

2007 Red and White Clover Grazing Tolerance Report

G.L. Olson, S.R. Smith, G.D. Lacefield and N.L. Taylor

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; 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. Table 10 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 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, 2005 and 2006. 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, 2006 and 2007 are presented in Table 1.

Data on percent stand are presented in Tables 2 through 7. Table 4 shows the results of red clover 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 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, several white clover entries persisted into the second season under the abusive grazing of these trials. Tables 8 and 9 summarize information about distributors and persistence across years.

Table 10 is a summary of stand persistence data from 2002-2007 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 10, 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; 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 10 to determine which yearly report to refer to.

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 November 1 to replenish root reserves for winter survival.

Authors

- G.L. Olson, Research Specialist, Forages, UK Department of Plant and Soil Sciences
- S.R. Smith, Extension Associate Professor, Forages, UK Department of Plant and Soil Sciences
- G.D. Lacefield, Extension Professor, Forages, UK Department of Plant and Soil Sciences
- N.L. Taylor, Professor, Clover Breeding, UK Department of Plant and Soil Sciences

Table 1. Temperature and rainfall at Lexington, Kentucky in 2004, 2005, 2006 and 2007.

	2004				2005				2006				2007 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	30	-1	3.14	+0.28	37	+6	4.35	+1.49	42	+11	4.77	+1.91	37	+6	2.93	+0.07
FEB	36	+1	1.32	-1.89	39	+4	1.68	-1.53	36	+1	2.13	-1.08	27	-8	1.83	-1.38
MAR	47	+3	3.43	-0.97	41	-3	2.79	-1.61	44	0	3.05	-1.35	52	+8	1.97	-2.43
APR	55	0	3.06	-0.82	56	+1	3.30	-0.58	59	+4	3.52	-0.36	53	-2	3.87	-0.01
MAY	68	+4	9.79	+5.32	61	-3	1.78	-2.69	62	-2	2.99	-1.48	68	+4	1.45	-3.02
JUN	72	0	3.13	-0.53	75	+3	1.33	-2.33	70	-2	1.82	-1.84	74	+2	1.77	-1.89
JUL	73	-3	7.65	+2.65	77	+1	3.30	-1.70	76	0	5.13	+0.13	74	-2	6.90	+1.90
AUG	71	-4	2.91	-1.02	78	+3	3.34	-0.59	76	+1	3.23	-0.70	80	+5	2.56	-1.37
SEP	68	0	2.61	-0.59	72	+4	0.59	-2.21	64	-4	9.27	+6.07	72	+4	1.15	-2.05
OCT	58	+1	5.65	+3.08	58	+1	0.92	-1.65	54	-3	4.88	+2.31	63	+6	5.28	+2.71
NOV	49	+4	6.29	+2.90	47	+2	1.54	-1.85	47	+2	1.78	-1.61	46	+1	2.86	-0.53
DEC	36	0	3.20	-0.78	32	-4	2.19	-1.79	42	+6	2.45	-1.53				
Total			52.18	+7.63			27.51	-17.04			45.02	+0.47			32.57	-8.00

¹ DEP is departure from the long-term average.

² 2007 data is for 11 months through November.

Table 2. Seedling vigor and stand persistence of red and white clover varieties sown September 3, 2004 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Type	Seedling Vigor ¹ Nov 8, 2004	Percent Stand					
			2005		2006		2007	
			Apr 8	Oct 31	Apr 4	Oct 23	Mar 30	Oct 25
Commercial Varieties-Available for Farm Use								
Ivory	Intermediate	3.5	58	88	93	79	45	43*
Patriot	Intermediate	3.0	60	79	80	63	45	43*
Barblanca	Intermediate	3.3	57	91	94	88	40	37*
Durana	Dutch	3.2	55	83	83	58	40	30
Colt	Intermediate	3.2	60	84	87	66	49	28
Alice	Intermediate	3.0	58	71	68	60	51	27
Seminole	Ladino	3.7	29	75	68	48	27	25
Experimental Varieties								
AGRTR219	Intermediate	3.3	62	88	90	62	38	43*
CW7000	Ladino	4.3	62	82	80	68	46	43*
KYSynthetic	Intermediate	3.2	67	87	89	75	57	40*
GA178	Ladino	4.7	65	80	83	68	38	38*
AGRTR216	Intermediate	3.0	48	84	83	60	47	26
AGRTR218	Intermediate	3.2	41	77	73	58	32	26
AGRTR217	Intermediate	4.2	52	63	63	49	35	22
AGRTAxA101	white x caucasian	2.5	68	51	52	31	28	16
AGRTAxA102	white x caucasian	2.8	58	55	48	24	17	8
GA1RC	red	4.3	25	43	38	9	8	1
GA-CAG-S	red	5.0	27	45	27	13	8	0
ZR009R	red	4.0	21	48	40	13	8	0
ZR003R	red	4.2	28	53	48	17	8	0
Mean		3.6	50	71	69	50	33	25
CV,%		15.0	37	14	15	29	33	38
LSD,0.05		0.6	21	11	12	17	12	11

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 3. Seedling vigor and stand persistence of red clover varieties sown September 7, 2005 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Nov 7, 2005	Percent stand			
		2006		2007	
		Apr 17	Nov 7	Mar 30	Oct 16
Commercial Varieties-Available for Farm Use					
Freedom! MR	2.8	78	37	25	1.7*
Kenland	2.5	80	40	23	1.2*
Common C	2.7	71	58	38	1.0
AA117ER	3.3	83	48	37	0.8
Kenton	3.3	88	38	33	0.8
Triple Trust 350	3.2	81	62	38	0.8
Freedom!	3.5	84	48	40	0.7
Kenway	3.5	82	25	23	0.7
Common A	3.2	77	36	25	0.5
Experimental Varieties					
RC 0002	3.7	86	38	37	2.2*
RC 0303	2.8	78	52	30	1.5*
RC 0201	2.5	81	40	25	1.2*
Mean	3.1	81	44	31	1.1
CV,%	25.3	15	37	45	84.6
LSD,0.05	0.9	14	19	16	1.1

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 red clover varieties sown September 22, 2005 in a cattle rotational grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Nov 7, 2005	Percent Stand			
		2006		2007	
		Apr 17	Oct 20	Mar 30	Oct 16
Commercial Varieties-Available for Farm Use					
Freedom!	3.7	89	96	84	28*
AA117ER	2.7	86	95	87	27*
Kenland	2.8	88	98	88	23*
Freedom! MR	3.2	86	94	83	21
Kenton	3.8	89	95	86	20
Triple Trust 350	2.8	90	95	83	13
Kenway	2.7	88	93	84	11
Common A	3.3	85	88	65	1
Common C	2.7	75	83	60	1
Experimental Varieties					
RC 0201	3.0	79	91	76	33*
RC 0303	2.8	84	95	89	29*
RC 0002	3.8	89	94	89	28*
Mean	3.1	86	93	81	20
CV,%	23.8	13	6	16	52
LSD,0.05	0.9	13	6	15	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.

Table 5. Seedling vigor and stand persistence of red clover varieties sown September 6, 2006 in a cattle grazing tolerance study at Lexington, Kentucky

Variety	Seedling Vigor ¹ Oct 25, 2006	Percent Stand		
		2006 Oct 25	2007 Mar 30 Oct 15	
Commercial Varieties-Available for Farm Use				
Cinnamon Plus	3.8	94	95	84*
Kenland	3.8	95	98	79*
Freedom!	4.0	91	95	68
Common O	4.7	96	98	60
Experimental Varieties				
RC 9806	4.5	95	97	93*
RC 0403G	3.8	91	99	92*
Mean	4.1	94	97	79
CV,%	14.0	4	3	16
LSD,0.05	0.7	5	3	15

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 6. Stand persistence of white clover varieties sown March 17, 2006 in a cattle grazing tolerance study at Lexington, Kentucky,

Variety	Type	Percent Stand		
		2006 Oct 20	2007 Mar 30 Oct 16	
Commercial Varieties-Available for Farm Use				
Patriot	Intermediate	88	81	80*
Colt	Intermediate	89	84	78*
Will	Ladino	76	78	68*
Durana	Dutch	85	75	61
Resolute	Intermediate	85	86	59
Alice	Intermediate	80	73	57
Barblanca	Intermediate	82	50	53
RegalGraze	Ladino	80	73	49
Kopu II	Intermediate	70	65	45
Regal	Ladino	66	57	33
Mean		80	72	52
CV,%		15	19	25
LSD,0.05		14	16	17

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

Table 7. Seedling vigor and stand persistence of white clover varieties sown September 8, 2006 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Type	Seedling Vigor ¹ Oct 25, 2006	Percent Stand		
			2006 Oct 25	2007 Mar 30 Oct 15	
Commercial Varieties-Available for Farm Use					
Crescendo	Ladino	4.0	94	91	94*
Will	Ladino	3.3	93	92	91*
Patriot	Intermediate	2.5	86	75	91*
RegalGraze	Ladino	4.3	95	90	91*
Durana	Dutch	1.7	86	75	90*
Insight	Ladino	5.0	93	91	90*
Resolute	Intermediate	2.8	87	83	90*
Colt	Intermediate	1.5	80	83	88
Kopu II	Intermediate	3.5	94	82	86
Regal	Ladino	2.8	89	86	84
Barblanca	Intermediate	3.7	91	43	83
Seminole	Ladino	4.0	94	71	83
Experimental Varieties					
CW 204	Ladino	3.0	93	91	93*
CW 9501	Ladino	3.7	90	83	87
Mean		3.3	90	82	89
CV,%		20.7	7	13	4
LSD,0.05		0.8	8	12	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.

Table 8. Summary of persistence of white clover varieties under heavy grazing pressure across years at Lexington, Kentucky.

Variety	Type	Proprietor/KY Distributor	2004 ¹						2006 ³			2006		
			Apr	Oct	Apr	Oct	Mar	Oct	Oct	Mar	Oct	Mar	Oct	
			2005 ²	2006	2006	2007	2006	2007	2007					
Commercial Varieties-Available for Farm Use														
Alice	Intermediate	Barenbrug USA	*	x ⁵	x	x	*	x	*	*	x			
Barblanca	Intermediate	Barenbrug USA	*	*	*	*	x	*	*	x	x	x	x	
Colt	Intermediate	Seed Research of Oregon	*	*	*	x	*	x	*	*	*	*	x	
Crescendo	Ladino	Seed Research of Oregon										*	*	
Durana	Dutch	Pennington Seed	*	*	*	x	*	x	*	*	x	x	*	
Insight	Ladino	Allied Seed										*	*	
Ivory	Intermediate	Cebeco International Seeds, Inc.	*	*	*	*	*	*						
Kopu II	Intermediate	Ampac Seed							x	x	x	*	x	
Patriot	Intermediate	Pennington Seed	*	*	x	x	*	*	*	*	*	x	*	
Regal	Ladino	Public							x	x	x	*	x	
RegalGraze	Ladino	Cal/West Seeds							*	*	x	*	*	
Resolute	Intermediate	FFR/Southern States							*	*	x	*	*	
Seminole	Ladino	Saddle Butte Ag, Inc	x	x	x	x	*	x				x	x	
Will	Ladino	Allied Seed							*	*	*	*	*	
Experimental Varieties														
AGRtAxA101 ⁴		AgResearch(USA) Limited	*	x	x	x	x	x						
AGRtAxA102 ⁴		AgResearch(USA) Limited	*	x	x	x	x	x						
AGRTR 216	Intermediate	AgResearch(USA) Limited	*	*	*	x	*	x						
AGRTR 217	Intermediate	AgResearch(USA) Limited	*	x	x	x	x	x						
AGRTR 218	Intermediate	AgResearch(USA) Limited	x	x	x	x	x	x						
AGRTP 219	Intermediate	AgResearch(USA) Limited	*	*	*	x	x	*						
CW204	Ladino	Cal/West Seeds										*	*	
CW7000	Ladino	Univ. of Georgia	*	*	x	x	*	*						
CW9501	Ladino	Cal/West Seeds										*	x	
GA178	Ladino	University of Georgia	*	*	*	x	x	*						
KY Synthetic (Intermediate)		KY Agric. Exper. Station	*	*	*	*	*	*						

¹ Establishment year.

² Date of rating of percent stand

³ This trial was planted in the spring of 2006 due to poor establishment from the fall of 2005 planting.

⁴ Cross between white and caucasian clover.

⁵ 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.

* Not significantly different from the most persistent white clover variety.

Table 9. Summary of persistence of red clover varieties under heavy grazing pressure and rotational grazing across years at Lexington, Kentucky.

Variety	Proprietor/KY Distributor	Continuous												Rotational			
		2004 ¹						2005				2006		2005			
		Apr	Oct	Apr	Oct	Mar	Oct	Apr	Nov	Mar	Oct	Mar	Oct	Apr	Oct	Mar	Oct
		2005 ²		2006		2007		2006		2007				2006		2007	
Commercial Varieties- Available for Farm Use																	
AA117ER	ABI Alfalfa						*	*	*	X ³			*	*	*	*	
Cinnamon Plus	FFR/Southern States											X	*				
Common A	Public						*	X	*	X			*	X	X	X	
Common C	Public						*	*	*	X			X	X	X	X	
Common O	Public										*	X					
Freedom!	Barenbrug USA						*	*	*	X	X	X	*	*	*	*	
Freedom! MR	Barenbrug USA						*	X	*	*			*	*	*	X	
Kenland (certified)	Public						*	X	X	*	*	*	*	*	*	*	
Kenton	Production Services Int'l						*	X	*	X			*	*	*	X	
Kenway	Smith Seed Services						*	X	X	X			*	*	*	X	
Triple Trust 350	ABI Alfalfa						*	*	*	X			*	*	*	X	
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						*	*	*	*			*	*	*	*	
RC 0403G	FFR/Southern States											*	*				
RC 9806	FFR/Southern States											*	*				
ZR003R	ABI Alfalfa, Inc.	*	*	*	*	*	*										
ZR009R	ABI Alfalfa, Inc.	*	*	*	*	*	*										

¹ Establishment year.

² Date of rating of percent stand

³ 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.

* Not significantly different from the most persistent red clover variety.

Table 10. Summary of Kentucky White Clover Grazing trials 2002-2007 (stand persistence shown as a percent of the mean of the commercial varieties in the test).

Variety	Type	Proprietor	2002 ^{1,2}	2004	2006 ³	2006	Mean ⁴ (#trials)
			2yr ⁵	3yr	2yr	1yr	
Alice	Intermediate	Barenbrug USA		81	98		90(2)
Barblanca	Intermediate	Barenbrug USA		111	91	94	99(3)
Colt	Intermediate	Seed Research of OR		84	134	100	106(3)
Crescendo	Ladino	Cal/West	84			106	95(2)
Durana	Dutch	Pennington		90	105	102	99(3)
Insight	Ladino	Allied Seed				102	
Ivory	Intermediate	Cebeco	132	129			131(2)
Kopu II	Intermediate	Ampac Seed			77	97	87(2)
Patriot	Intermediate	Pennington		129	137	103	123(3)
Regal	Ladino	Public	92		57	95	81(3)
RegalGraze	Ladino	Cal/West			84	103	94(2)
Resolute	Intermediate	FFR/Southern States			101	102	102(2)
Seminole	Ladino	Saddle Butte Ag. Inc.		75		94	85(2)
Tillman II	Ladino	Caudill Seed	92				-
Will	Ladino	Allied Seed			117	103	110(2)

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 2 years so the final persistence report would be "2004 Red and White Clover Grazing Tolerance Report" archived in the KY Forage website at <www.uky.edu/Ag/Forage>.

³ This trial was replanted in the spring of 2006 due to poor establishment in the fall of 2005

⁴ Mean only presented when respective variety was included in two or more trials.

⁵ Number of years of data.



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