COW AND CALF PERFORMANCE ON COASTAL OR TIFTON 85 BERMUDAGRASS PASTURES WITH AESCHYNOMENE CREEP-GRAZING PADDOCKS.

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ABSTRACT

Cow and calf performance was determined in a 2-yr 2 × 2 factorial grazing experiment using Coastal (C) or Tifton 85 (T85) replicated bermudagrass pastures (4 pastures each; each pasture 4.86 ha), without (NCG) or with aeschynomene creep grazing paddocks (CG; n = 4; 0.202 ha; planted in May each yr, 13.44 kg/ha). On June 10, 2004, and June 8, 2005, 96 tester winter-calving beef cows and their calves were grouped by cow breed [9 Angus (AN), 3 Polled Hereford (PH)/group], initial cow BW (592.9 ± 70.1 kg, 2-yr mean), age of dam, calf breed (AN, PH or AN × PH), calf sex, initial calf age (117 ± 20.1 d, 2-yr mean), initial calf BW (161.3 ± 30.4 kg), and randomly assigned to pastures. Additional cow-calf pairs and open cows were added as forage increased during the season. Forage mass was similar for all treatment pastures (*P* > 0.70; 2-yr mean, 6939 vs 6628 kg/ha, C vs T85; 6664 vs 6896 kg/ha, NCG vs CG), well above the targeted average of 2800 kg/ha, which allowed high degrees of forage selectivity by cows and calves on all pastures. Main effect interactions did not occur for performance variables (P > 0.10; 2-yr means), and year only affected initial and final BW of calves and cows. Least squares means were adjusted for covariate effects of birth weight, breed, sex, initial BW, initial age, and cow age for calves; and, breed, age, calf initial BW, and calf initial age for cows. Calf BW at weaning were adjusted to 205 d of age, for calf sex, cow age, and appropriate covariate effects. The 91-d tester calf ADG was 19% higher for calves grazing T85 than C (0.94 vs. 0.79 kg, *P* < 0.01), and 9.4% higher for calves creep grazing aeschynomene compared with calves without creep grazing (0.90 vs. 0.82 kg, *P* < 0.03). Calf 205-d adjusted weaning weights were 12.6 kg higher for calves grazing T85 than C (252.9 vs. 240.3 kg, *P* < 0.01), and 6.6 kg higher for calves with access to creep grazing (249.9 vs. 243.3 kg, *P* < 0.05). Cow 91-d total gain and stocking rates were higher (*P* < 0.01) for T85 than C. Pasture esophageal masticate IVDMD had a forage × creep grazing interaction (*P* < 0.05; C NCG = 57.4%; C CG = 52.1%; T85 NCG = 59.1%; T85 CG = 60.0%), and IVDMD was higher (*P* < 0.05) for T85 than for C pastures. These results complement previous research with T85, and indicated increased forage quality and higher performance of cattle grazing T85 pastures. Calf gains on T85 pastures, and to a lesser extent those for calves on creep grazed aeschynomene paddocks, were high enough to influence efficiency of cow-calf operations.

INTRODUCTION

Bermudagrass, a warm season perennial grass, is grown extensively throughout the Southeast for use as pasture and as harvested forage. Tifton 85 bermudagrass has higher quality and greater yields compared with Coastal bermudagrass (Burton et al., 1993). Tifton 85 has higher DM and fiber digestibility than Coastal, resulting in higher gains and

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utilization by cattle (Hill et al., 1993; Mandebvu et al., 1999; Hill et al., 2001a). Additional differing maturity dates (Hill et al, 2001b). Tifton 85 has lower concentrations of ether-linked research has indicated higher digestibility of Tifton 85 hay compared with Coastal hay at ferulic acid than Coastal, with decreased ether bonding in lignin in Tifton 85, which results in higher ruminal microbial digestion of this forage (Mandebvu et al., 1999; Hill et al., 2001a, 2001b). Aeschynomene *(Aeschynomene americana (L.))* is a high quality tropical legume with protein levels in the canopy reaching 21-24% (Hodges et al., 1982). Aeschynomene has potential to furnish high quality grazing during a crucial period when perennial grass quality does not meet the needs of calves. Bermudagrass pastures supply adequate nutrition for pregnant or lactating cows during spring and early summer; however, they may not provide adequate nutrition for growing calves during late summer before weaning. Creep grazing is the utilization of a high quality forage species by calves during the pre-weaning stage. If calves have access to a higher quality legume in creep grazing areas, late summer pre-weaning calf gains may be improved on bermudagrass pastures. Although Tifton 85 was released in 1993, experiments documenting large-scale replicated cow-calf grazing performance on this forage have not been reported. Our objectives were to compare cow-calf performance on Tifton 85 versus Coastal pastures, and to determine performance of calves that creep grazed aeschynomene paddocks during the summer prior to weaning.

MATERIALS AND METHODS

Grazing Experiment

Summer cow and calf performance was determined in a 2-yr replicated 2 × 2 factorial experiment using Coastal (C) or Tifton 85 (T85) bermudagrass pastures (4 pastures each; 4.86 ha each) without (NCG) or with aeschynomene (*Aeschynomene americana L.*) creep grazing (CG) paddocks (0.202 ha creep grazing area in each CG pasture; planted in May of each year at 13.44 kg/ha). The creep areas were divided by electric feces with access through wooden creep gates [4 M long (6 openings, 38 cm wide) by 1.22 M high] to each 0.202 ha paddocks. Aeschynomene was planted using a Brillion Seeder (Brillion Iron Works, Inc., Brillion, WI). The C and T85 pastures were established several years prior to initiation of this grazing experiment. Bermudagrass pastures were (Tifton sandy loam soils) fertilized with a blended fertilizer (24-6-12, $N–P_2O_5–K_2O$, at 336, 280, and 224 kg/ha, respectively, in March, early June and late July each year) following historical bermudagrass fertilizer recommendations. In the variable stocking rate study that began on June 10, 2004 and June 8, 2005, 96 winter-calving "tester" beef cows and their calves were grouped by cow breed [9 Angus (AN), 3 Polled Hereford (PH)/group], initial cow BW (592.9 ± 70.1 kg, 2 yr mean) age of dam (AOD), calf-breed (AN, PH or AN × PH), calf sex, initial calf age (117 ± 20.1 days, 2-yr mean), and initial calf weight (161.3 ± 30.4 kg, 2-yr mean) before groups were randomly assigned to pastures. Cows and calves were grazed in a put-and-take (Mott and Lucas, 1952) grazing management system. Cows similar to the tester cows in BW, age, background, and breeding were designated as "grazer" cows, and were used to adjust forage mass in pastures. Additional grazer cows included dry pregnant cows and replacement heifers (18 mo. of age). Total pasture forage mass was targeted at approximately 2,800 kg of DM/ha because we wished to provide enough forage to allow detection of differences in nutritive value of the forages unlimited by forage mass. At 14-d intervals beginning in June, forage mass was estimated using a double sampling procedure. Four quadrats (.1 m^2) were clipped to ground level in each pasture, and clipped samples were oven-dried. Pooled estimates were converted to a moisture-free basis using pooled DM values. Stocking rates were adjusted by addition or removal of grazer cows to achieve the targeted 2,800 kg of DM/ha in each pasture. Cows and calves were weighed at 28-d intervals, and initial and final BW were means of consecutive daily full weights. A commercial mineral (NaCl [maximum] 16.8%; Ca [maximum] 19.20%; P [minimum] 8.0%; Mg [minimum] 1.00%; Cu [minimum] 0.15%; Zn [minimum] 0.27%; Se [minimum] 0.003%; Beef 8™, W.B. Fleming Co., Tifton, GA) was provided free choice along with water in each pasture. All cattle were managed under procedures approved by the University of Georgia Animal Care and Use Committee Guidelines (IACUC AUP #A2005-10179-c1; Univ. of Georgia Animal Welfare Assurance #A3437-01).

Pasture Quality

Mature steers previously fitted with esophageal cannulas grazed each of the eight treatment pastures in June, August and September annually. In 2004, two esophageal cannulated steers were used to sample each pasture at each sampling date; in 2005, two steers were used in June, and four steers were used in August and September to sample each pasture. Cannulated steers grazed Coastal bermudagrass pastures before and after each forage mass sampling. Cannulated steers were confined in drylot with a 24 to 36 h feed restriction before each sampling period. This procedure was used because Fisher et al. (1989) reported no difference in forage particle size distribution or forage quality when esophageal cannulated steers were either fasted with no adaptation to forage to be sampled, or not fasted and adapted to the forage being grazed and sampled. In our study, cannulas were removed as steers sampled each pasture, and forage masticate was collected with small mesh hand fishnets. Steers were allowed to graze unrestricted in each pasture until 0.5 to 1.0 L of masticated forage was collected. Extrusa samples (forage and saliva) were quick-frozen in liquid N at the pasture site. Samples were stored (-15 degrees C) and the entire sample was subsequently lyophilized. The dried masticate samples were ground through a 1-mm screen in a Wiley mill (Arthur H. Thomas, Philadelphia, PA) in preparation for chemical analyses and IVDMD determination. Freeze-dried masticate samples were analyzed for acid insoluble ash and CP (micro-Kjeldahl; total N × 6.25) using AOAC (1991) procedures. The NDF and ADF were determined using methods described by Van Soest et al., (1991). The DAISY incubator (Ankom Tech., Macedon, NY) was used to determine IVDMD of forage samples from the freeze-dried masticate from pastures in the grazing experiment.

Statistical Analyses

Cow and calf data from grazing experiment were analyzed as a randomized complete block with two replications. The four treatments were arranged as a 2 × 2 factorial with cow-calf pairs as sampling units using Mixed Model Procedures of SAS (2003), with least squares means adjusted for covariate effects. Covariate adjustments included calf sex, birth weight, age, breed, initial weight, cow age, and cow breed. Statistical analyses of the esophageal steer grazing data and laboratory analyses of masticated forage were conducted using the GLM procedure of SAS (2003).

RESULTS AND DISCUSSION

Grazing Experiment

In the 2-yr cow-calf study, available forage mass in each pasture was targeted at 2,800 kg of DM/ha. This forage allowed adequate forage for gain and maintenance, and prevented forage shortages when rainfall distribution and amounts were unfavorable (Hill et al., 1993). The rainfall for the current study are shown in Figure 1, and data for May was included because of possible carryover effects on forage growth when the experiment was initiated in early June annually. Rainfall in May was similar between years, and near levels of the 80-yr average. Rainfall in June was higher than the average in both years, with more than twice as much occurring in June 2004 and about 50% higher rainfall in June 2005. During July and August 2004 rainfall was considerably below average; rainfall was near average for these months in 2005. The experiment ended in early September of each year, and forage production and cattle performance was likely influenced more by rainfall in August than September. Rainfall was apparently not limiting for forage production, because DM remained well above the forage mass target level of 2800 kg/ha throughout the study (Figure 2a,b). Initial cow BW was different between years (2004, 579.2 ± 75.3 kg; 2005, 606.5 ± 61.4 kg; $P < 0.01$), as well as initial calf BW (2004, 155.1 ± 32.3 kg; 2005, 167.5 ± 27.1 kg; $P < 0.01$). This was the only instance of year affecting cow or calf performance during the experiment. Year did not interact with treatments ($P > 0.20$), main effect interactions did not occur ($P > 0.10$) for cow and calf variables, and least squares means were adjusted for significant covariate effects as indicated in Table 1. Calf adjusted weaning weights and 205-d weaning weights, including Beef Improvement Federation (2006) adjustments for sex and age of dam, were higher ($P < 0.01$) for T85 than C, and these weights were higher ($P < 0.05$) for CG compared with NCG. The 91-d tester calf ADG was 19% higher ($P < 0.01$) for calves grazing T85 than C, and 9.4 % higher ($P < 0.03$) for calves on CG than calves on NCG. Calf gain/ha was higher ($P < 0.03$) for calves grazing T85 than C. Cow performance was higher on T85 than C; with higher cow 91-d ADG ($P < 0.04$), cow gain/ha ($P < 0.01$), and stocking rate/ha ($P < 0.01$). Improved cow and calf performance has been reported previously on other similar forages. Wyatt et al. (1997) reported an increase in BW of cows grazing bermudagrass-dallisgrass compared with cows grazing Alicia bermudagrass. In the same study, calves suckling cows grazing bermudagrass-dallisgrass pastures weighed 18% more at weaning than calves on Alicia bermudagrass pastures. Cow and calf performance were consistently greater for bermudagrass-dallisgrass than for Alicia bermudagrass pastures (Wyatt et al., 1997). Hill et al. (1985) reported higher cow gains, higher calf gains and higher weaning weights on Coastal bermudagrass pastures compared with Pensacola bahiagrass pastures. Calf ADG during summer approached 1.0 kg on T85 pastures in the present study (Table 1), similar to results reported by Rouquette et al. (1998), when C bermudagrass biomass did not limit ad libitum consumption of the forage.

Calf creep grazing treatments increased cow ADG ($P < 0.03$) and cow gain/ha ($P < 0.01$) compared with NCG, but cow stocking rate did not differ between treatments (Table 1). The 2-yr mean forage mass was similar for all pastures ($P > 0.70$; 6939 vs. 6628 kg/ha, C vs. T85; 6664 vs. 6896 kg/ha, NCG vs. CG), well above the targeted average of 2,800 kg/ha. The forage mass availability in pastures should allow a high degree of selectivity by cows and calves. A forage × creep grazing × sample date interaction ($P < 0.01$) occurred for forage mass in 2004; however all tests of effects involving treatments indicated no differences ($P > 0.10$), therefore only the means for forage × date are presented (Figure 3a). In 2004, forage mass was similar for C and T85 pastures throughout most of the grazing interval, but T85 had higher ($P < 0.05$) forage mass than C pastures on July 27, but forage mass was reduced to comparable levels with C by increasing stocking rates. The increased forage mass reflected recent fertilizer application and heavy rainfall. In 2005, only forage mass was affected by forage and date main effects ($P < 0.01$), but for ease of presentation forage × date interaction data are presented (Figure 3b) to illustrate the point that as the season progressed, relative differences in forage mass were maintained, with T85 pastures stocked at somewhat higher rates than C pastures. In this experiment, cows and calves were assigned to pastures in early June of each year after the spring breeding season. Earlier research has documented higher quality of C bermudagrass, and other cultivars in the spring (Hill et al., 1985; Utley et al., 1978), which often allows calves to begin rapid growth before summer grazing begins. The present study was designed to have cattle grazing during the summer months, which often present challenges to cow and calf production at our location related to potential for drought, high temperatures, and low forage quality and mass. Although all classes of beef cattle have grazed C over the years, cow-calf performance on T85 pastures in the US has not been reported. This experiment applied pressure to the forages to support calf gains during the last 90 d before weaning, a time when calf BW, nutrient requirements and forage DMI are increasing, but cow milk production is declining. Cow ADG during summer was above maintenance while they nursed calves, and ADG was higher for cows grazing T85 (Table 1), indicating that cows had recovered most of their BW following calving before assignment to pasture treatments in this study. Summer temperatures, rainfall amounts, and rainfall distribution often affect summer grazing performance of calves. Inclusion of a high quality legume as a creep grazed forage was predicted to supply additional nutrients for the calves as they approached weaning time in later summer, and aeschynomene allowed increased calf performance in this study.

Increased cow and calf performance on T85 pastures was consistent with previously reported increased steer performance on T85 pastures compared with Tifton 78 and C pastures (Hill et al., 1993; 1997a, b; 2001a). Creep-grazing aeschynomene paddocks (DM, CP, ADF, NDF, non-structural carbohydrates, and TDN was 91, 20, 36, 46, 27, and 59 % of DM, respectively) resulted in additional calf gains on both C and T85 pastures, which is consistent with older research (Ocumpaugh and Dusi, 1981) in which aeschynomene provided the highest calf gains of several legumes and grasses compared as creep grazing forages in addition to perennial grass pastures. Since T85 forage has higher quality than C, an interaction was anticipated from creep feeding the aeschynomene, because higher gains were expected on C pastures. However, calves on CG treatments for both C and T85 responded with increased gains, resulting in no pasture × CG interaction ($P > 0.10$). In south and central Florida, aeschynomene is the most widely adapted warm-season legume available for grazing. It performs well on the large expanses of poorly drained soils in Florida and in other tropical climates (Sollenberger and Quesenberry, 1985). Forage production ceases when air temperatures reach 10 C or lower, therefore it is better suited for tropical climates. At Tifton, GA, we are near the northern limit for aeschynomene production, and we observed slow forage growth from establishment in May, until mid-July, each year, which was probably a result of low rainfall during establishment (Figure 1). However, calves consistently responded to the CG treatment with increased gains during summer before weaning. The substantial increase in ADG of calves on T85 preweaning in our study is consistent with recent reports from Texas (Rouquette et al., 2004) for weaned calves grazing T85 pastures. Results of this experiment suggest that higher gains from calves grazing T85 during summer could improve production efficiency in southern cow-calf operations.

Pasture Quality

Chemical analyses of masticate samples from pastures in both years (Table 2) revealed no year interactions ($P > 0.10$). The CP concentrations were lower ($P < 0.05$) for September masticate samples compared with June and August samples ($P < 0.05$), but CP in masticate from all treatment pastures exceeded CP requirements (NRC, 1996) for cows and calves throughout the study interval. The CP concentrations and fiber in masticate samples were unaffected ($P > 0.10$) by treatments. Sampling dates were separated for ADF, NDF, CP and ADL ($P < 0.01$; P <0.01; $P < 0.05$; $P < 0.10$, respectively) for forage masticate. Higher inherent NDF in Tifton 85 masticate (Hill et al., 1993), and in T85 hay samples (Mandebvu et al., 1999; Hill et al., 2001b) has been reported. In the present study, increased NDF on C with creep grazing apparently occurred from increased grazing of aeschynomene on the C CG treatment resulting in higher forage mass, and higher fiber. Masticate IVDMD (Table 2) had a forage × creep grazing interaction ($P < 0.05$; C NCG = 57.4%; C CG = 52.1%; T85 NCG = 59.1%; T85 CG = 60.0%). The IVDMD was lower for C CG than C NCG ($P < 0.05$), but IVDMD was similar ($P > 0.10$) for T85 NCG and T85 CG. Additionally, IVDMD was higher ($P < 0.05$) for T85 than for C pastures, which corresponds to higher esophageal forage masticate IVDMD in May and September in a previous steer grazing study (Hill et al., 1993). Sampling date affected forage quality, with higher ($P < 0.01$) IVDMD in June than in August or September. The higher forage mass of all pastures (Figure 3a,b) throughout the study suggested that forage selectivity by cows and calves was high, but it may also indicate more maturity of pasture forages, resulting in somewhat lower IVDMD as indicated in the esophageal masticate samples.

CONCLUSIONS

Tifton 85 has produced substantially higher DM yields, higher digestibility, and higher ADG in steers, beef calves and cows compared with Coastal bermudagrass. Throughout our study, forage mass was abundant and tended to be higher for Tifton 85 than Coastal pastures. Cow and calf performance were considerably higher for Tifton 85 pastures in both years of the study. Under continuous stocking, Tifton 85 pastures had higher nutritive value and were stocked at a higher level than Coastal pastures. Calves with access to aeschynomene creep grazing paddocks had higher ADG and weaning weights on both Coastal and Tifton 85 pastures, indicating a need for supplemental high quality for calves before weaning. Results suggest higher gains from calves grazing Tifton 85 bermudagrass during the summer could improve production efficiency in cow-calf operations across much of the southeastern United States.

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Table 1. Two-year average cow and calf performance on Coastal or Tifton 85 bermudagrass pastures with or without aeschynomene creep grazing [a].

Item	**Pasture**		**Creep Grazing**			**Probability, *P* <**	
	C	T85	NCG	CG	SE	Pasture	Creep
Tester cow-calf pairs/yr	48	48	48	48			
Calf age, days[b]	119	119	118	120	0.97	0.70	0.22
Initial calf wt, kg[c]	158.9	159.4	160.3	157.9	3.17	0.80	0.29
Weaned calf wt, kg[d]	233.4	246.6	236.5	243.5	1.88	0.01	0.03
205-d BIF, adj. wt., kg[e]	240.3	252.9	243.3	249.9	2.18	0.01	0.05
Calf 91-d ADG, kg	0.79	0.94	0.82	0.90	0.02	0.01	0.03
Calf gain/ha, kg	202.6	261.9	224.2	240.3	12.00	0.03	0.40
Cow 91-d ADG, kg	0.04	0.14	0.03	0.15	0.04	0.04	0.03
Cow gain/ha, kg	14.5	57.1	16.8	54.8	6.8	0.01	0.01
Cow stocking rate/ha[f]	3.73	4.39	4.27	3.58	0.08	0.01	0.30

[a] Coastal (C), Tifton 85 (T85); Least squares adjusted means; [Proc MIXED (SAS, 2003)]; pasture × creep grazing ($P > 0.10$) for all variables.
[b] Covariate adjustments: calf sex, birth weight, age, breed, initial weight, cow age.
[c] Covariate adjustments: calf sex, birth weight, age, cow age, cow breed.
[d] Covariate adjustments: calf sex, birth weight, age, initial weight, cow age.
[e] Covariate adjustments: calf sex, birth weight, age, cow age.
[f] Cow stocking rate includes tester cows and grazer cows averaged over grazing period.

Table 2: Two-year forage quality of pastures determined using forage masticate of esophageal steers in June, August and September.[ab]

Item	Forage		Creep Grazing			Sampling month			
	C	T85	NCG	CG	SE	Jun	Aug	Sep	SE
	----------	----------	----------	----------	%	----------	----------	----------	
Chemical Composition									
DM	92.4	92.2	92.2	92.4	0.24	92.9[d]	91.2[e]	92.8[d]	0.31
Ash	9.2	9.5	9.6	9.2	0.31	9.2[d]	9.7[d]	9.3[d]	0.28
CP	16.5	16.9	17.0	16.4	0.39	17.4[m]	17.3[m]	15.4[n]	0.48
ADF	46.3	46.9	46.3	46.9	0.62	44.0[f]	49.1[d]	46.8[e]	0.55
NDF	70.1	71.9	70.9	71.0	0.88	69.7[d]	71.8[d]	71.4[d]	0.87
ADL	25.5	25.1	25.2	25.4	1.19	29.7[x]	22.5[y]	23.9[xy]	1.23
IVDMD[c]	54.7	59.5	58.2	56.0	2.12	63.3[d]	55.4[e]	52.7[e]	1.25

a Abbreviations: C = Coastal bermudagrass; T85 = Tifton 85 bermudagrass; NCG = pastures without creep grazing available; CG = pastures with creep grazing available.

[b] Data presented as main effect means for forages and creep grazing; there were no effects of year (*P* > 0.20) or year interactions (*P* > 0.20) for chemical data.

[c] A forage × creep grazing interaction ($P < 0.05$) occurred for IVDMD, (C NCG = 57.4%; C CG = 52.1%; T85 NCG = 59.1%; T85 CG = 60.0%).

[def] Least squares means for forage masticate at different sampling dates differ at ($P < 0.01$).

[mn] Least square means for a pasture forage masticate at different sampling dates differ at ($P < 0.05$).

[xy] Least square means for a pasture forage masticate at different sampling dates differ at ($P < 0.10$).

Figure 1: Rainfall (cm) distribution by months of grazing experiment in 2004 and 2005, compared with 80-yr average rainfall for the same months. Rainfall recorded at University of Georgia Coastal Plain Experiment Station, Tifton, an official USDA Weather Station, with weather data instrumentation located 500m from experimental pastures.

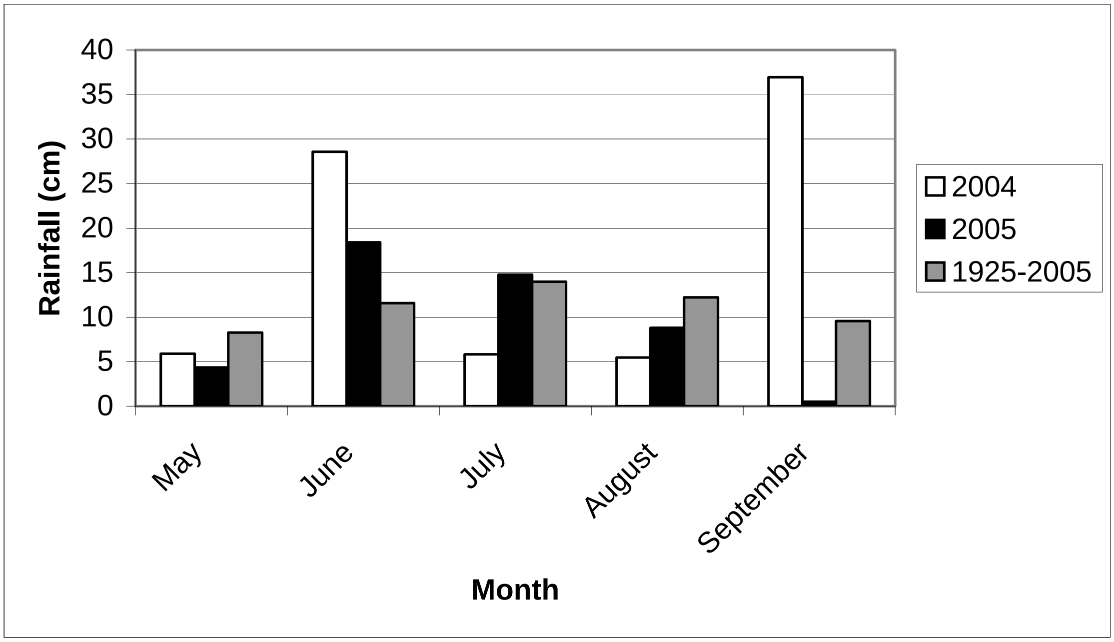
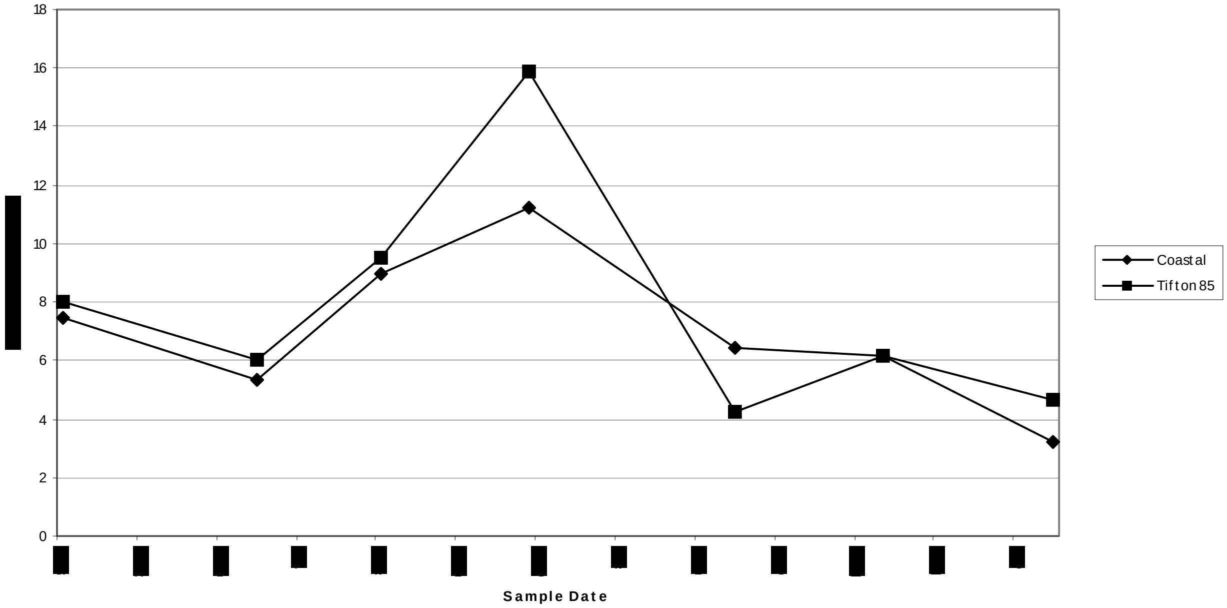


Figure 2. Forage mass (kg/ha) in Coastal and Tifton 85 pastures during the grazing interval; (a) 2004; forages within dates, SE = 722 kg/ha, LSD = 2122, 21 df; dates within forages, SE = 792 kg/ha, LSD = 2381, 15 df; (b) 2005; either direction, SE = 717, LSD = 2080, 27 df.

(a)



(b)