Comparison of Three Ladino Clovers Used for Food Plots in Northeastern Georgia

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Abstract: We compared production, utilization, and protein levels of 3 ladino clovers (*Trifolium repens*) in northeastern Georgia. Three 0.2-ha clover plots were planted side by side in 2 separate fields on Chestatee Wildlife Management Area. Samples were clipped, weighed, and analyzed monthly for a 26-month period beginning in April 1990. All clovers were utilized very heavily by deer (*Odocoileus virginianus*) and other wildlife averaging 392 kg/ha per month dry weight totalling 10,210 kg/ha for the study. With data for both fields combined, there was no significant difference ($P > 0.05$) in wildlife (predominantly deer) usage among the 3 varieties: Regal (428 kg/ha/month), Imperial Whitetail Mix (383 kg/ha/month), or Osceola (367 kg/ha/month). Overall use of all varieties was higher in a field ($P < 0.01$) with no other food plots were nearby. Highest monthly use occurred in June 1990 (1,107 kg/ha/month), May 1990 (974 kg/ha/month), August 1990 (887 kg/ha/month), and October 1990 (798 kg/ha/month). Production of Osceola (1,422 kg/ha/month) was highest of the 3 ($P < 0.01$). For both fields combined, May, August, and September were the months of highest production. Differences in height inside and outside exclosures were not significantly different ($P > 0.05$) by clover variety. Height differences were most apparent in November (54%), March (51%), and October (51%). All varieties averaged approximately 24% protein content. All varieties and mixes tested made excellent food plots for deer and other wildlife for at least 3 years. However, there were large differences in price. Regal ladino was the most economical followed by Big Buck (Osceola) and Imperial Whitetail (Regal and California Ladino Mixture).

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In recent years, there has been a tremendous resurgence in interest in planting food plots for wildlife — especially for white-tailed deer and wild turkeys (*Melea-*

gris gallopavo). Among the most highly regarded, expensive, and highly advertised are several varieties of ladino clover. Among these are Regal ladino clover, Imperial Whitetail 30–06 clover (a mixture of Regal (37%) and California (27%) clovers) and Big Buck (composed of Osceola ladino clover). All of the varieties are long-lived perennials in the upper South and are short-lived perennials or annuals in the lower South (Ball et al. 1991). Advertised prices, production, and utilization claims have varied widely, with the result being confusion and misinformation as to which variety is best suited to plant in various regions.

Our objective was to measure production, utilization, and protein levels of all 3 clovers (2 varieties and 1 mix) and determine which 1 was best suited for wildlife plantings on northeastern Georgia Wildlife Management Areas. We have planted Regal ladino clover mixed with annual grass for >10 years based on recommendations from University of Georgia agronomists. Our current food plot total exceeds 325 ha with 20% being replanted every year and 12 to 20 new hectares cleared per year. In addition, local hunting clubs, private citizens, conservation groups, and other governmental agencies are planting a large undetermined amount of clover every year for deer and turkeys. With cost of clover seed ranging as high as $6.00 per pound, and total costs for materials exceeding $80.00 per hectare, it was considered cost effective and beneficial to determine which of the 3 varieties is best for northeastern Georgia. There have been no quantitative studies published in the Southeast directly comparing the production, use, and quality of these clover varieties under actual field conditions with a free-ranging, hunted deer herd. Our research results have application to most of the Southeast from East Texas to Virginia.

In central Alabama, Waer et al. (1993) used observations of captive deer to rank 17 deer forages (11 cool-season and 6 warm-season plantings). They found that various deer forages, including ladino clovers, were preferred by deer when the plants were growing rapidly and were high in protein. No quantitative measures of use were reported. McDonald and Miller (1993) studied production and utilization of 8 cool-season plantings in the Georgia Piedmont. Regal ladino clover produced 6,997 kg/ha from January to October and was the most utilized cool-season forage in the study ($\bar{x}$ = 765 kg/ha/month). Osceola and Imperial mix were not tested in this study. Several clover production trials have been performed at Southeastern experiment stations with conflicting results reported for Regal, Osceola, and California Ladino clover production depending on the year, soils, and sites. Waer et al. (1991) found that in Piedmont soils of central Alabama during a severe drought, Redland II clover produced significantly higher forage than other clovers, including several ladinos. However, no utilization by deer was measured in this study and comparison of first-year production did not consider the many advantages of biennials or perennials in the second year and thereafter.

While the value of food plots for deer has been shown many times (Kammermeyer 1982, Kammermeyer et al. 1984, Wentworth et al. 1987, Johnson et al. 1987, Davis et al. 1988, Vanderhoof and Jacobson 1988), there is virtually no consensus among wildlife professionals or the public as to which plant to recommend for deer and turkeys in the various physiographic regions and soil types.

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Methods

Two 0.61-ha fields were selected for clover planting on Chestatee Wildlife Management Area (WMA), a 10,118-ha public hunting area on the Chattahoochee National Forest. The area lies on the edge of the Piedmont and Blue Ridge Mountain physiographic regions and has about 25 deer per square mile according to the Deer Camp population model (Moen et al. 1986). Field A was located at 549 m elevation and in close proximity to another 0.8-ha clover plot. Field B was located at 732 m elevation with another 0.4-ha clover field about 0.8 km away. The fields were divided into adjacent 0.2-ha sections. Each section contained 1 of the 3 randomly-selected clover varieties (Regal, Osceola, Imperial). The fields were limed and fertilized according to soil test results at planting and fertilized at 6-month intervals thereafter. Fields were planted with 11.2 kg/ha of clover seed in September 1989. Ten years of experience with clover planting had indicated a need for a high rate of seeding due to broadcasting seed without use of a cultipacker, immediate grazing pressure by deer, and the necessity of an immediate dense stand on erodible slopes. Two varieties were pre-inoculated and the other (Regal) was inoculated at planting. For pre-inoculated seed, 16.8 kg/ha were sowed to equal 11.2 kg/ha of actual seed due to the weight of the inoculant coating. Poast herbicide® (BASF Wyandote, Parsippany, N.J.) for weed control and 80% Sevin® (Rhone-Poulenc Co., Research Triangle Park, N.C.) for white grub control were applied in August 1991.

Three moveable wire cage exclosures were located randomly on each 0.2-ha section of both fields. Thus, each field had 9 exclosures, 3 for each clover variety. Exclosures were approximately 1 m in diameter, 1.3-m tall, and constructed from 5- by 10-cm mesh welded wire fencing. They were anchored by driving 2 hook-shaped pieces of iron reinforcing bar into the ground.

Each 0.2-ha plot was clipped at 1 month intervals during the first week of each month starting in November 1989 and ending in May 1992. All above-ground forage was removed by hand from a 0.5-m^2 area in the center of the exclosure. The exclosures were then moved 5 m and re-established for the next month's sampling (Wentworth 1989).

All clippings were placed in labeled bags and dried at 80° C. The dry-weight of the forage inside the exclosure represented the quantity of forage available to deer (monthly standing crop). Utilization was the difference between forage weight outside and inside the exclosure (Wentworth 1989). In addition, monthly height measurements were recorded inside and outside exclosures for each variety beginning in July 1990. Protein analyses were conducted on clover clippings from April 1990 through May 1991. Data from both fields were combined and run through the SAS General Linear Models Procedures (GLM). Analysis of variance

Table 1. Utilization of 3 varieties of ladino clover by month (1990–1992) for 2 fields in northeast Georgia.

	Use (kg/ha)								
	Regal			Osceola			Imperial		
Month	Field A	Field B	$\bar{x}$	Field A	Field B	$\bar{x}$	Field A	Field B	$\bar{x}$
Apr	220	925	572	333	552	442	126	931	529
May	1,231	1,244	1,237	865	565	715	1,291	652	971
Jun	738	1,916	1,327	379	466	422	1,730	1,410	1,570
Jul	253	0	126	313	186	249	133	239	186
Aug	253	1,577	915	412	1,264	838	519	1,297	908
Sep	153	645	399	0	0	0	27	0	13
Oct	685	1,044	865	925	712	818	625	798	712
Nov	166	732	449	366	898	632	612	419	516
Dec	0	33	17	0	0	0	0	0	0
Jan	80	13	47	0	93	47	0	67	33
Feb	206	140	173	106	113	110	100	213	156
Mar	319	439	379	233	439	336	213	539	376
Apr	0	612	306	0	379	190	0	412	206
May	659	605	632	286	0	143	100	0	50
Jun	792	1,271	1,031	1,018	832	925	213	931	572
Jul	27	333	180	1,151	758	955	1,337	526	931
Aug	279	412	346	439	532	486	166	539	353
Sep	120	299	210	605	173	389	0	93	47
Oct	632	559	595	998	958	978	918	659	788
Nov	146	173	160	266	299	283	279	200	239
Dec	20	7	13	47	0	23	60	7	33
Jan	13	0	7	20	13	17	20	7	13
Feb	27	73	50	20	73	47	53	40	47
Mar	206	86	146	93	27	60	246	53	150
Apr	352	433	392	80	107	93	326	173	249
May	546	565	555	465	226	346	200	413	306
Total	8,123	14,136	11,129	9,420	9,665	9,544	9,294	10,618	9,954
Mean	312	544	428	362	372	367	357	408	383

was used to test for differences among varieties and months. Multiple comparisons were made using Tukey tests.

Two 16-km hard mast survey routes were conducted on Chestatee WMA during late August or early September for all 3 years (Whitehead 1969). A mast availability index (on a scale of 0–10) was calculated from these data. Our hypothesis was that mast availability influenced deer use of clover fields for fall and winter periods of all 3 years. During the 3 study years, the ratings were 1.54 in 1989 (low), 2.69 in 1990 (medium), and 1.51 in 1991 (low).

Results and Discussion

Samples collected from November 1989 through March 1990 were lost in a fire at the University of Georgia. Hence, our data is for the period April 1990

through May 1992. Utilization of the clover by deer and other wildlife was heavy in both fields and for all 3 varieties (Table 1). Field A averaged 333 kg/ha/month of dry weight forage used while Field B averaged 428 kg/ha/month. Field B was much further away from the next nearest clover field and was used more heavily by deer. Highest use of all plots and varieties were recorded for Regal ladino clover in Field B with a 26-month total of 14,103 kg/ha and a monthly average of 544 kg/ha (Table 1).

The use of Regal ladino clover (428 kg/ha/month average for both fields) was not significantly greater ($P > 0.05$) than use of the Imperial whitetail mix (383 kg/ha/month) or the Osceola ladino clover (367 kg/ha/month). With both fields combined, use of Regal, Imperial, and Osceola was 11,129, 9,955, and 9,543 kg/ha respectively, for the 26-month period (Table 1).

Percent of standing crop utilized varied greatly by month and variety (ranging from negligible to 73%). Regal ladino showed the highest average percent use

Table 2. Standing crop and percent utilization for 3 varieties of ladino clover in two fields in northeastern Georgia from April 1990 through May 1992.

	Regal		Osceola		Imperial	
Month	Standing crop (kg/ha)	% use	Standing crop (kg/ha)	% use	Standing crop (kg/ha)	% use
Apr	1,557	0.34	1,799	0.25	1,923	0.26
May	4,135	0.30	4,224	0.17	4,085	0.24
Jun	2,046	0.64	2,086	0.21	2,957	0.54
Jul	1,736	0.09	2,062	0.13	1,923	0.10
Aug	2,758	0.31	3,396	0.19	2,954	0.30
Sep	2,568	0.15	3,316	0.00	2,930	0.01
Oct	2,222	0.39	2,604	0.32	2,222	0.33
Nov	1,178	0.35	1,547	0.34	1,344	0.40
Dec	143	0.09	136	0.00	176	0.00
Jan	200	0.20	143	0.26	156	0.17
Feb	266	0.66	259	0.23	243	0.62
Mar	768	0.53	768	0.45	838	0.44
Apr	1,377	0.27	1,530	0.15	1,480	0.15
May	1,776	0.36	1,543	0.09	1,394	0.04
Jun	1,933	0.53	2,076	0.45	1,580	0.33
Jul	858	0.21	1,999	0.47	1,703	0.52
Aug	1,211	0.29	1,480	0.34	1,244	0.27
Sep	1,799	0.14	2,195	0.17	1,663	0.03
Oct	1,131	0.54	1,710	0.59	1,440	0.56
Nov	339	0.49	402	0.71	376	0.64
Dec	67	0.19	67	0.24	63	0.45
Jan	40	0.15	47	0.36	50	0.25
Feb	153	0.38	106	0.44	100	0.47
Mar	263	0.59	120	0.46	220	0.63
Apr	343	0.62	150	0.22	267	0.47
May	756	0.53	589	0.41	802	0.33
Total	31,623		36,354		34,133	
Mean	1,216	0.36	1,398	0.29	1,313	0.33

on a monthly basis at 36% followed by Imperial at 33% and Osceola at 29% (Table 2).

Utilization of all clovers was highest in April, May, March, and October, respectively (Tables 1, 2). Periods of low use occurred in September due to hard mast availability and in mid-winter due to effect of cold on the clover. Despite moderate acorn production in the fall of 1990, use of clover became very heavy in October (798 kg/ha) and November (533 kg/ha).

To estimate value of the clover plots to the deer herd, we assumed that if the average monthly consumption is 392 kg/ha and each deer consumes about 1 kg (dry weight) of clover per day, then an average of 2.3 additional deer per ha of clover can be supported throughout the year. Of course, this is not true in the winter months when clover production is negligible, as is that of all other vegetation in northeastern Georgia.

Because production was zero in late fall, winter, and late spring, we obtained misleading monthly production figures by subtracting growth in 1 month from the next. Using this method but counting only positive growth months, annual production would be approximately 10,000 kg/ha dry weight for all varieties. Monthly standing crop was a more representative measure of growth and forage availability (Table 2). There was a significant difference ($P < 0.01$) in standing crop with Osceola averaging 1,422, Imperial 1,350, and Regal 1,239 kg/ha/month. Highest monthly standing crops (average for 3 varieties) were 4,148 kg/ha/month in May 1990, 3,036 in August 1990, and 2,938 in September 1990. Lowest occurred in December 1991 (65 kg/ha), January 1992 (46 kg/ha), and February 1992 (120 kg/ha). Overall average was 1,309 kg/ha/month.

Differences in height of clover inside and outside of the exclosures gave us another measure of clover use (Table 3). There was no significant difference ($P > 0.05$) in height among any of the 3 varieties tested. Monthly differences in height were greatest ($P < 0.05$) in November 1991 (54%), March 1991 (51%), and October 1991 (51%) (Table 3). Height data confirmed that overall growth and use of clover was heaviest in spring and fall when native vegetation was lacking in either quantity or quality.

Protein level of the clovers for all months combined averaged 24%, and there were no significant differences among them ($P > 0.05$) (Fig. 1). The months of February (31%), December (30%), January (29%), and March (29%) had significantly higher ($P < 0.05$) protein levels than other months (Fig. 1). There were only 2 months (Jun and Aug) when monthly combined averages of protein levels dropped below 20%.

These figures are well above levels determined for optimum growth of deer (13%–16% protein) and minimum maintenance for deer (7% protein) (Magruder et al. 1957, Murphy and Coates 1966). Native vegetation varies greatly but rarely exceeds 15% even in spring and often declines to levels below 7% in late summer, fall, and winter (Short 1969). Even high quality grasses during their best growth period in spring rarely exceed 15% (Short 1969).

Table 3. Height and height difference (cm) for 3 varieties of ladino clover in 2 fields in northeast Georgia from July 1990 through May 1992.

	Regal Ladino			Osceola Ladino			Imperial Mix		
	Height inside exclosure	Height difference inside vs out		Height inside exclosure	Height difference inside vs out		Height inside exclosure	Height difference inside vs out	
Month	cm	cm	%	cm	cm	%	cm	cm	%
Jul	30.7	7.9	0.26	33.0	8.5	0.26	34.8	7.8	0.22
Aug	28.7	10.0	0.34	31.4	12.2	0.38	29.5	9.2	0.30
Sep	28.7	4.0	0.14	28.9	2.5	0.09	30.4	2.2	0.07
Oct	25.9	7.5	0.29	27.0	5.0	0.19	26.5	8.4	0.31
Nov	16.0	7.0	0.44	20.0	9.4	0.47	19.2	10.3	0.53
Dec	3.5	1.0	0.26	3.4	0.9	0.25	3.5	0.5	0.13
Jan	2.9	0.9	0.30	2.7	0.5	0.18	2.9	0.7	0.24
Feb	3.2	1.0	0.31	3.5	1.5	0.42	3.5	1.2	0.32
Mar	11.3	6.3	0.57	11.8	5.8	0.50	12.2	5.7	0.46
Apr	25.9	7.2	0.29	25.9	4.5	0.20	25.5	4.5	0.18
May	32.0	12.7	0.39	34.0	13.4	0.40	32.2	13.5	0.42
Jun	27.3	8.9	0.31	31.9	9.7	0.30	30.4	7.7	0.25
Jul	27.2	9.0	0.34	24.4	8.9	0.34	28.2	13.2	0.47
Aug	25.0	3.7	0.15	24.7	4.0	0.16	24.4	4.5	0.18
Sep	26.8	1.3	0.05	30.9	3.0	0.10	29.2	4.3	0.15
Oct	19.0	8.9	0.47	19.5	11.0	0.56	20.5	10.2	0.50
Nov	8.0	4.4	0.54	8.0	4.2	0.52	9.7	5.7	0.57
Dec	3.5	1.4	0.39	2.7	0.7	0.20	3.4	1.4	0.40
Jan	1.2	0.2	0.12	1.2	0.2	0.12	1.2	0.4	0.18
Feb	4.1	1.6	0.40	3.7	1.3	0.36	4.0	1.9	0.46
Mar	5.3	2.9	0.56	4.0	1.7	0.42	4.9	2.5	0.50
Apr	16.0	8.0	0.51	11.3	4.0	0.36	14.9	5.6	0.39
May	25.2	10.9	0.43	24.5	7.8	0.33	27.5	9.7	0.37
Mean	17.3	5.5	0.34	17.7	5.2	0.31	18.2	5.7	0.33

Conclusions and Management Implications

Our studies showed no significant differences in consumption of 3 ladino clover varieties by wild, free-ranging deer and other wildlife in a hunted area. It also showed the value of all ladino clovers as forage for deer and other wildlife. In most areas of the United States, no annual clovers can compare in production or utilization with perennials over the long run due to limited seasonal production by annuals (either cool-season or warm-season, not both), the fragility of new seedlings immediately after planting, and the extra expense of having to replant or disk every year (Ball et al. 1991).

We did not test red clovers which are productive, palatable short-lived perennials (Ball et al. 1991, Waer et al. 1991). However, based on experience, we recommend both ladino (7 kg/ha) and red clover (3 kg/ha) mixed with 3 annual grasses: rye (30 kg/ha), ryegrass (20 kg/ha), and wheat (30 kg/ha) planted in early fall. These grasses are good deer forage, serve as a nurse crop for the clovers, and utilize excess nitrogen produced by the clover.

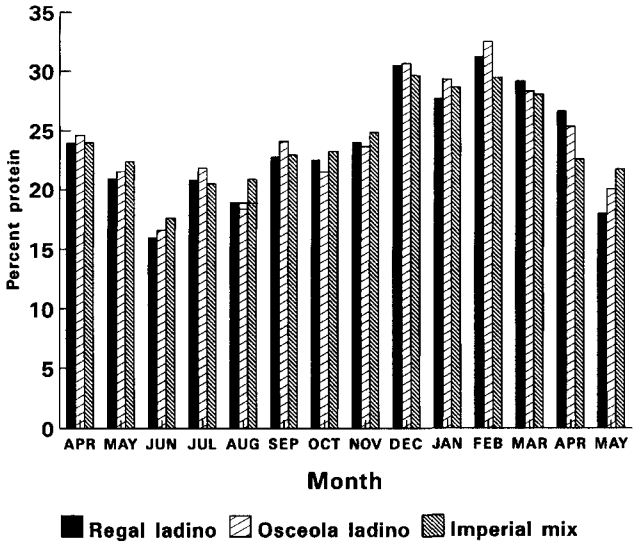

Figure 1. Protein levels of 3 varieties of ladino clover in 2 fields in northeastern Georgia from April 1990 through May 1992.

After the first year, the mixture reverts to ladino, red clover, and ryegrass. The stand usually requires mowing in August and fertilizing in September. We have maintained productive clover stands for 3 to 7 years.

Clover can be difficult and expensive to establish and maintain. Lime and fertilizer are essential. With perennial clover the extra expense in the first year of establishment (about $70.00 per ton of dry weight forage) drops to $12.00 per ton per year thereafter.

We found that the only significant difference in the 3 clover varieties tested was the greater production of Osceola ($P < 0.01$), but this curiously did not translate into greater use of this variety. Possibly, Osceola was less palatable or its randomized position in the fields caused less use. At any rate, all 3 clovers were used so heavily that palatability of any 1 of them could not be a problem. There was also a difference in the price of seed during this study: Regal was $3.00/lb, while Osceola (purchased as Big Buck) was $3.25/lb, and Imperial mix was $4.50/lb. At 1993 prices, purchasing each variety individually without extra advertising or premixing of varieties, the wholesale price of the 3 varieties is very similar (Regal and Osceola at $3.25 per pound and California at $2.95 per pound). Overall, the results of our study show that all ladino clover varieties tested can be extremely valuable food sources to several species of wildlife especially deer.

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