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SOIL POTASSIUM IN BERMUDAGRASS PASTURES UNDER LONG-TERM STOCKING RATES AND FERTILITY REGIMENS

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Background. Grazing of 'Coastal' and common bermudagrass research pastures at TAMU-Overton began in 1969. Each variety was grazed at three stocking rates and received split-applied total annual fertilizer levels of 200-100-100 lbs/ac (N-P₂O₅-K₂O) from 1969 through 1984. From 1985 through 1997, Coastal and common bermudagrass pastures at each of 3 stocking rates were subdivided into the two following treatments: (1) overseeded with annual ryegrass and fertilized with N only; and (2) overseeded with clover and fertilized with K only. No phosphorus was applied to any of the pastures from 1985 through 1997. Soil K was determined by inductively coupled argon plasma (ICAP) on a Thermo-Jarrell Ash Plasma 200. The objective of this experiment was to determine soil K status in bermudagrass pastures stocked at three rates and fertilized with either exclusive N or K.

Research Findings. After 15 consecutive years of annual applications of 100 lbs K₂O/ac, soil K levels tested about 60 ppm in the 0-6" soil depth and 40 ppm in the 6-18" soil depth (Table 1). These soil K levels in 1985 were very low even after 1500 lbs K₂O/ac (1245 lbs K/ac) applied since 1969.

Across all treatments sampled in 1996, soil K did not exhibit substantial variation between common and Coastal bermudagrass pastures (Table 2). Soil K differences between these two grasses occurred only at the 6-18" and 18-36" depths. Of particular interest in soil K levels of bermudagrass pastures were the stabilized levels of soil K that was evident in the lower soil depths.

Soil K differences between pastures treated with clover + K vs ryegrass + N were relatively predictable in the 0-6" and 6-18" soil depths with the K-applied pasture soils having the most K present. However, in the 18 to 60" depths, there was no significant difference in soil K between pastures that had received annual rates of 100 lbs K₂O/ac (clover) and pastures that had not received K fertilizer for 12 years (ryegrass). Thus, the importance and extent of nutrient cycling via grazing animals is a significant biological and economic factor in grassland agriculture. In Table 2, estimates of soil K in the 0-6" soil depth were 260 lbs/ac for clover + K and 175 lbs/ac for ryegrass + N. From a soil analysis perspective, however, these K levels at 0-6" would be very low (87 ppm) to moderate (132 ppm); whereas, all K levels from 6 to 60" would be rated as very low.

The influence of stocking rate on soil K as shown by the main factors in Table 2 is not as clear as for other nutrients. A closer examination of the data showed that the medium stocked common bermudagrass pastures, both for clover + K and ryegrass + N, acted as an outlier data point by

allowing soil K to increase to a significantly higher level than that of either low or high stocked pastures. In contrast to the effect of stocking rate on soil P, soil K was not affected in the same manner.

Application. Levels of fertilizer K used in this long-range grazing study apparently offer little pollution hazard to the soil-water environment. Other data summaries from this experiment have shown no forage stand losses attributable to non-K fertilization for 12 years. Fertilization ratios for exclusive hay meadows, however, should adhere to soil test recommendations rather than omit nutrients. The influence of recycled nutrients under grazing offers opportunities to reduce fertilizer costs.

Table 1. Soil potassium status of bermudagrass pastures after 15 years of K application (1985).

Bermudagrass	Soil Depths					
	0-6"			6-18"		
	-----K (ppm)-----					
	Min	Max	Avg	Min	Max	Avg
Coastal	43	78	58	23	60	39
Common	32	87	57	25	60	41

Table 2. Soil potassium (ppm) at various soil depths in bermudagrass pastures after 28-year total including 12 years of fertility x stocking rate treatments.

1996	Soil Depths				
	0-6"	6-18"	18-36"	36-48"	48-60"
	-----K (ppm)-----				
<u>Bermudagrass</u>					
Coastal	111.5 a ¹	46.3 b	51.6 b	71.0 a	77.9 a
Common	107.9 a	65.4 a	90.1 a	72.3 a	65.5 a
<u>Fertility</u>					
Clover + K	132.1 a	72.2 a	77.1 a	69.1 a	70.8 a
Ryegrass + N	87.3 b	39.6 b	64.6 a	74.1 a	72.6 a
<u>Stocking Rate</u>					
High	108.0 ab	45.6 b	53.4 b	69.9 a	64.7 b
Medium	131.7 a	75.3 a	91.7 a	81.6 a	93.4 a
Low	89.5 b	46.8 b	67.5 b	63.5 a	57.0 b

¹Numbers within a soil depth and major treatment category followed by different letter, differ (P<.01).