

Mississippi State University
AGRICULTURAL EXPERIMENT STATION

CLAY LYLE, Director

STATE COLLEGE

MISSISSIPPI

"CHIEF", A NEW RESEEDING VARIETY OF CRIMSON CLOVER

By HUGH W. BENNETT¹

AGRONOMY DEPARTMENT, MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

A new reseeding crimson clover variety, named Chief, has been developed at the Mississippi Agricultural Experiment Station in cooperation with the Crops Research Division, USDA.

Chief has the following improved characteristics:

- (1) Small seed size and consistent in percent hard seed
- (2) Greater seedling vigor
- (3) Equal to other varieties for plant emergence and survival during hot months and definitely superior during cold weather.
- (4) Equal or superior forage and seed yields, especially on heavier soils
- (5) Less sensitive to defoliation by clipping or grazing than other varieties
- (6) Produces slightly larger plants with a deeper green color
- (7) Higher dry matter content at comparable stages of growth.

The new variety is not readily distinguished from other varieties of crimson clover. For this reason it will be necessary for seed to be produced under certification in order that the improved characteristics be maintained.

Crimson clover (*Trifolium incarnatum* L.) is widely adapted to the Central and Eastern United States. As a forage crop it grows well alone and in combination with grass. Its use is increasing as a high quality plant in winter grazing mixtures and as a winter legume or cover crop.

The thin seed coat of the common crimson clover permits easy water absorption, causing germination at a moisture level too low for survival. This circumstance, which may occur at any time after the seed is mature, caused most failures with this crop. Development of a type of clover with varying degrees of hard seededness was needed to meet this disadvantage. This would help insure crop success and enable volunteering through the season, and self-reseeding in succeeding years. Additional improvement over other varieties were also sought, such as greater yields of forage and seed, greater seedling vigor, prolonged growing period, and other desirable characteristics.

Origin and Development

This new variety was derived from various commercial lots of common crimson clover by a water-soak mass-screening laboratory selection technique especially designed for this purpose. Since all common crimson clover seed tested averaged a fraction of a percent of "hard seed" (seed coat of higher degrees of impermeability) it was thought that by rigorous selection of such seeds from large masses of common seed new progeny lines of clover with higher hard seed percentage might be obtained. By further reselection from these lines, through successive generations, it was aimed to secure genetically fixed strains of clovers yielding higher and higher percentages of hard seed.

Bulk water-soak method of screening:

The initial screening consisted of saving the seed which were not swollen after soaking 3 days in water. The hard seed content of 120 pounds of composited common crimson clover seed from 42 sources averaged 0.775 percent. This 0.9 pound of hard seed was planted at the Natchez and North Mississippi Branch Stations and at the central station at State College. The hard seed content of harvests from these plantings averaged 3.3 percent at Natchez, 3.7 percent at North Mississippi, and 3.9 percent at State College.

Seed from these harvests were bulked, soaked 3 days, and the hard seed space planted at State College in 1940. Hard seed determinations were made on random plants in 1941 and the entire field was rolled down with a cultipacker. Several volunteer stands were obtained and lost during the summer and fall of 1941. Seed were harvested in 1942 from 300 selected plants from the volunteering stand and percent hard seed determined by the laboratory water-soak method.

Water-soak method of hard seed determination: Seed used for the determina-

tion of hard seed were removed from the hull by hand rubbing. No implement or gloved hand was ever used. Samples of 100 seed were taken by means of a vacuum seed counter from the hand-hulled seed from each plant selection. Each sample was placed in a small glass vial, covered with water, and kept at room temperature. Swollen seeds were removed and counts made on unswollen seed every 24 hours for 7 consecutive days, and again at the end of two weeks. Fresh tap water was added after each count and the seed were submerged at all times except for counting.

All hard seed determinations have been subjected to the normal seasonal variation of summer and fall temperatures existing in the laboratory at State College throughout the period of testing. This method of determining hard seed content served as the basis for selection regardless of any other plant characteristics.

All plantings have been isolated from other crimson clover by a minimum of 2500 feet. No attempt has been made otherwise to control pollination between plants or rows of plants within the isolated plantings. This procedure was used to permit the maintenance of a wide gene base. Selections were planted on clean isolated areas each year.

Severe selection pressure for lateness of spring growth was practiced through the last four years (1944-1947). The population of 1944 was rated for date of maturity and was found to be 62 percent early, 12 percent medium, and 26 percent late plants. Three weeks was the range in dates of maturity. Selection made from the late maturing plants gave the variety its late habit of growth.

A severe epidemic of sooty-blotch (*Cynaclothea trifolii* Fr.) occurred in 1947. Only late maturing and disease free plants were selected. The hard seed content of these selections averaged 62.93 percent. Eighty-four percent of this population contained 51 percent or more hard seed. The seed of this 84 percent were bulked and planted in an isolated block.

¹Agent, Research Agronomist, Crops Research Division, and Agronomist, Mississippi Agricultural Experiment Station.

Bulk volunteer stands were produced on this block during 1948, 1949, and 1950 before being placed in various testing programs.

Thus in nine years of successive selection by the water-soak mass-screening technique the average percentage of hard seed was increased progressively from 0.775 for the common stock to 4, 13, 16, 20, 43, 48, 49, and 63 for the last year selection was made. The details of this development may be seen in Table 1.

Description

Chief is quite similar to other crimson clover varieties and the improved characteristics are not readily distinguished by either seed or plant inspection except under carefully controlled conditions. It produces larger plants and the leaves have a deeper green color, with more black along the midribs of the leaflets. Chief is one of the latest maturing varieties and possesses the superior characteristics of making faster and more growth during cold weather than other varieties.

Seed counts of weighed samples of 3 varieties showed that there were 168,105 seed per pound of Chief, 114,830 seed of Dixie, and 102,390 of Common. A pound of Chief contained 46 percent more seed than a pound of Dixie, and 64 percent more than common crimson clover. Weighed samples of the 3 varieties graded over screens of varying diameters show that Chief contains a higher percent of its seed in the smaller sizes than other varieties.

The coefficient of correlation between the seed passing over each screen size and hard seed are highly significant. Hard seed and small seed have been found to be positively correlated in other studies.²

The higher percentage of small seed in Chief causes it to be more consistent in percent hard seed.

Seedling vigor: It was noted that Chief has greater seedling vigor than does Dixie. Differences in seedling vigor were not explained on the basis of percent hard seed or seed size.

Stand emergence and survival: Dates of seeding tests beginning July 1 and continuing through March 25 have been made for several years.³ Emergence counts were made every 2 weeks and stand sur-

vival counts were made just before harvest for forage yields.

These data show that Chief is equal to Common and Dixie in emergence and survival during the hot dry weather of summer and early fall, and superior during the cool fall and winter months. This has been observed for several years and the trend has been the same each year. Yield data from the dates of seeding tests have shown higher forage yields for Chief for 13 of 18 planting dates. A stand which can produce higher yields is more certain with Chief than with other varieties. Experience has shown that summer and fall emergence without sufficient moisture for stand establishment and survival has been the major cause of failures.

Yield: Chief was tested for forage yields in comparison with other crimson clover varieties at 3 locations in Missis-

sippi for four years and for two to four years in 9 other southern states. From these data it appears that Chief is equal in forage production to any variety now grown and superior to most.

Time of clipping tests have shown that seed yields of Chief are less adversely affected by defoliation than other varieties. This means that more grazing may be obtained with less danger of reducing seed production for harvest and reseed-ing.

Seed Supply

The Mississippi Experiment Station expects to have seed of the new Chief crimson clover available for distribution by June, 1959. A 2-acre block of breeders' seed is being produced at Mississippi State University and the Brown Loam Branch Station at Oakley has 12 acres which will produce seed next spring.

Table 1. Development of hard seed content in crimson clover by the water-soaking method of selection.

Classes of hard seed, %	Percent of population in each hard seed class								
	1939	1940	1941	1942	1943	1944	1945	1946	1947
0-10	100	100	35.5	0.7	12.5	0.0	3.9	0.0	0.5
11-20			57.7	0.7	44.3	2.2	16.1	0.4	0.8
21-30			6.4	2.2	26.1	11.6	13.6	4.4	1.7
31-40			0.0	16.7	10.2	30.4	27.8	22.2	4.2
41-50			0.4	36.2	5.7	33.2	26.6	36.7	8.6
51-60				38.4	1.1	14.4	6.3	28.2	17.5
61-70				5.1		6.6	3.9	6.5	35.6
71-80						1.7	1.5	1.6	27.1
81-90							0.5		3.7
90-94									0.3
Average	0.775	3.7	11.9	16.4	20.0	42.6	47.6	48.9	62.9
Range	0-5.4	0-0	3-41	4-69	5-58	13-74	6-85	16-78	7-92
Population	100 lbs.	100 lbs.	300	300	375	600	600	379	631

Table 2. Percent of seed of each size in 3 varieties

Variety	Diameter in inches					
	1/14	1/16	1/18	1/20	1/22	T1/22
Chief	1	36	48	10	3	2
Common	8	47	39	5	1	0
Dixie	5	55	37	2	1	0
Autauga	2	50	42	5	1	0
Kentucky	2	48	44	6	1	0

Table 3. Date of planting and total number of plants emerged.

Variety	Dates of planting and total number of plants emerged									
	10/4	10/18	11/1	11/15	12/1	12/15	1/2	1/29	2/28	Mean
Chief	77.5	273	148	103	114	142	142	130	167	144.0
Common	97.8	234	146	128	75	73	91	120	172	126.4
Dixie	67.8	188	128	105	36	25	106	73	112	93.4
Variety	Dates of planting and total number of plants surviving									
	25	188	84	127	55	80	105	109	143	99.5
Chief	25	188	84	127	55	80	105	109	143	99.5
Common	21	175	137	130	27	48	71	80	105	88.2
Dixie	24	165	88	82	10	16	81	56	106	69.8

Table 4. Average dry matter yields in pounds per acre of crimson clover varieties, 4 replications at each of 3 locations in Mississippi.

Variety	1949-50	1950-51	1951-52	1952-53
Auburn	1579	8046	4516	3344
Autauga	1993	7499	4012	3344
Chief	3267	8640	4916	4308
Common	1493	7380	4219	3116
Dixie	2908	8272	4368	3224
Talladega	1536	8699	4080	4189

²Potts, Howard C. The effect of defoliation, harvesting and processing on the hard seedness of crimson clover. Masters' Thesis. Mississippi State College. 1955.

³Knight, W. E. Clover breeding, disease and quality investigations. A.R.S., U.S.D.A. Ann. Rpt. 1953.