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## SOIL COMPACTION OF BERMUDAGRASS PASTURES GRAZED AT THREE STOCKING RATES FOR 25 YEARS

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**Background.** Grazing of both common and 'Coastal' bermudagrass pastures was initiated in 1969 at the Texas A&M University Agricultural Research and Extension Center at Overton. From 1969 to 1984 all pastures were fertilized identically with 200-100-100 lbs/ac of N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O and overseeded with various combinations of clovers and ryegrass. From 1984 to 1994, each stocking rate paddock was further sub-divided into two fertility treatments: a) overseeded with ryegrass and only N applied; b) overseeded with clover and only K<sub>2</sub>O applied. For a 25-year period, continuous grazing has been initiated, on average, in mid- to late-February and terminated in late September (approximately 200-225 days). Pastures have not been grazed during overseeding and growth of cool-season annual forages (October to February). The primary objective of this experiment was to quantify the effect of long-term stocking rates on soil compaction and related properties.

**Research Findings.** During a 25-year period, stocking rates on common bermudagrass pastures have averaged about 0.8, 1.4, and 2.0 animal-units per acre (AU/ac), and stocking rates on Coastal bermudagrass pastures have averaged about 1.0, 1.7, and 3.0 AU/ac (AU = 1500 lbs), respectively, for low, medium, and high. Using assumptions of hoof size, one 1500-lb AU approximates a force of 30 lbs/in<sup>2</sup> and occupies .6 ft<sup>2</sup> at any point in time. Soil texture on the experimental site and at each of 3 core depths (0-1½, 6-7½, 12-13½") was uniform at 78% sand, 11% silt, and 11% clay. Soil measurements made at each of three depths in all pastures and in an adjacent area that had been ungrazed for more than 25 years included bulk density, penetration resistance (penetrometer), and organic matter (OM). These measurements are associated with characterizing soil structure which can influence water movement and rooting patterns. Table 1 revealed that there were no differences in soil compaction due to bermudagrass species, stocking rate vs non-grazed, nor fertility-overseeding. Penetrometer readings showed that common bermudagrass had higher readings (more dense) than Coastal at all 3 depths which may have been due to more robust root development. The top 0-1½ inches of soil was apparently less compacted than the other two measured soil core layers because of OM content and biological activity. Organic matter (Table 2) was similar for both bermudagrasses. There was no apparent trend to the influence of non-grazed and stocking rates on OM content. There was higher OM content in the surface layer (0-1½") on the low and medium stocked pastures compared to non-grazed and high stocked pastures. The OM content in the surface layer was higher for Ryegrass + N compared to Clover + K<sub>2</sub>O; however, at the 6-7½" depth the trend

reversed, and at the 12-13½" depth there was no difference between fertility treatments.

**Application.** In the humid environment, sandy soil areas of East Texas, there were no adverse effects of stocking rate on soil compaction parameters. Stocking densities of 4500 lbs body weight per acre proved to be no more of a detriment to soil compaction than non-grazed areas. Thus, the need to "renovate" pastures on sandy sites to alleviate soil compaction may not be warranted. These data have application for pastures on the Coastal Plain soils of the southeastern US.

Table 1. Bulk Density (Blk Den) and Penetration Resistance (Pen Res) of three soil core depths.

ITEM	0-1.5"		6-7.5"		12-13.5"	
	Blk Den (mg/m <sup>3</sup> )	Pen Res (kg/cm <sup>2</sup> )	Blk Den (mg/m <sup>3</sup> )	Pen Res (kg/cm <sup>2</sup> )	Blk Den (mg/m <sup>3</sup> )	Pen Res (kg/cm <sup>2</sup> )
<u>Bermudagrass</u>						
Common	1.19 a <sup>1</sup>	85.1 a	1.42 a	105.2 a	1.41 a	106.9 a
Coastal	1.16 a	58.7 b	1.39 a	79.9 b	1.37 a	64.7 b
<u>Stocking Rate</u>						
Non-grazed	1.22 a	58.8 b	1.37 a	95.0 ab	1.32 b	88.0 a
Low	1.13 a	62.5 b	1.37 a	80.9 b	1.38 ab	83.4 a
Medium	1.21 a	92.6 a	1.43 a	103.0 a	1.41 ab	92.3 a
High	1.17 a	67.2 b	1.43 a	92.5 ab	1.42 a	80.5 a
<u>Fertility</u>						
Ryegrass + N	1.16 a	76.3 a	1.44 a	89.0 a	1.41 a	79.9 a
Clover + K	1.18 a	71.8 a	1.38 a	95.3 a	1.39 a	90.9 a

<sup>1</sup>Numbers followed by the same letters within a column and treatment class are not significantly different (p<0.05).

Table 2. Percent organic matter in pastures stocked for 25 years.

ITEM	Soil Depth (inches)		
	0-1.5"	6-7.5"	12-13.5"
<u>Bermudagrass</u>	(%)	(%)	(%)
Common	3.38 a <sup>1</sup>	1.06 a	0.50 a
Coastal	2.98 a	0.96 a	0.38 a
<u>Stocking Rate</u>			
Non-grazed	2.74 b	0.83 b	0.65 a
Low	3.36 a	0.95 ab	0.42 b
Medium	3.61 a	0.96 ab	0.47 b
High	2.79 b	1.06 a	0.32 c
<u>Fertility</u>			
Ryegrass + N	3.51 a	0.86 b	0.42 a
Clover + K	2.99 b	1.13 a	0.39 a

<sup>1</sup>Numbers followed by the same letters within a column and treatment class are not significantly different (p<0.05).