

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

Code : FT15N/78/P
Cat. No.: 1156

Title: EVALUATION OF TECHNIQUES FOR IMPROVING THE EFFICIENCY
OF N UTILISATION ON A KROONSTAD SOIL

1. Particulars of the project

This crop : Plant
Site : La Mercy Sub-station
Region : Coastal - N. Coast
Soil system : Berea
Soil series : Kroonstad
Design : Randomised block x 6 reps
Variety : NCo 376
Fertilizer/Ameliorants : N P K
 kg/ha see 60 225
 Treatments
 Zn 50 kg/ha Zn fert. materials

Soil analysis : Date: 17/10/78

<u>pH</u>	<u>O.M.%</u>	<u>Clay %</u>	<u>P.D.I.</u>
5,4	0,8	7	-

<u>ppm</u>					
<u>P</u>	<u>K</u>	<u>Ca</u>	<u>Mg</u>	<u>Zn</u>	<u>Al</u>
17	50	194	61	1,10	9

Age: 19,1 m Dates: 14/10/78-17/6/80
Rainfall: 1 212 mm L.T.M.: 1 7 20 mm
Irrigation: Nil

2. Objectives:

To evaluate techniques for improving the efficacy of nitrogen utilisation on a Kroonstad Series soil where leaching and denitrification is likely to occur.

3. Treatments:

1. 60 kg N/ha in the furrow + 1,2 kg N-Serve/ha (N-S1)
2. 60 kg N/ha " " " + 2,4 kg N-Serve/ha (N-S2)
3. 60 kg N/ha " " "
4. 90 kg N/ha top-dressed on the row immediately after planting
5. 30 kg N/ha in the furrow + 60 kg N/ha top-dressed 10 weeks later
6. 90 kg N/ha + Reverseal (20 l/ha in 840 l water) - applied in a 300 mm wide band over the row after covering, with a CP-3 knapsack sprayer.

Note: 1. N was applied as ammonium sulphate
2. N-Serve was thoroughly mixed with the ammonium sulphate before application and then covered over immediately to reduce volatilisation.

4. Results:

Treatments	Cane (t/ha)	Ers %	Ers (t/ha)	Stalk popn. x 10 ⁻³ /ha	Stalk ht. (cm)
1. N-S1 + 60 N if	107	15,2	16,3	134	203
2. N-S2 + 60 N if	112	15,0	16,8	131	209
3. 60 N if	114	15,1	17,1	132	213
4. 90 N t.d.	115	14,8	16,9	134	209
5. 30 N if + 60 N t.d.	118	15,1	17,8	134	212
6. Rev. + 90 N	116	14,7	17,2	132	216
C.V. %	8,5	4,0	9,9	5,5	-
S.E.	3,9	0,4	0,7	3,0	-
L.S.D. (0,05)	11,5	0,7	2,0	8,6	-

<u>MONTH</u>	<u>RAINFALL (mm)</u>	<u>L.T.M. (mm)</u>
October 1979	146	109
November	43	114
December	141	114
January 1980	69	125
February	41	118
March	24	127
April	30	76
May	8	49
June	10	35

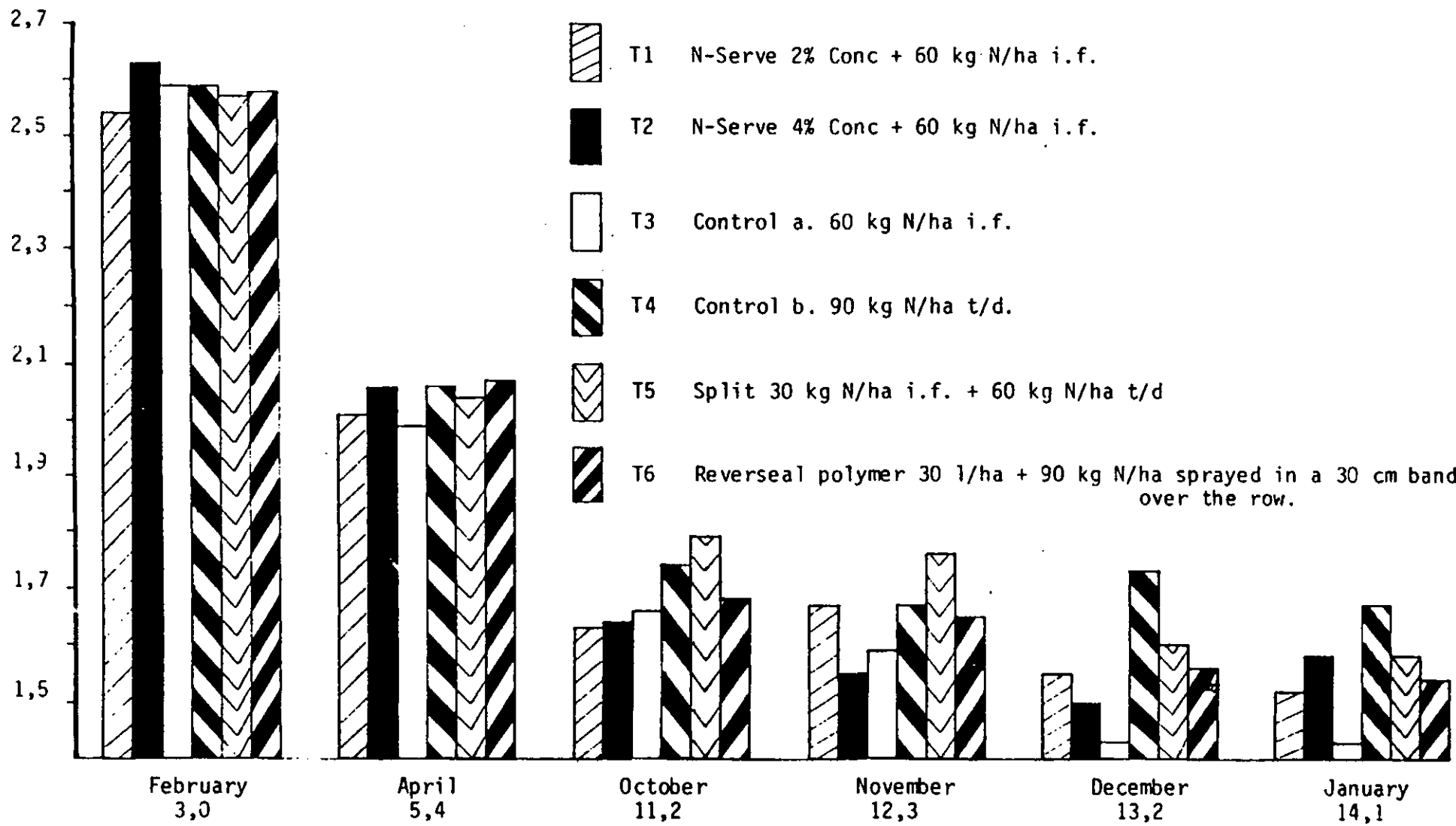
5. Comments on results:

1. Although treatment effects are very similar the most effective method of applying N fertilizer was the one with 30 N in the planting furrow and 60 N top-dressed 10 weeks later. Differences in yield between splitting N and applying all the N as a single top-dressing immediately after planting are not statistically significant. Nitrogen uptake was not markedly affected by split applications. Top-dressing tended to increase tillering and stalk height was unaffected.
2. N-Serve has on average tended to reduce yield (n.s.) but quality was not affected; this is reflected in lower stalk heights and population from an early age. The yield reduction was greatest at the lower concentration of N-Serve which is illogical. The N-Serve did not greatly affect early N uptake but in older cane third leaf N levels were higher.

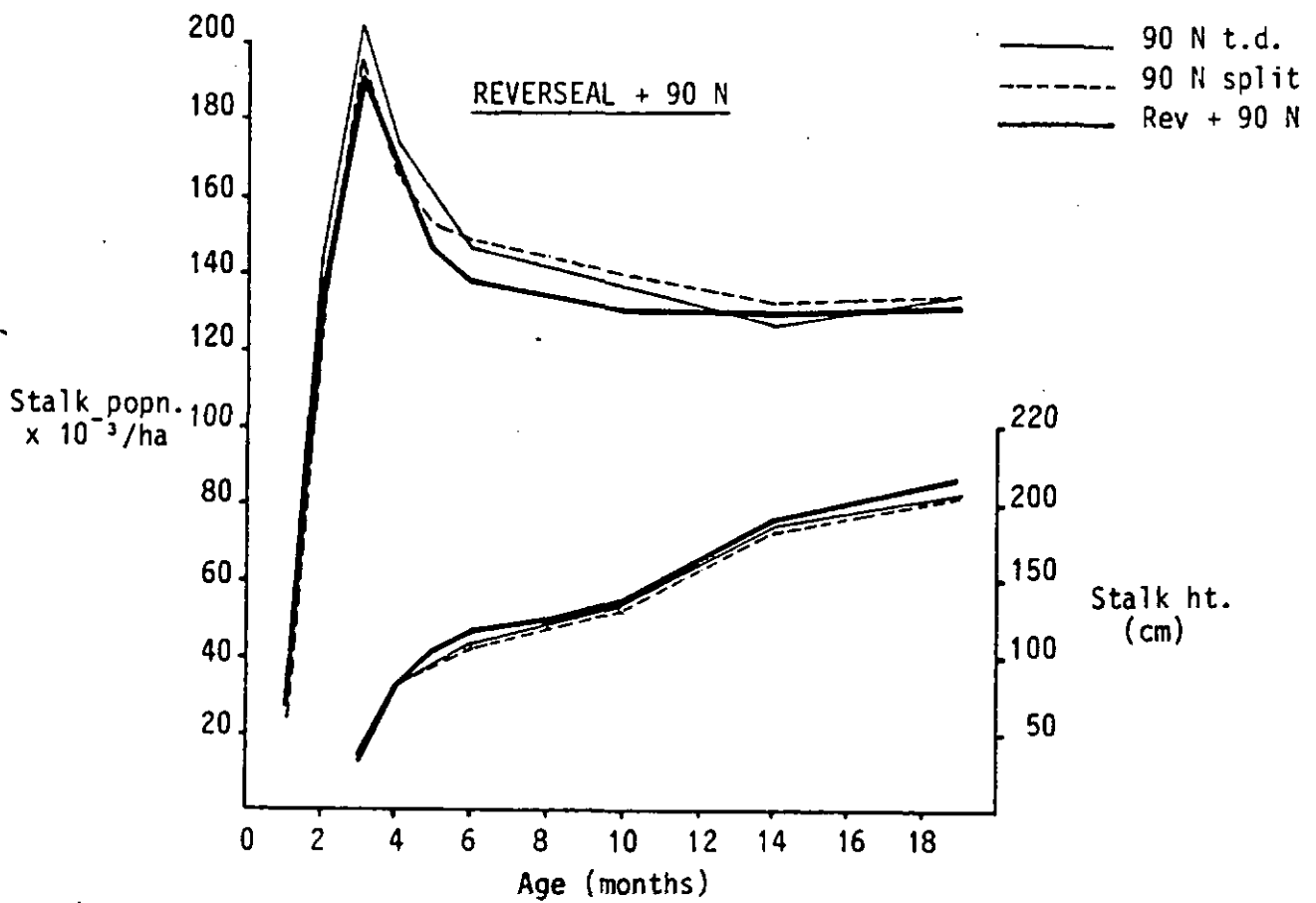
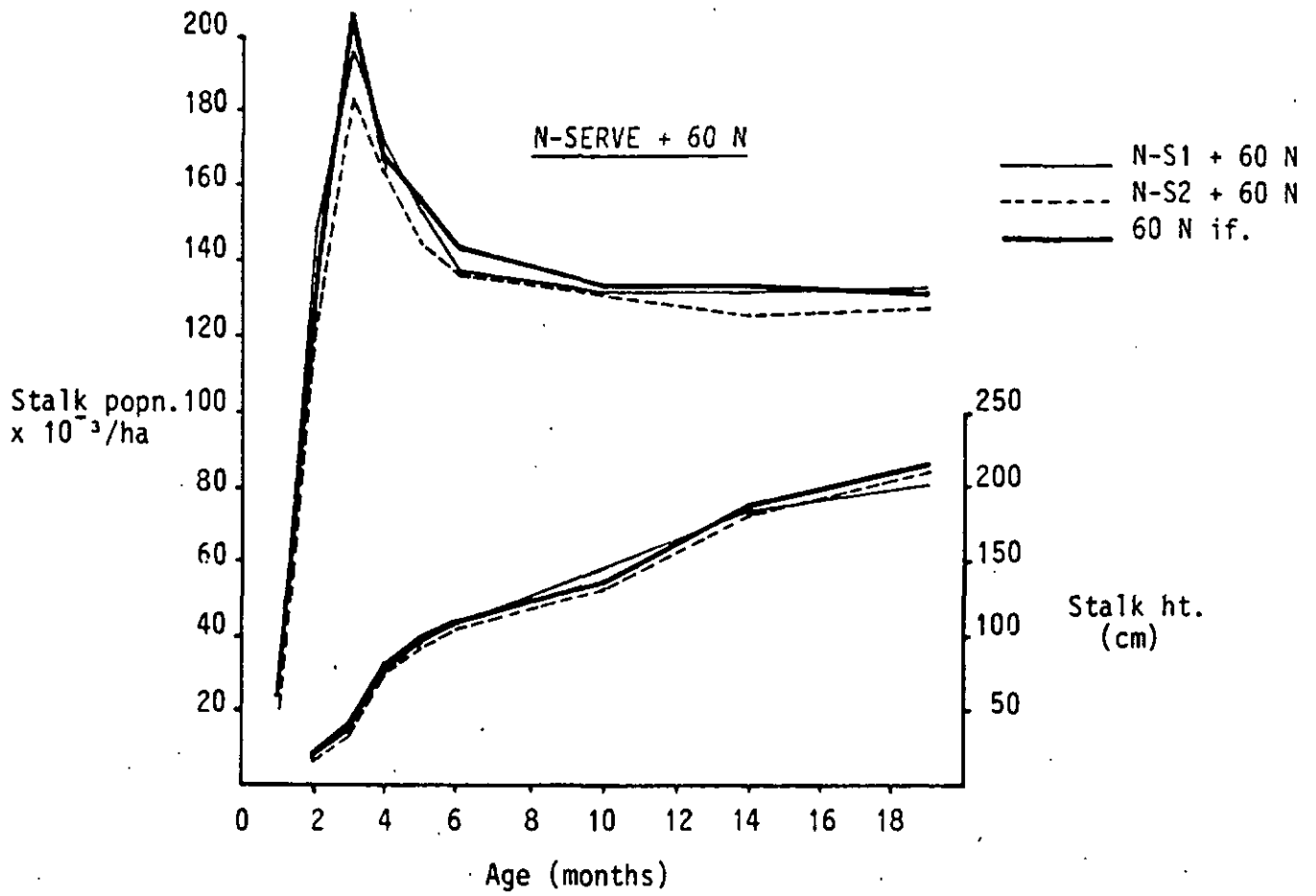
3. Reverseal did not affect yield or quality; stalk populations tended to be reduced and stalk height increased from an early age. Reverseal had little effect on early N uptake and in older cane third leaf N levels were lower.
4. Average yield was 9,4 tc/ha/100 mm gross rainfall or 6 tc/ha/month.

END/HDN
4 August 1980

3ro lead
D.M. % N



Sampling dates and age in months.



SOUTH AFRICAN SUGAR INDUSTRY

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Code: FT 15N/78/P

Cat. No.: 1156

TITLE: Rates of nitrogen and slow release nitrogen on a Kroonstad form soil on the North Coast.

1. Particulars of the project:

This crop: 1st ratoon

Site: La Mercy Sub Stn.

Region: Coastal - N. Coast

Soil system: Berea

Soil form/series: Kroonstad

Design: Randomised block
6 reps.

Variety: NCo 376

Fertilizer/ N P K
Ameliorants See - 125
 treatments

Soil analysis: Date: 17/6/80

<u>pH</u>	<u>O.M.%</u>	<u>Clay%</u>	<u>P.D.I.</u>
5,1	0,8	7	-

p.p.m.

<u>P</u>	<u>K</u>	<u>Ca</u>	<u>Mg</u>	<u>Zn</u>	<u>Al</u>
25	31	144	34	1,3	4

Age: 15,6 mths Dates: 17/6/80-5/10/81

Rainfall: 1537 mm L.T.M.: 1158 mm

Irrigation: Nil

Nov. Dec. Jan. Feb. Mar.

<u>Monthly</u>	117	94	225	128	35
<u>LTM</u>	114	114	125	118	127

2. Objectives:

2.1 To determine the effect of nitrogen applied as slow release formulations on ratoon growth and yield.

2.2 To determine the optimum level of N for ratoon cane on a Kroonstad soil form.

3. Treatments:

1. N - serve (2%) + 100 kg N/ha

2. Nitroform @ 100 kg N/ha

3. Nil kg N/ha

4. 100 " "

5. 150 " "

6. 200 " "

Notes on treatments:

- Nitrogen was applied as ammonium sulphate in a single application in mid-November at 20 weeks after harvest.
- Delay in delivery resulted in the N-serve treatment being applied one week later.

The fertilizer was applied in shallow furrows (approximately 30 mm) deep on one side of the row and the N-serve was sprayed over the fertilizer with a CP-3 knapsack and immediately covered over with soil.

° Potassium was applied as potassium chloride at 125 kg K/ha in mid-November.

4. Results

4.1 Yield and crop characteristics at harvest.

Treatments (kg/ha)	t/ha cane	Suc % cane	t/ha suc.	Stalk pop x 10 ⁻³ /ha	Stalk ht. (cm)
1. N-serve 2% + 100 N	109	14,7	15,9	140	207
2. Nitroform @ 100 N	91	14,4	13,2	121	191
3. Zero N	73	14,6	10,7	108	174
4. 100 N	106	14,5	15,4	133	203
5. 150 N	111	14,6	16,2	140	208
6. 200 N	116	14,2	16,4	136	213
Mean	101	14,5	14,6	130	199
C.V.%	10,4	3,8	9,8	5,3	5,6
S.E. Treat.mean +	4,3	0,23	0,6	3	0,6
L.S.D.(0,05)	13	0,7	1,7	8	13
L.S.D.(0,01)	17	0,9	2,4	11	18

4.2 Third leaf N (d.m. %)

Age + month of sampling	5	6	7	8	9
Treatment	28 Nov	22 Dec	16 Jan	17 Feb	13 Mar
1. N-serve + 100 N	1,72	2,07	2,07	2,11	2,08
2. Nitroform @ 100 N	1,84	1,84	1,69	1,86	1,93
3. Zero N	1,65	1,65	1,64	1,69	1,81
4. 100 N	1,92	2,27	2,00	2,02	1,97
5. 150 N	1,98	2,38	2,12	2,10	2,11
6. 200 N	1,99	2,33	2,19	2,11	2,09

5. Comments on Results

5.1 Amounts of nitrogen. The response to applied N in tons cane and sucrose was very substantial ($P = 0,01$) from the zero to 100 kg/ha level and was reflected in greater stalk population and lengths. There appeared to be a small response in tons cane from 100 to 200 kg N/ha levels but this did not attain a level of statistical significance. At 200 kg/ha N cane quality tended to be reduced and only a very small (n.s.) increase in tons sucrose was obtained. This would indicate that the optimum N level for cane in this soil is approximately 150 kg/ha. The yield of 56 tc/ha/annum was obtained with no applied N and 71 tc/ha/annum from plots with optimum N level. The optimum ratio of kg N/tc/ha would appear to be 1,35:1.

Third leaf N values indicated adequacy in all treatments except the zero N level which increased with time.

5.2 N-Serve. In the previous crop (plant) N-serve tended to reduce yield slightly (n.s.) and cane quality was unaffected, whereas in this crop yield and quality were unaffected by the addition of N-serve. Third leaf samples indicated adequacy in N from six months onwards but the indications from samples taken at 5 and 6 months old are that N-serve had delayed nitrification quite markedly. Rainfall in January was almost twice the L.T.M. and may have caused N losses.

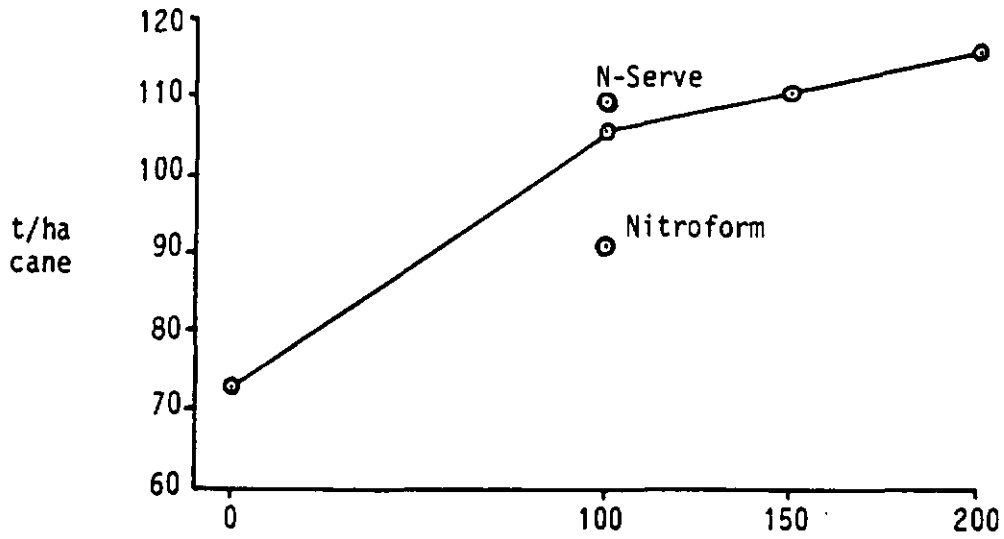
5.3 Nitroform. Yields were depressed substantially ($P = 0,05$) and this is reflected in reduced stalk heights and population.

Third leaf sampling indicated slow or inadequate release of nitrogen as N levels at two, six and ten weeks after treatment application were marginal but improved with time.

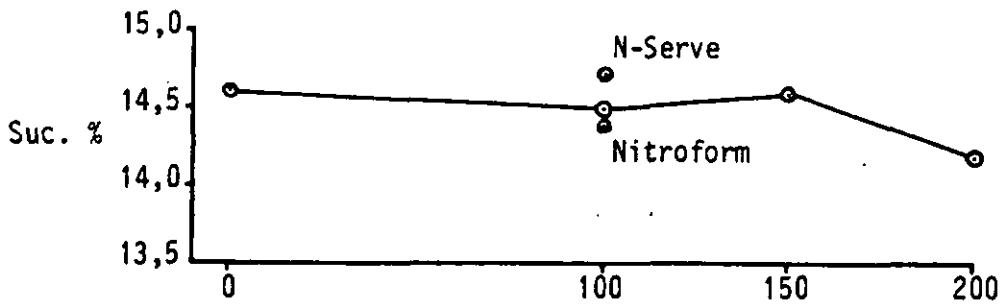
5.4 Rainfall was 132% of L.T.M. and the mean yield of 6,6 tc/ha/100 mm of rainfall and 6,5 tc/ha/month was obtained.

RESPONSE TO NITROGEN

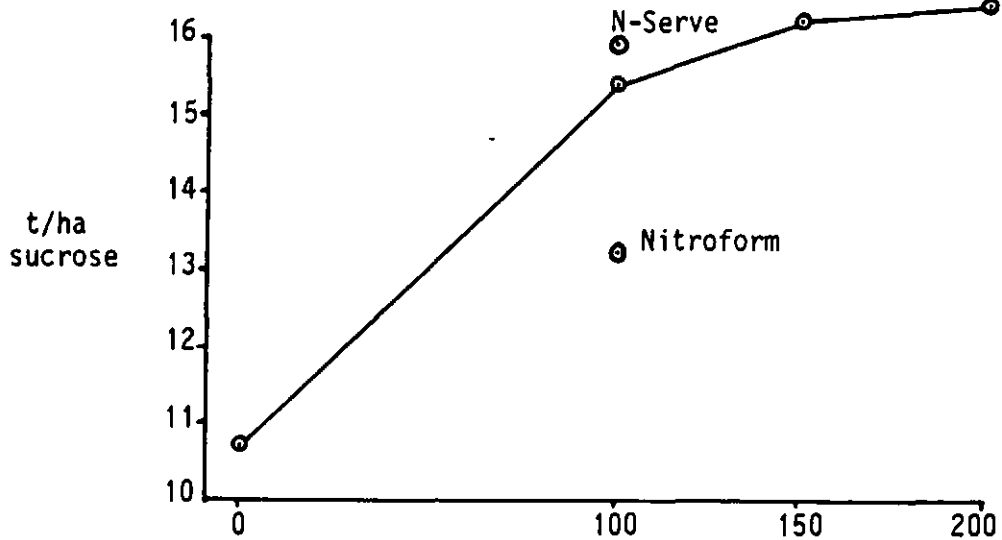
TONS CANE/HA



SUCROSE % CANE



TONS SUCROSE/HA



SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

Code: FT15N/78/R2
Cat.No: 1156

**Title: RATES OF NITROGEN AND SLOW RELEASE NITROGEN FOR RATOON CANE
ON A KROONSTAD SOIL FORM ON THE NORTH COAST**

1. Particulars of the project:

<p>This crop : 2nd ratoon</p> <p>Site : La Mercy Sub-Station</p> <p>Region : Coastal - N Coast</p> <p>Soil system : Berea</p> <p>Soil form/series : Kroonstad</p> <p>Design : Randomised block x 6 replications</p> <p>Variety : NCo 376</p> <p>Fertilizer kg/ha : N P K See 21 150 treatments</p>	<p>Soil analysis: Date: 5/10/81</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 15%;">pH</td> <td style="width: 15%;">OM%</td> <td style="width: 15%;">CLAY %</td> <td style="width: 15%;">PDI</td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> </tr> <tr> <td>5,4</td> <td>-</td> <td>7</td> <td>-</td> <td></td> <td></td> </tr> </table> <p style="text-align: center; margin-left: 100px;">ppm</p> <table border="0" style="width: 100%; border-top: 1px solid black;"> <tr> <td style="width: 15%;">P</td> <td style="width: 15%;">K</td> <td style="width: 15%;">Ca</td> <td style="width: 15%;">Mg</td> <td style="width: 15%;">Zn</td> <td style="width: 15%;">Al</td> </tr> <tr> <td>24</td> <td>39</td> <td>125</td> <td>33</td> <td>1</td> <td>8</td> </tr> </table> <p>Age : 19,9 months</p> <p>Dates : 5/10/81 - 2/6/83</p> <p>Rainfall : 1393 mm LTM: 1860 mm</p> <p>Irrigation: Nil</p>	pH	OM%	CLAY %	PDI			5,4	-	7	-			P	K	Ca	Mg	Zn	Al	24	39	125	33	1	8
pH	OM%	CLAY %	PDI																						
5,4	-	7	-																						
P	K	Ca	Mg	Zn	Al																				
24	39	125	33	1	8																				

Soil description: Light grey sand overlying a deep bleached E horizon

2. Objectives:

- ° To determine the effect of nitrogen applied as slow release formulations on ratoon growth and yield.
- ° To determine the optimum level of N for ratoon cane on a Kroonstad soil form.

3. Treatments:

1. N-Serve at 2% + 100 kg N/ha.
2. Nitroform at 100 kg N/ha.
3. Nil kg N/ha.
4. 100 kg N/ha.
5. 150 kg N/ha.
6. 200 kg N/ha.

Notes on Treatments:

- Nitrogen was applied as ammonium sulphate in a single application to all treatments except No 2 on 23 November, six weeks after harvest.
- N-Serve at 2,5 l/ha of product was sprayed over the ammonium sulphate in a shallow furrow and covered immediately with soil.
- K was applied as KCl at 150 kg/ha and P as superphosphate (10,5%) at 20 kg/ha in November.

4. Results:**Yield and crop characteristics at harvest**

Treatments (kg/ha)	Cane t/ha	Suc % cane	Suc t/ha	Stalk popln. $\times 10^{-3}/ha$	Stalk length (cm)	Stalks damaged by eidana/ 100 stalks
1. N-Serve 2% + 100 N	88	11,5	10,2	110	194	89,5
2. Nitroform at 100 N	72	11,1	8,0	103	176	88,8
3. Zero N	54	12,5	6,7	94	155	69,8
4. 100 N	81	11,7	9,5	101	181	88,5
5. 150 N	92	10,8	10,0	116	197	92,7
6. 200 N	89	10,6	9,6	109	197	94,5
Mean	79	11,4	9,0	105	183	87,5
CV %	13,9	8,5	19,4	6,1	9,0	
SE of Treatment means \pm	4,5	0,4	0,7	2,6	6,7	
LSD (0,05)	13,3	1,2	2,1	7,7	19,9	
(0,01)	18,1	1,6	2,9	10,5	27,1	

Third leaf N (% DM)

Treatments (kg/ha)	Age & date of sampling	
	4 months - 5 February	5,8 months - 31 March
1. N-Serve + 100 N	1,78	1,64
2. Nitroform at 100 N	1,60	1,51
3. Zero N	1,50	1,39
4. 100 N	1,84	1,51
5. 150 N	1,95	1,66
6. 200 N	1,97	1,70
Threshold value	1,70	1,60

5. Comments:

The cane was harvested when fairly old (19,9 m) and was badly infested with eldana borer with 88% of all stalks being damaged. CVs for tons cane and tons sucrose are fairly high (13,9% and 19,4%).

The rainfall was 75% of the LTM and the mean yield was 4 tc/ha/m and 5,7 tc/ha/100 mm of rainfall.

Nitrogen: The yield of 54 tc/ha was obtained with no nitrogen applied.

The response to applied N in tons cane and tons sucrose was substantial ($P=0,01$) and appears to be curvilinear with the optimum level at about 150 kg N/ha; the response was reflected in greater stalk length and population.

Cane quality was reduced substantially with increasing N levels. At the 150 kg N/ha level the optimum ratio of kg N;tc/ha would appear to be 1,63 kg/tc.

Third leaf data indicated adequacy in all treatments except the 100 N level at six months of age and the zero N level at both sampling dates.

The number of stalks damaged by eldana borer tended to increase with increasing N levels.

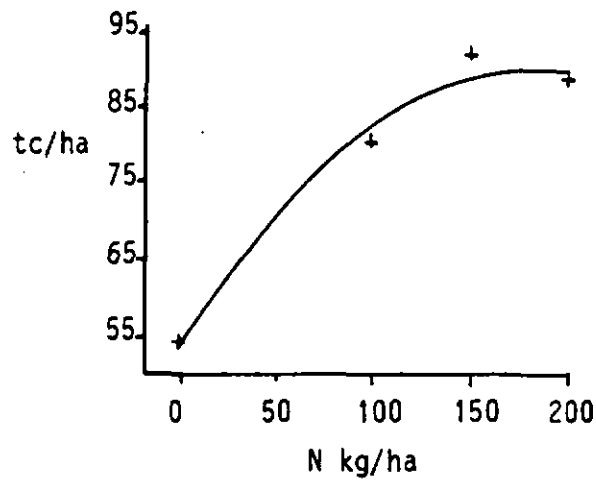
N-Serve: The addition of N-Serve to the fertilizer tended to reduce yields slightly in the plant crop; yields were unaffected in the first ratoon and there was only an indication of a slight positive response (ns) in this crop.

Nitroform: As in the previous ratoon Nitroform reduced yield (ns) and this is reflected in reduced stalk heights and population. The relative unavailability of Nitroform was indicated by the low third leaf N content in samples taken at four and six months of age.

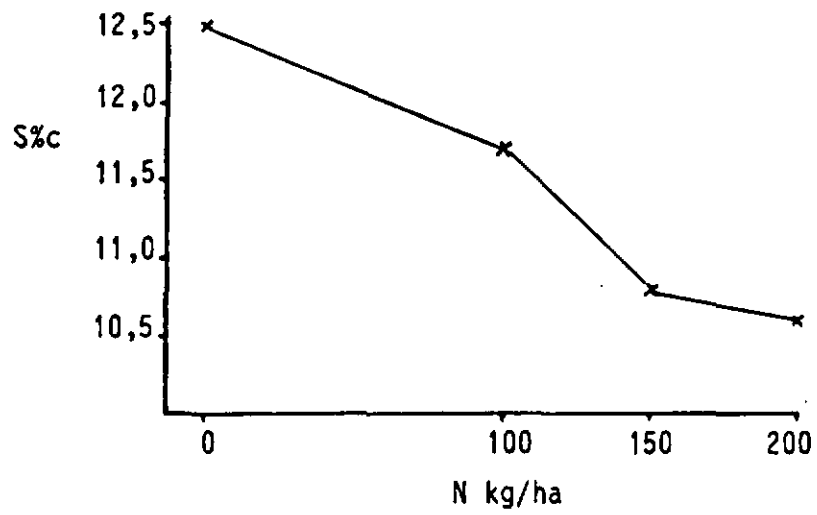
The trial continues into the third ratoon with the N-Serve and Nitroform treatments being discontinued and split vs single fertilizer applications and ammonium sulphate being tested.

FT 15N/78

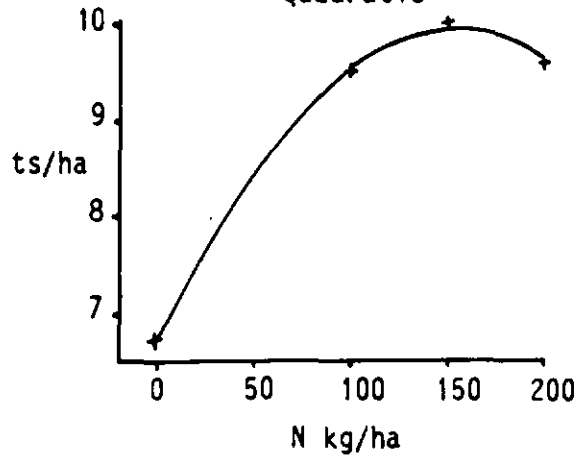
Tons cane
Quadratic



Sucrose % cane



Tons sucrose
Quadratic



Code: FT15N/78/R3

Cat. No.: 1156

Title: Rates of nitrogen, split applications and nitrogen carriers on a Kroonstad soil form on the North Coast

1. Particulars of the project

This crop	: Third ratoon	Soil analysis: Date: 02/06/83
Site	: La Mercy Farm	pH OM % Clay % PDI
Region	: Coastal - North Coast	4,87 0,93 7 -
Soil system	: Berea	ppm
Soil form/series	: Kroonstad	P K Ca Mg Zn Al S
Design	: Randomised block x six replications	21 36 129 28 0,8 11 17
Variety	: NCo376	Age: 17,6 months
Fertilizer	: N P K * nil 175	Dates: (02/06/83 - 20/11/84)
Soil description	: Light grey loamy sand overlying a deep bleached "E" horizon	Rainfall: 1771 mm 130% OF L.T.M.: 1357 mm Irrigation: Nil

2. Objectives

- i To test levels of nitrogen and the merit of splitting versus a single application of N and K on a Kroonstad soil form.
- ii To compare Ammonium Sulphate (21) and Urea (46) as nitrogen carriers where sulphur is suspected of being marginal.

3. Treatments

	(Kg/ha)			
	N		K	
T1	Nil	Urea	175	Single
T2	100	Urea	175	Single
T3	150	Urea	175	Single
T4	150	Urea	175	Split
T5	150	S/A	175	Single
T6	200	Urea	175	Single

Notes on treatments:

N as Urea (46) and Ammonium Sulphate (21) + K as KCl (50) were applied in a single dressing on 6/9/83 to the appropriate plots, excepting treatment 4 where equal quantities of Urea and KCl were applied on 6/9/83 and 19/10/83.

4. Rainfall (mm)

Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
1983/84	8	63	66	12	102	179	115	309	223	99	112	87
LTM	31	24	42	71	93	122	112	126	115	112	76	51
1984	22	128	67	13	95	68	Total = 1771					
LTM	30	26	42	70	93	122	Total = 1357					

5. Results

5.1 Yield and harvested crop characteristics

Treatments kg/ha	t/ha cane	sucrose % cane	t/ha sucrose	Stalk counts $\times 10^{-3}/ha$	Stalk length (cm)
T1 Nil + 175 K single	74	15,0	11,2	110	170
T2 100 N (Urea) + 175 K single	79	15,2	12,0	115	169
T3 150 N (Urea) + 175 K single	85	15,1	12,9	120	180
T4 150 N (Urea) + 175 K split	97	15,4	15,0	129	196
T5 150 N (S/A) + 175 K single	109	14,6	15,9	135	203
T6 200 N (Urea) + 175 K single	91	15,0	13,7	124	189
Mean	89	15,1	13,4	122	184
CV%	17,6	3,6	18,4	8,7	
SE of treatment mean +	6,4	0,22	1,01	4,36	
LSD (0,05)	18,89	0,65	2,97	12,85	
(0,01)	25,73	0,89	4,05	17,51	

5.2 Third leaf analyses (% dm)

Treatments kg/ha	6,8 m 27/12/83			8,3 m 10/2/84			9,2 m 19/3/84		
	N	K	S	N	K	S	N	K	S
T1 Nil + 175 K single	1,56	0,91	0,13	1,63	1,09	0,18	1,77	1,31	0,16
T2 100 N Urea + 175 K single	1,63	0,90	0,13	1,68	1,10	0,18	1,76	1,30	0,16
T3 150 N Urea + 175 K single	1,58	0,91	0,12	1,63	1,12	0,17	1,79	1,29	0,17
T4 150 N Urea + 175 K split	1,69	0,93	0,14	1,70	1,15	0,18	1,84	1,33	0,17
T5 150 N S/A + 175 K single	1,84	0,95	0,16	1,77	1,15	0,19	1,84	1,37	0,18
T6 200 N Urea + 175 K single	1,61	0,96	0,12	1,70	1,14	0,18	1,83	1,34	0,17

Comments

General

On this relatively poor sandy soil with a thick E horizon the variability increased over the four crops - CV% (tc/ha) was 8,5, 10,4, 13,9 and 17,6 in the plant to third ratoon crops respectively. Large responses or very clear trends were consequently necessary for levels of statistical significance to be attained in the latter crops and it has been decided to discontinue the trial.

Levels of N

There is a linear response to N in terms of tc and ts/ha indicating that levels greater than 200 kg/ha would be warranted. The high rainfall, 130% of LTM, probably contributed to this result. Third leaf N levels were marginal throughout and appeared to increase rather than decrease with time. This result is in line with the new N recommendations.

Single vs split applications of N and K

Splitting applications of N and K appeared to be superior + 12 + 6,4 tc/ha but it is not statistically significant ($P = 0,05$). The rain that was recorded during the six week interval between applications was not excessive so the response is surprising. Very few past experiments have shown an advantage to splitting applications, but as an insurance policy it is generally recommended that splitting of N be practised on poorly drained soil. This result, on a soil with a thick E horizon, is therefore in line with current recommendations. It is noteworthy that the third leaf N levels (not K) were substantially higher at the first sampling in December where N was applied as a single application.

Nitrogen carriers

Ammonium sulphate (A/S) was superior to urea in terms of tc and ts/ha ($P = 0,05$), but inferior (n.s.) in terms of S% C. Third leaf N and S were consistently higher when A/S was used. Whether the superiority is due to the S in A/S or the availability of nitrogen cannot be ascertained from these data but with third leaf S values as low as 0,13% dm when urea was used, it seems probable that S made a real contribution. The soil S level at 17 ppm was below the tentative new soil threshold of 20 ppm.

The previous three crops all received ammonium sulphate as the N carrier which evidently was unable to adequately build up the S level of the soil.

PKM/GC
7 January 1986

RESPONSES TO NITROGEN

