

Tall Fescue Workshop

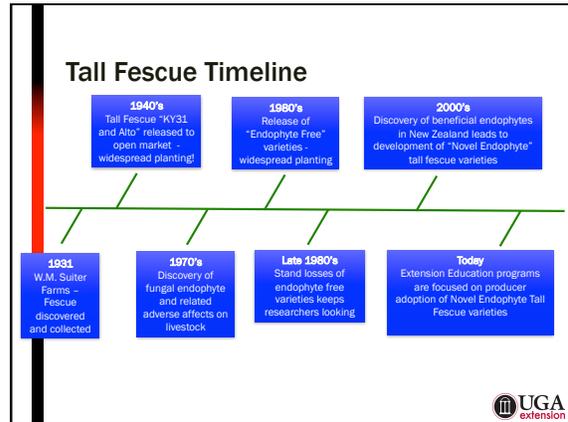
Grazing Tall Fescue: A Review of Animal Production Trials



**GRAZING TALL FESCUE:
A REVIEW OF ANIMAL
PRODUCTION TRIALS**

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Kentucky 31: Creating Animal Performance issues for 65+ years



Herd performance on Kentucky 31 tall fescue - 1950

- Trials were carried out at the Ohio Station to compare the effect of ladino-Kentucky 31 *Festuca pratensis* mixtures with improved *Poa pratensis* pastures, legume mixtures and barn feeding, on the performance of dairy heifers and milking cows.

Kentucky 31 (Tall Fescue)
+ Ladino (clover)

}

• Kentucky Bluegrass

Pratt, A.D., and J.L. Haynes. 1950. Herd performance on Kentucky 31 tall fescue. Ohio Farm Home Res. 35:10-11



Herd performance on Kentucky 31 tall fescue - 1950

Kentucky 31 (Tall Fescue)
+ Ladino (clover)

}

• Kentucky Bluegrass

- Results:
 - "animal performance on Kentucky 31 fescue was very poor."
 - Further tests are to be conducted on its performance in areas of milder climate.
 - For the present, the grass is not recommended for Ohio conditions.

Pratt, A.D., and J.L. Haynes. 1950. Herd performance on Kentucky 31 tall fescue. Ohio Farm Home Res. 35:10-11



Early Findings = Problematic:

- 1949.** A note on the cause of **tall fescue lameness** in cattle. Australian Vet. J. **25**: 27-28.
- 1952.** **Fescue foot** in cattle in Colorado. J. Am. Vet. Med. Assoc. **121**: 289-290.
- 1953.** **Fescue foot or ergotlike disease** in cattle in Kentucky. J. Am. Vet. Med. Assoc. **122**: 388-389.
- 1955.** **Fescue poisoning**. Tenn. Farm Home Sci. Progr. Rept. **16**: 8.
- 1956.** **Fescue poisons cattle**. Crops and Soils **9**: 26.
- 1956.** **Fescue lameness** in cattle. Am. J. Vet. Research **17**: 196-201.
- 1958.** **Fescue poisoning** of cattle on Florida muck land. J. Am. Vet. Med. Assoc. **132**: 493-494.
- 1961.** **Tall fescue (*Festuca arundinacea*) poisoning** in dairy cattle. Australian Vet. J. **37**: 312-313.



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Three Syndromes associated with Fescue Toxicosis

1. Elevated respiration rate and gangrene resulting in loss of hooves, tails, and ears
 - **"Fescue Foot"** most often occurred in Winter
 - First reported in New Zealand by Cunningham (1949)



Fescue foot in cattle. (Photo by George Garner.)



Three Syndromes associated with Fescue Toxicosis

2. Hard fat accumulation along the bovine intestinal tract in pastures where high rates of N were applied, resulting in upset digestion and difficult births
 - **"Fat Necrosis"**
 - Reported by
 - Bush et al., 1979
 - Stuedemann et al., 1975



Three Syndromes associated with Fescue Toxicosis

3. Multiple symptoms including: Failure to shed winter haircoat, High respiration rates, Intolerance to heat, Poor animal gains, Reduced milk production, Depressed feed intake, and Low conception rates
 - **"Summer Syndrome"**
 - Symptoms are most severe in warm weather





Fungus becomes suspect...



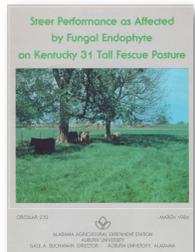
These findings resulted in the hypothesis that an endophyte was the causal agent in fescue toxicosis and stimulated further research (Bacon, 1995)

- Bacon, C.W., J.K. Porter, and J.D. Robbins. **1975**. Toxicity and occurrence of *Balansia* on grasses from toxic fescue pastures. *Appl. Microbiol.* 29:553-556.
- Bacon, C.W., J.K. Porter, J.D. Robbins, and E.S. Luttrell. **1977**. *Epichloë typhina* from toxic tall fescue grasses. *Appl. Environ. Microbiol.* 35:576-581.
- Porter, J.K., C.W. Bacon, and J.D. Robbins. **1979**. Lysergic acid amide derivatives from *Balansia epichloë* and *Balansia claviceps* (Clavicipitaceae). *J. Nat. Prod. (Lloydia)* 42:309.
- Robbins, J.D. **1983**. The tall fescue toxicosis problem. p. 1-4. In *Proc. Tall Fescue Toxicosis Workshop*. Georgia Agric. Ext. Serv., Atlanta, GA.



Steer Performance as Affected by Fungal Endophyte on Kentucky 31 Tall Fescue Pasture: Hoveland, 1984

- Marion Junction, AL - (1978-1982)
- 6 3-acre paddocks established to KY31 (October 1974)
- 3 of these paddocks were found to be nearly free of fungal endophyte (1978) while 3 others were considered highly infested.
- Creating an opportunity for a "fungal-free vs infested" tall fescue grazing evaluation
- 3 reps over 4 years




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Fescue Infection Status	1978-79	1979-80	1980-81	1981-82	Mean
Beef gain per acre (lbs)					
Fungus-Free	355 a*	436 a	437 a	478 a	428 a
Fungus-Infected	186 b	235 b	431 a	352 b	301 b
Average Daily Gain (lbs)					
Fungus-Free	1.42 a*	1.53 a	2.32 a	2.01 a	1.82 a
Fungus-Infected	0.57 b	0.72 b	1.75 b	1.03 b	1.00 b
Gain per testar steer (lbs)					
Fungus-Free	268 a*	297 a	344 a	377 a	322 a
Fungus-Infected	108 b	140 b	258 a	192 b	174 b

*Means within a column having the same letters are not significantly different at 5 percent level.

Hoveland, C.S., S.P. Schmidt, C.C. King Jr., J.W. Odum, E.M. Clark, J.A. McGuire, L.A. Smith, H.W. Grimes, and J.L. Holliman. 1984. Steer performance as affected by fungal endophyte on Kentucky 31 tall fescue pasture. Alabama Agricultural Experiment Station, Circular 270.

Fescue Infection Status	1978-79	1979-80	1980-81	1981-82	Mean
Beef gain per acre averaged 42% higher on fungus-free tall fescue!					
Fungus-Free	355 a*	436 a	437 a	478 a	428 a
Fungus-Infected	186 b	235 b	431 a	352 b	301 b
Average Daily Gain was 82% higher on fungus-free tall fescue!					
Fungus-Free	1.42 a*	1.53 a	2.32 a	2.01 a	1.82 a
Fungus-Infected	0.57 b	0.72 b	1.75 b	1.03 b	1.00 b
Individual tester steers gains were 85% higher on fungus-free tall fescue!					
Fungus-Free	268 a*	297 a	344 a	377 a	322 a
Fungus-Infected	108 b	140 b	258 a	192 b	174 b

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Steer Performance as Affected by Fungal Endophyte on Kentucky 31 Tall Fescue Pasture: Hoveland, 1984

<p>Fungus-infected</p> <ul style="list-style-type: none"> Elevated body temperature Rough hair coats that they did not shed in Spring Intolerance to heat Excessive salivation Nervousness 	<p>Fungus-free</p> <ul style="list-style-type: none"> Excellent condition Slick hair coats Tolerant of heat Grazing during the daytime instead of seeking shade
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UGA extension



The Effects of Fescue Toxicosis on Beef Cattle Productivity

- A published Review of Tall Fescue Research (1995)
 - 10 Pasture Based studies from 10 states
 - Publication dates ranged from 1982-1991

Patterson, J., C. Forchiero, B. Larson, M. Samford, and M. Kerley. 1995. The effects of fescue toxicosis on beef cattle productivity. J. Anim. Sci. 73:889-898.

UGA extension

Effect of endophyte level in tall fescue on daily gains by steers: 10 States, 10 Studies (1983-1991)

Location	Daily gain (lbs)	
	Low E	High E
Alabama	1.83	0.99
Arkansas	1.57	1.12
Georgia	1.30	0.99
Kentucky	1.54	0.99
Mississippi	1.50	1.01
Missouri	1.37	0.46
Oklahoma	1.87	1.37
Tennessee	1.48	1.06
Texas	2.14	1.01
Virginia	1.43	0.90

Patterson, J., C. Forchiero, B. Larson, M. Samford, and M. Kerley. 1995. The effects of fescue toxicosis on beef cattle productivity. J. Anim. Sci. 73:889-898.

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Grazing Tall Fescue: A Review of Animal Production Trials

Effect of endophyte-infected (E+) vs endophyte-free (E-) tall fescue on cow-calf performance: 7 studies, 1983-1993

Cows		Calves	
Daily gain, lbs	Pregnancy rate, %	Daily gain, lbs	205-d wean weight, lbs

Patterson, J., C. Forchiero, B. Larson, M. Samford, and M. Kerley. 1995. The effects of fescue toxicosis on beef cattle productivity. J. Anim. Sci. 73:889-898. 

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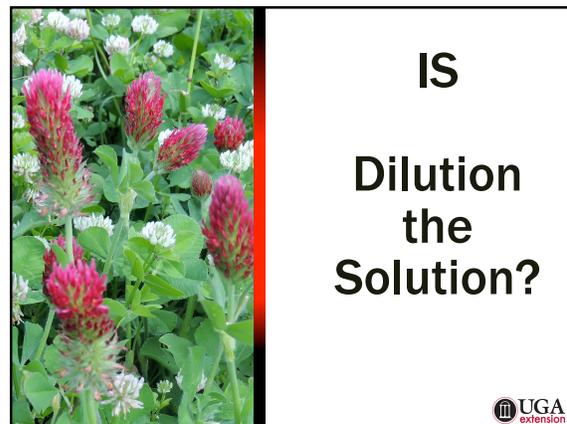
Cows				Calves			
Daily gain, lbs		Pregnancy rate, %		Daily gain, lbs		205-d wean weight, lbs	
E-	E+	E-	E+	E-	E+	E-	E+
1.01	-0.51	--	--	2.56	1.87	520	434
0.46	-0.11	95	55	1.72	1.37	474	410
0.42	0.60	87	58	1.63	1.30	490	419
0.09	-0.24	89	74	1.61	1.28		
0.79	0.46	78	49	2.25	1.90	529	461
0.44	0.02	--	--	2.36	1.19	--	--
0.24	-0.26	--	--	2.21	2.21	--	--

Patterson, J., C. Forchiero, B. Larson, M. Samford, and M. Kerley. 1995. The effects of fescue toxicosis on beef cattle productivity. J. Anim. Sci. 73:889-898. 

The Effects of Fescue Toxicosis on Beef Cattle Productivity

- Implications:
 - “The **losses** in cow-calf productivity due to fescue toxicosis **are significant**. Research has demonstrated how **consumption of E+** interacts with environmental conditions to **exacerbate the signs of toxicosis**. Future research should focus on how the toxic factors in E+ influence cellular receptor mechanisms in ruminants.”

Patterson, J., C. Forchiero, B. Larson, M. Samford, and M. Kerley. 1995. The effects of fescue toxicosis on beef cattle productivity. J. Anim. Sci. 73:889-898. 



Research began looking at alternative grazing methods to minimize the effects of Toxicosis

- Interseeding clovers or competitive species with similar growth cycles
- Adjusting stocking rates to decrease seedhead presence in pastures
- Providing alternative feeds as supplements (i.e. creep feeding calves)
- Grazing alternative forages during the warm season



Combined analysis of tall fescue steer grazing studies in the eastern United States (1993) R.W. Thompson et al.

- A review of research data conducted from 1979-1991
- Combined data collected from 12 individual studies
- 9 different locations
- Over varying years
- Spring grazing (March 1 to June 30)
- Summer grazing (July 1 to September 1)
- Low endophyte (LE: $\leq 5\%$ E+)
- Moderate endophyte (ME: $\geq 20\%$ to $\leq 35\%$ E+)
- High endophyte (HE $\geq 50\%$ to $\leq 97\%$ E+)
- With or Without Clover





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Grazing Tall Fescue: A Review of Animal Production Trials

Generalized least squares average daily gain means by steers grazing tall fescue pastures at different levels of endophyte infestation, with and without clover, during spring and summer grazing seasons: 12 studies (1979-1991) @ 9 locations

Tall Fescue Treatments	Spring	Summer	Spring + Summer
	Mean ADG (lb/d)		
Low E+			
Moderate E+			
High E+			
With Clover			
Low E+ Clover			
Moderate E+ Clover			
High E+ Clover			

Adapted from: Thompson, R.W., et al. 1993. Combined analysis of tall fescue steer grazing studies in the eastern United States. J. Anim. Sci. 71:1940-1947.



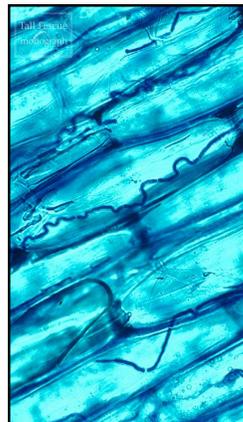
Generalized least squares average daily gain means by steers grazing tall fescue pastures at different levels of endophyte infestation, with and without clover, during spring and summer grazing seasons: 12 studies (1979-1991) @ 9 locations

Tall Fescue Treatments	Spring	Summer	Spring + Summer
	Mean ADG (lb/d)		
Low E+	1.85	1.19	1.50
Moderate E+	1.67	1.16	1.48
High E+	1.39	0.82	1.08
With Clover			
Low E+ Clover	2.14	1.33	1.79
Moderate E+ Clover	1.81	1.27	1.55
High E+ Clover	1.38	1.13	1.22

Adapted from: Thompson, R.W., et al. 1993. Combined analysis of tall fescue steer grazing studies in the eastern United States. J. Anim. Sci. 71:1940-1947.



- Multiple studies have indicated that the addition of legumes (including red and white clover, lespedeza, and alfalfa) has improved animal performance consistently in E- and E+ tall fescue pasture systems.
- Their presence improved animal performance by 25-50% (Lomas et al., 1999; Hoveland et al., 199; Fontenot et al., 2001)
- However – Persistence of legumes within tall fescue pasture has been a long standing problem with E+ KY31 tall fescue.



There's a new Endophyte in town!



Novel Endophyte Tall Fescue

- Development of "Novel endophyte tall fescue varieties" began in the mid to late 90's and multiple grazing evaluations in various locations of the transition zone have been conducted since the early 2000's.
- The consensus thus far from these evaluations has been:

"Animal performance with the novel endophytes is similar to that with E- tall fescue and consistently better than the E+ tall fescue"



Performance of stocker cattle grazing Jesup tall Fescues infected with AR542 compared to counterpart grazing tall fescue pasture infected with endemic endophyte or endophyte-free fescue (Spring)

Study, Location and Cultivar	Endophyte	Grazing Days	ADG (lb)
Parish/Eatonville, GA			
Jesup	E+	91	0.82
Jesup	E-	91	2.21
Jesup	AR542	91	1.76
Georgia 5	AR542	91	2.16
Waller/Grand Junction, TN			
Kentucky 31	E+	80	1.06
Kentucky 31	E-	80	1.63
Kentucky 31	AR542	80	1.61
W. Alleno/ Winnboro, LA			
Georgia 5	E+	112	2.09
Georgia 5	E-	112	3.02
Georgia 5	AR542	112	2.87
Jesup	AR542	112	2.82

S.A. Gantler and P.A. Beck. 2004. Novel Endophyte-Infected Tall Fescue for Growing Beef Cattle. JAS 82:E75-E82.



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W. Alison/Winnsboro, LA			
Georgia 5	E+	112	2.09
Georgia 5	E-	112	3.02
Georgia 5	AR542	112	2.67
Jesup	AR542	112	2.82

S.A. Gunter and P.A. Beck. 2004. Novel Endophyte-Infected Tall Fescue for Growing Beef Cattle. JAS 82:E75-E82. 

Performance of stocker cattle grazing Jesup tall Fescues infected with AR542 compared to counterpart grazing tall fescue pasture infected with endemic endophyte or endophyte-free fescue (Fall/Winter)

Study, Location and Cultivar	Endophyte	Grazing Days	ADG (lbs)
Parish/Eatonville, GA			
Jesup	E+	63	1.48
Jesup	E-	63	2.27
Jesup	AR542	63	2.05
Georgia 5	AR542	63	2.25
Waller/Grand Junction, TN			
Kentucky 31	E+	126	0.99
Kentucky 31	E-	126	1.61
Kentucky 31	AR542	126	0.97
Bransby/Crossville, AL			
Jesup	E+	224	1.65
Jesup	E-	224	1.98
Jesup	AR542	224	2.03

S.A. Gunter and P.A. Beck. 2004. Novel Endophyte-Infected Tall Fescue for Growing Beef Cattle. JAS 82:E75-E82. 

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Georgia 5	AR542	63	2.25
Waller/Grand Junction, TN			
Kentucky 31	E+	126	0.99
Kentucky 31	E-	126	1.61
Kentucky 31	AR542	126	0.97
Bransby/Crossville, AL			
Jesup	E+	224	1.65
Jesup	E-	224	1.98
Jesup	AR542	224	2.03

S.A. Gunter and P.A. Beck. 2004. Novel Endophyte-Infected Tall Fescue for Growing Beef Cattle. JAS 82:E75-E82. 

Body weight gain and physiologic measures for steers grazing tall fescue with varying endophyte status: 2008-2009 combined

	ADG lb/d	Rectal Temp. (°F)	Skin Temp. (°F)
E+			
NE + AR542 (MaxQ®)			
NE + AR584*			
E-			

* To be commercially released as 'Lacefield MaxQII' Novel Tall Fescue

J.M. Johnson, G. E. Aiken, T.D. Phillips, M. Barrett, J.L. Klotz, and F.N. Shrick. 2012. Steer and pasture responses for a novel endophyte tall fescue developed for the upper transition zone. JAS 90:2402-2409. 

Body weight gain and physiologic measures for steers grazing tall fescue with varying endophyte status: 2008-2009 combined

	ADG lb/d	Rectal Temp. (°F)	Skin Temp. (°F)
E+	1.39	104.5	98.9
NE + AR542 (MaxQ®)	1.85	103.8	97.7
NE + AR584	1.79	103.6	97.7
E-	1.79	103.6	97.5

J.M. Johnson, G. E. Aiken, T.D. Phillips, M. Barrett, J.L. Klotz, and F.N. Shrick. 2012. Steer and pasture responses for a novel endophyte tall fescue developed for the upper transition zone. JAS 90:2402-2409. 

Animal performance with the novel endophytes is **similar** to that with E- tall fescue and **consistently better** than the E+ tall fescue

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Summary

- Animal Performance **is negatively impacted** when grazing "E+" tall fescue
- Animal Performance **is improved** when livestock refrain from grazing "E+" tall fescue
- The effects of Fescue Toxicosis **can be diluted** (however still prevalent) by using alternative grazing methods, interseeding with non-toxic species, and/ or provide supplemental feed sources



Summary

- Novel Endophyte tall fescues **are a viable option** to replace E+ tall fescue and should be considered strongly
- There is still a lot to learn about Fescue Toxicosis




Questions?





www.georgiaforages.com

www.ugabeef.com

1-800-ASK-UGA1




- Pratt, A.D., and J.L. Haynes. 1950. Herd performance on Kentucky 31 tall fescue. Ohio Farm Home Res. 35:10-11
- Hoveland, C.S., S.P. Schmidt, C.C. King Jr., J.W. Odom, E.M. Clark, J.A. McGuire, L.A. Smith, H.W. Grimes, and J.L. Holliman. 1984. Steer performance as affected by fungal endophyte on Kentucky 31 tall fescue pasture. Alabama Agricultural Experiment Station, Circular 270.
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- Fribourg, H.A., D.B. Hannaway, and C.P. West. 2009. Tall Fescue for the 21st Century.



Steer Performance as Affected by Fungal Endophyte on Kentucky 31 Tall Fescue Pasture: Hoveland, 1984

Fescue Infection Status	Total animal grazing days per acre				
	1978-79	1979-80	1980-81	1981-82	Mean
Fungus-Free	250 a*	284 a	188 a	238 a	240 a
Fungus-Infected	328 b	326 b	247 a	343 b	311 b

*Means within a column having the same letters are not significantly different at 5 percent level.

Animal grazing days totaled **30%** greater on fungus-free tall fescue!

Hoveland, C.S., S.P. Schmidt, C.C. King Jr., J.W. Odom, E.M. Clark, J.A. McGuire, L.A. Smith, H.W. Grimes, and J.L. Holliman. 1984. Steer performance as affected by fungal endophyte on Kentucky 31 tall fescue pasture. Alabama Agricultural Experiment Station, Circular 270.



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Fungus-Infected	186 b	235 b	431 a	352 b	301 b

*Means within a column having the same letters are not significantly different at 5 percent level.

Beef gain per acre averaged **42%** higher on fungus-free tall fescue!

Hoveland, C.S., S.P. Schmidt, C.C. King Jr., J.W. Odom, E.M. Clark, J.A. McGuire, L.A. Smith, H.W. Grimes, and J.L. Holliman. 1984. Steer performance as affected by fungal endophyte on Kentucky 31 tall fescue pasture. Alabama Agricultural Experiment Station, Circular 270.



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Fescue Infection Status	Average Daily Gain (lbs)				Mean
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Fungus-Infected	0.57 b	0.72 b	1.75 b	1.03 b	1.00 b

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Average Daily Gain was **82%** higher on fungus-free tall fescue!

Hoveland, C.S., S.P. Schmidt, C.C. King Jr., J.W. Odom, E.M. Clark, J.A. McGuire, L.A. Smith, H.W. Grimes, and J.L. Holliman. 1984. Steer performance as affected by fungal endophyte on Kentucky 31 tall fescue pasture. Alabama Agricultural Experiment Station, Circular 270.



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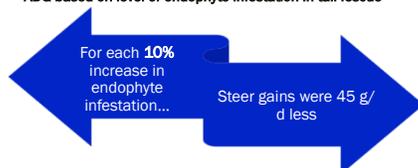
Individual tester steers weight gains were **85%** higher on fungus-free tall fescue!

Hoveland, C.S., S.P. Schmidt, C.C. King Jr., J.W. Odom, E.M. Clark, J.A. McGuire, L.A. Smith, H.W. Grimes, and J.L. Holliman. 1984. Steer performance as affected by fungal endophyte on Kentucky 31 tall fescue pasture. Alabama Agricultural Experiment Station, Circular 270.



Before *N. coenophialum* generated alkaloids became suspect....

- Research focused on developing "Predictions of expected Animal ADG based on level of endophyte infestation in tall fescue"



- Garner et al. (1984), Crawford et al. (1989), and Steudemann et al. (1985)



Steer Performance as Affected by Fungal Endophyte on Kentucky 31 Tall Fescue Pasture: Hoveland, 1984

Fescue Infection Status	Body temperature (°F)				Mean
	1978-79	1979-80	1980-81	1981-82	
Fungus-Free	102.7 b*	102.7 b	103.3 b	102.5 b	102.8 b
Fungus-Infected	104.8 a	104.8 a	104.9 a	103.5 a	104.5 a

*Means within a column having the same letters are not significantly different at 5 percent level.

Hoveland, C.S., S.P. Schmidt, C.C. King Jr., J.W. Odom, E.M. Clark, J.A. McGuire, L.A. Smith, H.W. Grimes, and J.L. Holliman. 1984. Steer performance as affected by fungal endophyte on Kentucky 31 tall fescue pasture. Alabama Agricultural Experiment Station, Circular 270.

