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CARBON CONCENTRATION AND UPTAKE BY TIFTON 85 BERMUDAGRASS IN FIVE CUTTINGS IN 2004

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Background. We analyzed carbon (C) in plant tissue from the study of Tifton 85 bermudagrass response to potassium (K) rates and sources at two nitrogen (N) rates on a site that was adequately fertilized with phosphorus (P) each year. The Darco soil was earlier treated with 3 tons of ECCE 100% calcitic limestone (4% Mg) per acre, surface applied. Two tons additional ECCE 72% calcitic limestone (≈1% Mg) were applied and incorporated by disking with the initial phosphorus treatment. In 2002, 2003, and 2004, 120 lb of P_2O_5/ac as triple superphosphate (0-46-0) was surface-applied at growth initiation of the bermudagrass each spring. Potassium sources were potassium chloride (KCl, 0-0-62-47% Cl) and KCl plus elemental sulfur (S) compared to potassium sulfate (K_2SO_4, 0-0-50-17.6% S). Potassium rates from all sources were 0, 134, 268, and 402 lb/ac as K_2O split-applied one-third at growth initiation and one-third each following an early- and a mid-season harvest to 10 x 18-ft plots with main plots fertilized at 80 or 160 lb of N/ac for each bermudagrass regrowth during the season. Yield and samples of plant material were collected from each plot at each harvest for dry matter and chemical analysis. Plant samples were dried at 60 °C, ground to < 20-mesh, and analyzed for C using a VarioMax CNS analyzer.

Research Findings. The C concentration in bermudagrass was unaffected by any treatment in the early harvests of 2004 or by increased N application throughout the growing season (Table 1). Increasing the rate of K significantly lowered C concentration in Tifton 85 bermudagrass. Applying S with KCl increased C concentration in the plant compared to KCl minus S in harvests 3 and 4. As expected, total C content in Tifton 85 bermudagrass was increased by treatments that increased DMY (Table 2). These treatments included increased rates of N and K. The C content of this forage was increased in the order KCl + S > K_2SO_4 > KCl minus S, with the KCl + S treatment yielding 6,095 lb C/ac. Regardless of treatment, the C content of the bermudagrass was directly related to dry matter yield according to the equation C = 100.61 + 0.4247X, where X = DM Yi in lb/ac. This correlation had an $r^2 = 0.9989$.

Application. The highest C yield of 6,095 lb/ac converts to 22,333 lb of carbon dioxide (CO_2)/ac taken up by 14,074 lb of Tifton 85 dry matter/ac, or each pound of bermudagrass dry matter required 1.6 lb of CO_2 to produce. Increasing biomass production in forage systems represents a sustainable management practice that allows conversion of substantial amounts of atmospheric CO_2 into plant C. By maintaining adequate amounts of K and S along with other plant nutrients in soils hosting bermudagrass pastures, producers can significantly increase dry

matter production and, therefore, plant C uptake. Properly fertilized forages have a tremendous potential to mitigate greenhouse emissions. Carbon present in the plant tissue can be recycled through the plant-animal-soil system and contribute to increase the organic matter pool in the soil.

Table 1. Tifton 85 bermudagrass C conc. response to N and K rates and K and S sources in 2004.

N rate	**Plant C concentration**[†]					
lb/ac/harv.	Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5	Season avg.
	----------%----------					
80	42.92	43.43	43.49	43.44	43.19	43.30
160	43.01	43.08	43.33	43.24	43.19	43.17
K rate						
lb K_2O/ac						
0	43.14	43.20	43.50	43.99 a	43.72 a	43.51 a
134	43.13	43.48	43.54	43.59 ab	43.47 ab	43.44 a
268	43.04	42.98	43.44	43.30 bc	43.01 b	43.15 ab
402	42.67	43.34	43.22	42.92 c	42.92 b	43.01 b
K Source						
KCl	42.95	43.35	43.06 b	42.94 b	43.01	43.06
K_2SO_4	43.02	43.10	43.65 a	43.36 a	43.30	43.29
KCl + S	42.87	43.35	43.49 a	43.52 a	43.09	43.26
R^2	0.33	0.33	0.50	0.56	0.49	0.49
c.v.	1.5	3.3	1.5	1.5	1.8	1.1

[†]Values in a column/group followed by a dissimilar letter are significantly different statistically ($\alpha = 0.05$).

Table 2. Tifton 85 bermudagrass C content response to N and K rates and K and S sources in 2004.

N rate	**Plant C content**[†]					
lb/ac/harv.	Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5	Total
	----------lb/ac----------					
80	443	624	1147	1465 b	1387 b	5065 b
160	524	695	1140	1802 a	1825 a	5987 a
K rate						
lb K_2O/ac						
0	403 b	487 b	802 b	1180 b	1323 b	4194 c
134	472 a	646 a	1108 a	1620 a	1576 a	5423 b
268	505 a	687 a	1213 a	1707 a	1611 a	5723 ab
402	501 a	702 a	1222 a	1726 a	1726 a	5877 a
K Source						
KCl	478	626 b	985 b	1531 b	1541 b	5161 c
K_2SO_4	490	704 a	1278 a	1712 a	1584 b	5766 b
KCl + S	510	705 a	1281 a	1810 a	1788 a	6095 a
R^2	0.65	0.68	0.71	0.79	0.75	0.84
c.v.	14.2	11.7	13.8	11.9	13.1	8.3

[†]Values in a column/group followed by a dissimilar letter are significantly different statistically ($\alpha = 0.05$).