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Kojonup maintenance Phosphorus and Sulphur Trial 68BR7EX

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SUMMARY OF 1972 SEASONAL RESULTS

68BR7/2573EX

KOJONUP MAINTENANCE PHOSPHORUS AND SULPHUR TRIAL

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REPORT OF 1972 SEASONAL RESULTS

68BR7/2573EX - M. WATSON - KOJONUP

MAINTENANCE SUPERPHOSPHATE AND SULPHUR TRIAL

Object: To determine the level of superphosphate to maintain near maximum plant and animal production with and without additional elemental sulphur.

Experimental: There are 41 plots with 29 treatments. 12 treatments have 2 replications.

Site: Very old land, whitegum and sheoak vegetation with grey-brown sandy loam and some quartz grit.

History: Superphosphate - ½ bag for 40 years - 3,600 lbs (1633 kg). 600 lb (272 kg) in the last 4 years to 1967.

Treatment:

5 Superphosphate rates: 0, 33.6, 67.2, 134.5 and 269 kg/ha

3 Elemental Sulphur rates: 0, 8.4 and 16.8 kg/ha.

3 Stocking Rates: 7.4, 11.1 and 13.6 sheep/ha

There are 5 sheep on each plot.

Grazing commenced in September 1968 with wether sheep. These were replaced in April 1970 by a new allocation. The second allocation was replaced in November 1971 with a third allocation because of a severe cobalt deficiency effect on the 1970 allocation.

Seasonal:

Low 1972 rainfall resulted in very little pasture growth in the spring period (see Table 1). As a result, total pasture availability is low and it is possible that the top stocking rate treatments will crash in the autumn 1973 period. Also the poor spring growth masked any possible responses to spot treatments on the plots.

Results:

Assessment of results from this trial is very difficult because of the incomplete factorial design, the lack of replication and the marked block effects. These factors rule out comparisons of gross treatment means or a simple analysis of variance. The only legitimate way to handle the results is to make a multiple regression analysis treating each plot as an individual observation. In this way, the relative contribution of various factors to the pasture yield or animal production parameters can be assessed. One drawback of this multiple regression approach is that it allows extrapolation and interpolation of results to treatments which have not been bracketed by experimental data. Such procedures can be very misleading. Also the regression technique can put undue weight on extreme observations.

For the above stated reasons, conclusions drawn from the results of this trial must be treated with caution.

(a) Pasture Assessments

Table 1 gives the pasture assessment data obtained in 1972.

TABLE 1 - RATE OF SUPER-SULPHUR-STOCKING RATE TRIAL
WATSONS - KOJONUP - 68BR7/1573EX

1972 Assessments					Date Assessed							
Plot No	Treatment			Block	20.6	20.6	20.6	3.8	4.10	16.10	16.10	1.3.73
	P Kg/ha	S kg/ha	S.R.		Yield kg/ha	% Clover -sorted	% Grass samples-	Yield kg/ha	Yield kg/ha	% Clover - visual -	% Grass	Body Wt kg per animal
1	134.5	8.4	11.1	1	462	38	57	1370	2095	30	50	56.4
2	134.5	0	11.1	1	707	18	56	1467	1994	25	50	56.1
3	67.2	8.4	13.6	1	720	26	54	1287	1320	45	30	51.8
4	134.5	16.8	11.1	1	829	18	70	1440	1758	15	75	55.0
5	67.2	0	13.6	1	511	28	33	1218	1101	40	35	51.0
6	67.2	16.8	13.6	1	614	25	55	1260	1792	45	40	51.9
7	134.5	16.8	13.6	1	736	15	80	1343	1842	30	55	52.0
8	67.2	16.8	7.4	1	863	7	93	2035	2802	15	85	56.5
9	67.2	8.4	11.1	1	592	24	57	1440	2634	35	55	55.1
10	67.2	16.8	11.1	1	582	27	69	1398	2432	30	55	54.7
11	33.6	16.8	7.4	1	691	16	82	1869	2735	20	75	59.5
12	134.5	8.4	13.6	1	951	13	27	1121	1169	50	20	50.1
13	134.5	0	13.6	1	677	12	24	1149	1101	50	20	46.1
14	67.2	0	11.1	1	579	21	58	1467	1943	20	60	55.1
15	269.0	0	13.6	1	803	16	35	1115	2710	40	25	54.9
16	33.6	16.8	13.6	2	876	25	45	1080	2061	40	25	53.0
17	67.2	0	7.4	2	749	11	86	2229	2735	15	75	59.0
18	33.6	16.8	11.1	2	602	22	71	1675	2145	20	70	52.3
19	33.6	0	7.4	2	482	12	88	2035	2213	15	80	55.6
20	134.5	8.4	11.1	2	598	3	93	1841	1994	15	80	52.0
21	269	0	11.1	2	706	12	86	1800	2836	20	70	53.7
22	67.2	8.4	7.4	2	780	6	94	2160	2718	15	80	56.0
23	134.5	8.4	13.6	2	755	23	66	1370	2432	25	55	55.3
24	134.5	0	7.4	2	910	8	90	2284	2567	20	80	54.2
25	269	16.8	13.6	2	765	36	55	1423	2231	40	30	52.9
26	0	0	7.4	2	726	27	71	1658	2381	30	60	52.1
27	33.6	0	11.1	2	676	22	77	1501	1741	30	60	49.6
28	269	16.8	11.1	3	857	14	82	1434	1825	30	55	53.7
29	67.2	0	11.1	3	529	17	74	1487	1996	25	65	50.8
30	0	16.8	13.6	3	692	29	70	1232	1876	50	40	50.2
31	134.5	0	11.1	3	555	18	81	1689	2288	15	75	51.3
32	134.5	16.8	13.6	3	1271	15	67	1282	1705	30	40	54.2
33	67.2	8.4	11.1	3	778	15	71	1789	3494	15	75	55.6
34	67.2	0	13.6	3	668	26	44	1041	1790	35	35	52.5
35	134.5	0	13.6	3	1347	27	53	1409	2390	40	20	51.9
36	67.2	16.8	13.6	3	777	24	43	1130	1636	35	25	49.9
37	134.5	16.8	11.1	3	924	15	83	1891	1979	10	80	51.3
38	134.5	8.4	7.4	3	821	4	96	2207	2684	10	85	57.2
39	67.2	8.4	13.6	3	662	15	84	1307	2082	35	45	50.4
40	67.2	16.8	11.1	3	859	12	87	1650	2202	40	45	53.3
41	134.5	16.8	7.4	3	1223	6	93	2497	3055	10	90	53.1

P = Super; S = Sulphur; S.R. = Stocking Rate (sheep/ha)

Regression of the October 1972 pasture figures as the dependent variable on the treatments and blocks as the independent variables gave the following equations after the block effects were dropped (symbols and units as in Table 1).

1. Clover % = 63.3 -0.156 P -10.2 S.R. + 0.000469 P^2 + 0.667 $S.R.^2$ R^2 = 69%

2. Ryegrass % = -1.58 + 0.144 P + 0.352 S + 18.9 S.R. -0.00047 P^2 -1.26 $S.R.^2$ R^2 = 78%

3. Herbs % = 40.3 -0.139 P -0.211 S -7.84 S.R. + 0.493 $S.R.^2$ + 0.0129 P x S.R. R^2 = 71%

4. Wt Clover = 1232 -6.05 P -128.5 S.R. + 0.0127 P^2 + 6.59 $S.R.^2$ -0.0925 P x S. +0.2816 P x S.R. + 0.899 S x S.R. R^2 = 54%

5. Wt Grass = 2470 + 2.77 P + 29.8 S -12.2 $S.R.^2$ - 0.179 P x S R^2 =82%

6. Wt grass = 2756 -11.45 $S.R.^2$ R^2 = 77%

7. Wt Herbs = 275.7 -6.55 P -0.0415 P x S + 0.638 P x S.R. R^2 = 59%

8. Total DM = 3743 + 40.5 S -190.7 S.R. -0.316 P x S + 0.39 P x S.R. R^2 = 61%

An example of how the regression equation smooths out observed results and gives response trends to treatment level where those trends are not obvious in the raw data is given in Table 2.

TABLE 2 - CALCULATED PASTURE YIELDS (kg/ha) USING EQUATION 8 COMPARED WITH MEASURED PASTURE ON OFFER TO THE SHEEP AT 4/10/72

(The measured values are in brackets - some are the means of two replicates)

		Superphosphate Level kg/ha				
Sheep/ha	Sulphur kg/ha	Nil	33.6	67.2	134.5	269
7.4	0	2329 (2381)	2427 (2213)	2524 (2735)	2719 (2566)	3108
	8.4	2670	2678	2686 (2718)	2702 (2684)	2734
	16.8	3010	2929	2847 (2802)	2684 (3055)	2359
11.1	0	1623	1769	1915 (1970)	2207 (2141)	2791 (2836)
	8.4	1963	2020	2076 (2566)	2190 (2044)	2416
	16.8	2303	2271	2238 (2317)	2172 (1868)	2041 (1825)
13.6	0	1151	1330	1508 (1146)	1866 (1746)	2580 (2718)
	8.4	1492	1581	1670 (1701)	1848 (1800)	2205
	16.8	1832	1832	1832 (1714)	1831 (1774)	1830 (2230)

The only major treatment effect which is large enough to be observed despite the design problems and block effects, is the effect of stocking rate on the various components of the pasture (Table 3).

TABLE 3 - CORRELATION OF PASTURE PARAMETERS ON TREATMENTS (OCTOBER 1972 SAMPLING)

	Super Rate	Sulphur Rate	Stocking Rate
Total Dry Matter	0.109 N.S.	0.009 N.S.	-0.645***
Weight clover	0.069 N.S.	0.0053 N.S.	0.486**
Weight grass	-0.046 N.S.	0.023 N.S.	-0.868***
Weight herbs	0.304 N.S.	-0.100 N.S.	0.654***

N.S. = Not significant; *** = Signif. $P < 0.001$; ** = signif. $P < 0.01$
* = signif. $P < 0.05$

Pasture composition appears to be changing towards grass dominance with time. There is a marked effect of stocking rate on pasture composition. Also the two nil superphosphate plots appear to be more clover dominant than the other phosphate treatments. However this expected effect of clover dominance on the low superphosphate plots has not yet become generally obvious indicating that either 33 kg/ha is adequate superphosphate to maintain the pasture composition or else the superphosphate "bank" has not yet run down.

(b) Animal Assessments

(i) Monthly body weight measurements were taken throughout 1972. Body weight trends with time reflected the seasonal availability of pasture but showed very little effect of treatment even when there were considerable differences in pasture availability between treatments.

In table 1, the body weight data for 1/3/73 are recorded. These data were regressed on the treatment variables and on the October 1972 pasture availability variables and the following relationships were obtained:-

Body Weight = 61.24 - 0.761 S.R. + 0.00057 P x S.R. R^2 = 38%

Body Weight = 46.77 + 0.00377 wt grass + 0.00584 wt herbs R^2 = 48%

Body Weight = f (blocks 1, 2, 3, S.R., P^2, S^2, P x S.R., S x S.R., wt clover, grass herbs) R^2 = 73.1%

From the correlation matrix, the following relationships were obtained:

	P	S	S.R.	Wt Grass	Wt Clover	Wt Herbs	D.M.
Body Weight r	0.038	0.066	-0.588	0.590	-0.164	-0.356	0.660
Signif.	N.S.	N.S.	***	***	N.S.	*	***

Again, only the stocking rate treatment and the pasture variables which correlate strongly with it, have any real effect on the body weight.

(ii) No reliable wool data is available as the 1970 allocation of sheep were affected by cobalt deficiency and the 1971 allocation had $3\frac{1}{2}$ months wool growth when they were put on the plots in November 1971. These sheep were shorn in August 1972 and will be shorn again in August 1973 when wool yields will be compared with treatment effects. The wool growth rate is to be crudely estimated using dye banding in November 1972 and April 1973.

Conclusions:

An economic interpretation of this trial is impossible because the effects of current dressings of fertiliser are confounded with the residual effects of past dressings of fertiliser. Thus it is not possible to determine an optimum treatment or optimum fertilising practice from the trial.

However, valuable biological information about the relationships of fertilising practice and grazing pressure on pasture production and the relationship between pasture production parameters and animal production can be obtained from such a trial.

To date, stocking rate appears to be the most important treatment affecting both pasture production and animal production. However, as the residual effects of past heavy superphosphate dressings fall away with time, fertiliser treatment effects should become obvious.