COMPARISON OF TWO METHODS OF DRYING OFF SUGARCANE

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Abstract

Two trials were conducted during 1973/74 to compare a gradual drying off process based on Class A pan evaporation, and a process in which irrigation was terminated at a predetermined time prior to harvest.

There were no differences between the two methods for July and September harvests, and drying off at 0,5 of pan evaporation for 4 months is recommended for both July and September harvests if the gradual method is used. If irrigation is to be terminated, a total of approximately 230 mm should be allowed to evaporate from a Class A pan between the last irrigation and harvest date.

Drying off does not overcome the adverse effects which late topdressings of N have on cane yield and quality of NCo 376. However, Co 1001 was unaffected by late topdressings.

Although tests of monitoring procedures were complicated by heavy flowering, it appears that the same methods of monitoring maturity can be used for both methods of drying off.

Introduction

Gosnell & Lonsdale[1] reported on trials testing a gradual drying off procedure based on evaporation from a Class A Pan. Two of the trials reported on were altered in the last ratoon to include treatments which involve drying off by ceasing irrigation at different times prior to harvest (Thompson, G. D. & Boyce, J. P.[3]). This paper reports these results and discusses the advantages of the two methods.

Methods and Materials

Two trials were conducted on the site of earlier drying off trials. The original trials were ratooned and the new treatments, except varieties, were re-randomised.

Experiment 1

This trial was harvested in mid July. Six drying off treatments (Table 1) were randomised 4 times in a randomised blocks design. Prior to drying off the trial was irrigated on a pan factor of 1,0.

TABLE 1

Treatments — Experiment 1

Treatment	March	April	May	June	July
D1, Pan ratio	1,0	1,0	1,0	1,0	—
D2, Pan ratio	0,67	0,67	0,67	0,67	—
D3, Pan ratio	0,50	0,50	0,50	0,50	—
D4	Cease irrigation 10 weeks prior to harvest (1st May)				
D5	Cease irrigation 8 weeks prior to harvest (15th May)				
D6	Cease irrigation 6 weeks prior to harvest (1st June)				

The variety was NCo 376 and the experiment was initiated in the 6th ratoon.

Gross plots were 18 m by 15 m and nett plots 8 m by 10 m.

Experiment 2

This trial was harvested in September. Six drying off treatments (Table 2) were randomised in three replications. Whole plots were split for two varieties (NCo 376 and Co 1001) and two N application treatments. Both N treatments had 80 kg/ha N application as ammonium nitrate at ratooning and 80 kg/ha topdressed, N1 being topdressed at 2 months age and N2 at 6 months age.

The trial was started in the 5th ratoon.

Gross plots were 15 m by 9 m and nett plots 10 m by 4,5 m.

TABLE 2

Treatments — Experiment 2

Treatment	May	June	July	August	Sept.
D1, Pan ratio	0,84	0,84	0,84	0,84	—
D2, Pan ratio	0,67	0,67	0,67	0,67	—
D3, Pan ratio	0,50	0,50	0,50	0,50	—
D4	Cease irrigation 10 weeks prior to harvest (1st July)				
D5	Cease irrigation 8 weeks prior to harvest (15th July)				
D6	Cease irrigation 6 weeks prior to harvest (1st August)				

General

Both trials were under sprinkler irrigation and as efficiency was assumed to be 85%, 59,6 mm of total water was applied to give 50,8 mm net.

The soil type for both trials was a PE1 sandy clay loam with an average depth of 75 cm. Data on moisture holding capacity are given in Table 3.

TABLE 3

Soil Moisture Characteristics

Depth (mm)	Field capacity (in field) %	Wilting Point (15 bar) %	Bulk density	Available moisture	
				mm/152 (mm)	Cumulative (mm)
0–152	17,2	6,9	1,48	23,2	23
152–305	19,6	9,1	1,46	23,3	46
305–457	20,2	11,1	1,51	20,9	67
457–610	20,6	12,6	1,50	18,2	86
610–762	20,3	12,6	1,55	18,1	104
762–914	19,0	14,3	1,54	12,4	116

The following tissue moisture contents were determined just before irrigation during drying off: 4/5 joint, 3-6 sheath and spindle. In addition, sucrose, brix, hand refractometer brix, fibre and numbers of green leaves were determined before each irrigation and at harvest.

Direct analysis of cane was employed, using the Jeffco cutter-grinder and Alfa Laval cold extractors. Estimated recoverable sugar % cane was calculated as follows:

e.r.s. % cane = sucrose — 0,451 (brix — sucrose) — 0,077 fibre.

Results

EXPERIMENT 1

TABLE 4

Results of Experiment 1 (6th ratoon)

Treatments	Precipitation (mm)		Tonnes cane/ha	Est. Recov. Sugar % cane	Tonnes Est. Recov. sugar/ha	Estim. Recov. Sugar Yield kg/m³ irrig.	Sucrose % cane	Brix % cane	Fibre % cane	% Purity	% Lodging	Stalk counts '000/ha
	Irrig.	Irrig. plus rain										
D1 (1,0)	994	1 872	117,8	12,22	14,29	1,44	13,99	15,8	12,2	88,3	39	139,1
D2 (0,67)	943	1 821	115,5	12,22	14,10	1,49	14,03	15,8	13,1	88,8	56	139,4
D3 (0,50)	816	1 694	121,8	12,48	15,15	1,86	14,31	16,3	12,2	87,7	36	143,1
D4 (10 weeks)	816	1 694	122,4	12,37	15,12	1,85	14,30	16,6	11,4	86,0	28	145,3
D5 (8 weeks)	841	1 719	116,6	11,69	13,59	1,62	13,64	15,8	12,7	86,3	36	143,1
D6 (6 weeks)	918	1 796	124,7	11,92	14,83	1,62	13,73	15,7	11,8	87,3	42	141,9
L.S.D. 5%			12,27	1,31	0,93	—	1,23	1,15	0,82	2,26	47	10,33
1%			16,97	1,81	1,29	—	1,70	1,59	1,14	3,13	65	14,29
C.V.%			6,80	7,17	4,27	—	5,83	4,78	4,45	1,72	79	4,83

Although there were no significant differences in cane yield or e.r.s.% cane, there were significant differences in t.e.r.s./ha (Table 4). Treatment D5, dried off for 8 weeks, was highly significantly poorer than the best treatment, and drying off at 0,5 of pan proved significantly better than drying off at 0,67.

The only other significant difference between treatments was in fibre content (D4 > D2). Treatments which were dried off by ceasing irrigation generally had a lower fibre content than those which were dried off gradually. Apart from this trend there was little difference between the two methods of drying off, drying off for 10 weeks or at 0,5 of pan being very similar in every other respect.

The total evaporation during the 10 weeks drying off was 241 mm.

TABLE 5.

Monitoring determinations — Experiment 1

Treats	E.r.s. % C	Hand refr. Brix %	Spindle moist. %	3-6 sheath moist. %	4/5 joint moist. %	Number of green leaves
D1	11,42	20,2	72,6	72,4	79,0	9,3
D2	11,38	20,4	73,6	72,6	79,2	9,5
D3	12,12	19,6	73,6	72,8	78,9	9,1
D4	11,25	20,2	74,1	70,8	78,0	9,1
D5	11,52	20,5	72,1	70,8	79,2	9,4
D6	11,36	20,0	72,6	72,4	77,2	10,2

Exceptionally heavy flowering resulted in complications with monitoring maturity (Table 5). Spindle moistures and green leaf counts were high and 4/5 joints and 3-6 sheath moistures were low. (Lonsdale & Gosnell[2] gave optimum values of: 71,7% moisture in the spindle, 7,4 green leaves, 85,3% moisture in the 4/5 joints and 75,5% moisture in the 3-6 sheaths.)

EXPERIMENT 2

TABLE 6

Results of Experiment 2 (5th Ratoon)

Treatments	Precipitation (mm)		Tonnes cane/ha	Est. Recov. Sugar % cane	Tonnes Est. Recov. sugar/ha	Estim. Recov. Sugar Yield kg/m³ irrig.	Sucrose % cane	Brix % cane	Fibre % cane	% Purity	% Lodging	Stalk counts '000/ha
	Irrig.	Irrig. plus rain										
D1 (0,84)	994	1 910	108,3	13,44	14,48	1,46	15,28	17,0	13,5	89,6	97	129,6
D2 (0,67)	918	1 834	108,0	13,94	14,97	1,63	15,69	17,4	12,8	90,2	95	128,1
D3 (0,50)	841	1 757	107,4	14,00	14,99	1,78	15,80	17,6	13,0	89,9	98	131,2
D4 (10 weeks)	816	1 732	104,3	13,94	14,49	1,78	15,78	17,6	13,4	89,7	95	122,4
D5 (8 weeks)	841	1 757	110,9	14,04	15,50	1,84	15,85	17,6	13,1	89,9	85	128,1
D6 (6 weeks)	892	1 808	107,1	13,68	14,60	1,64	15,46	17,1	13,4	90,4	96	124,3
L.S.D. 5%			12,05	0,89	1,72	—	0,82	0,71	0,58	1,45	11	12,04
1%			17,14	1,27	2,44	—	1,16	1,01	0,83	2,07	16	17,13
C.V.%			10,57	3,67	12,96	—	3,55	3,08	6,79	1,07	12	18,14
NCo 376			116,8	13,12	15,32	—	15,01	16,9	13,4	88,8	90,9	154,0
Co 1001			98,5	14,56	14,35	—	16,28	17,9	13,0	91,1	98,3	100,6
Significance			***	***	*	—	***	—	—	—	—	—

There was little difference between drying off at 0,50 for 5 months or ceasing irrigation 8 weeks prior to harvest, even though 41 mm of rain fell about a week prior to harvest. Evaporation during the 8 weeks (ignoring rainfall) was 220 mm.

There were no statistically significant yield differences, or differences in stalk counts, sucrose % cane, brix % cane, purity, lodging and flowering.

Fibre tended to be lower in the treatments dried off gradually.

The same amount of water was used when drying off for 4 months at 0,5 of pan as was used by cutting irrigation 8 weeks prior to harvest. However, slightly higher returns of sugar per unit of water applied, were obtained by the latter treatment.

TABLE 7

Interaction between time of N topdressing and variety in Experiment 2

				L.S.D.	
	NCo 376	Co 1001	N Means	5%	1%
t.e.r.s./ha—					
N1 (2 months)	16,71	14,36	15,54	0,91	1,22
N2 (6 months)	13,94	14,34	14,14		
V Means	15,32	14,35	—		
e.r.s. % c					
N1 (2 months)	13,42	14,78	14,10	0,27	0,36
N2 (6 months)	12,82	14,35	13,58		
V Means	13,12	14,56	—		
Tonnes cane/ha					
N1 (2 months)	124,7	97,0	110,9	6,10	8,15
N2 (6 months)	108,8	100,0	104,4		
V Means	116,8	98,5	—		

A highly significant interaction was obtained between variety and nitrogen treatment. NCo 376 showed marked declines in cane yield and quality with late topdressing of N, whereas Co 1001 was apparently unaffected.

There was no interaction between drying-off and time of topdressing, which indicates that the effects of nitrogen cannot be overcome by more severe drying off.

TABLE 8

Monitoring Determinations — Experiment 2

Variety	Treat.	Sucrose % cane	Hand refr. brix %	Spindle moist. %	3-6 sheath moist. %	4/5 joint moist. %	No. of green leaves
NCo376	D1	14,65	21,9	75,3	70,1	77,1	5,5
	D2	15,04	20,2	76,4	75,4	79,1	6,2
	D3	15,15	22,0	—	76,7	79,3	5,8
	D4	15,01	22,4	—	73,6	65,8	5,5
	D5	15,18	21,0	—	73,9	72,1	5,3
	D6	15,01	21,5	—	72,0	76,9	6,0
Co 1001	D1	15,91	23,6	70,5	71,5	80,1	7,3
	D2	16,34	22,8	73,4	71,1	81,4	7,0
	D3	16,45	23,3	73,1	71,2	81,8	6,2
	D4	16,54	23,1	75,1	72,1	79,1	6,8
	D5	16,53	23,8	71,9	70,5	78,9	6,1
	D6	15,90	22,7	76,0	72,6	81,1	7,5

Heavy flowering of NCo 376 resulted in high spindle moistures, low 4/5 joint moistures, and it also substantially reduced the number of green leaves.

Although Co 1001 did not flower, the number of green leaves was generally lower than in other seasons but tended to be a good indication of maturity. The moisture of 4/5 joints and 3-6 sheaths tended to be lower than the optima given by Lonsdale & Gosnell[2] for NCo 376, but it is not clear whether this is due to variety or season.

Discussion

There is very little difference between the two methods of drying off and in both the July-harvested and the September-harvested trials, drying off for 4 months at 0,5 of pan evaporation or terminating irrigation approximately 230 mm of evaporation prior to harvest, produced similar results.

In the dry season it appears that either method can be used. However, in the rainy season there will be greater certainty of applying stress to the crop by introducing 4 months of gradual drying off, than by terminating irrigation.

As observed by Gosnell & Lonsdale[1] there appeared to be slight differences between the drying off requirements in July and September, in that 0,5 of pan was considerably better than 0,67 in July but not in September. However, drying off at 0,5 of pan seems satisfactory for crops harvested in both these months.

Although the investigation was hampered by flowering it appears that the monitoring techniques recommended by Lonsdale & Gosnell[2] are suitable for both methods of drying off.

Flowering resulted in high spindle moistures presumably because spindles could only be cut from unflowered canes which presumably had not flowered because they were too young. Moisture of 4/5 joints was reduced probably because these joints became pithy in flowered canes. Similarly flowering led to a decline in moisture of 3-6 sheaths.

There were indications that optimum tissue moistures could be lower for Co 1001 than for NCo 376.

Topdressing N when the cane was six months old instead of doing so when it was 2 months old resulted in a highly significant decline in cane yield and quality of NCo 376, but did not affect Co 1001. The adverse effect on NCo 376 could not be overcome by more severe drying off.

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