SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

4200/13 POST-HARVEST IRRIGATION TRIAL

Cat.No. 1751

Object: To compare various methods of saving water in the post-harvest period and to determine their effects of yields.

This crop: Fourth ratoon **Age:** 12,0 months (13.6.89 to 13.6.90)

Location: ZSA Experiment Station, field K3

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

Design: Randomised blocks with split plots.

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

Planted 3rd May, 1985

Harvested:

	Harvest	Age
P	2.7.86	14,0 months
1R	6.7.87	12,2 "
2R	6.6.88.	11,0 "
3R	13.6.89	12,2 "
4R	13.6.90.	12,0 "

Fertiliser:

	N	P_2O_5	K_2O
P	120	100	60
1R-4R	*	60	60

* See treatments

Irrigation/ Rainfall (mm)

	Irrigation	Rainfall
P	1 256	653
1R	*	317
2R	*	686
3R	*	400
4R	*	498

* See treatments

Treatments: (a) Main plots: Post harvest irrigation practice

TREAT-MENTS	Irrigation immediately after harvest	Irrigation at mid point ($\frac{1}{2}$SE) between harvest and stalk elongation	Irrigation at onset of rapid stalk elongation (RSE)	Irrigation according to pan evaporation (Standard practice)
1	X			→
2	X	X		→
3	X		X	→
4	X	X	X	→
5		X	X	→
6		X	X	→

(b) Split plots: Post harvest nitrogen applications

TREAT-MENTS	N applied with first irrigation (kg/ha)	N applied with subsequent irrigation (kg/ha)
1	60	120
2	120	60
3	180	0

Conduct:

1. The third ratoon crop was harvested on 13th June 1989 after which irrigation was applied to treatment I1-I4 on 3 July 1989. All other treatments were applied according to schedules shown above. Subsequent irrigation for all treatments starting from 70 days after harvest reverted to standard practice.

2. Run-off water from plots during irrigations was determined by the use of a Washington flume.

3. All treatments recieved their first nitrogen application with the first irrigation. The second irrigation was as follows: a) Treatment I1-I5 with irrigation at 10 weeks.
   b) Treatment I6 with irrigation at 18 weeks.
   Posphate and Potash for all treatments were applied at 10 weeks.

4. Samples of one auger hole at 15cm intervals to a depth of 90cm were taken from each main plot to determine soil moisture deficit before and after irrigation. Sampling began from the first irrigation to the start of standard irrigation practice.

RESULTS

Relevant irrigation and rainfall data for the fourth ratoon crop are presented in Table 1. Rain (3,5mm) fell during the first 70 days after cutting, but it was not enough to interfere with nitrogen application and irrigation treatments.

(a) Irrigation data: Water applied to treatments other than control prior to start of standard practice varied from 90mm applied to the driest treatment I6 to 290mm applied to I4 (see Table 1).

When the first irrigation was applied soon after harvest and the second with-held until the onset of rapid stalk elongation (70 days after cutting) 40mm was saved without any yield losses (treatment I3). Delaying the first irrigation by more than 39 days after harvest (I5 and I6) reduced cane yield. The greatest yield losses occurred when early irrigation and nitrogen application were delayed for 70 days (I6). This represented a saving of 141mm of water for a 16% cane yield loss.

There was no benefit from increasing water by 59mm over the control (I4) before the onset of rapid stalk elongation of this June harvested cane.

(b) Soil moisture data: (See Table 2). Soil analysis prior to the first irrigation showed complete moisture depletion in the top 90cm of I3 and I4. moisture in I1 and I2 was 13,9 and 7,2 % respectively. Treatment I5 and I6 had high

moisture content at levels below 60cm. Seepage, however had little effect as both treatments gave low yield with I6 giving significantly lower yield than control.

(c) Harvest data: Relevant yield and quality data are presented in Table 3.

There were significant cane, ERC and ERF yield differences between irrigation treatments, with treatment I3 outyielding the rest followed by I2. ERC% cane was highest in I5 but was offset by low cane yeild.

Cane yield differences between nitrogen treatments were small and non-significant. Applying 60 kg/ha N with the first irrigation and 120 kg/ha N with subsequent irrigations gave marginal increases in quality and yield.

(d) Stalk data: Stalk characteristics did not vary much. The N1 treatment gave thinner shorter but more numerous stalks than others (see Table 5). Lodging was greater on treatments that gave higher cane yield and flowering was generally low and variable. There was no significant interactions between stalk characteristics and irrigation treatments.

CONCLUSIONS

Delaying the initial irrigation after harvest by 70 days reduced cane and ERC yields Results have consistently shown good water saving without yield losses when the first irrigation was applied soon after harvest and 6 - 10 weeks thereafter. There was no benefit from applying more water than the standard practice during the first 70 days of the June harvested cane. There has been no consistence in the nitrogen response pattern.

This trial continues into the 5th Ratoon crop.

CN/Nov'90
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Table 1. Irrigation Summary

Date of Irrigation	Days after Harvest	IRRIGATION TREATMENTS					
		I1	I2	I3	I4	I5	I6
3.7.89.	18	101,0	101,0	101,0	101,0	-	-
24.7.89	40	-	99,0	-	99,0	99,0	-
25.7.89.	41	49,0	-	-	-	-	-
15.8.89.	63	51,0	51,0	-	-	-	-
22.8.89	70	30,0	30,0	90,0	90,0	90,0	90,0
	TOTAL	231,0	281,0	191,0	290,0	189,0	90,0
31.8.89 to 7.4.90.		1 041,0	1 041,0	1 041,0	1 041,0	1 041,0	1 041,0
Total Water							
Irrigation		1 272,0	1 322,0	1 232,0	1 331,0	1 230,0	1 131,0
Rainfall		498,0	498,0	498,0	498,0	498,0	498,0
Total water on crop (mm)		1 770,0	1 820,0	1 730,0	1 829,0	1 728,0	1 629,0
Yields (t/ha)							
Cane		119,34	120,37	121,19	114,40	114,69	99,74
ERC		15,12	15,53	15,62	14,89	14,96	13,26
Water use Efficiency							
Cane t/ha per 100 mm		6,74	6,61	7,01	6,25	6,64	6,12
ERC t/ha per 100 mm		0,85	0,85	0,90	0,81	0,87	0,81

Table 2. Soil Moisture Determinations

Date of Sampling	Days Before or After Irrigation	AVAILABLE MOISTURE/TREATMENT (mm/90cm depth)					
		I1	I2	I3	I4	I5	I6
3.7.89.	0	13,85	7,18	0	0	-	-
5.7.89.	+2	99,84	93,33	93,27	97,43	-	-
24.7.89.	0	-	45,49		56,66	40,62	-
26.7.89.	+2	-	-		102,24	105,99	-
25.7.89.	0	34,86	-		-	-	-
27.7.89	+2	83,55	-		-	-	-
15.8.89.	0	30,17	63,27		-	-	-
17.8.89.	+2	80,27	83,76		-	-	-
21.8.89.	-1	63,08	60,26	44,13	43,88	63,18	31,93
24.8.89.	+2	111,71	108,91	113,35	132,98	128,90	126,57

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Table 3. Yield and Quality data at harvest

TREATMENTS	CANE YIELD t/ha	ERC% CANE	ERC YIELD t/ha	ERF% CANE	ERF YIELD t/ha
Irrigation					
I1	119,34	12,68	15,12	14,42	17,20
I2	120,37	12,91	15,53	14,43	17,35
I3	121,18	12,90	15,62	14,50	17,56
I4	114,40	13,01	14,89	14,45	16,54
I5	114,69	13,07	14,96	14,46	16,56
I6	102,31	12,98	13,26	14,60	14,94
Significance	*	N.S.	**	N.S.	*
L.S.D. 5%	12,69	-	1,50	-	1,81
1%	17,55	-	2,07	-	2,50
S.E. main plots ±	14,52	0,46	1,72	0,36	2,08
C.V.%	12,64	3,55	11,55	2,47	12,44
Nitrogen					
N1	118,23	13,04	15,41	14,59	17,24
N2	110,85	12,80	14,16	14,34	15,87
N3	117,07	12,94	15,12	14,50	16,97
Significance	N.S.	N.S.	*	N.S.	**
S.E. Sub-plots ±	12,76	0,55	1,80	0,51	1,90
C.V.%	11,06	4,22	12,05	3,51	11,35
Interaction	N.S.	N.S.	N.S.	N.S.	
Trial mean	115,38	12,93	14,90	14,48	16,69

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Table 4. Interactions

a) ERC% CANE

Irrigation Treatments	NITROGEN			MEAN
	N1	N2	N3	
I1	12,85	12,74	12,45	12,68
I2	12,85	12,99	12,89	12,91
I3	13,15	12,76	12,80	12,90
I4	13,23	12,93	12,87	13,01
I5	13,39	12,68	13,15	13,07
I6	12,76	12,73	13,46	12,98
Mean	13,04	12,80	12,94	12,93

b) CANE YIELD t/ha

Irrigation Treatments	NITROGEN			MEAN
	N1	N2	N3	
I1	121,02	112,13	124,88	119,34
I2	120,82	116,71	123,59	120,37
I3	126,52	115,53	121,51	121,18
I4	120,45	111,75	111,00	114,40
I5	115,42	114,25	114,40	114,69
I6	105,13	94,73	107,07	102,31
Mean	118,23	110,85	117,07	115,38

c) ERC YIELD t/ha

Irrigation Treatments	N1	N2	N3	MEAN
I1	15,55	14,25	15,57	15,12
I2	15,53	15,15	15,92	15,53
I3	16,59	14,74	15,53	15,62
I4	15,96	14,45	14,27	14,89
I5	15,47	14,41	15,01	14,96
I6	13,38	12,00	14,39	13,26
Mean	15,41	14,16	15,12	14,90

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Table 5. Stalk data at harvest

TREATMENTS	STALK COUNTS /ha.x.10^{-3}	STALK LENGTH (m)	CANE DIAMETER (cm/stalk)	STALK LODGING %	STALK FLOWERING %
Main Plots (Irrig)					
I1	155,82	2,61	2,16	5,33	2,7
I2	158,98	2,66	2,22	15,50	7,3
I3	155,89	2,61	2,15	22,67	3,0
I4	157,55	2,51	2,12	8,33	0,3
I5	155,88	2,58	2,13	6,33	5,0
I6	148,57	2,48	2,11	12,00	3,3
Significance	N.S.	N.S.	N.S.	-	-
S.E. Main plots ±	9,63	0,21	0,18	-	-
C.V.%	6,20	8,15	8,27	-	-
Sub-plots (Nitrogen)					
N1	160,02	2,55	2,13	-	-
N2	153,65	2,56	2,16	-	-
N3	152,67	2,62	2,15	-	-
Significance	***	N.S.	N.S.	-	-
S.E. Sub-plots ±	7,74	0,26	0,12	-	-
C.V.%	4,98	10,02	5,67	-	-
Interaction	N.S.	N.S.	N.S.	-	-
Trial mean	155,45	2,57	2,15	11,70	3,6