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SULFUR RATE AND SOIL TYPE INFLUENCE FORAGE AND
ROOT GROWTH OF TRIFOLIUM SPP.

F. M. Rouquette, Jr. and T. C. Keisling

SUMMARY

Arrowleaf and subterranean clovers exhibited the most dramatic improvement in forage production from additions of sulfur with respective yield increases of 189% and 195% between 0 and 80 lbs/ac sulfur on the Darco soil type. White clover showed the least improvement in yield due to additions of sulfur. Yield improvements due to sulfur on the Darco soil were twice that of the Cuthbert soil. However, the actual forage produced from the Cuthbert soil was 228% greater than yields from the Darco soil. The influence of sulfur rate on root weight was not clearly delineated, however, the effect of soil type was responsible for nearly a doubling of yield in favor of the Cuthbert soil. Data from this trial clearly indicates a need for applied sulfur for increased clover forage production, and that the choice of planting site (soil type) may be more important than sulfur level.

OBJECTIVE

To quantify the influence of rates of sulfur and soil types on the above- and below-ground growth of 4 clovers.

PROCEDURES

'Yuchi' arrowleaf, 'Dixie' crimson, 'La S-1' white and 'Mt. Barker' subterranean clovers were planted in the greenhouse using two soils, Darco (sandy) and Cuthbert (loamy), with an established sulfur deficiency. Separate pots containing each soil were well fertilized with the major nutrients. Rates of 0, 5, 10, 20, 40, and 80 lbs/ac sulfur were applied as gypsum in the four-replicate study. Forage yield was monitored from two clipping dates. At the termination of plant growth, the soil from each pot was washed from the clover roots. Root weights were taken for arrowleaf, white, and subterranean clovers. Due to early maturity, crimson roots had deteriorated sufficiently so that accurate weights could not be obtained. Both forage and root weights are reported as pot yields.

RESULTS

Tables 1-4 show the effect of rate of sulfur and soil type on crimson, arrowleaf, white, and subterranean clovers, respectively. Subterranean clover had the largest yields per pot on both soil types. Percentage-wise, the magnitude of forage production increase from the 0 to 80 lb/ac rate of sulfur on the Darco soil was 189% for arrowleaf and 195% for subterranean clover. White clover showed the least response to sulfur applied to the Darco soil with a yield improvement of only 84% from 0 to 80 lbs/ac. The same general trend held for the Cuthbert soil, with yield increases due to sulfur at 71, 70, 52, and 42%, respectively, for subterranean, arrowleaf, crimson, and white clover. The most striking yield improvements are shown in Table 5. The two-harvest average yields of all clovers grown on a Cuthbert soil were 228% greater than average yields from a Darco soil.

Root weights of the 3 clovers measured are shown in Tables 6-8. The increase in root weight between sulfur treatments was slight and somewhat erratic. Differences in root weights due to soil type, however, were substantial with Cuthbert advantages of 113%, 90%, and 43% for arrowleaf, white and subterranean clover, respectively. Perhaps this explains in part the repeated observations of slow to poor forage production from arrowleaf clover on deep, sandy soils. On the other hand, the subterranean clovers appear to be fairly well adapted to the deep sands. Table 9 presents averaged root weight data for both soil types. Overall, there was an approximate 90% advantage for Cuthbert soils.

Table 1. Crimson clover forage production from two harvests.

SULFUR RATE (lbs/ac)	FORAGE GREEN WEIGHT/POT (gms)					
	DARCO			CUTHBERT		
	1	2	Total	1	2	Total
0	4.14	3.51	7.65	15.69	14.48	30.17
5	3.16	2.67	5.83	13.65	11.36	25.01
10	3.98	3.03	7.01	15.38	13.80	29.18
20	5.27	3.66	8.93	19.26	14.23	33.49
40	9.48	5.18	14.66	22.75	18.45	41.20
80	11.14	6.78	17.92	23.89	22.10	45.99
AVG			10.33			34.17

Table 2. Arrowleaf clover forage production from two harvests.

SULFUR RATE (lbs/ac)	FORAGE GREEN WEIGHT/POT (gms)					
	DARCO			CUTHBERT		
	1	2	Total	1	2	Total
0	3.87	2.99	6.86	13.73	12.48	26.21
5	2.91	3.28	6.19	16.20	11.48	27.68
10	4.77	3.47	8.24	12.49	10.95	23.44
20	8.35	5.10	13.45	19.17	15.03	34.20
40	10.64	5.78	16.42	22.22	17.26	39.48
80	11.23	8.58	19.81	24.48	20.12	44.60
AVG			11.83			32.60

Table 3. White clover forage production from two harvests.

SULFUR RATE (lbs/ac)	FORAGE GREEN WEIGHT/POT (gms)					
	DARCO			CUTHBERT		
	1	2	Total	1	2	Total
0	2.33	3.16	5.49	16.91	14.50	31.41
5	4.35	3.03	7.38	18.52	12.56	31.08
10	3.50	3.77	7.27	17.47	15.40	32.87
20	5.65	3.28	8.93	21.48	19.83	41.31
40	6.99	4.14	11.13	22.43	18.83	41.26
80	6.62	3.48	10.10	24.92	19.65	44.57
AVG			8.38			37.08

Table 4. Subterranean clover forage production from two harvests.

SULFUR RATE (lbs/ac)	FORAGE GREEN WEIGHT/POT (gms)					
	DARCO			CUTHBERT		
	1	2	Total	1	2	Total
0	4.46	3.92	8.38	19.06	14.80	33.86
5	4.20	2.89	7.09	19.52	15.97	35.49
10	6.68	3.76	10.44	19.82	17.49	37.31
20	12.19	6.83	19.02	25.00	20.45	45.45
40	10.63	6.91	17.54	27.96	25.40	53.36
80	15.25	9.47	24.72	27.58	30.41	57.99
AVG			14.53			43.91

Table 5. Average clover production of all varieties from two soil types.

SULFUR RATE (lbs/ac)	FORAGE GREEN WEIGHT/POT (gms)	
	DARCO	CUTHBERT
	-----2-cut Totals-----	
0	7.10	30.41
5	6.62	29.82
10	8.24	30.70
20	12.58	38.59
40	14.94	43.83
80	18.14	48.29
AVG	11.27	36.94

Table 6. Arrowleaf clover root weights from two soil types.

SULFUR RATE (lbs/ac)	ROOT DRY WEIGHT/POT (gms)	
	DARCO	CUTHBERT
0	15.1	22.7
5	13.1	26.8
10	11.3	36.1
20	16.4	35.5
40	15.5	35.6
80	15.1	27.0
AVG.	14.4	30.6

Table 7. White clover root weights from two soil types.

SULFUR RATE (lbs/ac)	ROOT DRY WEIGHT/POT (gms)	
	DARCO	CUTHBERT
0	26.2	53.3
5	27.4	53.2
10	31.2	68.0
20	38.5	58.3
40	38.2	69.0
80	29.1	59.8
AVG	31.8	60.3

Table 8. Subterranean clover root weights from two soil types.

SULFUR RATE (lbs/ac)	ROOT DRY WEIGHT/POT (gms)	
	DARCO	CUTHBERT
0	19.5	37.8
5	38.2	42.6
10	18.6	46.8
20	19.5	35.3
40	27.9	67.7
80	26.9	34.1
AVG	25.1	44.05

Table 9. Average root weights of all varieties from two soil types.

<u>SULFUR</u> <u>RATE</u> (lbs/ac)	ROOT DRY WEIGHT/POT (gms)	
	<u>DARCO</u>	<u>CUTHBERT</u>
0	20.3	37.9
5	26.2	40.9
10	20.4	50.3
20	24.8	43.0
40	27.2	57.4
80	23.7	40.3
AVG	23.8	45.0