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RATES AND SOURCES OF POTASSIUM ON COASTAL BERMUDAGRASS

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SUMMARY

This study reports on the effect of potassium (K) sources and fertilization rates on Coastal bermudagrass production. During this 3 year study, we have observed significant increases in forage yield for higher K fertilization rates. Increases in forage yields are reported for 150 lbs K_2O/acre compared to an untreated control and also for 300 lbs of K_2O compared to the 150 lb rate. Potassium applied as sulfur-coated KCl produced higher yields than when applied as either K_2O (0-0-60) or sulfur-coated K_2SO_4. The response to K fertilization was greater in the second and third year of the study than in the first year. This indicated that soil K reserves were being depleted under the lower K fertilization treatments.

OBJECTIVES

To compare the influence of different rates of both single season and split applications of ordinary KCl (muriate of potash, 60% K_2O) with sulfur-coated KCl and K_2SO_4 on dry matter yield and stand maintenance of Coastal bermudagrass.

PROCEDURE

Two experiments were located on well established bermudagrass meadows. The soil at one location is a deep sand (Darco series) and the other is a somewhat rocky soil (Cuthbert series). Bermuda pastures at both sites had exhibited stand thinning, foliar diseases and reduced yield at low K rates.

Nitrogen was applied as ammonium nitrate in equal applications of 100 lbs/N/acre after each harvest. Phosphorus was applied once in the spring at 150 lbs P_2O_5/acre. Sulfur at 40 lbs S/acre was applied once in the spring as gypsum. Potassium fertilizer was broadcast over the plots by hand. Potassium fertilizer sources were muriate of potash (KCl), sulfur-coated muriate of potash (S-KCl), and sulfur-coated potassium sulfate (S-K_2SO_4). Each potassium fertilizer was applied once annually at 150 and 300 lbs K_2O per acre. The KCl was applied as a split application. Each

split application was 1/4 of the annual rate and was applied after each cutting. The nine treatments were as follows:

Treatment #	Treatment	Source	# Applications
1	0 lbs K_2O/ac		None
2	150 lbs K_2O/ac	0-0-60 (KCl)	1
3	300 lbs K_2O/ac	0-0-60 (KCl)	1
4	150 lbs K_2O/ac	0-0-60 (KCl)	4 (split)
5	300 lbs K_2O/ac	0-0-60 (KCl)	4 (split)
6	150 lbs K_2O/ac	Sulfur-coated KCl	1
7	300 lbs K_2O/ac	Sulfur-coated KCl	1
8	150 lbs K_2O/ac	Sulfur-coated K_2SO_4	1
9	300 lbs K_2O/ac	Sulfur-coated K_2SO_4	1

Harvest was in the boot stage when possible, otherwise, as the weather dictated. Dry matter yield was determined by mowing a 3 feet by 10 feet area, weighing and taking a subsample for subsequent moisture determination.

RESULTS

Both soils in this study were fairly high in K and no response to K fertilization early in the study were observed. The yearly response, and 3-year mean are given in table 1. On the rocky soil, the response of 150 lbs K_2O over the 0 rate is apparent in 1979 and 1980. On the deep sand only a very small increase in yield was observed for 1979 and 1980. In comparing the 300 vs the 150 lb rate, a trend was beginning in 1980 where there was a 907 and 632 lb increase in yield on the rocky and sandy soil, respectively. The forage yield for individual clippings in shown in Figure 1. These graphs illustrate the depletion of K, particularly where no K was applied, but also where 150 lb K_2O was applied. Little differences in yield are apparent between 150 and 300 lbs in harvest 1 or 2, however, by the 3rd or 4th clipping, the Coastal under the 300 lb rate is producing the highest yield in all years at both locations. The reason there is less response early in the growing season (1st harvest) is that K has been released by a natural weathering process and is

available for plant use. There is a gradual depletion of available K in the soil profile even at 150 lbs of K_2O per acre. This was evident from the soil tests where at the beginning of the study each soil location had 160 lbs K/acre, and after 3-years the available K on the rocky soil was 70 and 130 lbs/acre, respectively, for the 150 and 300 lb fertilization. On the deep sand, available soil K decreased to 80 and 93 lbs/acre, respectively, for the 150 and 300 lb fertilization treatments.

The effect of the split K_2O application can be observed in Tables 2 and 3. By comparing treatments 2 and 4 (150 lbs/acre) there were no significant differences. In fact, the nonsplit treatment for the 3-year mean had an advantage of 483 lbs/acre on the rocky soil and 853 lbs on the deep sand. In comparing the 300 lb K split vs the nonsplit treatment on the rocky soil, there was an advantage for the split application in 1979 only. On the deep sand there was an nonsignificant advantage of about 400 lbs/acre for the 3-year mean for the split application.

The sulfur coating treatment on 300 lbs of KCl (treatment 7) seemed to have some advantage over all other 300 lb K_2O treatments. This treatment fairly consistently produced the highest yield in several of the years and harvests. Since we had applied 400 lbs/acre of gypsum as a source of S, a response to S coating K fertilizer was unexpected. The S coating did reduce the pH levels of the soils to a greater extent than the noncoated treatments.

Table 1. Total forage yield of Coastal bermudagrass over 3-years at two locations at Overon, TX.

Pounds of K_2O/acre/year	Treatment	Pounds/acre of oven dried forage 1978	1979	1980	3-year mean
		Rocky soil (Cuthbert series)			
0	1	7180	7626	4332	6380
150 (0-0-60)	2	7898	11940	9899	9912
300 (0-0-60)	3	8263	11291	10806	10120
Advantage of 300 over 150		+365	-649	+907	
		Deep sand (Darco series)			
0	1	8073	16583	11105	11920
150 (0-0-60)	2	8163	17909	12170	12747
300 (0-0-60)	3	7933	16906	12802	12547
Advantage of 300 over 150		-230	-1003	+632	

All plots treated with 40 lbs S/acre (gypsum) and nitrogen was applied as ammonium nitrate in equal applications of 100 lbs N/acre in the spring and after each harvest.

Table 2. Total forage yields on Coastal bermudagrass plots fertilized with several rates of potash on a rocky soil (Cuthbert series) at Overton, TX.

Pounds of K_2O/acre/year	Treatment	Pounds/acre of oven dried forage			
		1978	1979	1980	3-year mean
0	1	7180	7627	4332	6380c*
150 (0-0-60)	2	7890	11940	9899	9909ab
300 "	3	8263	11291	10806	10120ab
150 " split	4	7933	11017	9329	9426b
300 " "	5	8242	14239	10313	1093a
150 S-coated KCl	6	8428	12104	10365	10299ab
300 " "	7	8092	14398	10360	10950a
150 S-coated K sulfate	8	8077	12603	9933	1018ab
300 " "	9	7898	11980	10384	10087ab
CV (%)		8.8	15.3	8.5	
LSD (5% level)		1026	2656	1181	

Each split application was 1/4 of the annual rate applied in the spring and after each harvest.

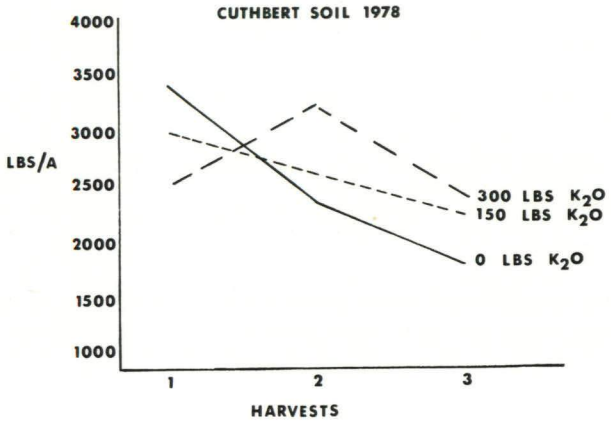
Means followed by the same letter are not different (.05 level) as judged by Duncan's test.

Table 3. Total forage yield on Coastal bermudagrass plots fertilized with several rates of potash on a deep sand (Darco series) at Overton, TX.

Pounds of K_2O/acre/year	Treatment	1978	1979	1980	3-yr mean
0	1	8073	16583	11105	11920b*
150 (0-0-60)	2	8163	17909	12170	12747b
300 "	3	7933	16906	12802	12547b
150 " split	4	8046	15380	12256	11894b
300 " "	5	8101	17525	13236	12954ab
150 S-coated KCl	6	8108	15898	11566	11857b
300 " "	7	8884	19199	14623	14235a
150 S-coated K sulfate	8	8262	18209	12808	13093ab
300 " "	9	8206	16760	12898	12621b
CV (%)		9.7	14.2	8.7	
LSD (5% level)		1161	3548	1650	

Each split application was 1/4 of the annual rate applied in the spring and after each harvest.

*Means followed by the same letter are not different (.05 level) as judged by Duncan's test.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LBS/A
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2
3
HARVESTS
300 LBS K_2O
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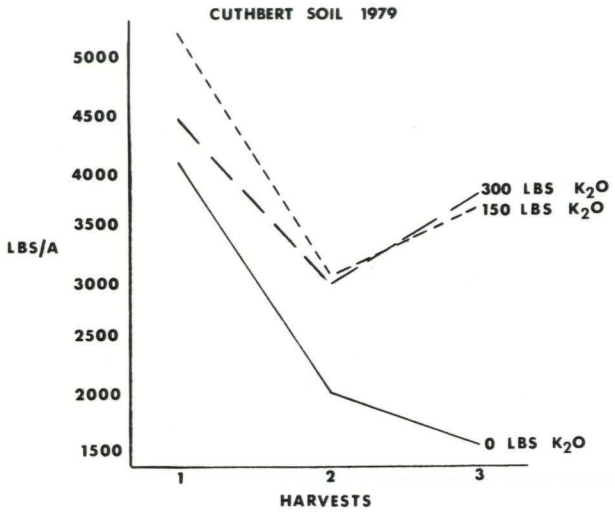
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LBS/A
5000
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4000
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1
2
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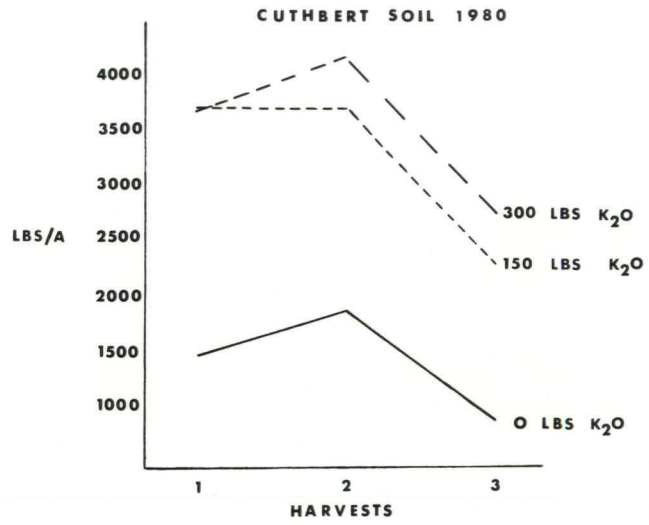
HARVESTS
300 LBS K_2O
150 LBS K_2O
0 LBS K_2O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LBS/A
4000
3500
3000
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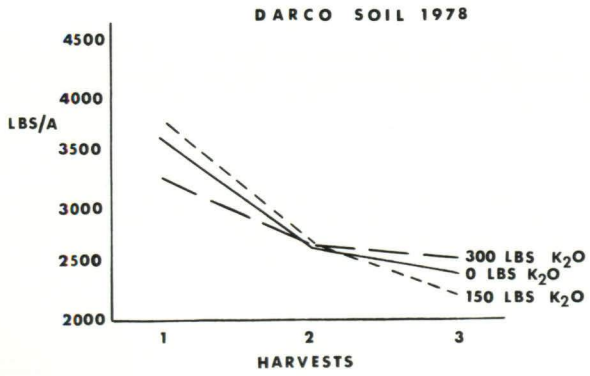
1000
1
2
3
HARVESTS
300 LBS K_2O
150 LBS K_2O
0 LBS K_2O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LBS/A
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4000
3500
3000
2500
2000
1
2
3
HARVESTS
300 LBS K_2O
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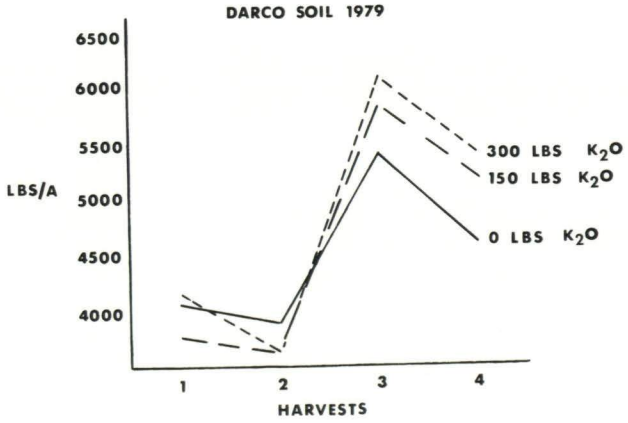
150 LBS K_2O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LBS/A
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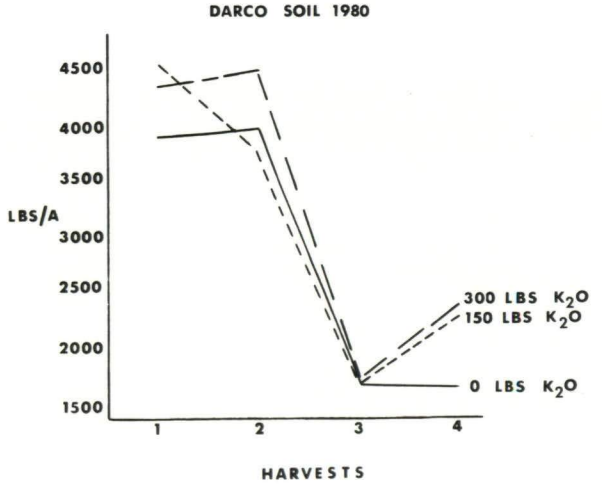
6000
5500
5000
4500
4000
1
2
3
4
HARVESTS
300 LBS K_2O
150 LBS K_2O
0 LBS K_2O


DARCO SOIL 1980
LBS/A
4500
4000
3500
3000
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1
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3
4
HARVESTS
300 LBS K_2O
150 LBS K_2O
0 LBS K_2O