

2015 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 fre-

quent 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 10-plus years. Go to the UK Forage Extension website, 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 2015 Red and White Clover Report (PR-695) (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 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.

Table 1. Temperature and rainfall at Lexington, Kentucky in 2012, 2013, 2014, and 2015.

	2012				2013				2014				2015 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	38	+7	4.80	+1.94	38	+7	4.50	+1.64	25	-6	2.28	-.58	32	+1	2.17	-0.69
FEB	40	+5	5.39	+2.18	36	+1	1.78	-1.43	30	-5	5.47	+2.26	26	14	3.08	-0.13
MAR	56	+12	5.64	+1.24	39	-5	5.47	+1.07	39	-5	3.08	-1.32	45	+1	7.34	+2.94
APR	56	+1	3.26	-0.62	55	0	4.46	+0.58	58	+3	5.27	-1.89	57	+2	13.19	+9.31
MAY	69	+5	4.02	-0.45	65	+1	5.23	+0.76	66	+2	5.72	+1.25	69	+5	3.02	-1.45
JUN	73	+1	2.42	-1.24	72	0	7.32	+3.66	75	+3	2.93	-0.73	75	+3	8.20	+4.54
JUL	81	+5	2.50	-2.50	72	-4	9.33	+4.33	74	-2	3.18	-1.82	77	+1	10.22	+5.22
AUG	75	0	1.68	-2.25	72	-3	3.68	-0.25	76	+1	6.53	+2.60	74	-1	3.49	-0.44
SEP	67	-1	6.40	+3.20	67	-1	2.21	-0.99	69	+1	3.63	+4.3	72	+4	3.49	+0.29
OCT	55	-2	2.00	-0.57	55	-2	7.02	+4.45	57	0	5.55	+2.98	59	+2	2.78	+0.21
NOV	43	-2	1.81	-0.65	41	-4	3.06	-0.33	41	-4	2.79	-0.60				
DEC	42	+6	9.57	+4.94	36	0	4.19	+0.21	40	+4	2.47	-1.51				
Total			49.49	+4.94			58.25	+13.70			49.4	+4.85			56.98	+19.80

¹ DEP is departure from the long-term average.

² 2015 data is for the ten months through October.

Description of the Tests

Red clover (fall of 2013 and 2014) and white clover (fall of 2011, 2012, 2013, and 2014) 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, 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 2012, 2013, 2014, and 2015 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 2015 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 2. Seedling vigor and stand persistence of red clover varieties sown September 6, 2013, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 14, 2013	Percent Stand				
		2013 Oct 14	2014 Apr 2 Oct 6		2015 Apr 6 Oct 22	
Commercial Varieties-Available for Farm Use						
LS 9703	2.8	90	92	94	66	21*
SS-0303RCG	4.5	98	99	97	53	18*
Kenland	3.3	95	92	93	70	18*
Freedom!	4.3	97	98	94	56	15
Cinnamon Plus	4.5	99	98	96	53	13
GA 9908	1.9	73	73	83	38	11
Experimental Varieties						
RC 0802	3.8	97	97	94	64	27*
RC 085X-1	4.0	98	99	96	62	26*
RC 0801	3.8	98	97	97	62	24*
RC 0401	4.8	98	98	95	48	20*
RC 0902	4.3	98	98	98	63	19*
RC 0902G	4.3	98	98	97	68	18*
GA Bulldog-S	4.1	98	98	95	33	10
GA Bull-AST	3.9	99	99	98	20	7
B-11.1816	2.3	88	84	90	2	3
Mean	3.8	95	95	94	51	17
CV,%	19.6	7	8	4	36	63
LSD,0.05	0.9	7	9	5	21	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 3. Seedling vigor and stand persistence of red clover varieties sown September 9, 2014, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 9, 2014	Percent Stand		
		2014 Oct 9	2015 Apr 6 Oct 21	
Commercial Varieties-Available for Farm Use				
Gallant	4.0	96	78	40*
Freedom!	4.4	96	78	34*
Kenland	3.7	94	82	29*
SS-0303RCG	3.8	93	80	28*
Common O	4.7	96	82	27*
LS 9703	3.6	92	73	25*
Mean	4.0	95	79	30
CV,%	19.4	3	12	68
LSD,0.05	0.9	4	11	25

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 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		2014		2015	
		Oct 11	Mar 23	Oct 10	Mar 28	Oct 15	Apr 3	Oct 9	Apr 6	Oct 30
Commercial Varieties-Available for Farm Use										
Durana	3.5	98	85	90	92	92	64	47	38	35*
Patriot	3.8	100	85	93	94	93	63	43	35	34*
Will	3.0	100	92	91	92	91	62	40	32	32*
Kopu II	4.4	100	71	86	86	86	43	35	28	31*
Pinnacle	4.5	100	88	86	89	78	40	30	20	24*
Regal Graze	4.8	100	82	83	88	84	50	30	22	20
Resolute	3.5	100	82	91	92	89	63	23	22	18
Experimental Varieties										
CW 040041	4.8	100	91	91	93	90	48	32	27	23*
NFWC04-49	2.9	97	78	88	87	83	47	33	25	21
NFWC04-29	3.4	100	88	92	93	87	55	28	20	19
Mean	3.9	100	84	89	91	87	54	34	27	26
CV,%	16.5	3	8	9	6	6	22	34	42	44
LSD,0.05	0.7	3	8	9	6	6	13	14	13	13

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 alfalfa.

*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 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

Table 5. 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		2014		2015	
		Oct 8	Mar 28 ²	Sep 19	Apr 3	Oct 9	Apr 6	Oct 22
Commercial Varieties-Available for Farm Use								
Will	3.8	98	80	60	69	64	62	45*
Regal Graze	4.5	98	63	28	28	38	37	33
Patriot	2.2	91	37	14	33	47	43	31
Kopu II	3.8	96	38	22	28	35	32	28
Durana	1.7	84	17	14	23	38	30	20
Experimental Varieties								
B-12.1218	2.3	89	35	22	37	43	35	28
Mean	3.0	93	45	27	36	44	40	31
CV,%	26.1	8	26	46	30	27	27	28
LSD,0.05	0.9	9	14	15	13	14	13	10

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

² Lower seedling vigor in some varieties and dry conditions in early fall resulted in less mature plants and higher than normal winterkill.

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

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, especially important with red clover

About the Authors

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Table 6. Stand persistence of white clover varieties sown April 10, 2014, in a grazing tolerance study at Lexington, Kentucky.

Variety	Percent Stand		
	2014	2015	
	Oct 6	Apr 6	Oct 22
Commercial Varieties-Available for Farm Use			
Will	98	90	73*
Regal Graze	97	79	65*
Kopu II	96	53	53*
Seminole	94	67	51
Durana	97	77	50
Canterbury	92	50	46
Patriot	95	81	46
Experimental Varieties			
GA 178	97	75	65*
NFWC04-49	93	73	64*
GA 21160	93	73	47
B-12.1216	96	67	38
Mean	95	72	54
CV,%	3	16	32
LSD,0.05	3	13	20

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

Table 7. Stand persistence of white clover varieties sown September 9, 2014, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Percent Stand		
	2014	2015	
	Nov 3	Apr 6	Oct 30
Commercial Varieties-Available for Farm Use			
Patriot	87	91	93*
Kopu II	96	95	93*
Regal Graze	93	93	93*
Alice	91	90	92*
Durana	83	88	91*
Canterbury	97	95	90*
Seminole	93	91	87*
Will	94	93	86*
Experimental Varieties			
NFWC04-29	94	94	94*
B-12.1216	90	93	93*
NFWC04-49	90	91	92*
SSS-SH1	84	88	91*
GA-178	94	93	90*
GA 21160	92	90	88*
PPG-TR101	80	88	88*
VS-41730	94	89	77
Mean	91	91	90
CV,%	7	5	8
LSD,0.05	7	5	8

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

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

Variety	Proprietor/KY Distributor	2013 ¹				2014	
		Apr	Oct	Apr	Oct	Apr	Oct
		2014 ²		2015		2015	
Commercial Varieties-Available for Farm Use							
Cinnamon Plus	FFR/Southern States	*	*	*	x ³		
Common O	Public					*	*
Freedom!	Barenbrug USA	*	x	*	*	*	*
Gallant	Turner Seed					*	*
GA 9908	Smith Seed	x	x	x	x		
Kenland (certified)	Public	*	x	*	*	*	*
LS 9703	Lewis Seed	*	x	*	*	*	*
SS-0303RCG	FFR/Southern States	*	*	*	*	*	*
Experimental Varieties							
B-11.1816	Blue Moon Farms	x	x	x	x		
GA Bull-AST	Univ of GA	*	*	x	x		
GA Bulldog-S	Univ of GA	*	*	x	x		
RC 0401	FFR/Southern States	*	*	x	*		
RC 0801	FFR/Southern States	*	*	*	*		
RC 085X-1	FFR/Southern States	*	*	*	*		
RC 0802	FFR/Southern States	*	x	*	*		
RC 0902	FFR/Southern States	*	*	*	*		
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 9. Summary of persistence of white clover varieties under heavy grazing pressure across years at Lexington, Kentucky.

Variety	Type	Proprietor/KY Distributor	2011 ¹												2012			2013			2014										
			Mar	Oct	2012 ²	Mar	Oct	2013	Mar	Oct	2014	Mar	Oct	2015	Apr	Oct	2014	Oct	2014	Apr	Oct	2015	Apr	Oct	2015						
Commercial Varieties-Available for Farm Use																															
Alice	Intermediate	Barenbrug																													
Canterbury	Dutch	Allied Seed	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Durana	Intermediate	Pennington Seed																													
Kopu II	Intermediate	Ampac Seed	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Patriot	Intermediate	Pennington Seed	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Pinnacle	Ladino	Allied Seed	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Regal Graze	Ladino	Cal/West Seeds	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Resolute	Intermediate	Allied Seed	X	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Seminole	Ladino	Saddle Butte/Caudill Seed																													
Will	Ladino	Allied Seed	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Experimental Varieties																															
B-12.1216	—	Blue Moon Farms																													
CW 040041	Ladino	Cal/West Seeds	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
GA 178	—	Smith Seeds																													
GA 21160	—	Univ of Georgia																													
NFWC04-29	—	Noble Foundation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
NFWC04-49	Intermediate	Noble Foundation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PPG-TR101	—	Mountain View Seeds																													
SSS-SH1	Ladino	Smith Seed																													
VS-41730	Ladino	Turner 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 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 2002-2015 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} 2yr ⁶	2004 4yr	2006 ³ 2yr	2006 2yr	2008 ⁴ 3yr	2008 4yr	2009 4yr	2010 4yr	2011 4yr	2013 2yr	Mean ⁵ (#trials)
Alice	Intermediate	Barenbrug USA		59	98								79(2)
Barblanca	Intermediate	Barenbrug USA		118	91	151							120(3)
Canterbury	Dutch	Allied Seed										84	-
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	107	126	91	104(8)
GWC-AS10	-	Ampac Seed								77			-
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	113	112	97	101(7)
KY Select	Intermediate	KY Agr Ex. Sta.						105		83			94(2)
Patriot	Intermediate	Pennington		110	137	122		100	111	110	123	84	112(8)
Pinnacle	Ladino	Allied Seed									87		-
Rampart	-	Oregro Seeds						90					-
Regal	Ladino	Public	92		57	54		93		103			80(5)
Regal Graze	Ladino	Cal/West			84	87	105	90	87	93	72	118	92(8)
Resolute	Intermediate	FFR/Southern States			101	106					65		91(3)
Seminole	Ladino	Saddle Butte Ag. Inc.		75		97	91					93	89(4)
Tillman II	Ladino	Caudill Seed	92										-
WBDX	Dutch	Saddle Butte Ag. Inc.								70			-
Will	Ladino	Allied Seed			117	87	107	105	108	143	115	133	114(8)

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 2010 was grazed for four years so the final persistence report would be "2014 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.



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