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Effects of Interseeding Ladino Clover into Tall Fescue Pastures of Varying Endophyte Status on Grazing and Subsequent Finishing Performance of Stocker Steers

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Effects of Interseeding Ladino Clover into Tall Fescue Pastures of Varying Endophyte Status on Grazing and Subsequent Finishing Performance of Stocker Steers

Abstract

Two hundred fifty-six yearling steers grazing tall fescue pastures were used to evaluate the effects of fescue cultivar and interseeding ladino clover on available forage, grazing gains and subsequent finishing performance in 2016, 2017, 2018, and 2019. Fescue cultivars evaluated were high-endophyte 'Kentucky 31,' low-endophyte Kentucky 31 'HM4,' and 'MaxQ.' In 2016, 2018, and 2019, 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 ($P > 0.05$). In 2017, steer gains were similar ($P > 0.05$) among all cultivars. High-endophyte Kentucky 31 pastures had more ($P < 0.05$) available forage than low-endophyte Kentucky 31, HM4, or MaxQ pastures during both 2016 and 2017. Steer gains and gain/a were similar ($P > 0.05$) between pastures fertilized with nitrogen in the spring and those interseeded with ladino clover during all four years. Fescue cultivar or legume treatment had little effect on finishing performance or carcass characteristics of steers grazed in 2016, 2017, or 2018. Steers that grazed high-endophyte Kentucky 31 in 2016 or 2018 had lower ($P < 0.05$) final finishing weight and lower ($P < 0.05$) carcass weight than those that grazed low-endophyte Kentucky 31, HM4, or MaxQ. In 2017, steers that grazed pastures interseeded with ladino clover had lower ($P < 0.05$) finishing gains and greater ($P < 0.05$) feed:gain than those that grazed pastures with no legume.

Keywords

tall fescue, ladino clover, interseeding, endophyte, grazing, subsequent finishing performance

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Effects of Interseeding Ladino Clover into Tall Fescue Pastures of Varying Endophyte Status on Grazing and Subsequent Finishing Performance of Stocker Steers

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Summary

Two hundred fifty-six yearling steers grazing tall fescue pastures were used to evaluate the effects of fescue cultivar and interseeding ladino clover on available forage, grazing gains and subsequent finishing performance in 2016, 2017, 2018, and 2019. Fescue cultivars evaluated were high-endophyte 'Kentucky 31,' low-endophyte Kentucky 31 'HM4,' and 'MaxQ.' In 2016, 2018, and 2019, 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 ($P > 0.05$). In 2017, steer gains were similar ($P > 0.05$) among all cultivars. High-endophyte Kentucky 31 pastures had more ($P < 0.05$) available forage than low-endophyte Kentucky 31, HM4, or MaxQ pastures during both 2016 and 2017. Steer gains and gain/a were similar ($P > 0.05$) between pastures fertilized with nitrogen in the spring and those interseeded with ladino clover during all four years. Fescue cultivar or legume treatment had little effect on finishing performance or carcass characteristics of steers grazed in 2016, 2017, or 2018. Steers that grazed high-endophyte Kentucky 31 in 2016 or 2018 had lower ($P < 0.05$) final finishing weight and lower ($P < 0.05$) carcass weight than those that grazed low-endophyte Kentucky 31, HM4, or MaxQ. In 2017, steers that grazed pastures interseeded with ladino clover had lower ($P < 0.05$) finishing gains and greater ($P < 0.05$) feed:gain than those that grazed pastures with no legume.

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. Interseeding legumes into tall fescue cultivars with the toxic endophyte should be an effective way of increasing gains of cattle grazing tall fescue. However, these cultivars lack the competitiveness of high-endophyte Kentucky 31 and their competitiveness with legumes could be a potential problem. Objectives of this study were to evaluate forage availability, stand persistence, and performance of stocker steers grazing tall fescue cultivars with non-toxic endophyte and high- and low-endophyte Kentucky 31 with and without ladino clover.

Experimental Procedures

Sixty-four mixed black yearling steers were weighed on two consecutive days and allotted to sixteen 5-acre established pastures of high-endophyte Kentucky 31 or low-endophyte Kentucky 31, HM4, or MaxQ tall fescue (4 replications per cultivar) on March 30, 2016 (535 lb); March 28, 2017 (597 lb); April 3, 2018 (581 lb); and April 2, 2019 (563 lb). HM4 and MaxQ are cultivars with a non-toxic endophyte. Two pastures of each cultivar had been interseeded with 5 lb/a of 'Will' ladino clover on February 22, 2016. Four steers were assigned to each pasture. Pastures without clover were fertilized with 80 lb/a nitrogen (N) on February 10, 2016, February 16, 2017, January 31, 2018, and March 6, 2019. All pastures were fertilized with 40 lb/a N and P_2O_5 and K_2O (as recommended via results of soil test) on September 13, 2016, September 11, 2017, September 25, 2018, and August 29, 2019.

Pasture was the experimental unit and weight gain was the primary measurement. No implants or feed additives were used. Cattle were weighed every 28 days. Forage availability was measured at the same time in 2016 and 2017 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. Four steers were removed from the study in 2016 for reasons unrelated to experimental treatment and replaced with grazers to maintain equal stocking rates. Pastures were grazed continuously until November 29, 2016 (244 days); December 6, 2017 (253 days); November 7, 2018 (218 days); and November 14, 2019 (226 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) to determine the effect of grazing treatment on subsequent finishing performance. Cattle that grazed in 2016, 2017, and 2018 were fed a finishing diet for 98 days, 98 days, and 112 days, respectively. Cattle were then slaughtered in a commercial facility, and carcass data were collected on each individual steer. Cattle that were grazed during 2019 were being finished for slaughter at the time this report was written.

Results and Discussion

Grazing and finishing performance is pooled across legume treatment and presented by tall fescue cultivar for 2016, 2017, and 2018 in Table 1, Table 3, and Table 5, respectively, and pooled across fescue cultivar and presented by legume treatment for 2016, 2017, and 2018 in Table 2, Table 4, and Table 6, respectively. Grazing performance for 2019 is presented by tall fescue cultivar and legume treatment in Table 7 and Table 8, respectively. There were significant interactions ($P < 0.05$) between fescue cultivar and legume treatment for average available forage DM in 2016 and average daily dry matter intake during the finishing phase in 2017. In 2016, 2018, and 2019, steers that grazed low-endophyte Kentucky 31, HM4, or MaxQ were heavier ($P < 0.05$) at the end of the grazing period, had greater ($P < 0.05$) grazing gain, greater ($P < 0.05$) daily gain, and produced greater ($P < 0.05$) gain/a than steers that grazed high-endophyte Kentucky 31. Average available forage DM of high-endophyte Kentucky 31 pasture was greater ($P < 0.05$) than that of low-endophyte Kentucky 31, HM4, or MaxQ. In 2016, MaxQ pasture had greater ($P < 0.05$) available forage DM than low-endophyte Kentucky 31. Average available forage DM of HM4 pasture was similar ($P > 0.05$) to that of low-endophyte Kentucky 31 and MaxQ pastures. In 2017, average available forage DM of low-endophyte Kentucky 31, HM4, or MaxQ pastures were similar ($P > 0.05$). Steer gains were similar ($P > 0.05$) between pastures fertilized with an additional 80 lb/a N and those interseeded with ladino clover in all four years. Pastures with clover had less ($P < 0.05$) available forage DM than those without clover for all cultivars except high-endophyte Kentucky 31 where available forage DM of pastures with and without clover were similar ($P > 0.05$).

In 2016, fescue cultivar had no effect ($P > 0.05$) on finishing gain, dry matter intake, or feed:gain ratio. However, steers that had previously grazed high-endophyte Kentucky 31 had lower ($P < 0.05$) weight at the end of the finishing phase and lower ($P < 0.05$) hot carcass weight than those that had previously grazed low-endophyte Kentucky 31, HM4, or MaxQ. The weight differential between cattle that grazed high-endophyte Kentucky 31 and those that grazed low-endophyte Kentucky 31, HM4, or MaxQ was similar at the end of the grazing phase (156 lb) and the end of the finishing phase (155 lb). Therefore, the weight advantage of cattle that grazed low-endophyte Kentucky 31, HM4, or MaxQ occurred during the grazing phase and was maintained during the finishing phase. Cattle that grazed high-endophyte Kentucky 31 did not exhibit any compensatory gain during the finishing phase. Backfat thickness of steers that grazed high-endophyte Kentucky 31 or HM4 were similar ($P > 0.05$) and lower ($P < 0.05$) than that of steers that grazed low-endophyte Kentucky 31 or MaxQ. Yield grade of steers that grazed high-endophyte Kentucky 31 was numerically lower ($P < 0.05$) than that of steers that grazed low-endophyte Kentucky 31 or MaxQ and similar ($P > 0.05$) to that of steers that grazed HM4. Fescue cultivar had no effect ($P > 0.05$) on ribeye area, marbling score, or percent of carcasses that graded USDA Choice. Overall gain of steers that grazed high-endophyte Kentucky 31 was lower ($P < 0.05$) than that of steers that grazed low-endophyte Kentucky 31, HM4, or MaxQ, and overall gain of steers that grazed low-endophyte Kentucky 31, HM4, or MaxQ were similar ($P > 0.05$). Legume treatment had no effect ($P > 0.05$) on finishing performance or carcass traits.

In 2017, fescue cultivar had no effect ($P > 0.05$) on finishing performance or overall performance. Steers that grazed pastures interseeded with ladino clover had lower ($P < 0.05$) finishing gains and greater ($P < 0.05$) feed:gain than those that grazed pastures with no legume.

In 2018, fescue cultivar had no effect ($P > 0.05$) on finishing gain. However, steers that had previously grazed low-endophyte Kentucky 31, HM4, or MaxQ maintained their weight advantage from the grazing phase, were heavier ($P < 0.05$) at the end of the finishing phase, had greater ($P < 0.05$) hot carcass weight, and greater overall gains than those that had grazed high-endophyte Kentucky 31. Legume treatment had little effect on grazing performance. Steers that grazed pastures interseeded with ladino clover had lower ($P < 0.05$) feed:gain than those that grazed pastures without clover that were fertilized with additional nitrogen.

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Table 1. Effects of cultivar on grazing and subsequent finishing performance of steers grazing tall fescue pastures, Kansas State University Southeast Research and Extension Center, 2016

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (244 days)				
Number of head	13	16	16	15
Initial weight, lb	533	535	535	537
Ending weight, lb	770a	920b	931b	924b
Gain, lb	238a	385b	396b	387b
Daily gain, lb	0.97a	1.58b	1.62b	1.59b
Gain/a, lb	190a	308b	310b	310b
Average available forage dry matter, lb/a*	7,365a	5,944b	6,139bc	6,300c
Finishing phase (98 days)				
Beginning weight, lb	770a	920b	931b	924b
Ending weight, lb	1219a	1374b	1366b	1386b
Gain, lb	449	454	435	462
Daily gain, lb	4.58	4.63	4.44	4.71
Daily dry matter intake, lb	26.2	27.4	28.3	28.3
Feed:gain	5.74	5.91	6.41	6.05
Hot carcass weight, lb	756a	852b	847b	859b
Backfat, in.	0.47a	0.60b	0.55a	0.60b
Ribeye area, sq. in.	12.7	12.8	12.7	12.9
Yield grade	2.3a	3.0b	2.9ab	3.0b
Marbling score[1]	627	669	623	616
Percentage USDA grade Choice	100	100	100	100
Overall performance (grazing plus finishing; 342 days)				
Gain, lb	687a	839b	831b	849b
Daily gain, lb	2.01a	2.45b	2.43b	2.48b

[1]600 = modest, 700 = moderate.
Means within a row followed by the same letter do not differ ($P < 0.05$).
*There was a significant ($P < 0.05$) fescue cultivar × legume interaction.

Table 2. Effects of interseeding ladino clover on grazing and subsequent finishing performance of steers grazing tall fescue pastures, Kansas State University Southeast Research and Extension Center, 2016

	Legume treatment	
Item	No legume	Ladino clover
Grazing phase (244 days)		
Number of head	30	30
Initial weight, lb	534	536
Ending weight, lb	868	905
Gain, lb	334	369
Daily gain, lb	1.37	1.51
Gain/a, lb	267	295
Average available forage dry matter, lb/a*	6,888a	5,986b
Finishing phase (98 days)		
Beginning weight, lb	868	905
Ending weight, lb	1320	1353
Gain, lb	453	448
Daily gain, lb	4.62	4.57
Daily dry matter intake, lb	27.4	27.6
Feed:gain	5.97	6.09
Hot carcass weight, lb	819	839
Backfat, in	0.55	0.56
Ribeye area, sq. in.	12.8	12.8
Yield grade	2.8	2.8
Marbling score[1]	619	649
Percentage USDA grade Choice	100	100
Overall performance (grazing plus finishing; 342 days)		
Gain, lb	786	817
Daily gain, lb	2.30	2.39

[1]600 = modest, 700 = moderate.
Means within a row followed by the same letter do not differ ($P < 0.05$).
*There was a significant ($P < 0.05$) fescue cultivar × legume interaction.

Table 3. Effects of cultivar on grazing and subsequent finishing performance of steers grazing tall fescue pastures, Kansas State University Southeast Research and Extension Center, 2017

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (253 days)				
Number of head	16	16	16	16
Initial weight, lb	597	597	597	597
Ending weight, lb	901	1029	986	1007
Gain, lb	304	432	389	411
Daily gain, lb	1.20	1.71	1.54	1.62
Gain/a, lb	244	346	311	328
Average available forage dry matter, lb/a	5,179a	4,728b	4,812b	4,808b
Finishing phase (98 days)				
Beginning weight, lb	901	1029	986	1007
Ending weight, lb	1311	1422	1374	1400
Gain, lb	410	393	389	393
Daily gain, lb	4.18	4.01	3.97	4.01
Daily dry matter intake, lb*	28.5	28.4	28.7	27.6
Feed:gain	6.82	7.13	7.25	7.01
Hot carcass weight, lb	813	882	852	868
Backfat, in.	0.46	0.58	0.58	0.52
Ribeye area, sq. in.	13.1	13.3	13.1	13.1
Yield grade	2.4	2.8	2.8	2.7
Marbling score[1]	659	694	754	701
Percentage USDA grade Choice	94	100	100	100
Overall performance (grazing plus finishing; 351 days)				
Gain, lb	715	826	778	803
Daily gain, lb	2.04	2.35	2.22	2.29

[1]600 = modest, 700 = moderate, 800 = slightly abundant.
Means within a row followed by the same letter do not differ ($P < 0.05$).
*There was a significant ($P < 0.05$) fescue cultivar × legume interaction.

Table 4. Effects of interseeding ladino clover on grazing and subsequent finishing performance of steers grazing tall fescue pastures, Kansas State University Southeast Research and Extension Center, 2017

	Legume treatment	
Item	No legume	Ladino clover
Grazing phase (253 days)		
Number of head	32	32
Initial weight, lb	597	597
Ending weight, lb	951	1011
Gain, lb	354	414
Daily gain, lb	1.40	1.64
Gain/a, lb	283	331
Average available forage dry matter, lb/a	5,215a	4,548b
Finishing phase (98 days)		
Beginning weight, lb	951	1011
Ending weight, lb	1363	1391
Gain, lb	412a	380b
Daily gain, lb	4.20a	3.88b
Daily dry matter intake, lb*	28.0	28.6
Feed:gain	6.68a	7.42b
Hot carcass weight, lb	845	862
Backfat, in	0.51	0.56
Ribeye area, sq. in.	13.0	13.3
Yield grade	2.7	2.7
Marbling score[1]	693	711
Percentage USDA grade Choice	97	100
Overall performance (grazing plus finishing; 351 days)		
Gain, lb	766	794
Daily gain, lb	2.18	2.26

[1]600 = modest, 700 = moderate, 800 = slightly abundant.
Means within a row followed by the same letter do not differ ($P < 0.05$).
*There was a significant ($P < 0.05$) fescue cultivar × legume interaction.

Table 5. Effects of cultivar on grazing and subsequent finishing performance of steers grazing tall fescue pastures, Kansas State University Southeast Research and Extension Center, 2018

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (218 days)				
Number of head	16	16	16	16
Initial weight, lb	581	581	581	581
Ending weight, lb	815a	954b	940b	953b
Gain, lb	234a	372b	359b	372b
Daily gain, lb	1.07a	1.71b	1.65b	1.70b
Gain/a, lb	187a	298b	287b	297b
Finishing phase (112 days)				
Beginning weight, lb	815a	954b	940b	953b
Ending weight, lb	1225a	1381b	1341b	1371b
Gain, lb	410	427	401	418
Daily gain, lb	3.66	3.81	3.58	3.73
Daily dry matter intake, lb	26.2	28.6	28.2	26.5
Feed:gain	7.16a	7.50ab	7.92b	7.12a
Hot carcass weight, lb	760a	856b	831b	850b
Backfat, in.	0.51	0.55	0.55	0.56
Ribeye area, sq. in.	12.7	13.1	12.9	13.2
Yield grade	2.7	2.8	2.8	2.8
Marbling score[1]	740ab	759a	671c	694bc
Percentage USDA grade Choice	100	100	100	100
Overall performance (grazing plus finishing; 330 days)				
Gain, lb	644a	799b	760b	789b
Daily gain, lb	1.95a	2.42b	2.30b	2.39b

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

Table 6. Effects of interseeding ladino clover on grazing and subsequent finishing performance of steers grazing tall fescue pastures, Kansas State University Southeast Research and Extension Center, 2018

	Legume treatment	
Item	No legume	Ladino clover
Grazing phase (218 days)		
Number of head	32	32
Initial weight, lb	581	581
Ending weight, lb	914	917
Gain, lb	332	336
Daily gain, lb	1.52	1.54
Gain/a, lb	266	269
Finishing phase (112 days)		
Beginning weight, lb	914	917
Ending weight, lb	1322	1337
Gain, lb	408	420
Daily gain, lb	3.64	3.75
Daily dry matter intake, lb	28.1	26.6
Feed:gain	7.73a	7.12b
Hot carcass weight, lb	820	829
Backfat, in	0.55	0.54
Ribeye area, sq. in.	12.8	13.1
Yield grade	2.8	2.8
Marbling score[1]	711	721
Percentage USDA grade Choice	100	100
Overall performance (grazing plus finishing; 330 days)		
Gain, lb	741	756
Daily gain, lb	2.24	2.29

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

Table 7. Effects of cultivar on performance of steers grazing tall fescue pastures, Kansas State University Southeast Research and Extension Center, 2019

	Tall fescue cultivar			
Item	High-endophyte Kentucky 31	Low-endophyte Kentucky 31	HM4	MaxQ
Grazing phase (226 days)				
Number of head	16	16	16	16
Initial weight, lb	563	563	563	563
Ending weight, lb	840a	915b	895b	915b
Gain, lb	278a	352b	332b	352b
Daily gain, lb	1.23a	1.56b	1.47b	1.56b
Gain/a, lb	222a	281b	266b	281b

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

Table 8. Effects of interseeding ladino clover on performance of steers grazing tall fescue pastures, Kansas State University Southeast Research and Extension Center, 2019

	Legume treatment	
Item	No legume	Ladino clover
Grazing phase (226 days)		
Number of head	32	32
Initial weight, lb	563	563
Ending weight, lb	891	892
Gain, lb	328	329
Daily gain, lb	1.45	1.45
Gain/a, lb	262	263

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