SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

7300/15 : DRYING - OFF X NITROGEN TRIAL

CAT. NO. 1437

TERMINAL REPORT

Object: To determine the effect of drying-off by cessation of irrigation at predetermined periods before harvest on the response of sugarcane to levels of nitrogen fertiliser on Chisumbanje basalt soils.

Planted: 31.8.86 (formerly 4200/10 : Irrigation x Nitrogen trial until 11.10.82).

Terminated: 7.10.86 after the 7th ratoon.

Harvest dates and ages:

Crop	Harvest	Age (months)
4R	10.10.83	12,0
5R	8.10.84	11,9
6R	8.10.85	12,0
7R	7.10.86	12,0

Location: Chisumbanje Experiment Station.

Soil type: Black basalt derived from vertisol clay ± 120cm deep.

Design: Randomised blocks with split-plots, 5 replications.

Variety/Spacing: NCo376 in 1,5m rows.

Fertiliser: (kg/ha)

	N	P_2O_5	K_2O
4R	Various	100	60
5R	"	100	60
6R	"	60	60
7R	"	60	60

Rainfall/Irrigation:

	Rainfall(mm)	Irrigation(mm)
4R	400	Variable
5R	445	"
6R	775	"
7R	563	"

Treatments:

a) Whole-plot treatments : Four drying-off commencement dates were determined by calculating the predicted class 'A' pan deficit at harvest if irrigation was stopped on these dates. Possibility of rainfall during this period was assumed to be nil. Assuming a harvest date of 7.10.86, the treatments were as follows in the 7th ratoon:

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Treatment	Predicted accumulated evaporation deficit (mm)	Commencement of drying-off: Days before harvest	Commencement of drying-off: Date of last irrigation
D1	150	20	17.9.86
D2	250	35	2.9.86
D3	350	54	14.8.86
D4	450	77	22.7.86

b) Split-plot treatments: consisted of four nitrogen levels:

	4th, 5th and 7th ratoons	6th ratoon
N1	60 kg/ha N	90 kg/ha N
N2	120 kg/ha N	180 kg/ha N
N3	180 kg/ha N	270 kg/ha N
N4	240 kg/ha N	360 kg/ha N

The nitrogen was applied as ammonium nitrate in two equal applications at 4 and 8 weeks after harvest. The sixth ratoon crop received an extra 50% of nitrogen in a third application at 12 weeks.

Conduct:

a) An in-row furrow system of irrigation was used based on a Class 'A' open pan deficit of 50mm at full canopy.
b) Drying-off treatments in the 6th and 7th ratoons were not affected by water shortages as they were in the 4th and 5th ratoons.

RESULTS

a) Irrigation data: Irrigation was stopped as scheduled for all drying-off dates in the 7th ratoon, and actual accumulated pan deficits at harvest were:

Treatment	Accumulated pan deficit from date irrigation ceased to harvest: Predicted	Actual
D1	150mm	133mm
D2	250mm	236mm
D3	350mm	350mm
D4	450mm	451mm

Rainfall interference in the 7th ratoon was negligible with a total of 7mm falling in the drying-off period, as apposed to 53mm in the 6th ratoon. The 7th ratoon drying-off treatments were the best of the four crop cycles as shown above by the good agreement between the actual and predicted accumulated pan deficits at harvest (see also Table 6). The accumulated deficits at harvest for the different drying-off regimes, over four crop cycles, were less than those predicted by a mean value of 29mm. Relevant irrigation data for the 7th ratoon were as follows overleaf:

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	D1	D2	D3	D4
Pre-drying-off period				
No. of irrigations	19	19	19	19
Amount (mm)	997	988	971	967
Mean application(mm)	53	52	51	51
Drying-off period				
No. of irrigations	7	5	3	1
Ammount (mm)	352	258	136	42
Mean application(mm)	50	52	45	42
Water applied				
Total irrigation (mm)	1 349	1 246	1 107	1 009
Total rainfall (mm)	563	563	563	563
Total water applied(mm)	1 912	1 809	1 670	1 572
Yields				
Cane yield t/ha	108,87	120,47	117,87	118,15
ERC yield t/ha	14,36	16,59	16,26	16,96
Efficiency of water use				
Tonnes cane/ha/100mm	5,69	6,66	7,06	7,52
ERC t/ha/100mm	0,75	0,92	0,97	1,08

There was a linear improvement in water-use efficiency for both cane and ERC yields with length of drying-off period as in previous ratoons (see Table 6). Efficiency of water-use dropped from the 4th to 6th ratoons due to a progressive increase in total water applied with each ratoon. The small improvement in efficiency in the 7th ratoon over the 6th ratoon was due to an increase in both cane and ERC yields from the 6th to 7th ratoons. Treatment D4 (450mm accumulated deficit) gave a mean increase of 1,17 t/ha ERC over treatment D1 (150mm predicted accumulated deficit), with a mean saving of 277mm in irrigation applied. This water saving was equivalent to between 5 and 6 irrigations

b) Yield data: Relevant yield data for all four crop cycles are shown in Tables 1-3.

i) Drying-off treatments. There was a consistent, significant improvement in ERC% cane with length of drying-off period. In the 6th and 7th ratoons this improvement resulted in a significant increase in sugar yield, because there was no decline in cane yield with drying-off, as occured in the 4th and 5th ratoons. Treatment D4 gave the best sugar quality and yield in all ratoons except the 4th, when D3 had the best sugar yield.

ii) Nitrogen Treatments. Both ERC and cane yields showed a quadratic response to nitrogen in the 4th-6th ratoons, whereas in the 7th ratoon cane yield declined linearly and the ERC yield showed no response. ERC% cane showed a quadratic response to nitrogen in the 5th and 6th ratoons, with a linear decline in the 4th ratoon and a linear increase in the 7th ratoon.
The N1 nitrogen treatment showed an atypical increase in cane yield from the 5th to 7th ratoons, such that it had the highest yield of all nitrogen treatments in the 7th ratoon. Likewise, treatments N3 and N4 had lower cane yields than expected in the 6th and 7th ratoons. In an attempt to explain these abnormalities, foliar N levels were examined and are presented overleaf:

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Nitrogen treatments	Foliar N% at ± 22 weeks				
	4R	5R	6R	7R	Mean
N1	1,60	1,42	2,02	1,94	1,75
N2	1,65	1,55	2,08	1,95	1,81
N3	1,71	1,67	2,10	1,95	1,86
N4	1,76	1,74	2,09	2,00	1,90
Mean	1,68	1,60	2,07	2,00	1,83

Mean foliar N% increased sharply from 1,60 in the 5th ratoon to 2,07 in the 6th ratoon, and only declined slightly to 2,00 in the 7th ratoon. In the 6th and 7th ratoons there was little difference between treatments, whereas in the 5th ratoon there was a marked linear increase in foliar N% with nitrogen level as might be expected.

iii) Drying-off x nitrogen interactions. Significant interactions were recorded for cane and ERC yields in the 4th and 5th ratoons (see Table 5). At 60 kg/ha N, cane and ERC yields in both seasons declined with increase in length of drying-off period.
In the 6th ratoon only ERC% cane showed a significant interaction. At all levels of nitrogen there was a general increase in ERC% cane with drying-off, the largest increases being at the 180 and 360 kg/ha N levels.
There were no significant interactions in the 7th ratoon crop.

c) Stalk characteristics: (See Table 4). Drying-off treatments showed little or no variation in stalk characteristics except that treatment D1 differed from D2-4 in the following respects:
i) It had the highest stalk population in the first three crop cycles, and the lowest population in the 7th ratoon.
ii) It lodged more, with lodging being most severe in the 7th ratoon.

Stalk lengths increased with increasing nitrogen level up to 180 kg/ha N, but stalk diameters and lodging were not affected. There was a trend for stalk populations to decrease as nitrogen levels increased, with N1 showing a much higher population than other nitrogen treatments in the 7th ratoon.

DISCUSSION

The sharp increase in foliar N% levels for all nitrogen treatments, especially treatments N1 and N2 from the 5th to 6th ratoons, suggests that the trial may have received more than the extra 50% nitrogen noted before. Other evidence to support this theory was that:
i) Foliar N% levels did not drop much from 6th to 7th ratoons, suggesting that the extra nitrogen had a residual effect on the 7th ratoon.
ii) Growth in the 7th ratoon was noticed to be very vigourous before any nitrogen was applied, which also suggests there was residual nitrogen from the 6th ratoon.
iii) The progressive increase in cane yield from the 5th to 7th ratoons in the N1 treatment, which is unlikely to have been caused by a mere extra 30 kg/ha N.

iv) The marginal foliar N% level used by ZSA for samples taken in March is 1,80, therefore all nitrogen treatments were well above marginal levels in the 6th and 7th ratoons.

These high nitrogen levels in the last two crop cycles interfered with the anticipated quadratic yield response, such that by the 7th ratoon the ERC yield response to nitrogen was non-existent.

The significant ERC yield response to drying-off in the last two crop cycles would also appear to be linked to these high nitrogen levels because:

i) Cane yield did not decline with drying-off in the 6th and 7th ratoons, as there was an adequate supply of nitrogen in all treatments.
ii) Conversely, the general decline in cane yield with drying-off in the 4th and 5th ratoons was due largely to the decline in the low nitrogen (60 kg/ha N) treatment (see Table 5).

Treatment D4 (450mm predicted deficit) gave the best ERC yield except in the 4th ratoon, when the trial experienced water shortages prior to drying-off. The total available moisture (TAM) on this site was estimated to be 150mm, therefore an accumulated deficit of 450mm (D4) would be equivalent to 3 x TAM. This result agrees with results from a previous trial (7300/14), where the treatment with a predicted deficit of 3 x TAM gave sugar yields as good as those for the control.

CONCLUSION

Results from this trial show that cane on Chisumbanje basalts could be dried-off to an accumulated deficit of 450mm (or a value equivalent to 3 x total available moisture on shallower soils), without adverse affect on yield provided:

a) the cane had not been water-stressed prior to drying-off, and
b) the supply of nitrogen had been adequate throughout the growth of the crop.

The benefits of this drying-off regime over drying-off to an accumulated deficit of 150mm were:

a) A considerable saving in water (equivalent to between 5 and 6 irrigations).
b) An improved quality which gave an improved ERC yield, provided there was no decline in cane yield.

There was an interaction between nitrogen and drying-off in that when nitrogen status was low, cane and ERC yields declined with length of drying-off period. The anticipated quadratic yield response to nitrogen was disturbed by extra nitrogen applied in the 6th ratoon, giving atypical responses in the last two crop cycles.

The trial was terminated after the 7th ratoon, inspite of clear-cut results, because it was proving difficult to manage from a distance.

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TABLE 1 : CANE YIELD

TREATMENTS	CANE YIELD t/ha				
	4R	5R	6R	7R	Mean
Main plots:					
D1	107,58	113,07	110,93	108,87	110,11
D2	105,34	110,05	109,79	120,77	111,49
D3	103,14	109,81	112,74	117,87	110,89
D4	96,55	108,58	110,54	118,15	108,46
Significance	*	N.S.	N.S.	N.S.	-
L.S.D. P = 0,05	6,58	-	-	-	-
P = 0,01	9,22	-	-	-	-
S.E. Main plot ±	9,54	13,06	9,61	13,84	-
S.E. Drying-off mean ±	2,13	2,92	2,15	3,09	-
C.V.%	9,25	11,83	8,66	11,89	-
Sub-plots:					
N1	77,62	76,02	98,13	120,34	93,03
N2	105,38	111,61	116,28	116,62	112,47
N3	115,45	126,70	113,86	117,11	118,28
N4	107,68	127,19	115,49	111,59	115,49
Linear effect	***	***	***	***	-
Quadratic effect	***	***	**	-	-
Cubic effect	-	-	*	-	-
L.S.D. P = 0,05	5,91	6,55	7,43	3,74	-
P = 0,01	7,89	8,75	9,92	4,99	-
S.E. sub-plot ±	9,27	10,28	11,65	5,88	-
S.E. Nitrogen mean ±	2,07	2,31	2,61	1,31	-
C.V.%	8,99	9,31	10,50	5,05	-
Interactions	DN'*	DN'*	N.S.	N.S.	-
	-	DN''*	-	-	-
Trial mean	103,16	110,38	110,94	116,41	110,22

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TABLE 2 : ERC % CANE

TREATMENTS	ERC % CANE				
	4R	5R	6R	7R	Mean
Main plots					
D1	13,43	11,74	11,38	13,20	12,44
D2	13,81	12,15	11,89	13,87	12,93
D3	14,24	12,54	12,53	13,80	13,28
D4	14,39	12,84	13,19	14,22	13,55
Significance	***	***	***	**	-
LSD P = 0,05	0,22	0,27	0,43	0,49	-
P = 0,01	0,31	0,38	0,60	0,69	-
S.E. Main plot ±	0,33	0,40	0,62	0,71	-
S.E. Drying-off mean ±	0,07	0,09	0,14	0,16	-
C.V.%	2,02	3,23	5,04	5,18	-
Sub-plots					
N1	14,23	12,45	11,91	13,54	13,03
N2	14,17	12,06	12,35	13,73	13,08
N3	13,05	12,34	12,39	13,87	12,91
N4	13,61	12,42	12,33	13,96	13,08
Linear effect	***	N.S.	***	**	-
Quadratic effect	N.S.	*	**	-	-
Cubic effect	-	-	-	-	-
LSD P = 0,05	0,18	0,26	0,23	0,32	-
P = 0,01	0,24	0,35	0,30	0,43	-
S.E. sub-plot ±	0,07	0,41	0,36	0,51	-
S.E. Nitrogen mean ±	0,06	0,09	0,08	0,11	-
C.V.%	2,02	3,30	2,91	3,70	-
Interactions	N.S.	N.S.	DN'*	N.S.	-
	-	-	DN''*	-	-
Trial mean	13,97	12,32	12,25	13,77	13,08

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TABLE 3 : ERC YIELD t/ha

TREATMENTS	ERC YIELD t/ha				
	4R	5R	6R	7R	Mean
Main plots					
D1	14,42	13,26	12,63	14,31	13,67
D2	14,51	13,35	13,05	16,59	14,38
D3	14,65	13,74	14,11	16,26	14,69
D4	13,89	13,93	14,59	16,96	14,84
Significance	N.S.	N.S.	***	**	-
LSD P = 0,05	-	-	0,76	1,36	-
P = 0,01	-	-	1,07	1,91	-
S.E. Main plot ±	1,37	1,69	1,11	1,97	-
S.E. Drying-off mean ±	0,31	0,38	0,25	0,44	-
C.V.%	9,54	12,47	8,15	12,30	-
Sub-plots					
N1	11,02	9,40	11,65	16,29	12,09
N2	14,92	13,45	14,38	16,02	14,70
N3	16,00	15,65	14,12	16,26	15,51
N4	15,54	15,79	14,24	15,59	15,29
Linear effect	***	***	***	N.S.	-
Quadratic effect	***	***	***	-	-
Cubic effect	-	-	*	-	-
LSD P = 0,05	0,80	0,76	0,88	-	-
P = 0,01	1,07	1,02	1,17	-	-
S.E. sub-plot ±	1,26	1,20	1,38	0,96	-
S.E. Nitrogen mean ±	0,28	0,27	0,31	0,21	-
C.V.%	8,76	8,83	10,11	5,99	-
Interactions	DN'***	DN'*	N.S.	N.S.	-
	DN''*	DN''*	-	-	-
Trial mean	14,37	13,57	13,60	16,04	14,40

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TABLE 4 : STALK DATA 4th - 7th Ratoons

TREATMENTS	STALK COUNTS/ha x 10^{-3}					STALK LENGTHS (m)				
	4R	5R	6R	7R	Mean	4R	5R	6R	7R	Mean
Main plots										
D1	196,5	185,7	194,1	159,9	184,1	1,89	2,00	2,00	2,27	2,04
D2	189,3	178,8	184,4	167,8	180,1	1,86	1,94	2,01	2,28	2,02
D3	191,1	181,2	184,3	167,4	181,0	1,82	1,92	2,05	2,29	2,02
D4	192,0	177,3	185,5	169,4	181,1	1,74	1,90	1,99	2,25	1,97
Sub-plots										
N1	190,5	185,0	197,0	183,7	189,1	1,52	1,53	1,84	2,22	1,78
N2	198,5	184,7	189,7	163,9	184,2	1,83	1,91	2,05	2,28	2,02
N3	191,5	176,4	180,4	162,2	177,6	1,97	2,15	2,12	2,31	2,14
N4	188,0	176,9	180,1	154,6	174,9	1,99	2,16	2,07	2,29	2,13
Trial Mean	192,2	180,7	187,1	166,1	181,5	1,83	1,94	2,02	2,27	2,02

TREATMENTS	STALK DIAMETER (cm)					LODGING %				
	4R	5R	6R	7R	Mean	4R	5R	6R	7R	Mean
Main plots										
D1	2,0	2,0	2,0	2,0	2,0	5,3	17,3	12,5	50,5	21,4
D2	2,0	2,1	2,0	2,0	2,0	1,5	5,5	2,5	30,0	9,9
D3	2,0	2,1	2,0	2,0	2,0	1,5	3,8	0,0	26,0	7,8
D4	2,1	2,1	2,1	2,0	2,1	1,3	7,8	4,0	8,0	5,3
Sub-plots										
N1	1,9	2,0	2,0	1,9	2,0	0,0	7,0	2,5	39,5	12,3
N2	2,0	2,1	2,1	2,1	2,1	0,0	5,8	2,5	30,0	9,6
N3	2,1	2,1	2,1	2,0	2,1	2,0	9,8	2,5	13,5	7,0
N4	2,0	2,1	2,1	2,1	2,1	7,0	11,8	10,0	31,5	15,1
Trial Mean	2,0	2,1	2,0	2,0	2,0	2,4	8,6	5,0	28,6	11,2

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TABLE 5 : INTERACTION TABLES

a) Cane Yield t/ha (Fourth Ratoon)

DRYING - OFF TREATMENTS	NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 150mm predicted deficit	94,09	108,62	111,11	116,51	107,58
D2 250mm " "	79,81	107,74	120,46	113,37	105,34
D3 350mm " "	73,26	104,69	117,05	117,58	103,14
D4 450mm " "	63,31	100,45	113,21	109,26	96,55
Mean	77,62	105,38	115,45	109,68	103,16

Significant interaction : DN'*
L.S.D. P = 0,05 = 11,82
P = 0,01 = 15,79

b) Cane yield t/ha (Fifth Ratoon)

DRYING - OFF TREATMENTS	NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 150mm predicted deficit	90,72	114,60	120,76	126,27	113,07
D2 250mm " "	70,32	110,89	134,29	124,69	110,05
D3 350mm " "	75,04	107,77	124,33	132,09	109,81
D4 450mm " "	68,02	113,17	127,41	125,74	108,58
Mean	76,02	111,61	126,70	127,19	110,38

Significant interactions : DN'* DN''*
L.S.D. P = 0,05 = 13,10
P = 0,01 = 17,50

c) ERC % Cane (Sixth Ratoon)

DRYING - OFF TREATMENTS	NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 150mm predicted deficit	11,31	11,31	11,50	11,39	11,38
D2 250mm " "	11,78	12,08	11,86	11,82	11,89
D3 350mm " "	12,07	12,59	12,98	12,46	12,53
D4 450mm " "	12,49	13,43	13,22	13,63	13,19
Mean	11,91	12,36	12,39	12,33	12,25

Significant interactions : DN'* DN'''*
L.S.D. P = 0,05 = 0,45
P = 0,01 = 0,61

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TABLE 5 cont. : INTERACTION TABLES

d) ERC Yield t/ha (Fourth Ratoon)

DRYING - OFF TREATMENTS	NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 150mm predicted deficit	12,94	14,72	14,66	15,35	14,42
D2 250mm " "	11,28	15,15	16,40	15,21	14,51
D3 350mm " "	10,66	15,27	16,48	16,20	14,65
D4 450mm " "	9,21	14,50	16,45	15,38	13,89
Mean	11,02	14,91	16,00	15,54	14,37

Significant interactions : DN'** DN''*
L.S.D. P = 0,05 = 1,61
P = 0,01 = 2,14

e) ERC yield t/ha (Fifth Ratoon)

DRYING - OFF TREATMENTS	NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 150mm predicted deficit	10,49	13,15	14,27	15,14	13,26
D2 250mm " "	8,61	13,15	16,51	15,14	13,35
D3 350mm " "	9,62	13,28	15,62	16,45	13,74
D4 450mm " "	8,88	14,22	16,20	16,43	13,93
Mean	9,40	13,45	15,65	15,79	13,57

Significant interactions : DN'* DN''*
L.S.D. P = 0,05 = 1,53
P = 0,01 = 2,04

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TABLE 6 : EFFICIENCY OF WATER USE - 4th - 7th Ratoons

DRYING - OFF TREATMENTS	CROP	Accumulated deficit at harvest (mm)	Total Applied water (mm)	Cane Yield t/ha	ERC Yield t/ha	Cane Yield t/ha/100mm Applied water	ERC Yield t/ha/100mm Applied Water
D1 150mm predicted accumulated pan deficit	4R	106	1 492	107,58	14,42	7,21	0,97
	5R	142	1 655	113,07	13,26	6,83	0,80
	6R	145	1 816	110,93	12,63	6,11	0,70
	7R	133	1 912	108,87	14,36	5,69	0,75
	Mean	132	1 719	110,11	13,67	6,46	0,81
D2 250mm predicted accumulated pan deficit	4R	211	1 394	105,34	14,51	7,56	1,04
	5R	248	1 547	110,05	13,35	7,11	0,86
	6R	174	1 773	109,79	13,05	6,19	0,74
	7R	236	1 809	120,47	16,59	6,66	0,92
	Mean	217	1 631	111,41	14,38	6,88	0,89
D3 350mm predicted accumulated pan deficit	4R	335	1 310	103,14	14,65	7,87	1,12
	5R	300	1 474	109,81	13,74	7,45	0,93
	6R	275	1 640	112,74	14,11	6,87	0,86
	7R	350	1 670	117,87	16,26	7,06	0,97
	Mean	315	1 524	110,89	14,69	7,31	0,97
D4 450mm predicted accumulated pan deficit	4R	426	1 267	96,55	13,89	7,62	1,10
	5R	410	1 395	108,58	13,93	7,78	1,00
	6R	388	1 535	110,24	14,59	7,18	0,95
	7R	451	1 572	118,15	16,96	7,52	1,08
	Mean	419	1 442	108,38	14,84	7,53	1,03
MEANS (of all 4 drying-off treatments)	4R	270	1 398	103,16	14,37	7,38	1,03
	5R	275	1 518	110,38	13,57	7,27	0,89
	6R	246	1 691	110,94	13,60	6,56	0,80
	7R	293	1 741	116,41	16,04	6,69	0,92

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SOUTH AFRICAN SUGAR INDUSTRY
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7300/15 DRYING-OFF AND NITROGEN TRIAL

Cat. 1437

Object: To determine the effect of drying-off by cessation of irrigation at pre-determined periods before harvest, and the response of sugarcane to levels of nitrogen fertiliser on Chisumbanje basalt-derived soils.

This crop: Fourth ratoon Age: 12,0 months (11.10.82 to 10.10.83) (formerly 4200/10 : Irrigation and Nitrogen Trial until 11.10.82).

Location: Chisumbanje Experiment Station.

Soil type: Black basalt-derived heavy vertisol clay ± 120cm deep.

Design: Randomised blocks with split-plots, 5 replications.

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

Fertiliser (kg/ha):

N	P_2O_5	K_2O
Various	100	60

Rainfall: 400mm **Irrigation:** Variable

Treatments: a) Whole-plot treatments: four drying-off commencement dates were determined by calculating the predicted accumulated class 'A' pan deficits expected at harvest if irrigation was ceased on these dates. The probability of rainfall during the drying-off period was assumed to be nil. The treatments were, assuming a harvest date of 10.10.83:

Treatment	Predicted accumulated evaporation deficit (mm)	Commencement of drying-off	
		Days before harvest	Date of last irrigation
D1	100 (150)*	13 (20)	27/9 (20/9)
D2	200 (250)	27 (35)	13/9 (5/9)
D3	300 (350)	45 (53)	26/8 (18/8)
D4	400 (450)	66 (75)	5/8 (27/7)

* Figures in brackets represent original proposed treatments.

b) Split-plot treatments consisted of four nitrogen levels:

N1 60 kg/ha N
N2 120 kg/ha N
N3 180 kg/ha N
N4 240 kg/ha N

The nitrogen was applied as ammonium nitrate, 8 weeks after ratooning.

2/Conduct.....

Conduct

a) Original treatments (see paragraph (a) above) were changed because Chisumbanje Experiment Station had no water to irrigate from 7th June (when an irrigation was due) until 5th August (9 days after drying-off was due to commence). A total of 39mm of rain fell druing this period, and 242mm of evaporation accumulated. The whole trial received a mean application of 71mm on 5th August, after which drying-off commenced.

b) An in-row furrow system of irrigation was used, based on a class 'A' open pan deficit of 50mm at full canopy. After 5th August, irrigation was based on a class 'A' pan deficit of 100mm due to scarcity of water. Irrigations coincided with dates of last irrigation given in paragraph (c) under Treatments above.

RESULTS

a) Irrigation data: Actual accumulated pan deficits at harvest were:

Treatment	Accumulated pan deficit from date irrigation ceased to harvest (mm)	
	Predicted	Actual
D1	100	106
D2	200	211
D3	300	335
D4	400	426

11mm of rain fell during the drying-off period, but it did not interfere with drying-off treatments. Evaporation over the same period was higher than expected and all four drying-off treatments had a slightly higher accumulated deficit than predicted. Relevant irrigation data were as follows:

Pre-drying-off period				
No. of irrigations	21	21	21	21
Amount (mm)	832	802	788	792
Mean application (mm)	40	38	38	38
Drying-off period				
No. of irrigations	4	3	2	1
Amount (mm)	260	192	122	75
Mean application (mm)	65	64	61	75
Water applied				
Total irrigation (mm)	1 092	994	910	867
Total rainfall (mm)	400	400	400	400
Total water applied (mm)	1 492	1 394	1 310	1 267
Yields				
TC/ha	107,58	105,34	103,14	96,55
TERC/ha	14,42	14,51	14,65	13,89
Efficiency of water use				
TC/ha/100mm	7,21	7,56	7,87	7,62
TERC/ha/100mm	0,97	1,04	1,12	1,10

The total water applied was at least 200mm less than what might have been expected due to problems with irrigation (see Conduct).

3/b) Yield data....

b) Yield data: Relevant harvest data are shown in Table 1

i) Drying-off treatments. ERC % cane increased whereas cane yield decreased with length of drying-off period. Consequently, TERC/ha showed no response to drying-off. D3 (300mm predicted deficit) was most efficient in terms of TC/ha and TERC/ha per 100mm of water applied.

ii) Nitrogen treatments. Cane yields showed a significant quadratic response to nitrogen, with 100 kg/ha N giving a maximum yield of 115,45 t/ha. ERC % cane declined linearly with an increase in nitrogen level. However, this decline was small compared with the cane yield response, therefore TERC/ha also showed a quadratic response to nitrogen. A maximum of 16,0 TERC/ha was achieved with 180 kg/ha N.

iii) Drying-off x nitrogen interactions. Significant interactions were recorded for cane and ERC yields (see Table 2). The effect of the drying-off regimes was most marked at 60 kg/ha N, where yields decreased with an increase in the length of the drying-off period. At 120 kg/ha N the difference was less marked and at 180 kg/ha N, D1 (100mm predicted deficit) had the lowest yields.

D2, D3 and D4 (200, 300, and 400mm predicted deficit respectively) showed a decrease in ERC yield from 100 to 240 kg/ha N level, whereas D1 (100mm predicted deficit) increased over this range. However, none of these differences were significant.

iv) Stalk characteristics. There was little or no variation in stalk characteristics with drying-off regime. Stalk length increased with nitrogen level, as did lodging, but stalk numbers and diameters were not affected.

CONCLUSIONS

The lack of a significant ERC yield response to drying-off regimes was probably due to the two-month period without irrigation. By the 5th August, when it was irrigated again, the cane showed visible signs of stress. Thus the trial had effectively been dried-off for two months before treatments were imposed. The trial will be continued.

DL/Dec'83
arg

7300/15 DRYING-OFF X NITROGEN TRIAL FOURTH RATOON

TABLE 1 HARVEST DATA

TREATMENTS	CANE YIELD t/ha	ERC % CANE	TERC/ha	STALK COUNTS/ha x 10^{-3}	STALK LENGTHS m	STALK DIAMETER cm	LODGING %
Main plots							
D1 100mm predicted accumulated pan deficit	107,58	13,43	14,42	196,5	1,89	2,0	5,3
D2 200mm " " " "	105,34	13,01	14,51	189,3	1,86	2,0	1,5
D3 300mm " " " "	103,14	14,24	14,65	191,1	1,82	2,0	1,5
D4 400mm " " " "	96,55	14,39	13,89	192,0	1,74	2,1	1,3
Significance	*	***	N.S.	-	-	-	-
L.S.D. P=0,05	6,58	0,22	-	-	-	-	-
P=0,01	9,22	0,31	-	-	-	-	-
S.E. single plot	9,54	0,33	1,37	-	-	-	-
S.E. treatment mean	2,13	0,07	0,31	-	-	-	-
C.V.%	9,25	2,02	9,54	-	-	-	-
Sub-plots							
N1 60 kg/ha N	77,62	14,23	11,02	190,5	1,52	1,9	0,0
N2 120 kg/ha N	105,38	14,17	14,91	193,5	1,83	2,0	0,0
N3 180 kg/ha N	115,45	13,05	16,00	191,5	1,97	2,1	2,0
N4 240 kg/ha N	107,68	13,61	15,54	188,0	1,99	2,0	7,0
Linear effect	***	***	***	-	-	-	-
Quadratic effect	***	N.S.	***	-	-	-	-
L.S.D. P=0,05	5,91	0,18	0,80	-	-	-	-
P=0,01	7,89	0,24	1,07	-	-	-	-
S.E. single plot	9,27	0,07	1,26	-	-	-	-
S.E. treatment mean	2,07	0,06	0,28	-	-	-	-
C.V.%	8,99	2,02	8,76	-	-	-	-
Interactions	DN'*	N.S.	DN'** DN"*	-	-	-	-
Trial mean	103,16	13,97	14,37	192,2	1,83	2,0	2,4

7300/15 DRYING-OFF X NITROGEN TRIAL FOURTH RATOON

TABLE 2: INTERACTION TABLE

a) Cane yield t/ha

DRYING-OFF TREATMENT	LEVELS OF NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 100mm predicted pan deficit	94,09	108,62	111,11	116,51	107,58
D2 200mm " " "	79,81	107,74	120,46	113,37	105,34
D3 300mm " " "	73,26	104,69	117,05	117,58	103,14
D4 400mm " " "	63,31	100,45	113,21	109,26	96,55
MEAN	77,62	105,38	115,45	109,68	103,16

Significant interaction DN'*

L.S.D. P=0,05 = 11,82
L.S.D. P=0,01 = 15,79

b) TERC/ha

DRYING-OFF TREATMENT	LEVELS OF NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 100mm predicted pan deficit	12,94	14,72	14,66	15,35	14,42
D2 200mm " " "	11,28	15,15	16,40	15,21	14,51
D3 300mm " " "	10,66	15,27	16,48	16,20	14,65
D4 400mm " " "	9,21	14,50	16,45	15,38	13,89
MEAN	11,02	14,91	16,00	15,54	14,37

Significant interactions: DN'**
DN''*

L.S.D P=0,05 = 1,61
L.S.D. P=0,01 = 2,14

N1 36

7300/15 DRYING-OFF AND NITROGEN TRIAL

Cat. No.: 1437

Object To determine the effect of drying-off by cessation of irrigation at pre-determined periods before harvest, and the response of sugarcane to levels of nitrogen fertiliser on Chisumbanje basalt-derived soils.

This crop: Fifth ratoon **Age:** 12,0 months(10.10.83 to 08.10.84) (formerly 4200/10: Irrigation and Nitrogen Trial until 11.10.82).

Location: Chisumbanje Experiment Station.

Soil type: Black basalt-derived heavy vertisol clay ± 120cm deep.

Design: Randomised blocks with split-plots, 5 replications

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

Fertiliser (kg/ha):

	N	P_2O_5	K_2O
4th ratoon	Various	100	60
5th ratoon	"	100	60

Rainfall: 445mm **Irrigation:** Variable

Treatments: a) Whole-plot treatments: 4 drying-off commencement dates were determined by calculating the predicted accumulated class 'A' pan deficits expected at harvest if irrigation was stopped on these dates. Probability of rainfall during this period was assumed to be nil. The treatments were; assuming a harvest date of 8.10.84.

Treatment	Predicted accumulated evaporation deficit (mm)	Commencement of drying-off: Days before harvest	Commencement of drying-off: Date of last irrigation
D1	150	20	18.9.84
D2	250	35	3.9.84
D3	350	54	15.8.84
D4	450	77	23.7.84

b) Split-plot treatments consisted of four nitrogen levels:

N1	60 kg/ha N
N2	120 kg/ha N
N3	180 kg/ha N
N4	240 kg/ha N

The nitrogen was applied as ammonium nitrate in two equal applications at 4 weeks and 8 weeks after harvest.

2/Conduct.....

Conduct: a) An in-row furrow system of irrigation was used based on a class 'A' open pan deficit of 50mm at full canopy.

b) There was no water to irrigate with in the Sabi River from 27th August to 26th September. Therefore treatment D2 received its last irrigation on 27th August (earlier than prescribed), and treatment D1 on 26th September (later than prescribed.

RESULTS

a) Irrigation data. Actual accumulated pan deficits at harvest were:

Treatment	Commencement of drying-off		Accumulated pan deficit from date irrigation ceased to harvest.	
	Prescribed	Actual	Predicted	Actual
D1	18.9.84	26.9.84	150	142
D2	3.9.84	27.8.84	250	248
D3	15.8.84	15.8.84	350	300
D4	23.7.84	23.7.84	450	410

A total of 61mm of rain fell during the drying-off period, thus lowering the actual accumulated deficit at harvest in all treatments.

Relevant irrigation data were as follows:

	D1	D2	D3	D4
Pre-drying-off period				
No. of irrigations	20	20	20	20
Amount (mm)	960	944	925	922
Mean application (mm)	48	47	46	46
Drying-off period				
No. of irrigations	5	4	3	1
Amount (mm)	249	158	104	28
Mean application	50	40	35	28
Water applied				
Total irrigation (mm)	1 210	1 102	1 029	950
Total rainfall (mm)	445	445	445	445
Total water applied (mm)	1 655	1 547	1 474	1 395
Yields				
Cane yield t/ha	113,07	110,05	109,81	108,58
ERC yield t/ha	13,26	13,35	13,74	13,93
Efficiency of water use				
Tonnes cane/ha/100mm	6,83	7,11	7,45	7,78
ERC t/ha/100mm	0,80	0,86	0,93	1,00

All treatments received 152mm more water on average in the fifth ratoon than they did in the fourth ratoon. Efficiency of water use was lower in fifth ratoon than in fourth ratoon.

3/Yield data.....

b) Yield data. Relevant yield and stalk data are shown in Tables 1 and 2.

i) Drying-off treatments. In the fourth and fifth ratoons, ERC % cane increased with increase in length of the drying-off period. Cane and ERC yields were not affected by drying-off treatments, except in the fourth ratoon, when cane yield declined with lengthening drying-off periods. Differences in ERC yields between treatments were not significant in either of the two crop cycles.

ii) Nitrogen treatments. Cane and ERC yield showed a significant quadratic response to nitrogen in both seasons. In the fourth ratoon, ERC % cane responded linearly to nitrogen, whereas in the fifth ratoon it showed a quadratic response.

iii) Drying-off x nitrogen interactions. Significant interactions were recorded for cane and ERC yields (see Table 3). At 60 kg/ha N, cane and ERC yields in both seasons declined with increase in length of the drying-off period.

iv) Stalk characteristics. There was little or no variation in stalk characteristics with drying-off regimes, apart from treatment D1 which lodged more than the other treatments in the fifth ratoon. Stalk lengths increased with the increasing nitrogen level, but stalk numbers, diameters and lodging were not affected.

DISCUSSION

Drying-off treatments were adversely affected by water shortages in both seasons. In the fourth ratoon, the trial was not irrigated for two months immediately prior to drying-off. This extra stress was probably why D4 had a lower sugar yield than D3 in the fourth ratoon and not in the fifth ratoon. In the fifth ratoon, only treatments D1 and D2 were affected by water shortage, as other treatments had already received their last irrigations. Treatment D2 received its last irrigation early, and would have had an accumulated deficit greater than the predicted value, had it not rained. Treatment D1 was not irrigated for one month before its last irrigation, thus accumulating a high deficit. As this deficit was not totally depleted by the last irrigation, part of it was added to the evaporation accumulted between the last irrigation and harvest. Thus the accumulated deficit for D1 was very close to the predicted value.

CONCLUSIONS

There was no drop in sugar yield with the increase in the length of the drying-off periods tested in this trial. In the fifth ratoon there was in fact a slight, but not significant, yield benefit by drying-off using a 450mm predicted deficit. The trial will be continued.

DEL/Nov'84
arg

7300/15 DRYING-OFF X NITROGEN TRIAL — FOURTH AND FIFTH RATOON

TABLE 1 HARVEST DATA

TREATMENTS	CANE YIELD t/ha			ERC % CANE			ERC YIELD t/ha		
	4R	5R	Mean	4R	5R	Mean	4R	5R	Mean
Main plots									
D1 150mm predicted accumulated pan deficit	107,58	113,07	110,33	13,43	11,74	12,59	14,42	13,26	13,84
D2 250mm " " " "	105,34	110,05	107,70	13,81	12,15	12,98	14,51	13,35	13,93
D3 350mm " " " "	103,14	109,81	106,48	14,24	12,54	13,39	14,65	13,74	14,20
D4 450mm " " " "	96,55	108,58	102,57	14,39	12,84	13,62	13,89	13,93	13,91
Significance	*	N.S.	-	***	***	-	N.S.	N.S.	-
L.S.D. P=0,05	6,58	-	-	0,22	0,27	-	-	-	-
P=0,01	9,22	-	-	0,31	3,30	-	-	-	-
S.E. single plot	9,54	13,06	-	0,33	0,40	-	1,37	1,69	-
S.E. treatment mean	2,13	2,92	-	0,07	0,09	-	0,31	0,38	-
C.V.%	9,25	11,83	-	2,02	3,23	-	9,54	12,47	-
Sub-plots									
N1 60 kg/ha N	77,62	76,02	76,82	14,23	12,45	13,34	11,02	9,40	10,21
N2 120 kg/ha N	105,38	111,61	108,50	14,17	12,06	13,12	14,91	13,45	14,18
N3 180 kg/ha N	115,45	126,70	121,08	13,05	12,34	12,70	16,00	15,65	15,83
N4 240 kg/ha N	107,68	127,19	117,44	13,61	12,42	13,02	15,54	15,79	15,67
Linear effect	***	***	-	***	N.S.	-	***	***	-
Quadratic effect	***	***	-	N.S.	*	-	***	***	-
L.S.D. P=0,05	5,91	6,55	-	0,18	0,26	-	0,80	0,76	-
P=0,01	7,89	8,75	-	0,24	0,35	-	1,07	1,02	
S.E. single plot	9,27	10,28	-	0,07	0,41	-	1,26	1,20	-
S.E. treatment mean	2,07	2,31	-	0,06	0,09	-	0,28	0,27	-
C.V.%	8,99	9,31	-	2,02	3,30	-	8,76	8,83	-
Interactions	DN'*	DN'*	-	N.S.	N.S.	-	DN'**	DN'*	
	-	DN"*	-	-	-	-	DN"*	DN"*	
Trial mean	103,16	110,38	106,77	13,97	12,32	13,15	14,37	13,57	13,97

7300/15 DRYING-OFF X NITROGEN TRIAL FOURTH AND FIFTH RATOONS

TABLE 2: STALK DATA

TREATMENTS	STALK COUNTS/ha x 10^{-3}			STALK LENGTHS m			STALK DIAMETER cm			LODGING %		
	4R	5R	Mean	4R	5R	Mean	4R	5R	Mean	4R	5R	Mean
Main plots												
D1 150mm predicted pan deficit	196,5	185,7	191,1	1,89	2,00	1,95	2,0	2,0	2,0	5,3	17,3	11,3
D2 250mm " " "	189,3	178,8	184,1	1,86	1,94	1,90	2,0	2,1	2,1	1,5	5,5	3,5
D3 350mm " " "	191,1	181,2	186,2	1,82	1,92	1,87	2,0	2,1	2,1	1,5	3,8	2,7
D4 450mm " " "	192,0	177,3	184,7	1,74	1,90	1,82	2,1	2,1	2,1	1,3	7,8	4,6
Sub-plots												
N1 60 kg/ha N	190,5	185,0	187,8	1,52	1,53	1,53	1,9	2,0	2,0	0,0	7,0	3,5
N2 120 kg/ha N	198,5	184,7	191,6	1,83	1,91	1,87	2,0	2,1	2,1	0,0	5,8	2,9
N3 180 kg/ha N	191,5	176,4	184,0	1,97	2,15	2,06	2,1	2,1	2,1	2,0	9,8	5,9
N4 240 kg/ha N	188,0	176,9	182,5	1,99	2,16	2,08	2,0	2,1	2,1	7,0	11,8	9,4
TRIAL MEAN	192,2	180,7	186,5	1,83	1,94	1,89	2,0	2,1	2,1	2,4	8,6	5,5

7300/15 DRYING-OFF X NITROGEN TRIAL — FOURTH AND FIFTH RATOONS

TABLE 3: INTERACTION TABLES

a) Cane yield t/ha

DRYING-OFF TREATMENT	FOURTH RATOON					FIFTH RATOON				
	LEVELS OF NITROGEN kg/ha				MEAN	LEVELS OF NITROGEN kg/ha				MEAN
	60	120	180	240		60	120	180	240	
D1 150mm predicted pan deficit	94,09	108,62	111,11	116,51	107,58	90,72	114,60	120,76	126,21	113,07
D2 250mm " " "	79,81	107,74	120,46	113,37	105,34	70,32	110,89	134,29	124,69	110,05
D3 350mm " " "	73,26	104,69	117,05	117,58	103,14	75,04	107,77	124,33	132,09	109,01
D4 450mm " " "	63,31	100,45	113,21	109,26	96,55	68,02	113,17	127,41	125,74	108,58
MEAN	77,62	105,38	115,45	109,68	103,16	76,02	111,61	126,70	127,19	110,38
Significant interactions	DN'* L.S.D. P=0,05 = 11,82 P=0,01 = 15,79					DN'* DN"* L.S.D. P=0,05 = 13,10 P=0,01 = 17,50				

b) ERC Yield t/ha

DRYING-OFF TREATMENT	FOURTH RATOON					FIFTH RATOON				
	LEVELS OF NITROGEN kg/ha				MEAN	LEVELS OF NITROGEN kg/ha				MEAN
	60	120	180	240		60	120	180	240	
D1 150mm predicted pan deficit	12,94	14,72	14,66	15,35	14,42	10,49	13,15	14,27	15,14	13,26
D2 250mm " " "	11,28	15,15	16,40	15,21	14,51	8,61	13,15	16,51	15,14	13,35
D3 350mm " " "	10,66	15,27	16,48	16,20	14,65	9,62	13,28	15,62	16,45	13,74
D4 450mm " " "	9,21	14,50	16,45	15,38	13,89	8,88	14,22	16,20	16,43	13,93
MEAN	11,02	14,91	16,00	15,54	14,37	9,40	13,45	15,65	15,79	13,57
Significant interactions	DN'** DN"* L.S.D. P=0,05 = 1,61 P=0,01 = 2,14					DN'* DN"* L.S.D. P=0,05 = 1,53 P=0,01 = 2,04				

N1

SOUTH AFRICAN SUGAR INDUSTRY
AGRONOMISTS' ASSOCIATION

65

7300/15 : DRYING-OFF X NITROGEN TRIAL

Cat: 1437.

OBJECT: To determine the effect of drying-off by cessation of irrigation at pre-determined periods before harvest and the response of sugarcane to levels of nitrogen fertiliser on Chisumbanje basalt soils.

THIS CROP: Sixth ratoon AGE: 12,0 months (8.10.84 - 8.10.85) (formerly 4200/10 : Irrigation and Nitrogen trial until 11.10.82).

LOCATION: Chisumbanje Experiment Station.

SOIL TYPE: Black basalt derived from heavy vertisol clay ± 120 cm deep.

DESIGN: Randomised blocks with split-plots, 5 replications.

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

FERTILISER: (kg/ha)

	N	P_2O_5	K_2O
4R	Various	100	60
5R	"	100	60
6R	"	60	60

RAINFALL/ IRRIGATION:

	Rainfall (mm)	Irrigation (mm)
4R	400	Variable
5R	445	"
6R	775	"

TREATMENTS: a) Whole-plot treatments ; Four drying-off commencement dates were determined by calculating the predicted accumulated class 'A' pan deficit at harvest if irrigation was stopped on these dates. Possibility of rainfall during this period was assumed to be nil. Assuming a harvest date of 8.10.85, the treatments were:

Treatment	Predicted accumulated evaporation deficit (mm)	Commencement of drying-off	
		Days before harvest	Date of last irrigation
D1	150	20	18.9.85
D2	250	35	3.9.85
D3	350	54	15.9.85
D4	450	77	23.7.85

2/b).....

b) Split-plot treatments consisted of four nitrogen levels:

	4th - 5th Ratoon	6th Ratoon
N1	60 kg/ha N	90 kg/ha N
N2	120 kg/ha N	180 kg/ha N
N3	180 kg/ha N	270 kg/ha N
N4	240 kg/ha N	360 kg/ha N

The Nitrogen was applied as ammonium nitrate in two equal applications at 4 weeks and 8 weeks after harvest. The sixth ratoon crop received an extra 50% of nitrogen in a third application at 12 weeks by mistake.

CONDUCT:

a) An in-row furrow system of irrigation was used based on Class 'A' open pan deficit of 50 mm at full canopy.

b) Drying-off treatments in the sixth ratoon crop were not affected by water shortages as they were in the previous two ratoons.

RESULTS

a) Irrigation data: Actual accumulated pan deficits at the sixth ratoon harvest were:-

Treatment	Commencement of drying-off		Accumulated pan deficit from date irrigation ceased to harvest	
	Prescribed	Actual	Predicted(mm)	Actual(mm)
D1	18.9.85	17.9.85	150	145
D2	3.9.85	3.9.85	250	174
D3	15.8.85	15.8.85	350	275
D4	23.7.85	23.7.85	450	388

A total of 53 mm of rain fell during the drying-off period, thus lowering the actual accumulated deficit at harvest in all treatments. The drying-off commencement date for treatment D1 was one day before the prescribed date because between the 14th and 17th of September the trial received 41,0 mm of rainfall. Therefore it was considered unnecessary to apply an irrigation on 18th September, 1985.

Relevent irrigation data for the sixth ratoon crop were as follows overleaf:-

3/ Pre-drying.....

	D1	D2	D3	D4
Pre-drying-off period				
No. of irrigations	17	17	17	17
Amount (mm)	786	788	746	735
Mean application (mm)	46	46	44	43
Drying-off period				
No. of irrigations	6	5	3	1
Amount (mm)	255	210	119	25
Mean application (mm)	43	42	40	25
Water applied				
Total irrigation (mm)	1041	998	865	760
Total rainfall (mm)	775	775	775	775
Total water applied (mm)	1816	1773	1640	1535
Yields				
Cane yield t/ha	110,93	109,79	112,74	110,24
ERC yield t/ha	12,63	13,05	14,11	14,59
Efficiency of water use				
Tonnes cane/ha/100 mm	6,11	6,19	6,87	7,18
ERC t/ha/100 mm	0,70	0,74	0,86	0,95

There was an improvement in efficiency of water use with length of drying-off period. This improvement was more marked for ERC yield than it was for cane yield due to the ERC yield response.

A comparison of water use efficiency for 4th, 5th and sixth ratoons is shown in Table 4. The total amount of water applied (meaned over 4 drying-off treatments) was 1398 mm, 1518 mm and 1391 mm for the 4th, 5th and 6th ratoons respectively. The changes in yield from one ratoon to the next were small, therefore efficiency of water use dropped consistently from 4th to 6th ratoons.

b) Harvest data. Relevent yield and stalk data are shown in Tables 1 and 2.

(i) Drying-off treatments. For the first time since the trial started, the 6th ratoon crop showed a significant ERC yield response to length of drying-off period. In all ratoons there was a good ERC% cane response to drying-off. However, there was no ERC yield response in the 4th and 5th ratoons due to a decline in cane yield with length of drying-off period.

(ii) Nitrogen treatments. Cane and ERC yields showed a significant quadratic response to nitrogen in all three seasons. In the 4th ratoon ERC% cane responded linearly to nitrogen whereas in the fifth and sixth ratoons it showed a quadratic response.

The 6th ratoon crops response to nitrogen was atypical. Treatment N1 had a higher cane yield and a lower ERC% cane value than expected. Treatments N3 and N4 showed a marked drop in cane and ERC yields

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from the 5th to 6th ratoons.

(iii) Drying-off x nitrogen interactions. Significant interactions were recorded for cane and ERC yields in the 4th and 5th ratoons (see Table 3). At 60 kg/ha N cane and ERC yields in both seasons declined with increase in length of drying-off period.

In the 6th ratoon, only ERC% cane showed a significant interaction. At all levels of nitrogen there was a general increase in ERC% cane with drying-off. This increase was largest at the 180 and 360 kg/ha N levels.

(iv) Stalk characteristics. There was little or no variation in stalk characteristics with drying-off regimes. Treatment D1 had the highest stalk count and lodged more than other drying-off treatments.

Stalk lengths increased with increasing nitrogen level up to 180 kg/ha N, but stalk numbers, diameters and lodging were not affected.

DISCUSSION

The 6th ratoon drying-off and nitrogen responses were atypical. There are two possible reasons for this, viz. the trial received more water and more nitrogen than in previous ratoons. The nitrogen response was definately influenced by the extra top dressing, which resulted in a 50% increase in total nitrogen applied to all treatments.

The drying-off response, however, was probably influenced by both extra water and extra nitrogen. Despite the fact that drying-off treatments were administered accordingly to schedule in the 6th ratoon, there was rainfall interference during the drying-off period. Thus, traetments D2, D3, and D4 were not as stressed as in previous ratoons, and this, coupled with the extra nitrogen applied, may have accounted for the lack of yield decline with drying-off.

Thus the improvement in quality in the 6th ratoon resulted in an improved sugar yield for the first time.

CONCLUSION

Drying-off has consistently improved ERC% cane in all seasons. However, there was only an ERC yield benefit in the 6th ratoon when drying-off did not cause a decline in cane yield. The trial will be continued for at least one more season to try and verify or disprove the 6th ratoon response.

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2300/15 : DRYING - OFF X NITROGEN TRIAL

TABLE 1 : YIELD DATA

TREATMENTS	CANE YIELD t/ha				ERC % CANE				ERC YIELD t/ha			
	4R	5R	6R	Mean	4R	5R	6R	Mean	4R	5R	6R	Mean
Main plots												
D1	107,58	113,07	110,93	110,53	13,43	11,74	11,38	12,18	14,42	13,26	12,63	13,44
D2	105,34	110,05	109,79	108,39	13,81	12,15	11,89	12,62	14,51	13,35	13,05	13,63
D3	103,14	109,81	112,74	108,56	14,24	12,54	12,53	13,10	14,65	13,74	14,11	14,17
D4	96,55	108,58	110,24	105,12	14,39	12,84	13,19	13,47	13,89	13,93	14,59	14,14
Significance	*	N.S.	N.S.	-	***	***	***	-	N.S.	N.S.	***	-
L.S.D. p = 0,05	6,58	-	-	-	0,22	0,27	0,43	-	-	-	0,76	-
p = 0,01	9,22	-	-	-	0,31	3,30	0,60	-	-	-	1,07	-
S.E. main plot ±	9,54	13,06	9,61	-	0,33	0,40	0,62	-	1,37	1,69	1,11	-
S.E. Drying-off mean ±	2,13	2,92	2,15	-	0,07	0,09	0,14	-	0,31	0,38	0,25	-
C.V. %	9,25	11,83	8,66	-	2,02	3,23	5,04	-	9,54	12,47	8,15	-
Sub-plots												
N1	77,62	76,02	98,13	83,92	14,23	12,45	11,91	12,86	11,02	9,40	11,65	10,69
N2	105,38	111,61	116,28	111,09	14,17	12,06	12,35	12,86	14,91	13,45	14,38	14,25
N3	115,45	126,70	113,86	118,67	13,05	12,34	12,39	12,59	16,00	15,65	14,12	15,26
N4	107,68	127,19	115,49	116,78	13,61	12,42	12,33	12,79	15,54	15,79	14,24	15,19
Linear effect	***	***	***	-	***	N.S.	***	-	***	***	***	-
Quadratic effect	***	***	**	-	N.S.	*	**	-	***	***	***	-
Cubic effect	-	-	*	-	-	-	-	-	-	-	*	-
L.S.D. p = 0,05	5,91	6,55	7,43	-	0,18	0,26	0,23	-	0,80	0,76	0,88	-
p = 0,01	7,89	8,75	9,92	-	0,24	0,35	0,30	-	1,07	1,02	1,17	-
S.E. sub-plot ±	9,27	10,28	11,65	-	0,07	0,41	0,36	-	1,26	1,20	1,38	-
S.E. Nitrogen mean ±	2,07	2,31	2,61	-	0,06	0,09	0,08	-	0,28	0,27	0,31	-
C.V. %	8,99	9,31	10,50	-	2,02	3,30	2,91	-	8,76	8,83	10,11	-
Interactions	DN'*	DN'*	N.S.	-	N.S.	N.S.	DN'*	-	DN'**	DN'*	N.S.	-
	-	DN''*	-	-	-	-	DN'''*	-	DN''*	DN''*	-	-
Trial mean	103,16	110,38	110,94	108,16	13,97	12,32	12,25	12,85	14,37	13,57	13,60	13,85

7300/15 : DRYING - OFF X NITROGEN TRIAL

TABLE 2 : STALK DATA FOURTH, FIFTH, AND SIXTH RATOONS

TREATMENTS	STALK COUNTS/ha x 10^{-3}				STALK LENGTHS m			
	4R	5R	6R	Mean	4R	5R	6R	Mean
Main-plots								
D1	196,5	185,7	194,1	192,1	1,89	2,00	2,00	1,96
D2	189,3	178,8	184,4	184,2	1,86	1,94	2,01	1,94
D3	191,1	181,2	184,3	185,5	1,82	1,92	2,05	1,93
D4	192,0	177,3	185,5	184,9	1,74	1,90	1,99	1,88
Sub-plots								
N1	190,5	185,0	197,0	190,8	1,52	1,53	1,84	1,63
N2	198,5	184,7	189,7	191,0	1,83	1,91	2,05	1,93
N3	191,5	176,4	180,4	182,8	1,97	2,15	2,12	2,08
N4	188,0	176,9	180,1	181,7	1,99	2,16	2,07	2,07
TRIAL MEAN	192,2	180,7	187,1	186,7	1,83	1,94	2,02	1,93

TREATMENTS	STALK DIAMETER cm				LODGING %			
	4R	5R	6R	Mean	4R	5R	6R	Mean
Main-plots								
D1	2,0	2,0	2,0	2,0	5,3	17,3	12,5	11,7
D2	2,0	2,1	2,0	2,0	1,5	5,5	2,5	3,2
D3	2,0	2,1	2,0	2,0	1,5	3,8	0,0	1,8
D4	2,1	2,1	2,1	2,1	1,3	7,8	4,0	4,4
Sub-plots								
N1	1,9	2,0	2,0	2,0	0,0	7,0	2,5	3,2
N2	2,0	2,1	2,1	2,1	0,0	5,8	2,5	2,8
N3	2,1	2,1	2,1	2,1	2,0	9,8	2,5	4,8
N4	2,0	2,1	2,1	2,1	7,0	11,8	10,0	9,6
TRIAL MEAN	2,0	2,1	2,0	2,0	2,4	8,6	5,0	5,3

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TABLE 3 : INTERACTION TABLES

a) Cane Yield t/ha (Fourth Ratoon)

DRYING - OFF TREATMENTS	NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 150 mm predicted deficit	94,09	108,62	111,11	116,51	107,58
D2 250 mm " "	79,81	107,74	120,46	113,37	105,34
D3 350 mm " "	73,26	104,69	117,05	117,58	103,14
D4 450 mm " "	63,31	100,45	113,21	109,26	96,55
MEAN	77,62	105,38	115,45	109,68	103,16

Significant interaction : DN'*
L.S.D. p = 0,05 = 11,82
p = 0,01 = 15,79

b) Cane yield t/ha (Fifth Ratoon)

DRYING - OFF TREATMENTS	NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 150 mm predicted deficit	90,72	114,60	120,76	126,27	113,07
D2 250 mm " "	70,32	110,89	134,29	124,69	110,05
D3 350 mm " "	75,04	107,77	124,33	132,09	109,81
D4 450 mm " "	68,02	113,17	127,41	125,74	108,58
MEAN	76,02	111,61	126,70	127,19	110,38

Significant interactions : DN' * DN"*
L.S.D. p = 0,05 = 13,10
p = 0,01 = 17,50

c) ERC % Cane (Sixth Ratoon)

DRYING - OFF TREATMENTS	NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 150 mm predicted deficit	11,31	11,31	11,50	11,39	11,38
D2 250 mm " "	11,78	12,08	11,86	11,82	11,89
D3 350 mm " "	12,07	12,59	12,98	12,46	12,53
D4 450 mm " "	12,49	13,43	13,22	13,63	13,19
MEAN	11,91	12,36	12,39	12,33	12,25

Significant interactions : DN'* DN'''*
L.S.D. p = 0,05 = 0,45
p = 0,01 = 0,61

7300/15 : DRYING - OFF X NITROGEN TRIAL

TABLE 3 cont : INTERACTION TABLES

d) ERC Yield t/ha (Fourth Ratoon)

DRYING - OFF TREATMENTS	NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 150 mm predicted deficit	12,94	14,72	14,66	15,35	14,42
D2 250 mm " "	11,28	15,15	16,40	15,21	14,51
D3 350 mm " "	10,66	15,27	16,48	16,20	14,65
D4 450 mm " "	9,21	14,50	16,45	15,38	13,89
MEAN	11,02	14,91	16,00	15,54	14,37

Significant interactions : DN'** DN''*
L.S.D. p = 0,05 = 1,61
p = 0,01 = 2,14

e) ERC yield t/ha (Fifth Ratoon)

DRYING - OFF TREATMENTS	NITROGEN kg/ha				MEAN
	60	120	180	240	
D1 150 mm predicted deficit	10,49	13,15	14,27	15,14	13,26
D2 250 mm " "	8,61	13,15	16,51	15,14	13,35
D3 350 mm " "	9,62	13,28	15,62	16,45	13,74
D4 450 mm " "	8,88	14,22	16,20	16,43	13,93
MEAN	9,40	13,45	15,65	15,79	13,57

Significant interactions : DN'* DN''*
L.S.D. p = 0,05 = 1,53
p = 0,01 = 2,04

7300/15 : DRYING - OFF X NITROGEN TRIAL

TABLE 4 : Efficiency of water use FOURTH, FIFTH, AND SIXTH RATOON

DRYING - OFF TREATMENTS	CROP	Accumulated deficit at harvest (mm)	Total Applied Water (mm)	Cane Yield t/ha	ERC Yield t/ha	Cane Yield t/ha/100 mm Applied water	ERC Yield t/ha/100 mm applied water
D1 150 mm predicted accumulated pan deficit	4R	106	1 492	107,58	14,42	7,21	0,97
	5R	142	1 655	113,07	13,26	6,83	0,80
	6R	145	1 816	110,93	12,63	6,11	0,70
	Mean	131	1 654	110,53	13,43	6,72	0,82
D2 250 mm predicted accumulated pan deficit	4R	211	1 394	105,34	14,51	7,56	1,04
	5R	248	1 547	110,05	13,35	7,11	0,86
	6R	174	1 773	109,79	13,05	6,19	0,74
	Mean	211	1 571	108,39	13,64	6,95	0,88
D3 350 mm predicted accumulated pan deficit	4R	335	1 310	103,14	14,65	7,87	1,12
	5R	300	1 474	109,81	13,74	7,45	0,93
	6R	275	1 640	112,74	14,11	6,87	0,86
	Mean	303	1 475	108,56	14,17	7,40	0,97
D4 450 mm predicted accumulated pan deficit	4R	426	1 267	96,55	13,89	7,62	1,10
	5R	410	1 395	108,58	13,93	7,78	1,00
	6R	388	1 535	110,24	14,59	7,18	0,95
	Mean	408	1 475	105,12	14,14	7,53	1,02
MEANS (of all 4 Drying-off treatments)	4R	270	1 398	103,16	14,37	7,38	1,03
	5R	275	1 518	110,38	13,57	7,27	0,89
	6R	246	1 691	110,94	13,60	6,56	0,80