Forage Production of Amclo and Crimson Clover on Pensacola and Coastal Bermudagrass Sods[1]

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Highlight

In an experiment completed at the Americus Plant Material Center, Americus, Georgia, amclo clover, *T. vesiculosum*, was grown on Pensacola bahiagrass and Coastal bermudagrass sods at 6 fertility levels and crimson clover was grown at one fertility level on the same sods. Data showed that amclo with adequate fertilization would make a contribution to the forage production of Pensacola bahiagrass when stands of the clover were obtained in the fall (with procedures used in this research). Stand failures occurred 50% of the time and further research on obtaining stands of amclo on bahiagrass and bermudagrass sods would appear to be in line. The data in this investigation showed that amclo was not as productive on Coastal bermudagrass sod as was crimson clover. Neither clover was as productive on Coastal as on bahiagrass. While fertilizer application had a positive effect on clover production, it did not necessarily assure high clover production.

Amclo clover, a variety of *Trifolium vesiculosum* (Savi), when grown on clean-tilled soil has produced relatively high yields of high quality forage when harvested at or before the full bloom stage (Beaty et al., 1963; Stanley, 1968). It has volunteered for a number of years at the Americus Plant Materials Center when grown for seed and the soil has been scarified by light disking in the fall.

Amclo seedlings have been slow to establish and do not appear to have high seedling vigor. However, once established, the plant is capable of rapid growth. While amclo produces high forage yields on non-sod soils (Beaty et al., 1965), its performance on sod is almost completely unknown. The purpose of this investigation was to establish the forage production potential of amclo on

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scarified and nonscarified Pensacola bahiagrass (*Paspalum notatum* (Flugge)) and Coastal bermudagrass (*Cynodon dactylon* (L.) Pers.) sods when grown at six fertility levels. A second objective was to compare the forage production of amclo with that of crimson clover, *T. incarnatum*, at one fertility level.

Procedure

The investigation was conducted on Eustis loamy sand at the Americus Plant Materials Center during the period November 1, 1963, to September 15, 1966. The first seeding of clover was made on October 29, 1962, but due to clover stand failure, clipping was delayed until after establishment of the clover following the fall seeding of 1963. Treatments were replicated four times on plots 6 × 10 ft and separated by plowed furrows. Whole plots consisted of scarification treatments in a randomized block design with 8 fertility and clover treatments in split plots (Table 1). Soil was scarified before clover planting in late October or the first week in November by vigorously raking the soil surface after a rain. Raking exposed the mineral soil but was not severe enough to damage the sod. Inoculated Amclo seed were broadcast on the soil surface at 10 lb/acre. Innoculated crimson clover was seeded at 30 lb/acre. After seeding, the fertilizer treatments were broadcast on the soil surface.

Starting on May 15 and continued at monthly intervals until September 15, 40 ft² of area from each treatment were mowed using a sickle bar mower. Forage was dried in a forced air dryer to obtain yields.

The bahiagrass and bermudagrass sods were located approximately ⅜ mile apart and yields are not directly comparable. During the fall and early spring the soil on which the bahiagrass was grown tended to hold more available moisture than did the soil on which the bermudagrass was grown. During the summer when the grasses were growing both areas were comparable as to moisture conditions.

Results and Discussion

At the May 15 harvest, the grass had done little growing and forage harvested was primarily clover. Clover yields when grown on bahiagrass sod are given in Table 1. Variation in clover yields reflected both a fertility effect and a year effect. During 1964 and 1965 clover production on bahiagrass sod was significant in terms of total production during the year and forage production during May. In 1966 an almost complete clover failure occurred. The clover yields on bahiagrass in 1964 and 1965 indicates the potential that amclo has of increasing forage production. By the same indication the low clover production in 1966 when combined with the stand failure in 1963 indicates the risk involved in growing amclo on bahiagrass.

The relatively low yield of crimson clover on bahiagrass (treatment 7) has been experienced previously (unpublished data) and indicates that amclo is much better adapted to grow on a bahiagrass sod than is crimson. When treatments 2 and 7 are compared, amclo averaged 692 lb/acre more forage per year than did crimson. The advantage in forage production due to fertilizers is not as clear cut. Amclo with no added fertilizer produced 481 lb more forage at the May harvest than did the no-clover no-fertilizer check. The application of 500 lb 0-12-12 increased forage production 501 lb over the same clover with no fertilizer. The addition of 20 lb N (treatment 3) increased forage production 956 lb over the no-fertilizer check with clover and 455 lb over the same P and K treatment with no N. Doubling the P and K in treatment 6 as compared to treatment 2 did not increase the forage production. Adding P without K (treatment 4) did not significantly increase forage production as compared to the no fertility check and the addi-

Table 1. Effect of fertilizer rate on forage yield (lb dry forage per acre) of Pensacola bahiagrass overseeded with amclo and crimson clovers.

Soil and Fertilizer Treatment	1964	1965	1966	Av.	Increase for clover and fertilization
Scarified					
1. Amclo clover + 0 fertilizer	4673	2553	1433	2886	658
2. Amclo + 500 lb 0-12-12	5710	4090	1638	3813	1585
3. Amclo + 500 lb 4-12-12	6298	5868	2281	4816	2588
4. Amclo + 500 lb 0-12-0	4280	2616	1565	2820	592
5. Amclo + 500 lb 0-0-12	5218	3652	1641	3504	1276
6. Amclo + 1000 lb 0-12-12	5560	3769	1858	3729	1501
7. Crimson clover + 500 lb 0-12-12	4274	2428	1531	2744	516
8. No clover or fertilizer	3482	1817	1386	2228	
Not scarified					
1. Amclo + 0 fertilizer	4457	2549	1464	2823	567
2. Amclo + 500 lb 0-12-12	5698	3398	1897	3664	1408
3. Amclo + 500 lb 4-12-12	5268	5116	2234	4206	1950
4. Amclo + 500 lb 0-12-0	5037	2673	1741	3150	894
5. Amclo + 500 lb 0-0-12	4605	2404	1512	2840	584
6. Amclo + 1000 lb 0-12-12	5745	3363	1955	3688	1432
7. Crimson clover + 500 lb 0-12-12	4477	2578	1644	2900	644
8. No clover or fertilizer	3553	1787	1428	2256	

LSD	05	01
Scarification	NS	
Years	810	1100
Fertility trts.	618	830

Table 2. Effect of fertilizer rate on forage yield (lb dry forage per acre) of coastal bermudagrass overseeded with amclo and crimson clovers.

Soil and Fertilizer Treatment	1964	1965	1966	Av.	Increase for clover and fertilization
Scarified					
1. Amclo + 0 fertilizer	2505	3296	2314	2705	248
2. Amclo + 500 lb 0-12-12	2764	3519	2302	2862	405
3. Amclo + 500 lb 4-12-12	3315	4414	2726	3485	1028
4. Amclo + 500 lb 0-12-0	2817	3103	2266	2729	272
5. Amclo + 500 lb 0-0-12	2781	2991	2080	2617	160
6. Amclo + 1000 lb 0-12-12	3319	3448	2396	3054	597
7. Crimson clover + 500 lb 0-12-12	3538	3719	2622	3293	836
8. No clover or fertilizer	2497	2832	2041	2457	
Not scarified					
1. Amclo + 0 fertilizer	2718	3102	1989	2603	154
2. Amclo + 500 lb 0-12-12	2520	2972	2072	2521	72
3. Amclo + 500 lb 4-12-12	3155	4347	2606	3370	921
4. Amclo + 500 lb 0-12-0	2934	3266	2588	2929	510
5. Amclo + 500 lb 0-0-12	2364	2688	2089	2380	69
6. Amclo + 1000 lb 0-12-12	3136	3274	2099	2836	387
7. Crimson clover + 500 lb 0-12-12	3833	4224	2462	3506	1057
8. No clover or fertilizer	2602	2683	2062	2449	

LSD	05	01
Scarification	NS	
Years	819	NS
Fertility trts.	387	514

Table 3. Effect of fertilizer rate on May forage harvest (lb dry forage per acre) of amclo and crimson clover growing on Pensacola bahiagrass.

Soil and Fertilizer Treatment	1964	1965	1966	Av.	Increase for clover and fertilization
Scarified					
1. Amclo clover + 0 fertilizer	1299	651	18	656	492
2. Amclo + 500 lb 0-12-12	2137	1779	24	1313	1149
3. Amclo + 500 lb 4-12-12	2205	3145	48	1799	1635
4. Amclo + 500 lb 0-12-0	1101	653	18	591	427
5. Amclo + 500 lb 0-0-12	1698	1564	12	1091	927
6. Amclo + 1000 lb 0-12-12	1727	1355	20	1034	870
7. Crimson clover + 500 lb 0-12-12	582	597	13	397	233
8. No clover or fertilizer	296	185	12	164	
Not scarified					
1. Amclo clover + 0 fertilizer	1231	617	26	625	470
2. Amclo + 500 lb 0-12-12	1759	1124	28	970	815
3. Amclo + 500 lb 4-12-12	1717	2442	19	1393	1238
4. Amclo + 500 lb 0-12-0	1459	686	31	725	570
5. Amclo + 500 lb 0-0-12	1009	618	28	552	397
6. Amclo + 1000 lb 0-12-12	1835	1071	21	976	821
7. Crimson clover + 500 lb 0-12-12	824	665	17	502	347
8. No clover or fertilizer	279	173	12	155	

LSD	05	01
Scarification	NS	
Years	762	981
Fertilizer trts.	618	897

tion of K without P (treatment 5) failed to give a consistent response.

The effect of the fertilizer on total forage yield followed rather closely the relationship between clover and fertility. The highest total yield of clover and grass was produced when bahiagrass was fertilized with 500 lb 4-12-12 and overseeded with amclo. The next highest yields were produced by bahiagrass when fertilized with 500 or 1000 lb 0-12-12 and overseeded with amclo. Adding K with soil scarification increased forage production but adding K without soil scarification did not.

Clover production on Coastal bermudagrass was far less striking than that on bahiagrass Table 2. The highest clover yield on Coastal bermudagrass was obtained by fertilizing crimson with 500 lb 0-12-12. The next highest yield was obtained by fertilizing amclo with 500 lb 4-12-12. Other clover and fertilizer treatments produced little or no more forage than did the no-clover and no-fertilizer check.

Total yields of Coastal bermudagrass, clover, and fertilizer followed the same pattern as did the clover. Highest yields were obtained when Coastal was overseeded with amclo and fertilized with 500 lb 4-12-12 or crimson clover was fertilized with 500 lb 0-12-12. Treatment 7, where amclo was

Table 4. Effect of fertilizer rate on May forage harvest (lb dry forage per acre) of amclo and crimson clover growing on Coastal bermudagrass sod.

Soil and Fertilizer Treatment	1964	1965	1966	Av.	Increase for clover and fertilization
Scarified					
1. Amclo clover + 0 fertilizer	558	1014	801	791	172
2. Amclo + 500 lb 0-12-12	658	1178	863	900	281
3. Amclo + 500 lb 4-12-12	832	1965	1146	1314	695
4. Amclo + 500 lb 0-12-0	634	905	873	804	185
5. Amclo + 500 lb 0-0-12	699	867	728	765	146
6. Amclo + 1000 lb 0-12-12	736	935	1025	899	280
7. Crimson clover + 500 lb 0-12-12	1432	1387	1016	1278	659
8. No clover or fertilizer	509	656	692	619	
Not scarified					
1. Amclo + 0 fertilizer	638	917	737	764	116
2. Amclo + 500 lb 0-12-12	623	804	789	739	91
3. Amclo + 500 lb 4-12-12	708	1861	1105	1225	577
4. Amclo + 500 lb 0-12-12	604	989	837	610	162
5. Amclo + 500 lb 0-0-12	434	659	795	629	19
6. Amclo + 1000 lb 0-12-12	569	903	829	767	119
7. Crimson clover + 500 lb 0-12-12	1467	1530	1026	1341	693
8. No clover or fertilizer	599	649	695	648	

	05	01
LSD		
Scarification	NS	
Years	530	
Fertility trts.	449	632

fertilized with 1000 lb 0-12-12, produced 291 lb more than the amclo no fertilizer check. Other fertilizer treatments were not significantly better than the clover no fertilizer check.

While the two areas are not directly comparable, data obtained would indicate that amclo with proper fertilization can be expected to make a sizeable contribution about 50% of the time when grown on bahiagrass. It appears that crimson clover is not likely to produce much forage under similar conditions. When Coastal bermudagrass is the sod crop, amclo is not likely to produce much forage while crimson clover will.

Average forage yield data by seasons are shown in Table 3 for Pensacola bahiagrass and Table 4 for Coastal bermudagrass. Over the 3-year period, average production of the two grasses without fertilization or clover (treatment 8) was essentially equal. The bahiagrass averaged 2242 lb/acre dry forage while the bermudagrass averaged 2453 lb. More year to year variation was obtained with bahiagrass than with bermudagrass. In 1964 the average yield of bahiagrass was approximately 3500 lb dry forage. In 1965 the average bahiagrass yield without clover was approximately 1800 lb and the 1966 average yield was approximately 1400 lb. The average yield by years for Coastal bermudagrass ranged between 2050 and 2750 lb/acre dry forage for the 3 years. The year to year variation in bahiagrass forage yield is related both to clipping and differences in distribution of rainfall (Beaty et al., 1960; Burton et al., 1957). The relatively stable forage production of the Coastal bermudagrass indicates that the seasons were relatively equal overall.

Soil scarification has little effect on yield of either grass or clover. Average yields of both grass and clover were increased by 50 to 150 lb/acre dry forage by soil scarification at time of planting clover. That increase in forage yield due to soil scarification was not significant and a considerably larger increase in yield would have been required for economic justification.

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