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Phosphorus Nutrition on Leaching Sands.

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Department of Agriculture

Western Australia

Summary of Experimental Results 1982

Phosphorus Nutrition on Leaching Sands

Compiled by D.M. Deeley

S.M. Mason

B.G. Barker

PLANT RESEARCH DIVISION

Sources of phosphorus on leaching sands

Introduction

The excessive amounts of nutrients entering the Peel-Harvey Estuarine system have resulted in a marked increase in the abundance of algal species within the estuary and reduced production on the sandy coastal soils of the catchment from which the nutrients are being leached. Recent stream samplings by D.C.E. have shown that the deep grey Bassendean sands may be contributing up to 40 per cent of the total P loading in the Harvey River. Agriculture Department trials around Albany on similar sands have shown that up to 80 per cent of the bicarb extractable P may be lost after only 150 mm of rain.

This trial program was set up to investigate six broad areas.

- a) To define soil test calibration curves on deep sands.
- b) To determine the response of pastures to current and residual P applications on a variety of coastal soils.
- c) To assess the 'Rundown' of P from different sources.
- d) To compare sources and rates with superphosphate applied at the break, 6 and 12 weeks after the break.
- e) To assess the efficiency of P sources with respect to leaching.
- f) To investigate the effect of liming Bassendean sands.

This is the first year of all trials reported here.

Phosphorus rundown trials

- 82HA14 - Old land irrigated pasture - Dardanup loam
- 82HA15 - Old land early germinated pasture - Coolup Association
- 82HA16 - Old land pasture - Wellesley Clay (Bungam)
- 82HA17 - Site topdressed by farmer in error trial abandoned June 1982
- 82HA18 - Old land pasture Pinjarra - Coolup association sand over clay

Soil test calibration curve trials

- 82HA20 - Old land pasture - Joel Sand
- 82HA21 - Old land pasture - Gavin Sand
- 82HA22 - New land pasture - Gavin Sand
- 82HA23 - Old land pasture - Gavin Sand
- 82HA24 - Old land pasture - Gavin Sand
- 82HA25 - Old land pasture - Gavin Sand
- 82HA26 - Old land pasture - Joel Sand
- 82HA27 - Old land pasture - Joel Sand
- 82HA28 - Old land pasture - Deep Coolup Association
- 82HA29 - Old land pasture - Gavin Sand
- 82HA30 - Old land pasture - Joel Sand

P sources x rates x times of application trials

- 82HA31 - Old land pasture - Joel Sand
- 82HA32 - New land pasture - Gavin Sand

P sources leaching trials

- 82HA33 - Same site as 82HA31
- 82HA34 - Same site as 82HA32

Lime rates with + P

82HA36 - Old land pasture - Coolup Association
82HA37 - Old land pasture - Gavin Sand
82HA38 - Old land same site as 82HA28

Phosphorus Rundown Trials

Trial : 82HA14
Location : McClure Road, Alcoa Farms Ltd.
Soil type : Irrigated Dandanup Loam
History : Old land pasture
Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum applied 14/4/1982
Treatments applied 14/4/1982
Soil sampled 14/7/1982 Tmts bulked
Site inspected no response 25/8/1982
Site grazed September 1982
Site inspected no response 4/11/1982
Soil sampled 1/2/1983
Results : Residual plots. Mean of 2 replicates

Rate of P (kg/ha)	Bicarb P 14/7/1982	Yield visual (kg/ha) 14/7/1982	Yield visual 4/11/1982 (kg/ha)
Nil	52.5	1,700	4,000
7.3	55.9	1,700	4,000
14.6	59.6	1,700	4,000
57.3	61.1	1,700	4,000

Comments : Pasture unresponsive to rate of phosphorus. Growth even at 80 per cent clover.

Trial : 82HA15
 Location : McClure Road, Dryland Alcoa Farms Ltd.
 Soil type : Coolup Association. Sand over clay at 50 cm
 History : Old land pasture. Watered for early germination
 Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum and treatments applied 14/4/1982.
 Soil sampled 14/7/1982 Tmts bulked
 Site inspected no response 25/8/1982
 Site inspected 14/11/1982
 Soil sampled 1/2/1983
 Results : Residual plots. Mean of 2 replicates

Rate of P (kg/ha)	Bicarb P 14/7/1982	Yield visual 4/11/1982 (kg/ha)
Nil	63.8	3,000
7.3	74.9	2,500
14.6	77.2	2,500
57.3	72.1	3,000

Comments : Pasture unresponsive to phosphorus. Growth even at 40 per cent clover.

Trial : 82HA16
Location : Buller Road, Alcoa Farms Ltd.
Soil type : Wellesley Clay (Bungam)
History : Old land pasture.
Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum and treatments applied 15/4/1982.
Site inspected no response 14/7/1982
Site inspected no response 25/8/1982
Site inspected no response 4/11/1982
Soil tested 1/2/1983
Comments : Site unresponsive to P. Results from 1983 soil test not back as yet.

Trial : 82HA18
 Location : Dwellingup Road, Pinjarra. Alcoa Farms Ltd.
 Soil type : Coolup Association. Sand over clay
 History : Old land pasture.
 Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum and treatments applied 14/4/1982.
 Site inspected no response 14/7/1982
 Site sampled Tmts bulked 14/7/1982
 Site inspected no response 14/7/1982
 Trial grazed September 1982
 Site inspected no response 4/11/1982
 Soil sampled 1/2/1983
 Results : Mean of 2 replicates lime tmts 1 rep only

Rate of P (kg/ha)	Bicarb P 14/7/1982	Yield visual 4/11/1982 (kg/ha)
Nil	43.6	1,500
7.3	39.8	1,500
14.6	45.3	1,500
57.3	54.4	1,500

+ 2,000 kg/ha ground limestone

Nil P	52.9	1,500
7.3	32.4	1,500
14.6	39.5	1,500
57.3	54.5	1,500

Comments : Site unresponsive to P or ground limestone.

Soil Test Calibration Curve Trials

Trial : 82HA20
 Location : Bombara, Johnston Road.
 Soil type : Bassendean Sand. Joel Series. Bicarb P 6.0 1/4/1982
 History : Cleared 1967 fertilizer to 1976 50 kg/ha/year super.
 Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum 5/5/1982.
 Treatments applied 5/5/1982
 Site reseeded Trikkala, Daliak, Dinninup L.P. and
 Innoculated 100 kg/ha 27/5/1982
 Visual assessment 1/7/1982
 Basal and Tmt 3 applied 14/7/1982
 Visual assessment 14/7/1982, 25/8/1982
 Basal and Tmt 3 applied 1/9/1982
 Plots rated and calibrated 19/10/1982
 Results : Soil sampling. Four replicates bulked

Rate of P (kg/ha)	Bicarb P 1/4/1982	Bicarb P 14/7/1982	Bicarb P 1/9/1982	% P in tops 8/11/1982
Nil	6.0	8.5	6.5	0.094
90		12.5	8.6	0.151
3 x 30		9.0 (1)	5.3 (2)	0.246 (3)
180		15.8	8.2	0.181

(2) = 2 of 3 applied

Yield responses mean of 4 replicates

Rate of P kg/ha	Visual 1/7/1982 kg/ha	Visual 14/7/1982 kg/ha	Visual 25/8/1982 kg/ha	Plate metered Calibrated 19/10/1982
Nil	200	288	700	3,489
90	300	463	1,650	5,161
3 x 30	275 (1)	700 (1)	1,500 (2)	5,488 (3)
180	300	813	1,725	5,830

(1) = 1 of 3 applied

Comment : 100 per cent clover. Trial 40 per cent response to phosphorus. Loss of Bicarb P from single application rates.

Trial: : 82HA21

Location : Jennings, Coronation Road.

Soil type : Bassendean Sand. Gavin phase

History : Old land. Cleared 1967 270 Kg/ha super Cu, Zn, Mo No. 1,
1968-1975 180 Kg/ha 5:1 super:KCl
1976 - 1981 90 Kg/ha 5:1 super:KCl
1981 application July

Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum and treatments
applied 27/4/1982.
Site reseeded Serradella, Trikkala, Daliak, Dinninup LP +
innoc mix 100 kg/ha 27/5/1982
Soil sampled Tmts bulked 14/7/1982
Basals and Tmt 3 applied, rating no response 14/7/1982

Site inspected 25/8/1982 no response
Soil sampled Tmts bulked 1/9/1982
Basals and Tmt 3 applied, rating no response 1/9/1982
Site inspected no response poor pasture 19/10/1982

Results : Soil testing 4 replicates bulked

Rate of P kg/ha	Bicarb P 26/3/1982	Bicarb P 14/7/1982	Bicarb P 1/9/1982
Nil	16.9	14.3	11.5
90		22.3	16.8
3 x 30		19.1 (1)	22.8 (2)
180		29.7	22.5

(1) = 1 of 3 applied

Comment : Pasture very poor 500 kg/ha at end of season, mostly
capeweed. High initial Bicarb P 26/3/1982 possibly due to
July 1981 application of super. Nil P plots decreased in
bicarb P throughout season, as did single application plots.

Trial : 82HA22
 Location : Moore, Alexander Road.
 Soil type : Bassendean Sand. Gavin Phase
 History : New land cleared. December 1981
 Seasonal Notes : Basals 100 kg/ha KCl, 100 kg/ha Gypsum, 5:1.5:0.1
 Cu:Zn:Mo + treatments applied 5/5/1982
 Seeded Serradella, Trikkala, Dinninup, Daliak L.P. + innoc
 100 kg/ha 3/6/1982
 Soil sampled basals and Tmt 3 14/7/1982
 Site rated (visual) 25/8/1982
 Soil sampled basals and Tmt 3 1/9/1982
 Site rated (visual) 19/10/1982
 Results : Soil testing. Four replicates bulked

Rate of P kg/ha	Bicarb P 26/3/1982	Bicarb P 14/7/1982	Bicarb P 1/9/1982
Nil	3.2	6.3	4.5
90		14.8	5.9
3 x 30		6.0 (1)	14.0 (2)
180		10.3	6.2

(1) = 1 of 3 applied

Yield responses mean of 4 replicates

Rate of P kg/ha	Yield 25/8/1982 visual	Yield 19/10/1982
Nil	150	300
90	250	550
3 x 30	240 (2)	790 (3)
180	290	610

(2) = 2 of 3 applied

Comment : This site shows very rapid leaching of single application plots. Also as evidence the 3 x 30 plot gave higher final yield than 180 plot. Site 62 per cent response to P.

Trial : 82HA23

Location : Denholm, Johnston Road.

Soil type : Bassendean Sand. Gavin Phase

History : Old land. Cleared 1972 360 kg/ha Super No. 1 (Cu, Zn, Mo)
1973 - 1981 90 kg/ha 5:1 Super:KCl 1979 CuSO₄. Used as
hay paddock, oats planted yearly.

Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum + all treatments
applied 5/5/1982
Soil sampled Tmts bulked, visual assessment, Basal Tmt 3
applied 14/7/1982
Site visual rating no response 25/8/1982
Basal + Tmt 3 applied, soil sampled 1/9/1982
Site rated no response 19/10/1982

Results : Soil testing. Four replicates bulked

Rate of P kg/ha	Bicarb P 26/3/1982	Bicarb P 14/7/1982	Bicarb P 1/9/1982
Nil	4.3	8.9	8.0
90		18.4	13.3
3 x 30		13.3 (1)	10.6 (2)
180		27.3	15.5

(1) = 1 of 3 applied

Yield responses mean of 4 replicates

Rate of P kg/ha	Yield 14/7/1982 visual	Yield 25/8/1982
Nil	850	950
90	880	950
3 x 30	880 (1)	950 (3)
180	1,080	1,000

(3) = 3 of 3 applied

Comment : Site 21 per cent response to P early in season no response
later. Pasture very poor all capeweed.

Trial : 82HA24

Location : Porter, Meredith Road.

Soil type : Bassendean Sand. Gavin Phase

History : Old land. Pasture cleared 1967 180 Kg/ha Super No. 1 (Cu, Zn, Mo) 1968-1978 14 kg/ha super, 1979-1980 23 kg/ha super + K, 1981 nil.

Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum + all treatments applied 5/5/1982
 Basal, Tmt 3 + soil sampled 14/7/1982
 Site rated no response 25/8/1982
 Basal, Tmt 3, soil sampled 1/9/1982
 Site rated no response 19/10/1982

Results : Soil testing. Four replicates bulked

Rate of P kg/ha	Bicarb P 1/4/1982	Bicarb P 14/7/1982	Bicarb P 1/9/1982
Nil	3.1	7.0	4.6
90		9.0	8.4
3 x 30		7.6 (1)	8.5 (2)
180		15.8	16.1

(1) = 1 of 3 applied

Comments : Pasture very poor 1,000 kg/ha capeweed. No response to P.

Trial : 82HA25
Location : Slee, Buller Road.
Soil type : Bassendean Sand. Gavin Phase
History : Old land pasture.
Seasonal Notes : Site topdressed Tmts + Basal 100 kg/ha KCl, 100 kg/ha
Gypsum 27/4/1982.
Site resited previously smashed by cattle break-in
Topdressed tmts + Basals, seeded Trikkala, Dinninup, Daliak
LP + innoc 100 kg/ha 27/5/1982
1/9 site abandoned for 1982 cattle smashed fence again.
Site will be used for 1983, after construction of
cattle-proof fence.

Trial : 82HA26
 Location : Wickham, Meredith Road.
 Soil type : Bassendean Sand. Joel Series
 History : Old land cleared 1956. 180 Kg/ha Super:KCl 3:2
 Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum + all treatments applied 5/5/1982
 Basal, soil samples, T3 14/7/1982
 Site rated 25/8/1982
 Basal, soil sampled, T3 1/9/1982
 Site inspected cattle smashed fence no final assessment.
 Results : Soil testing. Four replicates bulked

Rate of P kg/ha	Bicarb P 1/4/1982	Bicarb P 14/7/1982	Bicarb P 1/9/1982
Nil	3.0	8.1	3.7
90		13.6	9.8
3 x 30		8.5 (1)	9.1 (2)
180		14.9	11.5

(1) = 1 of 3 applied

Yield response. Mean of four replicates

Rate of P kg/ha	Yield visual 25/8/1982
Nil	450
90	850
3 x 30	725
180	650

Comments : No final assessment.

Trial : 82HA27

Location : Rothwell, Johnston Road.

Soil type : Bassendean Sand. Joel Series

History : Old land cleared 1962. 180 Kg/ha Super No. 1 (Cu, Zn, Mo) 1972-1978 Nil, 1979 180 Kg/ha 5:1 Super:KCl, 1980 90 Kg/ha 5:1 Super:KCl.

Seasonal Notes : Basal 100 kg/ha KCl, 100 Kg/ha Gypsum + all treatments applied 5/5/1982.
Soil sampled, T3, Basal 14/7/1982.
Site rated visual 25/8/1982 Tmt 5 applied
Soil sampled, T3, Basal 1/9/1982
Site rated and calibrated 19/10/1982

Results : Soil testing. Four replicates bulked

Rate of P kg/ha	Bicarb P 1/4/1982	Bicarb P 14/7/1982	Bicarb P 1/9/1982
Nil	10.6	7.7	9.0
90		11.5	16.5
3 x 30		10.1 (1)	8.2 (2)
180		14.1	15.4

(1) = 1 of 3 applied

Yield response. Mean of four replicates. T5 mean of 2 replicates

Rate of P kg/ha	Visual yield 25/8/1982 kg/ha	Plate meter Calibrated 19/10/1982	% P in tops 8/11/1982
Nil (T1)	700	2,990	0.196
Autumn 90 (T2)	575	3,140	0.252
3 x 30 (T3)	700 (2)	3,120 (3)	0.428
180 (T4)	500	2,860	0.316
Spring 90 (T5)	-	2,750	0.569

Comments : No yield response to P. % P in tops data show that 3 x 30 gives more P uptake than autumn 180, and spring 90 gives highest uptake.

Trial : 82HA28
 Location : Hyde, Coronation Road.
 Soil type : Coolup Assoc. Deep phase. Sand over clay at 1 m
 History : Old land pasture.
 Seasonal Notes : Basal 100 kg/ha KCl, 100 Kg/ha Gypsum + all treatments applied 27/4/1982.
 Soil sampled, T3, Basal 14/7/1982
 Site rated no response 14/7/1982
 Soil rated, T5 added 25/8/1982
 Soil sampled, T3, Basal 1/9/1982
 Site rated calibrated plate metering 19/10/1982
 Results : Soil testing. Four replicates bulked

Rate of P kg/ha	Bicarb P 25/3/1982	Bicarb P 14/7/1982	Bicarb P 1/9/1982
Nil	10.3	5.7	4.1
90		11.4	7.8
3 x 30		6.1 (1)	6.2 (2)
180		14.4	8.8

(1) = 1 of 3 applied

Yield response. Mean of four replicates

Rate of P kg/ha	Visual yield 25/8/1982 kg/ha	Plate meter Calibrated 19/10/1982	% P in tops 8/11/1982
Nil	538	3,070	0.166
90	700	3,190	0.250
3 x 30	750 (2)	3,310 (3)	0.275 (3)
180	688	3,200	0.247
Spring 90	-	-	0.440

Comments : Site only 7% response to P 3 x 30 of P giving higher yield than 180 of P. Rapid leaching of high rates of P (single application).

Trial : 82HA29

Location : Fregon, Johnston Road.

Soil type : Bassendean Sand Gavin phase

History : Old land pasture cleared 1972-1976 180 Kg/ha super.
 1977-1978 180 Kg/ha Super CuZn. 1979 180 Kg/ha Super.
 1981 135 Kg/ha 5:1 Super:KCl.

Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum + all treatments
 applied 27/4/1982.
 Soil sampled, T3, Basal 14/7/1982
 Site rated. No response 10% clover 14/7/1982
 Site rated 25/8/1982
 Soil sampled, T3, Basal 1/9/1982
 Site rated, no response 30% clover 19/10/1982

Results : Soil sampling. Four replicates bulked

Rate of P kg/ha	Bicarb P 25/3/1982	Bicarb P 14/7/1982	Bicarb P 1/9/1982
Nil	9.4	9.3	6.9
90		19.5	7.4
3 x 30		11.7 (1)	9.5 (2)
180		19.1	12.2

(2) = 2 of 3 applied

Comments : No response to P at any growth stage. Growth even at 2,000 kg/ha.

Trial : 82HA30

Location : Hardisty, Merredith Road.

Soil type : Bassendean Sand, Joel phase

History : Old land pasture. Cleared 1959-1966 5:1 Super:KCl. 1967-1981 200 kg/ha 5:1 Super:KCl. CuSO₄ yearly for stock.

Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum + all treatments applied 27/4/1982.
 Rotary hoed + reseeded Trikkala, Dinninup, Daliak L.P. and innoc 100 kg/ha 27/5/1982
 Soil sampled, basal, T3 14/7/1982
 Site rated visual 14/7/1982
 Site rated visual 25/8/1982
 Soil sampled, Basal, T3 1/9/1982
 Soil rated plate meter calibrated 4/11/1982

Results : Soil sampling. Four replicates bulked

Rate of P kg/ha	Bicarb P 1/4/1982	Bicarb P 14/7/1982	Bicarb P 1/9/1982
Nil	23	6.3	5.3
90		9.0	6.7
3 x 30		6.6 (1)	7.3 (2)
180		8.0	8.6

(2) = 2 of 3 applied

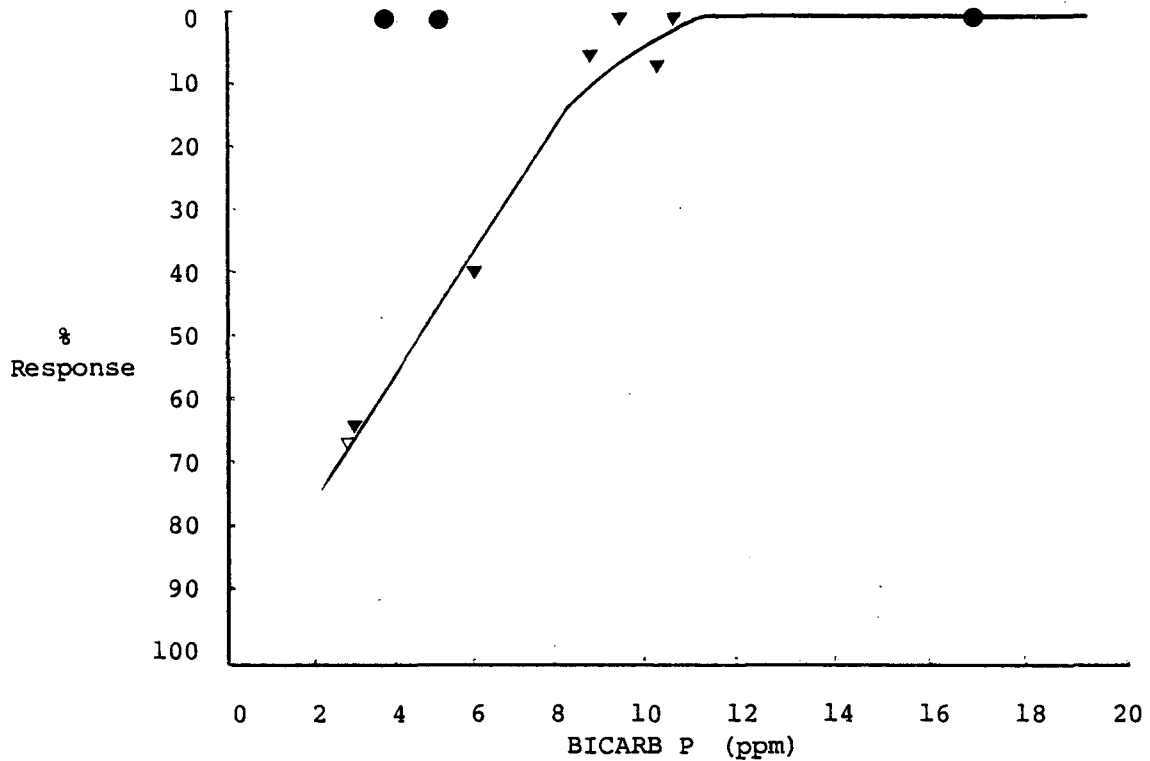
Yield response. Mean of four replicates

Rate of P kg/ha	Visual 14/7/1982 kg/ha	Visual 25/8/1982 kg/ha	Plate meter calibrated 4/11/1982	% P in tops 4/11/1982
Nil	600	930	6,220	0.162
90	680	1,250	6,500	0.209
3 x 30	600 (1)	1,130 (2)	6,600 (3)	0.282
180	680	1,380	6,640	0.223

Comments : Multiple applications more uptake than single applications in autumn.

Bicarb P 1/4/1982 very high possibly due to thick organic mat 5 cm thick. This mat was destroyed by rotary hoeing and initial Bicarb P probably much less than this approximately 9-10.

Summary of soil test calibration curve trials



● = poor pasture < 20% legume
▼ = new land trial

Relative efficiency of P yield at all rates
(P yield = D.M. x % P in tops)

Rate of P kg/ha	Treatment	Relative efficiency arbitrary units
Nil	1	.57
Autumn 90	2	.88
3 x 30	3	1.29
Autumn 180	4	1.00
Spring 90	5	1.72

Treat 4 = 1.0; Treats 1-3 Mean of 4 trials. Treat 5 mean of 2 trials

Spring application of 90 kg/ha P 1.72 times the uptake of the autumn application of 180 kg/ha. Three applications of 30 kg/ha P (T = 0, 6, 12 weeks after break of season) 1.29 times the P uptake of autumn 180 application.

Sources x Rates x Times of Application Trials

Trial : 82HA31
 Location : Eastcott, Alexander Road.
 Soil type : Bassendean Sand, Joel phase
 History : Old land pasture cleared 1960's-1979 360 Kg/ha 5:1 Super:KCl 1980-1981 180 Kg/ha Super.
 Seasonal Notes : Basal 100 kg/ha KCl, 100 kg/ha Gypsum + all treatments applied 12/5/1982.
 Site rated, no yield response, soil sample all plots, pasture sample all plots 17/8/1982.
 19/8/1982-23/8/1982 sheep graze trial hard.
 Basals applied 25/8/1982
 Site rated, no yield response, pasture sample all plots 4/11/1982
 Soil sampled all plots 22/12/1982
 Results : Initial Bicarb P (25/3/1982) 11.2

Soil sampling mean of 2 replicates

Rate of P kg/ha	Super	LS2	LS3	RR	GRP	C500
0	6.3					
10	12.1	9.3	7.4	9.6	12.5	8.9
20	8.8	10.1	8.5	10.8	8.8	10.1
40	6.7	10.8	9.6	8.1	9.2	9.0
80	8.7	10.2	11.8	6.0	8.9	18.4
160	9.9	13.5	17.4	8.5	9.6	16.4
200	8.1	14.2	33.7	9.8	10.7	16.9

Bicarb P 17/8/1982

See Overleaf for explanation of sources.

Plant uptake % P in tops. Mean of 2 replicates

Rate of P kg/ha	Super	LS2	LS3	RR	GRP	C500
Nil	0.35 (0.18)					
10	0.45 (0.24)	0.41 (0.23)	0.33 (0.20)	0.45 (0.25)	0.52 (0.28)	0.44 (0.24)
20	0.43 (0.23)	0.38 (0.21)	0.49 (0.26)	0.48 (0.28)	0.37 (0.22)	0.42 (0.22)
40	0.34 (0.22)	0.44 (0.23)	0.46 (0.26)	0.43 (0.23)	0.37 (0.24)	0.40 (0.26)
80	0.37 (0.24)	0.48 (0.31)	0.53 (0.31)	0.34 (0.25)	0.46 (0.29)	0.49 (0.33)
160	0.45 (0.27)	0.47 (0.31)	0.50 (0.29)	0.44 (0.29)	0.40 (0.27)	0.40 (0.29)
200	0.43 (0.24)	0.49 (0.31)	0.52 (0.34)	0.49 (0.28)	0.46 (0.30)	0.45 (0.30)

Sampled 17/8/1982

Bracketed figures sampled 4/11/1982

Description of sources

Source	Description	% of P H ₂ O Sol	% of P Citrate Sol	% of P Acid Insol	%P In source
Super	Triple superphosphate	76	14	5	19.7
LS2	Reacting Super + 12% CaO	33	55	12	8.3
LS3	Reacting Super + 18% CaO	17	71	12	7.6
RR	North Carolina Reactive Rock	0	95	5	13.5
GRP	Ground rock phosphate	0	0	100	17.0
C500	Calcined 'C' Grade Ore	0	0	100	13.0

Comments : Bicarb P 17/8/1982 shows better residual from LS3 with LS2 and C500 being reasonable also. No yield response to P during the growing season. Relative effectiveness of P uptake from sources. Super = 1.

Source	Early uptake 17/8/1982	23/8/1982 to Late uptake 12/9/1982
Super	1.00	1.00
LS2	6.67	2.00
LS3	11.00	5.67
RR	7.33	3.00
GRP	0.33	2.00
C500	3.67	4.67

Ratio of initial slopes of response curves.

There are large errors associated with those figures because of the flat uptake curves. (b around 20%)

Trial : 82HA32
 Location : Forestry Department Site. McLarty North
 Soil type : Bassendean Sand, Gavin phase
 History : New land cleared January 1982
 Seasonal Notes : Basals 100 kg/ha KCl, 100 kg/ha Gypsum 5:1.5:0.1 Cu:Zn:Mo +
 treatments applied 13/5/1982.
 Site seeded Trikkala, Dinninup, Seaton Park L.P. + innoc.
 100 kg/ha 12/5/1982.
 Site reseeded Daliak, Dinninup,, Trikkala 50 kg/ha 3/6/1982.
 Soil sample 2nd time application treatments, visual
 assessment, Basals 15/7/1982.
 Soil sampled, 3rd time application, Basals 3/9/1982
 Plate meter all plots 9/9/1982
 Plate meter all plots, pasture sample 12/10/1982
 Soil sample 12/10/1982

Results : Same sources as 82HA31 Initial Bic P 4.1
 Organic C 0.85%

Soil sampling. Mean of 2 replicates
 Bicarb P

Rate of P kg/ha	Super T = 0	Super T = 6 weeks	LS2	LS3	RR	GRP	C500
0	5.5 (4.4)						
10	5.9 (4.9)	(4.7)	5.7 (3.2)	5.3 (5.4)	5.4 (3.8)	4.9 (4.1)	5.6 (5.5)
20	9.4 (5.6)	(5.9)	8.7 (13.2)	7.8 (6.6)	6.5 (6.2)	4.7 (3.7)	7.2 (7.5)
40	10.7 (8.7)	(6.5)	9.0 (6.9)	10.9 (9.3)	7.4 (4.8)	5.7 (4.5)	8.6 (8.6)
80	18.8 (14.3)	(10.5)	14.1 (10.9)	13.0 (17.7)	5.2 (4.7)	6.5 (5.4)	10.7 (9.0)
160	26.9 (19.9)		30.4 (27.7)	19.6 (22.9)	7.0 (5.2)	7.6 (7.9)	14.4 (11.4)
200	47.9 (17.4)		24.5 (32.9)	27.4 (49.0)	6.3 (6.8)	6.5 (6.8)	14.8 (15.0)

Sampled 15/7/1982. Bracketed figures sampled 3/9/1982

Yield response. Final assessment calibrated plate meter 12/10/1982
Mean of 2 replicates

Rate of P kg/ha	Super T = 0	Super T = 6	Super T = 12	LS2	LS3	RR	GRP	C500
0	1,190							
10	3,200	3,930	2,220	2,080	1,860	1,290	1,800	3,230
20	5,000	4,150	2,170	4,390	2,620	3,890	1,930	4,470
40	4,320	5,480	1,840	6,650	4,990	4,970	4,570	4,550
80	6,980	5,490	1,890	6,960	5,520	4,220	6,530	5,690
160	5,780			6,620	6,760	4,970	5,710	6,000
200	5,700			6,120	7,240	6,660	6,360	6,050

% P in tops. Mean of 2 replicates 12/10/1982

Rate of P kg/ha	Super T = 0	Super T = 6	Super T = 12	LS2	LS3	RR	GRP	C500
0	0.09							
10	0.10	0.10	0.14	0.14	0.09	0.08	0.08	0.08
20	0.11	0.11	0.20	0.11	0.12	0.10	0.09	0.10
40	0.12	0.16	0.26	0.12	0.14	0.10	0.10	0.11
80	0.18	0.20	0.36	0.17	0.18	0.11	0.14	0.12
160	0.22			0.22	0.21	0.13	0.15	0.16
200	0.24			0.24	0.21	0.15	0.18	0.14

Comments : Bicarb P from LS2 and LS3 increased at high rates during season. LS3 gave highest yield at high rates 12/10/1982, but was poorer than super and LS2 at low rates. LS3 at top rate gave highest phosphorus yield (D.M. yield x % P in tops).

Relative effectiveness of sources during the season
Ratio of initial slopes from response curves

Source	14/7/1982 Visual	10/8/1982 Visual	9/9/1982 Calib. P.M.	12/10/1982 Calib. P.M.
Super T = 0	1.00	1.00	1.00	1.00
Super T = 6		0.04	0.20	0.71
Super T = 12			0.06	0.05
LS2	1.22	1.06	1.15	1.20
LS3	2.04	1.85	0.94	0.93
RR		0.43	0.35	0.66
GRP	0.60	0.79	0.77	1.16
C500	0.47	0.33	0.43	0.76

Very insoluble sources GRP and C500 improved relative to super as season progressed. Super applied at 6 weeks and 12 weeks after the break performed badly because of late break and new land site.

Summary

Sources x Rates x Times of application

LS2 and LS3 appear to leach away less than super (Bicarb P results) and are at least as good as super given yield and P uptake data. In the second and subsequent years it is expected that the higher residual value of these sources will improve their performance relative to super.

Leaching of phosphorus trials

Trial : 82HA33
 Location : Same site as 82HA31
 Trial Design : 9 sources x 1 rate (200 kg/ha P) x 1 replicate. Plots sampled to depth every 25 mm rain early to every 50 mm later in the season.
 Results : Organic C 4.00%

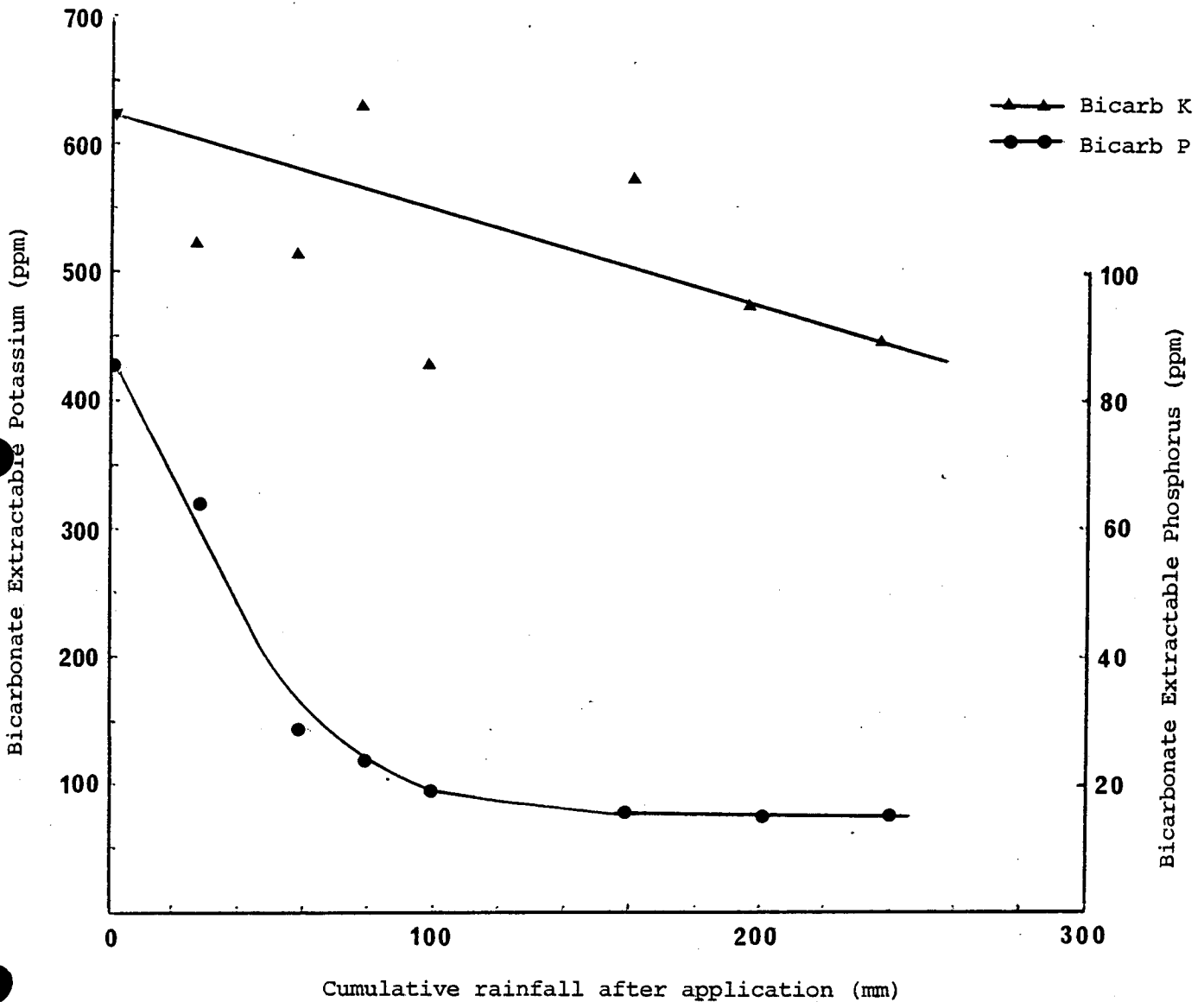
Source	Description	% of P H ₂ O Sol	% of P Citrate Sol	% of P Acid Insol	% of P In source
Super	Triple superphosphate	76	14	5	19.7
LS1	Reacting Super + 6% CaO	53	36	11	8.8
LS2	Reacting Super + 12% CaO	33	55	12	8.3
LS3	Reacting Super + 18% CaO	17	71	12	7.6
RR	North Carolina Reactive Rock	0	95	5	13.5
GRP	Ground Rock Phosphate	0	0	100	17.0
C500	Calcined 'C' grade Ore	0	58	42	13.0
MAG	Magamp (Magnesium Ammonium Phos)	37	63	0	17.4
KCl	Muriate of Potash 2000 kg/ha	-	-	-	-

KCl was used so the non sorbing Cl⁻ ion could be used to trace water movement

Table 1.

Source	TSP	LS1	LS2	LS3	RR	GRP	C500	MAG
% of initial Bic P remaining after 200 mm 0-10 cm	18.4	32.1	77.7	56.5	100	100	100	20.8

Bicarb P and Bicarb K vs. Cumulative Rain



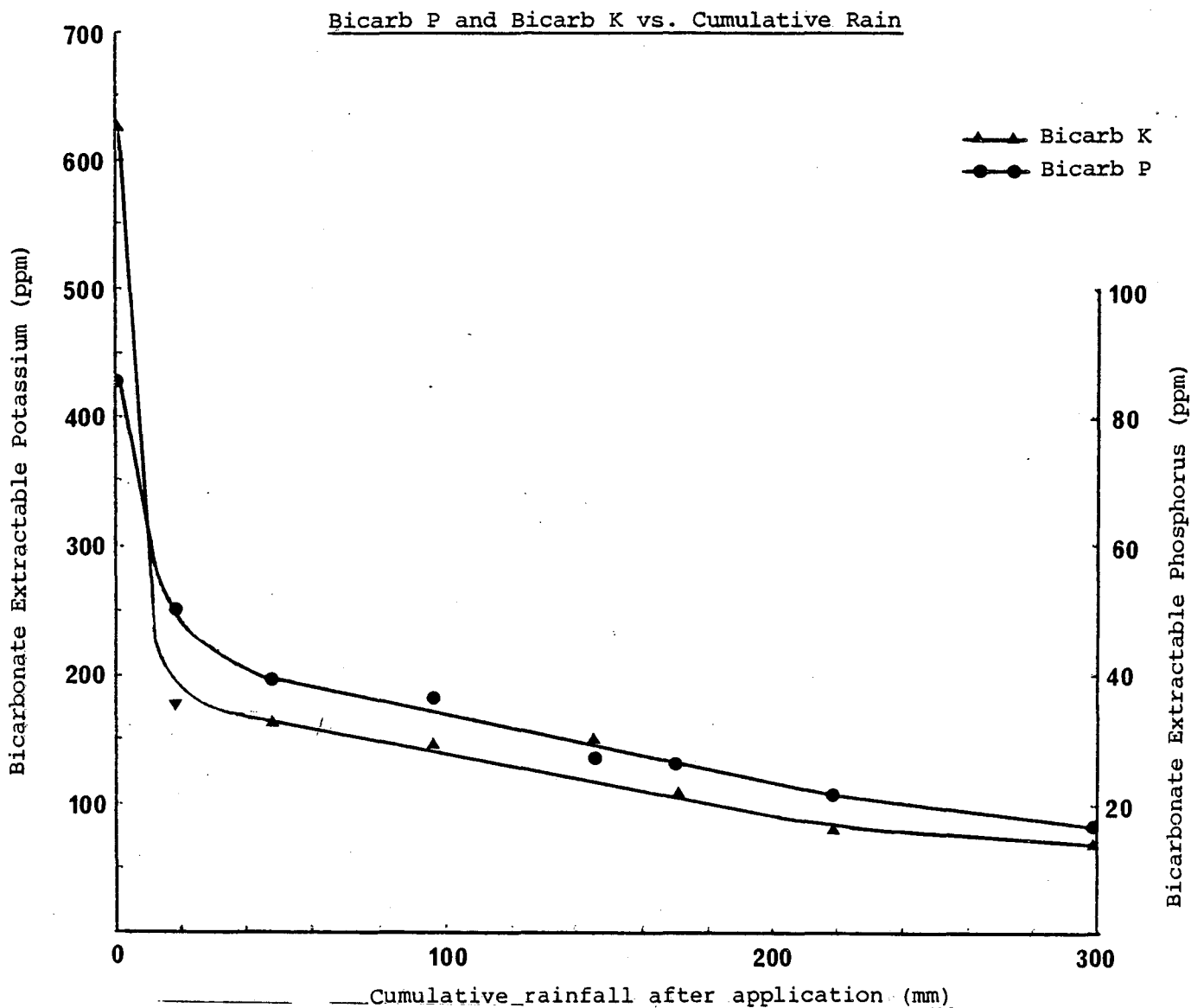
Comments

: A variety of sources with a range of solubilities give different rates of leaching loss. Table 1 summarises the loss in 0-10 cm after 200 mm of rain expressed as a percentage of the initial bicarb P value. Super and magamp with most of the P in the water soluble form lost the most P. The insoluble P ores lost no P during this period. This site had a reasonable build up of organic material in the 0-10 cm zone and so leaching of potassium is negligible. Water soluble P leaches out rapidly.

Trial : 82HA34
 Location : Same site as 82HA32
 Trial Design : Same design as 82HA32
 Results : Organic C 0.85%

Table 1

Source	TSP	LS1	LS2	LS3	RR	GRP	C500	MAG
% initial BIC P remaining after 220 mm	26.4	40.3	57.9	37.4	100	100	100	19.6



Comments

: Table 1 shows values similar to 82HA33 however leaching is more severe due to the lower moisture holding capacity of the 0-10 cm zone in the absence of any organic build up. This site is a new land site with no background nutrients whereas 82HA33 is an old land pasture with a considerable fertilizer history. The pattern of P leaching between the two sites is similar, but the absence of organic material has resulted in severe leaching of potassium at this site.

Rates of lime with + phosphorus

Trial : 82HA36
 Location : Rose, Browns Road
 Soil type : Coolup, sand over clay
 History : Old land pasture
 Seasonal Notes : Basals 100 kg/ha KCl, 65 kg/ha superphosphate to +P area, 100 kg/ha Gypsum to -P area, all lime rates applied 22/4/1982.
 Reseeded sub clover LP + innoc
 Site rated, no response 25/8/1982
 Basals, soil sample all plots + moly plots only 1/9/1982
 Site rated, no response 20/9/1982
 Site rated, no response 22/10/1982
 Results : Soil sampling. 3 replicates bulked 1/9/1982, 0-10 cm

Rate of Limestone kg/ha	+ P plots		- P plots	
	Bicarb P	pH	Bicarb P	pH
0	80.5	4.93	48.6	5.08
250	84.3	4.95	48.5	5.20
500	63.7	5.18	37.3	5.20
1,000	80.0	5.23	41.9	5.26
2,000	60.6	5.26	32.7	5.42
4,000	69.9	5.41	34.4	5.52
8,000	63.0	5.74	47.6	5.47

Comments : There was no response to either limestone or phosphorus at any stage through the season.

Trial : 82HA37

Location : Fregon, Johnston Road

Soil type : Bassendean Sand, Gavin phase

History : Old land pasture cleared 1972. 1972-1976 180 Kg/ha super.
1977-1978 180 Kg/ha Super CuZn. 1979 180 Kg/ha Super, 1981
135 Kg/ha 5:1 Super:KCl.

Seasonal Notes : Basals 100 Kg/ha KCL, 100 kg/ha Gypsum to - P area, 65
kg/ha Super to + P area + all lime tmts applied 22/4/1982.
Site reseeded sub clover L.P. + innoc
Site rated, poor germination. No response 19/5/1982
Site rated, poor pasture. No response 25/8/1982
Basals, soil sample 1/9/1982
Site rated poor pasture 800 kg/ha no response 19/10/1982

Results : Soil sample. 3 replicates bulked 1/9/1982, 0-20 cm

Rate of Limestone kg/ha	+ P plots		- P plots	
	Bicarb P	pH	Bicarb P	pH
0	8.4	5.64	5.0	5.64
250	5.8	5.68	5.8	5.79
500	6.3	5.73	4.7	5.98
1,000	7.9	5.84	4.6	6.01
2,000	6.9	6.09	5.1	6.00
4,000	5.8	6.18	3.8	6.39
8,000	7.6	6.51	4.4	6.35

Comments : Due to very poor pasture < 500 kg/ha, there was no response to either limestone or phosphorus.

Trial : 82HA38

Location : Hyde, Coronation Road

Soil type : Coolup Assoc. Deep phase sand over clay at approximately 1 m

History : Old land pasture

Seasonal Notes : Basals 100 kg/ha KCl, 65 kg/ha Super on + P plots, 100 kg/ha Gypsum on - P plots, + all lime treats applied 27/4/1982.
 Site inspected, good germination of clover 19/5/1982
 Basals, soil sample 1/9/1982
 Site rated 20/9/1982 calibrated P.M.
 Site mowed 20/9/1982
 Site rated 22/10/1982

Results : Soil sample. 3 replicates bulked 1/9/1982

Rate of Limestone kg/ha	+ P plots		- P plots	
	Bicarb P	pH	Bicarb P	pH
0	7.4	5.00	14.0	4.85
250	16.0	5.72	8.5	5.25
500	15.3	5.09	8.3	5.15
1,000	14.8	5.02	12.4	5.46
2,000	10.1	5.02	34.4	4.92
4,000	13.7	5.22	11.3	5.42
8,000	8.2	5.02	9.7	4.95

Yield results. Calibrated P.M. kg/ha 20/9/1982, 22/10/1982

Rate of Limestone kg/ha	+ P plots		- P plots	
		20/9/82 to 22/10/82	20/9/82 to 22/10/82	20/9/82 to 22/10/82
	0	3,610	3,120	2,440
250	3,550	3,380	2,870	3,640
500	3,270	3,360	2,930	3,750
1,000	3,670	3,440	2,400	3,300
2,000	3,730	3,400	3,060	3,400
4,000	3,170	3,370	2,710	3,550
8,000	3,130	3,340	2,720	3,570
Mean	3,450	3,340	2,740	3,510

Comments : The values obtained during the soil sampling of 1/9/1982 show great variability in both pH and bicarb P. It is not surprising there is no yield response to added limestone. The mean value across all lime rates suggests a response to phosphorus up to 20/9/1982 although this is not the case for the 22/10/1982 rating.

Overall summary

The reverted superphosphates are at least as good as normal superphosphate as far as pasture yield and P uptake are concerned, however bicarb P results indicate considerably less leaching. The very insoluble phosphate areas do not leach to any degree but are less efficient than superphosphate in pasture nutrition. The performance of these less leachable sources is expected to improve relative to superphosphate in subsequent years.

The two leaching trials show that there is little difference in P leaching on new and old land sites, however the build up of organic material on old land appears to have a marked effect on Potassium retention.

In 1983 all treatments in the soil test calibration curve trials should have different residual values of P and splitting each plot into untreated and adequately supplied halves should give many points for the soil test calibration curves.

From the three trials reported here it would appear that there is no interaction between P nutrition and added lime, however improved pasture management on these trials in 1983 should give more data.

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