

# 2002 Cool-Season Grass Grazing Tolerance Variety Report

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## Introduction

Cool-season grasses such as tall fescue and orchardgrass are the primary pasture grasses in Kentucky. Other species such as perennial ryegrass, festulolium, and prairie brome can be used in pasture systems. Little is known about the effect of variety on the grazing tolerance of these cool-season grass species.

The purpose of this report is to summarize current research on the grazing tolerance of varieties of tall fescue, orchardgrass, perennial ryegrass, and other species when they are subjected to continuous, heavy grazing pressure by cattle 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 in the fall of 1999, 2000, and 2001. The soils at this location are well-drained silt loams and are well suited to tall fescue, orchardgrass, and ryegrass production. Plots were 5 ft x 15 ft in a randomized complete block design with each variety replicated six times. In each test, 20 pounds of seed per acre (8 pounds/acre for timothy) were planted into a prepared seedbed using a disk drill. Grazing began in April and was continuous until late September. Plots were grazed down to below 4 inches quickly by feeder steers and kept at that height or below for the remainder of the grazing season. Supplemental hay or soybean hulls were 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 fertilizer (lime, P, and K) was applied as needed.

## Results and Discussion

Weather data for Lexington for 2000, 2001, and 2002 are presented in Table 1. The 2002 summer was the fourth hottest and driest on record. Data on percent stand are presented in Tables 2 through 9. 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.

Kentucky 31 tall fescue with the endophyte (KY31+) is considered to be the most grazing-tolerant variety and is the grazing-tolerant check entry in all tall fescue trials. The central questions in grazing tolerance among tall fescues are: 1) Can endophyte-free varieties persist as well as KY31+, and 2) Will

**Table 1. Temperature and rainfall at Lexington during the 2000, 2001, and 2002 growing seasons.**

	2000				2001				2002			
	Temp		Rainfall		Temp		Rainfall		Temp		Rainfall	
	° F	DEP	IN	DEP	° F	DEP	IN	DEP	° F	DEP	IN	DEP
JAN	32	+1	3.48	+0.62	31	0	0.9	-1.9	38	+7	2.12	-0.74
FEB	43	+8	4.97	+1.76	40	+5	3.2	0	38	+3	1.28	-1.93
MAR	48	+4	3.47	-0.93	40	-4	2.7	-1.7	45	+1	7.93	+3.53
APR	53	-2	4.10	+0.22	59	+4	1.7	-2.2	58	+3	4.19	+0.31
MAY	67	+3	2.96	-1.51	66	+2	4.9	+0.4	61	-3	4.36	-0.11
JUN	73	+1	3.22	-0.44	71	-1	2.0	-1.6	74	+2	2.45	-1.21
JUL	74	-2	3.42	-1.58	75	-1	5.6	+0.6	78	+2	1.10	-3.90
AUG	74	-2	3.38	-0.55	76	+1	4.8	+0.8	77	+2	0.95	-2.98
SEP	66	-2	5.47	+2.27	65	-3	3.0	-0.2	72	+4	4.90	+1.70
OCT	59	+2	0.92	-1.65	56	-1	3.6	+1.1	55	-2	5.61	+3.04
NOV	43	-2	1.59	-1.80	51	+6	2.8	-0.6	43	-2	3.76	+0.37
<b>AVG</b>	<b>57.5</b>	<b>+0.8</b>	<b>3.4</b>	<b>-0.8</b>	<b>57.3</b>	<b>+0.7</b>	<b>3.2</b>	<b>-0.5</b>	58.1	+1.6	3.5	-0.2

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

the new novel, or "friendly," endophyte materials persist as well as other tolerant varieties?

After three seasons, Cattle Club and Duo (a fescue-ryegrass hybrid) were comparable to KY31+, as were some endophyte-free experimental lines (e.g., KYFA9301 and KYFA9304) (Table 2). Three novel endophyte lines—Jesup (542), Jesup (584), and GA5 (584)—were comparable to KY31+ as well. The novel endophyte designation of these three lines contains the tall fescue variety (e.g., Jesup) and the particular strain of novel endophyte (e.g., 542 or 584). Jesup (542) is the experimental designation for the commercial variety MaxQ. It is logical that the extreme drought of 2002 should have led to greater stand loss in lines without grazing tolerance. The endophyte, therefore, is not necessary for persistence or tolerance to grazing abuse, at least for Central Kentucky conditions where other factors such as soil fertility and topsoil depth are not limiting.

Perennial ryegrass or ryegrass hybrids tended to be more persistent than prairie brome species (Table 5). Citadel, Linn, Duo, and Spring Green all had greater than 50% stand after two seasons. Some separation in ryegrass lines was observed even after one grazing season (Table 6).

Orchardgrass persistence is reported in Tables 7-9. Several commercial varieties of orchardgrass persisted well even after three seasons of heavy grazing, including Hallmark, Tekapo, and Haymate.

Table 10 (fescue, perennial ryegrass, and prairiegrass) and Table 11 (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. Shaded areas indicate that the variety was not in that particular test (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. Some varieties of endophyte-free as well as novel, or "friendly," endophyte tall fescue have been able to maintain equivalent stands to endophyte-infected KY31. There is no "KY31+" equivalent in orchardgrass; that is, no variety has historically been proven to be tolerant of overgrazing. Therefore, conclusions about orchardgrass grazing tolerance are limited. However, some varieties have exhibited good tolerance to grazing abuse even after three seasons.

**Table 2. Percent stand of tall fescue varieties planted October 4, 1999, in a cattle grazing tolerance study at Lexington, Kentucky.**

Variety	Seedling Vigor <sup>1</sup>	Percent Stand			
	Nov 4, 1999	Apr 4, 2001	Oct 15, 2001	Apr 2, 2002	Oct 11, 2002
<b>Commercial varieties — available for farm use</b>					
Duo (festulolium)	5	83	66	70	69*
KY31+ <sup>2</sup>	4	83	66	74	61*
Cattle Club	3	80	57	64	57
Select	2	77	51	64	47
Festorina	3	72	33	53	45
BAR 9TMP0	2	78	46	62	44
Stargrazer	2	74	34	56	43
<b>Experimental varieties</b>					
KYFA9301	4	83	69	75	65*
KYFA9304	3	85	69	76	63*
Jesup (542) <sup>3</sup>	2	81	63	72	60*
KYTF 2	3	82	68	73	60*
Ga 156L (542) <sup>3</sup>	3	80	64	71	59*
Jesup (584) <sup>3</sup>	2	86	61	75	58*
KY31- <sup>2</sup>	3	80	65	71	55
Ga 5 (584) <sup>3</sup>	2	78	48	63	49
Ampac pp7 mix	3	60	40	53	41
BARFaBTR 6	3	71	16	38	38
Ga 7 clone (542) <sup>3</sup>	3	68	39	56	38
BARFaBTR 7	3	73	16	40	36
Ga 153E (542) <sup>3</sup>	3	68	35	55	30
Ampac pp8 mix	4	51	14	38	23
Ampac pp3 mix	5	37	8	31	21
Mean	2.9	74	47	61	48
CV, %	15.1	9.07	23.10	13.93	21.05
LSD, 0.05	0.51	7.70	12.40	9.65	11.64

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

1 0 to 5 scale with 5 being most vigorous.

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

3 Novel endophyte tall fescue.

This information should be used along with yield and other information (for example, relative maturity in spring) 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 be to allow it to get completely established before grazing and to avoid overgrazing it during times of extreme stress, such as drought.

**Table 3. Percent stand of tall fescue and timothy varieties planted September 19, 2000, in a cattle grazing tolerance study at Lexington, Kentucky.**

Variety	Seedling Vigor <sup>1</sup>	Percent Endophyte Infection	Apr 9, 2001	Oct 15, 2001	Apr 2, 2002	Oct 14, 2002
<b>Commercial varieties — available for farm use</b>						
Cattle Club	4	0	90	68	68	74*
KY31+ <sup>2</sup>	5	60	89	74	76	74*
Hoedown	5	0	90	58	65	66*
Select	4	20	87	65	69	65*
Stargrazer	4	0	88	57	65	53
Kokanee	5	0	87	45	54	48
Tuukka (timothy)	2	0	87	22	46	6
<b>Experimental varieties</b>						
KYFA9304	5	0	90	70	73	73*
KYFA9402	5	0	90	71	76	71*
Q4508	5	80	90	55	70	71*
AGRFA 110	4	0	87	80	68	70*
KYFA9301	5	0	89	70	75	70*
KYFA9401	5	0	90	72	74	68*
KYFA9403	5	0	90	67	71	67*
KY31- <sup>2</sup>	5	20	90	73	77	66*
KYTF 2	4	0	89	66	69	63*
R4663 <sup>3</sup>	4	80	89	73	53	43
Mean	4.3	-	89	64	67	62
CV, %	10.51	-	2.09	11.07	10.15	16.76
LSD, 0.05	0.52	-	2.14	8.11	7.87	11.87

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

<sup>1</sup> 0 to 5 scale with 5 being most vigorous.

<sup>2</sup> "+" indicates variety is endophyte infected; "-" indicates variety is endophyte free.

<sup>3</sup> Novel endophyte tall fescue.

**Table 4. Percent stand of tall fescue varieties sown September 12, 2001, at Lexington, Kentucky, in a cattle grazing tolerance study.**

Variety	Seedling Vigor <sup>1</sup>	Apr 4, 2002	Oct 15, 2002
		Percent Stand	
<b>Commercial varieties — available for farm use</b>			
KY31+ <sup>2</sup>	5	90	88*
Felina (festulolium)	4	90	86*
Festival	4	90	84*
Maximize	4	90	84*
Select	3	90	83*
Cattle Club	4	90	82*
Spring Green (festulolium)	5	90	80*
Carmin	3	90	79
Johnstone	5	90	79
Stargrazer	3	90	78
Resolute	4	14	16
<b>Experimental varieties</b>			
KYFA9304	4	90	88*
KY31- <sup>2</sup>	5	90	85*
KYFA9301	4	90	84*
HM4 <sup>3</sup>	4	90	78
K5666V	3	90	65
PP10	4	90	59
Mean	3.9	86	76
CV, %	10.92	1.39	9.61
LSD, 0.05	0.49	1.37	8.45

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

<sup>1</sup> 0 to 5 scale with 5 being most vigorous.

<sup>2</sup> "+" indicates variety is endophyte infected; "-" indicates variety is endophyte free.

<sup>3</sup> Novel endophyte tall fescue.

**Table 5. Percent stand of perennial ryegrass, festulolium, and prairie brome (*Bromus willdenowii*) varieties planted September 19, 2000, at Lexington, Kentucky, in a cattle grazing tolerance study.**

Variety	Species	Seedling Vigor <sup>1</sup> Oct 31, 2000	Percent Stand			
			Apr 9, 2001	Oct 17, 2001	Apr 2, 2002	Oct 14, 2002
<b>Commercial varieties — available for farm use</b>						
Spring Green	festulolium	4	90	70	70	66*
Duo	festulolium	4	90	64	71	61*
Linn	perennial ryegrass	3	90	71	75	58
Citadel	perennial ryegrass	3	90	31	58	56
Matua	prairie brome	4	83	40	67	35
Polly II	perennial ryegrass	5	90	8	39	16
<b>Experimental varieties</b>						
AGRLP 103	perennial ryegrass	4	90	75	73	73*
AGRBW 101	prairie brome	4	88	51	71	58
AGR LH 101	perennial ryegrass	4	90	56	63	43
Mean	-	3.7	89	52	65	52
CV, %	-	14.13	1.79	15.24	10.26	21.25
LSD, 0.05	-	0.61	1.86	9.19	7.78	12.81

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

<sup>1</sup> 0 to 5 scale with 5 being the most vigorous.

**Table 6. Seedling vigor and percent stand of perennial ryegrass varieties sown September 12, 2001, at Lexington, Kentucky, in a cattle grazing tolerance study.**

Variety	Ploidy	Seedling Vigor <sup>1</sup> Nov 2, 2001	Percent Stand	
			Apr 4, 2002	Oct 15, 2002
<b>Commercial varieties — available for farm use</b>				
Grand Daddy	tetraploid	4	90	81*
Linn	diploid	3	90	80*
Aries	diploid	4	88	76*
Lasso	diploid	3	90	71*
Quartet	tetraploid	4	77	66
Polly II	tetraploid	5	83	51
Maverick Gold	diploid	5	34	16
<b>Experimental varieties</b>				
PP 11	mixture	5	54	26
Mean		4.1	76	58
CV, %		8.28	15.07	15.22
LSD, 0.05		0.40	13.39	10.39

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

<sup>1</sup> 0 to 5 scale with 5 being the most vigorous.

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

Variety	Seedling Vigor <sup>1</sup> Nov 11, 1999	Percent Stand			
		Apr 4, 2001	Oct 15, 2001	Apr 2, 2002	Oct 11, 2002
<b>Commercial varieties — available for farm use</b>					
Hallmark 1996 <sup>2</sup>	3	81	60	77	68
Sidekick (KBG)	1	76	49	68	67
Tekapo	2	78	63	71	65
Hallmark 1970 <sup>2</sup>	3	84	58	75	61
Haymate	2	78	56	63	60
Benchmark	2	80	53	67	59
<b>Experimental varieties</b>					
BAR Dgl 9 BTR G	1	87	58	81	79*
OG9705G	3	83	62	74	73*
KYO7G 23-335	2	80	63	75	71
BAR Dgl 9 BTR F	2	79	53	64	53
Mean	2	81	57	71	66
CV, %	18.44	6.15	21.61	9.39	10.22
LSD, 0.05	0.42	5.76	14.43	7.80	7.80

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

<sup>1</sup> 0 to 5 scale with 5 being the most vigorous.

<sup>2</sup> Seed for this test came from fields planted on dates indicated.

**Table 8. Percent stand of orchardgrass and prairie brome (*Bromus willdenowii*) varieties planted September 19, 2000, at Lexington, Kentucky, in a cattle grazing tolerance study.**

Variety	Seedling Vigor <sup>1</sup> Oct 31, 2000	Percent Stand			
		Apr 9, 2001	Oct 17, 2001	Apr 2, 2002	Oct 14, 2002
<b>Commercial varieties — available for farm use</b>					
Boone	3	90	76	76	75*
Prairie	3	89	71	73	70*
Benchmark	3	90	68	73	69*
Haymate	3	90	56	61	55
<b>Experimental varieties</b>					
OG9705G	2	89	73	73	75*
KYO7G 23-335	2	89	68	69	66*
CAS-LG31	2	90	73	74	63
K5633D (prairie brome)	5	77	15	47	29
K5568K	3	90	73	33	21
K5632M (prairie brome)	5	83	15	52	18
Mean	3.1	88	59	63	54
CV, %	7.91	5.18	18.14	17.44	18.22
LSD, 0.05	0.28	5.29	12.38	12.79	11.45

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

<sup>1</sup> 0 to 5 scale with 5 being the most vigorous.

**Table 9. Percent stand of orchardgrass varieties sown September 12, 2001, at Lexington, Kentucky, in a cattle grazing tolerance study.**

Variety	Seedling Vigor <sup>1</sup> Nov 2, 2001	Percent Stand	
		Apr 4, 2002	Oct 15, 2002
<b>Commercial varieties — available for farm use</b>			
Tekapo	5	90	88*
Albert	4	90	86*
Benchmark	5	90	86*
Crown Royale	5	90	86*
Hallmark	5	90	86*
Haymate	5	90	85*
Prairie	5	90	85*
Athos	5	90	83*
Megabite	4	90	83*
Mammoth	4	90	83*
Takena	4	90	83*
Amba	4	90	76
<b>Experimental varieties</b>			
OG9705G	3	90	86*
Mean	4.2	90	84
CV, %	12.60	0	6.39
LSD, 0.05	0.62	0	6.2

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

<sup>1</sup> 0 to 5 scale with 5 being the most vigorous.

**Table 10. Persistence of tall fescue, perennial ryegrass (PRG), prairie brome (*Bromus willdenowii*), festulolium, and timothy varieties under heavy grazing pressure across years and locations.**

		Lexington					
		1999 <sup>1</sup>		2000		2001	
Variety	Proprietor/KY Distributor	Oct 2000 <sup>2</sup>	Oct 2001	Oct 2002	Oct 2001	Oct 2002	Oct 2002
<b>Commercial varieties — available for farm use</b>							
Aries (PRG)	Ampac Seed Company						*
BAR 9TMPO	Barenbrug USA	*					
Carmine	DLF-Jenks						
Cattle Club	unknown	*				*	*
Citadel (PRG)	Donley Seed						
Duo (festulolium)	Ampac Seed Company	*	*	*		*	
Felina (festulolium)	DLF-Jenks						*
Festival	Pickseed West Inc.						*
Festorina	Advanta Seeds						
Grand Daddy (PRG)	Smith Seed Services						*
Hoedown	Jenks Seed Connection					*	
Johnstone	Willamette Seed Co./Public						
Kokanee	Ampac Seed Company						
KY31+ (endophyte infected)	KY Agric. Exp. Sta./Public	*	*	*	*	*	*
Lasso (PRG)	DLF-Jenks						*
Linn (PRG)	Public				*		*
Matua (prairie brome)	AgResearch (USA)						
Maverick Gold (PRG)	Ampac Seed Company						
Maximize	Turf-Seed, Inc.						*
Polly II (PRG)	FFR/Southern States						
Quartet (PRG)	Ampac Seed Company						
Resolute	Ampac Seed Company						
Select	FFR Cooperative	*				*	*
Spring Green (festulolium)	Turf-Seed, Inc.				*	*	*
Stargrazer	FFR/Southern States						
Tuukka (timothy)	Ampac Seed Company						
<b>Experimental varieties</b>							
AGRLP103 (PRG)	AgResearch (USA)				*	*	
AGRLH101 (PRG)	AgResearch (USA)						
AGRBW101 (prairie brome)	AgResearch (USA)						
AGRFA110	AgResearch (USA)				*	*	
Ampac pp3 mix	Ampac Seed Company						
Ampac pp7 mix	Ampac Seed Company						
Ampac pp8 mix	Ampac Seed Company						
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 5 584	GA Agric. Exp. Sta./Experimental	*					
GA 7 clone 542	GA Agric. Exp. Sta./Experimental						
HM4	FFR Cooperative						
Jesup 542	GA Agric. Exp. Sta./Experimental	*	*	*			
Jesup 584	GA Agric. Exp. Sta./Experimental	*	*	*			
K5666V	Ampac Seed Company						
KY31- (endophyte free)	KY Agric. Exp. Sta./Experimental	*	*		*	*	*

*continued on next page*

**Table 10. Persistence of tall fescue, perennial ryegrass (PRG), prairie brome (*Bromus willdenowii*), festulolium, and timothy varieties under heavy grazing pressure across years and locations.**

		Lexington					
		1999 <sup>1</sup>			2000		2001
Variety	Proprietor/KY Distributor	Oct 2000 <sup>2</sup>	Oct 2001	Oct 2002	Oct 2001	Oct 2002	Oct 2002
<b>Experimental varieties (continued)</b>							
PP10	Ampac Seed Company						
PP11	Ampac Seed Company						
KYFA 9301	KY Agric. Exp. Sta./Experimental	*	*	*		*	*
KYFA9304	KY Agric. Exp. Sta./Experimental	*	*	*		*	*
KYFA9401	KY Agric. Exp. Sta./Experimental					*	
KYFA9402	KY Agric. Exp. Sta./Experimental					*	
KYFA9403	KY Agric. Exp. Sta./Experimental					*	
KYTF 2	KY Agric. Exp. Sta./Experimental	*	*	*		*	
Q4508	Wrightson Seed Ltd.					*	
R4663	Wrightson Seed Ltd.				*		

<sup>1</sup> Establishment year.

<sup>2</sup> 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 11. Persistence of orchardgrass, Kentucky bluegrass (BG), and prairie brome (*Bromus willdenowii*) varieties under heavy grazing pressure across years and locations.**

		Lexington					
		1999 <sup>1</sup>			2000		2001
Variety	Proprietor/KY Distributor	Oct 2000 <sup>2</sup>	Oct 2001	Oct 2002	Oct 2001	Oct 2002	Oct 2002
<b>Commercial varieties — available for farm use</b>							
Albert	University of Wisconsin						*
Amba	DLF-Jenks						
Athos	DLF-Jenks						*
Benchmark	FFR/Southern States		*		*	*	*
Boone	KY Agric. Exp. Sta./Experimental				*	*	
Crown Royale	Grassland Oregon						*
Hallmark 1996 <sup>3</sup>	James VanLeeuwen	*	*				*
Hallmark 1970	James VanLeeuwen	*	*				
Haymate	FFR/Southern States		*				*
Mammoth	DLF-Jenks						*
Megabite	Turf-Seed Inc.						*
Prairie	Turner Seed Company				*	*	*
Sidekick (BG)	Ampac Seeds		*				
Takena	Smith Seed Services						*
Tekapo	Modern Forage Systems/Oldfields Seed	*	*				*
<b>Experimental varieties</b>							
BAR Dgl 9 BTR F	Barenbrug USA	*	*				
BAR Dgl 9 BTR G	Barenbrug USA	*	*	*			
CAS-LG31	DLF-Jenks				*		
K5568K	Ampac Seeds				*		
K5632M (prairie brome)	Ampac Seeds						
K5633D (prairie brome)	Ampac Seeds						
KYO7G 23-335	KY Agric. Exp. Sta./Experimental		*		*	*	
OG9705G	FFR Cooperative	*	*	*	*	*	*

<sup>1</sup> Establishment year.

<sup>2</sup> Date of visual estimation of percent stand.

<sup>3</sup> Seed for this test came from fields planted on dates indicated.

\* 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.