BUREAU OF SUGAR EXPERIMENT STATIONS QUEENSLAND, AUSTRALIA

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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

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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. 090

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)

	Tonr	nes cane	per hec	tare	Tonn	es sugar	per hec	tare
Variety	Time of harvest					Time of	harvest	
- 	Early	Mid	Late	Mean	Early	Mid	Late	Mean
NCo310 Q93 Q90 Mean	135.2 136.5 147.5 139.7	137.7 148.0 151.9 145.9	126.5 141.6 149.6 139.2	133.1 142.0 149.7 141.6	13.22 14.90 13.51 13.88	16.24 15.41 15.09 15.58	14.85 14.00 14.39 14.41	14.77 14.77 14.33 14.62
L.s.d. 5% 1% Between times 12.89 17.52 Between varieties 5.79 7.69					L.s.d. Betwee Betwee	n times n variet	5% 0.27 ies 0.22	1% 0.36 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	samplir	ıg	of	each	variety	i'n	the
	late	haı	rvest	plots (pl	ant	cane)		<u> </u>

Variety					
	18/6/74	20/8/74	3/10/74	21/11/74	Mean
NCo310 Q93 Q90 Mean	12.12 14.62 13.42 13.39	15.52 15.77 14.70 15.33	16.13 15.11 14.99 15.41	14.85 14.18 14.39 14.47	$14.66 \\ 14.92 \\ 14.38 \\ 14.65$
L. Be Be	s.d. tween varieti tween harvest tween times 3	ies times variety	5% 0.30 0.21 0.36	1% 0.40 0.28 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 ration cane harvest

Ratoon cane	Plant ca	ane harvest	time		Moon
narvest time	Early	Mid	Late		Mean
Early Mid Late Mean	90.7 99.8 109.7 100.1	78.9 88.4 102.7 90.0	61.8 65.7 83.7 70.4		77.1 84.7 98.7 86.8
L.s.d. Between plant	x ratoon 1	harvest tim	ie means	5% 10.79	1% 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.

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Ia	D I	e	4

Variety	Plant	cane harve	st time	Ratoon	cane harve	st 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.	varieti	5% 1%	5	% 1%		
Between		5.61 7.46	5.6	0 7.46		

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

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	NCo310 Q93					Q90			
harvest	Ratoon harvest		harvest Ratoon harvest			vest	Rato	on harv	vest
time	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late
Early Mid Late	94.3 79.9 64.8	93.4 83.8 61.4	101.4 91.3 81.4	88.7 78.1 58.3	98.9 89.7 67.7	108.3 107.4 79.5	89.1 78.7 62.2	107.2 91.7 68.1	119.5 109.3 90.1
		L.s. Betwo	d. een any	two mea	ins 9	5% .71 12.	1% 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.

T	al	51	е	6
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Ratoon cane	Plant c	Plant cane harvest time				
harvest time	Early	Mid	Late			
Early Mid Late Mean	13.43 14.73 13.87 14.01	12.92 14.45 13.91 13.76	12.17 13.88 13.77 13.27	12.84 14.35 13.85 13.68		
L.s.d. 5% 1% Between harvest time means 0.45 0.60						

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

Table 7

Varietal c.c.s. at each harvest date

Variety	Ratoon	Ratoon cane harvest time				
	Early	Mid	Late			
NCo310 Q93 Q90	13.09 13.21 12.21	15.03 14.35 13.69	13.99 14.03 13.52			
L.s.d. Between ha	rvest times wit	nin varieties	5% 1% 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

Variotu	Plant	cane harvest t	ime			
variety	Early	Mid	Lat	:e		
NCo310 Q93 Q90	14.31 14.43 13.29	14.02 14.03 13.23	13.7 13.1 12.9	78 .2 90		
L.s.d. 5% Between harvest times within varieties 0.43						

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

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.

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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			
	Rato	on harv	rest	Rato	on harv	est	Ratoon harvest			
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late	
Early Mid Late	13.44 13.46 12.39	15.23 15.08 14.79	14.27 13.51 14.18	13.93 13.18 12.52	15.13 14.63 13.29	14.25 14.28 13.57	12.92 12.11 11.59	13.85 13.65 13.56	13.09 13.93 13.56	
L.s.d. Between	any two	means	5% 0.75	1% 1.00						

Sugar yield

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

- 6 -

Table 10

Early

12.16

14.67

15.18

14.00

harvest time

Between any two means

Early Mid

Late

Mean

L.s.d.

- 7 -

THI I GOLD CT CT	nes of prant and ration harvest on	sugar yrerus
Ratoon cane	Plant cane harvest time	
		Mean

Mid

10.19

12,75

14.31

12.42

5%

1.56

Late

7.54

9.08

9.38

11.51

1%

2.08

9.96

12.17

13.67

11.93

Influence (oft	imes	of	plant	and	ration	harvest	ò'n	`sùdàr`	viel	гb
			•••	~ . ~	~	1 0 0 0 0 1 1			JUMUI	V I V I I	U .1

			The	dat	a for	indiv	idual	variet	ies a	it ea	ch	harvest	time,	Table
11,	show	there	were	no	signi	ficant	diffe	erences	betw	veen	the	followi	ng.	

- (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 ration harvest: rations 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			
	Rato	on harv	rest	Rato	on harv	vest	Ratoon harvest			
	Early	Mid	Late	Early	Mid	Late	Early	Mid	Late	
Early Mid Late	12.62 10.74 8.01	14.22 12.65 9.08	14.40 12.35 11.54	12.34 10.30 7.30	14.96 13.11 8.98	15.44 15.33 10.78	11.51 9.55 7.29	14.84 12.50 9.19	15.70 15.24 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

Table 12

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

Fibre per cent cane for each variety for each plant and ration

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

		Variety											
Growing	Age		NCo310			Q93			Q90				
period	months	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			

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