lb	200a	334b
Daily gain, lb	1.31a	2.20b
Gain/a, lb	160a	334b
Total DDG consumption, lb/head	---	829
Average DDG consumption, lb/head per day	---	5.5
DDG, lb/additional gain, lb	---	4.8
Finishing phase (113 days)		
Beginning weight, lb	748a	884b
Ending weight, lb	1,314a	1,414b
Gain, lb	566a	530b
Daily gain, lb	5.01a	4.69b
Daily dry matter intake, lb	26.8	27.5
Feed:gain	5.35a	5.87b
Hot carcass weight, lb	815a	877b
Backfat, in.	0.44a	0.53b
Ribeye area, sq. in.	12.6	13.2
Yield grade	2.7	3.0
Marbling score[1]	605	616
Percentage USDA grade choice	94	98
Overall performance (grazing plus finishing) (265 days)		
Gain, lb	765a	864b
Daily gain, lb	2.89a	3.26b

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

Table 11. Effects of dried distillers grains (DDG) supplementation on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2013

	DDG level (% body weight/head per day)	
Item	0	0.75
Grazing phase (196 days)		
No. of head	31	39
Initial weight, lb	600	600
Ending weight, lb*	880a	1,001b
Gain, lb*	280a	401b
Daily gain, lb*	1.43a	2.05b
Gain/a, lb	224a	401b
Total DDG consumption, lb/head	---	1194
Average DDG consumption, lb/head per day	---	6.1
DDG, lb/additional gain, lb	---	6.7
Finishing phase		
No. of days	116	102
Beginning weight, lb	880a	1,001b
Ending weight, lb	1,437	1,429
Gain, lb	557a	429b
Daily gain, lb	4.80a	4.20b
Daily dry matter intake, lb	26.2	26.1
Feed:gain*	5.49a	6.22b
Hot carcass weight, lb	891	886
Backfat, in.	0.52	0.51
Ribeye area, sq. in.*	13.2a	12.1b
Yield grade	2.7a	3.0b
Marbling score[1]	664	648
Percentage USDA grade choice	93	98
Overall performance (grazing plus finishing)		
No. of days	312	298
Gain, lb	837	830
Daily gain, lb	2.68	2.78

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

Table 12. Effects of dried distillers grains (DDG) supplementation on grazing and subsequent performance of steers grazing tall fescue pastures, Southeast Agricultural Research Center, 2014

	DDG level (% body weight/head per day)	
Item	0	0.75
Grazing phase		
No. of days	196	193
No. of head	32	40
Initial weight, lb	546	546
Ending weight, lb	876a	994b
Gain, lb	330a	448b
Daily gain, lb	1.68a	2.33b
Gain/a, lb	264a	448b
Total DDG consumption, lb/head	---	1153
Average DDG consumption, lb/head per day	---	5.9
DDG, lb/additional gain, lb	---	6.3
Finishing phase		
No. of days	120	106
Beginning weight, lb	876a	994b
Ending weight, lb	1,384	1,401
Gain, lb	507a	406b
Daily gain, lb	4.23a	3.84b
Daily dry matter intake, lb	26.2	26.0
Feed:gain	6.22a	6.79b
Hot carcass weight, lb	858	868
Backfat, in.	0.53	0.58
Ribeye area, sq. in.	12.5	13.1
Yield grade	2.9	2.6
Marbling score[1]	731	713
Percentage USDA grade choice	100	100
Overall performance (grazing plus finishing)		
No. of days	316	299
Gain, lb	837	854
Daily gain, lb	2.65a	2.86b

[1] 700 = moderate, 800 = slightly abundant.
Means within a row followed by the same letter do not differ ($P < 0.05$).

Table 13. Effects of tall fescue cultivar and dried distillers grains (DDG) supplementation on average available forage dry matter, Southeast Agricultural Research Center, 2009

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

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

Table 14. Effects of tall fescue cultivar and dried distillers grains (DDG) supplementation on average available forage dry matter, Southeast Agricultural Research Center, 2010

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

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

Table 15. Effects of tall fescue cultivar and dried distillers grains (DDG) supplementation on average available forage dry matter, Southeast Agricultural Research Center, 2011

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

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

Table 16. Effects of tall fescue cultivar and dried distillers grains (DDG) supplementation on average available forage dry matter, Southeast Agricultural Research Center, 2012

	DDG level (% body weight/head per day)	
Tall fescue cultivar	0	0.75
	lb/a	
High-endophyte Kentucky 31	6,203a	5,784d
Low-endophyte Kentucky 31	5,993bcd	6,024abc
HM4	5,837cd	6,004abc
MaxQ	5,837cd	6,004abc

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

Table 17. Effects of tall fescue cultivar and dried distillers grains (DDG) supplementation on average available forage dry matter, Southeast Agricultural Research Center, 2013

	DDG level (% body weight/head per day)	
Tall fescue cultivar	0	0.75
	lb/a	
High-endophyte Kentucky 31	6,766a	6,056b
Low-endophyte Kentucky 31	5,548c	5,333c
HM4	5,929b	5,531c
MaxQ	4,552d	5,462c

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

Table 18. Effects of tall fescue cultivar and dried distillers grains (DDG) supplementation on average available forage dry matter, Southeast Agricultural Research Center, 2014

	DDG level (% body weight/head per day)	
Tall fescue cultivar	0	0.75
	lb/a	
High-endophyte Kentucky 31	6,305a	6,067a
Low-endophyte Kentucky 31	5,492b	5,370b
HM4	5,587b	5,430b
MaxQ	5,311b	5,910a

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