



2019 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, 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 frequent 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 15 years. Due to minimal stands remaining after two

Table 1. Temperature and rainfall at Lexington, Kentucky, in 2016, 2017, 2018, and 2019.

	2016				2017				2018				2019 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	32	+1	0.80	-2.06	40	+9	6.81	+3.95	31	0	2.01	-0.85	33	+2	4.11	+1.25
FEB	38	+3	6.09	+2.88	47	+12	4.46	+1.25	45	+10	9.77	+6.56	42	+7	7.64	+4.43
MAR	52	+8	4.07	-0.33	48	+4	3.34	-1.06	42	-2	5.16	+0.76	43	-1	3.44	-0.91
APR	57	+2	3.97	+0.09	62	+7	4.17	+0.29	50	-5	5.52	+1.64	54	+4	4.76	+0.88
MAY	64	0	9.17	+4.70	66	+2	7.74	+3.27	73	+9	8.39	+3.92	69	+5	4.49	+0.02
JUN	76	+4	5.09	+1.43	73	+1	7.68	+4.02	76	+4	6.42	+2.76	73	+1	6.13	+2.47
JUL	79	+3	7.43	+2.43	76	0	4.49	-0.51	77	+1	6.15	+1.15	79	+3	3.30	-1.70
AUG	79	+4	4.37	+0.44	74	-1	6.66	+2.73	77	+2	6.45	+2.52	77	+2	2.42	-1.51
SEP	74	+6	2.18	-1.02	69	+1	4.72	+1.52	74	+6	12.88	+9.68	77	+9	0.18	-3.02
OCT	64	+7	0.37	-2.20	60	+3	6.06	+3.49	59	+2	6.54	+3.97	61	+4	8.15	+5.58
NOV	51	+6	1.94	-1.45	47	+2	3.09	-0.30	42	-3	5.64	+2.25				
DEC	37	+1	9.4	+5.42	35	-1	2.66	-1.32	40	+4	7.35	+3.37				
Total			54.88	+10.33			61.88	+17.33			82.28	+37.73			44.67	+7.49

¹ DEP is departure from the long-term average.

² 2019 data is for the ten months through October.

years of grazing, a summary table for red clover is not included in this report. Go to the UK Forage Extension website, at forages.ca.uky.edu, 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 2.5 to 3 years, with the year of establishment considered as the first year. The highest yields occur in the year following establishment. White clover generally persists longer than red clover, particularly in wet seasons and has the ability to reseed even under grazing. Refer to the 2018 Red and White Clover Report (PR-764) (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.

Description of the Tests

Red clover (fall of 2016, 2017, and 2018) and white clover (fall of 2015, 2016, 2017, and 2018) 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-May 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 is presented in Table 1.

Data on percent stand are presented in tables 2 through 8. 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.

Tables 9 and 10 show information about distributors for all red and white clover varieties included in these tests.

Table 11 is a summary of stand persistence data from 2002 to 2019 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 bet-

Table 2. Seedling vigor and stand persistence of red clover varieties sown September 8, 2016, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 4, 2016	Percent Stand						
		2016		2017		2018		2019
		Oct 4	Mar 15	Oct 11	Mar 15	Sep 26	Mar 28	Nov 5
Commercial Varieties-Available for Farm Use								
Freedom!	4.8	100	93	75	43	16	2	0*
Kenland (certified)	4.9	99	97	65	56	13	2	0*
SS0303RCG	4.9	100	97	89	80	9	2	0*
Experimental Varieties								
GA9908	4.9	100	90	82	61	11	3	0*
Mean	4.9	100	94	78	59	12	2	0
CV,%	5.8	1	5	13	28	57	82	0
LSD,0.05	0.4	1	5	13	20	9	2	0

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, 2017, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 11, 2017	Percent Stand				
		2017		2018		2019
		Oct 11	Mar 14	Sep 26	Mar 28	Nov 5
Commercial Varieties-Available for Farm Use						
Freedom!	5.0	100	99	45	14	0*
Gallant	4.7	100	99	47	18	0*
Kenland (certified)	4.9	100	100	65	27	0*
SS0303RCG	4.9	100	99	65	22	0*
Experimental Varieties						
GA1401	4.9	100	97	47	17	0*
GA1402	4.5	100	97	58	13	0*
GA1403	3.0	97	97	51	18	0*
GA9908	5.0	100	97	53	21	0*
GATPCP	4.7	100	99	52	20	0*
RC0705G	4.8	100	99	81	38	0*
Mean	4.6	100	98	56	21	0
CV,%	8.2	1	2	30	44	0
LSD,0.05	0.4	1	2	19	11	0

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 5, 2018, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Sep 28, 2018	Percent Stand		
		2018	2019	
		Sep 28	Mar 28	Nov 5
Commercial Varieties-Available for Farm Use				
Gallant	3.7	98	94	28*
Freedom! MR	4.8	99	97	25*
Kenland (certified)	4.3	96	92	23*
CW9901	4.8	99	96	22*
Barduro	4.5	97	89	19*
Common O	4.6	96	98	12*
SS0303RCG	4.4	98	97	10*
Mean	4.4	98	95	22
CV,%	10.4	3	4	66
LSD,0.05	0.7	4	5	20

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 white clover varieties sown September 3, 2015, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 11, 2015	Percent Stand								
		2015			2016			2017		2018
		Dec 11	Mar 24	Oct 5	Mar 22	Oct 12	Mar 15	Sep 26	Mar 28	Nov 5
Commercial Varieties-Available for Farm Use										
Durana	3.2	91	91	95	95	90	81	78	69	47*
Patriot	2.0	88	90	94	94	93	82	80	72	38*
Will	4.2	96	98	93	92	87	82	73	73	37*
Neches	4.0	95	95	96	94	88	78	72	73	32
Kopu II	4.5	96	95	88	87	84	73	77	65	27
RegalGraze	4.3	97	97	87	83	74	60	62	63	27
Alice	3.7	77	94	94	91	85	78	70	62	22
Renovation	1.2	71	68	78	77	72	65	66	63	17
Experimental Varieties										
GA-178	2.3	90	90	87	88	79	69	63	63	33
BARTRALRG	3.9	93	95	92	88	83	76	71	61	30
Mean	3.3	89	91	90	89	83	74	71	66	31
CV,%	26.7	14	8	6	7	6	12	11	14	36
LSD,0.05	1.0	15	8	7	7	6	10	9	11	13

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 8, 2016, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 4, 2016	Percent Stand						
		2016		2017		2018		2019
		Oct 4	Mar 15	Oct 11	Mar 16	Sep 26	Mar 28	Nov 5
Commercial Varieties-Available for Farm Use								
Will	4.5	100	98	94	94	94	88	48*
Durana	3.5	97	95	97	97	99	80	47*
Patriot	3.6	97	97	98	98	97	88	43*
RegalGraze	5.0	100	95	90	88	83	80	43*
Kopu II	4.8	100	89	94	94	92	68	42*
Alice	3.5	96	94	95	94	87	62	40*
Mean	4.2	98	95	95	94	92	78	44
CV,%	11.0	2	2	4	4	5	16	35
LSD,0.05	0.5	2	3	4	4	6	15	18

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 7. Seedling vigor and stand persistence of white clover varieties sown September 9, 2017, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 11, 2017	Percent Stand				
		2017		2018		2019
		Oct 11	Mar 14	Sep 26	Mar 28	Nov 5
Commercial Varieties-Available for Farm Use						
Patriot	3.2	95	95	96	95	50*
Will	4.3	97	98	95	94	50*
Kakariki	4.7	99	98	97	95	48*
Alice	3.9	96	96	97	95	42*
Renovation	3.6	96	95	96	95	40*
Durana	3.8	97	97	97	96	38*
RegalGraze	4.8	99	99	92	92	38*
Experimental Varieties						
NFWC04-29	3.7	97	97	95	95	52*
Mean	4.0	97	97	95	94	45
CV,%	18.5	2	2	3	3	38
LSD,0.05	0.9	2	2	4	3	20

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.

ter than average, and varieties with percentages less than 100 persisted less than average. Direct, statistical comparisons of varieties cannot be made using the Table 11 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 11 to determine the yearly report that should be referenced. Due to minimal stands remaining after two years of grazing, a summary table for red clover is not included in this report.

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 7 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, especially important with red clover

For further information about grazing clover management, refer to the College of Agriculture publications, available at the local Extension office or in the publication section of the UK Forage website at forages.ca.uky.edu.

- Renovating Hay and Pastures Fields (AGR-26)
- Weed Control Strategies for Alfalfa and Other Forage Legume Crops (AGR-148)
- Rotational Grazing (ID-143)
- Grazing Red Clover in Kentucky (AGR-33)
- Grazing White Clover in Kentucky (AGR-195)
- Managing Legume Induced Bloat in Cattle (ID-186)

About the Authors

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Table 8. Seedling vigor and stand persistence of white clover varieties sown September 5, 2018, in a cattle grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Sept 28, 2018	Percent Stand		
		2018	2019	
		Sep 28	Mar 28	Nov 5
Commercial Varieties-Available for Farm Use				
Will	3.9	93	88	87*
Alice	3.8	93	64	79*
RegalGraze	4.1	96	89	78*
Durana	2.5	84	67	75*
Patriot	2.8	79	62	70*
Kopu II	3.5	93	55	63
Mean	3.4	90	71	75
CV,%	17.1	9	15	20
LSD,0.05	0.7	10	13	18

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 9. Proprietors and clover type of white clover varieties in current grazing trials in Kentucky.

Variety	Type	Proprietor/KY Distributor
Commercial Varieties-Available for Farm Use		
Alice	Intermediate	Barenbrug
Durana	Intermediate	Pennington Seed
Kakariki	Ladino	Luisetti Seeds
Kopu II	Intermediate	Ampac Seed
Patriot	Intermediate	Pennington Seed
Neches	Intermediate	Barenbrug
Regal Graze	Ladino	Cal/West Seeds
Renovation	Intermediate	Smith Seed
Will	Ladino	Allied Seed
Experimental Varieties¹		
BARTRALRG	–	Barenbrug
GA 178	–	Smith Seed
GA 21160	–	Univ of Georgia
NFWC04-29	Intermediate	Noble Foundation

¹ Experimental varieties are not available commercially, but provide an indication of the progress being made by forage breeding companies.

Table 10. Proprietors of red clover varieties in current grazing trials in Kentucky.

Variety	Proprietor/KY Distributor
Commercial Varieties-Available for Farm Use	
Barduro	Barenbrug USA
Common O	Public
CW9901	Barenbrug USA
Freedom!	Barenbrug USA
Gallant	Turner Seed
Kenland (certified)	Public
SS-0303RCG	Southern States
Experimental Varieties¹	
GA1401	Univ. of Georgia
GA1402	Univ. of Georgia
GA1403	Univ. of Georgia
GA9908	Univ. of Georgia
GATPCP	Univ. of Georgia
RC0705G	Hood River Seeds

¹ Experimental varieties are not available commercially, but provide an indication of the progress being made by forage breeding companies.



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