

2013 Red and White Clover Grazing Tolerance Report

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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 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 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.

Important Selection Considerations

Local adaptation and persistence. The variety should be adapted to Kentucky as indicated by superior performance across years and locations in replicated yield trials, such as those reported in this publication. High-yielding varieties are generally also those varieties that are the most persistent. Improved red clover generally produces measurable yields for 2½ to 3 years, with the year of establishment considered as the first year. The highest yields occur in the year following establishment. White clover may persist longer than red clover, particularly in wet seasons, and has the ability to reseed even under grazing. Refer to the 2012 Red and White Clover Report (or previous years if needed) for yield data on specific varieties of interest.

Seed quality. Buy premium-quality seed that is high in germination and purity and free from weed seed. Buy certified seed or proprietary seed of an improved variety. An improved variety is

Table 1. Temperature and rainfall at Lexington, Kentucky, in 2010, 2011, 2012, and 2013.

	2010				2011				2012				2013 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	29	-2	2.40	-0.46	29	-2	2.10	-0.76	38	+7	4.80	+1.94	38	+7	4.50	+1.64
FEB	29	-6	1.38	-1.83	39	+4	6.34	+3.13	40	+5	5.39	+2.18	36	+1	1.78	-1.43
MAR	47	+3	1.05	-3.35	47	+3	4.76	+0.36	56	+12	5.64	+1.24	39	-5	5.47	+1.07
APR	59	+4	2.74	-1.14	58	+3	12.36	+8.48	56	+1	3.26	-0.62	55	0	4.46	+0.58
MAY	67	+3	7.84	+3.37	64	0	6.72	+2.25	69	+5	4.02	-0.45	65	+1	5.23	+0.76
JUN	76	+4	4.61	+0.95	74	+2	2.61	-1.05	73	+1	2.42	-1.24	72	0	7.32	+3.66
JUL	78	+2	5.49	+0.49	80	+4	6.29	1.29	81	+5	2.50	-2.50	72	-4	9.33	+4.33
AUG	78	+3	1.54	-2.39	75	0	2.89	-1.04	75	0	1.68	-2.25	72	-3	3.68	-0.25
SEP	71	+3	1.14	-2.06	66	-2	5.52	+2.32	67	-1	6.40	+3.20	67	-1	2.21	-0.99
OCT	59	+2	1.22	-1.35	55	-2	4.10	+1.53	55	-2	2.00	-0.57	55	-2	8.10	+5.53
NOV	47	+2	4.58	+1.19	50	+5	9.53	+6.14	43	-2	1.81	-0.65				
DEC	28	-8	2.15	-1.93	41	+5	5.58	+1.60	42	+6	9.57	+4.94				
Total			36.14	-8.41			68.80	+24.25			49.49	+4.94			52.08	+14.90

¹ DEP is departure from the long-term average.

² 2013 data is for the ten months through October

Table 2. Seedling vigor and stand persistence of red clover varieties sown September 13, 2011, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 11, 2011	Percent Stand					
		2011		2012 ²		2013	
		Oct 11	Mar 23	Oct 10	Mar 28	Oct 29	
Commercial Varieties—Available for Farm Use							
Kenland (certified)	4.1	100	77	69	63	18*	
LS 9703	4.3	100	54	73	69	18*	
Cinnamon Plus	4.5	100	53	65	60	16*	
Freedom!	4.8	100	55	73	58	14*	
Common O	4.9	100	75	62	58	8	
Experimental Varieties							
CW 0400040	4.9	100	45	71	70	18*	
RC 0302	3.8	100	58	72	68	18*	
RC 0705G	4.0	100	56	72	69	17*	
RC 0301	3.5	100	64	76	67	16*	
RC 0303G	4.7	100	58	74	68	16*	
CW 202	4.6	100	42	55	53	15*	
RC 0004	3.9	100	57	65	61	14*	
RC 0402	3.3	100	52	61	58	11*	
B-7.1865	2.3	100	87	87	71	8	
Mean	4.1	100	59	70	64	15	
CV,%	10.7	0	15	13	17	41	
LSD,0.05	0.5	0	11	11	12	7	

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

² Due to sclerotinia outbreak after sowing this trial and new seedling growth in the spring of 2012, this trial was grazed rotationally during the summer of 2012 to allow establishment of the red clover.

*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 August 30, 2012, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 8, 2012	Percent Stand			
		2012		2013	
		Oct 8	Mar 21 ²	Sep 19	
Commercial Varieties—Available for Farm Use					
Cinnamon Plus	4.3	99	67	28*	
Kenland (certified)	4.7	99	85	21	
LS 9703	3.1	95	60	21	
Freedom!	4.6	98	64	20	
Common O	5.0	100	86	8	
Experimental Varieties					
RC 0902G	3.3	98	83	35*	
RC 0401	4.8	99	62	30*	
RC 0402	2.9	94	70	28*	
RC 0802	3.8	99	63	28*	
RC 0705G	3.6	99	72	27*	
RC 0303G	4.4	100	80	25	
GABull-AST	4.1	99	53	13	
GABulldog-S	4.3	98	28	9	
B-11.1815	1.8	94	5	1	
Mean	3.9	98	63	21	
CV,%	10.2	2	23	37	
LSD,0.05	0.6	2	16	9	

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

² At the spring rating there was evidence of sclerotinia, therefore resulting in stand reduction..

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

one that has performed well in independent trials, such as those reported in this publication. Other information on the label will include the test date (which must be within the previous nine months), the level of germination, and the 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

Red clover (fall of 2011 and 2012) and white clover (fall of 2009, 2010, 2011 and 2012) tests for grazing were established in Lexington. Soils at the test site are well-drained silt loams and are well suited to clover production. Plots were 5 feet 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,

Table 4. 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		2011		2012		2013	
		Oct 12	Apr 7	Nov 22 ²	Apr 14	Nov 7	Mar 23	Oct 24	Apr 12	Oct 29	
Commercial Varieties—Available for Farm Use											
Patriot	1.6	96	95	—	21	69	65	43	27	37*	
Will	3.8	98	99	—	16	65	79	45	31	36*	
Durana	1.9	96	95	—	45	69	75	37	23	34*	
Kopu II	2.8	96	96	—	10	54	58	28	18	31*	
Regal Graze	4.3	100	99	—	12	59	77	37	25	29*	
Experimental Varieties											
CW 040041	2.2	92	97	—	7	50	76	38	27	28*	
KYMC	2.0	92	96	—	4	53	72	26	18	28*	
Mean	2.7	96	97	—	16	60	72	36	24	32	
CV,%	28.0	2	2	—	80	32	21	29	40	26	
LSD,0.05	0.9	2	2	—	15	23	18	12	11	10	

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.

plots were grazed from mid-April to mid-September to a height of 1 inch 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 2010, 2011, 2012, and 2013 are presented in Table 1.

Data on percent stand are presented in tables 2 through 7. 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 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 to 2013 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 Table 10 summary, 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 to which yearly report to refer.

Table 5. Seedling vigor and stand persistence of white clover varieties sown September 1, 2010, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 26, 2010	Percent Stand						
		2010	2011			2012		2013
		Oct 26	Mar 15	Nov 7	Mar 23	Oct 25	Apr 12	Oct 17
Commercial Varieties—Available for Farm Use								
Durana	2.4	93	93	95	92	36	25	35*
Patriot	3.2	92	90	93	95	34	31	33*
Will	3.3	96	95	95	97	31	26	32*
Regal	3.8	97	97	89	92	33	28	30*
GWC-AS10	2.4	94	95	90	86	28	19	28*
Kopu II	3.3	90	89	87	87	33	23	28*
KY Select	2.8	92	91	91	92	23	19	26
WBDX	3.1	96	95	87	84	18	16	24
Regal Graze	2.8	94	94	89	90	21	20	21
Experimental Varieties								
CW 040041	3.2	89	89	85	84	27	25	24
Mean	3.0	93	92	90	90	28	23	28
CV,%	28.3	5	5	6	7	26	25	22
LSD,0.05	1.0	6	6	6	7	9	7	7

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. Seedling vigor and stand persistence of white clover varieties sown September 13, 2011, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 11, 2011	Percent Stand				
		2011	2012 ²		2013	
		Oct 11	Mar 23	Oct 10	Mar 28	Oct 15
Commercial Varieties—Available for Farm Use						
Patriot	3.8	100	85	93	94	93*
Durana	3.5	98	85	90	92	92*
Will	3.0	100	92	91	92	91*
Resolute	3.5	100	82	91	92	89*
Kopu II	4.4	100	71	86	86	86
Regal Graze	4.8	100	82	83	88	84
Pinnacle	4.5	100	88	86	89	78
Experimental Varieties						
CW 040041	4.8	100	91	91	93	90*
NFWC04-29	3.4	100	88	92	93	87
NFWC04-49	2.9	97	78	88	87	83
Mean	3.9	100	84	89	91	87
CV,%	16.5	3	8	9	6	6
LSD,0.05	0.7	3	8	9	6	6

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

² Due to sclerotinia outbreak after sowing this trial and new seedling growth in the spring of 2012, this trial was grazed rotationally during the summer of 2012 to allow establishment of the red clover.

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

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 informa-

tion 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 regazing; 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, especially important with red clover

About the Authors

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

Variety	Proprietor/KY Distributor	2011 ¹				2012	
		Mar	Oct	Mar	Oct	Mar	Sep
		2012 ²		2013		2013	
Commercial Varieties—Available for Farm Use							
Cinnamon Plus	FFR/Southern States	x ³	x	*	*	*	*
Common O	Public	x	x	*	x	*	x
Freedom!	Barenbrug USA	x	x	*	*	x	x
Kenland (certified)	Public	*	x	*	*	*	x
LS 9703	Lewis Seed	x	x	*	*	x	x
Experimental Varieties							
B-7.1865	Blue Moon Farms	*	*	*	x		
B-11.1815	Blue Moon Farms					x	x
CW 0400040	Cal/West	x	x	*	*		
CW 202	Cal/West	x	x	x	*		
GABull-AST	Univ of GA					x	x
GABulldog-S	Univ of GA					x	x
RC 0004	FFR/Southern States	x	x	*	*		
RC 0301	FFR/Southern States	x	x	*	*		
RC 0302	FFR/Southern States	x	x	*	*		
RC 0303G	FFR/Southern States	x	x	*	*	*	x
RC 0401	FFR/Southern States					x	*
RC 0402	FFR/Southern States	x	x	*	*	*	*
RC 0705G	FFR/Southern States	x	x	*	*	*	*
RC 0802	FFR/Southern States					x	*
RC 0902G	FFR/Southern States					*	*

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 7. Seedling vigor and stand persistence of white clover varieties sown August 30, 2012, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 8, 2012	Percent Stand		
		2012		2013
		Oct 8	Mar 28 ²	Sep 19
Commercial Varieties—Available for Farm Use				
Will	3.8	98	80	60*
Regal Graze	4.5	98	63	28
Kopu II	3.8	96	38	22
Patriot	2.2	91	37	14
Durana	1.7	84	17	14
Experimental Varieties				
B-12.1218	2.3	89	35	22
Mean	3.0	93	45	27
CV,%	26.1	8	26	46
LSD,0.05	0.9	9	14	15

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

² At the spring rating there was evidence of sclerotinia, therefore resulting in stand reduction..

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

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

Variety	Type	Proprietor/KY Distributor	2009 ¹			2010			2011			2012		
			Apr 2010 ²	Apr 2011	Apr 2013	Mar 2011	Mar 2012	Mar 2013	Mar 2011	Mar 2012	Mar 2013	Mar 2011	Mar 2012	Mar 2013
Commercial Varieties—Available for Farm Use														
Durana	Intermediate	Pennington Seed	x ³	*	*	*	*	*	*	*	*	*	*	*
GWC-AS10	—	Ampac Seed												
Kopu II	Intermediate	Ampac Seed	X	*	X	*	X	*	X	*	X	*	X	*
KY Select	Intermediate	KY Ag. Ex. Sta./Saddle Butte												
Patriot	Intermediate	Pennington Seed	X	*	*	*	*	*	*	*	*	*	*	*
Pinnacle	Ladino	Allied Seed												
Regal	Ladino	Public												
Regal Graze	Ladino	Cal/West Seeds	*	X	*	*	*	*	*	*	*	*	*	*
Resolute	Intermediate	Allied Seed												
WBDX	Dutch	Saddle Butte												
Will	Ladino	Allied Seed	*	X	*	*	*	*	*	*	*	*	*	*
Experimental Varieties														
B-12.1218	—	Blue Moon Farms												
CW 040041	Ladino	Cal/West Seeds	X	X	*	*	*	*	*	*	*	*	*	*
KY MC	Intermediate	KY Agric. Exper. Station	X	X	*	*	*	*	*	*	*	*	*	*
NFWC04-29	—	Noble Foundation												
NFWC04-49	—	Noble Foundation												

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 10. Summary of 2002-2013 Kentucky white clover grazing tolerance trials in Lexington (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	2009	2010	2011	Mean ⁵ (#trials)
			2yr ⁶	4yr	2yr	2yr	3yr	4yr	4yr	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		115	102	123	105	105(7)
GWC-AS10	–	Ampac Seed								98		–
Insight	Ladino	Allied Seed				77						–
Ivory	Intermediate	DLF International	132	142								137(2)
Ivory II	Intermediate	DLF International					102					–
Kopu II	Intermediate	Ampac Seed			77	122	96		93	98	98	97(6)
KY Select	Intermediate	KY Agr Ex. Sta./Saddle Butte						105		91		96(2)
Patriot	Intermediate	Pennington		110	137	122		100	111	116	106	115(7)
Pinnacle	Ladino	Allied Seed									89	–
Rampart	–	Oregro Seeds						90				–
Regal	Ladino	Public	92		57	54		93		105		80(5)
Regal Graze	Ladino	Cal/West			84	87	105	90	87	74	96	89(7)
Resolute	Intermediate	FFR/Southern States			101	106					102	103(3)
Seminole	Ladino	Saddle Butte Ag. Inc.		75		97	91					88(3)
Tillman II	Ladino	Caudill Seed	92									–
WBDX	Dutch	Saddle Butte Ag. Inc.								84		–
Will	Ladino	Allied Seed			117	87	107	105	108	112	104	106(7)

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 Web site 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.



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