Forage Research in Texas

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Location: Overton

COMPARISON OF SULFUR-COATED MURIATE OF POTASH AND POTASSIUM SULFATE WITH SINGLE AND SPLIT APPLICATIONS OF MURIATE OF POTASH

OBJECTIVES:

Our objectives were 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, stand maintenance and disease incidence.

PROCEDURE:

The study was conducted on two soil types, one a deep sand (Darco series) and the other was a rocky soil (Cuthbert series). Established Coastal bermudagrass pastures at both sites had exhibited some stand thinning, foliar diseases, and reduced yield at low K rates.

Phosphorus was applied once in the spring at 168 kg P_2O_5/hectare. Sulfur at 45 kg/ha was applied once in the spring as gypsum. Nitrogen was applied as ammonium nitrate in equal applications of 112 kg/N/ha after each harvest. 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 168 and 336 kg K_2O per hectare. KCl was split applied at 1/4 of the annual rate after each cutting. The nine treatments were as follows:

Treatment #	Treatment	Source	# Applications
1	0 kg K_2O/ha		None
2	168 kg K_2O/ha	0-0-60 (KCl)	1
3	336 kg K_2O/ha	0-0-60 (KCl)	1
4	168 kg K_2O/ha	0-0-60 (KCl)	4 (split)
5	336 kg K_2O/ha	0-0-60 (KCl)	4 (split)
6	168 kg K_2O/ha	Sulfur-coated KCl	1
7	336 kg K_2O/ha	Sulfur-coated KCl	1
8	168 kg K_2O/ha	Sulfur-coated K_2SO_4	1
9	336 kg K_2O/ha	Sulfur-coated K_2SO_4	1

Forage was harvested in the boot stage when possible; otherwise, as the weather dictated. Dry matter yield was determined by mowing a 2.79 square meter area, weighing and taking a subsample for subsequent moisture determination.

RESULTS AND DISCUSSION: By comparing treatments 1, 2 and 3 we can determine the effect of three rates of K fertilization on Coastal bermudagrass yield. The yield data (Table 1) indicates a difference between soil types and a response to K fertilization. On the Cuthbert soil, there was an increase of 805 kg forage in 1978 between 0 and 168 kg K_2O/ha. In 1979 and 1980, the response increased to 4,836 and 6,240 kg/ha, respectively. On the Darco soil, a large increase due to K fertilization was not apparent; however, there was a 100 kg (1978), 1486 kg (1979), and 1193 kg (1980) increase due to the 168 kg K_2O/ha rate. The Darco soil is a deep sand and mineralization of K is apparently occurring which provide some K to the Coastal bermudagrass. Yield differences caused by the 168 and 336 kg K_2O/ha treatments are not apparent until the final year (1980) of the study. On the Cuthbert soil there was a response of 1017 kg forage/ha, while on the Darco soil the response was only 709 kg/ha. By studying the individual harvests (Table 4 and 5) over each year, it is apparent that the greatest response to K_2O occurred late in the growing season. On the Cuthbert soil (Table 4), this trend showed up on each of the 3-years when comparing treatments 2 and 3. In the Darco soil there was not much difference between the 168 and 336 K_2O treatments, although a slight trend was evident in 1978 and 1980.

The effect of the split K_2O applications can be observed in Tables 2 and 3. In comparing treatments 2 and 4 (168 kg K_2O), there were no significant differences. In fact, the nonsplit treatment for the 3-year mean had a nonsignificant advantage of 511 kg/ha. In comparing the split versus the nonsplit 336 kg K_2O rate, there was an advantage of 3305 kg in 1979 (Table 2) for the split treatment; however, in 1980, this was reversed and the nonsplit treatment produced a slightly higher yield. In this study, the split application of K fertilizer did not improve forage yields.

The sulfur coating treatments may have some advantages. In particular, the 336 kg S-coated KCl treatment consistently produced the higher total forage yield (Table 2 and 3). This trend was most evident on the Darco soil in 1979 and 1980 (Table 5). It was significantly higher (using the LSD compared to the 336 kg K_2O on treatment 3) on the 4th harvest in 1979, and the 2nd harvest in 1980 (Table 5). The S-coated potassium sulfate treatment does not appear to have any advantages over the other treatments.

Stands were reduced only in the 0 kg/ha K (check) on the Cuthbert soil, and this was evident from the forage yield. In the Darco soil, the relatively high soil fertility even in the 0 - K treatment allowed good stands to be maintained throughout the study. Significant foliar diseases were not observed in this study on any of the treatments.

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

Kg K_2O/ha/year	1978	1979	1980	3-year mean
	Rocky soil (Cuthbert series) kg/ha oven dried forage			
0	8,049	8,550	4,857	7,152
168 (0-0-60)	8,854	13,386	11,097	11,109
336 (0-0-60)	9,263	12,658	12,114	11,345
Advantage of 336 over 168	+ 418	- 728	+1,017	
	Deep sand (Darco series)			
0	9,051	18,591	12,450	13,364
168 (0-0-60)	9,151	20,077	13,643	14,290
336 (0-0-60)	8,893	18,953	14,352	14,066
Advantage of 336 over 168	- 258	-1,124	+ 709	

All plots treated with 45 kg S/ha (gypsum) each spring.

All plots treated with 168 kg P_2O_5/ha each spring.

Nitrogen was applied as ammonium nitrate in equal applications of 112 kg N/ha 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.

Kg K_2O/ha per year	1978	1979	1980	3-yr mean
	kg/ha of oven dried forage			
0	8,049	8,550	4,857	7,152c[2/]
168 (0-0-60)	8,845	13,386	11,097	11,109ab
336 "	9,263	12,658	12,114	11,345ab
168 " split[1/]	8,984	12,351	10,458	10,598b
336 " "	9,240	15,963	11,562	12,255a
168 S-coated KCl	9,448	13,570	11,620	11,546ab
336 " "	9,072	16,141	11,614	12,275a
168 S-coated potassium sulfate	8,976	14,129	11,136	11,414ab
336 " " "	8,854	13,431	11,641	11,309ab
CV (%)	8.8	15.3	8.5	
LSD (5% level)	1,150	2,976	1,324	

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

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

All plots treated with 45 kg S/ha (gypsum) each spring.

All plots treated with 168 kg P_2O_5/ha each spring.

Nitrogen was applied as ammonium nitrate in equal applications of 112 kg N/ha in the spring and after each harvest.

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

Kg K_2O/ha per year	1978	1979	1980	3-yr mean
	kg/ha of oven dried forage			
0	9,051	18,591	12,450	13,364b[2/]
168 (0-0-60)	9,151	20,077	13,643	14,290b
336 "	8,893	18,953	14,352	14,066b
168 " split[1/]	9,020	17,242	13,740	13,334b
336 " "	9,082	19,647	14,839	14,523ab
168 S-coated KCl	9,090	17,822	12,966	13,293b
336 " "	9,960	21,523	16,394	15,959a
168 S-coated potassium sulfate	9,262	20,414	14,359	14,678ab
336 " " "	9,199	18,789	14,460	14,149b
CV (%)	9.7	14.2	8.7	
LSD (5% level)	1,302	3,978	1,799	

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

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

Table 4. Forage yield (kg/ha) of Coastal bermudagrass for potash fertility levels over harvest dates and years on a rocky soil (Cuthbert series).

Kg/K_2O/ha per year	1978 Harvests			1979 Harvests			1980 Harvests			
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd	4th
0	3334	2693	2023	4517	2290	1744	1642	2014	983	218
168 (0-0-60)	3389	2945	2510	5812	3457	4116	4122	4151	2598	226
336 "	2884	3652	2727	5027	3351	4279	4155	4649	3096	214
168 " split	3408	3310	2265	5209	2989	4154	3804	3872	2578	205
336 " "	3416	3128	2696	6684	4586	4694	3905	4213	3170	275
168 S-coated KCl	3414	3412	2623	6558	3222	3790	4236	4072	3029	283
336 " "	3060	3282	2730	7116	3750	5275	3759	4411	3140	305
168 S-coated potassium sulfate	3424	3048	2504	6637	3330	4163	4204	4012	2663	258
336 " " "	3246	2984	2624	5532	3498	4401	4037	4338	3005	261
CV(%)	15.5	14.7	12.2	28.0	27.4	12.0	15.0	10.9	11.1	37.3
LSD (5% level)	1/	1/	449	1/	1/	709	826	632	437	1/

1/ Not significantly different at .05 level of probability.

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

All plots treated with 45 kg S/ha (gypsum) each spring.

All plots treated with 168 kg P_2O_5/ha each spring.

Nitrogen was applied as ammonium nitrate in equal applications of 112 kg N/ha in the spring and after each harvest.

Table 5. Forage yield (kg/ha) of Coastal bermudagrass for potash fertility levels over harvest dates and years on a deep sand (Darco series).

Kg/K_2O/ha per year	1978 Harvests			1979 Harvests				1980 Harvests			
	1st	2nd	3rd	1st	2nd	3rd	4th	1st	2nd	3rd	4th
0	3871	2737	2444	4167	3976	5677	4771	4348	4443	1853	1806
168 (0-0-60)	4035	2823	2293	4274	3668	6470	5666	5067	4212	1827	2537
336 "	3497	2771	2624	3811	3661	6134	5346	4865	5003	1863	2621
168 (0-0-60) split[2/]	3736	2761	2523	3035	3645	4850	5713	4012	5304	1890	2535
336 " "	3689	2925	2468	4601	3966	5293	5788	4906	5421	1908	2605
168 S-coated KCl	3831	2812	2448	2803	4117	4980	5923	4508	4819	1462	2177
336 " "	3947	3144	2869	4083	4113	7101	6226	5449	6409	1986	2551
168 S-coated potassium sulfate	3886	3196	2181	4264	3758	6568	5824	4973	5040	1868	2475
336 " " "	3699	2808	2693	3661	3689	5695	5745	4877	5284	1829	2470
CV (%)	11.4	13.8	12.1	33.9	8.1	21.2	9.2	12.7	14.5	12.2	9.7
LSD (5% level)	1/	1/	1/	1/	1/	1/	762	1/	1077	326	342

1/ Not significant at .05 level of probability.

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

All plots treated with 45 kg S/ha (gypsum) each spring.

All plots treated with 168 kg P_2O_5/ha each spring.

Nitrogen was applied as ammonium nitrate in equal applications of 112 kg N/ha in the spring and after each harvest.