Results and Discussion

The results are summarized in Table 1. Three sub clover lines were identified which maintained 60 percent or more hard seed after the 90-day storage for both 1984 and 1985. After 90 days of storage, Mt. Barker sub clover dropped to 40 and 45 percent hard seed in 1984 and 1985, respectively.

In field experiments conducted at Overton and Angleton, Mt. Barker sub clover germinated over 98 percent of total seed that germinated in the summer or fall preceding seed maturation. Under these conditions, no hard seed carried over to the next year was available to compensate for stand failures. In this situation, reseeding management becomes crucial. One stand failure due to fall drought, unseasonably cold weather, or insect infestation could break the reseeding cycle.

Further testing is required to determine if the high hard seed sub clover lines identified in this study have improved reseeding capability under field conditions. Other characteristics such as forage production, maturity, and pest resistance will determine if these lines are directly usable as improved sub clover germplasm or if they would only be used in a crossing program to introduce the hard seed character into other lines with desirable agronomic qualities.

Seasonal Production of Annual Forage Legumes at Overton, 1983-1985

G. R. Smith and C. L. Gilbert

Summary

Thirty-four annual clovers, including arrowleaf, crimson, subterranean, berseem, ball, and rose were evaluated for forage production and adaptation at Overton in 1983-84. Twenty-seven annual clovers and six vetches were evaluated in 1984-85. 'Chief' crimson and 'Wilton' rose clover were top forage producers in 1983-84, with yields of 4,411 and 3,878 lb DM/A, respectively. In 1984-85 'Meechee' arrowleaf topped the annual clover trial with 3,100 lb DM/A. Vetch yields ranged from 3,549 to 244 lb DM/A for 'Hairy' and 'Vantage,' respectively. Ten rose clover experimental lines, in production trials for the first time, were all higher yielding than the three check varieties.

Introduction

Annual forage legumes have the potential to improve the seasonal distribution of high quality forage in Texas beef and dairy production systems without high inputs of nitrogen fertilizer. The objectives of these experiments were: 1) to determine seasonal distribution of annual forage legume dry matter production; and 2) to observe the general adaptation of annual forage legumes to East Texas soil and climatic conditions.

KEYWORDS: Annual clovers/East Texas/seasonal distribution/yields.

Procedure

Eighteen annual clovers were drilled into a native sod of common bermudagrass and *Paspalum setaceum* on October 14, 1983. Twenty-seven annual clovers and six vetches were drilled into a mixed 'Coastal' and common bermudagrass sod on October 11, 1984. Stands were lost in 1984 on 14 annual clovers, including arrowleaf, ball, berseem, and crimson, due to grasshopper and/or cricket damage. These clovers were replanted on November 12, 1984. A small-plot drill with six double disk openers, spaced 9 inches apart, was used to place seed one-half inch deep in 5×7 foot plots. Fertilizer and lime were applied according to soil test (Table 1). The clovers were harvested at 2.25 inches and the vetch at 1.75 inches with a rotary mower.

Sixteen varieties or experimental lines of subterranean (sub) clover were established in 6×12 foot plots on a prepared seedbed September 17, 1981. These plots were fertilized at planting and in fall 1982 with 0-20-20 at 450 lb/A. Summer growth of grass and weeds was removed prior to planting by mowing at 2 inches. In September 1983, fertilizer was applied according to soil test (Table 1). The sub clover was harvested with a rotary mower at 1.25 inches.

Seeding rates and *Rhizobium* inoculants for each legume species are shown in Table 2. Peat inoculant, supplied by the Nitragin Co., was applied at 1 oz per pound of seed with Pelgel solution used as an adhesive to stick inoculant to the seed.

Each experiment was arranged in a randomized complete block design with four replications. At each harvest, forage samples were weighed, dried at 70°C for 48 hours, and weighed again. Percent dry matter of the samples was used to calculate dry matter yield per acre.

TABLE 1. SOIL pH, FERTILIZER, AND LIME FOR FORAGE LEGUME PRODUCTION TRIALS IN 1983-85

Experiment	Year	Soil Type	Soil pH	Fertilizer and Lime			
				P_2O_5	K_2O	S	Lime
				Pounds/acre			
Annual clover	1983	Sawtown	6.8	90	90	0	0
Reseeding sub[1]	1983	Bowie	7.1	90	90	0	0
Annual clover	1984	Sawtown	5.9	72	116	44[2]	2,000
Rose clover	1984	Sawtown	5.9	72	116	44[2]	2,000
Vetch	1984	Sawtown	5.9	72	116	44[2]	2,000

[1]Established in 1981.

[2]Applied as K-Mag, supplied by Duval Corporation.

Results and Discussion

1983-84

Total production in the sod-seeded annual clover test ranged from 4,411 to 1,189 lb DM/A for 'Chief' crimson and 'CH-N' crimson clover, respectively (Table 3). The annual clovers produced more in May with the exception of 'Autauga,' 'Tibbee,' 'Dixie' crimson, and 'Kondinin' rose clover which peaked in April. Tibbee, Autauga, and Chief crimson were the highest yielding at the first harvest. Arrowleaf clover yields at Overton in 1983-84 were lower than expected. Total rainfall during March, April, and May 1984 was five inches below the 17-year average. This low soil moisture condition was a factor in reducing arrowleaf clover yields at the last harvest in May.

TABLE 2. SEEDING RATES AND *RHIZOBIUM* INOCULANTS USED IN EVALUATION OF ANNUAL FORAGE LEGUMES

Species	Seeding Rate lbs/acre	Inoculant Type[1]
Arrowleaf	14.3	O
Ball	3.6	B
Berseem and Crimson	19.6	R
Rose and Subterranean	19.6	WR
Common Vetch	35.0	C
Hairy and Big Flower Vetch	25.0	C

[1]Supplied by the Nitragin Co., Milwaukee, WI. Applied at 1.0 oz per pound of seed with Pelgel solution as an adhesive.

TABLE 3. SEASONAL PRODUCTION OF ANNUAL CLOVERS AT OVERTON, TEXAS, 1983-84

Variety	Harvest Date 3-19	4-12	5-11	Total
	Pounds DM/Acre			
Chief[3]	564	1,914	1,933	4,411 a[1]
Wilton Rose	293	1,472	2,113	3,878 ab
Autauga[3]	797	1,752	915	3,464 abc
Tibbee[3]	872	1,595	838	3,305 abc
287973 Rose	151	1,121	1,978	3,250 abc
RRPS-5[2]	265	666	2,123	3,054 abc
Dixie[3]	522	1,487	1,029	3,038 abc
Kondinin Rose	548	1,241	1,014	2,803 abcd
Meechee[2]	117	430	2,249	2,796 abcd
Syn 4[2]	174	658	1,891	2,723 bcd
Yuchi[2]	256	659	1,657	2,572 bcd
Syn 2[2]	87	489	1,912	2,488 bcd
Syn 3[2]	78	650	1,738	2,466 bcd
Amclo[2]	103	756	1,472	2,331 bcd
Segrest Ball	0	392	1,565	1,957 cd
Common Ball	0	373	1,500	1,873 cd
Bigbee Berseem	124	360	751	1,235 d
CH-N[3]	175	447	567	1,189 d

C.V. = 21.1%

[1]Yields followed by the same letter are not significantly different at the 0.01 level using Student Newman-Keuls Multiple Range Test.

[2]Arrowleaf clover.

[3]Crimson clover.

TABLE 4. SEASONAL PRODUCTION OF RESEEDING SUBTERRANEAN CLOVER AT OVERTON, TEXAS, 1983-84

Variety	Harvest Date 3-28	5-14	Total
	Pounds DM/Acre		
209924	2,132	1,074	3,206 a[1]
Woogenellup	2,040	970	3,010 a
Tallarook	1,683	1,233	2,916 a
Miss. Ecotype	1,344	1,301	2,645 a
239907	1,213	1,363	2,576 a
319146	1,057	1,474	2,531 a
Nangeela	1,259	1,175	2,434 a
291917	768	1,629	2,397 a
311499	744	1,571	2,315 a
168638	636	1,586	2,222 a
311498	660	1,455	2,115 a
184962	858	1,230	2,088 a
209927	588	1,350	1,937 a
Mt. Barker	578	1,392	1,970 a
319145	463	886	1,349 a
Nungarin[2]	0	0	

C.V. = 18.4%

[1]Yields followed by the same letter are not significantly different at the 0.05 level using Student Newman-Keuls Multiple Range Test.

[2]Did not reseed in 1981-82. Not included in statistical analysis.

Production of sub clover varieties and lines in their second reseeding stand ranged from 3,206 to 1,349 lb DM/A for lines 209924 and 319145, respectively (Table 4). The reseeding sub clover test was harvested twice with P.I. 209924 and 'Woogenellup' as the highest producers during the March harvest. The experimental line 209924 produced more forage during both the 1982-83 and the 1983-84 seasons than in 1984-85.

In late December 1983 extreme cold temperatures were recorded (three consecutive nights below 10°F). Performance of both the reseeding sub clover test and the newly established annual clover test was diminished by these adverse conditions. However, even with these conditions, no clover lines in these tests were rated as winter-killed.

1984-85

Total production in the sod-seeded annual clover test ranged from 3,100 to 1,866 lb DM/A for 'Meechee' arrowleaf and Autauga crimson, respectively (Table 5). Tibbee and Dixie crimson were the highest yielding at the first harvest. Although total production was lower than the last few years, possibly due to the later planting date, ball clover production was higher.

Forage production for the rose clover variety test ranged from 2,617 lb DM/A for M-13 to 647 lb DM/A for 'Hykon.' M-13 and D-17 rose clover produced higher yields during the March harvest (Table 6). At the April harvest, the varieties Hykon and Kondinin were in full bloom, 'Wilton' was in partial bloom and the experimental lines were still vegetative or in the bud stage. These experimental rose clovers were developed at Overton with selection for improved forage production and late maturity. Although grasshopper damage caused stand

losses in the 1984 annual clover test, no insect damage was noted on the rose clover lines in this test.

Total production for the vetch test ranged from 3,549 to 244 lb DM/A for 'Hairy' and 'Vantage' vetch, respectively (Table 7). 'Cahaba White' was not included in the analysis due to cold damage and stand loss. Hairy vetch yielded the most during the first harvest while Woodford produced more at the May harvest. 'Nova II' and Vantage did not regrow after the March harvest.

TABLE 5. SEASONAL PRODUCTION OF ANNUAL CLOVERS AT OVERTON, TEXAS, 1984-85

Variety	Harvest Date 3-29	4-30	Total
	Pounds DM/Acre		
Meechee[2]	643	2,457	3,100 a[1]
Segrest Ball	609	2,353	2,962 a
Amclo[2]	551	2,310	2,861 a
Chief[3]	736	2,109	2,845 a
Common Ball	524	2,210	2,734 a
Yuchi[2]	761	1,962	2,723 a
Tibbee[3]	1,129	1,483	2,612 a
Dixie[3]	941	1 597	2,538 a
Syn 2[2]	392	1,937	2,329 a
Syn 3[2]	381	1,681	2,062 a
Syn 4[2]	429	1,578	2,007 a
Y1[2]	405	1,477	1,882 a
Bigbee Berseem	,405	1,464	1,869 a
Autauga[3]	635	1,231	1,866 a

C.V. = 22%

[1]Yields followed by the same letter are not significantly different at the 0.01 level using the Student Newman-Keuls Multiple Range Test.

[2]Arrowleaf clover.

[3]Crimson clover.

TABLE 6. FORAGE PRODUCTION OF ROSE CLOVER AT OVERTON, 1984-85

Variety	Harvest Date 3-26	4-16	5-14	Total
	Pounds DM/Acre			
M-13	824	1,546	247	2,617 a[1]
F-20	704	1,668	187	2,559 a
D-17	801	1,383	214	2,398 ab
M-16	629	1,510	163	2,302 ab
R-12	501	1,388	309	2,198 ab
J-3	534	1,511	118	2,163 ab
O-15	531	1,310	207	2,048 abc
H-18	495	1,300	188	1,983 abc
H-7	398	1,345	238	1,981 abc
D-3	465	1,275	136	1,876 abc
Wilton	292	953	215	1,460 bcd
Kondinin	401	637	87	1,125 cd
Hykon	299	315	33	647 d

C.V. = 19.6%

[1]Yields followed by the same letter are not significantly different at the 0.01 level using the Student Newman-Keuls Multiple Range Test.

[2]Entries identified by letter-number combinations are experimental rose clover lines from the Overton clover breeding program.

TABLE 7. SEASONAL PRODUCTION OF VETCH AT OVERTON, 1984-85

Variety	Harvest Date 3-26	5-1	Total
	Pounds DM/Acre		
Hairy	1,595	1,954	3,549 a[1]
Woodford	353	2,318	2,671 a
Vanguard	414	1,039	1,453 b
Nova II	466		466 bc
Vantage	244		244 c
Cahaba White[2]			

C.V. = 24.4

[1]Yields followed by the same letter are not significantly different at the 0.01 level using Student Newman-Keuls Multiple Range Test.

[2]Not included in the analysis.

Herbicide Residue Damage to Sod-Seeded Clovers

G. R. SMITH

Summary

Herbicide formulations containing picloram and dicamba were evaluated for residue effects on sod-seeded clovers. Picloram + 2,4-D and dicamba + 2,4-D were applied to bermudagrass sod at 1, 2, and 4 pints/A in June, July, August, and September prior to clover planting in October. No permanent damage was noted on any clover tested due to dicamba residue. Picloram, at low rates, applied at least 90 days before clover planting, caused little permanent damage to arrowleaf, crimson, or white clover. Damage and stand reduction of subterranean clover by picloram residue increased with rate and later application dates.

Introduction

Both chemical weed control and sod-seeding with cool-season legumes on warm season perennial grass sods are sound management techniques. Using both techniques in combination is often difficult because forage legumes are often susceptible to herbicides used for summer weed control in grass sods. The objective of this research was to determine optimum application dates and rates of picloram + 2,4-D (1:4) and dicamba + 2,4-D (1:3) applied to bermudagrass sod for establishment and production of sod-seeded clovers.

KEYWORDS: Picloram/dicamba/application rates/application dates/residue damage/clovers.