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FORAGE AND BEEF CATTLE RESEARCH

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RESEARCH CENTER

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Abstract of findings of a preliminary study on the effect of a certain type of forage on the growth and health of beef cattle. The study was conducted at the Texas A&M University Agricultural Research and Extension Center at Overton, Texas. The results of the study are presented in this report.

FORAGE AVAILABILITY AND SOME BLOOD METABOLITES OF THE COW

F. M. Rouquette, Jr. and R. D. Randel

SUMMARY

'Coastal' and common bermudagrass, 'Pensacola' bahiagrass, and common weeping lovegrass were grazed at two levels of forage availability (stocking rates) with cows and calves. Cows on low forage availability paddocks lost 0.5 lbs/day, whereas, cows grazing high forage availability paddocks gained 0.98 lbs/day. The suckling calves gained 1.14 and 2.17 lbs/day, respectively, on low and high forage availability paddocks. Some of the range in concentrations of various blood metabolites assayed were: 252 to 347 mg/100 ml total lipids; 25.4 to 31.0 mg/100 ml glucose; 83.2 to 110.4 ppm calcium; 17.8 to 24.2 ppm magnesium; 3.9 to 5.7 mg/100 ml phosphorus; 5.3 to 7.3 g/100 ml total protein; and 13.7 to 19.8 mg/100 ml urea nitrogen. The level of forage availability did not appear to have a dramatic influence on blood metabolites.

OBJECTIVES

This study was initiated to quantify the effect of level of forage availability and grass specie on some blood metabolites of mature F-1 (Brahman x Hereford) cows.

PROCEDURES

'Coastal' and common bermudagrass, 'Pensacola' bahiagrass, and common weeping lovegrass were grazed at two levels of forage availability each with 4-6 mature F-1 (Brahman x Hereford) cows and their calves. A low level of forage availability was defined as >95% utilization of forage above a 2-inch height; whereas, a high level of forage availability was defined as <80% utilization above a 2-inch height. No mineral supplement was available during the test period (April 17 to July 9). Cows were weighed at 28-day intervals and cows were bled via tail puncture. Blood plasma was assayed for total lipids, glucose, calcium, inorganic phosphorus, magnesium, total protein, and urea nitrogen.

RESULTS

The performance of both cows and calves from all grasses and levels of forage availability are presented in Table 1. On the average, cows lost .5 lbs/day and calves gained 1.14 lbs/day on the low forage availability paddocks. The average daily gain of cows and calves from the high forage availability paddocks was 0.98 and 2.17 lbs, respectively.

The influence of forage availability of four warm-season perennial grasses is shown in Figures 1-7. Bahiagrass appeared to produce a higher concentration of total lipids in blood plasma as compared to the other three grasses. There was a trend toward increased total lipid concentration in the high forage availability paddocks. There were no identifiable trends associated with blood plasma glucose as influenced by grass specie or level of forage availability. Blood plasma calcium was also somewhat erratic, but indicated that Coastal bermudagrass produced the least quantities in blood. The results of inorganic phosphorus was interesting since the low levels of forage availability accounted for the highest levels in blood plasma. The level of inorganic phosphorus was particularly high from Coastal bermudagrass-grazed cows. The content of blood plasma magnesium was found to be approximately 22 ppm, but there was no definite influence from forage treatments. Cows grazing bahiagrass exhibited the greatest quantities of total protein in blood plasma; whereas, those cows grazing the low available Coastal bermudagrass had the highest concentration of urea nitrogen in blood plasma.

Table 1. Average daily gain/loss of cows and calves grazing four grasses at two levels of forage availability.

GRASS	FORAGE AVAILABILITY	AVERAGE DAILY GAIN (lbs)	
		COW	CALF
WEeping LOVEGRASS	Low ¹	-0.53	1.15
	High ²	0.44	1.94
COMMON BERMUDAGRASS	Low	0.18	0.98
	High	0.86	2.27
PENSACOLA BAHIA GRASS	Low	-0.78	1.16
	High	1.18	2.23
COASTAL BERMUDAGRASS	Low	-0.88	1.27
	High	1.44	2.24
AVERAGE OF ALL GRASSES	Low	-0.50	1.14
	High	0.98	2.17

¹Low forage availability indicates a high stocking rate and a forage utilization of >95% of forage above a 2-inch height.

²High forage availability indicates a low stocking rate and a forage utilization of <80% of forage above a 2-inch height.

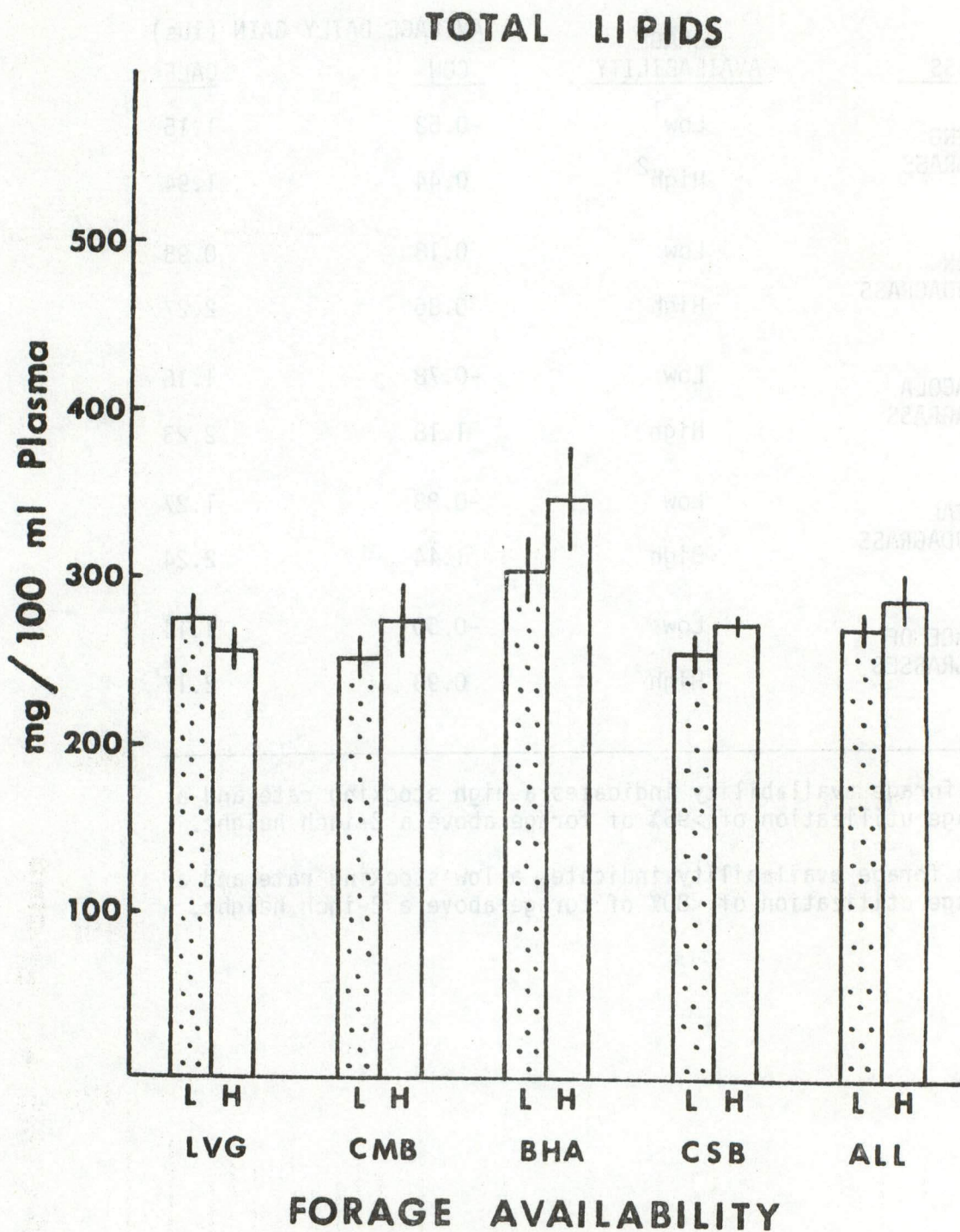


Figure 1. Total lipid content of blood plasma from cows grazing lovegrass (LVG), common bermudagrass (CMG), bahiagrass (BHA), and Coastal bermudagrass (CSB) at low (L) and high (H) levels of forage availability.

CALCIUM

GLUCOSE

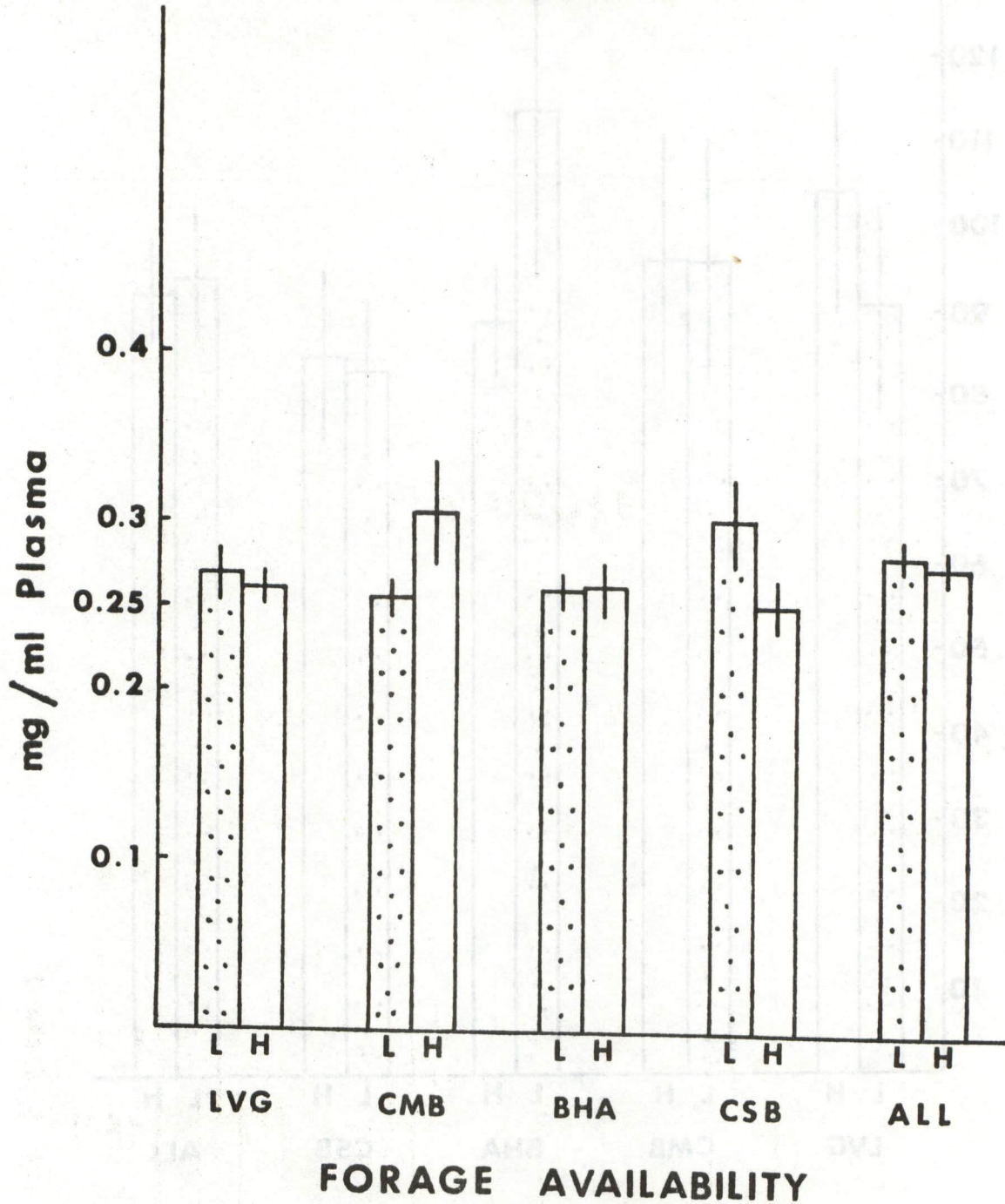


Figure 2. Glucose of blood plasma from cows grazing lovegrass (LVG), common bermudagrass (CMB), bahiagrass (BHA), and Coastal bermudagrass (CSB) at low (L) and high (H) levels of forage availability.

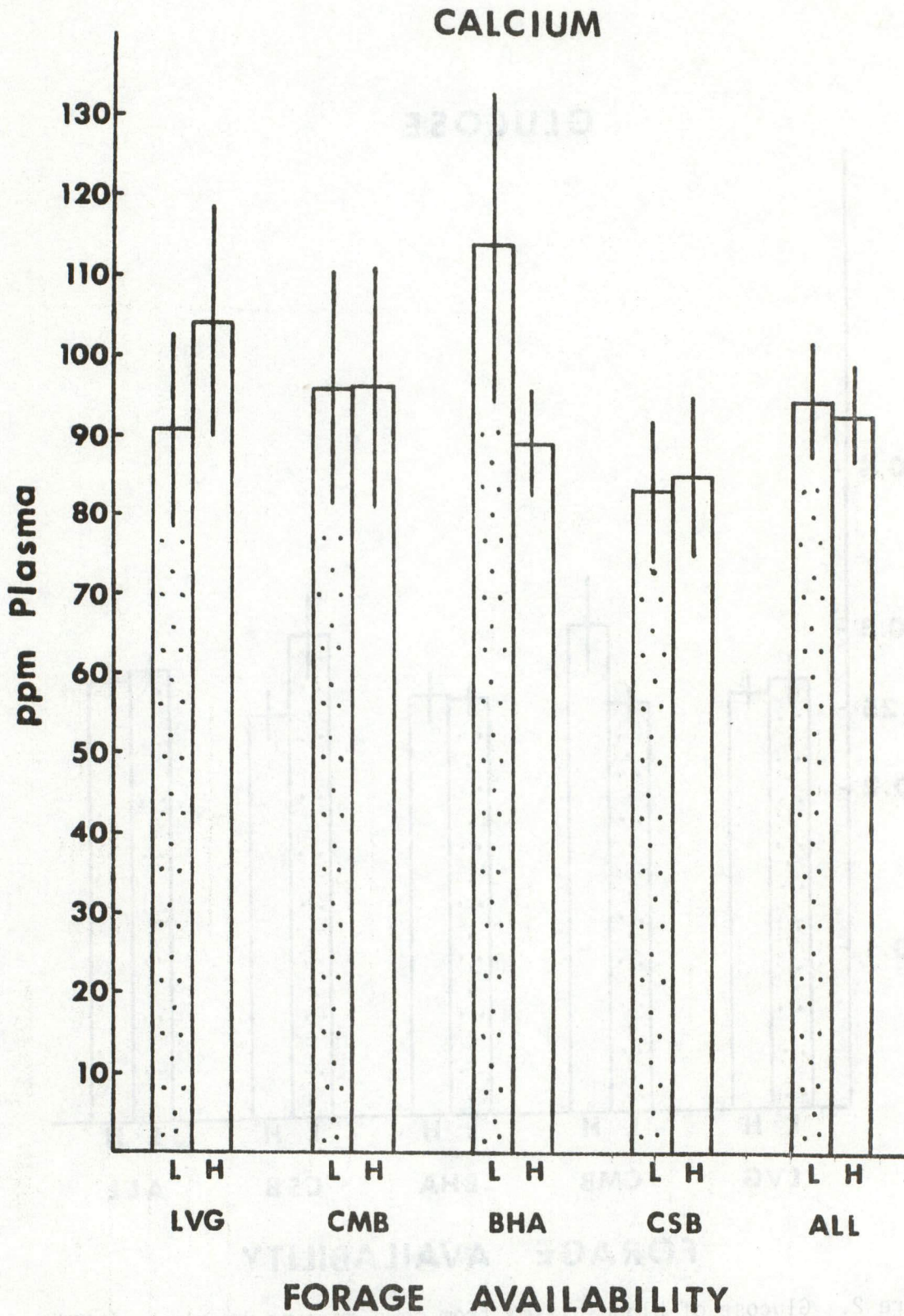


Figure 3. Calcium content of blood plasma from cows grazing lovegrass (LVG), common bermudagrass (CMB), bahiagrass (BHA), and Coastal bermudagrass (CSB) at low (L) and high (H) levels of forage availability.

INORGANIC PHOSPHORUS

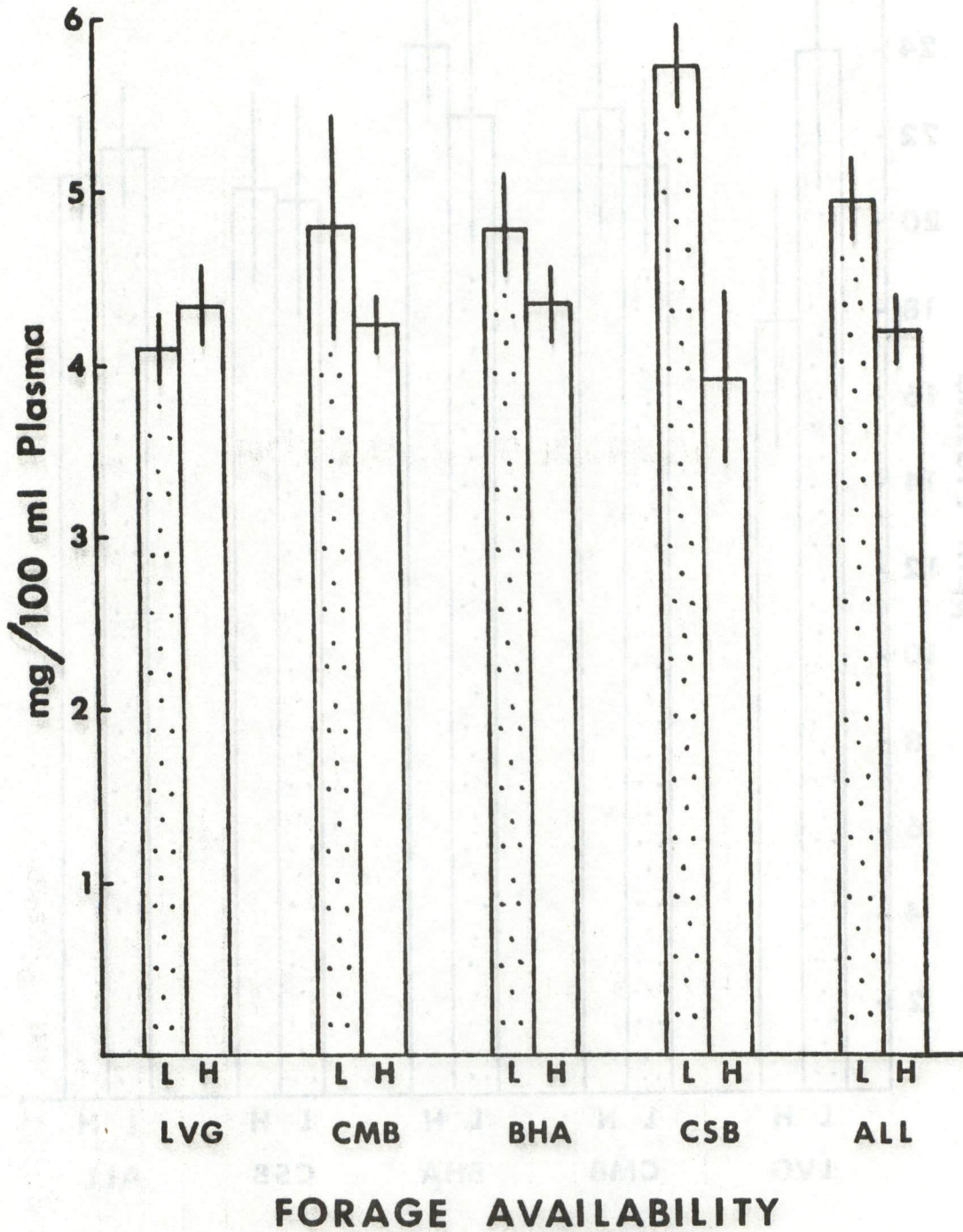


Figure 4. Inorganic phosphorus of blood plasma from cows grazing lovegrass (LVG), common bermudagrass (CMB), bahiagrass (BHA), and Coastal bermudagrass (CSB) at low (L) and high (H) levels of forage availability.

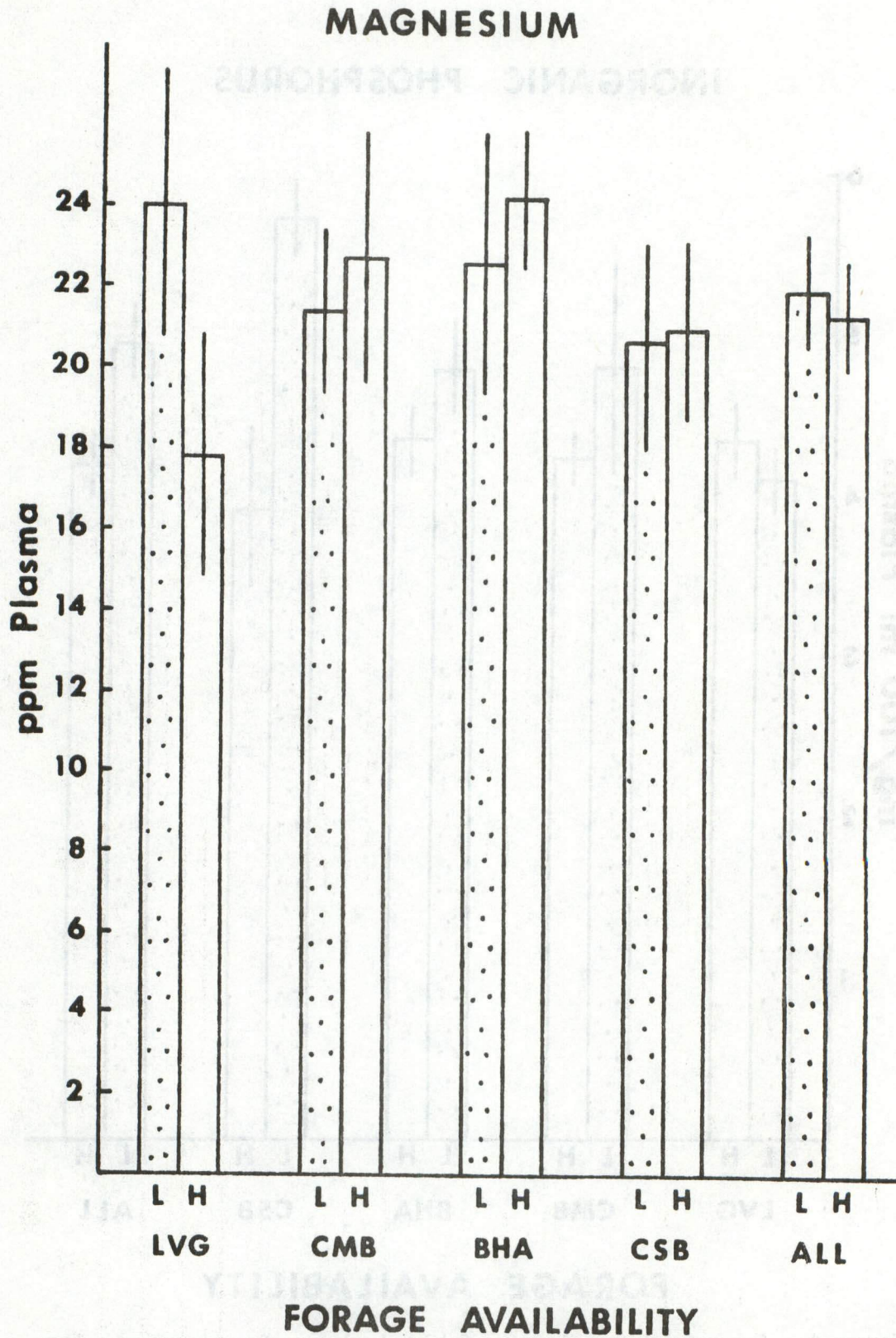


Figure 5. Magnesium content of blood plasma from cows grazing lovegrass (LVG), common bermudagrass (CMG), bahiagrass (BHA), and Coastal bermudagrass (CSB) at low (L) and high (H) levels of forage availability.

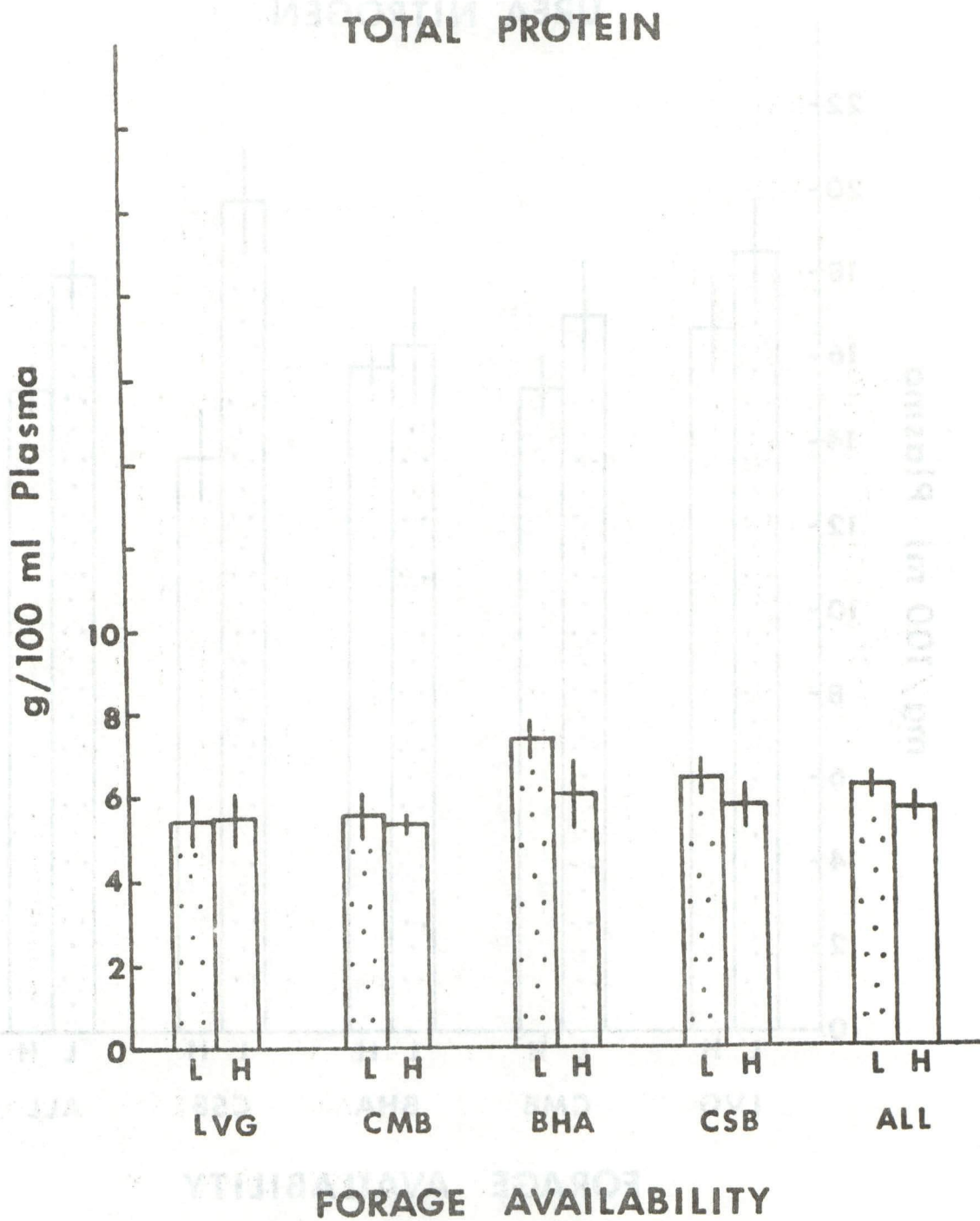


Figure 6. Total protein of blood plasma from cows grazing lovegrass (LVG), common bermudagrass (CMG), bahiagrass (BHA), and Coastal bermudagrass (CSB) at low (L) and high (H) levels of forage availability.

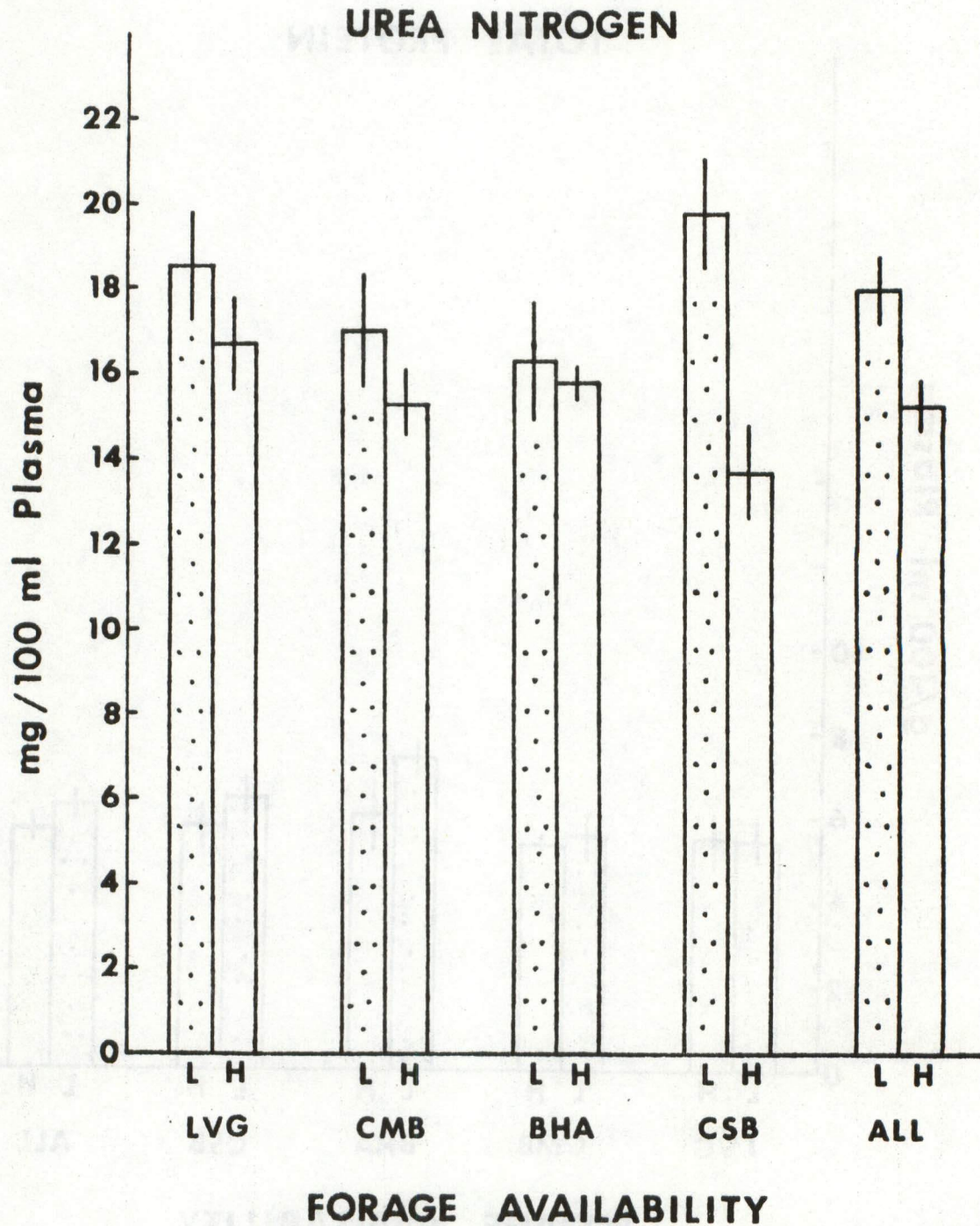


Figure 7. Urea nitrogen content of blood plasma from cows grazing lovegrass (LVG), common bermudagrass (CMG), bahiagrass (BHA), and Coastal bermudagrass (CSB) at low (L) and high (H) levels of forage availability.

a ryegrass-clover-bermudagrass pasture. Average age at slaughter of these fall-born calves was 259 days. Immediately at weaning, all calves were weighed and transported 60 miles to a slaughter facility and the following carcass data recorded 48 hours post-mortem: carcass weight (warm and chilled), fat thickness, KPH fat, fat color, marbling, marbling texture, maturity, USDA yield grade, USDA quality grade, conformation, ribeye area, lean color, lean firmness, lean texture, and tenderness via Armour Tenderometer.

Six carcass sides, one heifer and one steer from each treatment, were broken to determine the following composition traits: percent and total wholesale bone-in cuts, percent and total boneless trimmed primal cuts, percent total fat trim, percent total bone, percent total lean, and percent tendons, fascia, and connective tissue. In addition, three steaks were removed from the 10th-12th rib region of each carcass and frozen for future sensory evaluations. At the time of the taste panel evaluation, steaks 1-inch in thickness were oven broiled in a 177°C oven to an internal temperature of 75°C (medium well). The 8-member taste panel scored carcasses from the three stocking rates as well as the long-fed cattle on the following traits: juiciness, tenderness, connective tissue, flavor desirability, and overall desirability. Shear force values were derived from 1/2-inch cores obtained from each steak and are reported as pounds of force required to shear through each core.

RESULTS

The F-1 (Brahman x Hereford) cows and their 1/2 Santa Gertrudis calves grazed ryegrass-arrowleaf clover-bermudagrass paddocks at 3 grazing pressures to predetermined levels of forage availability. The resulting 3 stocking rates were 2.54, 1.83, and 1.10 cow-calf pairs per acre for the 146-day grazing period (February 18 to July 14). Liveweight performance of both steers and heifers from each grazing pressure treatment are presented in Table 1. A 200-pound spread in weaning weights were recorded between heifers on high-stocked paddocks and steers on low-stocked paddocks. Calves on the low-stocked paddocks had 22% higher gains per animal than calves on high-stocked paddocks. Conversely, the high-stocked paddocks produced 58% more beef per acre than the low-stocked paddocks. Steer calves had higher average daily gains (ADG) on both the high- and low-stocked paddocks than did heifers by 19.4 and 17.3%, respectively.

The percent allocation of USDA quality grades of calves slaughtered at weaning are shown in Table 2. There were no Choice carcasses in the entire treatment, and only the medium- and low-stocked paddocks produced Good grade carcasses. The majority of the calves slaughtered graded Standard. Table 3 presents carcass composition information from one steer and one heifer slaughtered from each grazing pressure treatment. The most noticeable difference in carcasses due to stocking rate was in percent fat trim.

Figures 1-5 illustrate sensory trait differences between conventional long-fed yearling cattle and calves slaughtered at weaning. The weanling calf carcasses rated nearly as high in all traits measured with the exception of tenderness. Flavor, juiciness, overall desirability and cooking loss characteristics were almost identical among the weanling calf treatment carcasses and between long-fed and non-fed carcasses.

Table 4 shows the differences in estimated tenderness between steer and heifer carcass as measured via Armour Tenderometer and the Warner-Bratzler shear force technique. These data confirmed that of the taste panel in that there was very close tenderness similarities between treatments. From these tenderness estimates, all carcasses would have been rated as relatively tender.

Table 1. Pre-weaning performance of steers and heifers.

Stocking Rate (Cow-calf Units/Ac)	Feb. 18 to July 14 (146 days)											
	Age at Weaning		Weaning Weight		Average Daily Gain		Gain per Acre					
	Heifer	Steer	Avg	Heifer	Steer	Avg	Heifer	Steer	Avg			
2.54	266	249	258	496	542	519	1.34	1.60	1.47	497	593	545
1.83	259	259	259	530	575	553	1.67	1.69	1.68	446	452	449
1.10	254	258	261	574	696	635	1.97	2.31	2.14	316	371	344

Table 2. USDA quality grade of calves at weaning.

STOCKING RATE (Cow-calf Units/ac)	Grades			
	Utility (%)	Standard (%)	Good (%)	Choice (%)
2.54	57	43	-	-
1.83	14	57	29	-
1.10	-	75	25	-

Table 3. Carcass composition of one steer and one heifer from each stocking rate treatment.

ITEM	HIGH SR	MED SR	LOW SR
Side Weight (lbs)	146	162	189
<u>% Wholesale Bone-in Cuts</u>			
Rib	7.3	7.5	7.1
Loin	15.7	15.6	14.6
Chuck	27.5	26.3	28.0
Rump	4.6	4.5	4.8
Round	18.9	18.6	17.3
TOTAL Wholesale Primal Cuts	74.0	72.5	71.8
<u>% Boneless Trimmed Primal Cuts</u>			
Rib	5.0	5.3	4.9
Loin	10.2	10.9	10.0
Chuck	21.0	20.9	23.2
Rump	3.2	3.1	3.3
Round	16.1	15.5	14.4
TOTAL Boneless Trimmed Primals	55.5	55.7	55.8
% Total Fat Trim	4.7	7.9	8.0
% Total Bone	22.9	17.8	17.7
% Total Lean	69.4	72.4	71.9
% Tendons, facia, connective tissue	1.5	1.5	1.5

Table 4. Armour Tenderometer and Warner-Bratzler shear force values for weanling carcasses.

TREATMENT	ARMOUR TENDEROMETER ¹	WARNER-BRATZLER ² SHEAR FORCE
HIGH STOCKING RATE		
HEIFER	14.0	13.0
STEER	14.5	10.2
AVG	14.25	11.60
MEDIUM STOCKING RATE		
HEIFER	14.7	12.9
STEER	16.5	10.0
AVG	15.6	11.45
LOW STOCKING RATE		
HEIFER	13.4	11.6
STEER	13.9	11.0
AVG	13.65	11.3

¹ Readings of 14.5 or less are considered to be relatively tender. The higher the reading, the less tender the meat.

² Higher values indicate less tender meat.

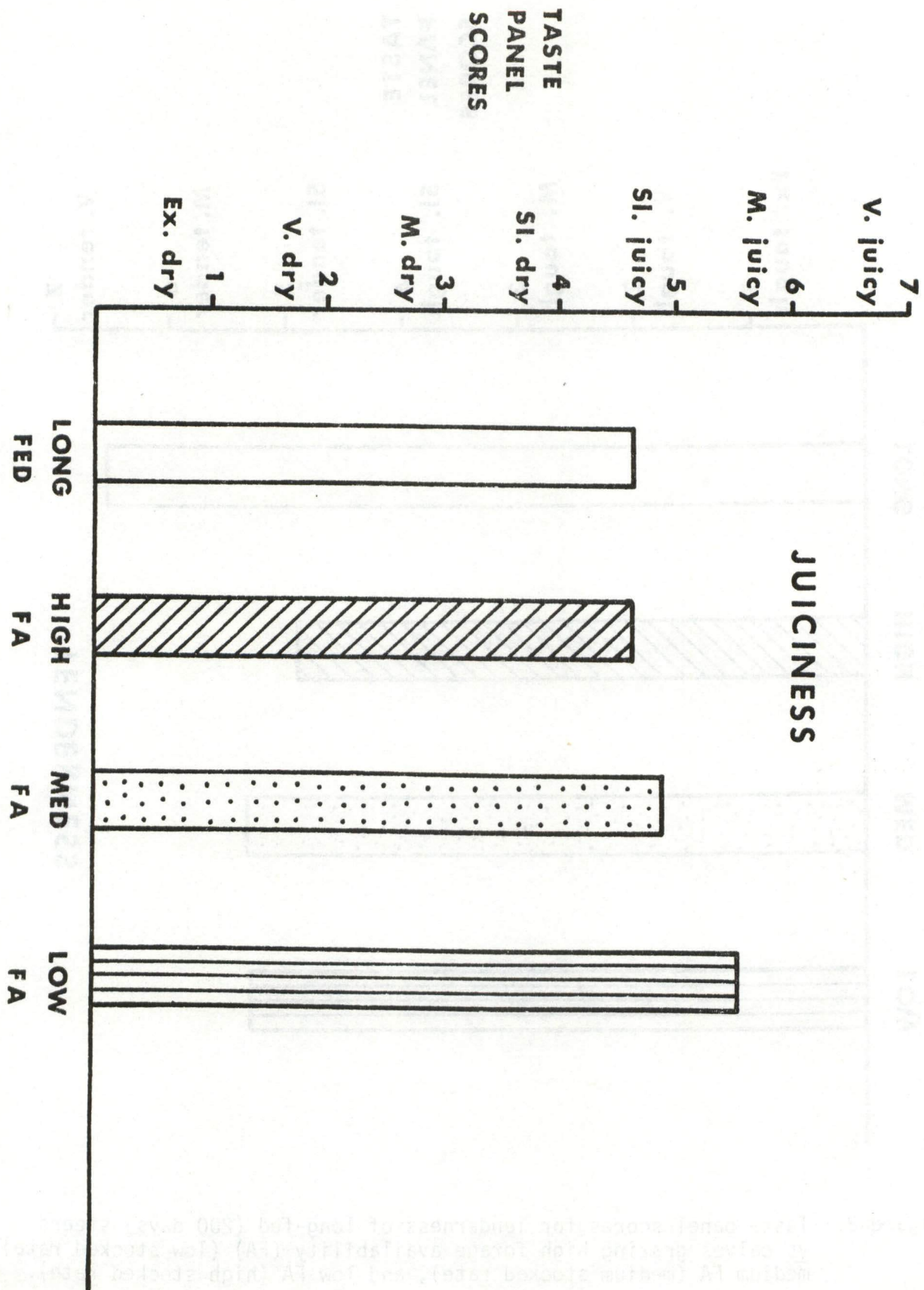


Figure 1. Taste panel scores for Juiciness of long-fed (200 days) steers vs calves grazing high forage availability (FA) (low stocked rate), medium FA (medium stocked rate), and low FA (high stocked rate).

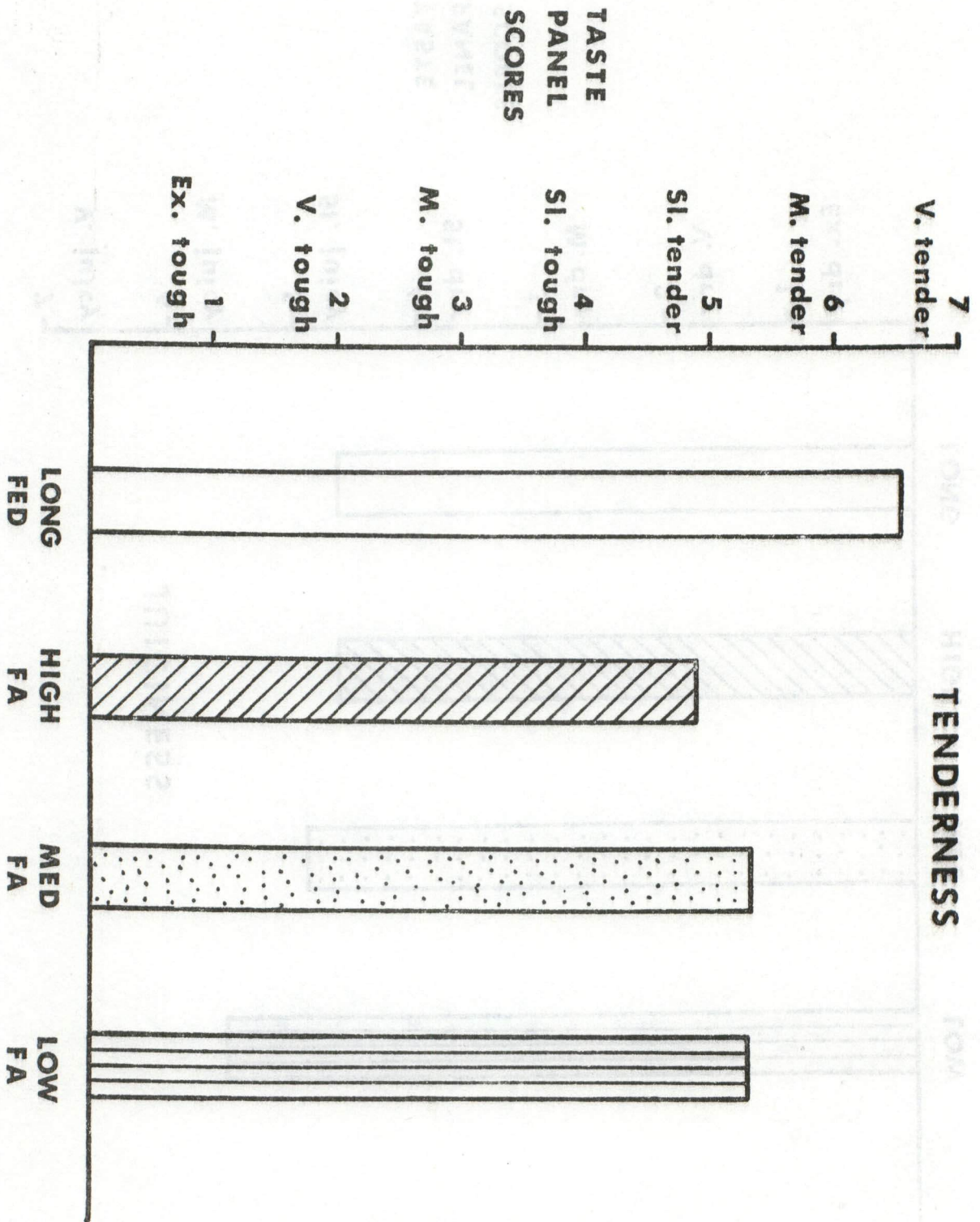


Figure 2. Taste panel scores for Tenderness of long-fed (200 days) steers vs calves grazing high forage availability (FA) (low stocked rate), medium FA (medium stocked rate), and low FA (high stocked rate).

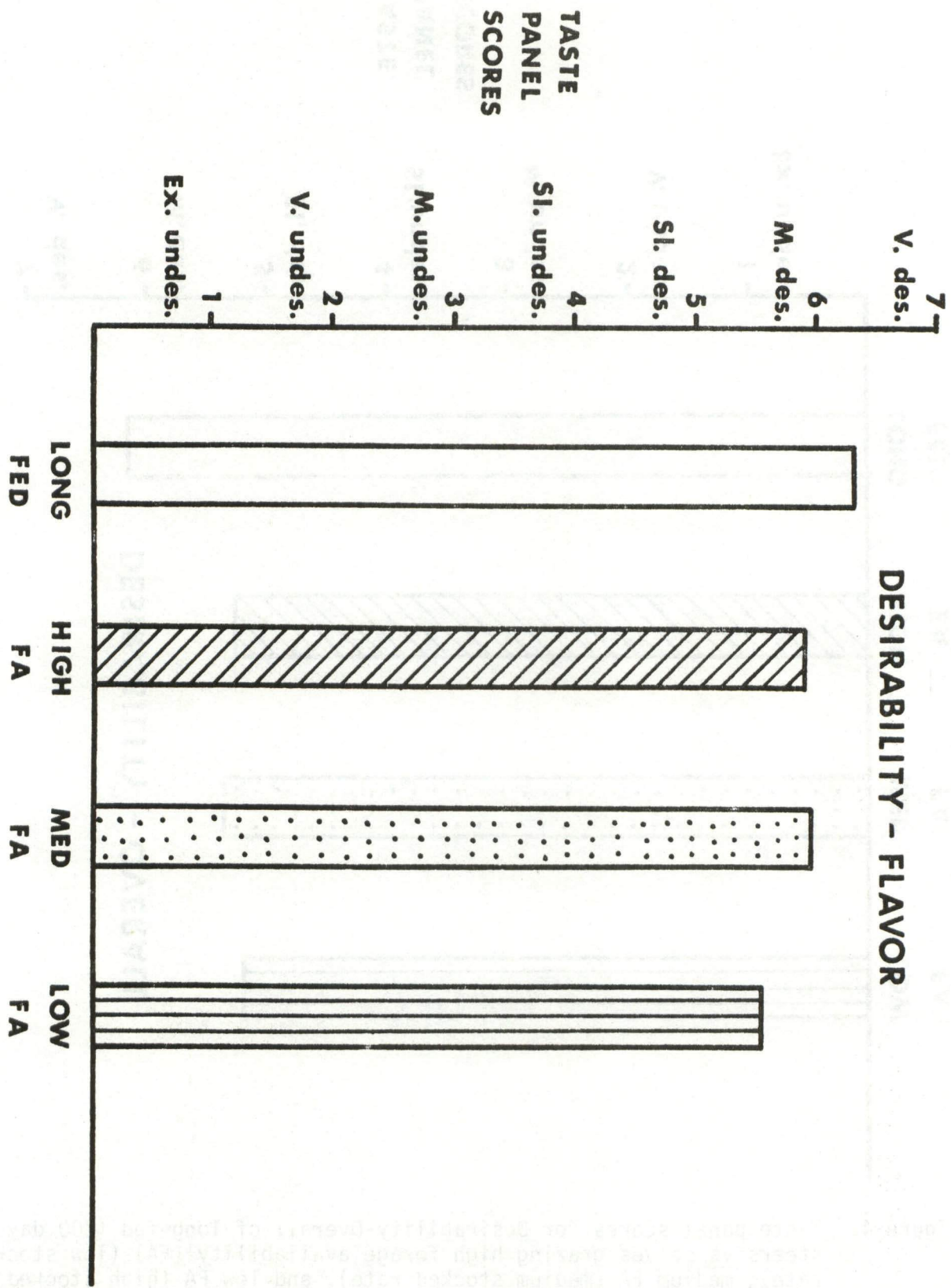


Figure 3. Taste panel scores for Desirability-Flavor of long-fed (200 days) steers vs calves grazing high forage availability (FA) (low stocked rate), medium FA (medium stocked rate), and low FA (high stocked rate).

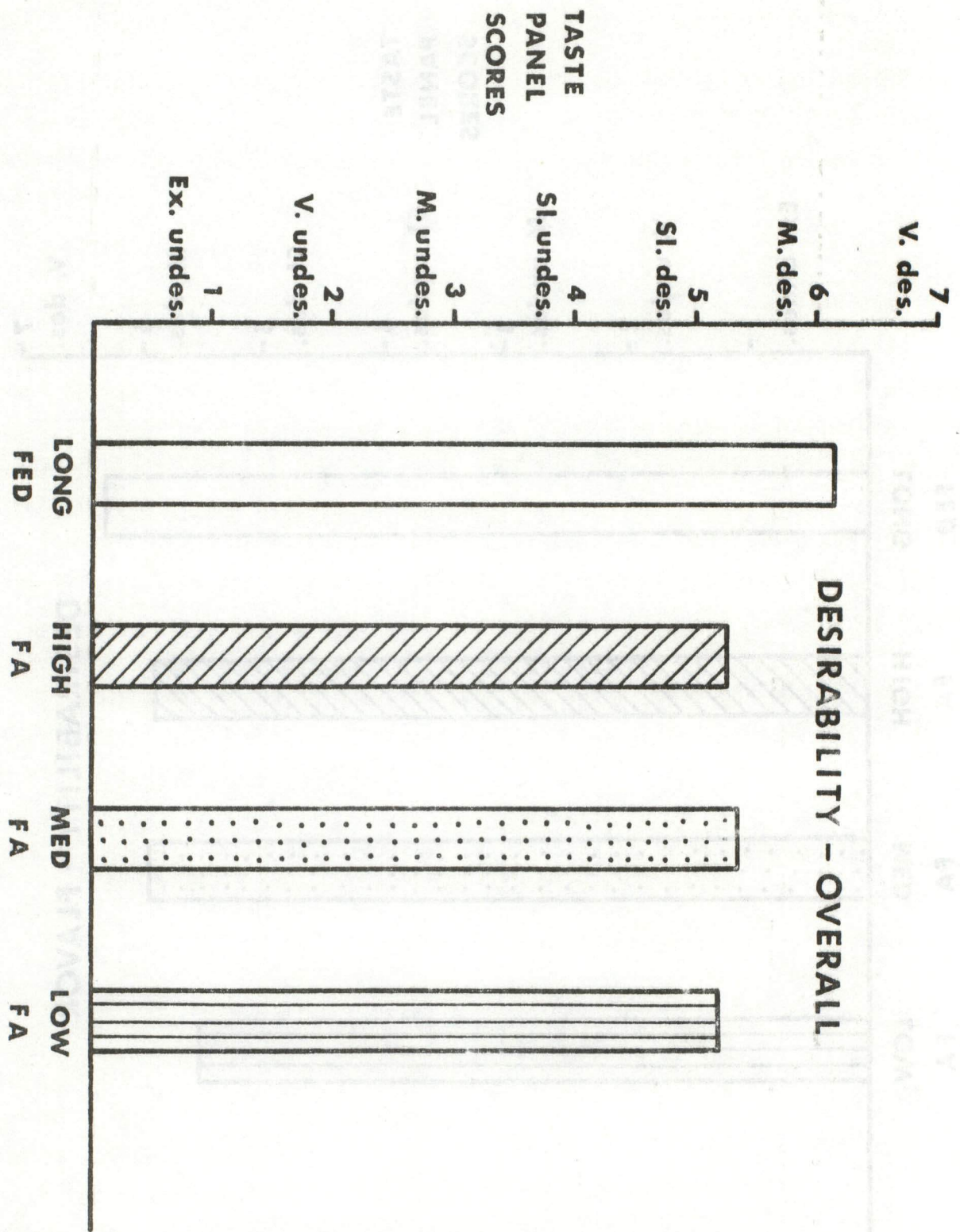


Figure 4. Taste panel scores for Desirability-Overall of long-fed (200 days) steers vs calves grazing high forage availability (FA) (low stocked rate), medium FA (medium stocked rate), and low FA (high stocked rate).

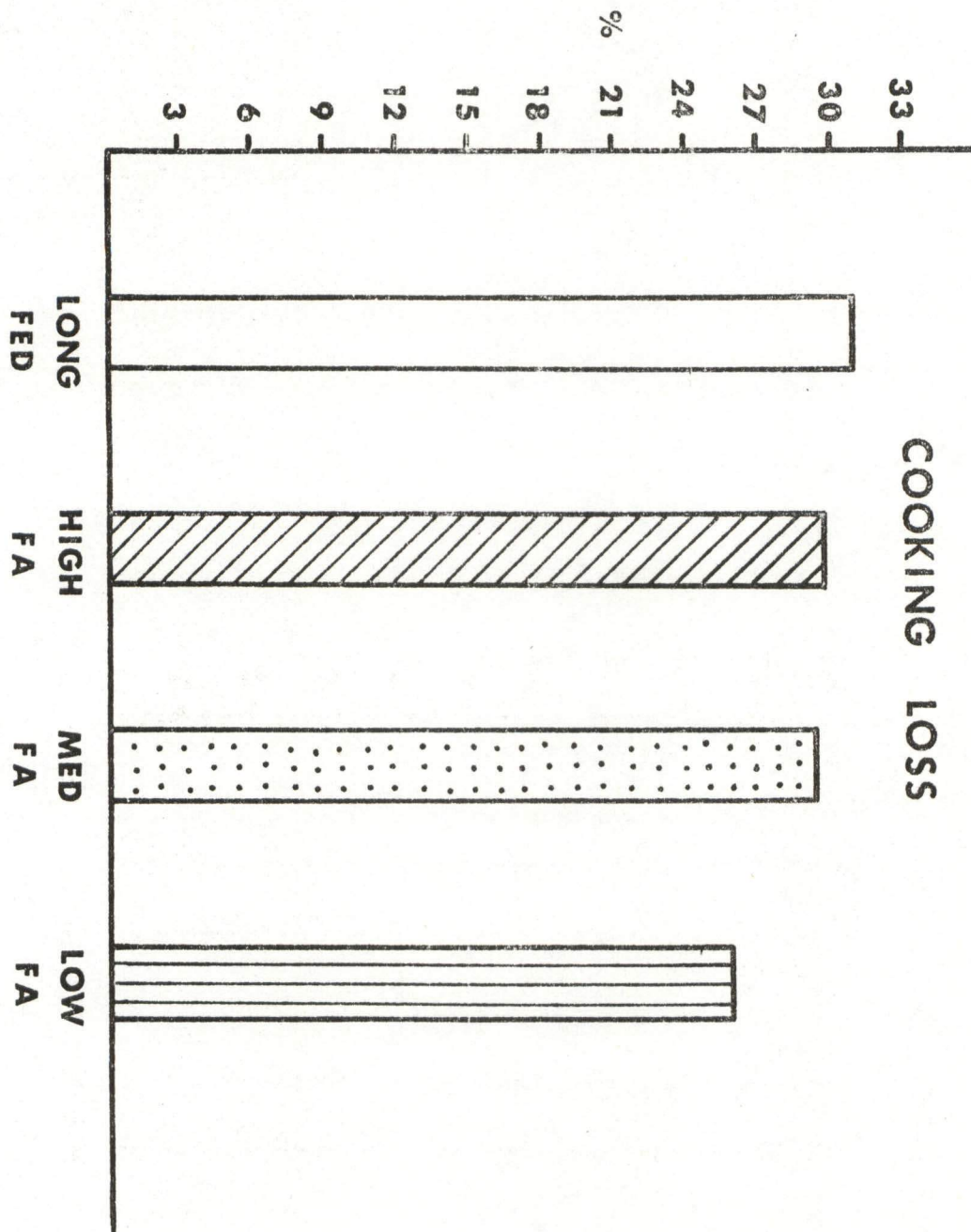


Figure 5. Taste panel scores for Cooking Loss of long-fed (200 days) steers vs calves grazing high forage availability (FA) (low stocked rate), medium FA (medium stocked rate), and low FA (high stocked rate).