1975

The influence of time of harvest on yields and CCS and the subsequent ratoon crop. (Growth analysis trials, Bundaberg, 1973-1975)

Moller, RB

BUREAU OF SUGAR EXPERIMENT STATIONS
QUEENSLAND, AUSTRALIA

PROJECT S32(a) GROWTH ANALYSIS TRIALS

BUNDABERG
1973 - 1975

THE INFLUENCE OF TIME OF HARVEST ON YIELDS AND C.C.S. AND THE SUBSEQUENT RATOON CROP

by R.B. Moller

PROJECT S32(a) GROWTH ANALYSIS TRIALS

THE INFLUENCE OF TIME OF HARVEST ON YIELDS AND C.C.S. AND THE SUBSEQUENT RATOON CROP

PROJECT REPORT

INTRODUCTION

This report deals with the second trail of the growth analysis trial programme on the Southern Sugar Experiment Station. Full details of the purpose of this programme are outlined in Project Report 73/1, October, 1973.

EXPERIMENTAL DETAILS

A 3 x 3 factorial split plot trial with four replications was established on a Krasnozem soil on the Southern Sugar Experiment Station, Bundaberg in March and April 1973. Replications 1, 2 and 3 were planted on 26th to 27th March, 1973 and replication 4 on 9th to 10th April, 1973. Each plot consisted of three variety sub-plots, six rows wide x 15.85 m long, suitably randomised. Whole plots were a 3 x 3 factorial of plant harvest times and ratoon harvest times. Suitable width headlands surrounded each plot to facilitate burning at harvest.

The three varieties selected for trial were:-

1. NCo310
2. Q93
3. Q90

Q90, a variety with probable commercial potential, replaced Q47 of the earlier trial.

The trial was planted under very wet soil conditions and germination was a little patchy particularly in some plots of Q90. The field was irrigated in May because of excessive drying out. No further irrigation was necessary.

Ratoons were treated in accordance with district practice. All plots were ratooned, fertilized and cultivated as required. No irrigation was possible during the spring because of the unharvested plots. Good rains were received towards the end of the harvest and thereafter irrigation was unnecessary. In effect, this was an unirrigated trial. Because of the moist location and good rainfall distribution the crop did not suffer greatly through lack of moisture.

As in the first trial, harvest times were spaced as widely as possible. The objective was to have the first harvest coincide as closely as possible with the commencement of district harvesting and the third harvest with the completion of harvest. The second harvest was roughly mid-way between. Actual harvest times were:

	Plant cane	Ratoon cane
First harvest	10/ 7/74	22 to 23/ 7/75
Second harvest	3 to 4/10/74	22/ 9/75
Third harvest	27 to 29/11/74	27 to 28/11/75

Six stalk maturity samples were taken at regular intervals in both crops. The c.c.s. quoted and used for calculation throughout this report is laboratory mill c.c.s. minus 1.5 units. Fibre analysis, using the Jeffco cutter grinder, and the standard method outlined in the Laboratory Manual, were made for each variety of each replication at each harvest time.

RESULTS

Plant cane

Plant crop yields presented in Table 1 show greater variability than data from the previous trial.

This variability was in part attributed to:

1. Rather patchy germination in some plots.
2. Planting interrupted by rain for three weeks.
3. Filed very wet in early crop stage.
4. Severe lodging in part of the field making yield estimation less reliable.
5. Different method of yield assessment for the third harvest period.

Table 1

Tonnes cane per hectare and tonnes sugar per hectare for each variety at each harvest time (plant cane)

Variety	Tonnes cane per hectare				Tonnes sugar per hectare			
	Time of harvest				Time of harvest			
	Early	Mid	Late	Mean	Early	Mid	Late	Mean
NCo310	135.2	137.7	126.5	133.1	13.22	16.24	14.85	14.77
Q93	136.5	148.0	141.6	142.0	14.90	15.41	14.00	14.77
Q90	147.5	151.9	149.6	149.7	13.51	15.09	14.39	14.33
Mean	139.7	145.9	139.2	141.6	13.88	15.58	14.41	14.62
L.s.d.		5%	1%		L.s.d.		5%	1%
Between times		12.89	17.52		Between times		0.27	0.36
Between varieties		5.79	7.69		Between varieties		0.22	0.30

The superiority of Q93 for early harvest was again demonstrated but not to the same degree as in the previous trial. NCo310 compared more favourably in this trial but it is obviously not suitable for early harvest as plant cane. Its mid-season superiority was quite marked.

Table 2

Mean c.c.s. data for each sampling of each variety in the late harvest plots (plant cane)

Variety	Sampling date				
	18/6/74	20/8/74	3/10/74	21/11/74	Mean
NCo310	12.12	15.52	16.13	14.85	14.66
Q93	14.62	15.77	15.11	14.18	14.92
Q90	13.42	14.70	14.99	14.39	14.38
Mean	13.39	15.33	15.41	14.47	14.65

L.s.d.	5%	1%
Between varieties	0.30	0.40
Between harvest times	0.21	0.28
Between times x variety	0.36	0.48

The plant crop as in the previous trial maintained a high c.c.s. late in the season compared to early season c.c.s.

Ratoon cane

Cane yield

There was a distinct increase in yield with age of the crop at harvest, determined both by (a) time of ratoon cane harvest and (b) time of harvest of the previous crop. This was consistent with the findings of the previous trial. Table 3 shows a progressive ratoon crop yield increase with successive harvests, for each plant cane harvest time, and distinct from the previous trial where there was much less increase from mid-season to late season ratoon cane harvest.

Table 3

Yield response in tonnes cane per hectare to time of plant cane and time of ratoon cane harvest

Ratoon cane harvest time	Plant cane harvest time			Mean
	Early	Mid	Late	
Early	90.7	78.9	61.8	77.1
Mid	99.8	88.4	65.7	84.7
Late	109.7	102.7	83.7	98.7
Mean	100.1	90.0	70.4	86.8

L.s.d.	5%	1%
Between plant x ratoon harvest time means	10.79	14.62

Table 4 shows the three varieties reacted similarly in relation to the effect of time of plant cane harvest and time of ratoon cane harvest on ratoon cane yields.

Table 4

Influence of plant cane harvest data and ratoon cane harvest date on ratoon yield (tonnes per hectare) of each variety

Variety	Plant cane harvest time			Ratoon cane harvest time		
	Early	Mid	Late	Early	Mid	Late
NCo310	96.3	85.0	69.2	79.6	79.5	91.4
Q93	98.6	91.7	68.5	75.0	85.4	98.4
Q90	105.3	93.2	73.5	76.7	89.0	106.3
L.s.d.				5%	1%	
Between varieties x harvest times				5.61	7.46	
					5%	1%
					5.60	7.46

Reference to Table 5 shows that NCo310 ratoons from early harvested plant cane were superior to all other ratoons available for early harvest. Their yield was not significantly greater than yields of ratoons from early harvested Q90 and Q93. This result was again similar to the findings of the previous trial.

Table 5

The effect of plant and ratoon cane harvest trials on yield, in tonnes per hectare, of each variety

Plant cane harvest time	NCo310			Q93			Q90		
	Ratoon harvest			Ratoon harvest			Ratoon harvest		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Early	94.3	93.4	101.4	88.7	98.9	108.3	89.1	107.2	119.5
Mid	79.9	83.8	91.3	78.1	89.7	107.4	78.7	91.7	109.3
Late	64.8	61.4	81.4	58.3	67.7	79.5	62.2	68.1	90.1
L.s.d.					5%	1%			
Between any two means					9.71	12.92			

By mid season Q90 ratoons from early harvested plant cane were superior to all other ratoons. This superiority continued through to late ratoon harvest. However, Q93 ratoons from early and mid season plant harvest and Q90 ratoons from mid season plant harvest were fairly comparable and were ahead of any NCo310 ratoons. In this trial, ratoon yield continued to increase with age to harvest time as distinct from the previous trial in which maximum yield was obtained at mid season and thereafter remained constant.

C.C.S.

The relationship between time of ratoon harvest and c.c.s. was less marked in this trial (Table 6). C.C.S. increased from early to mid season harvest but fell by one half unit at late season harvest as distinct from the previous trial in which it rose appreciably at late season harvest. This was mainly due to NCo310 which showed a c.c.s. reduction in excess of one unit (Table 7) while the other two varieties remained relatively constant.

Table 6

Influence of plant and ratoon cane harvest dates on c.c.s.

Ratoon cane harvest time	Plant cane harvest time			Mean
	Early	Mid	Late	
Early	13.43	12.92	12.17	12.84
Mid	14.73	14.45	13.88	14.35
Late	13.87	13.91	13.77	13.85
Mean	14.01	13.76	13.27	13.68

L.s.d.	5%	1%
Between harvest time means	0.45	0.60

Table 7

Varietal c.c.s. at each harvest date

Variety	Ratoon cane harvest time		
	Early	Mid	Late
NCo310	13.09	15.03	13.99
Q93	13.21	14.35	14.03
Q90	12.21	13.69	13.52

L.s.d.	5%	1%
Between harvest times within varieties	0.43	0.58

Late harvest of the plant crop was associated with a reduction of ratoon c.c.s. for all three varieties. This was most marked in Q93 (Table 8). The difference between ratoons from early and mid season harvested plant cane was minimal for all varieties.

Table 8

The influence of plant cane harvest date on the ratoon c.c.s. of each variety

Variety	Plant cane harvest time		
	Early	Mid	Late
NCo310	14.31	14.02	13.78
Q93	14.43	14.03	13.12
Q90	13.29	13.23	12.90
L.s.d.			5% 1%
Between harvest times within varieties			0.43 0.58

Reference to Table 9 indicates NCo310 and Q93 ratoons from early and mid season harvested plant cane are most suitable for early harvest. At mid season the same situation still exists. At late harvest there is very little meaningful difference between any of the three varieties, irrespective of their plant cane harvest times.

Table 9

Effects of plant cane harvest date and ratoon cane harvest date on c.c.s. of each variety

Plant cane harvest time	NCo310			Q93			Q90		
	Ratoon harvest			Ratoon harvest			Ratoon harvest		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Early	13.44	15.23	14.27	13.93	15.13	14.25	12.92	13.85	13.09
Mid	13.46	15.08	13.51	13.18	14.63	14.28	12.11	13.65	13.93
Late	12.39	14.79	14.18	12.52	13.29	13.57	11.59	13.56	13.56
L.s.d.			5%	1%					
Between any two means			0.75	1.00					

Sugar yield

Table 10 shows sugar yield was markedly influenced by both plant and ratoon harvest times. This was not surprising.

Table 10

Influence of times of plant and ratoon harvest on sugar yields

Ratoon cane harvest time	Plant cane harvest time			Mean
	Early	Mid	Late	
Early	12.16	10.19	7.54	9.96
Mid	14.67	12.75	9.08	12.17
Late	15.18	14.31	11.51	13.67
Mean	14.00	12.42	9.38	11.93
L.s.d. Between any two means		5% 1.56	1% 2.08	

The data for individual varieties at each harvest time, Table 11, show there were no significant differences between the following.

(a) Early ratoon harvest: ratoons from all early harvested plant treatments irrespective of variety.

(b) Mid season ratoon harvest: ratoons from all early season harvested plant treatments irrespective of variety.

(c) Late season ratoon harvest: ratoons from all early season harvested plant treatments and mid season harvested Q90 and Q93 treatments.

All the above mentioned ratoons were superior to all other variety x time of harvest combinations.

Table 11

Effects of time of plant cane harvest and time of ratoon cane harvest on yield of tonnes sugar per hectare

Plant cane harvest time	NCo310			Q93			Q90		
	Ratoon harvest			Ratoon harvest			Ratoon harvest		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Early	12.62	14.22	14.40	12.34	14.96	15.44	11.51	14.84	15.70
Mid	10.74	12.65	12.35	10.30	13.11	15.33	9.55	12.50	15.24
Late	8.01	9.08	11.54	7.30	8.98	10.78	7.29	9.19	12.22
L.s.d. Between means		5% 1.34	1% 1.78						

Fibre

No conclusions can be drawn from fibre data presented in Table 12.

Table 12

Fibre per cent cane for each variety for each plant and ratoon cane harvest combination

Plant cane harvest time	NCo310			Q93			Q90		
	Ratoon harvest			Ratoon harvest			Ratoon harvest		
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Early	12.38	14.05	13.36	12.04	13.48	12.95	11.35	12.59	12.71
Mid	12.56	14.06	13.26	13.15	13.63	13.30	11.70	13.24	12.60
Late	12.56	14.23	14.10	12.48	13.50	13.99	11.33	13.20	13.13

INTERPRETATION OF RESULTS

This experiment has confirmed the most important findings of the previous trial. Sugar per hectare yields increased with age of the crop. At each harvest time, the oldest ratoons produced the highest yields. This was due to both cane yield and c.c.s. at early harvest, but at late harvest yield was high but c.c.s. tended to be variable with an overall reduction from the mid season level. One of the features of this trial was the tendency for yield of cane to increase at each ratoon harvest time, irrespective of age of cane i.e. independent of time of plant cane harvest. This relationship was much more evident than in the previous trial.

For all practical purposes, ratoons can be grouped into age classes of 10, 12 and 14 months grown during different periods of the year. This grouping in Table 13 allows a comparison of respective yields. There were also late-early and early-late ratoons of eight and 16 months approximately but these have not been included in the table.

10 month ratoons

The late-mid ratoons suffered reduced yield because their growth commenced in November. The cane yield of the mid-early crop was poor compared to most of the 12 and 14 month ratoons but it was of the same order in the previous trial.

12 month ratoons

Yield differences in the 12 month ratoons were much less than as the previous trial and the yields were lower than the 14 month ratoons. The late-late ratoon produced a better relative cane yield but this was offset by poorer c.c.s.

14 month ratoons

These were the highest yielders of tonnes of cane and tonnes of sugar except for the one 16 month ratoon.

This trial confirms the two major findings of the previous trial:

1. Ratoons grown from late harvested fields produce the smallest crops irrespective of when they are cut.
2. Ratooning of fields harvested late in the season is obviously a poor management practice which should be avoided.

A third finding that ratoon yield is a function of crop age should be recognised when arranging harvesting schedules.

Table 13

Ratoon yields and c.c.s. of each variety in relation to age and period of growth

Growing period	Age months	Variety								
		NCo310				Q93		Q90		
		Cane t/ha	Sugar t/ha	C.C.S.	Cane t/ha	Sugar t/ha	C.C.S.	Cane t/ha	Sugar t/ha	C.C.S.
Mid-early	10	79.9	10.74	13.46	78.1	10.30	13.18	78.7	9.55	12.11
Late-mid	10	61.4	9.08	14.79	67.7	8.98	13.29	68.1	9.19	13.56
Early-early	12	94.3	12.62	13.44	88.7	12.34	13.93	89.1	11.51	12.92
Mid-mid	12	83.8	12.65	15.08	89.7	13.11	14.63	91.7	12.50	13.65
Late-late	12	81.4	11.54	14.18	79.5	10.78	13.57	90.1	12.22	13.56
Early-mid	14	93.4	14.22	15.23	98.9	14.96	15.13	107.2	14.84	13.85
Mid-late	14	91.3	12.35	13.51	107.4	15.33	14.28	109.3	15.24	13.93