

Alfalfa Grazing Tolerance Variety Report

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Introduction

Alfalfa (*Medicago sativa*) is historically 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 as well as the release of varieties reported tolerant of heavy and even continuous grazing have raised the following questions:

- Are the differences among varieties seen under Kentucky conditions?
- Are there are differences in tolerance among varieties?

This report summarizes current research on the grazing tolerance of alfalfa varieties when they are subjected to continuous, heavy grazing pressure during the grazing season. Although some yield data are presented, the focus is on plant stand survival.

Description of the Tests

Alfalfa variety tests for grazing tolerance were established in Lexington in the fall of 1994, 1996, and 1997. The soils at this location are well-drained silt loams and are well suited to alfalfa. Plots were 5 by 15 feet in a randomized complete block design with each variety replicated either four times (1994 study) or six times (1996, 1997).

In each test, 20 pounds of seed per acre were planted into a prepared seedbed using a disk drill. All seed lots were treated with metalaxyl and inoculated if they had not been supplied with these treatments. Plots were harvested with a sickle-type mechanized harvester in the spring for yield. Fresh weights were measured in the field and converted to dry matter production using long-term averages for alfalfa dry matter percent or oven-dried bulk samples. Plots were allowed to regrow to 6 to 8 inches and then were grazed down quickly to below 4 inches by cows and/or heifers. The plots were kept at that height or below for the remainder of the grazing season. Supplemental hay was fed during periods of slowest growth.

Animals were removed from alfalfa plots annually on September 15. Visual ratings of percent stand were made in the fall and spring after each grazing season. Pests (weeds and insects) were controlled so they would not limit yield or persistence. Fertilizer (lime, P, K, and Boron) were applied as needed.

Included in each trial were AlfaGraze as the grazing-tolerant check variety and Apollo as the grazing-susceptible check variety.

The varieties included in the 1994 seeding for grazing tolerance were re-randomized and planted in a small plot yield trial operated under hay management for all cuttings. This study was seeded on the same day as the grazing-tolerance plot (Table 2). In 1996, harvests after June 10 were not available due to grazing. The 1997 yield data in this table represent the May 20 harvest only.

The varieties seeded in the 1996 plot for grazing tolerance were also re-randomized and planted using the methods above and harvested for yield. The initial seeding was made on the same day as that of the grazing-tolerance study. However, due to severe erosion, the original seeding was destroyed and replanted in the spring of 1997 (Table 4).

Results and Discussion

Data on percent stand and on dry matter yield are presented in Tables 1 through 5. Tables 2 and 4 represent only dry matter yield data taken from studies planted with varieties identical to those in Tables 1 and 3. This parallel structure was meant to determine both grazing tolerance and yield under the same environmental conditions.

Due to problems with the establishment of the 1996 hay management trial (erosion), this trial was reseeded in the spring of 1997. Therefore, the data from Tables 3 and 4 are from slightly different periods of time.

Statistical analyses were performed on all alfalfa yield data (including experimentals) to determine if the apparent differences are truly due to variety or just due to chance. 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.

In general, the level of grazing pressure applied was sufficient to severely deplete the stands of Apollo in each trial. Stands of other varieties that are good when managed for hay (such as Pioneer 5373 and Fortress) were also depleted by this abusive grazing management. Varieties that had been developed using grazing during the breeding process (such as AlfaGraze) tended to be tolerant of the abusive grazing em-

ployed in these studies. Some varieties (such as Amerigraze 401 Z, ABT 405 and WL326GZ) exhibit both high yields and grazing tolerance (Tables 3 through 4).

Summary

These studies indicate alfalfa varieties have been developed that express tolerance to overgrazing without going out of stand compared to standard hay-type alfalfas. In addition, newer grazing-tolerant varieties have significantly improved yields over AlfaGraze. It should be noted, however, that even though these varieties were abused during the growing season, they were allowed to regrow and be cut for hay each spring and were rested after September 15 to prepare for winter.

This information should be used along with yield and pest resistance information in selecting the best alfalfa variety for each individual use. It is *not* recommended that alfalfa be continuously grazing as was done in this trial. While several varieties expressed tolerance to the level of grazing pressure used in these trials, overgrazing greatly reduces yield and therefore profitability of these alfalfas.

Good management for maximum life from grazing alfalfa would include:

- allowing grazing alfalfa to become completely established before grazing
- rotationally grazing harvesting-available forage in seven days or less and resting for 28 days before regrazing
- adding any needed fertilizer and lime
- removing grazing livestock from alfalfa fields from mid-September to November 1 to replenish root reserves.

Table 1. Percent stand and dry matter yields (tons/acre) for alfalfa varieties sown September 3, 1994, at Lexington, Kentucky, for grazing purposes. Yields represent early cuttings (first 2 in 1995, and first cuttings only in 1996 and 1997) prior to grazing and are not full-season yields.

Variety	1995 Yield			1996 Yield	1997 Yield	3-yr Total	% Stand			
	May 12	Jun 9	Total	May 13	May 20		Nov 8 1995	May 13 1996	Jan 7 1997	Jun 7 1997
Commercial Varieties - Available for sale										
AlfaGraze	1.4	0.5	1.9	0.9	0.89*	3.69*	85.0 *	91.3 *	57.5*	62.5*
Wintergreen	1.3	0.8*	2.1	1.1*	0.42	3.61*	86.3 *	95.0 *	75*	60.0*
ABT205	1.2	0.7*	1.8	1.1*	0.45	3.41*	83.8 *	96.3 *	72.5*	57.5*
ABT405	1.4	1.0*	2.3*	0.9	0.76*	3.99*	76.3 *	92.5 *	50*	45.0
Spredor-3	1.3	0.7*	1.9	0.7	0.63*	3.26	71.3	83.8 *	45	45.0
Quantum	1.2	0.7*	1.9	1.0*	0.58*	3.49*	87.5 *	95.0 *	45	45.0
Cut-n-Graze	1.0	0.6	1.7	0.9	0.74*	3.30	81.3 *	95.0 *	50*	42.5
Pasture-Plus	1.6*	0.8*	2.5*	0.9	0.78*	4.15*	86.3 *	91.3 *	57.5*	37.5
Magnagraz	1.5*	0.6	2.1	0.8	0.52*	3.42*	80.0 *	76.3	50*	35.0
Apollo	1.5	0.8*	2.3*	0.4	0.91*	3.64*	71.3	71.3	45	30.0
Fortress	1.2	0.4	1.7	0.7	0.43	2.77	78.8 *	81.3	32.5	25.0
Rushmore	1.3	0.8*	2.1	0.7	0.36	3.13	71.3	72.5	35	20.0
Legacy	1.9*	1.0*	2.9*	0.5	0.70*	4.09*	65.0	63.8	27.5	20.0
5373	1.5	0.7*	2.2	0.6	0.73*	3.54*	72.5	72.5	25	12.5
Experimental Varieties - Not available for sale										
ZG9429	1.2	0.7*	1.9	1.1*	0.50*	3.50*	82.5 *	97.5 *	75*	72.5*
ZG9426	1.4	0.9*	2.3*	1.2*	0.68*	4.20*	85.0 *	97.5 *	62.5*	70.0*
ZG9415	1.3	0.6	1.8	1.1*	0.46	3.35	87.5 *	93.8 *	75*	67.5*
ZG9416	1.4	0.9*	2.3*	1.0*	0.44	3.69*	80.0 *	91.3 *	60*	67.5*
ZG9425	1.3	0.8*	2.2	1.1*	0.77*	4.05*	87.5 *	96.3 *	65*	62.5*
ZG9436	1.2	0.5	1.7	0.8	0.61*	3.09	85.0 *	86.3 *	47.5	55.0*
ZG9417	1.0	0.5	1.5	1.0*	0.58*	3.11	82.5 *	91.3 *	67.5*	55.0*
ZG9438	1.3	0.7*	2.0	0.8	0.66*	3.44*	78.8 *	88.8 *	42.5	50.0
ZG9445	1.2	0.5	1.8	0.9	0.91*	3.55*	76.3 *	88.8 *	57.5*	47.5
93IO6PL1	1.2	0.7*	1.8	0.8	0.49*	3.11	73.8	86.3 *	50*	45.0
GA-APGC	1.2	0.6	1.8	0.6	0.73*	3.14	73.8	82.5	52.5*	40.0
CW3070	1.3	0.9*	2.2	0.5	0.83*	3.58*	75.0 *	66.3	42.5	30.0
92WO3PE1	1.4	0.6	2.0	0.9	0.60*	3.45*	76.3 *	80.0	27.5	25.0
92-132	1.3	0.8*	2.1	0.8	0.61*	3.45*	76.3 *	85.0 *	25	22.5
Mean	1.3	0.7	2.0	0.8	0.63	3.51	79.2	86.0	50.6	44.6
LSD (alpha = 0.05)	0.42	0.37	0.62	0.27	0.44	0.81	12.7	14.5	26.9	20.8
CV, %	22.7	37.8	21.8	22.6	49.11	16.49	11.4	12	37.8	35.8

Table 2. Dry matter yields (tons/acre) of alfalfa varieties sown September 3, 1994, at Lexington, Kentucky, for hay management purposes.

Variety	1995 Total	1996 Harvests		1996 Total	1997 May 20	3-yr Total
		May 13	Jun 10			
Commercial Varieties - Available for farm use						
Cut-n-Graze	4.75*	1.12*	1.07*	2.19*	0.78*	7.71*
Rushmore	4.54*	0.92*	1.00*	1.92*	0.68*	7.13*
5373	4.60*	0.85*	0.88*	1.73	0.78*	7.11*
Fortress	4.32*	0.91*	1.06*	1.97*	0.78*	7.07*
Legacy	4.22*	0.81	0.92*	1.73	0.84*	6.79*
Apollo	4.10*	0.78	1.04*	1.82*	0.84*	6.76*
ABT405	3.98*	1.08*	1.05*	2.13*	0.60*	6.71*
Spredor-3	3.59*	1.00*	0.92*	1.92*	1.08*	6.59*
Pasture-Plus	4.13*	0.92*	1.07*	1.98*	0.45	6.56*
Magnagraz	4.11*	0.83	0.95*	1.78	0.52	6.41*
92-132	3.39*	0.79	0.94*	1.73	0.95*	6.07*
AlfaGraze	3.61*	1.12*	1.04*	2.16*	0.5	6.28
Experimental Varieties - Not available for farm use						
92WO3PE1	4.74*	1.01*	1.04*	2.05*	0.52	7.30*
ZG9445	3.86*	1.03*	1.11*	2.15*	1.00*	7.01*
ZG9438	3.92*	1.11*	1.06*	2.17*	0.58	6.67*
93IO6PL1	3.63*	0.99*	1.03*	2.02*	0.89*	6.54*
CW-3070	3.78*	0.71	0.92*	1.64	0.79*	6.21*
ZG9416	3.36*	1.14*	1.10*	2.24*	0.61*	6.21*
MEAN	4.03	0.95	1.01	1.96	0.73	6.73
CV, %	24.54	17.47	17.18	15.59	47.17	18.83
LSD, 0.05	1.41	0.24	0.25	0.43	0.49	1.80
1995 total includes 5 harvests dated May 11, Jun 09, Jul 07, Aug 08, and Oct 30. 1996 harvests after June 10 were not available due to grazing. 1997 yield is from May 20 harvest only. * Not significantly different from the highest numerical value in the column, based on the 0.05% LSD.						

Table 3. Dry matter yields (tons/acre) and percent stand of alfalfa varieties sown August 23, 1996, at Lexington, Kentucky, for grazing tolerance.					
Variety	Harvest May 19, 1997	Harvest May 21, 1998	2-yr Total	% Stand Jun 8, 1998	% Stand Sep 9, 1998
Commercial Varieties - Available for farm use					
Feast	1.78 *	1.86	3.64 *	96.67 *	82.40 *
ABT405	1.70	1.90	3.60 *	91.33 *	72.21 *
Spredor 3	1.79 *	1.91	3.70 *	85.00 *	68.51 *
Amerigraze 401Z	2.01 *	1.95 *	3.96 *	92.67 *	66.66 *
WL326 GZ	1.65	1.98 *	3.63 *	91.67 *	65.73 *
AlfaGraze	1.69	1.86	3.55 *	86.67 *	55.55
Grazeking	1.82 *	1.77	3.59 *	87.00 *	50.92
Saranac AR	1.80 *	1.98 *	3.78 *	82.67	42.59
Haygrazer	1.79 *	1.87	3.66 *	91.67 *	41.66
Apollo	1.66	1.83	3.50	75.00	41.66
Stampede	1.67	2.22 *	3.89 *	87.67 *	40.74
Fortress	1.81 *	1.91	3.72 *	80.00	39.81
Arc	1.64	1.79	3.43	58.33	21.29
Experimental Varieties - Not available for farm use					
CAR9426	1.82 *	2.00 *	3.82 *	95.17 *	71.29 *
GA-APGC	1.83 *	1.88	3.71 *	91.67 *	70.36 *
W116	1.72	1.99 *	3.71 *	93.33 *	60.18
A9508	1.72	1.98 *	3.70 *	82.67	54.62
94IO5PL1	1.72	1.93	3.65 *	81.67	31.48
MEAN					
	1.76	1.92	3.68	86.16	54.32
CV, %					
	13.13	12.71	9.67	13.95	26.86
LSD, 0.05					
	0.27	0.28	0.41	13.80	16.74
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.					

Table 4. Dry matter yields (tons/acre) of alfalfa varieties sown April 15, 1997, at Lexington, Kentucky, for hay management purposes.

Variety	1997 Total	1998 Harvests					1998 Total	2-yr Total
		May 6	Jun 18	Jul 17	Aug 19	Oct 28		
Commercial Varieties - Available for farm use								
Haygrazer	2.40*	1.40*	1.76*	1.39*	1.17*	0.29*	6.01*	8.41*
WL326GZ	2.29*	1.30*	1.76*	1.33*	1.13*	0.27	5.80*	8.16*
Fortress	2.28*	1.36*	1.68	1.21	1.08	0.29*	5.62	8.15*
ABT405	2.25*	1.38*	1.78*	1.38*	1.18*	0.24	5.96*	8.10*
Stampede	2.20*	1.40*	1.71	1.27	1.07	0.30*	5.74	8.09*
GrazeKing	2.19*	1.29	1.64	1.23	1.08	0.26	5.50	7.99*
Amerigraze 401Z	2.18*	1.38*	1.79*	1.36*	1.19*	0.25	5.97*	7.94*
Saranac-AR	2.14*	1.41*	1.81*	1.22	1.07	0.24	5.75	7.88*
Feast	2.11*	1.41*	1.82*	1.41*	1.18*	0.27	6.10*	7.70
Arc	2.00	1.28	1.60	1.11	1.01	0.25	5.24	7.42
Spredor 3	1.94	1.42*	1.73*	1.15	0.96	0.18	5.44	7.25
Apollo	1.94	1.24	1.64	1.15	1.01	0.26	5.31	7.24
AlfaGraze	1.91	1.40*	1.66	1.16	0.89	0.19	5.29	7.20
Experimental Varieties - Not available for farm use								
94IOSPL1	2.39*	1.20	1.75*	1.32*	1.14*	0.36*	5.78*	8.22*
A9508	2.36*	1.36*	1.83*	1.22	1.08	0.24	5.74	8.22*
CAR9426	2.16*	1.40*	1.74*	1.38*	1.12*	0.20	5.82*	7.90*
GAAPGC	2.07*	1.32*	1.74*	1.25	1.07	0.19	5.56	7.64
W116	1.97	1.35*	1.59	1.28*	1.05	0.18	5.45	7.38
MEAN	2.16	1.35	1.72	1.27	1.08	0.25	5.67	7.83
CV, %	11.79	6.56	4.79	7.68	6.27	21.99	4.13	4.89
LSD, 0.05	0.36	0.13	0.12	0.14	0.10	0.08	0.33	0.54

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

Table 5. Dry matter yields (tons/acre) and percent stand of alfalfa varieties sown September 2,1997, at Lexington, Kentucky, for grazing tolerance.

Variety	Harvest May 18, 1998	% Stand Jun 8, 1998	% Stand Sep 29, 1998
Commercial Varieties - Available for farm use			
ABT405	1.51 *	98.00 *	96.33 *
AlfaGraze	1.36	98.67 *	94.50 *
ABT205	1.56 *	98.67 *	90.83
Amerigraze	1.54 *	98.67 *	89
Wintergreen	1.51 *	99.67 *	87.17
Apollo	1.34	99.33 *	85.33
Haygrazer	1.60 *	99.33 *	81.67
Grazeking	1.46 *	99.33 *	78
Experimental Varieties - Not available for farm use			
ZG9641	1.57 *	98.33 *	98.17 *
ZG9631A	1.36	100.0*	98.17 *
ZG9632	1.63 *	99.33 *	98.17 *
ZG9633	1.41 *	98.67 *	96.33 *
ZG9640	1.54 *	99.33 *	94.50 *
BARUSA96-54	1.59 *	97	90.83
A9201	1.44 *	97.33	90.83
A9303	1.36	99.33 *	79.83
MEAN			
	1.49	98.81	90.6
CV, %			
	13.14	2.08	6.56
LSD, 0.05			
	0.23	2.37	6.84

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

Table 6. Characterization and persistence of alfalfa varieties under heavy grazing pressure across years and locations.		Variety Characteristics ¹							Lexington							
		Disease Resistance ²							1994 ³				1996		1997	
		FD ⁴	Bw	Fw	An	PRR	APH	Nov ⁵ 1995	May 1996	Jan 1997	Jun 1997	Jun 1998	Sep 1998	Jun 1998	Sep 1998	
Variety	Proprietor/KY Distributor															
5373	Pioneer	4	HR	HR	HR	MR	LR									
ABT205	ABT/Scott Seed/Sphar Seed	2	HR	HR	HR	HR	R	*	*	*	*			*	*	
ABT405	ABT/Scott Seed/Sphar Seed	4	HR	HR	HR	HR	R	*	*	*		*	*	*	*	
AlfaGraze	America's Alfalfa/Scott Seed/SS	2	MR	R	MR	LR	-	*	*	*	*	*	*	*	*	
Amerigraze401+Z	ABI/America's Alfalfa	4	HR	HR	HR	HR	R					*	*	*		
Apollo	ABI/America's Alfalfa/Scott Seed	4	R	R	LR	R	-							*		
Arc	Public	4	LR	MR	HR	-	-									
Cut-N-Graze	ABI Alfalfa	3	HR	HR	HR	HR	R	*	*	*						
Feast	ABI/AgriPro	3	HR	HR	MR	HR	R					*	*			
Fortress	Northrup King	3	R	R	R	HR	-	*								
Grazeking	FFR/Southern States	5	MR	HR	HR	R	S					*		*		
Haygrazer	Great Plains Research	4	HR	HR	R	R	MR					*		*		
Legacy	Genesis Group/Green Seed	4	R	R	R	R	R									
Magnagraze	Dairyland Seed Company	3	HR	HR	R	HR		*		*						
Pasture-Plus	PGI / MBS	3	HR	HR	R	HR		*	*	*						
Quantum	ABI Alfalfa	2	HR	HR	HR	HR	R	*	*							
Rushmore	Novartis	4	HR	HR	HR	HR	HR									
Saranac AR	Public	4	MR	R	HR	LR	-									
Spredor-3	Novartis	1	HR	HR	R	MR	S		*			*	*			
Stampede	Allied Seed	3	HR	R	R	HR	R					*				
Wintergreen	ABI Alfalfa/Renk Seed (Wisconsin)	3	HR	HR	HR	HR	R	*	*	*	*			*		
WL326GZ	W-L Research Inc./Green Seed	4	HR	HR	HR	HR	HR					*	*			
Experimental Varieties - Not available for farm use																
92-132	W-L Research	3	HR	HR	HR	HR		*	*							
92WO3PE1	Pioneer Hi-Bred	2	HR	-	HR	R	LR	*								
93IO6PL1	Pioneer Hi-Bred	4	R	-	LR	HR	LR		*	*						
A9201	FFR Cooperative	4	HR	HR	HR	HR	R									
A9303	FFR Cooperative	4	R	HR	R	HR	R							*		
A941O5PL1	Pioneer/Experimental	4	HR	-	HR	R	LR									
A9508	FFR/Experimental	-	-	-	-	-	-									
BARUSA96-54	Barenbrug	HR	R	HR	HR	HR	HR									
CAR9426	ABI Alfalfa/Experimental	-	-	-	-	-	-					*	*			
CW3070	Cal/West Seeds	5	MR	HR	HR	HR	R	*								
GA-APGC	GA Agric. Exp. Sta./Experimental	3	R	R	R	R	MR			*		*	*			
W116	W-L Research/Experimental	3	HR	HR	R	HR	LR					*				
ZG9415	ABI Alfalfa/Experimental	2	HR	HR	HR	HR	R	*	*	*	*					
ZG9416	ABI Alfalfa/Experimental	2	HR	HR	HR	HR	R	*	*	*	*					
ZG9417	ABI Alfalfa/Experimental	2	HR	HR	R	HR	MR	*	*	*	*					
ZG9425	ABI Alfalfa/Experimental	2	HR	HR	HR	HR	R	*	*	*	*					
ZG9426	ABI Alfalfa/Experimental	2	HR	HR	HR	HR	R	*	*	*	*					
ZG9429	ABI Alfalfa/Experimental	2	HR	HR	HR	HR	R	*	*	*	*					
ZG9436	ABI Alfalfa/Experimental	3	HR	HR	R	HR	R	*	*		*					
ZG9438	ABI Alfalfa/Experimental	3	HR	HR	R	HR	R	*	*							
ZG9445	ABI Alfalfa/Experimental	4	HR	HR	HR	HR	R	*	*	*						
ZG9631A	ABI Alfalfa/Experimental	3	HR	HR	HR	HR	HR							*	*	
ZG9632	ABI Alfalfa/Experimental	3	HR	HR	HR	HR	HR							*	*	
ZG9633	ABI Alfalfa/Experimental	3	HR	HR	HR	HR	HR							*	*	
ZG9640	ABI Alfalfa/Experimental	4	HR	HR	HR	HR	HR							*	*	
ZG9641	ABI Alfalfa/Experimental	3	HR	HR	HR	HR	HR							*	*	

¹ Variety Characteristics: FD= Fall Dormancy Bw=Bacterial Wilt Fw=Fusarium Wilt An=Anthracnose PRR=Phytophthora Root Rot APH=Aphanomyces Root Rot

² Disease Resistance: S=Susceptible LR=Low Resistance MR=Moderate Resistance R=Resistance HR=High Resistance

³ Establishment Year

⁴ Fall Dormancy 2 Vernal 3 Ranger 4 Saranac 5 DuPuits

⁵ Date of measurement of percent stand.

Shaded boxes indicate that the variety was not in the test.

Open boxes indicate the variety was in the test, but its persistence was significantly less than the top-ranked variety in the test.

* Not significantly different from the top-ranked variety in the test.

