BUREAU OF SUGAR EXPERIMENT STATIONS
QUEENSLAND, AUSTRALIA

FINAL REPORT
SRDC PROJECT BS70S
OPTIMUM TIME OF HARVEST FOR HIGH EARLY SUGAR VARIETIES

by

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SD97012

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This project was funded by the Sugar Research and Development Corporation during 1992/93, 1993/94, 1994/95, 1995/96 and 1996/97 financial years.

BSES Publication **October 1997**
SRDC Final Report SD97012

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1.0 SUMMARY

To assess the optimum time of harvest for high early ccs varieties, two experiments were conducted on the BSES Experiment Station at Bundaberg between 1993 and 1996. The first experiment included eight varieties selected to represent early, mid-season and late maturing varieties, planted in both spring and autumn. The varieties were harvested in May, June, July, August and September in plant, first and second ratoon crops. Ratoon crops were 12 months old at harvest. Data on cane yields and ccs for each harvest date allowed assessment of the benefits of high early ccs varieties for extending the harvest season and for increasing productivity during the normal harvest season.

The second experiment compared variety performance under green cane trash blanketing and conventional burnt cultivation for early season harvesting in May and June. The trial included six varieties, again with a range of maturation characteristics. Data were collected on shoot counts and cane yield, ccs and extraneous matter levels at harvest.

In Experiment 1 the autumn plant cycle performed significantly better than the spring plant cycle mainly due to higher overall cane yields and early season ccs in the plant crop. It was concluded that it would be preferable to establish an early season harvesting program from autumn plant cane, but it was also noted that this meant a loss of yield potential in the plant crop. High early ccs varieties gave higher ccs and sugar yields for early harvests and higher overall crop cycle ccs and sugar yields than mid- to late-season maturing varieties. In particular, the recently released high early ccs varieties Q151 and Q155 out-yielded all other varieties in the trial and performed well throughout the harvest season. Average sugar yields for these varieties over the full autumn and spring plant crop cycles was 16.5 tonnes sugar/ha compared to 15.1 tonnes sugar/ha for the older varieties Q141, Q146 and CP51-21, 15.2 tonnes sugar/ha for the late maturing variety Q150 and 12.6 tonnes sugar/ha for Q110 and CP44-101.

Gross returns were calculated for a range of early season harvesting strategies and trial results indicated a significant reduction in returns for a May to September harvest season compared to June to September. For non-selective harvesting of varieties with different maturity characteristics the inclusion of high early ccs varieties increased gross returns significantly. Benefits from high early ccs varieties were increased if they were harvested selectively in May and June. The greatest returns were obtained where Q151 and Q155 were harvested selectively in May and June.

In Experiment 2 green cane trash blanketing gave a small increase in cane and sugar yields over first and second ratoon crops for combined May and June harvest dates. This trend was not consistent over first and second ratoon crops with burnt cane performing better in the first ratoon crop and the green cane trash blanket better in the second ratoon. The reverse trends were mainly due to lower ccs under a trash blanket in the first ratoon and higher ccs and cane yield in the second ratoon.

There was a significant clone by year interaction with only Q155 giving a positive response to trash blanketing in the first ratoon and all varieties except Q151 responding

positively in the second ratoon. Q155 showed the greatest overall response to trash blanketing.
Harvesting in May compared to June had no impact on cane yield in either burnt or green cane trash blanketed treatments but sugar yield was reduced due to the lower ccs as expected. As for Experiment 1 the high early season ccs varieties Q151 and Q155 clearly out-yielded other varieties in the trial.

Stalk counts taken after harvest of the first ratoon crop showed no adverse effect from green cane trash blanketing for the May harvest but stalk numbers were reduced following the June harvest. Stalk numbers had almost recovered by the final count in early December.

Extraneous matter levels recorded at harvest of the first ratoon crop were higher for the May harvest than the June harvest. This was attributed to heavier tops at the May harvest. It is likely that the trash blanket would be thicker for early season harvests as a result.

2.0 BACKGROUND

Most sugarcane varieties have an optimum relative ccs at particular times of the season, for example, early, mid or late. Varieties with different ccs curves provide options for the maximisation of sugar production. As ccs is lowest and varietal differences are greatest early in the season, the harvest of high early sugar varieties at the appropriate time will maximise sugar production and provide greater opportunity for extension of the harvest season.

Preliminary studies (BS25S) Cox *et al.* (1994) identified a number of clones with early ccs levels much greater than current commercial varieties. Breeding and selection for early sugar is now being practised with selected clones being included in the core program. The program has already resulted in the release of varieties for the southern region with high early ccs.

In order to maximise total productivity through strategic use of these varieties for early harvest, reliable information is needed on early cane yield, ratoon performance after an early harvest, and on ccs levels both prior to and at normal harvest start times. Farming systems appropriate to early harvest need to be developed and the effect of green cane trash blanketing on ratooning needs to be assessed. Provided production is not compromised through timely harvest for ccs, the gains in returns to growers and millers will be large.

3.0 OBJECTIVES

- Determine yield and ccs of cane varieties, particularly high early ccs types at various times during the season.
- Evaluate ratooning of varieties harvested at different times.
- Assess the effect of harvesting system on ratoon performance.

- Examine the economic implications of strategic timing in the harvest of varieties.

4.0 METHODOLOGY

The trial program consisted of two experiments planted in 1993 and designed to test a range of varieties under various harvest schedules from pre-season to mid-season. Details of the experiments are as follows:

Experiment 1:

8 varieties:	CP44-101, CP51-21, Q110, Q141, Q146, Q150, Q151, Q155. These include early to late maturing varieties.
Planting times:	Autumn (15.4.93), and Spring (1.10.93)
Harvest times:	Five times including May, June, July, August and September. All ratoon crops were cut at approximately 12 months of age and the plant crop at various ages from 8 months to 17 months depending on planting time and harvest date.
Replicates:	3

Experiment 2:

6 varieties:	Q110, Q141, Q146, Q150, Q151, Q155. These include early to late maturing varieties.
Planting times:	Autumn (20.4.93)
Harvest times:	May and June
Cultural treatments:	Green and burnt
Replicates:	3

Both experiments were randomised complete-block designs with plots consisting of 4 rows, 1.5 m apart and 8 m in length. Data, collected from the centre 2 rows, include ccs, cane yield, sugar yield, stalk counts, fibre and conductivity (some harvests). All treatments were cut green and in the appropriate plots trash was subsequently raked and burnt. Experiment 1 was furrow irrigated and Experiment 2 spray irrigated. Analyses of variance were conducted.

5.0 RESULTS AND DISCUSSION

5.1 Experiment 1

5.1.1 CCS trends

The overall ccs trends for each crop class at different times of harvest averaged over all varieties for the autumn and spring plant cycles are given in Figure 1.

In the plant crop there was a large depression in ccs for spring plant cane compared to autumn plant cane for harvests in May and June of approximately 5.5 and 5.1 units, respectively. This differential was reduced to 2.0 units at the July harvest. Over the full crop cycle the autumn plant cane ccs was one unit higher than for spring plant cane (Table 1). This indicates that it may be preferable to use autumn plant cane for setting up an early harvest cycle.

Table 1: Cane yields, ccs and sugar yield comparisons for autumn and spring plant crop cycles over all varieties

Crop class	Cane yield t/ha		CCS		Sugar yield t/ha	
	autumn	spring	autumn	spring	autumn	spring
Plant	134.2	101.7	15.54	12.65	20.93	13.22
First ratoon	91.9	100.3	14.38	14.40	13.20	14.47
Second ratoon	91.7	98.5	14.14	14.03	13.10	13.90
Cycle mean	105.9	100.2	14.69	13.69	15.74	13.86

In both plant and second ratoon crops there was a depression in ccs of 2.0 to 3.0 units at the May harvest time compared to the normal season starting time in June, but this was less pronounced in the first ratoon crop (Figure 1).

Mean ccs levels for the different harvest dates over the full crop cycle are given in Table 2. These confirm the trends indicated in Figure 1 with an average ccs depression in May, June and July harvests for the spring plant cycle of 1.9, 1.4 and 0.8 units, respectively.

CCS curves for individual varieties over the full crop cycle are shown in Figure 2. As clone x plant, clone x harvest x plant, and clone x harvest x plant x year interactions were not significant (Appendix 2), these curves were averaged over three crops and autumn and spring plants. The shape of these curves is similar for the early maturing varieties CP51-21, Q146, Q151 and Q155 starting at approximately 12 ccs and peaking at around 17 ccs. The older varieties CP44-01 and Q110 and the vigorous, late maturing variety Q150 started the season at approximately 9 ccs, peaking at 16 ccs. The mid-season variety, Q141, commenced the season at a ccs of 10, peaking at approximately 17 ccs. These figures clearly show the early season gains in ccs for recently released early ccs varieties (Q151 and Q155) and the older early maturing varieties (CP51-21 and Q146). They also indicate some potential for selective harvesting of varieties to take advantage of high early ccs.

Fig.1 Monthly ccs, cane yield, and sugar yield for autumn and spring planted crops

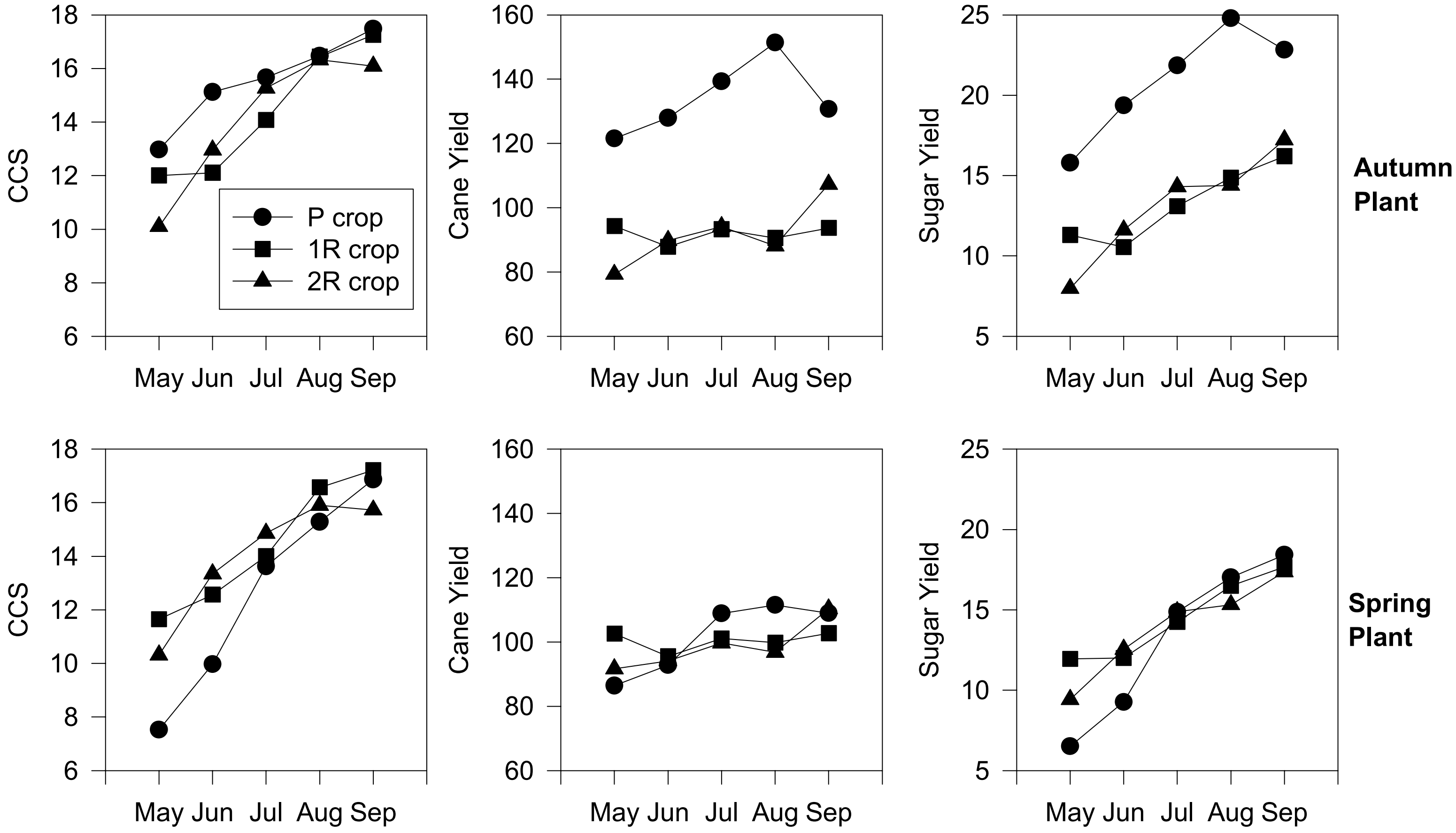


Fig. 2 Seasonal ccs response of varieties averaged over two plantings and three crop classes

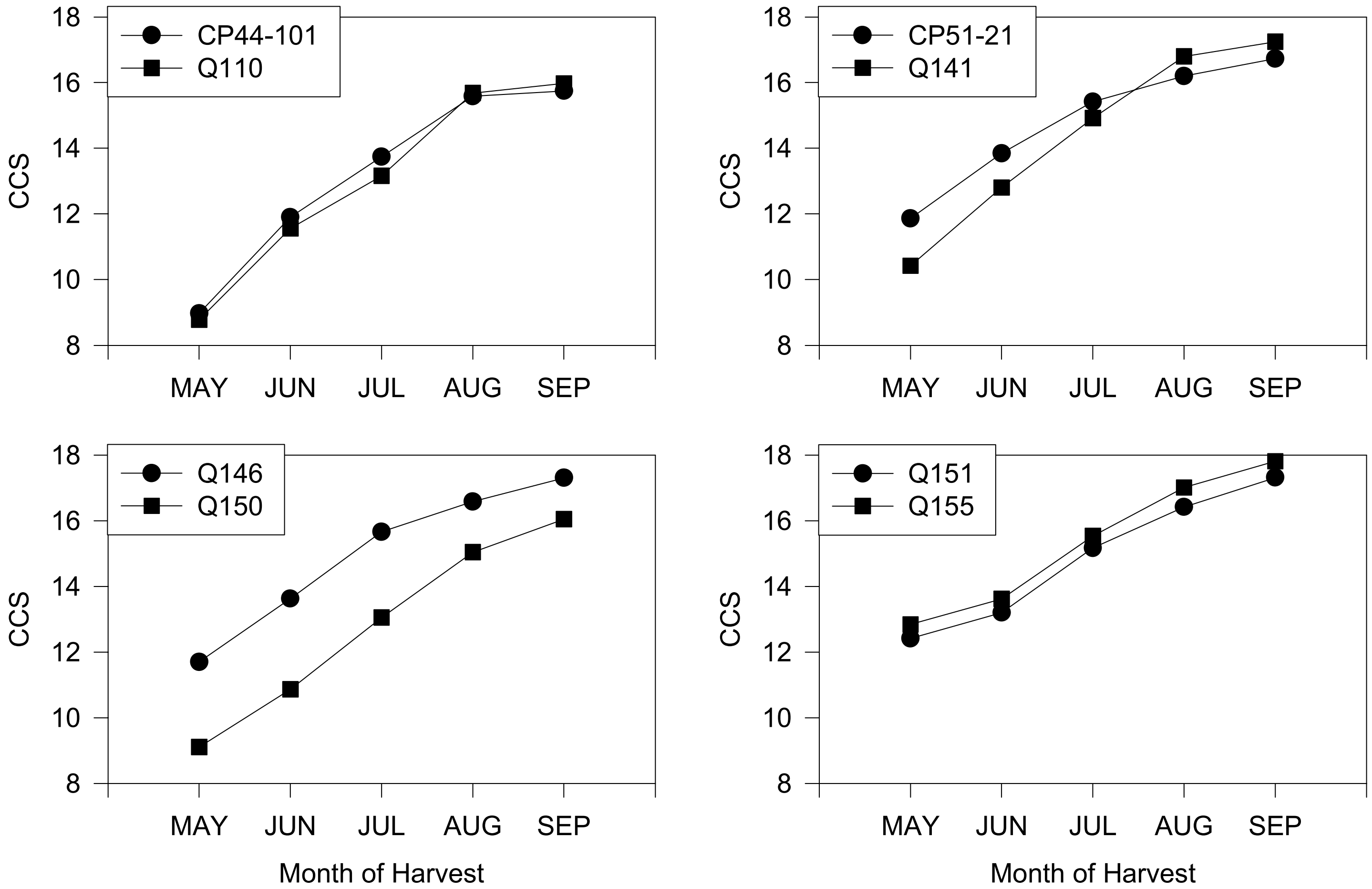


Table 2: Mean ccs, cane yield and sugar yield for different harvest dates over the full autumn and spring plant cycles

Time of harvest	Cane yield t/ha		CCS		Sugar yield t/ha	
	autumn	spring	autumn	spring	autumn	spring
May	100.0	94.5	11.69	9.83	11.69	9.29
June	103.4	94.2	13.39	11.96	13.84	11.27
July	109.5	97.7	15.00	14.16	16.42	14.66
August	109.8	102.3	16.41	15.92	18.02	16.28
September	110.7	107.3	16.94	16.60	18.75	17.82

CCS comparisons between spring and autumn plant cane over all harvests of plant, first and second ratoon crops are shown in Figure 3. This shows that ccs differed significantly only in the plant crop.

Average crop cycle ccs for the eight varieties for autumn and spring plant cane and all times of harvest are compared in Figure 4. This again shows the superior performance of Q155, Q151, Q146, Q141 and CP51-21 compared to the older varieties CP44-101 and Q110 and the vigorous variety Q150.

5.1.2 Cane yield comparisons

The overall cane yield trends for different crop classes and times of harvest are shown in Figure 1. Cane yields at successive harvests in the plant crop show growth of approximately 30 and 25 tonnes/ha, respectively in autumn and spring plant cane between May and August, followed by a fall in yield in September, presumably due to drying off. This indicates a loss of yield potential in plant cane with early harvesting under the growing conditions in the 1993-94 season.

There was a strong differential in yield in the plant crop between autumn and spring plant cane as expected with an age difference of 5.5 months.

All ratoon crops were harvested at approximately 12 months of age and there was little effect of time of harvest on yields (Figure 1). The apparent increase in yield between August and September harvests in the second ratoon crop may be due to rainfall just prior to the September harvest.

Yield comparisons between spring and autumn plant cycles for plant, first and second ratoon crops are shown in Figure 3. In ratoons, cane yields were higher following spring plant cane than following autumn plant cane. Overall crop cycle yields are summarised in Table 1. These indicate only marginally higher average yields for the autumn plant cycle than for the spring plant cycle. This is due to the opposing yield trends in the plant and ratoon crops.

Fig. 3 CCS, cane yield (TCH), and sugar yield (TSH) in three crop classes (plant, first (1R), and second (2R) ratoon crops) following autumn and spring plantings

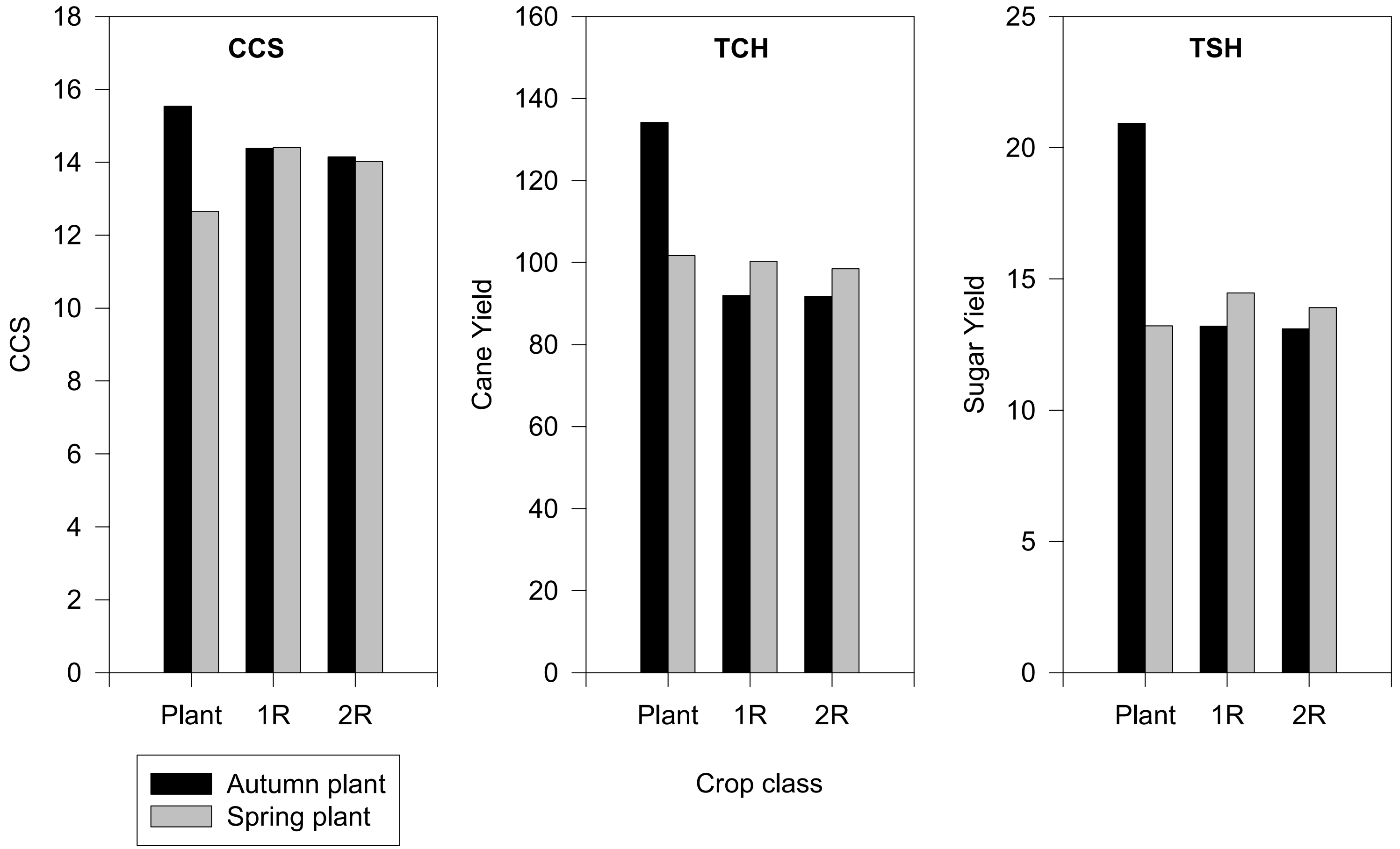
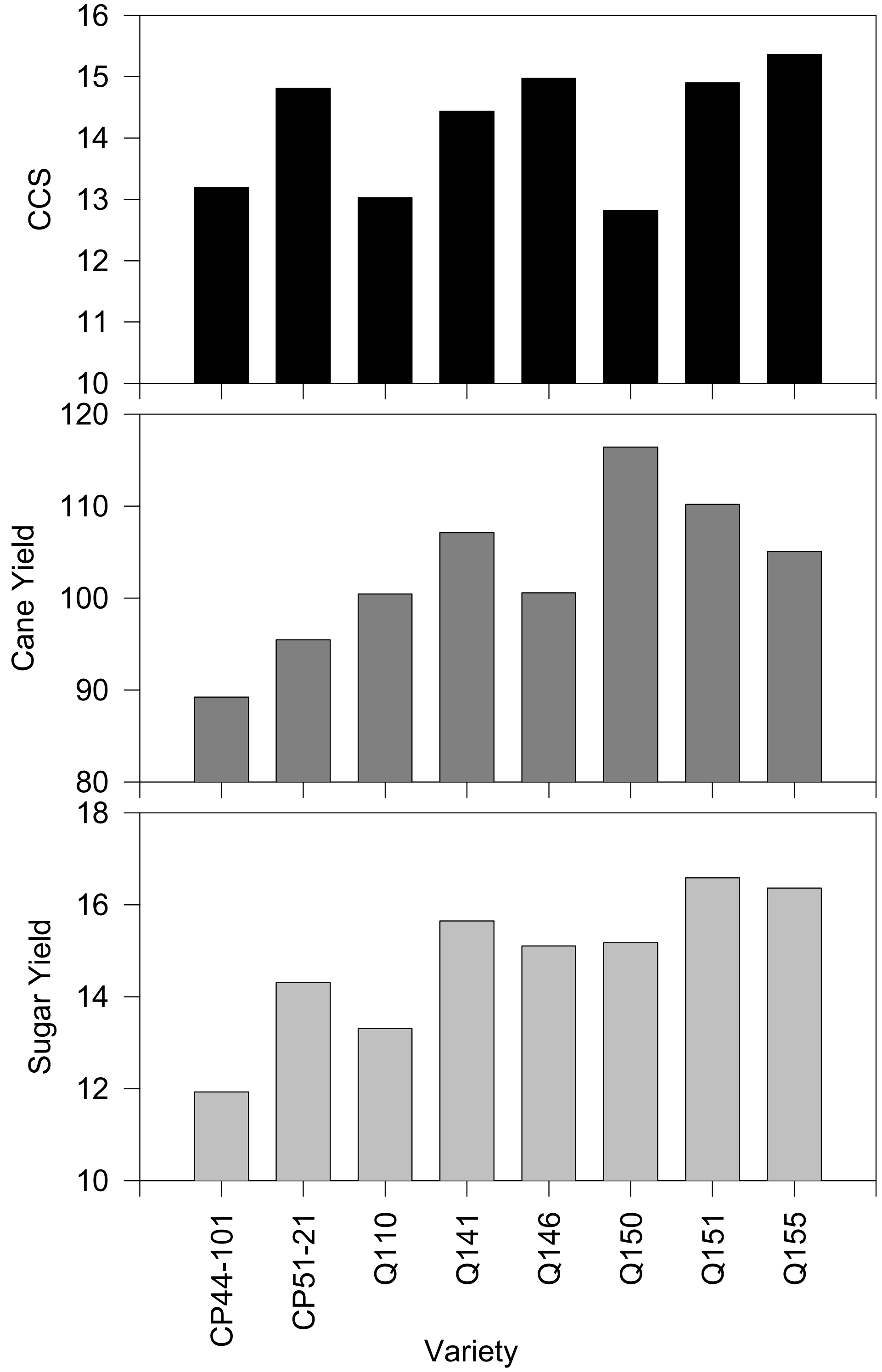


Fig. 4 Average productivity of eight varieties over two plantings, five times of harvest, and three crops



Yields for the different harvest dates over the full autumn and spring plant cycles are summarised in Table 2. In the autumn plant cycle there is some loss in yield for the May and June harvests only; but in the spring plant cycle there is a gradual increase in yield up to the final harvest in September.

Mean varietal yields for the spring and autumn plant cycles and for a combined cycle are summarised in Table 3 and Figure 4.

Table 3: Cane yield comparisons for varieties in the spring and autumn plant and combined cycles

Variety	Cane yield t/ha		
	spring	autumn	combined
CP44-101	86.6	91.9	89.2
CP51-21	93.2	97.8	95.5
Q110	99.6	101.3	100.4
Q141	105.7	108.6	107.1
Q146	99.6	101.5	100.6
Q150	107.0	125.8	116.4
Q151	105.7	114.7	110.2
Q155	104.1	106.0	105.0

These indicate a general upward progression in yields between older and more recently released varieties, with the vigorous variety Q150 giving the highest overall cane yield. Analysis of variance showed there was a significant interaction between clone and planting time for cane yield (Appendix 2).

5.1.3 Sugar yield comparisons

Mean squares (with significance levels) and coefficients of variation (CVs) for each individual harvest are provided in Appendix 1. Coefficients of variation (6.1-17.3, mean 11.2) indicated that trials were conducted with reasonable precision.

Sugar yield trends for different times of harvest and crop classes in the autumn and spring plant cycles are shown in Figure 1.

These show the expected sugar yield increase during the season with crop maturity and growth (plant crops only) and a large difference in plant crop sugar yield between autumn and spring plant crops at all harvest times. Except for the May and June harvests in immature cane the spring plant crop gave similar yields to 12 month old ratoon cane.

The mean sugar yields for the autumn and spring plant cycles over all harvest times are shown in Table 1 and Figure 3. As mentioned above there is a large differential in sugar yield between autumn and spring plant cane due to both ccs and cane yield benefits, and over the full cycle this amounts to 1.9 tonnes sugar per harvested hectare.

For all the individual harvest dates there is a yield benefit in the autumn plant cycle compared to the spring plant cycle as illustrated in Table 2. The difference ranges from a high of 2.6 tonnes sugar/ha in June to 0.9 tonnes sugar/ha in September.

Crop cycle sugar yields averaged over autumn and spring plant for the eight varieties are illustrated in Figure 4. Q151 and Q155 performed very well, followed by Q141, Q146 and Q150, Q110 and CP44-101. Again this illustrates the high yield potential of the recently released high early ccs varieties, Q151 and Q155. The vigorous variety Q150 was shown to have less potential due to its low ccs.

5.1.4 Economic benefit from high early ccs varieties

To assess the economic benefit from high early ccs varieties using the trial data from Experiment 1, mean cane yield, ccs and sugar yield averaged over all crops were calculated for six scenarios:

1. Grouping the four mid- to late-season varieties together - CP44-101, Q110, Q141 and Q150.
2. Using mean data for all varieties.
3. Simulated harvesting of the four high early ccs varieties in May and June (CP51-21, Q146, Q151 and Q155) and all trial varieties from then on.
4. Simulated harvesting of the highest yielding early maturing varieties in May and June (Q151 and Q155) and all trial varieties from then on.
5. Full season harvesting of only the early maturing varieties (CP51-21, Q146, Q151 and Q155).
6. Full season harvesting of only Q151 and Q155.

These six scenarios were evaluated for a May to September and a June to September harvest season. The yield and ccs data were then used to calculate net return to growers after deducting harvest costs (Table 4).

The figures in Table 4 and Figure 5 indicate the relative gain from including early maturing varieties in the harvest program. If these are harvested non-selectively throughout the season, the net gain is $226/ha and $215/ha for May-September and June-September harvest seasons, respectively. Where only early maturing varieties are harvested in May and June the gains are $393/ha and $287/ha, respectively. If only the recently released high early ccs varieties Q151 and Q155 are harvested in May and June the gains are $446/ha and $310/ha, respectively. Where only high early maturing varieties are considered for the full season the gains are $516/ha and $439/ha, respectively. Similarly, for Q151 and Q155 harvested throughout the season, the net gains are $697/ha and $623/ha, respectively. A further scenario with Q151 and Q155 harvested up to August and Q141 and Q150 in September gave similar results to scenario 6.

For the various harvest scenarios, the high early ccs varieties produce greater gains for a May-September harvest season than a June-September harvest season as expected. Also because of their high productivity in Experiment 1, returns would be greater if only high early ccs varieties were harvested all season; and if Q151 and Q155 were harvested exclusively. This reflects the gains in both ccs and total productivity with Q151 and Q155 in particular, and with CP51-21, Q146, Q151 and Q155 as a group.

The selection of high early ccs varieties was demonstrated to be beneficial both for selective early ccs harvesting and for improving full season productivity.

Table 4: An economic assessment of high early ccs varieties for May to September and June to September harvest seasons

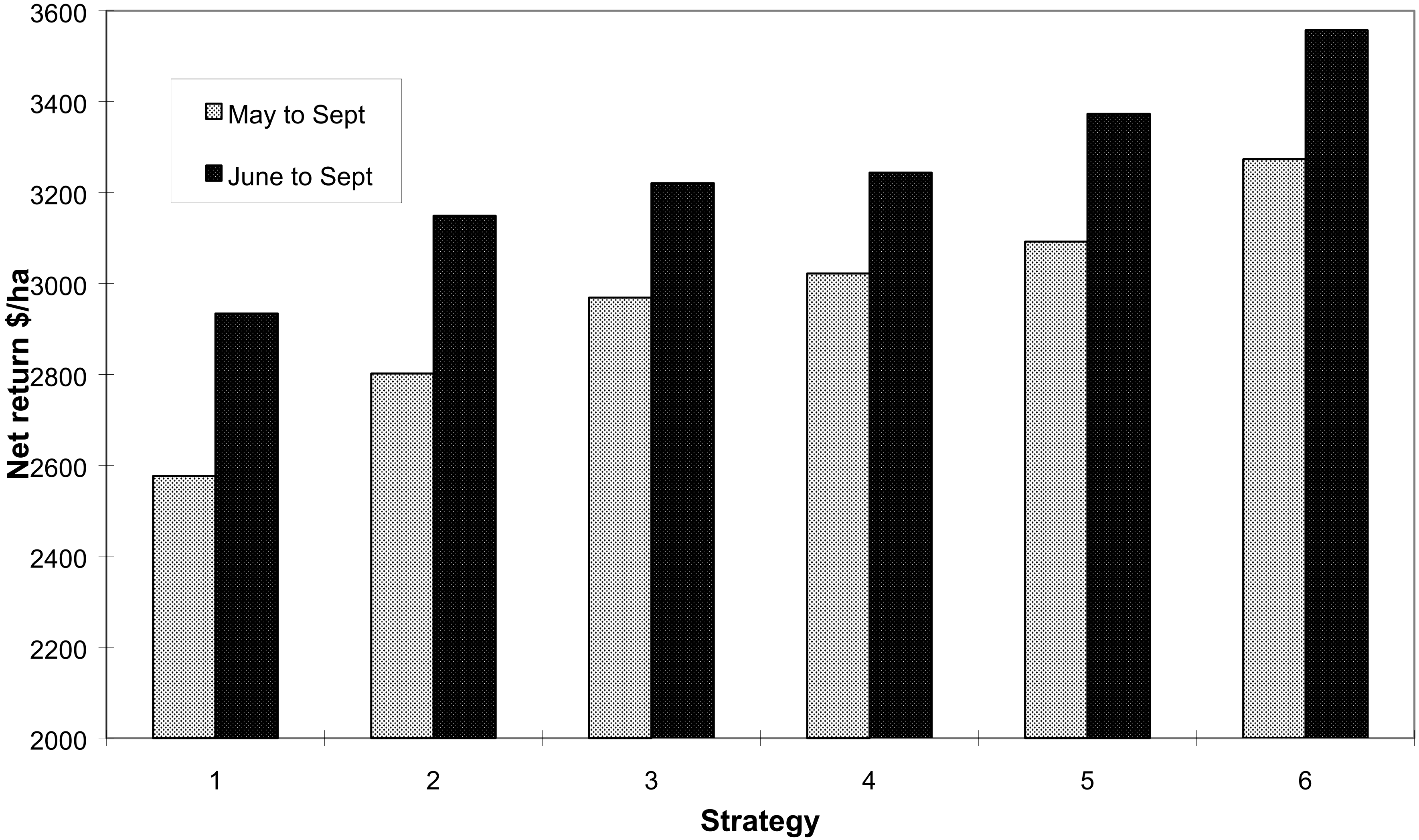
Harvest season* /variety group	Cane yield		Net return $/ha**	Gain $/ha#
	t/ha	ccs		
May to September				
1	103.3	13.48	2 576	-
2	103.1	14.19	2 802	226
3	102.7	14.74	2 969	393
4	104.3	14.76	3 022	446
5	102.8	15.11	3 092	516
6	107.6	15.22	3 273	697
June to September				
1	104.8	14.45	2 934	-
2	104.8	15.10	3 149	215
3	104.8	15.32	3 221	287
4	106.3	15.25	3 244	310
5	105.0	15.76	3 373	439
6	110.4	15.79	3 557	623

* 1 = Variety group CP44-101, Q110, Q141, Q150
2 = All trial varieties
3 = Group (CP51-21, Q146, Q151, Q155) in May-June, all varieties rest of season
4 = Group (Q151, Q155) in May-June, all varieties rest of season
5 = Group (CP51-21, Q146, Q151, Q155) harvested all season
6 = Group (Q151, Q155) harvested all season

** Assuming sugar price of $350/tonne sugar and harvesting cost $5.50 per tonne cane
Price of cane = {0.009 Price Sugar (ccs-4)} + 0.578

Relative to mid- to late-maturing varieties in trial (Group 1)

Fig. 5 Net return from different harvesting strategies for varieties



5.2 Experiment 2

5.2.1 CCS trends

CCS comparisons between burnt cane cultivation and green cane trash blanketing for the six trial varieties, averaged over the two times of harvest and first and second ratoon cane, are shown in Figure 6. Q155 is the only variety to show an overall ccs benefit from green cane trash blanketing, with little difference in ccs for Q141, Q150 and Q151 and a depression in ccs in Q110 and Q146. Trends varied between the first and second ratoon crop with all varieties except Q155 showing a depression in ccs with trash blanketing in the first ratoon crop; and all except Q146 showing an increase in ccs in the second ratoon crop (Figure 7). There was a significant interaction between agronomic treatments and year as expected from the above (Appendix 3). The reason for the reverse trends in the first and second ratoon crops is uncertain. The major difference between growing conditions for the first and second ratoon crops was that estimated effective rainfall in the first six months of the crop in 1995 was 157 mm compared to 329 mm in 1996. This would have given better early growth in 1996, particularly under the trash blanket. Both crops received late rain just prior to the May harvest.

Over both crops the average ccs for May and June harvests, respectively, for plant and first ratoon crops was 10.60 and 12.15. This difference was highly significant statistically ($P<0.01$, Appendix 3). CCS differences between May and June harvests for each variety averaged over the first and second ratoon crops are illustrated in Figure 8. All varieties showed a significant increase in ccs between May and June harvests. The high early ccs varieties Q146, Q151 and Q155 performed best at both harvest times with Q141 giving intermediate ccs levels and the late maturing varieties, Q110 and Q150, the lowest ccs.

Average ccs levels for burnt and green cane at the May and June harvests are given in Table 5. These show no effect of trash blanketing on ccs at either time of harvest, confirmed by the overall analysis of variance (Appendix 3).

Table 5: Mean cane yield, ccs and sugar yield for burnt and green cane for the two harvest dates over first and second ratoon crops

Treatment	Cane yield t/ha	CCS	Sugar yield t/ha
Burnt			
May	104.0	10.63	11.06
June	104.5	12.20	12.75
Green			
May	110.8	10.56	11.70
June	108.1	12.25	13.24

Fig 6. Effect of harvesting practice on varietal ccs averaged over first and second ratoon

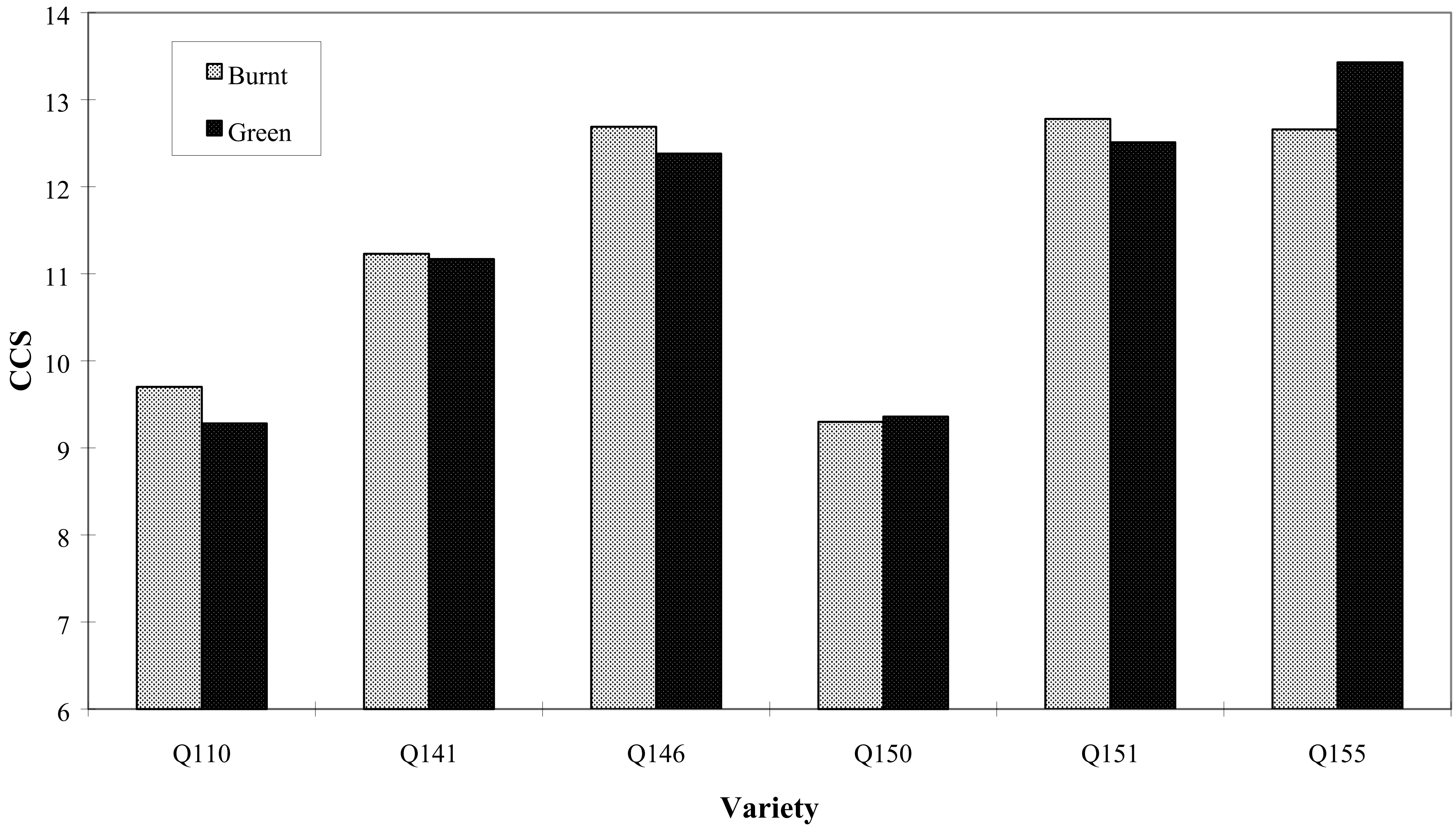


Fig. 7 Effect of time of harvest on varietal ccs in first and second ratoon crops

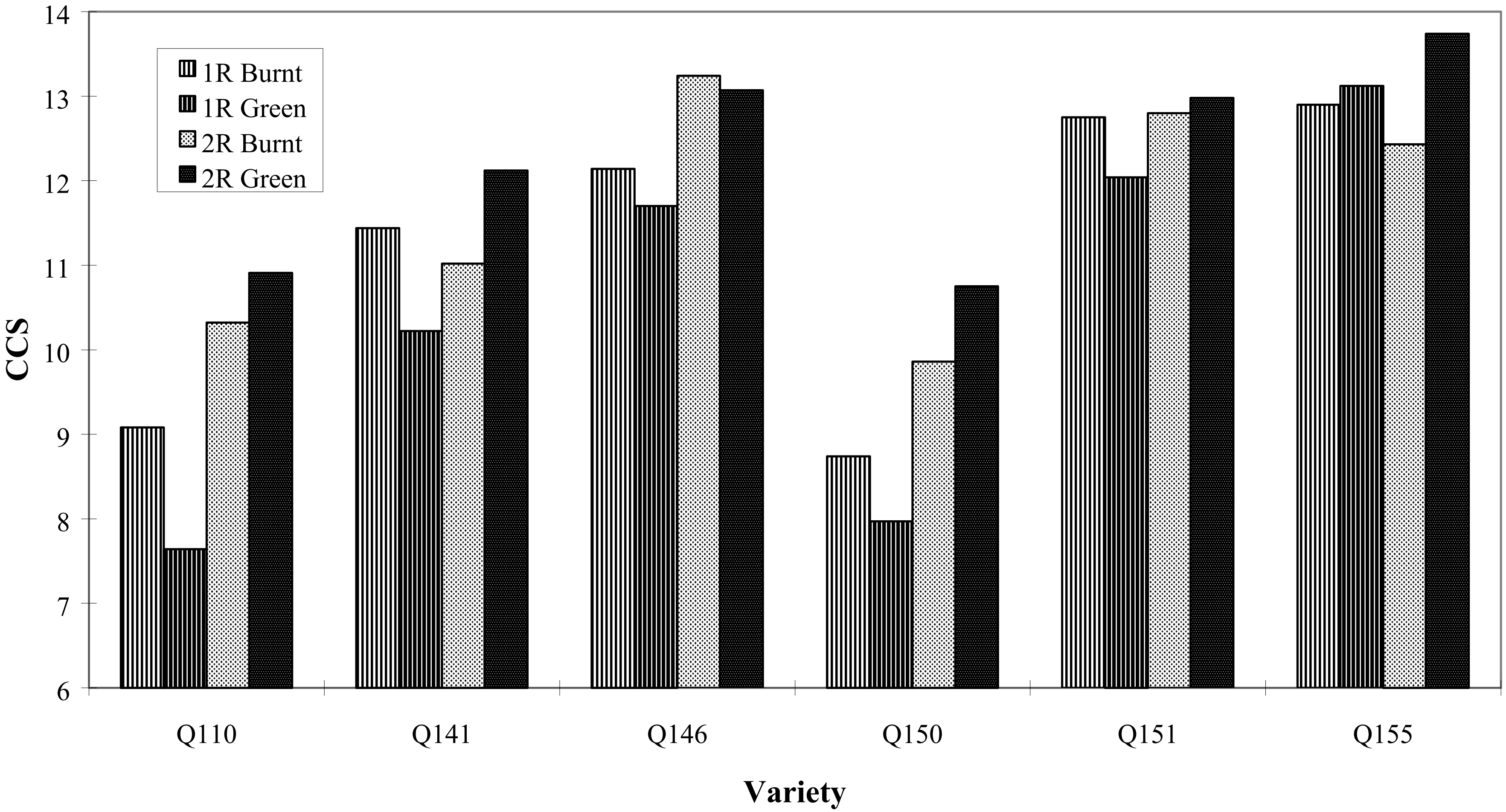
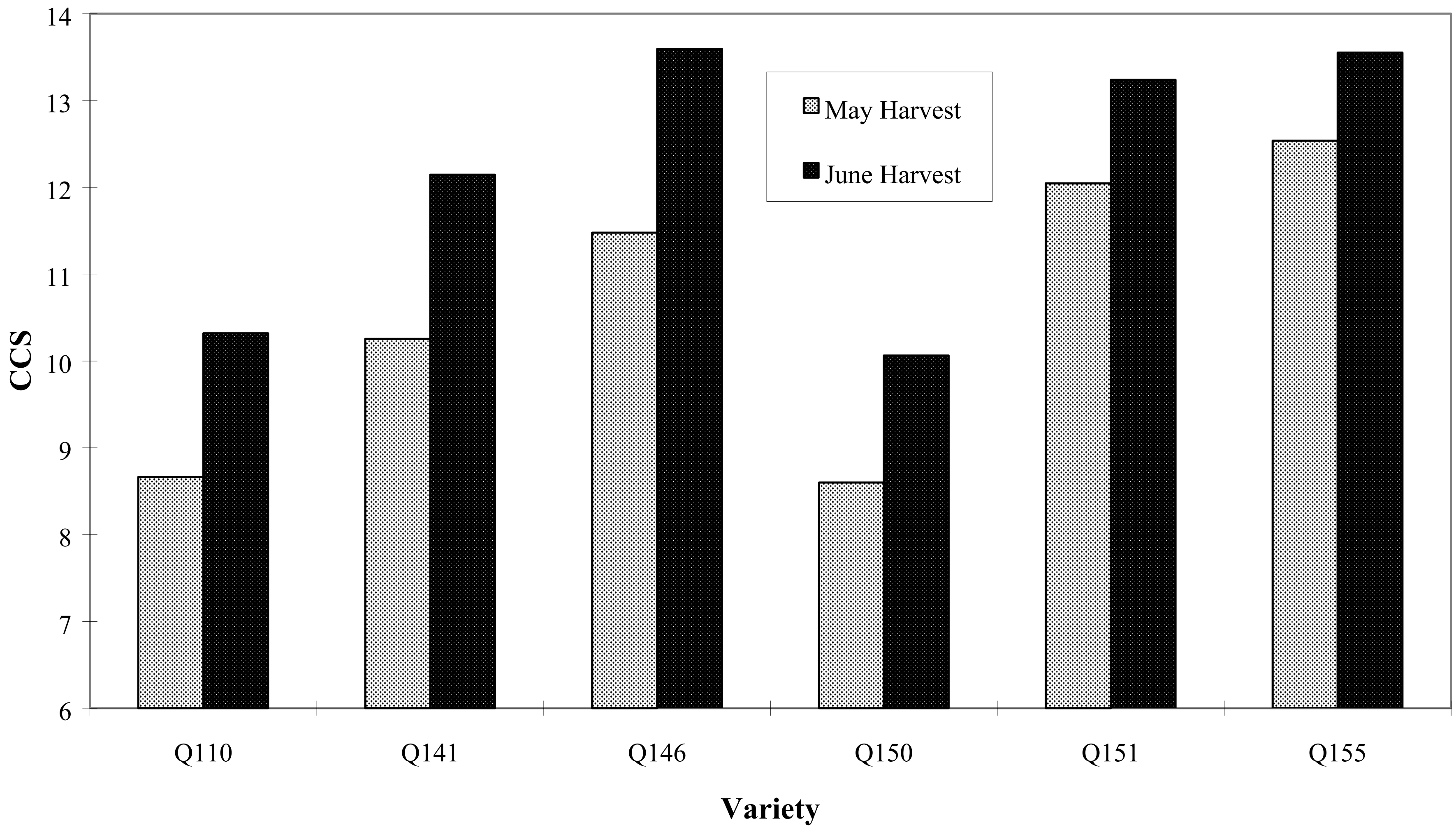


Fig.8 Effect of time of harvest on varietal ccs in trash blanket trial



5.2.2 Cane yield comparisons

Cane yields for the six varieties in burnt and green cane averaged over times of harvest and first and second ratoon crops are given in Figure 9. Over all varieties, there was a yield gain of 5 tonnes/ha with Q110 and Q155 showing the greatest response, followed by Q150 and Q146. Q141 and Q151 showed no yield response to trash blanketing. As for ccs, cane yield response to trash blanketing was greatest in the second ratoon crop (Figure 10). The higher rainfall in the first six months of the crop in the second ratoon may have had some bearing on yield responses with better utilisation of available water under the trash blanket.

The cane yield was similar for May and June harvests over the two ratoon crops (Table 5). However, there were some differences in varietal yields for the two harvest dates (Figure 11). Q141 and Q150 gave higher yields after early harvest in both years whereas Q155 yielded better after the June harvest. Q146 and Q151 also gave slightly higher yields after a June harvest with Q110 showing no time of harvest effect on cane yield. Clone x harvest interaction was highly significant (Appendix 3).

5.2.3 Sugar yield comparisons

Sugar yield comparisons between burnt and green cane for the six trial varieties averaged over first and second ratoons are shown in Figure 12. For all varieties, mean sugar yields for burnt and green cane were 11.9 and 12.5 tonnes/ha, respectively. This difference was statistically significant (P=0.04, Appendix 3). This difference was mainly due to Q155 which yielded significantly better with a green cane trash blanket (a gain of 1.9 tonnes sugar/ha). Q110 produced a smaller response, with similar yields for burnt cane cultivation and green cane trash blanketing in Q141, Q146 and Q150. There was a marked difference in response to green cane trash blanketing in the first and second ratoon crops (Figure 13). In the first ratoon crop only Q155 responded positively to trash blanketing whereas all varieties except Q151 responded positively in the second ratoon. The variety x year interaction was highly significant (Appendix 3) reflecting the above trends. Q155 was clearly favoured by trash blanketing under the trial conditions.

Total sugar yields over all treatments in the six varieties followed the order Q151 > Q155, Q146, Q141 > Q150 > Q110. This clearly indicates the benefits from the recently released high early sugar varieties for early season harvests.

Over the two crops the average sugar yield of all varieties for May and June harvests was 11.4 and 13.0 tonnes/ha, respectively, which was highly significant statistically (Appendix 3). Varietal sugar yields for May and June harvests averaged over both crops are summarised in Figure 14. Q146, Q151 and Q155 gave the largest differential between May and June reflecting their rapid maturity increase early in the season. Differences were less marked in Q110, Q141 and Q150.

Fig. 9 Effect of harvesting practice on varietal cane yield averaged over first and second ratoon

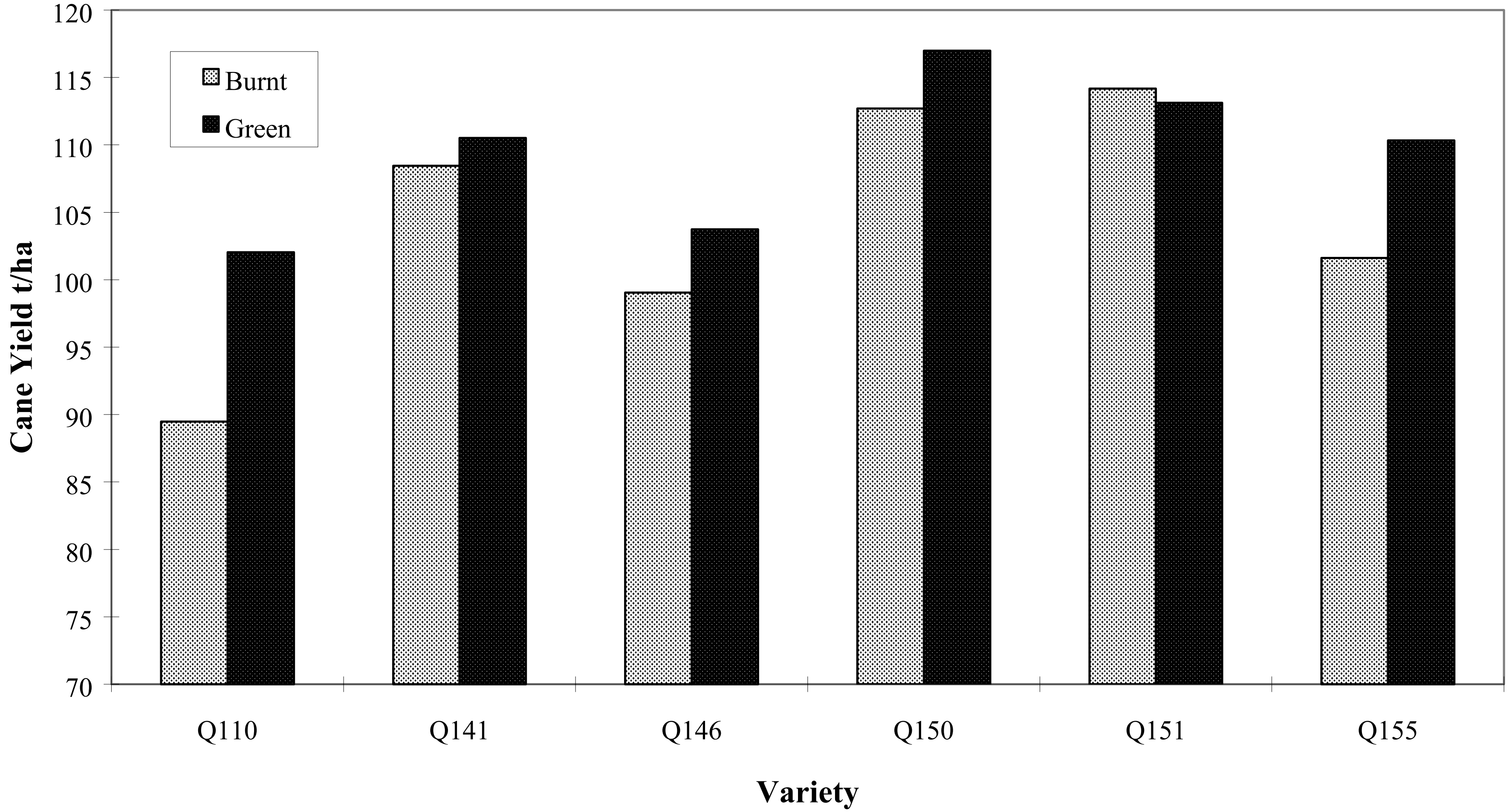


Fig. 10 Effect of harvesting practice on varietal cane yield in first and second ratoon crops

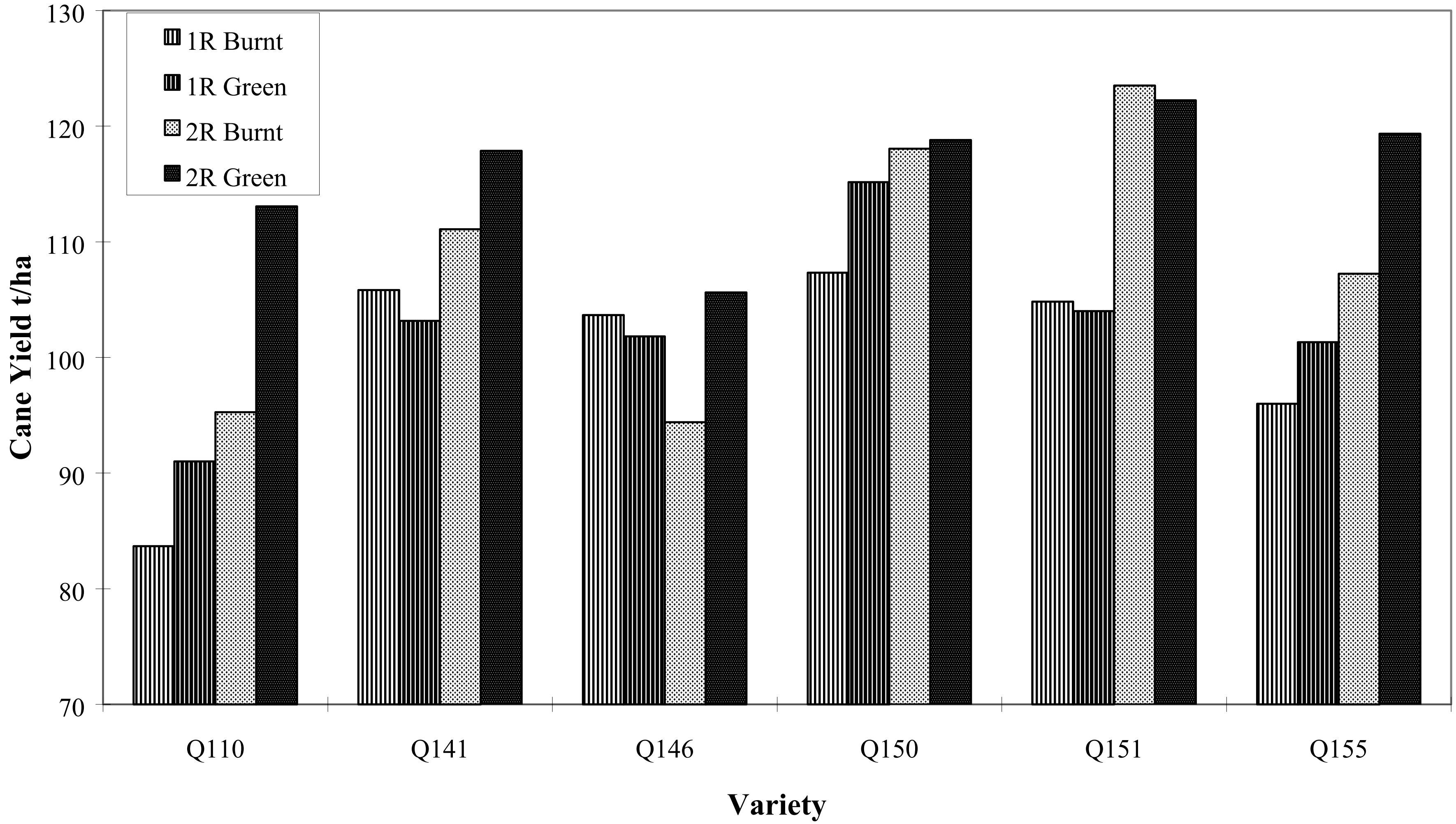


Fig. 11 Effect of time of harvest on varietal cane yield in trash blanket trial

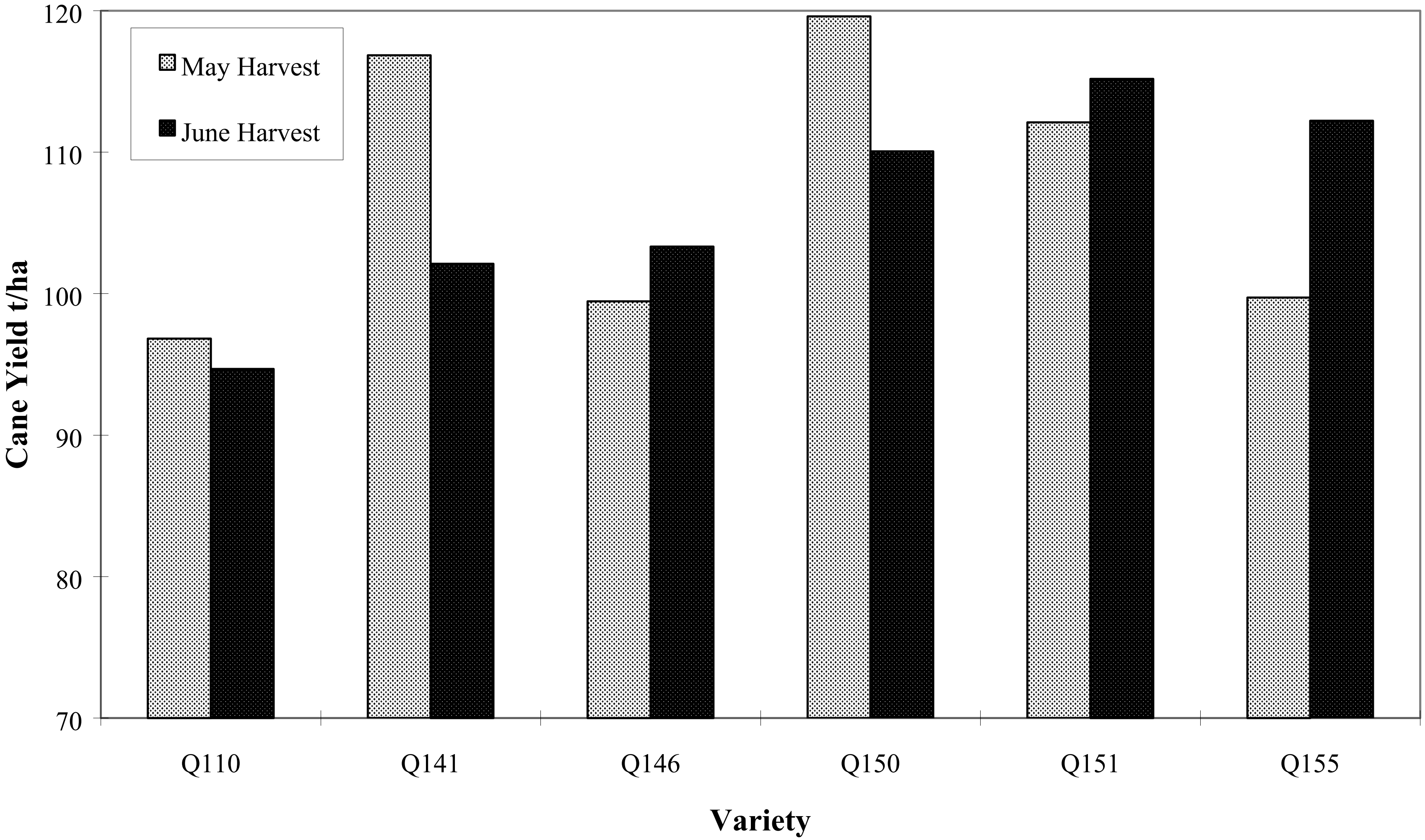


Fig. 12 Effect of harvesting practice on sugar yield averaged over first and second ratoon

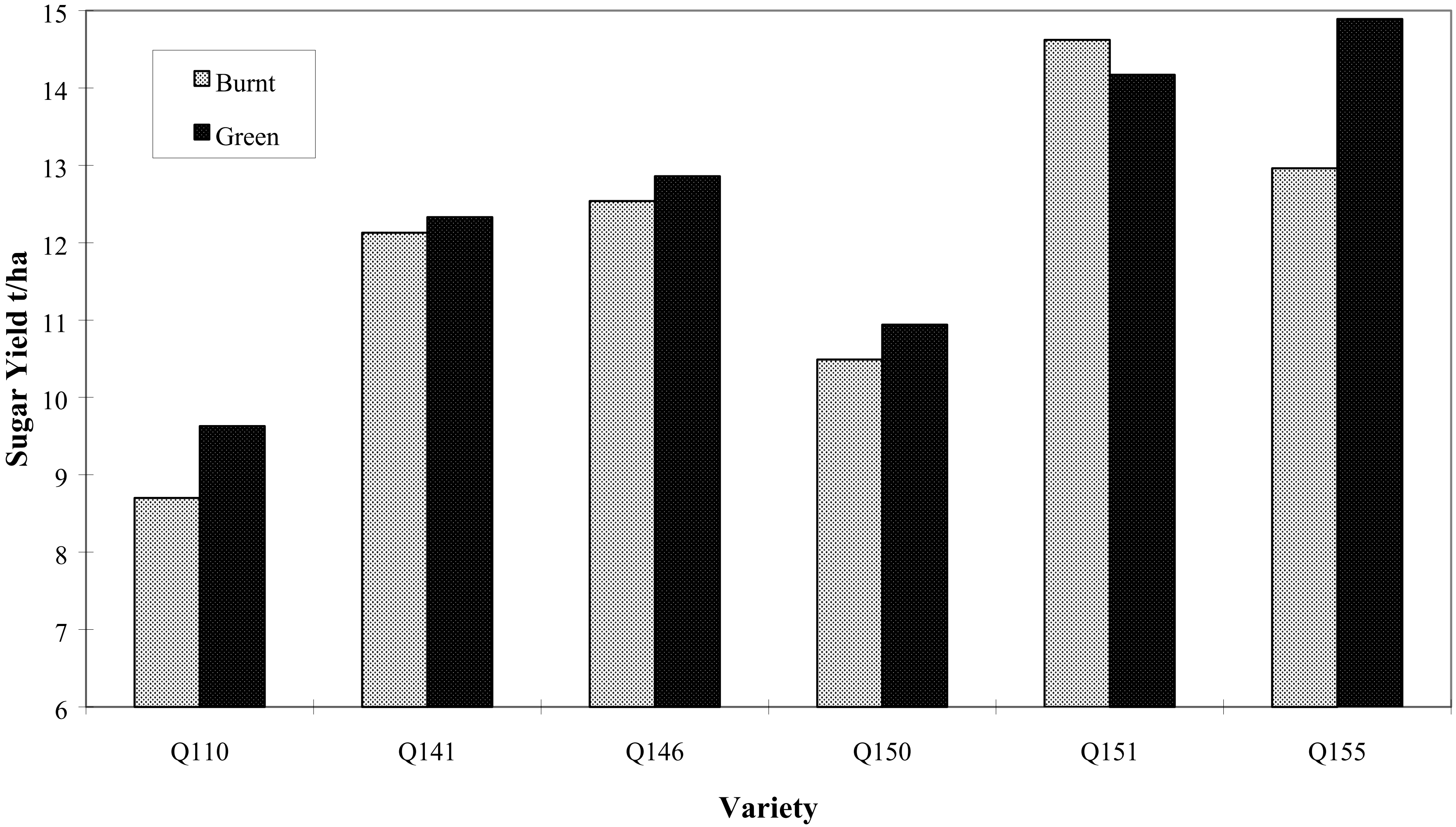


Fig. 13 Effect of harvesting practice on varietal sugar yield for first and second ratoon crops

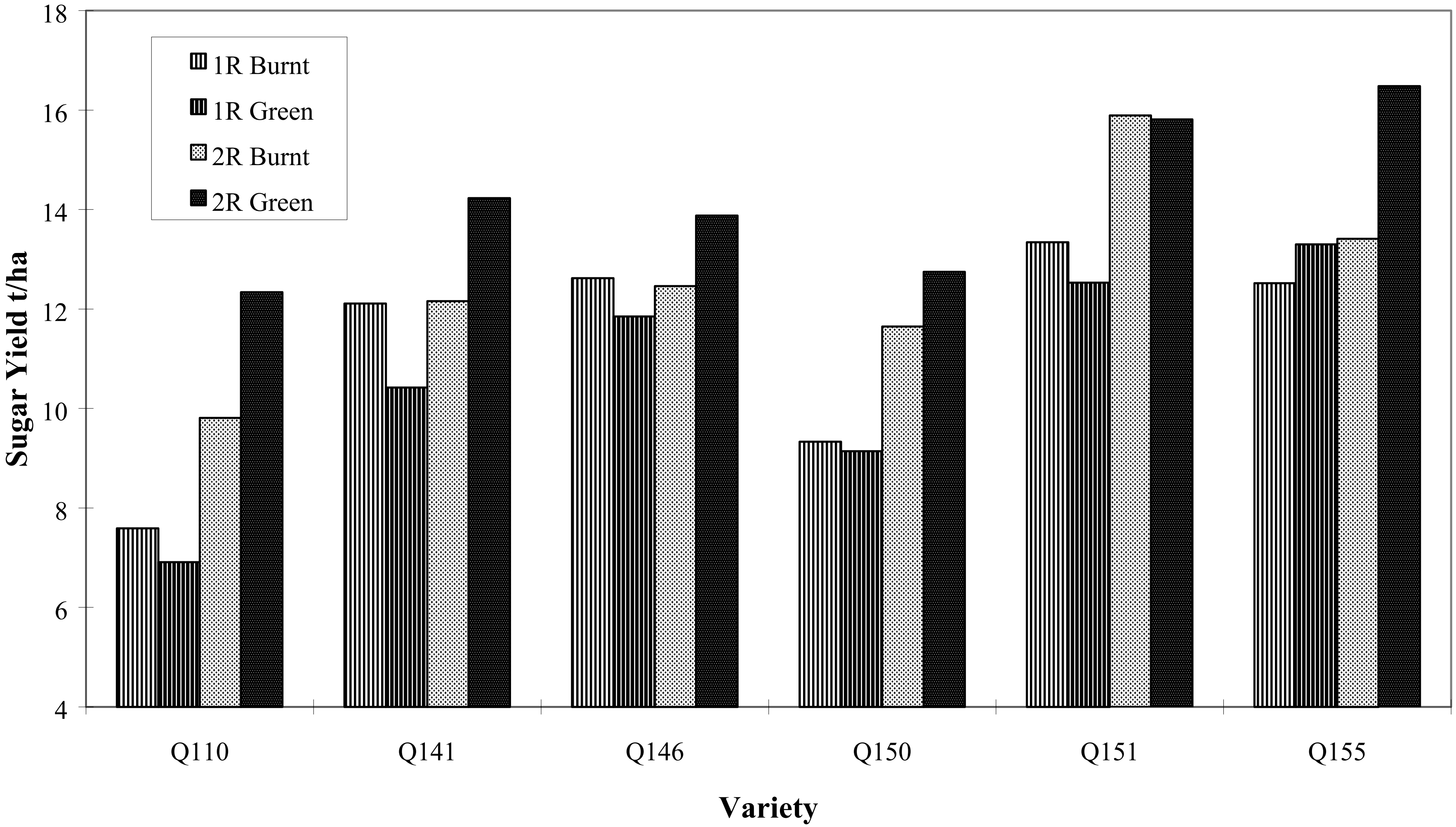
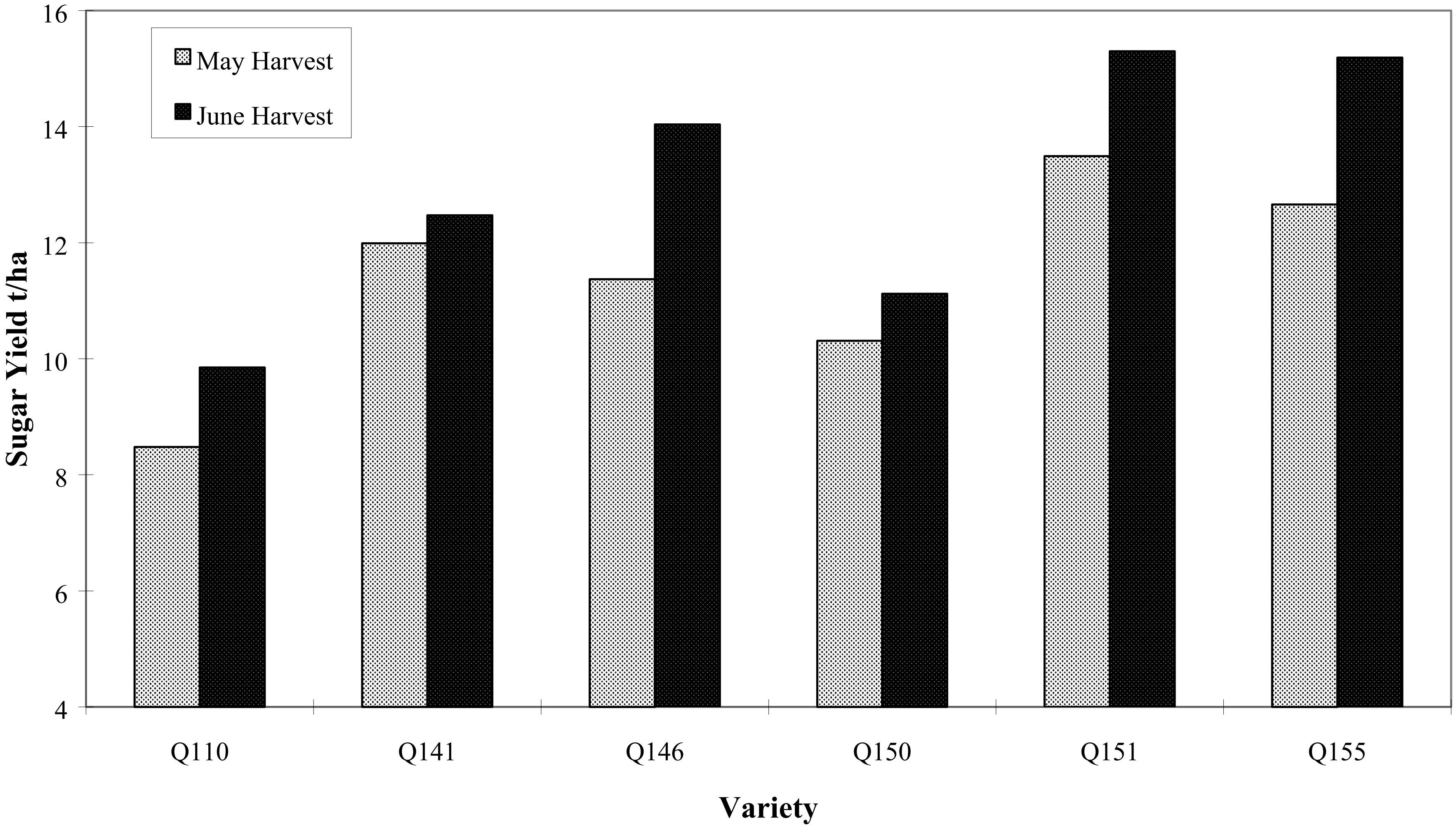


Fig. 14 Effect of time of harvest on sugar yield averaged over first and second ratoon crops



5.2.4 Extraneous matter

Extraneous matter levels for the six varieties at the two times of harvest in the first ratoon crop are given in Figure 15. There was a significant varietal effect on extraneous matter levels with Q110 having extremely high extraneous matter levels and Q141 intermediate values. The other four varieties Q146, Q150, Q151 and Q155 had similar and lower extraneous matter levels. There was a trend to higher extraneous matter levels at the May harvest compared to the June harvest but this did not reach significance at the 5% level. The increase in EM was attributed to heavier tops at the May harvest. There was no effect of trash blanketing on extraneous matter levels.

5.2.5 Stalk counts

Stalk counts were taken at three times after harvest of the first ratoon crop with the latest count in early December. No final stalk counts were available due to lodging. Counts were higher following the May harvest than the June harvest up to the December count (Figure 16).

For the May harvest average shoot counts were higher for green cane trash blanketed plots at all three count dates, but following the June harvest counts were higher in the burnt cane cultivated plots (Figure 17). Averaged over all count dates, burnt cane shoot counts were slightly higher than counts under green cane trash blanketing. This difference was statistically significant ($P=0.04$, Appendix 4).

Varietal shoot counts for the May and June harvests are summarised in Figures 18 and 19, respectively. For the May harvest these show higher initial shoot counts in Q110 and Q151 under a green cane trash blanket; lower initial counts in Q146 and no apparent effect of trash blanketing in Q141, Q150 and Q155. For the June harvest all varieties showed lower initial shoot counts under a green cane trash blanket but counts were similar in burnt and green cane by December for Q110, Q150, Q151 and Q155. Burnt cane shoot counts were higher in December for Q141 and Q146. All interactions among clone, time of measurement and harvest time were highly significant ($P<0.01$, Appendix 4).

Mean stalk counts over both harvest dates and all counting dates for each variety in burnt and green cane are summarised in Figure 20. Q110 is the only variety showing significantly higher counts in green cane with Q141, Q150 and Q151 showing similar counts with each trash treatment, and Q146 and Q155 lower counts under green cane trash. The interaction of clone and trash treatment (clone x agron, Appendix 4) was highly significant.

Fig. 15 Effect of time of harvest on varietal extraneous matter level in first ratoon crop

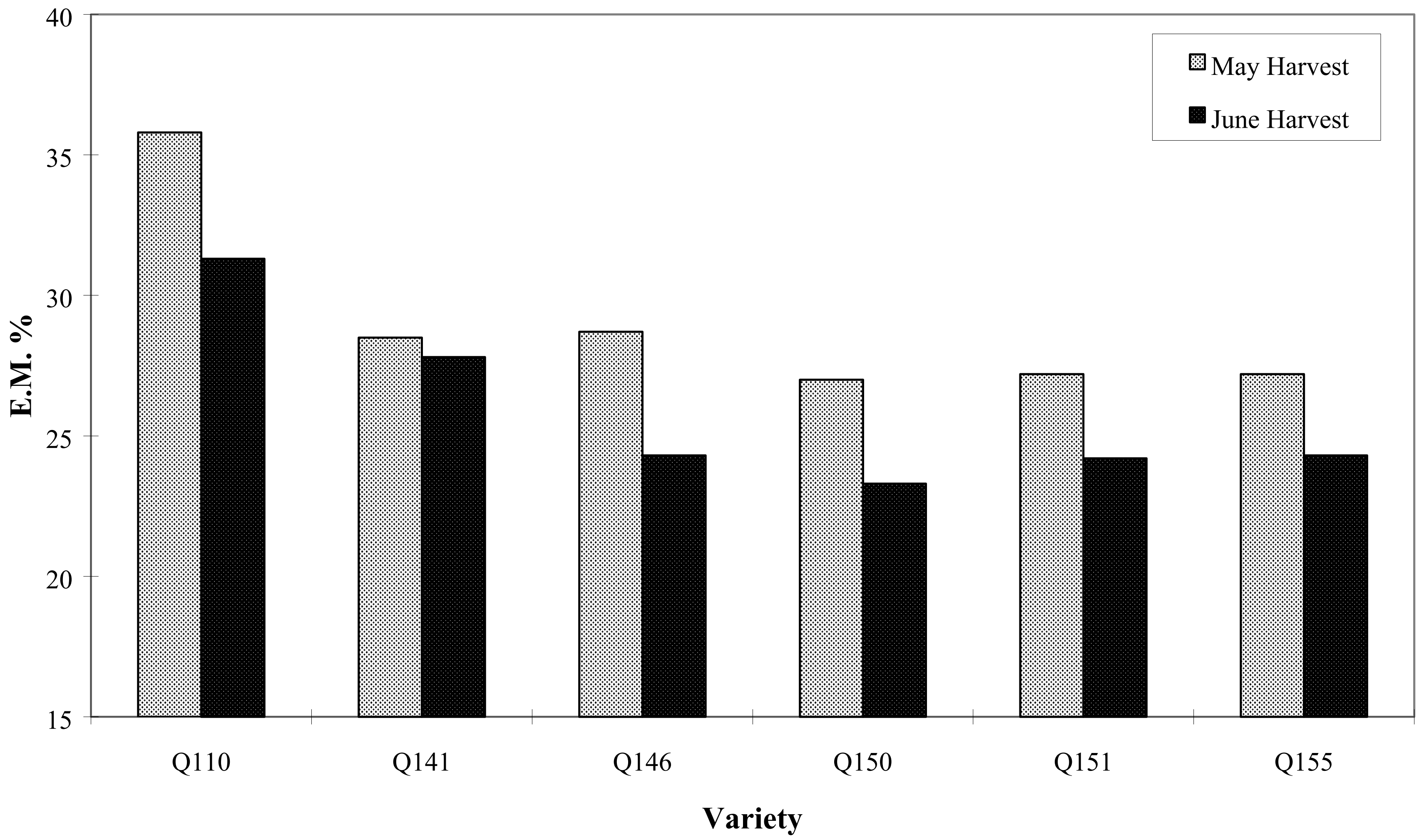


Fig. 16 Stalk number at three dates after first ratoon harvests in May and June

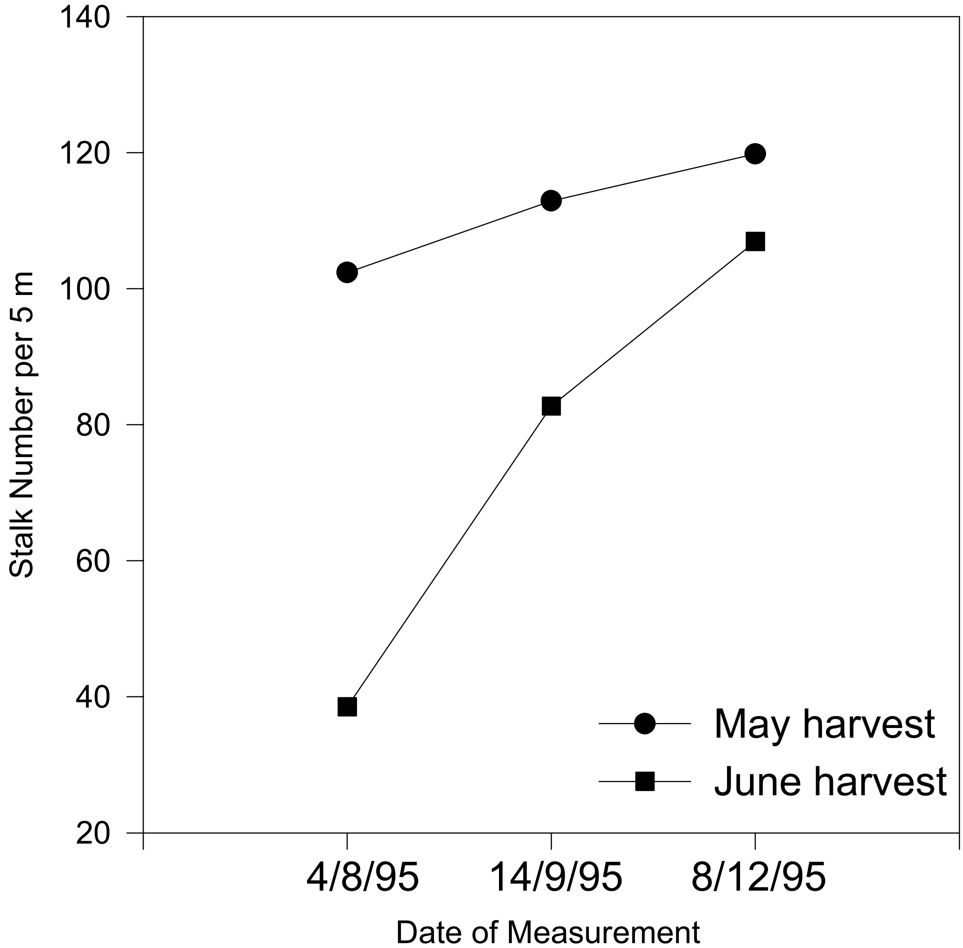


Fig. 17 Stalk count comparisons for burnt and green cane following May and June harvests

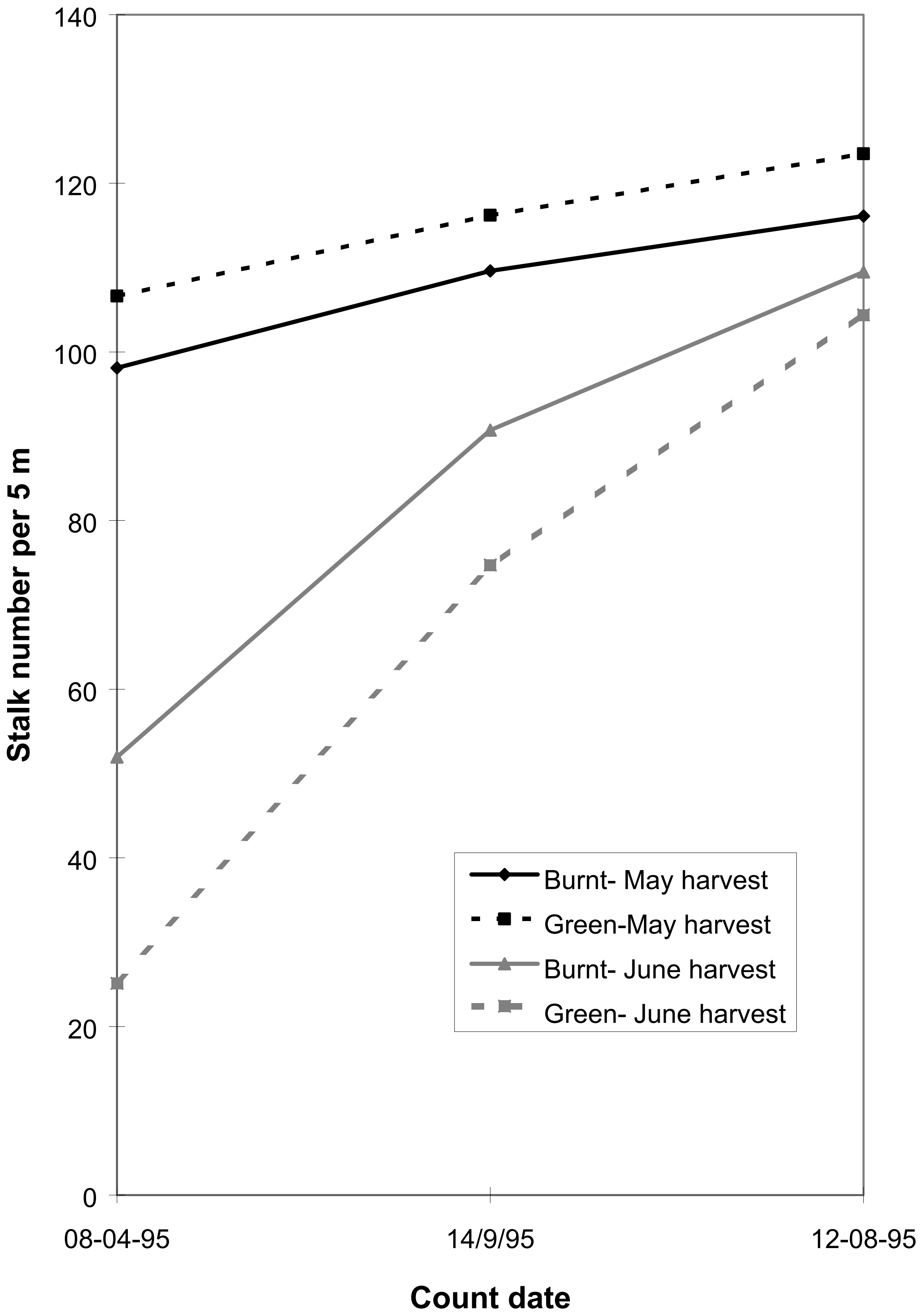


Fig. 18 Stalk numbers of six varieties following May harvest under burnt and green cane trash blanket systems

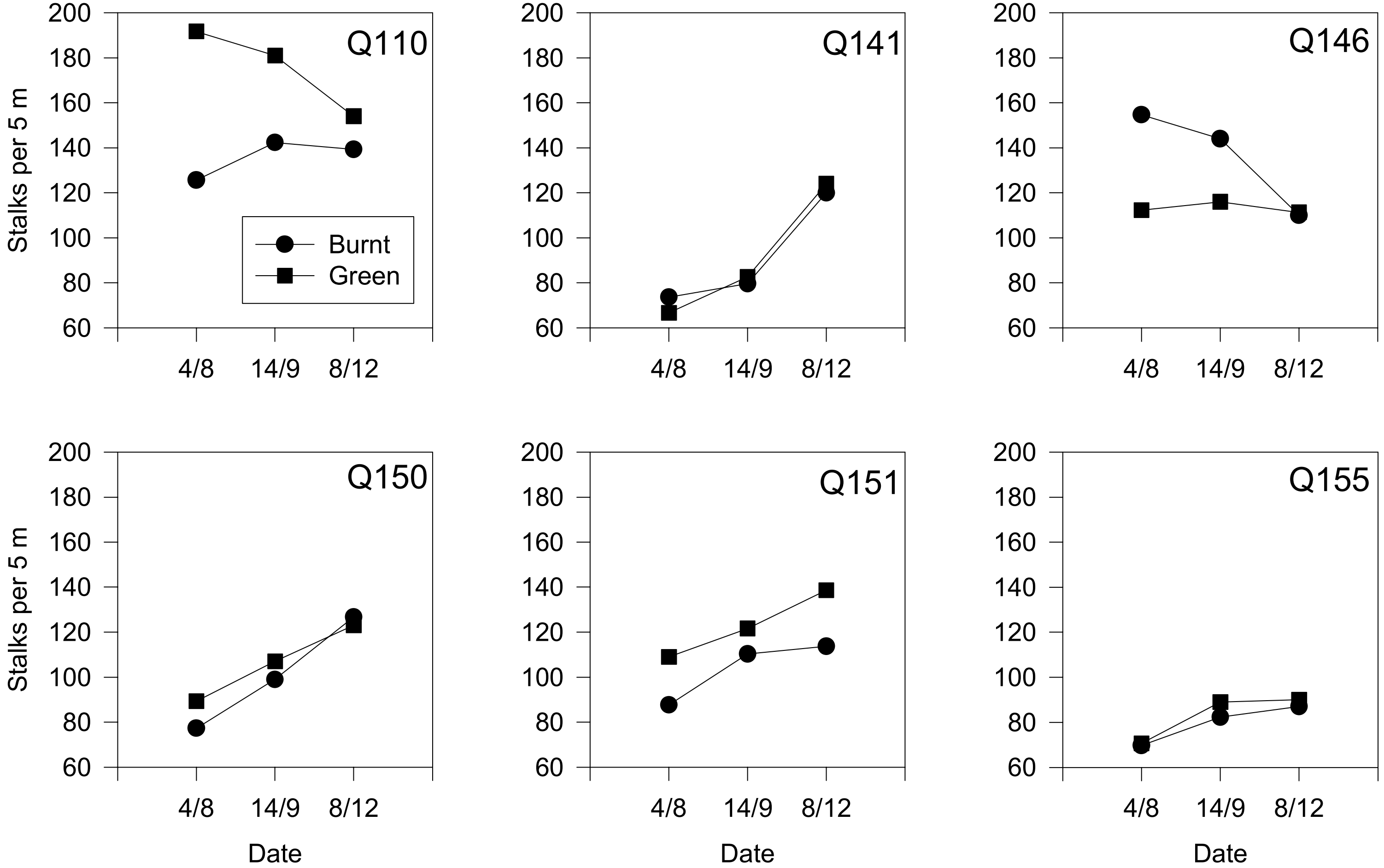


Fig. 19 Stalk numbers of six varieties following June harvest under burnt and green cane trash blanket systems

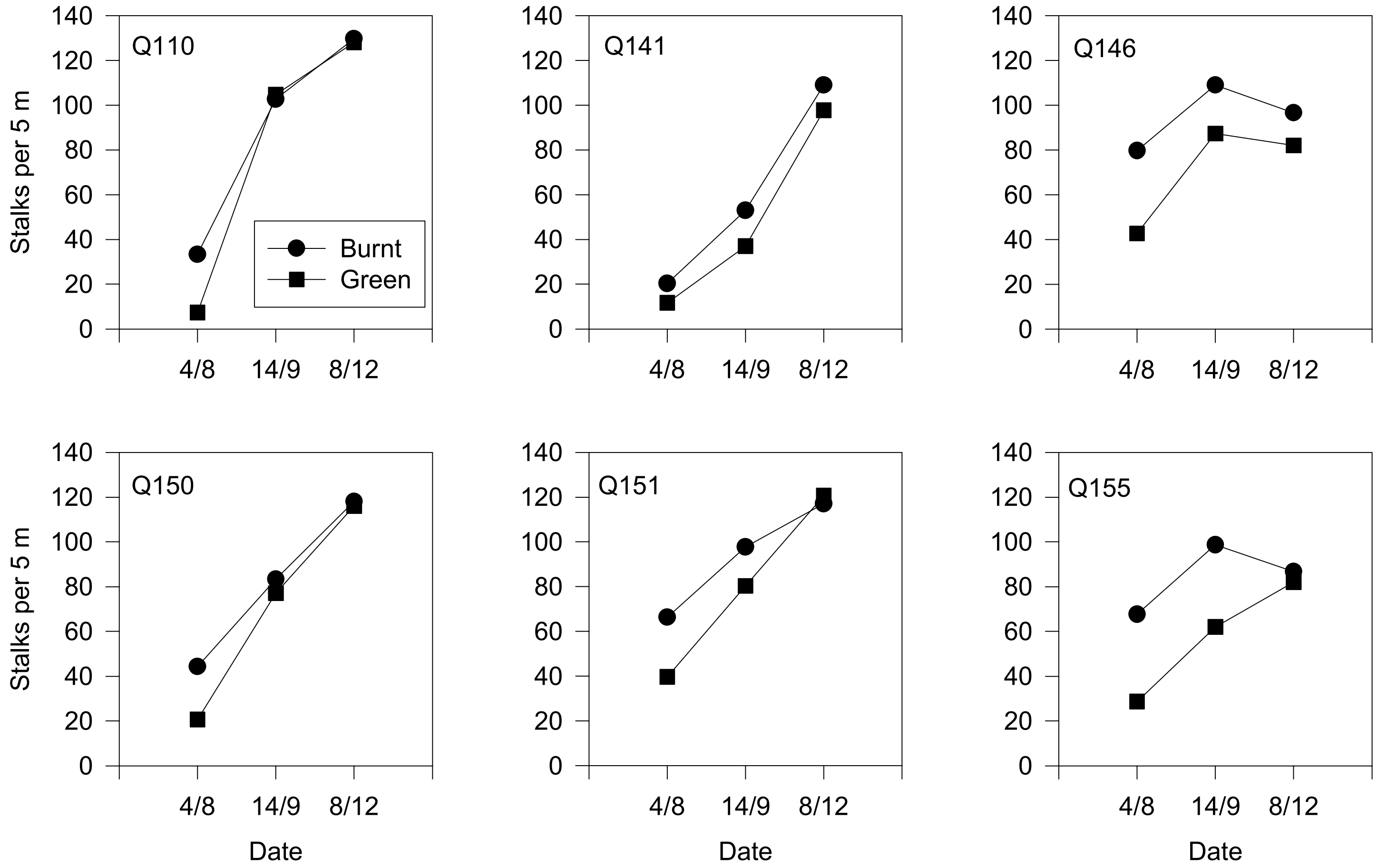
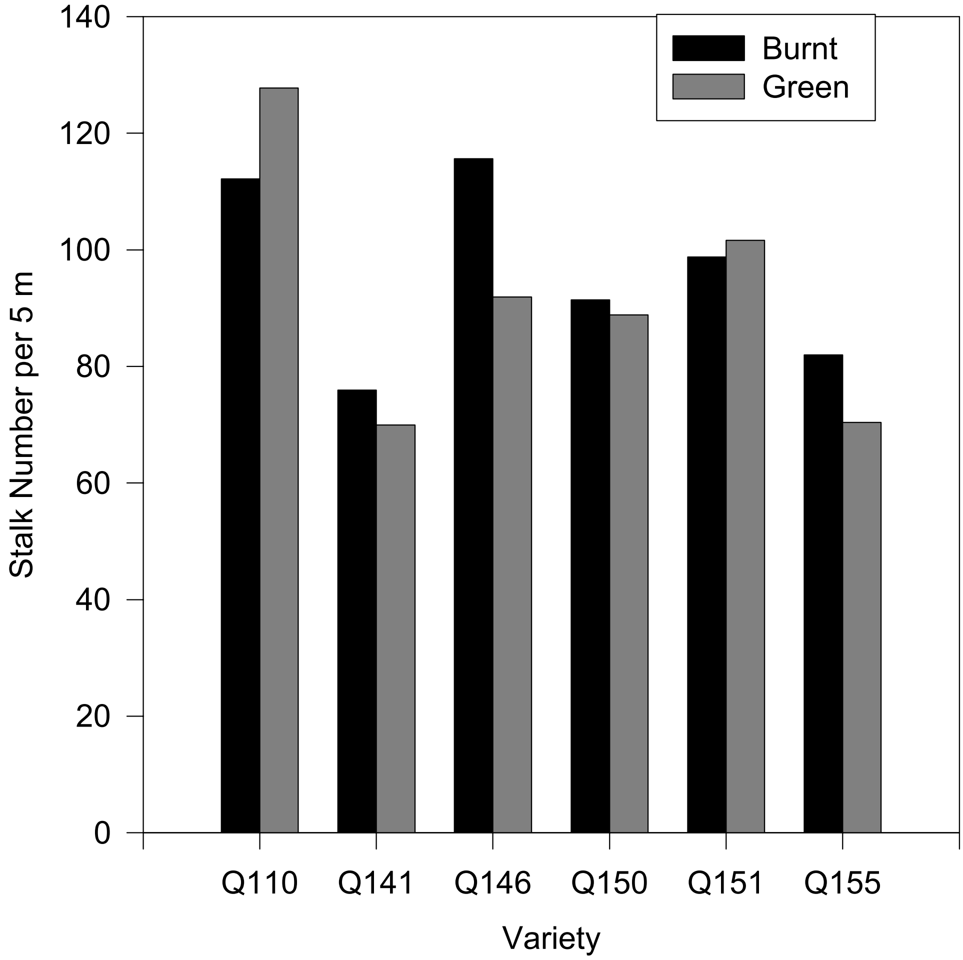


Fig. 20 Average stalk numbers of six varieties under burnt and green cane trash blanket systems



6.0 DIFFICULTIES ENCOUNTERED DURING PROJECT

The commencement of the project was delayed by the finding of ratoon stunting disease (RSD) in some clones selected for the initial planting. This led to transfer of the trial on to the Bundaberg Experiment Station with some management benefits. The other difficulty in the trials was the management of irrigation with small plots harvested over the period May to September. This may have led to some loss of yield potential due to later ratooning of early cut blocks and drying out of late cut blocks.

7.0 RECOMMENDATIONS FOR FURTHER RESEARCH

This project has clearly demonstrated the gains to be made from high producing, early maturing varieties at Bundaberg and similar research in other districts is desirable. The data obtained at Bundaberg are also a valuable resource for economic evaluation of extended season harvesting strategies.

8.0 APPLICATION OF RESULTS TO THE INDUSTRY

The project results can be applied immediately in southern Queensland through the use of varieties such as Q151 and Q155 for early harvesting. Similar benefits will be achieved in other districts as high early season ccs varieties become available. The trial results will also allow informed decisions to be made about extended season harvesting strategies.

9.0 PUBLICATIONS ARISING

There have been no publications from the project to date.

10.0 REFERENCES

Cox M C, Hansen P B, Halili E R (1994) Growth and sugar accumulation in one and two year crop cycles in New South Wales. Proc. Aust. Soc. Sugar Cane Technol., 1994 Conf., pp 38-46.

11.0 ACKNOWLEDGMENTS

The funding support from the Sugar Research and Development Corporation for this project is gratefully acknowledged, together with the contribution of technical support staff for the project: Greg Sullivan, Scott Hewson and Bradley Hussey.

12.0 APPENDIX 1

Mean squares of block, clone, and error, and coefficient of variation (CV) from individual analyses of variance of sugar yield (t/ha) (Experiment 1) of eight clones and three blocks over two plantings, five harvests, and three crops

Plant	Crop	Harvest	Mean squares			CV (%)
			block	clone	error	
Autumn	P	1	6.213	36.57**	2.328	9.7
		2	10.94	26.64**	5.713	12.3
		3	50.15**	48.08**	3.700	8.8
		4	54.44**	42.82**	6.645	10.3
		5	40.85**	59.19**	5.657	10.4
	1R	1	13.38**	7.454**	1.737	11.7
		2	70.88**	1.874	1.218	10.5
		3	62.76**	10.61**	2.024	10.9
		4	82.53**	10.75**	2.113	9.8
		5	2.585	14.78**	2.361	9.5
	2R	1	40.50**	2.788	1.374	14.7
		2	14.15**	6.669*	1.914	11.9
		3	65.13**	4.899*	1.460	8.4
		4	70.60**	11.38**	1.990	9.8
		5	25.74**	21.92**	1.391	6.8
Spring	P	1	0.3193	9.299**	1.265	17.3
		2	3.742	9.647**	1.005	10.8
		3	3.947	18.78*	5.798	16.2
		4	60.74**	15.69*	5.193	13.4
		5	65.08**	19.69*	6.952	14.3
	1R	1	9.239*	14.49**	1.667	10.8
		2	1.081	7.529**	0.5409	6.1
		3	27.48**	18.35**	2.688	11.5
		4	66.43**	9.789**	1.714	7.9
		5	28.14**	6.947	4.149	11.5
	2R	1	12.18**	3.558	1.695	13.8
		2	18.64**	3.066	1.380	9.4
		3	61.94**	5.188	2.439	10.5
		4	89.01**	2.858	3.810	12.7
		5	15.73	7.487	5.936	14.0

** $P \leq 0.01$ * $P = 0.01$-0.05

13.0 APPENDIX 2

Mean squares, probability (P), and coefficients of variation (CV) from combined analyses of variance of CCS, cane yield (TCH), and sugar yield (TSH) (Experiment 1) for eight clones and three blocks over two plantings, five harvests, and three crops

Source	Df	CCS		TCH		TSH	
		Mean square	P	Mean square (x 1000)	P	Mean square (x 10)	P
Year	2	7.106	<0.01	39.92	<0.01	93.27	<0.01
Block(Year)	6	1.084	0.04	7.440	<0.01	16.53	<0.01
Plant	1	177.1	<0.01	5.941	<0.01	63.64	<0.01
Plant x Year	2	161.6	<0.01	32.09	<0.01	153.2	<0.01
Harvest	4	890.9	<0.01	4.716	<0.01	150.5	<0.01
Harvest x Year	8	21.75	<0.01	2.499	<0.01	7.935	<0.01
Harvest x Plant	4	14.92	<0.01	0.124	-	1.514	0.03
Harvest x Plant x Year	8	24.68	<0.01	0.313	0.20	2.421	<0.01
Clone	7	92.00	<0.01	6.590	<0.01	22.26	<0.01
Clone x Year	14	2.351	<0.01	0.680	<0.01	1.682	<0.01
Clone x Plant	7	0.142	-	0.761	<0.01	1.503	<0.01
Clone x Plant x Year	14	0.709	0.14	0.088	-	0.350	-
Clone x Harvest	28	4.817	<0.01	0.210	-	0.868	0.04
Clone x Harvest x Year	56	0.842	<0.01	0.148	-	0.455	-
Clone x Harvest x Plant	28	0.587	0.24	0.107	-	0.241	-
Clone x Harvest x Plant x Year	56	0.356	-	0.119	-	0.360	-
Error	474						
CV (%)		4.97		14.53			

14.0 APPENDIX 3

Mean squares, probability (P), and coefficients of variation (CV) from combined analyses of variance of CCS, cane yield (TCH), and sugar yield (TSH) (Experiment 2) for six clones and three blocks over two agronomic treatments, two harvests, and two crops

Source	Df	CCS		TCH		TSH	
		Mean square	P	Mean square (x 1000)	P	Mean square (x 10)	P
Year	1	45.54	<0.01	41.35	<0.01	213.6	<0.01
Block(Year)	4	0.693	0.38	3.680	0.03	9.445	<0.01
Agron	1	0.058	-	9.775	<0.01	11.42	0.04
Agron x Year	1	17.13	<0.01	2.592	0.15	45.24	<0.01
Clone	5	64.79	<0.01	64.97	<0.01	93.46	<0.01
Clone x Year	5	4.340	<0.01	18.39	0.02	6.134	0.04
Clone x Agron	5	1.111	0.14	6.998	0.36	3.881	0.19
Clone x Agron x Year	5	0.884	0.25	4.386	-	1.933	-
Harvest	1	87.05	<0.01	0.483	-	93.76	<0.01
Harvest x Year	1	1.778	0.10	3.693	0.09	1.261	-
Harvest x Agron	1	0.200	-	0.941	-	0.215	-
Harvest x Agron x Year	1	1.596	0.12	0.061	-	1.499	-
Clone x Harvest	5	1.047	0.17	29.14	<0.01	4.771	0.11
Clone x Harvest x Year	5	1.062	0.16	2.018	-	3.272	0.28
Clone x Harvest x Agron	5	0.574	-	5.690	-	3.883	0.19
Clone x Harvest x Agron x Year	5	0.270	-	13.19	0.07	4.496	0.13
Error	92	0.653		115.8		2.537	
CV (%)		7.10		10.50		13.07	

15.0 APPENDIX 4

Mean squares, probability (P), and coefficient of variation (CV) from combined analysis of variance of stalk number measured at three times following harvest of the first ratoon crop for six clones, two harvest times, two agronomic treatments, and two crops

Source	Df	Mean square (x100)	P
Time	2	340.1	<0.01
Block(Time)	6	6.505	0 .01
Clone	5	114.1	<0.01
Clone x Time	10	23.98	<0.01
Harvest	1	685.5	<0.01
Harvest x Time	2	120.9	<0.01
Clone x Harvest	5	37.86	<0.01
Clone x Harvest x Time	10	10.27	<0.01
Agron	1	9.711	0.04
Agron x Time	2	4.807	0.13
Clone x Agron	5	15.92	<0.01
Clone x Agron x Time	10	2.282	-
Agron x Harvest	1	74.44	<0.01
Agron x Harvest x Time	2	5.891	0.09
Clone x Harvest x Agron	5	6.393	0.02
Clone x Harvest x Agron x Time	10	2.879	0.28
Error	138	2.364	
CV (%)		16.38	

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FINAL REPORT – SRDC PROJECT BS70S – OPTIMUM TIME OF HARVEST FOR HIGH EARLY SUGAR VARIETIES

by

D R RIDGE AND M C COX

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