



2000 Cool-Season Grass Grazing Tolerance Variety Report

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Introduction

Cool-season grasses such as tall fescue and orchardgrass are the dominant pasture grasses in Kentucky. While variety evaluations for yield have been carried out for many years, little work has been done to establish the grazing tolerance of these varieties.

The purpose of this report is to summarize current research on the grazing tolerance of varieties of tall fescue and orchardgrass and other species when they are subjected to continuous, heavy grazing pressure within the grazing season. The main focus will be on plant stand survival.

Description of the Tests

Grass variety tests for grazing tolerance were established in Lexington, Kentucky in the falls of 1997, 1998, and 1999. The soils at this location are well-drained silt loams and are well suited to tall fescue and orchardgrass production. Plots were 5 x 15 feet in a randomized complete block design with each variety replicated six times. In each test, 20 pounds of seed per acre were planted into a prepared seedbed using a disk drill. Grazing began in April. In past years, each grazing tolerance study was harvested for hay and then allowed to regrow before stocking with livestock. In 1999 and 2000, in order to put more stress on varieties and to separate varieties more clearly, all studies were grazed for the entire season. Plots were grazed down quickly to below 4 inches by feeder steers and kept at that height or below it for the remainder of the grazing season. Supplemental hay was fed during periods of slowest growth. Animals were removed from plots after all fall growth had been removed and when little regrowth was expected. Visual ratings of percent stand were made in the fall and spring after each grazing season. Grass plots were fertilized with 60 pounds of actual N per acre in the spring, and other fertilizers (lime, P, and K) were applied as needed.

Results and Discussion

Weather data for Lexington for 1998, 1999, and 2000 are presented in Table 1. Dry weather was a limiting factor in the second half of 1998. Year 1999 was a drought year with above average temperatures, and forage growth was significantly reduced. Year 2000 weather was close to normal.

Data on percent stand are presented in Tables 2 through 7. Statistical analyses were performed on all entries (including experimentals) to determine if the apparent differences are truly due to variety. Varieties not significantly different from the highest numerical value in a column are marked with one asterisk (*). To determine if two varieties are truly different, compare the difference between the two varieties to the Least Significant Difference (LSD) at the bottom of the column. If the difference is equal to or greater than the LSD, the varieties are truly different when grown under the conditions at a given location. The Coefficient of Variation (CV), which is a measure of the variability of the data, is included for each column of means. Low variability is desirable, and increased variability within a study results in higher CVs and larger LSDs.

Tall fescue: Kentucky 31 tall fescue with the endophyte (KY31+) is considered to be the most grazing-tolerant variety and is the grazing-tolerant check variety. In the studies in this report, several endophyte-free or low-endophyte tall fescues have been grazed continuously and heavily to see if they can tolerate overgrazing as well as KY31+ and whether differences exist among varieties (Tables 2, 3, and 4).

Tall fescue studies were grazed harder in 1999 and 2000 than in previous years to put greater pressure on stands. After only one year of grazing (Table 4), almost all of the tall fescues had stand ratings not significantly different from KY31+. After two years of grazing (Table 3), Kenhy, Johnstone, Select, Jesup EF, and Cattle Club had stands similar to KY31+. After three years of grazing (Table 2), only Festorina had a stand rating equal to KY31+.

It is routine to check the endophyte status of tall fescues in the grazing trials, either by checking the tillers from the plots themselves or from the seed. It is expected that all commercial varieties should have zero or near zero endophyte content. However, tillers from the 1997 seeding taken from the commercial varieties ranged from 0 to 10% infection (Table 2). Infected KY31 had nearly 100% infection, as was expected. The source of the low levels of endophyte infection is not clear, but it could be residual low levels of endophyte contained in the original seed or contaminated manure of the grazing animals (seed ingested prior to the study and then deposited in the plots). Most of the commercial varieties in the 1998 seeding had zero percent endophyte infection (Table 3).

Orchardgrass: As with tall fescue, all orchardgrass studies were grazed harder in 1999 and 2000 than in previous years to separate varieties.

Stands of orchardgrass declined with age. Tekapo was the best in the 1997 and 1999 seedings (Tables 5 and 7), while Boone, Benchmark, Crown, Hallmark, Tekapo, and Shiloh were at the top of the 1998 seeding (Table 6).

In spite of season-long intensive grazing as well as a drought in 1999, both tall fescue and orchardgrass varieties seemed to come back well, generating relatively good stand ratings.

Tables 8 (fescue) and 9 (orchardgrass) summarize information about distributors and persistence across locations and years for all varieties in these tests. Varieties are listed in alphabetical order with experimental varieties listed at the bottom. In Tables 8 and 9 shaded areas indicate that the variety was not in that particular test (tests are labeled at the top of the column), while clear blocks mean the variety was in the test. A single asterisk (*) means that the variety was not significantly different from the top-yielding variety in that study. It is best to choose a variety that has performed well over several years.

Summary

These studies indicate that there are varieties of cool-season grasses that can tolerate overgrazing for multiple seasons and still maintain reasonable stands. Several varieties of endophyte-free tall fescue have been able to maintain equivalent stands to

endophyte-infected KY31. There is no ‘KY31+’ equivalent to orchardgrass—that is, there is no variety that has historically been proven to be tolerant of overgrazing. Therefore, comparison of the limited years of data on orchardgrass grazing tolerance is difficult. However, it does appear that some separation is occurring among orchardgrass cultivars in the current studies.

This information should be used along with yield and other information (relative maturity in spring, for example) in selecting the best grass variety for each individual use. It is *not* recommended that tall fescue or orchardgrass be continuously overgrazed, as was done in these trials. While several varieties expressed tolerance to the level of grazing pressure used in these trials, overgrazing greatly reduces yield and therefore profitability of these varieties. This information should be an indication of those varieties that will better withstand the occasional overgrazing that sometimes becomes necessary in livestock operations.

Good management for maximum life from any grass would involve allowing it to become completely established before grazing and avoiding the overgrazing of it during times of extreme stress (such as drought).

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Table 1. Temperature and rainfall at Lexington, Kentucky during the 1998, 1999, and 2000 growing seasons.

	1998				1999				2000			
	Temp		Rainfall		Temp		Rainfall		Temp		Rainfall	
MON	°F	DEP	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP
JAN	41	+10	3.96	+1.10	36	+5	5.64	+2.78	32	+1	3.48	+0.62
FEB	41	+6	2.54	-0.67	40	+5	2.32	-0.89	43	+8	4.97	+1.76
MAR	46	+2	3.40	-1.00	40	-4	3.27	-1.13	48	+4	3.47	-0.93
APR	54	-1	6.20	+2.32	56	+1	1.87	-2.01	53	-2	4.10	+0.22
MAY	67	+3	6.14	+1.67	65	+1	1.35	-3.12	67	+3	2.96	-1.51
JUN	73	+1	10.81	+7.15	74	+2	3.89	+0.23	73	+1	3.22	-0.44
JUL	75	-1	7.98	+2.98	80	+4	1.00	-4.00	74	-2	3.42	-1.58
AUG	76	+1	0.29	-3.64	75	0	1.31	-2.62	74	-2	3.38	-0.55
SEP	74	+6	0.61	-2.59	69	+1	1.03	-2.17	66	-2	5.47	+2.27
OCT	58	+1	2.41	-0.16	57	0	1.91	-0.66	59	+2	0.92	-1.65

Note: DEP is departure from the long-term average for that location.

Table 2. Percent stand ratings for tall fescue varieties sown September 5, 1997 at Lexington, Kentucky in a grazing tolerance study.

Variety	Percent Endophyte Infection ¹	Percent Stand		
		Nov 9, 1999	Mar 21, 2000	Oct 20, 2000
Commercial varieties — available for farm use				
KY31+ ²	97.0	76.7 *	63.3	60.0 *
Festorina	3.3	83.3 *	76.7 *	55.0 *
Johnstone	1.7	70.0	61.7	48.3
Jesup EF	6.7	85.0 *	70.0 *	47.5
Martin II	10.0	66.7	66.7	41.7
Cattle Club	5.0	68.3	51.7	31.7
Southern Cross	0.0	63.3	58.3	24.2
Experimental varieties — not available for farm use				
KYFA9304	8.3	75.0	66.7	64.2 *
KYFA9303	14.2	76.7 *	70.0 *	60.5 *
KYFA9301	0.0	70.0	61.7	59.2 *
KY31- ²	18.3	75.0	68.3 *	51.7 *
KYTF2	21.7	71.7	55.0	49.2
B-1	3.3	73.3	73.3 *	43.3
TF8805	8.3	76.7 *	65.0	40.8
KYFA9302	1.7	70.0	70.0 *	38.3
WVPB-TF-500	10.8	63.3	51.7	38.3
Mean	-	72.8	64.4	47.1
CV, %	-	11.99	12.85	23.20
LSD, 0.05	-	10.04	9.51	12.57
<p>* Not significantly different from the highest numerical value in the column based on the 0.05 LSD. ¹ Means of six replications using tiller samples taken on April 29, 1999. ² "+" indicates variety is endophyte infected; "-" indicates variety is endophyte free.</p>				

Table 3. Percent stand for tall fescue and perennial ryegrass (PRG) varieties sown September 15, 1998 at Lexington, Kentucky in a grazing tolerance study.

Variety	Percent Endophyte Infection ¹	Percent Stand		
		Oct 4, 1999	Mar 21, 2000	Oct 10, 2000
Commercial varieties — available for farm use				
Kenhy	0.0	79.2 *	88.3 *	74.7 *
Johnstone	3.3	81.7 *	88.3 *	67.2 *
KY31+ ²	83.3	71.7	86.7 *	66.8 *
Select	0.0	81.7 *	86.7 *	65.3 *
Jesup EF	3.3	84.2 *	90.0 *	64.0 *
Cattle Club	0.0	78.3 *	88.3 *	63.8 *
Vulcan	6.7	73.3	88.3 *	61.7
Bronson	0.0	73.3	86.7 *	42.0
Fuego	0.0	73.3	85.0 *	33.0
TF33	0.0	74.2	78.3	31.7
Polly II (PRG)	0.0	61.7	90.0 *	24.2
Experimental varieties — not available for farm use				
KYTF2	36.7	75.8 *	88.3 *	70.0 *
KYFA 9301	13.3	80.0 *	88.3 *	66.3 *
KY31- ²	6.7	81.7 *	90.0 *	65.0 *
Ampac pp1	6.7	84.2 *	88.3 *	60.5
Jesup 542	96.7	79.2 *	90.0 *	59.5
Jesup EI	100.0	84.2 *	90.0 *	56.8
Jesup 502	93.3	84.2 *	86.7 *	51.3
Woodburn 97	23.3	39.2	40.0	41.3
Georgia 5-542	96.7	71.7	83.3	39.2
Mean	-	75.6	85.1	55.2
CV, %	-	10.2	5.8	18.5
LSD, 0.05	-	8.9	5.7	11.7

* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

¹ Means of six replications using tiller samples taken on April 29, 1999.

² "-" indicates variety is endophyte free; "+" indicates variety is endophyte infected.

Table 4. Percent stand of tall fescue varieties sown October 4, 1999 at Lexington, Kentucky in a grazing tolerance study.

Variety	Vigor Nov 4, 1999	Percent Stand Oct 23, 2000
Commercial varieties — available for farm use		
Cattle Club	2.5	85.7 *
Ky31+ ¹	3.5	85.2 *
BAR9TMPO	2.0	83.3 *
Duo (festulolium)	4.5 *	82.1 *
Select	1.8	80.4 *
Stargrazer	2.0	76.3
Festorina	2.8	74.4
Experimental varieties — not available for farm use		
Jesup 584	2.2	87.9 *
KYFA 9304	3.0	87.1 *
Ky31- ¹	3.2	86.7 *
Jesup 542	2.3	85.4 *
KYFA 9301	3.5	85.4 *
KYTF 2	3.2	83.8 *
GA 5 584	2.3	79.6 *
GA 156L 542	2.5	78.5 *
BARFaBTR 6	2.8	78.0 *
BARFaBTR 7	3.0	77.1
GA 7 clone 542	2.7	73.0
Ga153E 542	2.5	70.4
Ampac pp7 mix	3.3	66.9
Ampac pp8 mix	3.8	43.3
Ampac pp3 mix	4.8 *	22.8
Mean	2.9	76.1
CV, %	15.10	11.50
LSD, 0.05	0.51	10.00
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.		
¹ "+" indicates variety is endophyte infected; "-" indicates variety is endophyte free.		

Table 5. Percent stand of orchardgrass varieties sown September 8, 1997 at Lexington, Kentucky in a grazing tolerance study.

Variety	Percent Stand			
	Mar 30, 1999	Nov 9, 1999	Mar 21, 2000	Oct 20, 2000
Commercial varieties — available for farm use				
Tekapo	84.2	78.3 *	61.7 *	65.0 *
Benchmark	87.5 *	68.3	61.7 *	60.0 *
Ambrosia	76.7	63.3	43.3	54.7 *
Crown	87.5 *	65.0	58.3 *	53.3
Warrior	85.0	66.7	46.7	50.0
Takena	84.2	60.0	38.3	47.5
Condor	83.3	53.3	38.3	45.8
Haymate	85.0	58.3	40.0	44.2
Experimental varieties — not available for farm use				
93E	89.2 *	73.3 *	66.7 *	63.0 *
AV61	86.7 *	61.7	48.3	55.0 *
93M	86.7 *	63.3	51.7	54.2 *
93L	85.8	58.3	51.7	47.5
Mean	85.1	64.2	50.5	53.4
CV, %	3.12	10.30	18.43	17.58
LSD, 0.05	3.08	7.64	10.78	10.85

* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 6. Percent stand of orchardgrass varieties sown September 15, 1998 at Lexington, Kentucky in a grazing tolerance study.

Variety	Percent Stand		
	Oct 4, 1999	Mar 21, 2000	Oct 20, 2000
Commercial varieties — available for farm use			
Boone	89.2 *	90.0 *	81.7 *
Benchmark	83.3	88.3 *	78.3 *
Shiloh	85.0 *	90.0 *	77.5 *
Haymate	80.8	90.0 *	76.7 *
Crown	80.8	88.3 *	74.2 *
Hallmark A	84.2 *	88.3 *	73.0 *
Cheyenne	81.7	86.7	71.7
WP 300	77.5	88.3 *	71.0
Tekapo	85.0 *	90.0 *	70.8
Hallmark B	85.8 *	90.0 *	70.8
Pizza	75.0	90.0 *	70.0
Experimental varieties — not available for farm use			
OG 9501	86.7 *	90.0 *	82.5 *
Kyo7g 23-335	82.5	90.0 *	81.7 *
OG 9705g	85.0 *	90.0 *	79.7 *
Kydg 9303	84.2 *	88.3 *	72.7 *
Ampac pp2	80.0	81.7	48.0
Mean	82.9	88.8	73.8
CV, %	5.46	3.14	12.31
LSD, 0.05	5.21	3.20	10.44

* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 7. Seedling vigor and percent stand of orchardgrass and Kentucky bluegrass (BG) varieties sown October 1, 1999 at Lexington, Kentucky in a grazing tolerance study.

Variety	Seedling Vigor ¹	Percent Stand
	Nov 11, 1999	Oct 23, 2000
Commercial varieties — available for farm use		
Hallmark A	2.67 *	84.17 *
Tekapo	1.67	83.33 *
Hallmark B	2.67 *	82.50 *
Benchmark	2.17	80.00
Haymate	1.83	77.83
Sidekick (BG)	1.00	65.00
Experimental varieties — not available for farm use		
Bardgl9btr-g	1.00	86.67 *
OG 9705g	2.50 *	82.50 *
Bardgl9btr-f	2.00	82.00 *
Kyo7g 23-335	2.00	80.00
Mean	1.95	80.40
CV, %	18.44	6.62
LSD, 0.05	0.42	6.19
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.		
¹ 0 to 5 scale with 5 being most vigorous.		

Table 8. Persistence of tall fescue and perennial ryegrass (PRG) varieties under heavy grazing pressure across years and locations.		Lexington						
		1997 ¹			1998			1999
Variety	Proprietor/KY Distributor	Nov 1999 ²	Mar 2000 ²	Oct 2000 ²	Oct 1999 ²	Mar 2000 ²	Oct 2000 ²	Oct 2000 ²
Commercial varieties — available for farm use								
BAR 9TMPO	Barenbrug USA							*
Bronson	Ampac Seeds					*		
Cattle Club	Green Seed				*	*	*	*
Duo (festulolium)	Ampac Seeds							*
Festorina	Advanta Seeds	*	*	*				
Fuego	Advanta Seeds					*		
Jesup EF	Pennington Seeds	*	*		*	*	*	
Johnstone	Willamette Seed Co./Public				*	*	*	
Kenhy	Public				*	*	*	
KY31+ (endophyte infected)	KY Agric. Exp. Sta./Public	*		*		*	*	*
Martin II	International Seeds Inc.							
Polly II (PRG)	FFR/Southern States					*		
Select	FFR				*	*	*	*
Southern Cross								
TF 33	Barenbrug							
Vulcan	International Seeds					*		
Experimental varieties — not available for farm use								
Ampac pp1 mix	Ampac Seeds				*	*		
Ampac pp3 mix	Ampac Seeds							
Ampac pp7 mix	Ampac Seeds							
Ampac pp8 mix	Ampac Seeds							
B-1	Olsen-Fennell Seeds Inc.		*					
BARFaBTR 6	Barenbrug USA							*
BARFaBTR 7	Barenbrug USA							
GA 153E 542	GA Agric. Exp. Sta./Experimental							
GA 156L 542	GA Agric. Exp. Sta./Experimental							*
GA 5 542	GA Agric. Exp. Sta./Experimental							
GA 5 584	GA Agric. Exp. Sta./Experimental							*
GA 7 clone 542	GA Agric. Exp. Sta./Experimental							
GA Jesup EI	GA Agric. Exp. Sta./Experimental				*	*		
Jesup 502	GA Agric. Exp. Sta./Experimental				*	*		
Jesup 542	GA Agric. Exp. Sta./Experimental				*	*		*
Jesup 584	GA Agric. Exp. Sta./Experimental							*
KY31- (endophyte free)	KY Agric. Exp. Sta./Experimental	*	*	*	*	*	*	*
KYFA 9301	KY Agric. Exp. Sta./Experimental			*	*	*	*	*
KYFA 9302	KY Agric. Exp. Sta./Experimental		*					
KYFA 9303	KY Agric. Exp. Sta./Experimental	*	*	*				
KYFA 9304	KY Agric. Exp. Sta./Experimental	*		*				*
KYTF 2	KY Agric. Exp. Sta./Experimental				*	*	*	*
TF 8805	FFR Cooperative	*						
Woodburn 97	Western Production Inc.							
WVPB TF500	Western Production Inc.							

¹ Establishment year.
² Date of visual estimation of percent stand.
* Not significantly different from the most persistent variety in the test. Shaded boxes indicate that the variety was not in the test. Open boxes indicate the variety was in the test but persistence was significantly less than the top ranked variety in the test.

Table 9. Persistence of orchardgrass and Kentucky bluegrass varieties (BG) under heavy grazing pressure across years and locations.		Lexington					
		1997 ¹			1998		1999
		Nov 1999 ²	Mar 2000 ²	Oct 2000 ²	Mar 2000 ²	Oct 2000 ²	Oct 2000 ²
Variety	Proprietor/KY Distributor						
Commercial varieties — available for farm use							
Ambrosia	Pennington Seeds			*			
Benchmark	FFR/Southern States		*	*	*	*	
Boone	KY Agric. Exp. Sta/Experimental				*	*	
Cheyenne	Western Production Inc.						
Condor	Hansford Seed Co.						
Crown	Scott Seed Co./Sphar Seed Co.		*		*	*	
Hallmark B	James VanLeeuwen				*		*
Hallmark A	James VanLeeuwen				*	*	*
Haymate	FFR/Southern States				*	*	
Pizza	Advanta Seeds West				*		
Shiloh	Green Seed				*	*	
Sidekick (BG)	Ampac Seeds						
Takena	Smith Seed						
Tekapo	Ampac Seeds	*	*	*	*		*
Warrior	Olsen-Fennel Seeds Inc.						
WP 300	Western Productions, Inc.						
Experimental Varieties — not available for farm use							
Ampac pp2	Ampac Seeds						
AV61	Western Production Inc.			*			
BAR Dgl 9 BTR F	Barenbrug USA						*
BAR Dgl 9 BTR G	Barenbrug USA						*
KYOG 9303	KY Agric. Exp. Sta/Experimental				*	*	
KYO7G 23-335	KY Agric. Exp. Sta/Experimental				*	*	
OFI93E	Olsen-Fennel	*	*	*			
OFI93L	Olsen-Fennel						
OFI93M	Olsen-Fennel			*			
OG9501	FFR Cooperative				*	*	
OG 9705G	FFR Cooperative				*	*	*
¹ Establishment year. ² Date of visual estimation of percent stand. * Not significantly different from the most persistent variety in the test. Shaded boxes indicate that the variety was not in the test. Open boxes indicate the variety was in the test but persistence was significantly less than the top ranked variety in the test.							



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