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RESEEDING OF CRIMSON CLOVER

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Summary

Seven crimson clover (*Trifolium incarnatum* L.) varieties were evaluated for their reseeding potential in northeast Texas when grazing was terminated at 2-week intervals from 1 April to 13 May 1994. None of the varieties flowered and produced seed at the 13 May grazing termination date (GTD), and only 'Columbus' did at the 29 April GTD. Grazing crimson clover until 15 April in northeast Texas did not reduce flower density, seed production or seed wt/flower. Hard seed percentage averaged about 35% after seed harvest but decreased to 12% 90 days later. There were significant differences among varieties for hardseededness. 'Auburn' had the highest hard seed percentage and Columbus and 'Tibbee' the lowest 90 days after seed harvest. 'Flame' and Auburn had the best volunteer seedling density the following fall and Columbus and Tibbee the worst. Reseeding potential of crimson clover needs to be improved by selecting for increased hard seed percentages and slower rate of seed softening during the summer.

Introduction

Crimson clover is one of the predominant cool-season annual legumes grown in the eastern half of Texas and the southeastern United States (Knight, 1985). Its primary use is for overseeding warm-season perennial grasses to extend the grazing season and reduce the need for nitrogen fertilizer (Dunavin, 1982; Knight, 1970). Because of its large seed, crimson clover has better seedling vigor and earlier forage production than most other cool-season annual clovers (Evers, 1982). The early maturity of crimson clover is also an advantage when overseeding, since there is less competition in the spring when warm-season grasses resume growth.

If crimson clover could be managed to reseed each fall, the annual costs of seed and planting ($15 to $20/acre) could be eliminated. Other advantages of volunteer stands are that the seed are already present when the first significant rainfall occurs in early fall and stands may be

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thicker because of more seed/acre than the recommended seeding rate. A disadvantage of managing cool-season annuals for reseeding is the unutilized forage in spring when livestock must be removed or stocking rate reduced to allow for seed production. Successful reseeding of cool-season annual clovers is dependent on hard seed production. Hard seed refers to seeds with an impermeable seed coat which prevents absorption of moisture to initiate germination (Kendall and Stringer, 1985). Seed coat impermeability (hardseededness) of crimson clover declines rapidly after seed maturity and therefore it is considered a poor reseeder (Williams and Elliott, 1960). Reseeding potential of seven crimson clover varieties was determined when grazing was terminated on different dates.

Procedures

Test site was on a Sacul fine sandy loam (clayey, mixed, thermic aquic Hapludult) with a pH of 6.5 with 18 ppm P and 133 ppm K. Sixty lbs of P and K and 1 lb boron/acre were applied on 24 September 1993. Auburn, 'AU Robin', 'Chief', Columbus, 'Dixie', Flame, and Tibbee crimson clovers were planted at 16 lbs PLS (pure live seed)/acre on 29 September. Seed were drilled in 7-in. rows in a lightly disked bermudagrass (*Cynodon dactylon* [L.] Pers.) sod in 4- by 40-ft strips. Experimental design was a complete randomized block with four replications. Cattle were allowed to graze the test site beginning in late February. On 1 April, a temporary electric fence was used to exclude the animals from 10 ft of one end of the 40-ft strips. The electric fence was moved an additional 10 ft across the grazed area every 2 weeks to simulate grazing termination dates (GTD) of 1 April, 15 April, 29 April and 13 May.

When the clover matured, a random 3-ft length of row was hand cut from each plot to record seedhead density. Seed were cleaned by hand using rubber covered rubbing surfaces and weighed within 2 weeks of seedhead harvest. One hundred seed from each plot were placed on a 3- by 3-in. indented germination pad which was placed in a 3.25 by 2-in. petri dish. Petri dishes were placed in a germinator set at 77°F day and 59°F night temperatures with 12-hr days. The germination pad was kept moist with deionized water during the study. After 10 days the number of remaining hard seed was recorded.

Extra seed not used for the initial germination test were placed in an incubator at high diurnal alternating temperatures of 104°F and 77°F for 90 days. This treatment simulates summer soil surface temperatures and is used to measure the rate of hard seed softening (Smith, 1988).

At 30 and 90 days of heat treatment, another germination test identical to the initial test was conducted on 100 seed to determine hard seed percentage.

During the summer, the study site was grazed by livestock until early October. Volunteer clover stands were estimated by counting the number of clover seedlings in two random 12- by 14-in. quadrants in each plot. Data were analyzed as a split plot design with GTD as main plots and varieties as subplots. Mean separation was by Waller-Duncan at $P \leq .05$.

Results and Discussion

None of the varieties produced flowers at the 13 May GTD and only the late maturing Columbus variety produced flowers and seed at the 29 April GTD. Therefore, statistical analysis was run only on the two earlier GTDs. Although flower density, seed yield and seed weight/flower were higher for the 15 April GTD, they were not significantly different from the 1 April GTD (Table 1). Variety did have an influence on flower density and seed weight/flower. Dixie, Flame, and Tibbee varieties of crimson clover had a combination of high flower density and seed weight/flower. Columbus had a low flower density but a high seed weight/flower. Seed yields ranged from about 100 lbs/acre for Auburn and AU Robin to 232 lbs/acre for Tibbee with a variety average of about 150 lbs/acre. These yields are low compared to 800 lbs/acre under seed production conditions in Oregon. Lower seed yields in this study are probably due to a combination of grazing and climate. However, if only 10% to 15% of these seed produced healthy seedlings in the autumn, it would be equal to a recommended seeding rate of 16 to 20 lbs/acre.

Averaged across GTDs, the initial hard seed percentage was about 35% but decreased to about 12% in 90 days (Table 2). The initial and 30-day hard seed percentage was higher for the 15 April GTD, but there was no difference at 90 days. There were significant differences among varieties for hard seed percentage. The ranking of varieties varied but Auburn usually had the highest hard seed percentage and Columbus always had the lowest. There was a GTD x variety interaction for hard seed percentage at 90 days. Auburn, AU Robin, Chief, and Flame had a 50% increase in hard seed percentage from the 1 April to 15 April GTD with very small increases for Columbus, Dixie and Tibbee (data not shown).

The number of volunteer clover seedlings in the autumn is dependent on seed production and hard seed percentage. Grazing termination date did not influence volunteer seedling density because there were no significant differences in seed production (Table 1) or hard seed percentage at 90 days (Tables 2). Flame had the highest volunteer seedling density because of average seed production and hard seed percentage. Auburn and AU Robin had good hard seed percentage but low seed production. Because seed of Auburn crimson clover are not commercially available, old seed were used for this study which may have influenced plant vigor and seed production. Poor volunteer reseeding of Tibbee and Columbus was due to very low hard seed percentage.

Because of later maturity, Columbus was the only variety to flower and produce seed at the 29 April GTD. A comparison of the data from this date is made with the two earlier dates in Table 3. Grazing Columbus until 29 April decreased flower density, seed production, and seed/flower; however, hard seed percentage increased slightly as grazing was extended. Volunteer reseeding was less at the 29 April GTD because of lower seed production.

Crimson clover varieties can be grazed until 15 April in northeast Texas without harming their reseeding potential. Varieties did vary in reseeding ability with Auburn and Flame reseeding the best. Tibbee and Columbus had the poorest reseeding because of very low hard seed percentage. Reseeding potential of crimson clover varieties can be improved by selecting for improved hardseededness and evaluating management practices and soil fertility to increase seed production.

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Table 1. Influence of grazing termination date and variety on crimson clover flower density, seed yield, and seed wt/flower.

	Flower density	Seed yield	Seed weight per flower
	No./ft^2	lb/acre	mg
Grazing Termination Date (GTD)			
Apr 1	26.7 a[1]	124 a	45.2 a
Apr 15	32.6 a	184 a	59.2 a
Variety			
Auburn	26.5 bc	105 a	38.9 c
AU Robin	22.5 c	104 a	48.4 a-c
Chief	38.6 a	155 a	41.6 bc
Columbus	25.7 bc	164 a	66.3 ab
Dixie	30.3 a-c	157 a	51.3 a-c
Flame	30.6 a-c	163 a	50.9 a-c
Tibbee	33.3 ab	232 a	68.2 a
GTD x Variety	NS	NS	NS

[1]Values in a column for GTD and variety followed by the same letter are not significantly different at .05 level.

Table 2. Influence of grazing termination date and variety on crimson clover hard seed percentage and volunteer stands.

	Hard Seed Percentage			
	Initial	30 days	90 days	Seedling density
	%			no./ft²
Grazing Termination Date (GTD)				
Apr 1	30.3 b[1]	23.5 b	10.0 a	11.6 a
Apr 15	40.4 a	33.5 a	14.6 a	9.9 a
Variety				
Auburn	43.3 ab	51.0 a	32.0 a	14.0 ab
AU Robin	32.1 bc	34.5 bc	16.1 b	10.4 bc
Chief	48.0 a	38.0 b	12.9 bc	11.4 bc
Columbus	26.5 c	6.4 e	1.6 e	4.0 d
Dixie	28.9 c	26.5 cd	11.3 cd	12.0 bc
Flame	34.4 a-c	31.1 b-d	14.8 bc	17.4 a
Tibbee	38.3 a-c	23.4 d	7.1 d	8.0 cd
GTD x Variety	NS	NS	*	NS

[1]Values within a column for GTD and variety followed by the same letter are not significantly different at .05 level.

Table 3. Influence of three grazing termination dates (GTD) on seed production and hard seed percentage of Columbus crimson clover.

	GTD		
	1 Apr	15 Apr	29 Apr
Flower density (No./ft^2)	24.5	26.8	21.7
Seed yield (lb/acre)	156	172	107
Seed wt/flower (mg)	37.0	38.2	29.1
Initial hard seed (%)	22.3	30.8	33.8
30 day hard seed (%)	5.5	7.3	11.0
90 day hard seed (%)	1.5	1.8	4.0
Seedling density (No./ft^2)	4.3	3.8	2.1