

**SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION**

Code : FT 15P/90
Cat.No. : 1860

TITLE: Phosphorus requirement on neutral to alkaline sandy soils

1. Particulars of the project

This crop : Plant Site : Glenbarlyn Est Mtubatuba Region : Zululand Soil system : Berea Soil form/series: Dundee Design : Split plots x 4 reps Variety : NCo 376, N12 Fertilizer : N P K Kg/ha 92 ↓ 92 See treatments	<p style="text-align: center;"><u>Soil analysis: Date:20/3/1990</u></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: left;">pH</td> <td style="text-align: left;">OM%</td> <td style="text-align: left;">Clay%</td> <td style="text-align: left;">P.D.I.</td> <td colspan="3"></td> </tr> <tr> <td>6.8</td> <td>*2.08</td> <td>30</td> <td>-</td> <td colspan="3"></td> </tr> <tr> <td colspan="7" style="text-align: center;">ppm</td> </tr> <tr> <td style="text-align: left;">P</td> <td style="text-align: left;">K</td> <td style="text-align: left;">Ca</td> <td style="text-align: left;">Mg</td> <td style="text-align: left;">Zn</td> <td style="text-align: left;">Al</td> <td></td> </tr> <tr> <td>74</td> <td>216</td> <td>1573</td> <td>>350</td> <td>2.25</td> <td>-</td> <td></td> </tr> </table> <p>Age:14.1 month Dates:20/3/90-23/5/91 Rainfall: 1400mm 129% of L.T.M.1087mm Irrigation: Occasional/Supplimentary</p>	pH	OM%	Clay%	P.D.I.				6.8	*2.08	30	-				ppm							P	K	Ca	Mg	Zn	Al		74	216	1573	>350	2.25	-	
pH	OM%	Clay%	P.D.I.																																	
6.8	*2.08	30	-																																	
ppm																																				
P	K	Ca	Mg	Zn	Al																															
74	216	1573	>350	2.25	-																															

2. Objectives:

To help in establishing whether the threshold values of 31ppm and 11ppm used for determining the P requirement of plant and ratoon cane respectively need adjustment on neutral to alkaline alluvial soils.

Alternatively to help in determining whether the Truog procedure should be replaced by another extractant that is more selective for measuring plant available P in sandy alluvial soils.

To help determine whether a varietal correction factor or a lower value is necessary when interpreting the third leaf P content of N12.

3. Motivation:

Glasshouse studies have shown responses to P fertilizer when Truog levels were well in excess of 31ppm. These results need to be confirmed in the field.

Also N12 has shown consistently lower P values in the leaf compared to NCo 376 in variety trials. There is thus a need to determine whether this is due to a higher requirement for P or merely a varietal characteristic which should be taken into account in the interpretation of leaf analysis results of N12.

Rainfall (mm) Riverview Station

Months	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
1990/91	129	68	9	3	20	68	26	112	70	106	194	176
L.T.M.	30	64	58	45	36	38	85	85	88	85	129	147
1991	203	35	181	Total: 1400.1 mm								
L.T.M.	91	64	43	Total: 1087.5 mm								

Irrigation (mm)

Months	Mar	May	Jun	Jul	Oct	Jan	Apr	Total + Rainfall
	50	100	50	100	50	50	100	500 + 1400 = 1900

4. Treatment:

Sub plots

Phosphorus rates (kg/ha)

<u>Plant cane (i.f.)</u>	<u>Ratoon 1 Broadcast (b/c)</u>
T1 = 0	30
T2 = 20	0
T3 = 20	15
T4 = 20	30
T5 = 20	45
T6 = 40	0
T7 = 60	0

Whole plots

Varieties : N12 , NCo 376

4.1 Notes on treatments:

- The old crop was eradicated with Roundup and volunteers retreated.
- The trial site was ripped and ridged on 19 March 1990.
- Soil samples were taken in two replicates at 0-20cm (18 cores per plot) and in selected plots to depth.

- Fertilizer treatments were applied in the furrow and lightly covered before planting. This included Single supers (10.5%) at the appropriate rates and 1.0.1(47) at 200 kg/ha applied on 20 March 1990.
- Seedcane was stripped and planted double whole stick in the furrow and chopped into setts. Seedcane was young and appeared to be good quality.
- The balance of nitrogen and potassium was applied as a top-dressing of 1.0.1(47) at 200 kg/ha on 11 April 1990.
- It was noted that germination was very poor for N12 but good for NCo 376.
- N12 was gapped up using hot water treated seed (1/2 an hour at 50°C) on 29 May 1990.

5. Results

Table 1. Yield

Treatment P (kg/ha) i.f.	Cane t/ha		Suc % cane		Suc t/ha	
	376	N12	376	N12	376	N12
T1 0	136	137	9.71	9.82	13.1	13.5
T2 20	141	124	9.27	10.02	13.0	12.4
T3 20	144	138	10.28	10.23	14.9	14.1
T4 20	151	133	10.75	10.10	16.4	13.4
T5 20	144	121	10.94	10.55	15.7	12.8
T6 40	140	135	9.78	10.49	13.8	14.2
T7 60	143	125	11.01	10.95	15.8	13.7
Mean	143	131	10.25	10.31	14.7	13.4
C.V. %	10.2		5.7		12.8	
S.E. of treatment mean ±	5.66		0.24		0.74	
S.E. diff ±	8.01		0.34		1.04	
L.S.D. (0.05)	16.53		0.69		2.15	
(0.01)	22.38		0.94		2.91	

Table 2. Mean yield and crop characteristics: P mean

Treatment P (kg/ha) i.f.	Cane t/ha	Sucrose % cane	Sucrose t/ha
T1 0	137	9.77	13.3
T2 20	132	9.65	12.7
T3 20	141	10.25	14.5
T4 20	142	10.43	14.9
T5 20	133	10.74	14.3
T6 40	137	10.13	14.0
T7 60	134	10.98	14.8
Mean	137	10.28	14.1
S.E. Diff \pm	13.6	0.6	1.7

Table 3. Third leaf dm % analysis at 10.3 months sampled on 30 January 1991

Treatment P (kg/ha) i.f.	dm %					
	N		P		K	
	376	N12	376	N12	376	N12
T1 0	1.86	1.61	0.23	0.17	1.44	1.31
T2 20	1.84	1.66	0.23	0.18	1.43	1.28
T3 20	1.71	1.65	0.21	0.17	1.37	1.23
T4 20	2.01	1.72	0.24	0.17	1.41	1.22
T5 20	1.68	1.51	0.21	0.16	1.36	1.16
T6 40	1.78	1.69	0.22	0.17	1.41	1.17
T7 60	1.92	1.72	0.24	0.18	1.39	1.15
Mean	1.83	1.65	0.23	0.17	1.40	1.22

Table 4. Soil analysis by treatment before (2 reps only) and after treatment.

Treatment P (kg/ha) i.f.	Start plant crop				End plant crop			
	pH	P ppm	K ppm	Ca ppm	pH	P ppm	K ppm	Ca ppm
T1 0	7.04	79	213	1650	7.03	76	172	1538
T2 20	7.02	79	198	1608	6.94	74	185	1511
T3 20	6.60	70	206	1464	6.93	73	182	1415
T4 20	7.15	77	218	1628	6.94	75	190	1409
T5 20	6.64	75	228	1586	6.73	71	198	1446
T6 40	6.47	69	209	1506	6.78	74	212	1450
T7 60	6.67	71	238	1571	6.86	70	187	1436

6. Comments.

General:

Cane yields were 7.5 t/ha/100mm gross moisture received for NCo376 and 6.9 t/ha/100mm for N12. Yields were 10.14t/ha/month and 9.3t/ha/month for NCo 376 and N12 respectively.

The rainfall received was above long term average particularly over the summer months.

Yield

Cane

No differences in cane yield reached a level of statistical significance and there was considerable variability in growth due to poor germination in N12 particularly.

Quality

The low cane quality was probably due to the early season of harvest and the better than average rainfall experienced in the later summer months. There was statistical evidence of differences between treatments and plots with applied phosphorus appeared to have a higher cane quality.

Sucrose

Inspite of individual treatments differing by a statistically significant amount there was no consistency in the trend and these differences do not appear to be treatment related.

Leaf nutrient status

In samples taken at 10.3 months of age there was no evidence of any improvement in P in the leaf due to treatment. However a large difference was apparent between varieties such that N12 was apparently deficient based on the NCo 376 threshold but NCo376 was adequate.

Potassium appeared to be decreased slightly by P application but levels were still above the threshold.

Soils analysis

The phosphorus level in the soil was adequate according to the standard analysis (Truog) both before and after application of the treatments. There was also no evidence of any treatment related increase in soil P levels.

Conclusions

Yields with and without added phosphorus were good and there was no benefit to added P.

There was no increase in soil P status after treatment.

There was no increase in leaf P due to treatment.

There appears to be little point in applying extra phosphorus on these soils.

Low leaf P status was related to variety N12 only.

PETT/lb
7 January 1993

**SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION**

Code : FT 15P/90
Cat.No.: 1860

TITLE: Phosphorus requirement on neutral to alkaline sandy soils

1. Particulars of the project

This crop : 1st Ratoon Site : Glenbarlyn Est Mtubatuba Region : Zululand Soil system : Berea Soil form/series: Dundee Design : Split plots x 4 reps Variety : NCo 376, N12 Fertilizer : N P K Kg/ha 146 ↓ 146 See treatments	Soil analysis: Date:24/6/1991 <hr/> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">pH</td> <td style="text-align: center;">OM%</td> <td style="text-align: center;">Clay%</td> <td style="text-align: center;">P.D.I.</td> <td colspan="2"></td> </tr> <tr> <td style="text-align: center;">6.89</td> <td style="text-align: center;">2.08</td> <td style="text-align: center;">30</td> <td style="text-align: center;">-</td> <td colspan="2"></td> </tr> </table> <hr/> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">P</td> <td style="text-align: center;">K</td> <td style="text-align: center;">Ca</td> <td style="text-align: center;">Mg</td> <td style="text-align: center;">Zn</td> <td style="text-align: center;">S</td> </tr> <tr> <td style="text-align: center;">73</td> <td style="text-align: center;">189</td> <td style="text-align: center;">1458</td> <td style="text-align: center;">350</td> <td style="text-align: center;">1.27</td> <td style="text-align: center;">23</td> </tr> </table> <hr/> Age:12.7 month Dates:23/5/91-15/6/92 Rainfall: 498mm 50% of L.T.M. 988mm Irrigation: Occasional/Supplimentary	pH	OM%	Clay%	P.D.I.			6.89	2.08	30	-			P	K	Ca	Mg	Zn	S	73	189	1458	350	1.27	23
pH	OM%	Clay%	P.D.I.																						
6.89	2.08	30	-																						
P	K	Ca	Mg	Zn	S																				
73	189	1458	350	1.27	23																				

2. Objectives:

To help establish whether the threshold values of 31ppm and 11ppm for plant and ratoon cane respectively need adjustment on neutral to alkaline alluvial soils.

Alternatively to help in determining whether the Truog procedure should be replaced by another extractant that is more selective for measuring plant available P in sandy alluvial soils.

To help determine whether a varietal correction factor or a lower value is necessary when interpreting the third leaf P content of N12.

3. Motivation:

Glasshouse studies have shown responses to P fertilizer when Truog levels were well in excess of 31ppm. These results need to be confirmed in the field.

Also N12 has shown consistently lower P values in the leaf compared to NCo 376 in variety trials. There is thus a need to determine whether this is due to a need for extra P or merely a varietal characteristic which should be taken into account in the interpretation of leaf analysis results of N12.

Rainfall (mm) Riverview Station

Months	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1991-92	1	39	38	10	16	81	30	57	37	34	121	18
L.T.M.	15	45	36	38	85	85	88	85	129	147	91	64
1992	0	16	Total: 497.7 mm									
L.T.M.	58	23	Total: 988.1 mm									

Months	Sept	Dec	Jan	Feb	Mar	Total + Rainfall
1991/2	100	100	100	100	50	450 + 498 = 948 mm

4. Treatment:

Sub plots	
Phosphorus rates (kg/ha)	
<u>Plant cane (i.f.)</u>	<u>Ratoon 1 Broadcast (b/c)</u>
T1 = 0	30
T2 = 20	0
T3 = 20	15
T4 = 20	30
T5 = 20	45
T6 = 40	0
T7 = 60	0

Whole plots
Varieties : N12 , NCo 376

4.1 Notes on treatments:

It was noted that germination was very poor for N12 but good for NCo376 in the plant crop.

N12 was gapped up using hot water treated seed on 29 May 1990 in the plant crop.

- * Top dressed all the plots with 620 kg/ha 1.0.1 (47) on 11/9/91 3.6 months after harvesting the plant crop.
- * Single supers (10.5) at rates applicable to the appropriate treatment was applied to this 1st ratoon crop on 11/9/91.

5. **Results****Table 1. Yield**

Treatment (kg/ha)			Cane t/ha		S % C		Suc t/ha	
P (i.f.)		1R	376	N12	376	N12	376	N12
T1	0	30	146	140	12.5	11.1	18.1	15.8
T2	20	0	151	133	12.2	12.6	18.4	16.7
T3	20	15	161	125	10.8	12.3	16.9	15.3
T4	20	30	131	131	10.6	11.8	13.9	15.6
T5	20	45	139	116	12.6	12.6	17.5	14.6
T6	40	0	170	121	12.1	11.7	20.2	14.0
T7	60	0	159	138	11.8	13.0	18.8	17.9
Mean			151	129	11.8	12.2	17.7	15.7
C.V. %			16.8		8.4		17.4	
S.E. of treat. mean ±			1.4		0.3		0.4	
S.E. diff ±			1.9		0.4		0.5	
L.S.D. (0.05)			8.3		1.9		2.2	
(0.01)			19.1		4.3		5.0	

Table 2. Other crop characteristics at harvest

Treatments (kg/ha)			Stalk counts x1000/ha		Stalk length (cm)	
P (i.f.)		1R	376	N12	376	N12
T1	0	30	146	159	271	274
T2	20	0	138	148	242	245
T3	20	15	132	137	270	229
T4	20	30	140	138	274	256
T5	20	45	133	133	279	231
T6	40	0	154	123	263	248
T7	60	0	137	143	273	251
Mean			139	140	267	248

Table 3. Mean yield and crop characteristics: P mean

Treatment (kg/ha)		Cane t/ha	Suc % cane	Suc t/ha	Count x1000/ha	Length (cm)	
P (i.f.)	1R						
T1	0	30	143	11.8	17.0	152	272
T2	20	0	142	12.4	17.5	139	244
T3	20	15	143	11.5	16.1	135	249
T4	20	30	131	11.2	14.8	139	265
T5	20	45	128	12.6	16.1	133	255
T6	40	0	146	11.9	17.1	139	256
T7	60	0	148	12.4	18.3	140	262
Mean			140	12.0	16.7	139	258
S.E. Diff		±	13.6	0.6	1.7	12.7	10.7

Table 4. Third leaf dm % Phosphorus at 6.4 and 7.2 months sampled on 4/12/91 and 30/1/1992

Treatment (kg/ha)		P %				
		6.4 months		7.2 months		
		P (i.f.)	1R	376	N12	376
T1	0	30	0.19	0.18	0.16	0.15
T2	20	0	0.20	0.16	0.19	0.15
T3	20	15	0.20	0.17	0.16	0.16
T4	20	30	0.19	0.17	0.17	0.15
T5	20	45	0.20	0.17	0.18	0.14
T6	40	0	0.19	0.17	0.18	0.15
T7	60	0	0.20	0.16	0.16	0.15
Mean			0.20	0.17	0.17	0.15

Table 5. Soil analysis by treatment at the end of the plant and first ratoon crops.

Treatment P (kg/ha)	End plant crop				End Ratoon 1			
	pH	P ppm	K ppm	Ca ppm	pH	P ppm	K ppm	Ca ppm
T1 0 + 30	7.03	76	172	1538	7.05	75	224	1596
T2 20 + 0	6.94	74	185	1511	7.00	75	242	1601
T3 20 + 15	6.93	73	182	1415	7.03	75	236	1532
T4 20 + 30	6.94	75	190	1409	7.02	75	219	1610
T5 20 + 45	6.73	71	198	1446	6.83	73	195	1537
T6 40 + 0	6.78	74	212	1450	6.84	76	232	1522
T7 60 + 0	6.86	70	187	1436	6.97	70	218	1535

COMMENTS

Yield

A high degree of variability was present at this site due to poor germination of the plant crop, some damage due to installation of moveable irrigation pipes and since the irrigation system was unable to reach all areas of the trial.

In general yields were excellent in spite of very poor rainfall of 498mm which was 50% of the long term mean. These were 15.9 tc/ha/100mm and 13.6 tc/ha/100mm for NCo376 and N12 respectively. This was equivalent to 11.9 tc/ha/m and 10.2 tc/ha/m for the two varieties respectively.

There was no indication of any difference due to treatments even after attempting to remove plots affected by the irrigation system. This was also the case in terms of cane quality and sucrose yields.

Leaf phosphorus

There was no indication of any treatment related differences in leaf phosphorus. However as occurred in the plant crop N12 showed markedly lower levels than NCo376.

Soil nutrient status

There appears to be no effect of treatments on soil levels of phosphorus (as determined by the Truog procedure) or potassium or calcium.

Conclusions

Yields were high in this first ratoon crop in spite of poor rainfall and there would appear to be little if any response to extra applications of phosphorus. These results confirm those of the plant crop suggesting that it would not provide any economic benefit to apply extra phosphorus in this situation.

PETT/lb
7 January 1993