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1976 Phosphorus and sulphur sources trials

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SUMMARY 1976 SEASONAL RESULTS
PHOSPHORUS AND SULPHUR SOURCES TRIALS

by M.D.A. BOLLAND
PLANT RESEARCH DIVISION

1. PHOSPHORUS SOURCES TRIALS

(A) Pasture trials

i) High rainfall areas

a) Sand

76BU1/334OEX: New land P sources trial,
T. O'Byrne, Yalingup

76BU4/334OEX: Old land P sources trial,
T. Coombes, Busselton

76EX37/334OEX: Young land P sources trial,
F. Fels, Esperance

b) Gravel

76MT10/334OEX: New land P sources trial,
Mt. Barker Research Station

76MT9/334OEX: Old land P sources trial,
Mt. Barker Research Station

ii) Medium rainfall areas

a) Sand

75NO7A/334OEX: New land P sources trial,
D. Gillespie, East Chittering

b) Gravel

75NO7B/334OEX: New land P sources trial,
D. Gillespie, East Chittering

iii) Low rainfall areas

a) Sand

76WH9/334OEX: New land P sources trial,
Wongan Hills Research Station

76WH10/334OEX: Young land P sources trial
Wongan Hills Research Station

76WH14/334OEX: Old land P sources trial,
Wongan Hills Research Station

b) Gravel

76N4/3340EX: New land P sources trial,
Newdegate Research Station

76N6/3340EX: Old land P sources trial,
Newdegate Research Station

76LG6/3340EX: Young land P sources trial,
Clarke, Newdegate

(B) Crop Trial

76M028, P sources trial on lupins and wheat,
N. Girando, North Gingin

2. SULPHUR SOURCES TRIALS

(A) Pasture Trials

i) Long term S sources trials

76BU5/2684EX: Old land sulphur sources trial,
P. Coombes, Busselton

76KE1/2684EX: Old land sulphur sources trial,
J. Hill, Keysbrook

ii) Short term S sources trial

76KE2/2684EX: G. Elliot, Keysbrook

(B) Crop Trials

76M029/2684EX: Lupins sulphur trial, N. Girando,
North Gingin

TRIALS GIVING NO RESULTS IN 1976

Because of the very dry start to the season the following trials suffered severely from drought and yielded no results in 1976:

76M028 - P sources lupin and wheat trial

76M029 - Lupin sulphur trial

76WH9 - P sources trial (pasture)

76WH10 - P sources trial (pasture)

76N4 - P sources trial (pasture)

76LG6 - P sources trial (pasture)

No further reference will be made to these trials in this summary.

1. PHOSPHORUS SOURCES TRIALS

The phosphorus sources compared are:

- (1) Single superphosphate, 9.6% total P, 12.5% S, obtained from C.S.B.P.
- (2) Christmas Island C grade ore, 11.2% total P, nil S, donated by The British Phosphate Commissioners.
- (3) Calciphos 500, calcined (500°C) Christmas Island C grade ore, 13.6% total P, nil S, donated by The British Phosphate Commissioners.
- (4) Queensland rock phosphate, 13.1% total P, nil S, donated by Broken Hill South.
- (5) Ground rock phosphate, 16% total P, nil S, obtained from C.S.B.P.

TITLE: New Land P Sources Trial, 76BU1/334OEX
(T. O'Byrne, Yalingup)

AIM: To compare the short term and long term (residual) P supply to pasture from single superphosphate, C grade ore and calciphos 500 on a P responsive (virgin) sandy soil (low P fixing) in the high rainfall area.

SOIL TYPE: Sand over massive gravel (60-30 cm)

SITE HISTORY: New land, cleared March 1976

TRIAL COMMENCED: 27/4/76

RESULTS: Only the small rate trials in the nil blocks were assessed for dry weight pasture yields. When the treatments were applied to the residual plots most of the plots had been topdressed with the drill more than once. The tyres of both the tractor and the drill compacted the soil, resulting in a greater water holding capacity in the tyre marks, affecting the yields of the subclover dramatically. It was impossible to separate the effect of compaction and the effect of the P treatments on subclover yields. Plant samples were collected from the residual plots for analysis of plant P levels. The trial was heavily grazed with sheep in late August-early September and the effect of compaction on the residual plots appears to have largely disappeared.

RESULTS OF SMALL RATE TRIAL WITHIN NIL BLOCKS - ASSESSED
30/8/76

Source	kg P/ha	Dry wt. pasture yield (kg/ha)	% max. yield
Single Superphosphate	nil	60	3
	2.5	500	23
	5	160	7
	10	780	36
	15	980	45
	20	510	23
	50	1 030	47
	100	2 130	97
	200	1 320	60
	400	1 270	55
Calciphos 500	nil	128	6
	6.3	360	16
	12.5	480	22
	25	630	29
	37.5	670	31
	50	320	15
	125	1 140	52
	250	1 010	46
	500	780	35
	1 000	2 030	92
C Grade Ore	nil	100	5
	11.6	120	6
	23.3	60	3
	46.5	80	4
	69.8	140	6
	93	320	15
	232.5	320	15
	465	290	13
	930	1 040	47
	1 860	680	31

Mean of 2 reps (third rep discarded as had previous
super history)

1976 "DECIDE" C PARAMETERS FOR 76BU1

Source	Single superphosphate	Calciphos 500	C Grade Ore
C Value*	0.023	0.0023	0.0006

* As estimated graphically, assuming the three sources have the same A value.

TITLE: Old Land P Sources Trial, 76BU4,334OEX
(T. Coombes, Busselton)

AIM: To compare single superphosphate, calciphos 500 and C grade ore as maintenance dressings for P on old land on deep sand (low P fixing soil) in the high rainfall area.

SOIL TYPE: Deep sand

SITE HISTORY: Old land, 40 year super history

TRIAL COMMENCED: 13/4/76

RESULTS: (1) P response: the site is not yet P responsive, and no comparisons between sources were possible in 1976.

(2) S response: the site was S responsive.

In autumn the (-S) plots were yellow in colour. In springtime the (-S) plots had very much less clover % in the pasture, and the plots yielded less dry weight pasture. Small sulphur rate trials (using gypsum) were placed in the nil (-S) plots, and the following results obtained:

RESULTS FOR SMALL GYPSUM RATE TRIALS IN NIL (-S) PLOTS

Assessed 21/10/76, Gypsum Applied / /76

kg S/ha (as Wyalkatchem gypsum)	Dry wt. yield (kg/ha)	% max yield
nil	2 397	82
2	2 649	90
4	2 935	100
8	2 851	97
16	2 895	99

Mean of 9 reps

Though the dry weight yield results do not vary much, the per cent clover as observed visually varied dramatically, the clover responding strongly to the sulphur treatments. In future pasture composition measurements will be made in this trial.

TITLE: New Land Phosphorus Sources Trial - 76MT10/3340EX
(Mt. Barker Research Station)

AIM: To compare the short term and long term (residual) P supply to pasture from single superphosphate, C grade ore, and calciphos 500 on a P responsive gravel (high P fixing soil) in the high rainfall area.

SOIL TYPE: Loamy gravel

SITE HISTORY: New land, cleared early May 1976.

TRIAL COMMENCED: 11/5/76

RESULTS: (1) Results for small rate trials within nil blocks (assessed 27/9/76)

Source	kg P/ha	Dry Wt. Yield (kg/ha)	% Max Yield
Single Superphosphate	nil	800	18
	2.5	600	14
	5	820	19
	10	840	19
	15	1 120	26
	20	2 100	48
	50	3 620	83
	100	3 930	90
	200	4 060	93
	400	4 328	100
Calciphos 500	nil	400	9
	7.5	600	14
	15	520	12
	30	560	13
	45	1 280	29
	60	1 080	25
	150	1 680	37
	300	2 754	63
	600	3 328	77
	1 200	3 182	73
C grade ore	nil	400	9
	14.25	400	9
	28.5	400	9
	57	400	9
	85.5	400	9
	114	440	10
	285	470	11
	570	610	14
	1 140	620	14
	2 280	1 800	41

Mean of 3 reps

(2) RESULTS FROM RESIDUAL BLOCKS, ASSESSED 27/9/76

Source	Treatment No.	kg P/ha	Dry Wt. Yield (kg/ha)	% Max Yield
Single Superphosphate	A1	21	2 486	51
	A2	47	3 772	77
	A3	63	4 078	83
	TE1	47	3 818	78
	TE2	87	4 371	89
	TE3	174	4 857	99
	LT1	47	3 634	74
	LT2	87	4 496	92
	LT3	174	4 836	99
	LT4	435	4 907	100
Calciphos 500	A1	31	600	12
	A2	62	1 120	23
	A3	123	1 720	35
	TE1	76	800	16
	TE2	151	2 494	51
	TE3	302	2 880	59
	LT1	76	1 480	30
	LT2	151	2 457	50
	LT3	302	2 905	59
	LT4	605	3 047	62
C grade ore	A1	66	440	9
	A2	131	560	11
	A3	197	1 000	20
	TE1	131	400	8
	TE2	262	1 120	23
	TE3	524	1 600	33
	LT1	131	600	12
	LT2	262	1 000	20
	LT3	524	1 280	26
	LT4	786	2 000	41

Mean of 3 reps

1976 "DECIDE" C VALUES FOR 76MT10

Source	Single superphosphate	Calciphos 500	C Grade Ore
C Value *	0.03	0.002	0.0003

* As estimated graphically, assuming all sources have the same A value.

TITLE: Old Land Phosphorus Sources Trial - 76M9/334OEX
(Mt. Barker Research Station)

AIM: To compare single superphosphate, calciphos 500 and C grade ore as maintenance P dressings on old land on gravel (high P fixing soil) in the high rainfall area.

SOIL TYPE: Loamy gravel

SITE HISTORY: Old land

TRIAL COMMENCED: 20/4/76

RESULTS: Because of the high past applications of single superphosphate on the site, the site is not as yet P responsive, and therefore no comparisons between treatments were possible. There was no response to sulphur (as Wyalkatchem gypsum) in the (+S) plots.

TITLE: New Land Phosphorus Sources Trial - 75N07A/334OEX
(D.J. Gillespie, East Chittering)

AIM: To compare the short term and long term (residual) P supply to subclover pasture from single superphosphate, calciphos 500 and calciphos 900 on a P responsive (virgin) sandy soil in the medium rainfall area.

SOIL TYPE: Coarse leached white sand over gravel (50-90 cm)

SITE HISTORY: New land 1975

TRIAL COMMENCED: July 23, 1975

RESULTS: The site yielded very patchy results and no comparisons between P treatments were possible. The trial was eventually abandoned 8/10/76.

TITLE: New Land Phosphorus Sources Trial - 75N07B
(D.J. Gillespie, East Chittering)

AIM: To compare single superphosphate, calciphos 500 and calciphos 900 in the short term and long term as P fertilisers to subclover pasture on P responsive gravel (high P fixing soil) in the medium rainfall area.

SOIL TYPE: Gravel sand to 3 feet (60% gravel)

SITE HISTORY: New land 1975

TRIAL COMMENCED: 23/7/75

RESULTS: (1) Results for Small Rate Trials Within nil Plots

Assessed 18/8/76

Assessed 14/9/76

Source	kg P/ha	Dry Wt. Yield (kg/ha)	% Max Yield	Dry Wt. Yield (kg/ha)	% Max Yield
Single Superphosphate	nil	228	9.0	556	17
	20	560	22.4	875	27
	40	835	33.4	1 215	37
	60	780	31.2	1 718	53
	150	2 050	82.0	3 069	94
	300	2 319	92.8	3 252	100
Calciphos 500	nil	107.7	4.3	556	17
	80	154	6.2	621	19
	160	268	10.7	751	23
	240	209	8.4	798	25
	600	380	15.2	993	31
	1 200	479	19.2	1 124	35
Calciphos 900	nil	231	9.2	849	26
	160	327	13.1	1 228	38
	320	885	35.4	1 828	56
	480	863	34.5	1 443	44
	1 200	814	32.6	1 705	52
	2 400	1 006	40.2	2 560	79

Mean of 3 reps

DECIDE C VALUES (ESTIMATED GRAPHICALLY) FOR 75N07B

	Single Superphosphate	Calciphos 500	Calciphos 900
1975	0.02	0.003	0.0015
1976	0.013	0.0004	0.0004

TITLE: Old Land Phosphorus Sources Trial - 76WH14/3340EX
(Wongan Hills Research Station)

AIM: To compare single superphosphate, calciphos 500 and C grade ore as maintenance dressings for P on old land on sandy soil (low P fixing soil) in the low rainfall area.

SOIL TYPE: Wongan sandy loam

SITE HISTORY: Very old land

TRIAL COMMENCED: 27/5/76

RESULTS: The site is not yet P responsive and no comparisons between the treatments was possible. The (-S) plots were yellow in colour in July, but this effect soon disappeared and there was no S response later on in the year.

TITLE: Old Land Phosphorus Sources Trial - 76N6/3340EX
(Newdegate Research Station)

SOIL TYPE: Shallow sand over gravel

SITE HISTORY: Very old land

TRIAL COMMENCED: 14/5/76

RESULTS: The site is not yet Presponsive and no comparison between P treatments was possible. There was no affect of the sulphur treatments.

2. SULPHUR SOURCES TRIAL

i) Long Term Trials

The sulphur sources compared in the 2 long term sulphur trials are:

- i) Wyalkatchem gypsum, 17.7% S, obtained from Gypsum Industries.
- ii) Elemental sulphur, 100% S, obtained from C.S.B.P.
- iii) Iron pyrites, 48% S, donated by Electrolytic Zinc Company of Australia, from Rosebury, Tasmania.

TITLE: Old Land Sulphur Sources Trial - 76BU5/2684EX
(T. Coombes, Busselton)

AIM: To compare the short term and residual S supply to pasture from Wyalkatchem gypsum, elemental sulphur and iron pyrites.

SOIL TYPE: Deep sand

SITE HISTORY: Old land, 40 year super history

TRIAL COMMENCED: 14/5/76

RESULTS: The trial was very grassy. Visual responses to the S treatments were first noted in mid October. Responses to elemental sulphur and gypsum were very obvious - these plots compared to the nil blocks and iron pyrites treatments were very green and had much higher per cent clover in the pasture. The spring treatments for the small rate trials in the nil blocks for the elemental sulphur and Wyalkatchem gypsum treatments were visually superior to the autumn treatments as regards pasture production. However, the dry weight yield results for the trial showed very little differences between any treatments. Measurements of pasture composition and

78078:

(2) Results for Residual Plots - 1976 Response to Current P (Super) Applied 1976 to 1975 Treatments

Date of Assessment	Source 1975 P Levels (kg P/ha) 1976 Super Rates (kg P/ha)	Single Superphosphate						Calciphos 500						Calciphos 900					
		50		100		200		234		460		920		237		474		949	
		Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield
18/8/76	Nil	615	21	1513	50	2732	91	600	20	532	18	965	32	395	13	389	13	854	28
	2.5	838	28	1585	53	2462	82	414	14	854	29	745	25	435	15	482	16	699	23
	5	653	22	1430	48	2388	80	377	13	615	21	823	27	284	10	464	16	1319	44
	10	879	30	1935	65	2335	78	414	14	296	10	1247	42	429	14	556	19	1201	40
	15	789	26	1737	58	2586	86	491	16	674	23	1064	36	370	12	832	28	873	29
	20	814	27	1889	63	2493	83	581	19	959	32	1021	34	460	15	618	21	776	26
	50	1647	55	2459	82	2115	71	1024	34	1331	44	1601	53	817	27	1464	49	854	29
	100	2081	69.4	2992	100	2645	88	1982	66	1625	54	1795	60	1381	46	1393	46	1405	47
	200	2493	83	2961	99	2926	98	1771	59	1811	60	2632	88	1725	58	2264	76	2388	80
14/9/76	Nil	1319	26	3676	74	4333	87	1267	25	1437	29	2821	56	1039	21	1548	31	2201	44
	2.5	1424	29	3787	76	4577	92	1071	21	1985	40	1972	39	1111	22	1437	29	2560	51
	5	1548	31	3023	61	4440	89	1104	22	1672	33	2155	43	993	20	1750	35	2697	54
	10	1972	39	3370	67	4420	88	1248	25	1025	21	2952	59	1437	29	3154	63	2906	58
	15	1446	39	3565	71	4793	96	1346	27	1853	37	2860	57	1280	26	2168	43	2455	49
	20	1927	39	3298	66	4173	84	1319	26	2153	43	3252	65	1594	32	1750	35	2769	55
	50	2442	49	3631	73	4055	81	2566	51	2952	59	3552	71	2038	41	3154	63	2965	59
	100	4101	82	4199	84	4186	84	3161	63	3618	72	3793	76	3226	65	3180	64	2926	59
	200	3389	68	4022	80	4362	87	3572	71	3532	71	5393	100	3409	68	3944	79	3911	78

plot S levels need to be made in the future.

(1) Results for residual plots - assessed 21/10/76

Source	kg S/ha	Dry Wt Yields (kg/ha)	% Max Yield
nil	nil	2 871	74
Wyalkatchem gypsum	20	3 286	85
	40	3 359	86
	80	3 351	86
	160	3 733	96
Elemental sulphur	20	3 392	87
	40	3 741	96
	80	3 889	100
	160	3 758	97
Iron pyrites	20	3 254	84
	40	3 058	79
	80	3 205	82
	160	3 026	78

Mean of 3 reps

(2) Results for the small rate trials within the nil blocks
(assessed 21/10/76)

Source	kg S/ha	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield
	nil	3 156	81	3 660	94
	2	3 294	85	3 611	93
	4	3 327	85	3 506	90
	6	3 709	95	3 229	83
	8	3 140	81	3 229	83
	10	3 448	88	3 278	84
	20	3 741	96	3 156	81
	40	3 937	100	3 327	85
	80	3 685	95	3 563	91
	nil	3 546	91	3 245	83
	2	3 636	93	3 481	89
	4	3 563	91	3 221	83
	6	3 571	92	2 945	76
	8	3 091	79	3 359	86
	10	4 050	100	3 132	80

Source	kg S/ha	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield
	20	3 245	83	3 327	85
	40	3 506	90	3 310	85
	80	3 197	82	3 489	90
	nil	3 351	86	3 213	82
	2	3 327	85	2 839	73
	4	3 270	84	3 067	79
	6	3 229	83	3 058	78
	8	3 359	86	2 847	73
	10	3 278	84	2 961	76
	20	3 384	87	3 278	84
	40	3 156	81	3 113	80
	80	3 384	87	3 424	88

Mean of 3 reps

TITLE: Old Land Sulphur Sources Trial - 76KE1/2684EX
(J. Hill, Keysbrook)

AIM: To compare the short term and long term (residual) S supply to pasture from Wyalkatchem gypsum, elemental sulphur and iron pyrites.

SOIL TYPE: Deep sand

SITE HISTORY: Old land, 40 year super history

TRIAL COMMENCED: 15/6/76

RESULTS: The trial was unresponsive

(1) Results For Residual Blocks (assessed 26/10/76)

kg S/ha in 1976	Dry Wt Yield (kg/ha)	% Max Yield
nil	2 887	80
20	3 017	94
40 as Wyalkatchem	3 068	95
80 gypsum	3 180	99
160	2 962	92
20	2 590	80
40 As elemental sulphur	3 177	99
80	3 109	97
160	2 700	84
20	2 732	85
40 as iron pyrites	2 592	81
80	2 586	80
160	2 690	84

Mean of 3 reps

(2) Results of Small Rate Trials within the nil Blocks

Source	kg S/ha	Autumn		Spring	
		Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield
Wyalkatchem Gypsum	nil	2 685	84	2 624	82
	2	2 829	88	2 503	78
	4	2 336	73	2 766	86
	6	2 857	89	2 581	81
	8	2 725	85	3 158	99
	10	2 657	83	3 006	94
	20	2 358	74	2 880	90
	40	2 490	78	2 624	82
	80	2 493	78	2 791	87
Elemental Sulphur	nil	2 473	77	2 270	71
	2	2 609	82	2 468	77
	4	2 925	91	2 522	79
	6	2 869	90	2 715	85
	8	2 834	89	2 506	78
	10	2 814	88	2 399	75
	20	2 743	86	2 546	80
	40	2 763	86	2 637	82
	80	2 854	89	2 849	89
Iron Pyrites	nil	2 382	74	2 586	81
	2	2 801	88	2 202	67
	4	2 324	73	2 288	72
	6	2 389	75	2 500	78
	8	2 303	72	2 179	68
	10	2 109	66	2 411	75
	20	2 410	75	2 725	85
	40	2 410	75	2 465	77
	80	2 695	84	2 599	87

Mean of 3 reps

(ii) Short Term Sulphur Trial

TITLE: Short Term Sulphur Sources Trial - 76KE2/2684EX
(G. Elliot, Keysbrook)

AIM: To compare the short term S supply to subclover pasture (Seaton Park/Trikkala Mix) of Wyalkatchem Gypsum (Gypsum Industries, 17.7% S), Newdegate Gypsum (Palmers, Collie; 16.8% S), Fe SO₄ (La Porte, Australind, 11.2% S), Waroona Gyplap (C.⁴Maff, Waroona; 8.5% S), Elemental Sulphur (C.S.B.P., 100% S), and single superphosphate (C.S.B.P.; 12% S).

SOIL TYPE: Deep grey sand

SITE HISTORY: Old land

RESULTS: Assessed (28/9/76)

kg S/ha	Wyalkatchem Gypsum		Newdegate Gypsum		Single Superphosphate		Waroona Gylap		Elemental S		FeSO ₄	
	Dry Wt Yield (kg/ha)	% Max. Yield	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield	Dry Wt Yield (kg/ha)	% Max Yield
nil	1 230	41	1 077	36	1 187	40	987	33	919	31	1 021	34
2	2 191	73	1 927	64	1 910	64	1 451	48	893	30	1 651	55
4	2 493	83	1 898	63	1 902	63	1 791	60	923	31	2 123	71
6	1 910	64	2 115	71	2 502	83	1 672	56	855	29	2 189	73
8	1 966	66	2 225	74	2 391	78	1 672	56	1 128	38	2 166	72
10	2 055	69	2 046	68	2 948	98	1 684	56	1 145	38	1 978	66
20	3 076	100	2 655	89	2 957	99	2 102	70	1 306	44	2 178	73
40	2 446	82	2 408	80	2 863	95	2 038	68	1 179	39	2 510	84
80	2 442	81	2 493	83	2 705	90	2 251	75	1 530	51	2 157	72

Mean 3 reps - 5 treatments applied (25/8/75)

The results indicate that Wyalkatchem Gypsum, Newdegate Gypsum, single superphosphate and FeSO_4 (La Porte) are equivalent per mt of S as sulphur sources. In fact the super results are slightly higher, though this may not prove statistically significant. The trial area had adequate P applied as aerophos. Elemental sulphur applied in spring is clearly inferior as an S source in the short term, but may have a better residual value. The Waroona gyplap is somewhere in between elemental sulphur and the other 4 sources as supply of S in the short term to sub-clover pasture. This may be because the fertiliser is coarse, and it may also have a better residual S supply.