

2010 Red and White Clover Grazing Tolerance Report

G.L. Olson, S.R. Smith, and G.D. Lacefield, UK Department of Plant and Soil Sciences;
E. Vanzant, UK Department of Animal and Food Sciences

Introduction

Red clover (*Trifolium pratense L.*) is a high-quality, short-lived, perennial legume that is used in mixed or pure stands for pasture, hay, silage, green chop, soil improvement and wildlife habitat. This species is adapted to a wide range of climatic and soil conditions. Stands of improved varieties are generally productive for two and a half to three years, with the highest yields occurring in the year following establishment. Red clover is used primarily as a renovation legume for grass pastures. It is a dominant forage legume in Kentucky because it is relatively easy to establish and has high forage quality, high yield and animal acceptance.

White clover (*Trifolium repens L.*) is a low-growing, perennial pasture legume with white flowers. It differs from red clover in that the stems (stolons) grow along the surface of the soil and can form adventitious roots that may lead to the development of new plants. Three types of white clover grow in Kentucky: Dutch, intermediate and ladino. Dutch white

clover, sometimes called common, naturally occurs in many Kentucky pastures and even lawns. It is generally long lived and reseeds readily, but its small leaves and low growth habit result in low forage yield. The intermediate type is a cross between ladino and Dutch white clover, and has been developed to give higher yields than the Dutch type and 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 and is the highest yielding of the three white clover types.

This report summarizes current research on the grazing tolerance of clover varieties when subjected to continuous grazing pressure. Table 9 shows a summary of all white clover varieties tested in Kentucky during the last nine 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 clover tests for grazing were established in Lexington in the fall of 2008 and 2009. White clover tests for grazing were established in Lexington in the spring of 2008 and in the fall of 2008 and 2009. 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 lb/A and white clover at 3 lb/A 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

Table 1. Temperature and rainfall at Lexington, Kentucky in 2007, 2008, 2009 and 2010.

	2007				2008				2009				2010 ²			
	Temperature		Rainfall		Temperature		Rainfall		Temperature		Rainfall		Temperature		Rainfall	
	°F	DEP ¹	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP
JAN	37	+6	2.93	+0.07	32	+2	3.91	+1.05	28	-3	2.45	-0.41	29	-2	2.40	-0.46
FEB	27	-8	1.83	-1.38	36	+1	6.11	+2.90	38	+3	2.86	-0.35	29	-6	1.38	-1.83
MAR	52	+8	1.97	-2.43	44	+1	6.51	+1.91	48	+4	2.19	-2.21	47	+3	1.05	-3.35
APR	53	-2	3.87	-0.01	55	0	5.89	+2.01	55	0	4.48	+0.60	59	+4	2.74	-1.14
MAY	68	+4	1.45	-3.02	62	-2	4.33	+0.14	64	0	5.05	+0.58	67	+3	7.84	+3.37
JUN	74	+2	1.77	-1.89	74	+2	3.59	-0.07	74	+2	5.41	-1.75	76	+4	4.61	+0.95
JUL	74	-2	6.90	+1.90	76	0	3.41	-1.59	71	-5	5.89	+0.89	78	+2	5.49	+0.49
AUG	80	+5	2.56	-1.37	75	0	2.18	-1.75	73	-2	5.38	+1.45	78	+3	1.54	-2.39
SEP	72	+4	1.15	-2.05	72	+4	1.42	-1.78	68	0	5.37	+2.17	71	+3	1.14	-2.06
OCT	63	+6	5.28	+2.71	57	0	1.53	-1.04	54	-3	4.83	+2.26	59	+2	1.22	-1.35
NOV	46	+1	2.86	-0.53	43	-2	2.53	-0.86	49	+4	0.94	-2.45				
DEC	40	+4	5.29	+1.31	35	-1	6.03	+2.05	36	0	3.86	-0.12				
Total			37.86	-6.69			47.24	+2.69			48.71	+4.16			29.41	-7.77

¹ DEP is departure from the long-term average.
² 2010 data is for ten months through October.

Table 2. Seedling vigor and stand persistence of red clover varieties sown September 10, 2008 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 13, 2008	Percent Stand				
		2008		2009		2010
		Oct 13	Apr 8	Oct 12	Apr 6	Nov ²
Commercial Varieties—Available for Farm Use						
Kenland	3.2	99	100	81	81*	
Freedom!	4.0	100	99	81	77*	
Juliet	3.5	98	100	70	71	
Common O	4.0	100	100	71	67	
Cinnamon Plus	3.2	100	99	86	66	
Experimental Varieties						
B-7.1865	3.3	100	100	95	90*	
CW 0400040	3.8	99	99	88	80*	
CW 202	3.2	98	100	86	77*	
GA-100(RC)	3.0	99	100	86	75*	
GA-9908	2.5	98	99	84	70	
Mean	3.4	99.2	99.6	82.7	75.2	
CV,%	29.3	2.2	1.2	11.6	17.5	
LSD,0.05	1.1	2.5	1.4	11.1	15.3	

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
² Due to very dry weather there was not enough regrowth after the cattle were removed to obtain a valid stand rating.
* 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 3, 2009 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 12, 2009	Percent Stand		
		2009		2010
		Oct 12	Apr 7	Nov ²
Commercial Varieties—Available for Farm Use				
Freedom!	4.4	99	100*	
Kenland	3.2	97	99*	
Cinnamon Plus	3.7	99	98*	
Experimental Varieties				
RC 9703	4.3	99	99*	
RC 0004	2.5	97	98*	
RC 0302	3.1	98	98*	
RC 0301	2.5	98	98	
Mean	3.4	98.1	98.5	
CV,%	17.6	1.6	1.7	
LSD,0.05	0.7	1.8	2.0	

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
² Due to very dry weather there was not enough growth after the cattle were removed to obtain a valid stand rating.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

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 2007, 2008, 2009 and 2010 are presented in Table 1.

Data on percent stand are presented in Tables 2 through 6. 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.

Several white clover entries persisted into the second season under the abusive

Table 4. Stand persistence of white clover varieties sown April 8, 2008 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Percent Stand					
	2008		2009		2010	
	Jul 17	Oct 17	Apr 8	Oct 12	Apr 6	Nov ¹
Commercial Varieties—Available for Farm Use						
Will	95	95	90	87	98*	
RegalGraze	95	92	83	77	96*	
Ivory II	94	92	87	84	93*	
Kopu II	92	87	73	70	88*	
Seminole	94	91	79	68	83	
Experimental Varieties						
GO-ABC	97	95	86	79	92*	
GO-HSM	89	84	73	73	88*	
GO-AJ	94	89	83	62	83	
GO-BSG	90	85	64	49	79	
Mean	93.3	89.8	79.8	72.0	88.7	
CV,%	6.4	7.6	14.6	15.0	10.9	
LSD,0.05	6.9	7.9	13.6	12.6	11.3	

¹ Due to very dry weather there was not enough regrowth after the cattle were removed to obtain a valid stand rating.
* 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 white clover varieties sown September 10, 2008 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 13, 2008	Percent Stand				
		2008		2009		2010
		Oct 13	Apr 8	Oct 12	Apr 6	Nov 22 ²
Commercial Varieties—Available for Farm Use						
Durana	2.0	95	96	100	87	53*
Patriot	2.0	94	95	99	97	45*
Will	2.2	96	97	100	100	42*
Regal	4.0	99	99	99	96	35
Rampart	2.0	95	94	99	68	33
RegalGraze	3.0	98	100	98	98	23
Experimental Varieties						
Ky Select	3.2	98	100	100	96	48*
CW 0401	4.2	98	99	96	89	30
Mean	2.8	96.6	97.4	98.8	91.2	38.6
CV,%	31.4	3.3	2.7	1.6	10.5	36.1
LSD,0.05	1.0	3.7	3.1	1.9	11.2	16.4

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
² Due to very dry weather there was not much regrowth after the cattle were removed, therefore these stand values may not be valid.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 6. Seedling vigor and stand persistence of white clover varieties sown September 3, 2009 in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 12, 2009	Percent Stand		
		2009		2010
		Oct 12	Apr 7	Nov ²
Commercial Varieties—Available for Farm Use				
Will	3.8	98	99*	
RegalGraze	4.3	100	99*	
Kopu II	2.8	96	96	
Patriot	1.6	96	95	
Durana	1.9	96	95	
Experimental Varieties				
CW 040041	2.2	92	97	
KYMC	2.0	92	96	
Mean	2.7	95.5	96.6	
CV,%	28.0	2.1	1.8	
LSD,0.05	0.9	2.3	2.1	

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
² Due to very dry weather there was not enough growth after the cattle were removed to obtain a valid stand rating.
 * Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

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

Variety	Proprietor/KY Distributor	2008 ¹		2009	
		Apr	Oct	Apr	Apr
		2009 ²		2010	2010
Commercial Varieties—Available for Farm Use					
Cinnamon Plus	FFR/Southern States	*	*	x	*
Common O	Public	*	x ³	x	
Freedom!	Barenbrug USA	*	x	*	*
Juliet	Caudill Seed	*	x	x	
Kenland (certified)	Public	*	x	*	*
Experimental Varieties					
B-7.1865	Blue Moon Farms	*	*	*	
CW 0400040	Cal/West	*	*	*	
CW 202	Cal/West	*	*	*	
GAC1RC	Univ. of Georgia				
GA-100(RC)	Univ. of Georgia	*	*	*	
GA-9908	Univ. of Georgia	*	*	x	
RC 0004	FFR/Southern States				*
RC 0301	FFR/Southern States			x	x
RC 0302	FFR/Southern States				*
RC 9703	Lewis Seed				*

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.

grazing of these trials. Tables 7 and 8 summarize information about distributors and persistence across years.

Table 9 is a summary of stand persistence data from 2002 to 2010 of commercial white clover varieties that have been entered in the Kentucky trials. The data are 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 percent—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 9, 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 9 to determine which yearly report to refer to.

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

Variety	Type	Proprietor/KY Distributor	2007 ¹					2008				2009
			Jul	Oct	Apr	Oct	Apr	Apr	Oct	Apr	Nov	Apr
			2008 ²		2009		2010	2009		2010		2010
Commercial Varieties—Available for Farm Use												
Durana	Intermediate	Pennington Seed						*	*	x	*	x
Ivory II	Intermediate	DLF International	*	*	*	*	*					
Kopu II	Intermediate	Ampac Seed	*	x ³	x	x	*					x
Patriot	Intermediate	Pennington Seed						x	*	*	*	x
Rampart	—	Oregro Seeds						x	*	x	x	
Regal	Ladino	Public						*	*	*	x	
RegalGraze	Ladino	Cal/West Seeds	*	*	*	*	*	*	x	*	x	*
Seminole	Ladino	Saddle Butte Ag, Inc	*	*	*	x	x					
Will	Ladino	Allied Seed	*	*	*	*	*	*	*	*	*	*
Experimental Varieties												
CW 0401	Ladino	Cal/West Seeds						*	x	*	x	
CW 040041	Ladino	Cal/West Seeds										x
GO-ABC	Intermediate	Grassland Oregon	*	*	*	*	*					
GO-AJ	Intermediate	Grassland Oregon	*	*	*	x	x					
GO-BSG	Intermediate	Grassland Oregon	*	x	x	x	x					
GO-HSM	Intermediate	Grassland Oregon	*	x	x	x	*					
KYMC	Intermediate	Ky. Agric. Exper. Station										x
KY Select	Intermediate	Ky. Agric. Exper. Station						*	*	*	*	

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 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 Kentucky White Clover Grazing trials 2002-2010 (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	2008 ⁴	2008	Mean ⁵ (#trials)
			2yr ⁶	4yr	2yr	2yr	3yr	2yr	
Alice	Intermediate	Barenbrug USA		59	98				79(2)
Barblanca	Intermediate	Barenbrug USA		118	91	151			120(3)
Colt	Intermediate	Seed Research of OR		114	134	122			123(3)
Crescendo	Ladino	Cal/West	84			72			78(2)
Durana	Intermediate	Pennington		83	105	103		138	107(4)
Insight	Ladino	Allied Seed				77			-
Ivory	Intermediate	Cebeco	132	142					137(2)
Ivory II	Intermediate	DLF International					102		-
Kopu II	Intermediate	Ampac Seed			77	122	96		98(3)
Patriot	Intermediate	Pennington		110	137	122		117	122(4)
Rampart	-	Oregro Seeds						86	-
Regal	Ladino	Public	92		57	54		91	74(4)
RegalGraze	Ladino	Cal/West			84	87	105	60	84(4)
Resolute	Intermediate	FFR/Southern States			101	106			104(2)
Seminole	Ladino	Saddle Butte Ag. Inc.		75		97	91		88(3)
Tillman II	Ladino	Caudill Seed	92						-
Will	Ladino	Allied Seed			117	87	107	109	105(4)

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 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 This trial was replanted in the spring of 2008 due to poor establishment in the fall of 2007.

⁵ Mean only presented when respective variety was included in two or more trials.

⁶ Number of years of data.

Summary

Although these varieties were abused during the growing season, they were allowed to rest and regrow after September 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. This is especially important with red clover.

Authors

G.L. Olson, Research Specialist, Forages
 S.R. Smith, Extension Professor, Forages
 G.D. Lacefield, Extension Professor, Forages
 E. Vanzant, Associate Professor, Beef Cattle Nutrition



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