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SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

6400/21 MOVEMENT OF FERTILISER NITROGEN IN THE SOIL AND IT'S EFFECT ON PLANT GROWTH IN FLOOD BEDS

Catalogue: 1203

Object : To determine the effects of different moisture regimes on the movement of different levels of nitrogen in the soil profile and their effects on plant growth.

This crop : Plant **Age :** 11,9 months (29.6.79 to 26.6.80)

Location : ZSA Experiment Station, Field N1.

Soil type : PE.1 sandy clay loam derived from gneiss

Variety/spacing : NCo 376, rows spaced 1,5m apart.

Fertiliser :

Nitrogen	Phosphate
(See treatments)	60 kg $P_2O_5 ha^{-1}$

Rainfall : 776mm

Irrigation : **Treatments :-** 1. 715mm
2. 1 109mm
3. 1 482mm

Treatments : **Main Experiment** (cropped)

Irrigation regimes - see conduct (first digit)

1. 33mm water per irrigation ($3m^3$ per flood bed - $90m^2$)
2. 56mm " " " ($5m^3$ " " " " ")
3. 78mm " " " ($7m^3$ " " " " ")

Levels of nitrogen (second digit)

1. Control - no added nitrogen
2. 150 kg N ha^{-1}
3. 300 kg N ha^{-1}

CONDUCT All flood beds were irrigated at the same time based on a Class A pan factor of 0,5 to full canopy and a factor of 1,0 thereafter for treatment 2 i.e. 56mm water per irrigation.

Nitrogen was broadcast and growth measurements were recorded from 20 stalks (10 for sucrose analysis and 10 for growth measurements) harvested sequentially from the inner guard row at four weekly intervals.

RESULTS : Relevant data are summarised in the attached tables for the plant crop.

I. **Data recorded at harvest**

a) **Cane yields.** The different moisture regimes had no effect on cane yields, however there was a highly significant quadratic response to increasing levels of nitrogen.

2./ b) **ERC%** .....

b) ERC% cane. There was a highly significant linear decline in cane quality with increasing levels of nitrogen.

c) TERC ha^{-1} There was a highly significant quadratic response to increasing levels of nitrogen due to the greater effect that increasing levels of nitrogen produce on cane yields than cane quality.

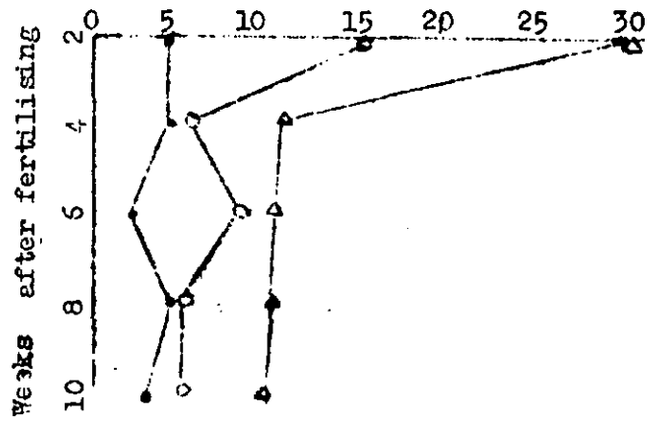
d) RS% cane, TFAS% cane and TTFAS ha^{-1}. At harvest the slightly greater concentration of reducing sugars in treatments which received nitrogen was accountable for the similar TFAS% cane between the control and 150 kg N ha^{-1}. Otherwise as expected, total fermentables as sucrose were greater than yields for estimated crystal recoveries, and response trends were similar for both. Again there were no responses to different moisture regimes.

e) Stalk counts, lengths and diameters. Responses to levels of nitrogen were largely accountable to greater stalk densities, stalk lengths and slightly greater stalk diameters.

II Data recorded during growth

f) Available soil nitrogen.

Fig. 1 Average soil N content (ppm) in the soil profile (0 - 60cm)



Control (•), 150 kg N ha^{-1} (○), 300 kg N ha^{-1} (▲)

Two weeks after broadcasting ammonium nitrate onto the soil surface in all irrigation regimes, high levels of available nitrate - N and ammonium - N were observed in all soil horizons i.e. 0 - 20cm, 21 - 40cm, and 41 - 60cm. (Table 2). This indicates that both sources of nitrogen i.e. nitrate - N and ammonium - N are leached. However, in spite of relatively large quantities of nitrogen being leached, nitrogen was also rapidly immobilised. Later more nitrogen from 300 kg N ha^{-1} than 150 kg N ha^{-1} became available for plant uptake for at least 10 weeks after application (Fig.1).

3. g) Irrigation ...

g) Irrigation regimes. Although it was estimated that $3m^3$ of water per irrigation based on a Class A pan factor of 0,5 up to full canopy and 1,0 thereafter would result in some stress. This did not occur, and as a result there were no measurable differences between moisture regimes (Table 3).

h) Stalk volume per unit area.

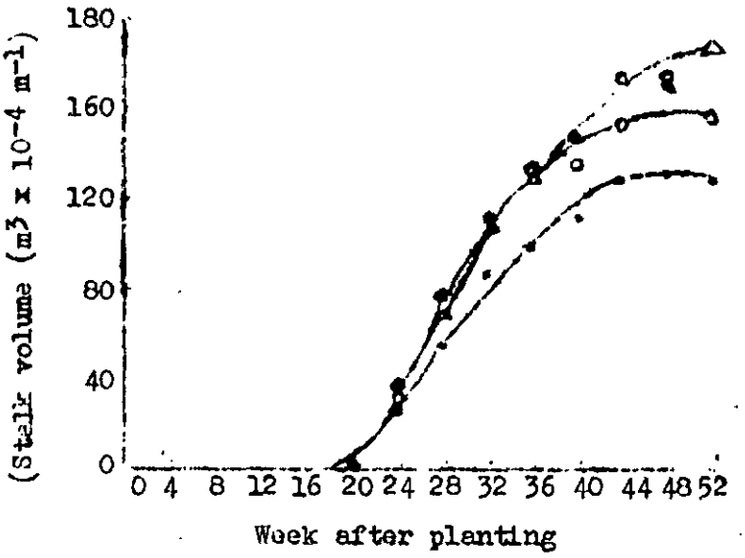


Fig. 2. Effects of levels of nitrogen on increases in stalk volume.
No added nitrogen (•), 150 kg N ha^{-1} (◦)
300 kg N ha^{-1} (○)

Four weeks after the onset of rapid elongation (24 weeks after planting) stalk volume per unit area was greater in flood beds receiving nitrogen than the control (no added nitrogen). These differences increased up to 52 weeks after planting. However, stalk volumes in flood beds receiving 300 kg N ha^{-1} only became markedly greater than flood beds receiving 150 kg N ha^{-1} 40 weeks after planting and differences increased up to the final sampling (52 weeks after planting).

Different moisture regimes had no consistant effect on stalk volumes.

4./ i) Dry mass .....

i) Dry mass accumulation

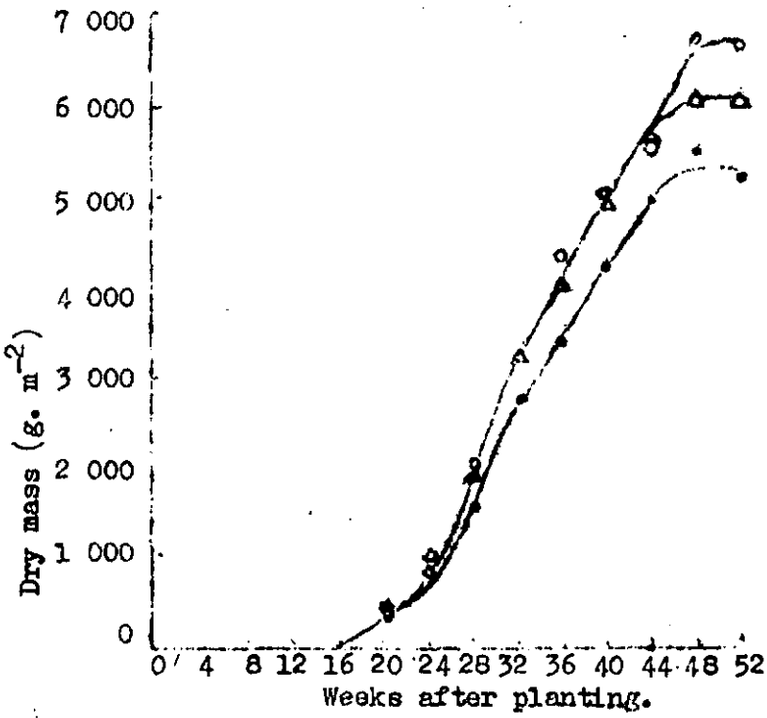


Fig.3 Effects of levels of nitrogen on dry mass accumulation per unit area. Control (•), 150 kg N ha^{-1}(○), 300 kg N ha^{-1} (▵).

Soon after the onset of rapid growth rates of dry mass accumulated faster when nitrogen was applied than the control (no added nitrogen). When nitrogen was applied i.e. 150 and 300 kg N ha^{-1} rates of dry mass accumulation were similar up to 44 weeks after planting while dry mass accumulated at the same rate for 150 kg N ha^{-1} for the next four weeks it declined when 300 kg N ha^{-1} was applied after which no further dry mass accumulated in all nitrogen treatments.

Irrigation regimes had no effect on dry mass accumulation.

j) Sugar accumulation .....

Fig.4

j) Sugar accumulation

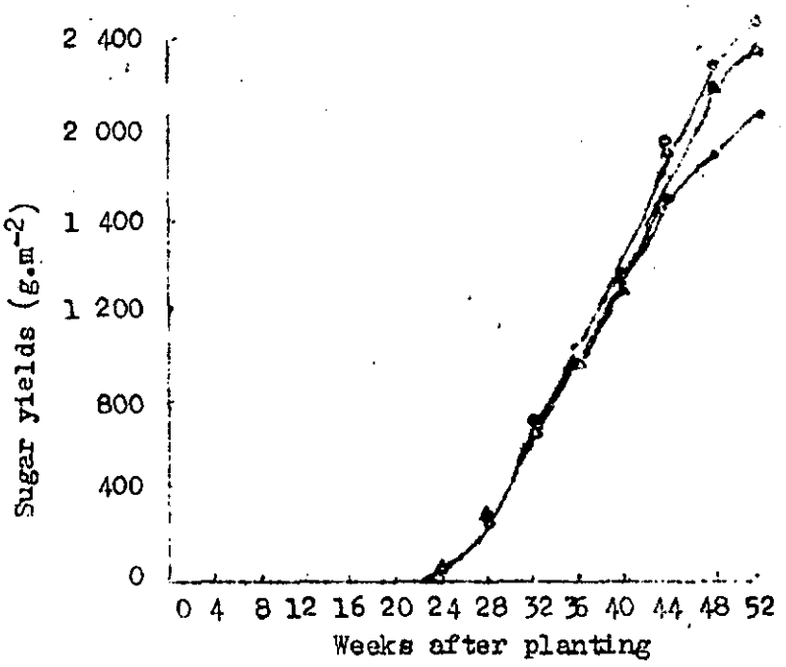


Fig.4 Effects of levels of nitrogen on accumulation of sugar per unit area. Control (·), 150 kg N ha^{-1}(◦), 300 kg N ha^{-1} (◇).

Rates of sugar accumulation were similar up to 32 weeks after planting for all levels of nitrogen. Thereafter rates of sugar accumulation was greater in plots receiving 150 kg N ha^{-1} than 300 kg N ha^{-1} and the control (no added nitrogen).

Again different irrigation regimes had no effect on rates of sugar accumulation.

CONCLUSIONS

Although it was anticipated that $3m^3$ of water per plot scheduled for irrigation at a Class A pan factor of 0,5 to full canopy and at a factor of 1,0 thereafter would stress the plant this did not occur. However, two weeks after applying different levels of nitrogen, soil nitrogen concentrations in all soil horizons increased indicating considerable leaching of nitrogen had occurred. In spite of leaching a high proportion of the leached nitrogen in each soil horizon was rapidly immobilised, some of which soon afterwards became available for plant uptake which is accountable for the differences in cane yields. The lack of response in dry mass per unit area to the highest level of available soil nitrogen i.e. from

6./ applying .....

applying 300 kg N ha^{-1} suggests that sufficient nitrogen was mineralised from 150 kg N ha^{-1} but insufficient from the control (no added nitrogen) to give maximum dry mass and similarly fresh mass. The greater stalk volume per unit area from 300 kg N ha^{-1} than 150 kg N ha^{-1} and the control indicates that while high available nitrogen levels for uptake had no effect on the synthesise of cellulose i.e. fibre it appears to inhibit the accumulation of sugar which is also implied by the lower ERC% cane values, and although the concentrations of sucrose in stalks from the control was greater than when nitrogen was applied, the much smaller stalk volume per unit area accounted for the correspondingly smaller sugar yields.

R.J.H./Oct. '80.
rw

6400/21 MOVEMENT OF FERTILISER NITROGEN IN THE SOIL AND ITS EFFECT ON PLANT GROWTH IN FLOOD BEDS

PLANT DATA

Table 1.

	Cane t ha^{-1}	ERC % Cane	TERC ha^{-1}	RS % cane	TFAS % cane	TTFAS ha^{-1}	Stalk counts	Stalk lengths (m)	Stalk diam. (cm)
Irrigation regimes									
3 m^3 water per 90m^2 of land	155,1	12,50	19,34	0,91	14,74	22,88	140,7	2,84	2,29
5 m^3 water per 90m^2 of land	155,1	12,20	18,89	0,88	14,42	22,31	139,7	2,88	2,27
7 m^3 water per 90m^2 of land	155,9	12,20	19,07	0,91	14,44	22,62	140,7	2,85	2,27
Levels of nitrogen									
Control - no added nitrogen	137,0	12,66	17,30	0,78	14,77	20,25	123,1	2,75	2,25
150 kg N ha^{-1}	167,5	12,45	20,85	0,96	14,74	24,67	148,7	2,90	2,28
300 kg N ha^{-1}	162,6	11,78	19,15	0,96	14,10	22,90	149,4	2,91	2,30
Linear effect	P=0,001	P=0,001	P=0,01	-	-	-	-	-	-
Quadratic effect	P=0,001	N.S.	P=0,001	-	-	-	-	-	-
L.S.D. P=0,05	10,4	0,35	1,21	-	-	-	-	-	-
P=0,01	14,0	0,46	1,63	-	-	-	-	-	-
Interactions	N.S.	N.S.	N.S.	-	-	-	-	-	-
Trial mean	155,7	12,30	19,10	0,90	14,53	22,60	140,4	2,85	2,28
S.E. single plot	14,0	0,46	1,63	-	-	-	-	-	-
S.E. treatment means	3,6	0,12	0,42	-	-	-	-	-	-
C.V.%	9,0	3,78	8,52	-	-	-	-	-	-

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Table 2. Available soil nitrogen (ppm) at different soil depths

Treatments	Weeks after planting	0 - 20cm NO_3^-	NH_4^+	Total	21 - 40cm NO_2^-	NH_4^+	Total	41 - 60cm NO_3^-	NH_4^+	Total	Mean
Irrigation regimes											
$3m^3$ water/$90m^2$	12	3	2	5	3	2	5	3	2	5	5
	14	13	10	23	12	8	20	8	6	14	19
	16	3	5	8	3	2	5	3	3	6	6
	18	4	2	6	5	3	8	4	2	6	7
	20	2	3	5	2	4	7	3	4	7	6
	22	3	4	7	3	3	6	3	3	6	6
$5m^3$ water/$90m^2$	12	4	2	6	4	2	6	3	2	5	6
	14	12	10	22	11	10	21	9	6	15	19
	16	4	2	6	5	2	7	4	4	8	7
	18	5	2	7	3	2	5	3	1	4	5
	20	3	4	7	4	4	8	2	4	6	7
	22	2	4	6	2	3	5	3	2	5	5
[illegible]^3 water/$90m^2$	12	3	2	5	4	3	7	3	2	5	6
	14	12	8	20	6	9	15	7	3	10	15
	16	3	2	5	4	2	6	3	2	5	5
	18	7	2	9	9	2	11	4	2	6	9
	20	2	4	6	3	4	7	3	3	6	6
	22	2	4	6	3	3	6	3	2	5	6
Levels of nitrogen											
Control	12	3	2	5	4	2	6	3	2	5	5
	14	3	1	4	3	2	5	2	2	4	4
	16	2	2	4	2	2	4	2	1	3	4
	18	1	1	2	1	1	2	2	1	3	2
	20	2	4	6	1	3	4	1	2	3	4
	22	2	2	4	1	2	3	1	2	3	3
150 kg N ha^{-1}	12	4	2	6	3	3	6	4	2	6	6
	14+	17	8	15	13	6	19	8	4	12	15
	16	4	2	6	3	2	5	3	3	6	6
	18	4	2	6	7	3	10	5	2	7	8
	20	2	3	5	2	3	5	2	3	5	5
	22	2	4	6	2	3	5	0	2	4	5
300 kg N ha^{-1}	12	3	2	5	4	2	6	4	2	6	6
	14+	17	18	35	17	15	32	14	10	24	30
	16	10	5	15	5	3	8	5	5	10	11
	18	9	3	12	8	3	11	6	2	8	10
	20	3	4	7	6	5	11	6	6	12	10
	22	2	7	9	5	4	9	6	3	9	9

+ nitrogen applied after sampling i.e. 12 weeks after planting.

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Table 3. Dry mass accumulation per unit area ($g.m^{-2}$)

Weeks after planting	Moisture regimes - m^3 water/$90m^2$			Levels of nitrogen kg N ha^{-1}			Mean
	3	5	7	0	150	300	
0	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
12	-	—	-	-	-	-	-
16	-	-	-	-	-	-	-
20	310	315	316	280	323	339	314
24	812	832	854	726	824	948	833
28	1 798	1 791	1 831	1 557	1 999	1 864	1 807
32	3 026	3 074	3 088	2 725	3 253	3 210	3 063
36	3 790	3 975	4 002	3 420	4 342	4 005	3 922
40	4 539	5 033	4 601	4 278	4 999	4 895	4 724
44	5 631	5 467	5 408	4 999	5 598	5 910	5 502
48	5 730	6 368	6 248	5 506	6 753	6 079	6 115
52	6 198	5 780	5 904	5 167	6 664	6 050	5 961

Table 4. Accumulation of sugar per unit area ($g.m^{-2}$)

Weeks after Planting	Moisture regimes - m^3 water/$90m^2$			Levels of nitrogen kg N ha^{-1}			Mean
	3	5	7	0	150	300	
0	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-
24	45	42	46	52	39	42	44
28	250	265	258	233	258	283	258
32	647	660	693	665	660	675	667
36	989	987	992	976	1 024	969	989
40	1 327	1 286	1 327	1 302	1 350	1 287	1 313
44	1 795	1 864	1 858	1 678	1 922	1 918	1 839
48	1 963	2 212	2 144	1 864	2 271	2 183	2 106
52	2 309	2 250	2 280	2 030	2 462	2 346	2 280

6400/21 MOVEMENT OF FERTILISER NITROGEN IN THE SOIL AND ITS EFFECT ON PLANT GROWTH IN FLOOD BEDS, PLANT DATA

Table 5. Increases in stalk volume per unit area ($m^3 \times 10^{-4}\ m^{-1}$)

Weeks after planting	Moisture regimes - m^3 water/90m^3 3	5	7	Levels of nitrogen kg N ha^{-1} 0	150	300	Mean
0	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-
20	4	4	4	4	4	4	4
24	31	32	33	27	31	37	32
28	64	67	68	56	76	68	66
32	100	104	99	86	109	108	101
36	114	119	122	97	129	129	118
40	131	134	128	112	135	147	131
44	151	155	146	127	152	174	151
48	152	164	158	130	174	170	158
56	146	159	163	127	154	187	156

SOUTH AFRICAN SUGAR INDUSTRY
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Title: MOVEMENT OF FERTILIZER NITROGEN IN THE SOIL AND IT'S EFFECT ON PLANT GROWTH IN FLOOD BEDS 6400/21

Cat No.: 1203

Object : Plant crop - To determine the effects of different moisture regimes on the movement of different levels of nitrogen in the soil profile and their effects on plant growth.

1st ratoon - It was not possible to destructively sample the same area sampled in the plant crop again in the 1st ratoon for growth measurements. Therefore only harvest measurements were recorded in the 1st ratoon.

This crop : 1st ratoon Age : 12,1 months

Location : ZSA Experiment Station, Field N1

Soil type : PE.1 sandy clay loam derived from gneiss

Variety/Spacing : NCo 376, rows spaced 1,5 m apart

Fertiliser :

Nitrogen	Phosphate
(See treatments)	60 kg P_2O_5/ha

Rainfall : 873,7 mm

Irrigation : Treatment - 1. 693 mm
2. 1 176 mm
3. 1 638 mm

Treatments : Main experiment (cropped)

Irrigation regimes - see conduct (first digit)

1. 33 mm water per irrigation (3 m^3 per flood bed - 90 m^2)
2. 56 mm " " " (5 m^3 " " " ")
3. 78 mm " " " (7 m^3 " " " ")

Levels of nitrogen (second digit)

1. Control - no added nitrogen
2. 150 kg N/ha
3. 300 kg N/ha

CONDUCT :

All flood beds were irrigated at the same time based on a Class A pan factor of 0,5 to full canopy and a factor of 1,0 thereafter for treatment 2 i.e. 56 mm water per irrigation.

RESULTS :

Relevant data are summarised in the attached table for the 1st ratoon (Table 1)

2./ (a) .....

a) Cane yields : Irrigation regimes had no effect on cane yields whereas there was a highly significant quadratic response to greater levels of nitrogen.

b) ERC % cane : There is no apparent reason to account for the significant depression in ERC % cane after applying 5 m^3 water per 90 m^2 of land per day. Levels of nitrogen had no effect on ERC % cane.

c) TERC/ha : There were no significant TERC/ha responses to irrigation regimes. However the highly significant quadratic effect of nitrogen on cane yields produced a similar significant effect on TERC/ha.

d) RS % cane, TF % cane and TF t/ha : Some of the depression in ERC % cane after applying 5 m^3 water 90 m^2 of land was apparently due to greater RS % cane. Otherwise TF % cane and TF t/ha produced similar responses as those observed in ERC % cane and TERC/ha.

e) Stalk counts, stalk lengths and stalk diameters. Increasing the amount of water applied at each irrigation slightly increased stalk counts whilst applying 150 kg N/ha markedly increased them. Irrigation regimes had little effect on stalk lengths and diameters whereas 150 kg N/ha markedly increased stalk lengths and had no effect on stalk diameters.

PROGRESS REPORT

Planted : 29.6.79

Harvested :

	Harvest	Age
P	26.6.80	11,9 months
1R	30.6.81	12,1 months

Fertiliser :

	N	P
Plant	See treatments	60 kg P_2O_5/ha
Ratoons	" "	" "

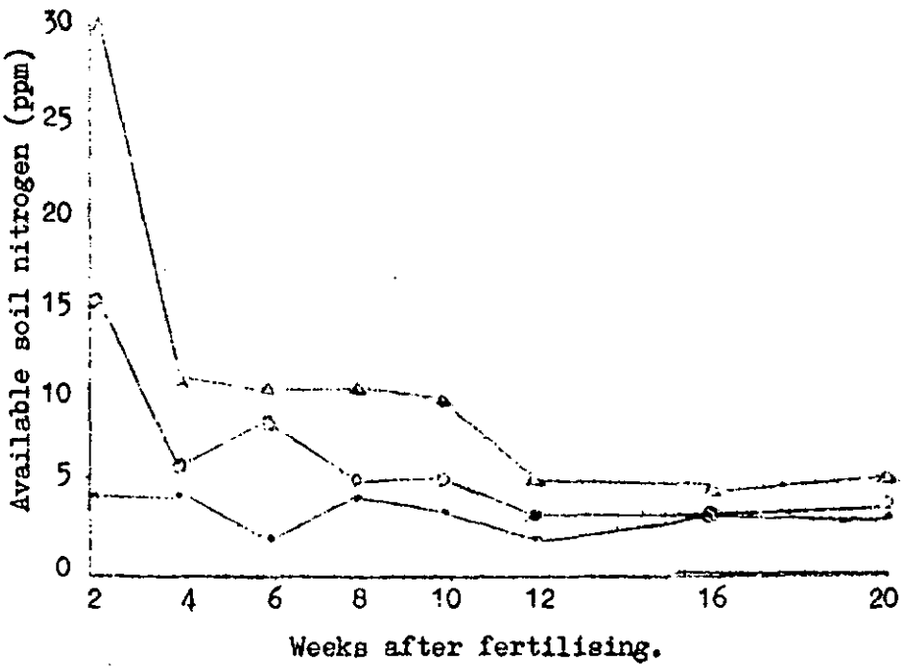
RESULTS :

I. Data recorded after planting and not repeated on the 1st ratoon (Tables 2-5)

a) Available soil nitrogen.

3./ Fig. 1. ...

Fig. 1. Average soil nitrogen (ppm) per 20 cm horizon in the sampled soil profile (0-60 cm)



Control (·), 150 kg N/ha (○), 300 kg N/ha (△)

Two weeks after broadcasting ammonium nitrate onto the soil surface in all irrigation regimes, high levels of available nitrate - N and ammonium - N were observed in all soil horizons. i.e. 0-20 cm, 21-40 cm and 41-60 cm (Table 2). This indicates that both sources of nitrogen i.e. nitrate - N and ammonium - N are leached. However, in spite of relatively large amounts of nitrogen being leached, nitrogen was also rapidly immobilised and/or fixed. Later more nitrogen from 300 kg N/ha than 150 kg N/ha became available for plant uptake for at least 20 and 10 weeks after application, respectively (Fig. 1).

4./ b) Stalk ...

b) Stalk volume per unit area.

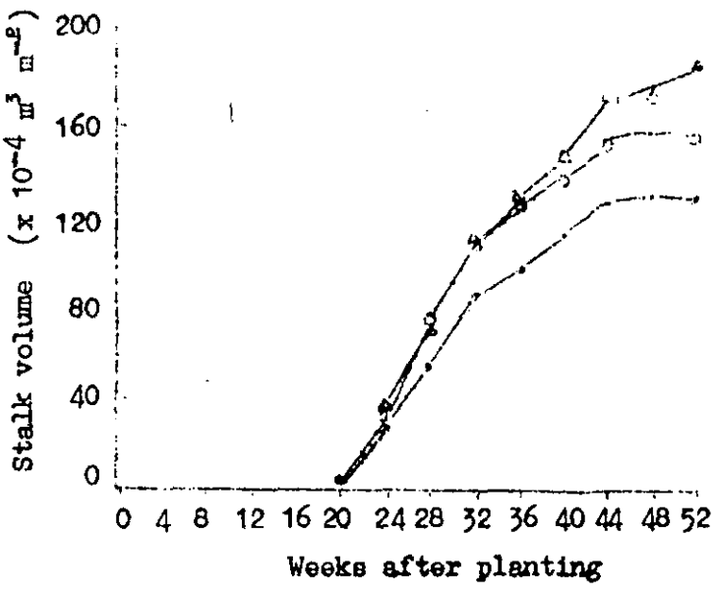


Fig. 2. Effects of levels of nitrogen on increases in stalk volume. No added nitrogen (•) 150 kg N/ha (o), 300 kg N/ha (▲).

Four weeks after the onset of rapid elongation (24 weeks after planting) stalk valume per unit area was greater in flood beds receiving nitrogen than the control (no added nitrogen). These differences increased up to 52 weeks after planting. However, stalk volumes in flood beds receiving 300 kg N/ha only became markedly greater than flood beds receiving 150 kg N/ha 40 weeks after planting and differences increased up to the final sampling (52 weeks after planting).

Different moisture regimes had no consistant effect on stalk volume.

5./ c) Dry ...

c) Dry mass accumulation

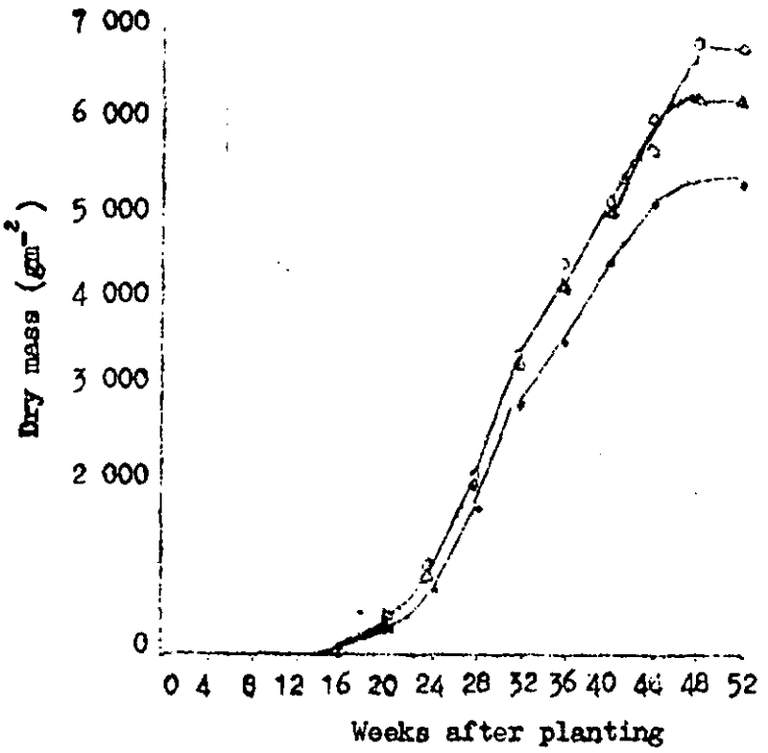


Fig. 3. Effects of levels of nitrogen on dry mass accumulation per unit area. Control (•) 150 kg N/ha (o), 300 kg N/ha (▲).

Soon after the onset of rapid growth rates of dry mass accumulated faster when nitrogen was applied than in the control (no added nitrogen). When nitrogen was applied i.e. 150 and 300 kg N/ha rates of dry mass accumulation were similar up to 44 weeks after planting while dry mass accumulated at the same rate for 150 kg N/ha for the next four weeks it declined when 300 kg N/ha was applied after which no further dry mass accumulated in all nitrogen treatments.

Irrigation regimes had no effect on dry mass accumulation.

6./ d) sucrose ..

d) Sucrose accumulation

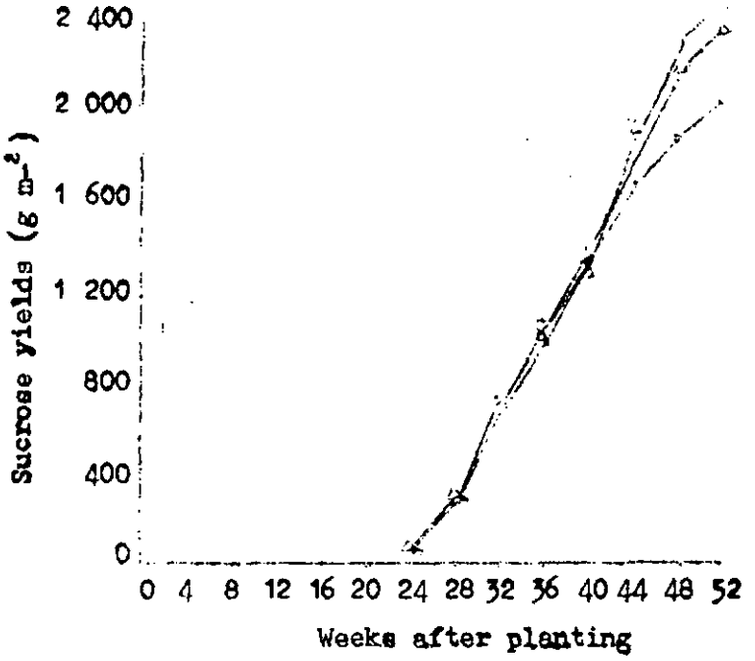


Fig. 4. Effects of levels of nitrogen on the accumulation of sucrose per unit area. Control (·), 150 kg N/ha (▫), 300 kg N/ha (▪)

Rates of sucrose accumulation were similar up to 32 weeks after planting for all levels of nitrogen. Thereafter rates of sucrose accumulation were greater in plots receiving 150 kg N/ha than in 300 kg N/ha and the control (no added nitrogen).

Again different irrigation regimes had no effect on rates of sucrose accumulation.

Data recorded in both the plant and 1st ratoon (Tables 6-8)

II

II a) Cane yields. In both the plant and 1st ratoon crops irrigation regimes had no effect on cane yields, whereas levels of nitrogen had a highly significant quadratic effect.

b) ERC % cane. The effects of treatments tended to be variable. Five cubic metres of water per 90 m² of land significantly reduced quality in the 1st ratoon but had no effect in the plant crop. Whereas greater levels of nitrogen significantly depressed quality in the plant crop but had no effect on the 1st ratoon.

c) TERC/ha. Overall, the effects of cane yield on TERC/ha masked the smaller effects of variations in quality. As a result, irrigation regimes had no effect on TERC/ha and the greater levels of nitrogen produced a highly significant quadratic effect.

d) R S % cane. Irrigation regimes produced no consistant RS% cane trends whereas there was a tendancy for RS% cane to be greater after nitrogen had been applied.

7./ e) TF%..

e) TF % cane and TF t/ha. Overall irrigation regimes had little effect on both TF % cane and TF t/ha. TF t/ha was greater after applying 150 and 300 kg N/ha than in the control.

f) Stalk counts, stalk lengths and diameters. Irrigation regimes had no effect on stalk counts, stalk lengths and diameters. However, applying at least 150 kg N/ha markedly increased stalk counts and stalk lengths.

CONCLUSIONS

Although it was anticipated that the dry regime would stress the plant, this did not occur in either crop. However, two weeks after applying different levels of nitrogen (measurements were only recorded in the plant crop) available soil nitrogen (NH_4^+ and NO_3^-) increased in all soil horizons indicating considerable leaching of nitrogen had occurred. In spite of leaching a high proportion of the leached nitrogen in each soil horizon was rapidly fixed and/or immobilised, some of which became available soon afterwards for plant uptake which accounts for the differences in cane yields. The lack of response in dry mass per unit area to the highest level of available soil nitrogen suggests that sufficient nitrogen was taken up after applying 150 kg N/ha but insufficient from the control to give maximum dry mass and similarly fresh mass. In the plant crop stalk valume was not associated with greater sucrose yields. However, it does appear that if stalk volume is less than the "threshold" i.e. the controls (no added nitrogen) then sucrose yields may be markedly less.

RJH/Oct. '81.
rw

6400/21 IRRIGATION X NITROGEN TRIAL, 1ST RATOON DATA

Table 1.

Treatments	Cane yields t/ha	ERC % Cane	TERC/ha	RS % cane	TF % cane	TF t/ha	Stalk counts x 10^{-3}	Stalk lengths (m)	Stalk diameters (cm)
Irrigation regimes									
3 m^3 water/90 m^2 of land	139,5	14,12	19,72	0,47	15,95	22,26	130,8	2,70	2,17
5 m^3 " " "	146,3	13,54	19,77	0,64	15,67	22,94	135,7	2,84	2,15
7 m^3 " " "	143,1	14,04	20,11	0,49	16,02	22,94	138,3	2,74	2,09
L.S.D. P=0,05	N.S.	0,35	N.S.	-	-	-	-	-	-
Levels of nitrogen									
Control - no added nitrogen	111,1	13,80	15,29	0,48	15,76	17,51	116,3	2,37	2,12
150 kg N/ha	157,6	13,85	21,82	0,57	15,90	25,06	142,8	2,91	2,15
300 kg N/ha	160,2	14,04	22,49	0,55	15,98	25,60	145,6	2,99	2,15
Linear effect	P=0,001	N.S.	P=0,001	-	-	-	-	-	-
Quadratic effect	P=0,001	N.S.	P=0,001	-	-	-	-	-	-
L.S.D. P=0,05	10,1	0,35	0,74	-	-	-	-	-	-
P=0,01	13,6	0,47	1,00	-	-	-	-	-	-
Interactions	N.S.	N.S.	N.S.	-	-	-	-	-	-
Trial mean	143,0	13,90	19,87	0,53	15,88	22,72	134,9	2,76	2,14
S.E. single plot	13,6	0,47	1,97	-	-	-	-	-	-
S.E. treatment means	3,5	0,12	0,51	-	-	-	-	-	-
C.V.%	9.5	3.35	9.89	-	-	-	-	-	-

Table 2. Available soil nitrogen (ppm) at different soil depths.

Treatments	Weeks after planting (fertilising)		0–20 cm NO_3	0–20 cm NH_4	0–20 cm Total	21–40 cm NO_3	21–40 cm NH_4	21–40 cm Total	41–60 cm NO_3	41–60 cm NH_4	41–60 cm Total	Mean
Irrigation regimes												
3 m^3 water 90 m^2	12	0	3	2	5	3	2	5	3	2	5	5
	14	2	13	10	23	12	8	20	8	6	14	19
	16	4	3	5	8	3	2	5	3	3	6	6
	18	6	4	2	6	5	3	8	4	2	6	7
	20	8	2	3	5	2	4	7	3	4	7	6
	22	10	3	4	7	3	3	6	3	3	6	6
	24	12	2	2	4	2	2	4	2	1	3	4
	28	16	1	2	3	1	2	3	1	2	3	3
	32	20	2	3	5	2	2	4	2	2	4	4
5 m^3 water 90 m^2	12	0	4	2	6	4	2	6	3	2	5	6
	14	2	12	10	22	11	10	21	9	6	15	19
	16	4	4	2	6	5	2	7	4	4	8	7
	18	6	5	2	7	3	2	5	3	1	4	5
	20	8	3	4	7	4	4	8	2	4	6	7
	22	10	2	4	6	2	3	5	3	2	5	5
	24	12	3	1	4	2	2	4	2	2	4	4
	28	16	1	2	3	2	2	4	2	2	4	4
	32	20	2	2	4	2	2	4	2	3	5	4
7 m^3 water 90 m^2	12	0	3	2	5	4	3	7	3	2	5	6
	14	2	12	8	20	6	9	15	7	3	10	15
	16	4	3	2	5	4	2	6	3	2	5	5
	18	6	7	2	9	9	2	11	4	2	6	9
	20	8	2	4	6	3	4	7	3	3	6	6
	22	10	2	4	6	3	3	6	3	2	5	6
	24	12	1	2	3	2	1	3	2	2	4	3
	28	16	2	1	3	2	1	3	2	1	3	3
	32	20	2	2	4	1	3	4	2	2	4	4
Levels of nitrogen												
Control	12	0	3	2	5	4	2	6	3	2	5	5
	14	2	3	1	4	3	2	5	2	2	4	4
	16	4	2	2	4	2	2	4	2	1	3	4
	18	6	1	1	2	1	1	2	2	1	3	2
	20	8	2	4	6	1	3	4	1	2	3	4
	22	10	2	2	4	1	2	3	1	2	3	3
	24	12	1	1	2	1	1	2	1	1	2	2
	28	16	1	2	3	1	1	2	2	1	3	3
	32	20	2	2	4	1	2	3	1	2	3	3
150 kg N/ha	12	0	4	2	6	3	3	6	4	2	6	6
	14	2	17	8	15	13	6	19	8	4	12	15
	16	4	4	2	6	3	2	5	3	3	6	6
	18	6	4	2	6	7	3	10	5	2	7	8
	20	8	2	3	5	2	3	5	2	3	5	5
	22	10	2	4	6	2	3	5	0	2	4	5
	24	12	2	1	3	2	1	3	2	1	3	3
	28	16	1	2	3	2	1	3	2	1	3	3
	32	20	2	2	4	2	2	4	2	2	4	4
300 kg N/ha	12	0	3	2	5	4	2	6	4	2	6	6
	14	2	17	18	35	17	15	32	14	10	24	30
	16	4	10	5	15	5	3	8	5	5	10	11
	18	6	9	3	12	8	3	11	6	2	8	10
	20	8	3	4	7	6	5	11	6	6	12	10
	22	10	2	7	9	5	4	9	6	3	9	9
	24	12	4	2	6	1	2	3	3	2	5	5
	28	16	2	2	4	2	2	4	3	2	5	4
	32	20	2	3	5	2	3	5	3	3	6	5

6400/21 MOVEMENT OF FERTILISER NITROGEN IN THE SOIL AND ITS EFFECT ON PLANT GROWTH IN FLOOD BEDS. PLANT DATA

Table 3. Dry mass accumulation per unit area ($g\ m^{-2}$)

Weeks after planting	Moisture regimes m^3 water $90m^2$ 3	5	7	Levels of nitrogen kg N/ha 0	150	300	Mean
0	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-
20	310	315	316	280	323	339	314
24	812	832	854	762	824	948	833
28	1 798	1 791	1 831	1 557	1 999	1 864	1 807
32	3 026	3 074	3 088	2 725	3 253	3 210	3 063
36	3 790	3 975	4 002	3 420	4 342	4 005	3 922
40	4 539	5 033	4 601	4 728	4 999	4 895	4 724
44	5 631	5 467	5 408	4 999	5 598	5 910	5 502
48	5 730	6 368	6 248	5 506	6 753	6 079	6 115
52	6 198	5 780	5 904	5 167	6 664	6 050	5 961

Table 4. Accumulation of sugar per unit area ($g\ m^{-2}$)

Weeks after planting	Moisture regimes m^3 water 90 m^2 3	5	7	Levels of nitrogen kg N/ha 0	150	300	Mean
0	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-
24	45	42	46	52	39	42	44
28	250	265	258	233	258	283	258
32	674	660	693	665	660	675	667
36	989	987	992	976	1 024	969	989
40	1 327	1 286	1 327	1 302	1 350	1 287	1 313
44	1 795	1 864	1 858	1 678	1 922	1 918	1 839
48	1 963	2 212	2 144	1 864	2 271	2 183	2 106
52	2 309	2 250	2 280	2 030	2 462	2 346	2 280

6400/21 MOVEMENT OF FERTILISER NITROGEN IN THE SOIL AND ITS EFFECT ON PLANT GROWTH IN FLOOD BEDS. PLANT DATA

Table 5. Increase in stalk volume per unit area (x 10^{-4} m^3 m^{-3})

Weeks after planting	Moisture regimes m^3 water $90m^2$ 3	5	7	Levels of nitrogen kg N/ha 0	150	300	Mean
0	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-
20	4	4	4	4	4	4	4
24	31	32	33	27	31	37	32
28	64	67	68	56	76	68	66
32	100	104	99	86	109	108	101
36	114	119	122	97	129	129	118
40	131	134	128	112	135	147	131
44	151	155	146	127	152	174	151
48	152	164	158	130	174	170	158
56	146	159	163	127	154	187	156

6400/21 IRRIGATION X NITROGEN TRIAL - PLANT AND 1ST RATOON DATA

Table 6

Treatments	Cane yields t/ha		ERC % cane		TERC/ha	
	P	1R	P	1R	P	1R
Irrigation regimes						
3 m^3 water/90 m^2 of land	155,1	139,5	12,50	14,12	19,34	19,72
5 m^3 " " "	155,1	146,3	12.20	13,54	18,89	19,77
7 m^3 " " "	156,9	143,1	12,20	14,04	19,07	20,11
L.S.D.	N.S.	N.S.	N.S.	0,35	N.S.	N.S.
Levels of nitrogen						
Control - no added nitrogen	137,0	111,1	12,66	13,80	17,30	15,29
150 kg N/ha	167,5	157,6	12,45	13,85	20,85	21,82
300 kg N/ha	162,6	160,2	11,78	14,04	19,15	22,49
Linear effect	P=0,001	P=0,001	P=0,001	N.S.	P=0,01	P=0,001
Quadratic effect	P=0,001	P=0,001	N.S.	N.S.	P=0,001	P=0,001
L.S.D. P=0,05	10,4	10,1	0,35	0,35	1,21	0,74
P=0,01	14,0	13,6	0,46	0,47	1,63	1,00
Interactions	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Trial mean	155,7	143,0	12,30	13,90	19,10	19,87
S.E. single plot	14,0	13,6	0,46	0,47	1,63	1,97
S.E. treatment means	3.6	3.5	0.12	0,12	0,42	0,51
C.V.%	9,0	9,5	3,78	3,35	8,52	9,89

Table 7

Treatments	RS % cane		TF % cane		TF t/ha	
	P	1R	P	1R	P	1R
Irrigation regimes						
3 m^3 water per 90 m^2 of land	0,91	0,47	14,74	15,95	22,88	22,26
5 m^3 " " " "	0,88	0,64	14,42	15,67	23,31	22,94
7 m^3 " " " "	0,91	0,49	14,44	16,02	22,62	22,94
Levels of nitrogen						
Control - no added nitrogen	0,78	0,48	14,77	15,76	20,25	17,81
150 kg N/ha	0,96	0,57	14,74	15,90	24,67	25,06
300 kg N/ha	0,96	0,55	14,10	15,98	22,90	25,60
Trial mean	0,90	0,53	14,53	15,88	22,60	22,72

Table 8.

Treatments	Stalk count x 10^{-3}		Stalk lengths (m)		Stalk diameters (cm)	
	P	1R	P	1R	P	1R
Irrigation regimes						
3 m^3 water/90 m^2 of land	140,7	130,8	2,84	2,70	2,29	2,17
5 m^3 " " "	139,7	135,7	2,88	2,84	2,27	2,15
7 m^3 " " "	140,7	138,3	2,85	2,74	2,27	2,09
Levels of nitrogen						
Control - no added nitrogen	123,1	116,3	2,75	2,37	2,25	2,12
150 kg N/ha	148,7	142,8	2,90	2,91	2,28	2,15
300 kg N/ha	149,4	145,6	2,91	2,99	2,30	2,15
Trial mean	140,4	134,9	2,85	2,76	2,28	2,14

SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCAITION

Cat. No.: 1203

6400/21 MOVEMENT OF FERTILISER NITROGEN IN THE SOIL AND ITS EFFECT ON PLANT GROWTH IN FLOOD BEDS

OBJECT: Plant crop - To determine the effect of different moisture regimes on the movement of different levels of nitrogen in the soil profile and their effects on plant growth.

Ratoons - It was not possible to destructively sample the same area sampled in the plant crop in the ratoons for growth measurements. Therefore only harvest measurements were recorded.

THIS CROP: 2nd ratoon **Age:** 11,9 months (30.6.81-28.6.82)

LOCATION: ZSA Experiment Station, Field N1.

SOIL TYPE: P.E.1 sandy clay loam derived from gneiss.

VARIETY/ SPACING: NCo 376, rows spaced 1,5m apart.

FERTILISER:

Nitrogen	Phosphate
(See treatments)	60 kg P_2O_5/ha

RAINFALL: 443mm

IRRIGATION: Treatment - 1 508mm
2 1456mm
3 1984mm

TREATMENTS: Main experiment (cropped)

Irrigation regimes - see conduct (first digit)

1. 33mm water per irrigation ($3m^3$ water per flood bed - $90m^2$)
2. 56mm " " " ($5m^3$ " " " " " ")
3. 78mm " " " ($7m^3$ " " " " " ")

Levels of nitrogen (second digit)

1. Control - no added nitrogen
2. 150 kg N/ha
3. 300 kg N/ha

CONDUCT: All flood beds were irrigation at the same time based on a Class A pan factor of 0,5 to full leaf canopy and a factor of 1,0 thereafter for treatment 2 i.e. 56mm water per irrigation.

2/RESULTS.....

RESULTS

Relevant data are summarised in the attached table for the 2nd ratoon (Table 1)

(a) Cane yields: Applying 150 kg N/ha significantly increased cane yields, but increasing the level to 300 kg N/ha had no further beneficial effects. Although there were no significant differences between moisture regimes there was a small benefit from applying at least 56mm water per irrigation.

(b) ERC % cane: There were no significant quality differences between treatments.

(c) TERC/ha: Applying 150 kg N/ha and 300 kg N/ha produced significantly greater TERC/ha than the control (no added nitrogen). Although there were no significant differences between irrigation treatments, there was a small benefit from increasing applications from 33mm to 78mm water per irrigation.

(d) RS % cane, TF % cane and TF t/ha: Treatments had no effect on RS % cane. TF % cane and TF t/ha produced similar responses to those observed in ERC % cane and TERC/ha.

(e) Stalk counts, stalk lengths and stalk diameters: Increasing the moisture regime from 33mm water per irrigation to 56mm per irrigation caused a slight increase in stalk numbers, but irrigation treatments had no effect on stalk lengths or diameters. On the other hand greater levels of nitrogen increased stalk numbers and also stalk lengths, but they had no effect on stalk diameters.

PROGRESS REPORT

PLANTED 29.6.79

HARVESTED		Harvest	Age
	P	26.6.80	11,9 months
	1R	30.6.81	12,1 months
	2R	28.6.82	11,9 months

FERTILISER:		N	P
	Plant	See treatments	60 kg P_2O_5/ha
	Ratoons	" "	" "

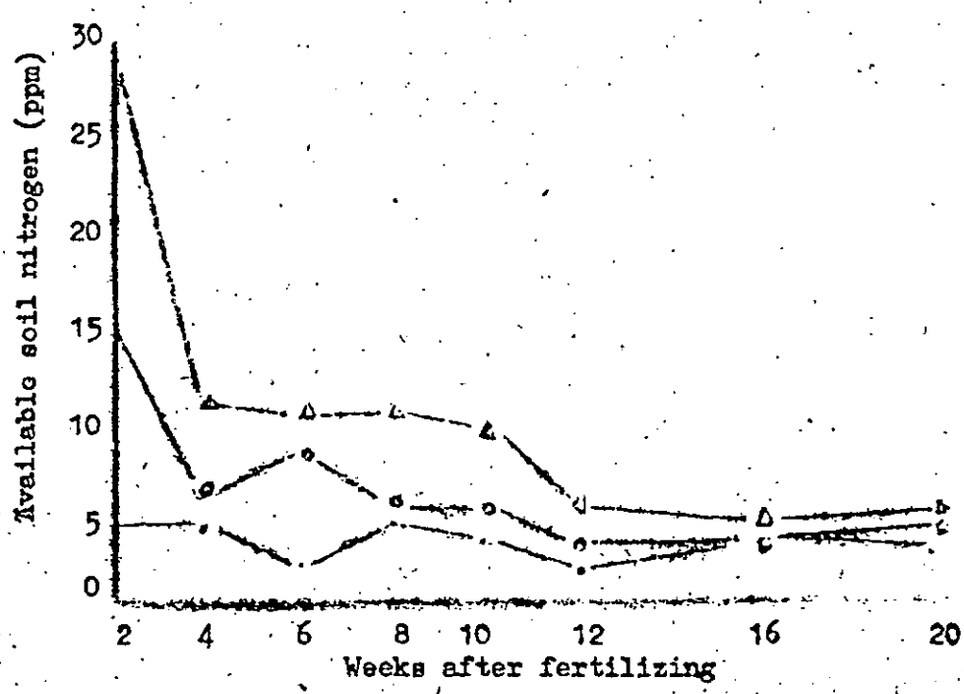
3/RESULTS....

RESULTS

I. Data recorded after planting and not repeated on the ratoon crops (Tables 2-6).

a) Available soil nitrogen.

Fig 1. Average soil nitrogen (ppm) per 20cm horizons in the sampled soil profile (0-60cm)



Control (•). 150 kg N/ha (○), 300 kg N/ha (△)

Two weeks after broadcasting ammonium nitrate onto the soil surface (in all irigation regimes), high levels of available nitrate-N and ammonium-N were aboserved in all soil horizons, i.e. 0-20cm, 21-40cm and 41-60cm (Table 2 and 3). This indicated that both sources of nitrogen i.e. nitrate-N and ammonium-N were leached. However, in spite of relatively large amounts of nitrogen being leached, it was also rapidly immobilised and/or fixed. More nitrogen from 300 kg N/ha than 150 kg N/ha became available later for plant uptake for at least 20 and 10 weeks after application respectively. (Fig.1)

4/Fig.2....

b) Stalk volume per unit area

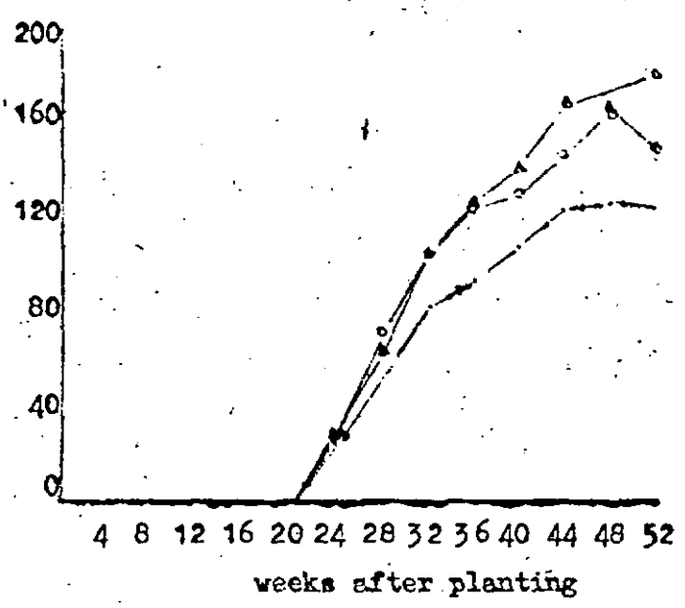


Fig. 2. Effects of levels of nitrogen on increases in stalk volume. No added nitrogen (•) 150 kg N/ha (▲), 300 kg N/ha (△)

Four weeks after the onset of rapid stalk elongation (24 weeks after planting) stalk volume per unit area was greater in the fertiliser treatments than in the control, and these differences increased up to 52 weeks after planting. However, stalk volumes in treatments receiving 300 kg N/ha only became markedly greater than treatments receiving 150 kg N/ha 40 weeks after planting, and differences increased up to the final sampling (52 weeks after planting).

Different moisture regimes had no consistent effect on stalk volume.

c) Dry mass accumulation

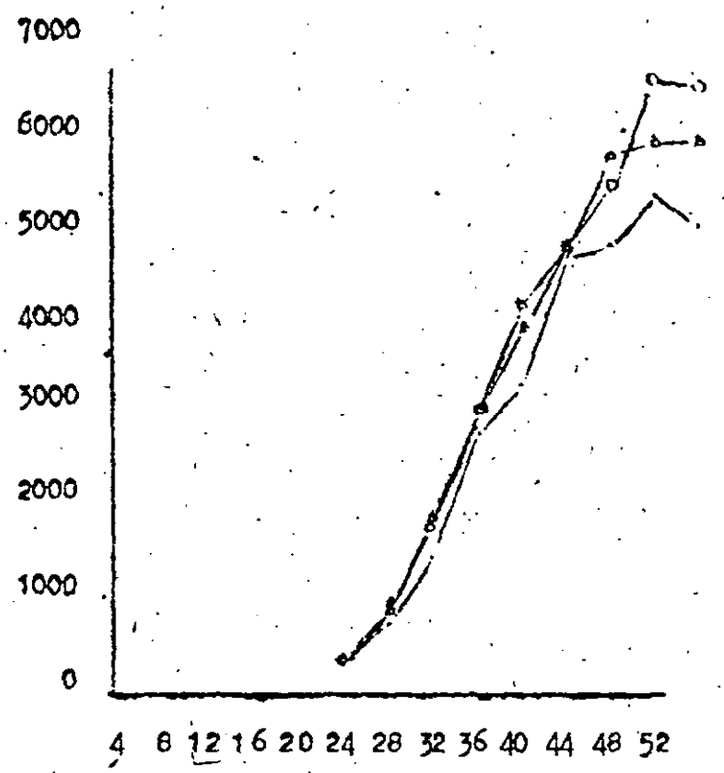


Fig.3. Effects of levels of nitrogen on dry mass accumulation per unit area. Control (·) 150 kg N/ha (○), 300 kg N/ha (△)

Soon after the onset of rapid growth rates, dry mass (DM) accumulated faster when nitrogen was applied than in the control. In the fertilizer treatments, rates of DM accumulation were similar up to 14 weeks after planting, but thereafter, they declined more rapidly in the 300 kg N/ha treatment until all DM gain had ceased by 52 weeks.

Irrigation regimes had no effect on dry mass accumulation.

d) Sucrose accumulation

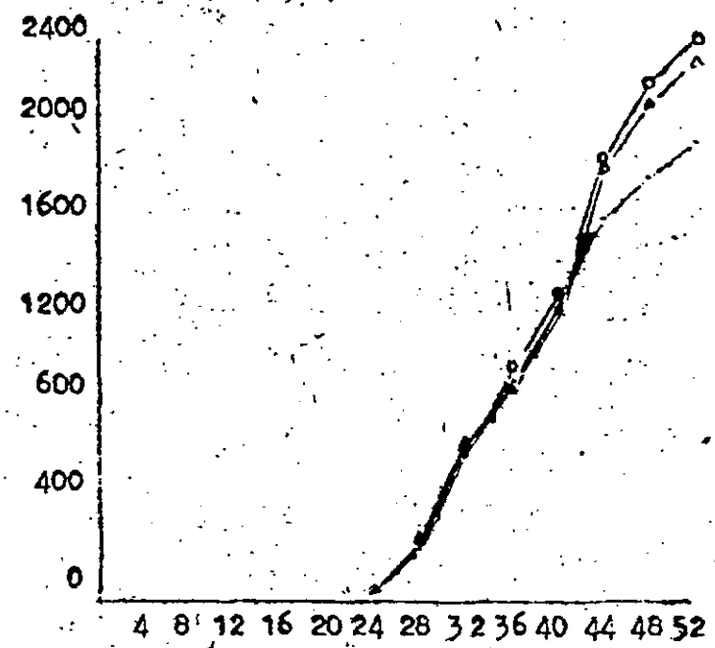


Fig. 4. Effects of levels of nitrogen on the accumulation of sucrose per unit area. Control (-), 150 kg N/ha (•), 300 kg N/ha (△)

Rates of sucrose accumulation were similar up to 32 weeks after planting for all treatments, but thereafter they were greater in plots receiving 150 kg N/ha than in 300 kg N/ha and the control.

Different irrigation regimes had no effect on rates of sucrose accumulation.

7/II.Data....

II. Data recorded in both the plant crop and ratoons (Tables 1-9)

(a) Cane yields: In all crops irrigation regimes had no significant effect on cane yields, but in both ratoons yields were less when 33mm water per irrigation was applied. In all crops levels of nitrogen produced a highly significant quadratic yield response.

(b) ERC % cane: In both ratoon crops the intermediate water regime depressed quality, while greater levels of nitrogen significantly depressed quality in the plant crop, but had no effect on the ratoons.

(c) TERC/ha: Although treatment differences between irrigation regimes were not significant there was a trend towards greater TERC/ha when more water was applied. Applying 150 kg N/ha significantly increased TERC/ha in all crops, but doubling the rate did not produce a further significant response.

(d) RS % cane: Irrigation regimes produced no consistent RS % cane trends whereas there was a tendency for RS % cane to be greater after nitrogen had been applied.

(e) TF % cane and TF t/ha: Irrigation regimes and levels of nitrogen had no effect on quality. On the other hand TF t/ha was greater when at least 56mm of water and 150 kg N/ha had been applied.

(f) Stalk counts, stalk lengths and diameters: Applying at least 56mm of water slightly improved stalk populations but had no effect on stalk lengths or diameters. Also applying at least 150 kg N/ha improved stalk populations and stalk lengths, but had no effect on stalk diameters.

CONCLUSION

Results have shown that the dry irrigation regime only mildly stressed plants in the ratoon crops. However, two weeks after applying different levels of nitrogen (measurements were only recorded in the plant crop) available soil nitrogen (NH_4 and NO_3) increased in all soil horizons and irrigation treatments indicating that considerable leaching of nitrogen had occurred. However, a high proportion of the leached nitrogen, in each soil horizon, was rapidly fixed and/or immobilised, but some became available soon afterwards for plant uptake, and this accounted for the differences in cane and sucrose yields. The lack of response in dry mass to the highest level of available soil nitrogen suggested that sufficient nitrogen was taken up after applying 150 kg N/ha.

The small differences in cane and TERC/ha yields in the ratoons indicated that 150 kg N/ha was also sufficient to satisfy the plant's nitrogen requirements. In the plant crop stalk volume was not associated with greater sucrose yields. However, it does appear that if stalk volume is less than the 'threshold' i.e. the control (no added nitrogen) then sucrose yields may be markedly less.

RJH/August 1982
arg

6400/21 IRRIGATION x NITROGEN TRIAL, 2nd RATOON DATA

Table 1

Treatments	Cane yields t/ha	ERC % cane	TERC/ha	RS % cane	TF % cane	TF t/ha	Stalk counts x 10^{-3}	Stalk lengths(m)	Stalk diam.(cm)
Irrigation regimes									
$3m^3$ water /$90m^2$ of land	133,5	12,27	16,39	0,66	14,33	19,15	138,8	2,69	2,3
$5m^3$ " " " "	139,9	12,05	16,82	0,61	14,08	19,79	143,8	2,70	2,2
$7m^3$ " " " "	141,7	12,33	17,54	0,62	14,35	20,41	144,9	2,69	2,2
L.S.D. P = 0,05	N.S.	N.S.	N.S.	-	-	-	-	-	-
Levels of nitrogen									
Control - no added nitrogen	104,2	12,24	12,76	0,58	14,19	14,80	125,2	2,38	2,2
150 kg N/ha	153,7	12,22	18,78	0,68	14,37	22,18	148,6	2,79	2,2
300 kg N/ha	157,3	12,20	19,21	0,63	14,21	22,37	153,7	2,91	2,2
Linear effect	P=0,01	N.S.	P=0,001	-	-	-	-	-	-
Quadratic effect	P=0,001	N.S.	P=0,01	-	-	-	-	-	-
L.S.D. P = 0,05	14,54	N.S.	1,85	-	-	-	-	-	-
P = 0,01	19,55	N.S.	2,49	-	-	-	-	-	-
Interactions	N.S.	N.S.	N.S.	-	-	-	-	-	-
Trial Mean	138,3	12,22	16,92	0,63	14,26	19,78	142,5	2,69	2,2
S.E. single plot ±	19,6	0,44	2,49	-	-	-	-	-	-
S.E. treatment means ±	5,0	0,11	0,64	-	-	-	-	-	-
C.V. %	14,1	3,61	14,71	-	-	-	-	-	-

6400/21 MOVEMENT OF FERTILIZER NITROGEN IN THE SOIL AND ITS EFFECT ON PLANT GROWTH IN FLOOD BEDS - PLANT DATA - AVAILABLE SOIL NITROGEN (PPM) AT DIFFERENT SOIL DEPTHS.

Table 2.

Treatments	Week after Planting	Week after Fertilizing	0-20cm NO_3	0-20cm NH_4^+	0-20cm Total	21-40cm NO_3	21-40cm NH_4^+	21-40cm Total	41-60cm NO_3	41-60cm NH_4^+	41-60cm Total	Mean
Irrigation regimes												
$3m^3$ water/$90m^2$ (33mm water per irrigation	12	0	3	2	5	3	2	5	3	2	5	5
	14	2	13	10	23	12	8	20	8	6	14	19
	16	4	3	5	8	3	2	5	3	3	6	6
	18	6	4	2	6	5	3	8	4	2	6	7
	20	8	2	3	5	2	4	7	3	4	7	6
	22	10	3	4	7	3	3	6	3	3	6	6
	24	12	2	2	4	2	2	4	2	1	3	4
	28	16	1	2	3	1	2	3	1	2	3	3
	32	20	2	3	4	2	2	1	2	2	4	4
$5m^3$ water/$90m^2$ (56mm water per irrigation)	12	0	4	2	6	4	2	6	3	2	5	6
	14	2	12	10	22	11	10	21	9	6	15	19
	16	4	4	2	6	5	2	7	4	4	8	7
	18	6	5	2	7	3	2	5	3	1	4	5
	20	8	3	4	7	4	4	8	2	4	6	7
	22	10	2	4	6	2	3	5	3	2	5	5
	24	12	3	1	4	2	2	4	2	2	4	4
	28	16	1	2	3	2	2	4	2	2	4	4
	32	20	2	2	4	2	2	4	2	3	5	4
$7m^3$ water/$90m^2$ (78mm water per irrigation)	12	0	3	2	5	4	3	7	3	2	5	6
	14	2	12	8	20	6	9	15	7	3	10	15
	16	4	3	2	5	4	2	6	3	2	5	5
	18	6	7	2	9	9	2	11	4	2	6	9
	20	8	2	4	6	3	4	7	3	3	6	6
	22	10	2	4	6	3	3	6	3	2	5	6
	24	12	1	2	3	2	1	3	2	2	4	3
	28	16	2	1	3	2	1	3	2	1	3	3
	32	20	2	2	4	1	3	4	2	2	4	4

6400/21 MOVEMENT OF FERTILIZER NITROGEN IN THE SOIL AND ITS EFFECT ON PLANT GROWTH IN FLOOD BEDS - PLANT DATA - AVAILABLE SOIL NITROGEN (PPM) AT DIFFERENT SOIL DEPTHS

Table 3

Treatments	Weeks after Planting	Weeks after Fertilizing	0-20cm NO_3	0-20cm NH_4^+	0-20cm Total	21-40cm NO_3	21-40cm NH_4^+	21-40cm Total	41-60cm NO_3	41-60cm NH_4^+	41-60cm Total	Mean
Levels of nitrogen												
control - no added nitrogen	12	0	3	2	5	4	2	6	3	2	5	5
	14	2	3	1	4	3	2	5	2	2	4	4
	16	4	2	2	4	2	2	4	2	1	3	4
	18	6	1	1	2	1	1	2	2	1	3	2
	20	8	2	4	6	1	3	4	1	2	3	4
	22	10	2	2	4	1	2	3	1	2	3	3
	24	12	1	1	2	1	1	2	1	1	2	2
	28	16	1	2	3	1	1	2	2	1	3	3
	32	20	2	2	4	1	2	3	1	2	3	3
150 kg N/ha	12	0	4	2	6	3	3	6	4	2	6	6
	14	2	17	8	15	13	6	19	8	4	12	15
	16	4	4	2	6	3	2	5	3	3	6	6
	18	6	4	2	6	7	3	10	5	2	7	8
	20	8	2	3	5	2	3	5	2	3	5	5
	22	10	2	4	6	2	3	5	0	2	4	5
	24	12	2	1	3	2	1	3	2	1	3	3
	28	16	1	2	3	2	1	3	2	1	3	3
	32	20	2	2	4	2	2	4	2	2	4	4
300 kg N/ha	12	0	3	2	5	4	2	6	4	2	6	6
	14	2	17	18	35	17	15	32	14	10	24	30
	16	4	10	5	15	5	3	8	5	5	10	11
	18	6	9	3	12	8	3	11	6	3	9	10
	20	8	3	4	7	6	5	11	6	6	12	10
	22	10	2	7	9	5	4	9	6	3	9	9
	24	12	4	2	6	1	2	3	3	2	5	5
	28	16	2	2	4	2	2	4	3	2	5	4
	32	20	2	3	5	2	3	5	3	3	6	5

6400/21 MOVEMENT OF FERTILIZER NITROGEN IN THE SOIL AND ITS EFFECT ON PLANT GROWTH IN FLOOD BEDS. PLANT DATA

Table 4. Dry mass accumulation per unit area (g/m^2)

Weeks after planting	Moisture regimes m^3 water $90m^2$ 3	5	7	Levels of nitrogen kg N/ha 0	150	300	Mean
0	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-
20	310	315	316	280	323	339	314
24	812	832	854	762	824	948	833
28	1798	1791	1831	1557	1999	1864	1807
32	3026	3074	3088	2725	3253	3210	3063
36	3790	3975	4002	3420	4342	4005	3922
40	4539	5033	4601	4728	4999	4895	4724
44	5631	5467	5408	4999	5598	5910	5502
48	5730	6368	6248	5506	6753	6079	6115
52	6198	5780	5904	5167	6664	6050	5961

Table 5. Accumulation of sucrose per unit area (g/m^2)

Weeks after planting	Moisture regimes m^3 water $90m^2$ 3	5	7	Levels of nitrogen kg N/ha 0	150	300	Mean
0	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-
24	45	42	46	52	39	42	44
28	250	265	258	233	258	283	258
32	674	660	693	665	660	675	667
36	989	987	992	976	1024	969	989
40	1327	1286	1327	1302	1350	1287	1313
44	1795	1864	1858	1678	1922	1918	1839
48	1963	2212	2144	1864	2271	2183	2106
52	2309	2250	2280	2030	2462	2346	2280

6400/21 MOVEMENT OF FERTILIZER NITROGEN IN THE SOIL AND ITS EFFECT ON PLANT GROWTH IN FLOOD BEDS - PLANT DATA

Table 6 Increase in stalk volume per unit area (x $10^{-4}m^3/m^2$)

Weeks after Planting	Moisture regimes m^3 water/$90m^2$ 3	5	7	Levels of nitrogen kg N/ha 0	150	130	Mean
0	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-
20	4	4	4	4	4	4	4
24	31	32	33	27	31	37	32
28	64	67	68	56	76	68	66
32	100	104	99	86	109	108	101
36	114	119	122	97	129	129	118
40	131	134	128	112	135	147	131
44	151	155	146	127	152	174	151
48	152	164	158	130	174	170	158
52	146	159	163	127	154	187	156

6400/21 IRRIGATION x NITROGEN TRIAL - CANE YIELDS, ERC % CANE, TERC/HA

Table 7

Treatments	Cane yields t/ha P	1R	2R	Mean 1R+2R	ERC % cane P	1R	2R	Mean 1R+2R	TERC/ha P	1R	2R	Mean 1R+2R
Irrigation regimes												
3m³ water/90m² of land	155,1	139,5	133,5	136,5	12,50	14,12	12,27	13,20	19,34	19,72	16,39	18,06
5m³ " " " "	155,1	146,3	139,9	143,1	12,20	13,54	12,05	12,80	18,89	19,77	16,82	18,30
7m³ " " " "	156.9	143,1	141,7	142,4	12,20	14,04	12,33	13,18	19,07	20,11	17,54	18,82
L.S.D.	N.S.	N.S.	N.S.	-	N.S.	0,35	N.S.	-	N.S.	N.S.	N.S.	-
Levels of Nitrogen												
Control - no added nitrogen	137,0	111,1	104,2	107,6	12,66	13,80	12,24	13,02	17,30	15,29	12,76	14,02
150 kg N/ha	167,5	157,6	153,7	155,6	12,45	13,85	12,22	13,04	20,85	21,82	18,78	20,30
300 kg N/ha	162,6	160,2	157,3	158,8	11,78	14,04	12,20	13,12	19,15	22,49	19,21	20,85
Linear effect	P=0,001	P=0,001	P=0,001	-	P=0,001	N.S.	N.S.	-	P=0,01	P=0,001	P=0,001	-
Quadratic effect	P=0,001	P=0,001	P=0,001	-	N.S.	N.S.	N.S.	-	P=0,001	P=0,001	P=0,01	-
L.S.D. P=0,05	10,4	10,1	14,54	-	0,35	0,35	N.S.	-	1,21	0,74	1,85	-
P=0,01	14,0	13,6	19,55	-	0,46	0,47	N.S.	-	1,63	1,00	2,49	-
Interaction	N.S.	N.S.	N.S.	-	N.S.	N.S.	N.S.	-	N.S.	N.S.	N.S.	-
Trial mean	155,7	143,0	138,4	140,7	12,30	13,90	12,22	13,06	19,10	19,87	16,92	18,39
S.E. single plot ±	14,0	13,6	19,6	-	0,46	0,47	0,44	-	1,63	1,97	2,49	-
S.E. treatment means ±	3,6	3,5	5,0	-	0,12	0,12	0,11	-	0,42	0,51	0,64	-
C.V. %	9,0	9,5	14,1	-	5,78	3,35	3,61	-	8,52	9,89	14,71	-

6400/21 IRRIGATION x NITROGEN TRIAL – R.S. % CANE, TF % CANE, TF T/HA

Table 8

Treatments	% Cane P	% Cane IR	% Cane 2R	Mean IR+2R	TF % Cane P	TF % Cane IR	TF % Cane 2R	Mean IR+2R	TF t/ha P	TF t/ha IR	TF t/ha 2R	Mean 1R+2R
Irrigation regimes												
$3m^3$ water/$90m^2$ of land	0,91	0,47	0,66	0,56	14,74	15,95	14,33	15,14	22,88	22,26	19,15	20,70
$5m^3$ " " " "	0,88	0,64	0,61	0,62	14,42	15,67	14,08	14,88	23,31	22,94	19,79	21,36
$7m^3$ " " " "	0,91	0,49	0,62	0,56	14,44	16,02	14,35	15,18	22,62	22,94	20,41	21,68
Levels of nitrogen												
Control – no added nitrogen	0,78	0,48	0,58	0,53	14,77	15,76	14,19	14,98	20,25	17,81	14,80	16,30
150 kg N/ha	0,96	0,57	0,68	0,62	14,74	15,90	14,37	15,14	24,67	25,06	22,18	23,62
300 kg N/ha	0,96	0,55	0,63	0,59	14,10	15,98	14,21	15,10	22,90	25,60	22,37	23,98
Trial Mean	0,90	0,53	0,63	0,58	14,53	15,88	14,26	15,07	22,60	22,72	19,78	21,25

Table 9

Treatments	P	IR	2R	Mean IR+2R	P	IR	2R	Mean IR+2R	P	IR	2R	Mean IR+2R
Irrigation regimes												
3 m^3 water/$90m^2$ of land	140,7	130,8	138,8	134,8	2,84	2,70	2,69	2,70	2,3	2,2	2,3	2,2
5 m^3 " " " "	139,7	135,7	143,8	139,8	2,88	2,84	2,70	2,77	2,3	2,2	2,2	2,2
7 m^3 " " " "	140,7	138,3	144,9	141,6	2,85	2,74	2,69	2,72	2,3	2,1	2,2	2,2
Levels of nitrogen												
Control – no added nitrogen	123,1	116,3	125,2	120,8	2,75	2,37	2,38	2,38	2,2	2,1	2,2	2,2
150 kg N/ha	148,7	142,8	148,6	145,7	2,90	2,91	2,79	2,85	2,3	2,2	2,2	2,2
300 kg N/ha	149,4	145,6	153,7	149,6	2,91	2,99	2,91	2,95	2,3	2,2	2,2	2,2
Trial mean	140,4	134,9	142,5	138,7	2,85	2,76	2,69	2,73	2,3	2,2	2,2	2,2