INFLUENCE OF PASTURE PLANTING METHOD ON ANNUAL COOL SEASON PASTURE FORAGE AVAILABILITY FOR GRAZING BY GROWING BEEF CATTLE – A FOUR YEAR SUMMARY

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INTRODUCTION

The planting of cool season annuals, such as ryegrass (*Lolium multiflorum*), oats, rye and (or) wheat, is common in the Coastal Plain region of the southeastern USA to provide grazing for beef cattle during the late fall-winter-spring season (usually from November to May). The length of the grazing season and amount of pasture forage can be influenced by many factors other than weather. Some of these factors include 1) forage species, 2) forage variety within species, 3) planting a single species (mono-crop) vs. blend of forage species, 4) species used within a forage blend, 5) pasture cultivation/planting method, 6) planting date, 7) soil fertility, and 8) dryland or irrigated management (Ball et al., 1998).

The objective of the study reported here was to compare clean tilled (prepared seedbed) and sod-seeded pastures with different combinations of cool season annual forages in regards to forage yield and quality, and weight gain and total grazing days by grazing growing beef cattle over the late fall-winter-spring (November to May) grazing season.

MATERIALS AND METHODS

The study consisted of two experimental cool season grazing trials (experiments) that were conducted at the North Florida Research and Education Center (NFREC) of the University of Florida located at Marianna in northwest Florida. These trials, each lasting two years, were carried out over four consecutive years from 2001 to 2005 during the months of October through May. Both trials were designed as a 2 x 2 factorial to evaluate two different pasture forage types -- small grains (rye and oats mix; RO) with or without ryegrass (RG) for the first two years (Exp. 1), and oats with ryegrass or ryegrass only for the last two years (Exp. 2). For both trials, the winter annuals were planted by two pasture land preparation/planting methods -- tilled or prepared seedbed (PS) and sod-seeded (SS).

For each year within each trial, eight 3.2 ac fenced pastures were utilized for grazing by growing beef cattle. The pastures were divided into two groups -- four pastures for the sod seeding treatments and four for the prepared seedbed treatments. Each of the four forage and cultivation combination treatments was assigned to two pastures each year, thereby giving two replicates per pasture treatment per year. The four pastures of the PS treatments were prepared by deep plowing followed by disc harrowing, and the annual pasture crops were planted using a grain

drill. In the four pastures assigned for SS treatments, a no-till seed drill was used and the pasture forage treatments were planted into dormant warm season bahiagrass *(Paspalum notatum).*

Soil fertility was analyzed every year for each pasture separately. These soils are well drained with a loamy sand surface and a sandy clay loam to sandy clay subsurface, and are typically acidic in nature. Initial fertilization and liming rates were applied to the pastures based on soil analyses by a commercial lab (Waters Agricultural Laboratories, Inc., Camilla, Georgia). The planting dates used for various forage treatments were based on University of Florida-IFAS recommendations (October for PS and November for SS). Grazing was started when the forage was about 8 to 12 inches in height. Grazing ended upon insufficient forage re-growth of the PS pastures. The SS treatments were terminated upon the end of the last PS treatment. All pastures over the four years were grown under dry land conditions. These pastures were top dressed twice with nitrogen fertilizer, each time with 75 lb of actual N per ac, within each year.

For each year within each trial, 32 growing Angus and Angus crossbred heifers and steers for Exp. 1, and 32 heifers only for Exp. 2 (Brahman/Angus cross, Simmental, Brangus, Angus/Brangus cross and Angus/Hereford cross) were utilized. Animals had an average initial body weight (BW) of 565 and 576 lb for year 1 and year 2 (Exp. 1), and 631 and 550 lb for year 3 and year 4 (Exp. 2), respectively. All cattle were allotted equally within replicate into groups of four, known as "tester cattle", based on sex, initial weight, and genetic background. The treatments were assigned at random to groups within replicate within year. The tester animals were allotted to their treatment groups upon initiation of grazing of the first pasture. The animal groups whose pastures were not ready for grazing were fed hay (bermudagrass) and supplement (80:20, rolled corn: cottonseed meal) until their assigned pastures were ready to graze. The tester cattle were weighed before pasturing and the experimental period started. While grazing, the tester cattle were weighed every 28 d as well as at the end of the experimental grazing periods. The weights were taken after fasting the animals overnight. Along with these groups of four tester animals, some extra cattle from the same calf crop as the testers, known as "put and take" cattle, were also used when available forage in the pastures was greater in quantity than the tester cattle could graze. The number and days the put and take cattle used in each pasture were also recorded. All the animals were offered a free-choice mineral supplement recommended for beef cattle on pasture.

Three exclusion cages per pasture, about 4 ft x 4 ft x 4 ft in size, were placed just before the start of grazing each year at random locations within each pasture to provide an ungrazed area for forage sampling. For each year of both trials, forage samples were collected from a square meter area within each cage at the start of grazing of the pastures and twice monthly thereafter until the end of grazing season. The start and end dates of grazing were different each year due to differences in planting dates that were due to differences in weather conditions and moisture availability during the late fall-winter-spring grazing seasons. Thus, all years did not have the same months represented.

Forage samples collected from the cages were dried at 120-130° F, weighed, sub-sampled, and ground in a Wiley mill to pass through a 2 mm stainless steel screen. The final sample obtained per pasture per sampling date was a pooled sample of the three sampling points per pasture. The weight taken was used to estimate forage dry matter (DM) yield of each pasture. The forage samples were further pooled by month before analyses at the laboratory. A portion of each sample was submitted to the Forage Evaluation Support Lab (FESL) of the Agronomy Department at the University of Florida to determine crude protein (CP) and in vitro organic matter digestibility (IVOMD) concentrations. The IVOMD was determined according to a modification of the two-stage Tilley and Terry (1963) technique by Moore and Mott (1974). Forage CP was determined by measuring total nitrogen on an Alpkem autoanalyzer (Alpkem Corporation, Clackamas, OR, USA) as described by Noel and Hambleton (1976).

Data collected included weight gain of the "tester" cattle, animal grazing days ("tester" plus "put and take" cattle), estimated pasture forage DM yield, and pasture forage quality (CP, IVOMD). Estimated cattle weight gain per acre was also measured and was calculated from average daily gain of the tester cattle and total animal grazing days per acre. For each trial (Exp.), data were analyzed as a 2 x 2 factorial design combined over years. The main effects evaluated included pasture forage type and pasture planning/cultivation method. Since the main effect of pasture planting/cultivation was similar for both trials, data were also combined and analyzed over all four years. Monthly pasture forage yield and quality data were also analyzed over all four years for the main effect of pasture planting/cultivation using repeated measures with month as the repeated measure. The months of November and May were not included in the yield results due to limited complete month data.

RESULTS AND DISCUSSION

The overall average monthly rainfall amounts and temperatures over the four years of the study during the October to May period were similar to the thirty-year average at Marianna except for the month of May (Table 1). The month of May, on average, was drier and hotter than the thirty-year average. As expected, there was much year-to-year variation in weather. This year-to-year variation resulted in differences between the years in regards to most of the parameters measured (i.e. animal grazing days, pasture forage DM yield, cattle weight gain per acre; $P<0.01$ to $P<0.10$). However, no meaningful year by treatment interactions ($P>0.10$) were noted. The results therefore were combined and averaged over the two years within each experiment.

For each year within each trial, we were able to graze the PS pastures sooner than the SS pastures (Table 2). In Exp. 1, adding RG to the RO pasture forage delayed the start, but increased the grazing season into May for the second year but not the first year. Dry conditions during year 1 of Exp. 1 forced us to terminate grazing sooner than planned. In Exp. 2, we were able to start grazing sooner for the ORG blend pastures than the mono-crop RG pastures for the second year, but not the first year. Dry conditions during the fall delayed planting and unusually cold and dry conditions during late fall and winter delayed the start of grazing for first year 1 in

Exp. 2. Weather conditions were more favorable during the second year of Exp. 2, however, we had to temporarily take the cattle off of some pastures during January because of the lack of forage growth due to cool growing conditions. The cattle were given hay and supplement and weight gains and grazing days were adjusted.

Even though the SS pastures were on average planted 40 days later than the PS pastures in Exp. 1 and 20 days later in Exp. 2, grazing did not start until an average of 58 days and 42 days after the start of grazing of the PS pastures (Table 2). Thus, average length of grazing was greater ($P<0.01$) for the PS pastures than the SS pastures (Tables 3 and 4) in each trial. In Exp. 1, forage treatment did not result in an increase ($P>0.10$) in grazing season (Table 3) even though we were able to graze the RORG pastures into May of the second year. In Exp. 2, planting with a blend of O and RG resulted in an overall slightly longer ($P=0.07$) grazing season than pastures seeded with RG alone (Table 4).

Estimated forage DM yield averaged 48 and 19% in Exp. 1 and 2, respectively, greater for the PS pastures than that noted for the SS pastures ($P>0.01$; Tables 3 and 4). The PS pastures had greater ($P<0.01$) DM yield earlier in the grazing periods than the SS pastures, but by March and continuing through April, yields were similar ($P>0.10$; March and April together). In Exp. 1, pasture forage treatment had no effect ($P>0.01$) on overall pasture forage DM yield (Table 3). In Exp. 2, the ORG blended pastures tended, on average, to have greater DM yield ($P=0.08$) over the grazing seasons than the RG only pastures (Table 4).

Total number of cattle grazing days for the PS pastures averaged 79 and 33% greater for Exp. 1 and 2, respectively, than for the SS pastures ($P>0.01$; Tables 3 and 4). Cattle grazing days are a combination of the grazing days of the "tester" and "put and take" cattle. Average stocking density, however, was less ($P<0.01$) for the PS pastures in each trial as compared to the SS pastures (Tables 3 and 4). These differences were probably due to the longer period of time that the PS pastures were grazed during the coolest time of the year (November through February) when forage growth was limited. Estimated cattle weight gain per acre of pasture, as expected, was greater ($P<0.01$) for the PS pastures than the SS pastures (Tables 3and 4) in both trials. Within either trial, pasture forage treatment had no effect ($P>0.10$) on estimated cattle weight gain per acre. This lack of an effect was in spite of the slightly greater forage DM yield and animal grazing days noted for the ORG pasture compared to RG pastures in Exp. 2. The reason for this was that cattle on the ORG pastures had a lower average daily gain ($P=0.04$; Table 4) than cattle on the RG only pastures.

Since planting/cultivation method was the same in both trials, when averaged over all four years, the PS pastures resulted in greater animal grazing days per acre (196 for PS vs. 126 for SS; $P<0.01$, SE = 5), pasture forage DM yield (4232 vs. 3083 lb/ac; $P<0.01$, SE = 201), and estimated cattle weight gain (462 vs. 266 lb/ac; $P<0.01$, SE = 16) than the SS pastures. Monthly pasture forage DM yield over all four years is depicted in Figure 1. As expected, PS pastures out yielded ($P<0.01$) the SS pastures early on in the grazing periods with the SS pastures out yielding

(P<0.01) the PS pastures during April. This increase for the SS in April may be due to the emerging warm season bahiagrass increasing total yield.

As expected, both lVOMD and CP values of pasture forage samples were high (Tables 3 and 4). Monthly averages over all four years for PS and SS are depicted in Figures 2 and 3. Within each trial, the PS pastures had slightly but significantly higher IVOMD (P<0.01) and CP (P<0.01) than the SS pastures. The differences noted were due to differences during the latter part of the grazing seasons (Tables 3 and 4; Figures 2 and 3). This may have been the result of the emerging lower quality bahiagrass diluting the values obtained. Botanical composition of the pasture forage samples was not determined. Within Exp. 1 or 2, pasture forage treatment affected IVOMD but not CP (Tables 3 and 4). Again, the differences with IVOMD were small but significant (P<0.05 for Exp. 1 and P< 0.01 for Exp. 2). The CP and IVOMD values were highest early in the grazing season and lowest late in grazing season. The slightly lower IVOMD for the ORG forage compared to the RG noted in Exp. 2 may have contributed to the lower ADG noted for the cattle grazing the ORG pastures compared to RG.

The main reason for the increased pasture forage DM yield and subsequently increased animal grazing days for the PS pastures was the longer grazing season for planting/cultivation method compared to SS as noted above. The longer season was due mainly to the earlier planting dates for the PS pastures (Table 2). Another reason may be the competitive effect of the bahiagrass. There is evidence from other studies that bahiagrass, even when dormant, can have a negative effect on the growth of the crop seeded into the sod of this grass (Wright et al., 1982). The delay in peak forage DM yield noted (Figure 1) for the SS pastures compared to the PS pastures may also be a result of this effect. However, the longer period between planting and grazing for the SS compared to the PS pastures may be due more to the influence of the cooler weather on plant growth than competition from the bahaigrass.

The planting of a blend of forages, in particular a blend of a cereal (or cereals) with annual ryegrass, is recommended as a means to increase forage yield, grazing season length, and to hedge against varied weather conditions (Ball et al., 1998). However, in our study we saw only a small advantage. The lack of a larger impact may have been due to dry and hotter weather encountered during May over the four years. Under good growing conditions, annual ryegrass can extend the growing season well into May and even into June (Ball et al., 1998) in the Coastal Plain region of the southeastern USA.

The overall results of all four years of the overall study indicated a large advantage to planting cool season annual pastures into a clean tilled, prepared seedbed. Our results overall, indicated about a 50% advantage in regards to grazing season length, animal grazing days and most important, cattle weight gain per unit of land. Our results, however, were not as dramatic as that of an earlier study done in southern Georgia in which an almost two fold difference was noted (Utley et al., 1976). This advantage of planting into a prepared seedbed, however, would have to

be weighed against increased land preparation costs compared to sod-seeding. Perhaps if the SS pastures can be planted earlier, then their productivity may be similar to PS pastures.

CONCLUSION

The planting of cool season annuals into a prepared seedbed resulted in increased pasture productivity during the late fall-winter-spring grazing season than planting (sod-seeding) into dormant warm season bahiagrass. Unfortunately, this pasture planting/cultivation method goes against the philosophy of reduced tillage. However, many diversified farms (i.e., row crops and cattle) will have open land available during the late fall-winter-spring period that can benefit from the planting of cool season annuals as a cover crop. This cover crop can provide high quality grazing for beef cattle.

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Table 1. Average monthly 24 hr mean temperature and rainfall during the experimental periods

	Month							
Year[a]	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
---------- Temperature °F ----------								
2001-02	66	64	58	52	51	58	72	75
2002-03	71	56	50	46	54	63	68	76
2003-04	68	62	48	50	50	62	65	75
2004-05	71	61	50	48	56	58	64	73
Avg.	69	61	51	49	53	60	67	75
30 Yr Avg[b]	67	58	51	49	53	59	65	73
---------- Rainfall, in ----------								
2001-02	1.50	1.69	0.51	3.82	2.44	5.51	5.87	2.09
2002-03	5.16	7.52	7.50	0.24	6.27	7.35	4.61	2.84
2003-04	1.69	4.19	1.58	3.19	7.67	0.90	4.37	1.19
2004-05	3.90	4.98	3.25	3.36	2.37	8.04	6.70	1.72
Avg.	3.06	4.60	3.21	2.65	4.69	5.45	5.39	1.96
30 Yr Avg[b]	2.90	4.12	3.86	6.09	4.81	6.11	3.84	4.21

[a]2001-02 and 2002-03, Exp. 1; 2003-04 and 2004-05, Exp. 2.
[b]Marianna, FL, USA.

Table 2. Experimental grazing periods

	Planting Date		Grazing start		Grazing end	
---------- Experiment 1 ----------						
Treatment[a]	First year[b]	Second year[b]	First year[b]	Second year[b]	First year[b]	Second year[b]
PS RO	2 Oct	3 Oct	7 Dec	20 Nov	25 Apr	9 Apr
PS RORG	3 Oct	13 Oct	7 Dec	18 Dec	25 Apr	20 May
SS RO	28 Nov	14 Nov	31 Jan	12 Feb	25 Apr	20 May
SS RORG	28 Nov	14 Nov	31 Jan	12 Feb	25 Apr	20 May
---------- Experiment 2 ----------						
PS ORG	31 Oct	12 Oct	16 Jan	24 Nov	30 Apr	12 May
PS RG	31 Oct	12 Oct	16 Jan	7 Dec	30 Apr	25 May
SS ORG	17 Nov	2 Nov	12 Mar	11 Jan	30 Apr	25 May
SS RG	17 Nov	2 Nov	12 Mar	8 Feb	30 Apr	25 May

[a]Key: PS = prepared seedbed; SS = sod-seeded into dormant bahiagrass; OR = oats and rye; ORRG = oats, rye, annual ryegrass; ORG = oats and annual ryegrass; RG = annual ryegrass only.
[b]First year = 2001-2002 and Second year = 2002-2003 for Exp. 1, and First year = 2003-2004 and Second year = 2004-2005 for Exp. 2.

Table 3. Main effects of pasture cultivation/planting method and pasture forage blend on pasture forage yield and quality, and on growth performance of growing beef cattle: Exp 1

Item	Cultivation method		Forage blend		SEM[e]	Significance		
	PS[a]	SS[b]	OR[c]	ORRG[d]		Cult[g]	For[h]	C × F[i]
Grazing season length, d	142	89	114	118	-------	NS	NS	NS
Cattle grazing days/ac	221	124	174	170	5	**	NS	NS
Avg. daily cattle wt. gain, lb/d	2.35	2.00	2.20	2.16	0.06	**	NS	NS
Stocking density, head/ac	1.4	1.6	1.5	1.5	0.1	*	NS	NS
Estimated cattle wt gain[j], lb/ac	526	248	399	374	20	**	NS	NS
Forage DM yield, lb/ac:								
Overall	5060	3476	4186	4351	366	*	NS	NS
Dec	900	0	431	467	106	**	NS	NS
Jan	651	0	326	325	58	**	NS	NS
Feb	773	684	780	677	68	**	NS	NS
Mar	1468	1008	1254	1222	63	**	NS	+
Apr	750	1334	907	1175	61	**	*	+
Forage IVOMD, %:								
Overall	82.4	77.4	79.2	80.6	0.2	**	*	NS
Mar - Apr	81.1	76.8	78.6	79.2	0.4	**	NS	NS
Forage CP %:								
Overall	27.7	22.0	23.0	25.9	0.7	**	*	NS
Mar - Apr	24.1	22.6	22.6	24.1	0.7	NS	NS	NS

[a] PS – Prepared seedbed (clean tilled).

[b]SS – Sod-seeded into dormant bahiagrass.

[c]OR – Oats and rye blend.

[d]ORRG - Oats, rye and annual ryegrass blend.

[e]Standard error of the mean; n = 8.

[f]Key: ** = P<0.01, * = P<0.05, + = P<0.10, and NS = P>0.10.

[g]Cult – pasture cultivation/planting method (PS vs. SS).

[h]For = pasture forage treatment (OR vs. ORRG).

[i]C x F = Cult x For.

[j]Calculated from tester cattle ADG and total cattle grazing days.

Table 4. Main effects of pasture cultivation/planting method and pasture forage blend on pasture yield and quality, and on growth performance of growing beef cattle: Exp.2

	Cultivation Method		Forage blend			Significance		
Item	PS[a]	SS[b]	ORG[c]	RG[d]	SEM[e]	Cult[g]	For[h]	C × F[i]
Grazing season length, d	115	80	104	90	5	**	+	NS
Cattle grazing days/ac	170	129	163	136	9	**	+	NS
Avg. daily cattle wt. gain, lb/d	2.42	2.31	2.24	2.46	0.07	NS	*	NS
Stocking density, head/ac	1.5	1.7	1.6	1.5	0.1	**	NS	NS
Estimated cattle wt gain[j], lb/ac	399	283	356	326	23	**	NS	NS
Forage DM yield, lb/ac:								
Overall	3402	2690	3285	2807	165	*	+	NS
Dec	288	88	266	110	15	**	**	NS
Jan	292	175	235	231	11	**	NS	*
Feb	441	230	372	298	22	**	+	*
Mar	972	819	1074	717	70	NS	*	NS
Apr	933	937	906	963	43	NS	NS	NS
Forage IVOMD, %:								
Overall	81.2	78.0	78.9	80.2	0.2	**	**	NS
Mar – Apr	80.3	78.9	78.5	80.8	0.3	**	**	NS
Forage CP %:								
Overall	23.2	20.1	21.2	22.1	0.4	**	NS	NS
Mar- Apr	20.6	21.1	19.9	21.7	0.4	NS	*	NS

[a] PS – Prepared seedbed (clean tilled).

[b]SS – Sod-seeded into dormant bahiagrass.

[c]ORG – Oats and annual ryegrass mix.

[d]RG – Annual ryegrass only.

[e]Standard error of the mean; n = 8.

[f] Key: ** = P<0.01, * = P<0.05, + = P<0.10, and NS = P>0.10.

[g] Cult – pasture cultivation/planting method (PS vs. SS).

[h] For = pasture forage treatment (ORG vs. RG).

[i]C x F = Cult x For.

[j]Calculated from tester cattle ADG and total cattle grazing days.

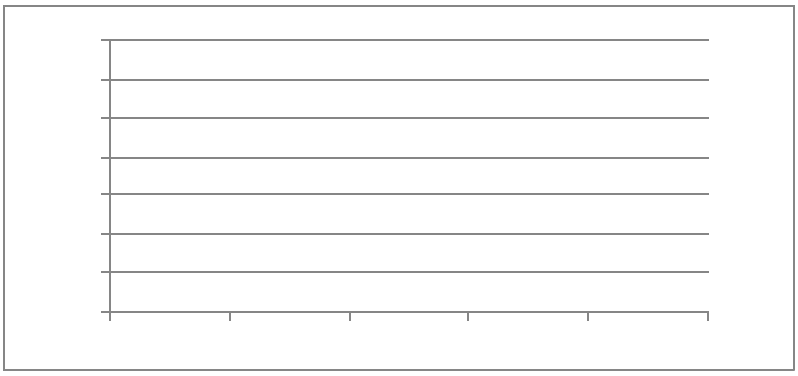

Figure 1. Effect of pasture cultivation/planting method on monthly pasture forage DM yield, lb/ac (PS = prepared seed bed; SS = sod seeded into dormant bahiagrass; SEM = 49; effect of month, P < 0.01; averaged over both Exp 1 and 2 – four years).

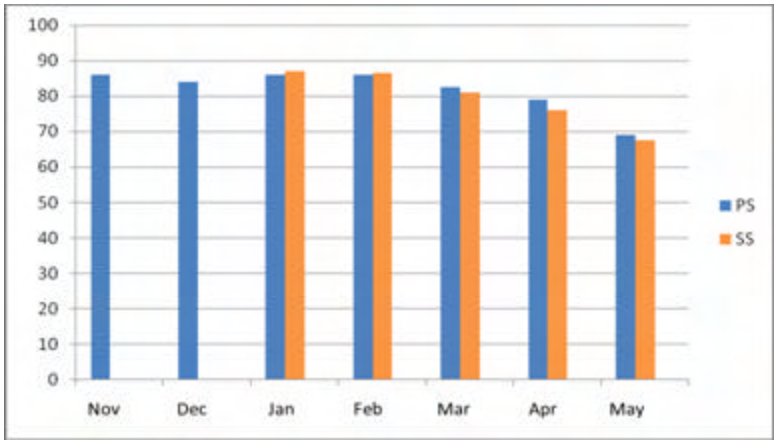

Figure 2. Effect of pasture cultivation/planting method on monthly pasture forage IVOMD, % (PS = prepared seedbed; SS = sod-seeded into dormant bahiagrass; SEM = 1; effect of month, P < 0.01, n = 8, 10, 12, or 16; averaged over Exp 1 and 2 – four yr average; DM basis).

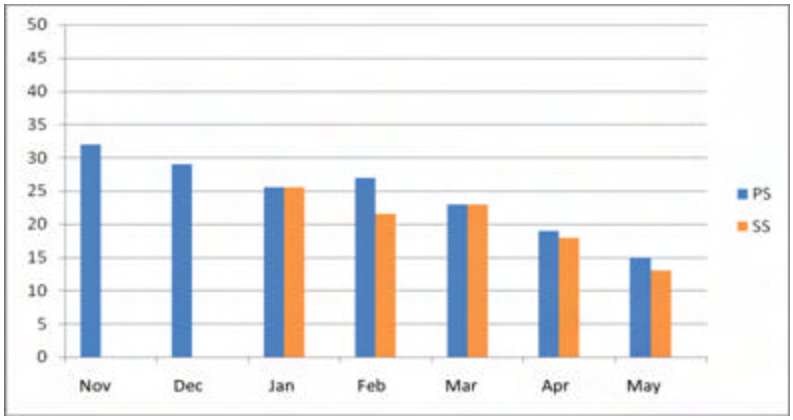

Figure 3. Effect of pasture cultivation/planting method on monthly pasture forage CP, % (PS = prepared seedbed; SS = sod-seeded into dormant bahiagrass; SEM = 1; effect of month, P < 0.01, n = 8, 10, 12, or 16; averaged over Exp 1 and 2 – four yr average; DM basis).