University of Kentucky
College of Agriculture, Food and Environment
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2017 Alfalfa Grazing Tolerance Report

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Introduction

Alfalfa (*Medicago sativa*) is the highest-yielding, highest-quality forage legume grown in Kentucky. It forms the basis of Kentucky's cash hay enterprise and is an important component in dairy, horse, beef, and sheep diets. Recent emphasis on its use as a grazing crop and the release of grazing-tolerant varieties have raised the following question: Do varieties differ in tolerance to grazing? We have chosen to use the standard tolerance test recommended by the North American Alfalfa Improvement Conference. This test uses continuous heavy grazing to sort out differences in grazing tolerance in a relatively short period of time.

This report summarizes research on the grazing tolerance of alfalfa varieties when subjected to continuous heavy grazing pressure during the grazing season. Table 6 shows a summary of all alfalfa varieties tested in Kentucky during the last 18 years. The UK Forage Extension website, at www.uky.edu/Ag/Forage, contains electronic versions of all forage variety testing reports from Kentucky and surrounding states and from a large number of other forage publications.

Important Selection Considerations

Local Adaptation and Seasonal Yield. The variety should be adapted to Kentucky as indicated by good winter survival and good performance across years and locations in replicated yield and grazing trials, such as those presented in this publication. Choose high-yielding, persistent varieties and varieties that are productive during the desired season of use. Refer to the 2017 Alfalfa Report (PR-727) (or previous years if needed) for yield data on specific varieties of interest.

Seed Quality. Buy premium-quality seed that is high in germination, high in purity, and free from weed seed. Buy certified seed or proprietary seed of an improved variety. An improved variety is one that has performed well in independent trials. Other information on the label will include the test date (which must be within the previous nine months), the level of germination, and percentage of other crop and weed seed. Order seed well in advance of planting time to assure that it will be available when needed.

Description of the Tests

Alfalfa variety tests for grazing tolerance were established in Lexington in the fall of 2013, 2014, and 2016. The soils at this location are well-drained silt loams and are well-suited to alfalfa. Plots were 5 feet by 20 feet in a randomized complete block design, with each variety replicated six times. In each test, 20 pounds per acre of seed were planted into a prepared seedbed using a disk drill. All seed lots were treated with metalaxyl fungicide and inoculated if not supplied with these treatments. Plots were grazed continuously beginning the first spring after seeding. Grazing pressure was maintained to keep plant height to less than 3 inches. In general, plots were grazed from mid-May until mid-September. Supplemental hay was fed during periods of slowest growth. Visual ratings of percent stand were made in the fall several weeks after the cattle were removed to check stand survival after the grazing season. Ratings were made in the spring prior to grazing to check on winter survival and spring growth. Since trials were seeded in rows, persistence ratings were based on density within a row and not total ground cover. Pests (weeds and insects) were controlled so they would not limit yield or persistence. Fertilizers (lime, P, K, and boron) were applied based on soil test recommendations. In each trial, Alfagraze was the grazing-tolerant check variety, and either Apollo or 5432 was the grazing-intolerant check variety.

Results and Discussion

Weather data for Lexington for 2014, 2015, 2016, and 2017 are presented in Table 1.

Data on percent stand are presented in tables 2, 3, and 4. Statistical analyses were performed on all alfalfa yield data (including experimentals) to determine whether the apparent differences are truly due to variety or just due to chance. Varieties not significantly different from

Table 1. Temperature and rainfall at Lexington, Kentucky, in 2014, 2015, 2016, and 2017.

	2014				2015				2016				2017[2]			
	Temp		Rainfall		Temp		Rainfall		Temp		Rainfall		Temp		Rainfall	
	°F	DEP[1]	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP
JAN	25	-6	2.28	-.58	32	+1	2.17	-0.69	32	+1	0.80	-2.06	40	+9	6.81	+3.95
FEB	30	-5	5.47	+2.26	26	-9	3.08	-0.13	38	+3	6.09	+2.88	47	+12	4.46	+1.25
MAR	39	-5	3.08	-1.32	45	+1	7.34	+2.94	52	+8	4.07	-0.33	48	+4	3.34	-1.06
APR	58	+3	5.27	-1.89	57	+2	13.19	+9.31	57	+2	3.97	+0.09	62	+7	4.17	+0.29
MAY	66	+2	5.72	+1.25	69	+5	3.02	-1.45	64	0	9.17	+4.70	66	+2	7.74	+3.27
JUN	75	+3	2.93	-0.73	75	+3	8.20	+4.54	76	+4	5.09	+1.43	73	+1	7.68	+4.02
JUL	74	-2	3.18	-1.82	77	+1	10.22	+5.22	79	+3	7.43	+2.43	76	0	4.49	-0.51
AUG	76	+1	6.53	+2.60	74	-1	3.49	-0.44	79	+4	4.37	+0.44	74	-1	6.66	+2.73
SEP	69	+1	3.63	+.43	72	+4	3.49	+0.29	74	+6	2.18	-1.02	69	+1	4.72	+1.52
OCT	57	0	5.55	+2.98	59	+2	2.78	+0.21	64	+7	0.37	-2.20	60	+3	6.06	+3.49
NOV	41	-4	2.79	-0.60	51	+6	3.72	+0.33	51	+6	1.94	-1.45				
DEC	40	+4	2.47	-1.51	49	+13	8.42	+4.44	37	+1	9.4	+5.42				
Total			49.4	+4.85			69.12	+24.57			54.88	+10.33			56.13	+18.95

[1] DEP is departure from the long-term average.
[2] 2017 data is for the ten months through October.

the highest numerical value in a column are marked with one asterisk (*). To determine whether 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.

Apollo and 5432 have been used widely in trials as the grazing-intolerant varieties. Therefore, the response of these varieties provides a useful measure of the severity of the grazing pressure applied to the plots. In general, types developed for tolerance to grazing tolerated heavy grazing pressure better than hay types. Table 5 summarizes information about distributors, fall dormancy ratings, disease resistance information and persistence across years for all varieties included in these tests.

Table 6 is a summary of stand persistence data from 1998 to 2017 of commercial varieties that have been entered in the Kentucky trials. The data for each specific trial are listed as a percentage of the grazing-tolerant variety Alfagraze. In other words, in each trial Alfagraze is 100 percent—varieties with percentages over 100 persisted better than Alfagraze and varieties with percentages less than 100 persisted less than Alfagraze. Direct, statistical comparisons of varieties cannot be made using the summary Table 6, but these comparisons do help to identify varieties for further consideration. Varieties that have performed better than average over many years and at several locations have stable performance, while others may have performed well in wet years or on particular soil types. These details may influence variety choice, and the information can be found in the yearly reports. See footnote in Table 6 to identify specific yearly reports which contain more detailed persistence information.

Table 2. Seedling vigor and stand persistence of alfalfa varieties sown September 6, 2013, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 14, 2013	Percent Stand								
		2013	2014		2015		2016		2017	
		Oct 14	Apr 2	Oct 9	Apr 6	Oct 21	Mar 24	Oct 6	Mar 22	Oct 19
Commercial Varieties-Availablr for Farm Use										
Ameristand 403T	3.9	99	98	98	98	98	93	74	47	33*
Bulldog-505	4.4	99	100	100	99	95	88	73	48	28*
Alfagraze	3.6	95	96	96	97	94	92	66	44	28*
Apollo	4.1	98	98	98	98	92	84	57	30	24
Experimental Varieties										
GA-ALFG-1	4.8	100	100	100	99	95	93	75	45	37*
DSD08-SC	4.7	99	99	99	98	98	93	63	33	28*
Mean	4.2	98	98	99	98	95	90	68	41	30
CV,%	13.1	2	2	2	2	4	5	14	40	32
LSD,0.05	0.7	2	2	3	3	4	5	11	20	12

[1] Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Summary

Measurements taken after multiple years of grazing in these trials indicate that alfalfa varieties have been developed that exhibit improved tolerance to heavy grazing pressure compared to standard hay-type varieties. The grazing management imposed in these trials included continuous stocking from the initiation of grazing in spring until mid-September, when grazing was terminated for the season to allow stands to acclimate to winter. Heavy grazing pressure was used purposely in these trials to better differentiate among varieties for relative grazing tolerance. Research has shown that abusive grazing tests are a good way to sort out differences in grazing tolerance between varieties in a relatively short period of time. Recommended rotational grazing management would improve alfalfa forage productivity and stand persistence.

The information in this report should be used in conjunction with other yield, pest resistance, and adaptation informa-

Table 3. Seedling vigor and stand persistence of alfalfa varieties sown September 9, 2014, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 9, 2014	Percent Stand						
		2014	2015		2016		2017	
		Oct 9	Apr 6	Oct 21	Mar 24	Oct 5	Mar 22	Oct 19
Commercial Varieties-Available for Farm Use								
Alfagraze	2.8	85	76	68	56	23	20	17*
Ameristand 403T	3.6	98	77	76	57	15	9	11*
Bulldog 505	3.5	96	73	69	53	14	10	9
Apollo	3.3	85	71	66	44	11	7	4
Alfagraze 600 RR	5.0	99	53	47	30	8	5	2
Experimental Varieties								
NF11ALF0006	3.7	96	73	69	50	10	5	4
Mean	3.6	93	70	66	48	14	9	8
CV,%	15.7	9	25	27	29	56	64	66
LSD,0.05	0.7	10	21	21	17	9	7	6

[1] Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 4. Seedling vigor and stand persistence of alfalfa varieties sown September 8, 2016, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 4, 2016	Percent Stand		
		2016	2017	
		Oct 4	Mar 15	Oct 11
Commercial Varieties-Available for Farm Use				
Alfagraze	3.8	98	98	88*
Ameristand 403TPlus	4.7	99	99	86*
Experimental Varieties				
CW A123010	4.8	100	100	89*
AFX143009	4.5	100	100	82
Mean	4.4	99	99	86
CV,%	9.2	2	2	3
LSD,0.05	0.5	2	2	4

[1] Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

tion in selecting the best alfalfa varieties for use in each individual situation.

When grazing alfalfa, good management for maximum life includes:

- Allowing grazing alfalfa to become completely established before grazing
- Using rotational grazing where animals harvest available forage in seven days or less, followed by resting for 28 days before regrazing
- Adding any needed fertilizer and lime
- Removing grazing livestock from alfalfa fields from mid-September until November 1 to replenish root reserves for winter survival
- Follow recommended practices to reduce the potential for bloat.

For further information about grazing alfalfa management, refer to the following College of Agriculture publications, available at the local county extension office or in the Publications section of the UK Forage Web site at www.uky.edu/Ag/Forage.

- Grazing Alfalfa (ID-97)
- Managing Legume Induced Bloat in Cattle (ID-186)
- Extending Grazing and Reducing Stored Feed Needs (AGR-199)

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Table 5. Characterization and summary of persistence of alfalfa varieties under heavy grazing pressure across years at Lexington, Kentucky.

Variety	Proprietor/KY Distributor	Variety Characteristics[1]						2013[3]						2014						2016	
			Disease Resistance[2]					Apr	Oct	Apr	Oct	Mar	Oct	Apr	Oct	Mar	Oct	Mar	Oct	Mar	Oct
		FD[4]	BW	FW	AN	PRR	APH	2014[5]		2015		2016		2017		2015		2016		2017	
Commercial Varieties-Available for Farm Use																					
Alfagraze	America's Alfalfa	2	MR	R	MR	LR	-	x[6]	x	*	x	*	*	*	*	*	*	*	*	*	*
Alfagraze 600 RR	America's Alfalfa	6	–	R	HR	R	R								x	x	x	x	x	x	
Ameristand 403T	America's Alfalfa	4	HR	HR	HR	HR	HR	*	*	*	*	*	*	*	*	*	*	*	x	*	
Ameristand 403T Plus	America's Alfalfa	4	HR	HR	HR	HR	HR													*	*
Apollo	ABI/America's Alfalfa	4	R	R	LR	R	-	*	*	*	x	x	*	x	*	*	x	*	x	x	
Bulldog-505	Univ. of GA	5	–	HR	–	R	–	*	*	*	*	*	*	*	*	*	*	*	x	x	
Experimental Varieties																					
AFX143009	Alforex Seeds	4	HR	HR	HR	HR	HR													*	x
CW A12310	Alforex Seeds	4	–	–	–	–	–													*	*
GA-ALFG-1	Univ. of GA	–	–	–	–	–	–	*	*	*	*	*	*	*							
DSD08-SC	Dairyland Seed	4	HR	HR	HR	HR	HR	*	*	*	*	*	x	*							
NF11ALF0006	Noble Foundation	6	–	–	–	–	–									*	*	*	x	x	

[1] Variety characteristics: FD = Fall Dormancy, BW = Bacterial Wilt, FW = Fusarium Wilt, AN = Anthracnose, PRR = Phytophera Root Rot, APH = Aphanomyces Root Rot.
[2] Disease resistance: S = Susceptible, LR = Low Resistance, MR = Medium Resistance, R = Resistance, HR = High Resistance.
[3] Establishment year.
[4] Fall dormancy: 2 = Vernal, 3 = Ranger, 4 = Saranac, 5 = DuPuits.
[5] Date of rating percent stand.
[6] "x" in the block indicates the variety was in the test but the stand survival was significantly less than the most persistent variety. An open block indicates the variety was not in the test.
*Not significantly different from the most persistent variety.

Table 6. Summary of Kentucky alfalfa grazing trials 1998-2017 (stand persistence shown as a percent of the grazing tolerant Alfagraze).

		Variety Characteristics[1]						Lexington													
			Disease Resistance[2]					1998[3,4]	2000	2000	2001	2004	2005	2006	2008	2009	2010	2011	2012	2013	2014	Mean[5]
Variety	Proprietor	FD	Bw	Fw	An	PRR	APH	3yr[6]	2yr	3yr	3yr	4yr	4yr	3yr	4yr	4yr	4yr	4yr	4yr	4yr	3yr	(#trials)
ABT 350	W-L Research	3	HR	HR	HR	HR	HR			46												–
ABT 405	W-L Research	4	HR	HR	HR	HR	R			46	100											73(2)
Alfagraze	America's Alfalfa	2	MR	R	MR	R	–	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100(14)
Alfagraze 300 RR	America's Alfalfa	3	HR	R	HR	HR	HR											110				–
Alfagraze 600 RR	America's Alfalfa	6	–	R	HR	R	R														12	–
Amerigraze 401+Z	America's Alfalfa	4	HR	HR	HR	HR	R	56	26	85	125											73(4)
Ameristand 403T	America's Alfalfa	4	HR	HR	HR	HR	HR						141	144	50		91		144	118	65	108(7)
Ameristand 403TPlus	America's Alfalfa	4	HR	HR	HR	HR	HR									133		90				112(2)
Ameristand 407TQ	America's Alfalfa	4	HR	HR	HR	HR	HR						136			50		80				89(3)
Apollo	America's Alfalfa	4	R	R	R	R	–	47	17	31	25		36	27	25	17	27	70	55	86	24	37(13)
Archer III	America's Alfalfa	5	HR	HR	HR	HR	HR									33		83				58(2)
Baralfa 54	Barenbrug USA	–	R	HR	HR	HR	HR	78														–
Bulldog-505	Univ. of GA	5	–	HR	–	R	–												144	100	57	100(3)
FK 421	Donley Seed Co.	4	HR	H	H	H	H				100											–
Feast	Garst Seeds	3	HR	HR	HR	HR	R		87	92												90(2)
Gold Plus	PGI Alfalfa	4	HR	HR	HR	HR	R	81														–
Grazeking	Southern States	5	MR	HR	HR	R	S				50											–
Haygrazer	Great Plains Research	4	HR	HR	R	R	MR			38												–
Integrity	PGI Alfalfa	4	HR	HR	HR	HR	HR						172									–
LegenDairy5.0	Croplan Genetics	3	HR	HR	HR	HR	HR								0			87				44(2)
PGI 424	Producers Choice	4	HR	HR	HR	HR	HR										45					–
PGI 459	Producers Choice	4	HR	HR	HR	HR	HR									17		93				55(2)
Pioneer 98	Pioneer	3	HR	R	HR	R	–	56														–
ProGro	MBS Inc.	4	HR	HR	R	HR	MR	81														–
Rebel	Target Seed	4	HR	HR	HR	HR	HR							79								–
Rugged	Target Seed	3	HR	HR	HR	HR	HR							146								–
Saranac AR (cert.)	Public	4	MR	R	HR	LR	–				100											–
Spredor 3	Syngenta	1	HR	HR	R	MR	S	75					68									72(2)
Spredor 4	Syngenta	2	HR	HR	HR	HR	R								25							–
TS 4007	Producers Choice	4	HR	R	HR	HR	HR										82					–
TS 4010/A4535	Producers Choice	4	HR	R	HR	HR	HR									83	145	120				116(3)
Triple Trust 450	ABI/America's Alfalfa	5	HR	HR	HR	HR	HR						145									–
Wintergreen	ABI Alfalfa	3	HR	HR	HR	HR	R	72														–
WL 326GZ	W-L Research	4	HR	HR	HR	HR	HR	88														–
115 Brand	Monsanto	3	HR	HR	R	HR	R		56	85												71(2)
5432	Pioneer	4	HR	HR	–	MR	–					51										–

[1] Variety characteristics: FD = fall dormancy, Bw = bacterial wilt, Fw = fusarium wilt, An = anthracnose, PRR = phytophthera root rot, APH-aphanomyces root rot. Information provided by seed companies.
[2] Disease resistance: S = susceptible, LR = low resistance, MR = moderate resistance, R = resistance, HR = high resistance.
[3] Year trial was established.
[4] Use this summary table as a guide in making variety decisions, but refer to specific yearly reports to determine statistical differences in stand persistence between varieties. To find actual persistence ratings, look in the yearly report for the final year of each specific test. For example, the Lexington trial planted in 2011 was grazed for four years so final persistence report would be "2015 Alfalfa Grazing Tolerance Report" archived in the KY Forage website at www.uky.edu/Ag/Forage.
[5] Mean only presented when respective variety was included in two or more trials.
[6] Number of years of data.

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