

2006 Red and White Clover Grazing Tolerance Report

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Introduction

Red clover (*Trifolium pratense*) and white clover (*Trifolium repens*) are both high-quality forage legumes that are used primarily in mixed stands with tall fescue or orchardgrass for improving yield and quality of pastures. Stands of improved red clover are generally productive for two to three years, while white clover can be productive for three to four years. Their high palatability causes them to be overgrazed easily. Red clover is not persistent under heavy, close grazing, but white clover is tolerant to close grazing. Three types of white clover grow in Kentucky: Dutch, intermediate, and ladino. The intermediate type has been developed to persist better than the ladino type under pasture or continuous grazing conditions. Ladino white clover has larger leaves and taller growth than the intermediate and Dutch types.

This report summarizes current research on the grazing tolerance of clover varieties when subjected to continuous grazing pressure. New for 2006, Table 8 shows a summary of all white clover varieties tested in Kentucky during the last five years. Go to the UK Forage Extension Web site at <www.uky.edu/Ag/Forage> to obtain electronic versions of all forage variety testing reports from Kentucky and surrounding states and from a large number of other forage publications.

Description of the Tests

Red and white clover tests for grazing were established in Lexington in the fall of 2004 and 2005. Soils at the test site are well-drained silt loams and are well suited to clover production. Plots were 5 by 15 feet in a randomized complete block design with each variety replicated six times.

Red clover was seeded at the rate of 12 pounds per acre and white clover at 3 pounds per acre into a prepared seedbed using a disk drill. All seed lots were inoculated prior to planting. Plots were grazed continuously beginning the spring after fall seeding. In general, plots were grazed from mid-April to mid-September to a

height of 1 to 3 inches. 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 on total ground cover. Fertilizers (lime, P, K, and Boron) were applied according to University of Kentucky recommendations.

Results and Discussion

Weather data for Lexington for 2004, 2005, and 2006 are presented in Table 1.

Data on percent stand are presented in Tables 2 through 5. Table 4 shows the results of varieties under rotational grazing as compared to the same varieties under continuous grazing (Table 3). Statistical analyses were performed on these data 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

Table 1. Temperature and rainfall at Lexington, Kentucky in 2004, 2005, and 2006.

	2004				2005				2006			
	Temp.		Rainfall		Temp.		Rainfall		Temp.		Rainfall	
	°F	DEP	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP
JAN	30	-1	3.14	+0.28	37	+6	4.35	+1.49	42	+11	4.77	+1.91
FEB	36	+1	1.32	-1.89	39	+4	1.68	-1.53	36	+1	2.13	-1.08
MAR	47	+3	3.43	-0.97	41	-3	2.79	-1.61	44	0	3.05	-1.35
APR	55	0	3.06	-0.82	56	+1	3.30	-0.58	59	+4	3.52	-0.36
MAY	68	+4	9.79	+5.32	61	-3	1.78	-2.69	62	-2	2.99	-1.48
JUN	72	0	3.13	-0.53	75	+3	1.33	-2.33	70	-2	1.82	-1.84
JUL	73	-3	7.65	+2.65	77	+1	3.30	-1.70	76	0	5.13	+0.13
AUG	71	-4	2.91	-1.02	78	+3	3.34	-0.59	76	+1	3.23	-0.70
SEP	68	0	2.61	-0.59	72	+4	0.59	-2.21	64	-4	9.27	+6.07
OCT	58	+1	5.65	+3.08	58	+1	0.92	-1.65	54	-3	4.88	+2.31
NOV	49	+4	6.29	+2.90	47	+2	1.54	-1.85	47	+2	1.78	-1.61
DEC	36	0	3.20	-0.78	32	-4	2.19	-1.79				
Total			52.18	+7.63			27.51	-17.04			42.57	+2.00

DEP is departure from the long-term average.

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.

There were differences in persistence between white versus red clover. Red clover entries did not tolerate continuous, heavy grazing (Table 2). In contrast, there were several white clover entries that persisted into the second season under the abusive grazing of these trials. Tables 6 and 7 summarize information about distributors and persistence across years.

Table 8 is a summary of stand persistence data from 2002-2006 of commercial white clover varieties that have been entered in the Kentucky trials. The data is listed as a percentage of the mean of the commercial varieties entered in each specific trial. In other words, the mean for each trial is 100%—varieties with percentages over 100 persisted better than average and varieties with percentages less than 100 persisted less than average. Direct, statistical comparisons of varieties cannot be made using the summary Table 8, but these comparisons do help to identify varieties for further consideration. Varieties that have performed better than average over many years have very stable performance, while others may have performed very 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 8 to determine which yearly report to refer to.

Table 2. Percent stand and seedling vigor rating of red and white clover varieties sown Sept. 3, 2004, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Species	Seedling Vigor ¹ Nov 8, 2004	Percent Stand			
			Apr 8, 2005	Oct 31, 2005	Apr 4, 2006	Oct 23, 2006
Commercial Varieties—Available for Farm Use						
Barblanca	white ²	3.3	57	91	94	88*
Ivory	white	3.5	58	88	93	79*
CW7000	white	4.3	62	82	80	68
Colt	white	3.2	60	84	87	66
Patriot	white	3.0	60	79	80	63
Alice	white	3.0	58	71	68	60
Durana	white	3.2	55	83	83	58
Seminole	white	3.7	29	75	68	48
Experimental Varieties						
KYSynthetic	white	3.2	67	87	89	75*
GA178	white	4.7	65	80	83	68
AGRTR219	white	3.3	62	88	91	62
AGRTR216	white	3.0	48	84	83	60
AGRTR218	white	3.2	41	77	73	58
AGRTR217	white	4.2	52	63	63	49
AGRTAxA101	white x caucasian	2.5	68	51	52	31
AGRTAxA102	white x caucasian	2.8	58	55	48	24
ZR003R	red	4.2	28	53	48	17
GA-CAG-5	red	5.0	27	45	27	13
ZR009R	red	4.0	21	48	40	13
GA1RC	red	4.3	25	43	38	9
Mean		3.6	50	71	69	50
CV,%		15.0	37	14	15	29
LSD,0.05		0.6	21	11	12	17

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

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.

² Tables 7 and 8 specify the type of white clover: ladino, intermediate, or Dutch.

Table 3. Percent stand and seedling vigor rating of red clover varieties sown Sept. 7, 2005, in a cattle grazing study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Nov 7, 2005	Percent Stand	
		Apr 17, 2006	Nov 7, 2006
Commercial Varieties—Available for Farm Use			
Triple Trust 350	3.2	81	62*
Common C	2.7	71	58*
AA117ER	3.3	83	48*
Freedom!	3.5	84	48*
Kenland	2.5	80	40
Kenton	3.3	88	38
Freedom! MR	2.8	78	37
Common A	3.2	77	36
Kenway	3.5	82	25
Experimental Varieties			
RC0303	2.8	78	52*
RC0201	2.5	81	40
RC0002	3.7	86	38
Mean	3.1	81	44
CV,%	25.3	15	37
LSD,0.05	0.9	14	19

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

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.

Table 4. Percent stand and seedling vigor rating of red clover varieties sown Sept. 22, 2005, in a cattle rotational grazing study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Nov 7, 2005	Percent Stand	
		Apr 17, 2006	Oct 20, 2006
Commercial Varieties—Available for Farm Use			
Kenland	2.8	88	98*
Freedom!	3.7	89	96*
AA117ER	2.7	86	95*
Kenton	3.8	89	95*
Triple Trust 350	2.8	90	95*
Freedom! MR	3.2	86	94*
Kenway	2.7	88	93*
Common A	3.3	85	88
Common C	2.7	75	83
Experimental Varieties			
RC 0303	2.8	84	95*
RC 0002	3.8	89	94*
RC 0201	3.0	79	91
Mean	3.1	86	93
CV,%	23.8	13	6
LSD,0.05	0.9	13	6

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

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.

Summary

Although these varieties were abused during the growing season, they were allowed to rest and regrow after Sept. 15 to prepare for winter. 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.

This information should be used along with yield and pest resistance information in selecting the best clover variety for each individual use. It is not recommended that clover be continuously grazed 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 clovers.

Good management for maximum life from grazing clover would include:

- allowing clover 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. Less time is required for white clover.
- adding any needed fertilizer and lime.
- removing grazing livestock from clover fields from mid-September to Nov. 1 to replenish root reserves for winter survival.

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Variety	Percent Stand Oct 20, 2006
Commercial Varieties—Available for Farm Use	
Colt	89*
Patriot	88*
Durana	85*
Resolute	85*
Barblanca	82*
Alice	80*
Will	76*
Kopu II	70
Regal	66
Experimental Varieties	
CW9701	80*
Mean	80
CV,%	15
LSD,0.05	14

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

Variety/Proprietor		Continuous				Rotational			
		2004 ¹		2005		2005		2005	
		Apr 2005 ²	Oct 2005	Apr 2006	Oct 2006	Apr 2006	Nov 2006	Apr 2006	Oct 2006
Commercial Varieties—Available for Farm Use									
AA117ER	ABI Alfalfa					*	*	*	*
Common A	Public					*	X	*	X
Common C	Public					*	*	X	X
Freedom!	Barenbrug USA					*	*	*	*
Freedom! MR	Barenbrug USA					*	X	*	*
Kenland (cert.)	Public					*	X	*	*
Kenton	Production Services Int'l					*	X	*	*
Kenway	Smith Seed Services					*	X	*	*
Triple Trust 350	ABI Alfalfa					*	*	*	*
Experimental Varieties									
GAC1RC	University of Georgia	*	*	*	*				
GA-CAG-S	University of Georgia	*	*	X	*				
RC0002	FFR/Southern States					*	X	*	*
RC0201	FFR/Southern States					*	X	*	X
RC0303	FFR/Southern States					*	*	*	*
ZR003R	ABI Alfalfa, Inc.	*	*	*	*				
ZR009R	ABI Alfalfa, Inc.	*	*	*	*				

¹ Establishment year.
² Date of rating of percent stand
 *Not significantly different from the most persistent red clover variety.
 An "x" in the block indicates the variety was in the test but the stand survival was significantly less than the most persistent red clover variety.
 An open block indicates the variety was not in the test.

Table 7. Summary of persistence of white clover varieties under heavy grazing pressure across years at Lexington, Kentucky.

Variety (Type)/Proprietor		2004 ¹				2005
		Apr 2005 ²	Oct 2005	Apr 2006	Oct 2006	Oct 2006
Commercial Varieties—Available for Farm Use						
Alice (Intermediate)	Barenbrug USA	*	X	X	X	*
Barblanca (Intermediate)	Barenbrug USA	*	*	*	*	*
Colt (Intermediate)	Seed Research of Oregon	*	*	*	X	*
Durana (Dutch)	Pennington Seed	*	*	*	X	*
Ivory (Intermediate)	Cebeco Internatiional Seeds, Inc.	*	*	*	*	
Kopu II (Intermediate)	Ampac Seed					X
Patriot (Intermediate)	Pennington Seed	*	*	X	X	*
Regal (Ladino)	Public					X
RegalGraze (Ladino)	Cal/West Seeds	*	*	X	X	
Resolute (Intermediate)	FFR/Southern States					*
Seminole (Ladino)	Saddle Butte Ag, Inc	X	X	X	X	
Will (Ladino)	Allied Seed					*
Experimental Varieties						
AGRTAxA101 ³	AgResearch(USA) Limited	*	X	X	X	
AGRTAxA102 ³	AgResearch(USA) Limited	*	X	X	X	
AGRTR 216	AgResearch(USA) Limited	*	*	*	X	
AGRTR 217	AgResearch(USA) Limited	*	X	X	X	
AGRTR 218	AgResearch(USA) Limited	X	X	X	X	
AGRTP 219	AgResearch(USA) Limited	*	*	*	X	
CW 9701 (Ladino)	Cal/West Seeds					*
GA178	Unversity of Georgia	*	*	*	X	
KY Synthetic (Dutch)	KY Agric. Exper. Station	*	*	*	*	

¹ Establishment year.
² Date of rating of percent stand
³ Cross between white and caucasian clover.
*Not significantly different from the most persistent white clover variety.
An "x" in the block indicates the variety was in the test but the stand survival was significantly less than the most persistent white clover variety.
An open block indicates the variety was not in the test.

Table 8. Summary of Kentucky White Clover Grazing trials, 2002-2006 (stand persistence shown as a percent of the mean of the commercial varieties in the test).

Variety/Proprietor		2002 ^{1,2} 2yr ⁴	2004 2yr	2005 1yr	Mean ³ (# trials)
Alice (intermediate)	Barenbrug USA		91	100	96(2)
Barblanca (Intermediate)	Barenbrug USA		133	103	118(2)
Colt (intermediate)	Seed Research of OR		100	111	106(2)
Crescendo (Ladino)	Cal/West	84			–
Durana (Dutch)	Pennington		88	106	97(2)
Ivory (Intermediate)	Cebeco	132	119		133(2)
Kopu II (Intermediate)	Ampac Seed			88	–
Patriot (intermediate)	Pennington		95	110	103(2)
Regal (Ladino)	Public	92		83	93(2)
RegalGraze (Ladino)	Cal/West		103		–
Resolute (Intermediate)	FFR/Southern States			106	–
Seminole (Ladino)	Saddle Butte Ag. Inc.		72		–
Tillman II (Ladino)	Caudill Seed	92			–
Will (Ladino)	Allied Seed			95	–

¹ Year trial was established.
² 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 trial planted in 2002 was grazed for two years so the final persistence report would be "2004 Red and White Clover Grazing Tolerance Report" archived in the Kentucky Forage Web site at <www.uky.edu/Ag/Forage>.
³ Mean only presented when respective variety was included in two or more trials.
⁴ Number of years of data.