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# Environmental and varietal factors predisposing to suckering

## in sugarcane in the wet tropics

Thesis submitted by

Barry SALTER BSc (Hons) Monash

in July 2002

for the degree of Doctor of Philosophy

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in Tropical Agriculture

within the School of Tropical Biology

James Cook University

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5/01/03

Barry Salter

#### ABSTRACT

A recent review of the trends in productivity of sugarcane grown in the wet tropics of Australia revealed a decline in sugar content at the mill. Many factors were implicated in this decline. Sugarcane suckers are shoots that appear when the original stalks produced by the crop are more or less mature. Suckers are harvested along with the mature stalks in crops that are mechanically harvested. The low sugar content of suckers, due to their immaturity, causes dilution of the sugar content of the harvested material. Suckers also increase the amount of extraneous matter in the harvested material, this results in further dilution of the sugar content. Farmers are paid on a formula which is biased towards high sugar content. The additional yield, as a result of sucker growth, does not outweigh the loss due to the lower sugar content of the crop. This results in a loss of profitability. Little was known about suckering in sugarcane. The few observations that exist in the literature are mostly speculative. That meant that there was a need to better describe suckering and to establish what environmental factors cause it.

Sugarcane suckers of three cultivars were found to have different morphology to normal stalks of similar age. Suckers had greater maximum breadth of the leaf lamina, longer leaf sheaths, produced their leaves at a greater height above ground and had thicker internodes. When allowed to grow, the buds produced on a sucker did not posses this altered morphology, which indicted that the change in morphology was transient. Gene expression in the apex of sucker stalks was also found to be different to that of normal stalks, which provides further evidence for the differences between the stalk types and

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could potentially provide some evidence as to why these differences occur. Some evidence was found for the translocation of sucrose from the mature parent stalk to a young developing sucker. This matter needs to be investigated further as mature stalks may lose substantial amounts of sucrose to sucker stalks even before dilution occurs at the mill. This negative impact of suckering on productivity has yet to be considered by the industry. The presence of a mature parent stalk was also found to have an effect on sucker morphology. In the absence of a mature stalk, sucker morphology changed to being more similar to that of a normal stalk. This too provides evidence for the translocation of substances from the mature stalk to the sucker.

The availability of nitrogen and moisture was shown to increase suckering. A significant interaction effect was also found between these two factors. The availability of light beneath the crop canopy was also shown to have an effect on suckering in some experiments but for the most part the results were inconclusive. Further investigation is required in order to establish the role of light in suckering. The data generated from this study has many implications for crop agronomy and plant breeding. Farmers could potentially reduce suckering by careful management of nitrogen fertilisation. The work has also highlighted a need to understand the link between trash blanketing and suckering. The breakdown of a trash blanket may provide nitrogen to the plant at the time that suckers are being produced. In order to reduce suckering plant breeders may need to alter the weighting of some traits in the breeding program. Many of these traits relate to the ability of the crop to remain erect under wet and windy conditions. Managed environment selection trials may also need to be considered. The required environmental conditions for such a trial have been defined. These trials would provide data on the genetic differences in suckering propensity in years when these differences

IV

would not normally be expressed. While much remains to be done, this work has laid the groundwork for starting to manage the problem of suckering in sugarcane.

#### ACKNOWLEDGMENTS

I would like to thank my supervisors Dr. Graham Bonnett and Dr. Robert Lawn for all their hard work, encouragement, friendship and help throughout the duration of this project. It was fantastic to work with people who are very knowledgeable about all aspects of the sugar industry and have a very broad range of experience in agricultural science.

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VI

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Sugarcane suckers growing in a crop in the Mulgrave district near Cairns, Australia. Photograph provided by Dr. Nils Berding.

#### **TABLE OF CONTENTS**

STATEMENT OF ACCESS	
ABSTRACT	III
ACKNOWLEDGMENTS	VI
LIST OF FIGURES	XVII
LIST OF TABLES	XXII
STATEMENT ON SOURCES	XXVIII
DECLARATION	XXVIII
Part A: Introduction and Literature Review	1
Chapter 1. Introduction	2
Chapter 2. Literature review	
2.1 Sugarcane, its origin and agriculture	8
2.1.1 Origin of commercial sugarcane	
2.1.2 Sugarcane agriculture within Australia	11
2.1.3 Agronomic practices	12
2.2 Productivity trends in sugarcane grown in the wet tropics of Austra	lia 14
2.2.1 Factors thought to contribute to CCS decline	
2.2.2 Suckering in sugarcane	
2.3 Tillering in sugarcane and other grasses	
2.3.1 Light	
2.3.2 Nitrogen	22
2.3.3 Moisture	
2.3.4 Temperature	

2.3.5 Plant hormones
2.4 Role of plant physiology in plant/crop improvement
2.4.1 Plant breeding
2.4.2 Agronomy
2.5 Concluding remarks
Part B: Biology of sugarcane suckers
Chapter 3. Sucker Morphology 34
3.1 Differences in morphology between sucker and 'normal' stalks
3.1.1 Introduction
3.1.2 Methods
3.1.2.1 Field experiment design and data collection, 1998
3.1.2.2 Field experiment design and data collection, 1999
3.1.2.3 Pot experiment design and data collection, 2001
3.1.2.4 Statistical analysis
3.1.3 Results
3.1.3.1 Field experiment 1998, cultivar Q138 39
3.1.3.2 Field experiment 1999, cultivar Q152 45
3.1.3.3 Pot experiment, 2001 46
3.1.4 Discussion 50
3.2 Morphology of shoots grown from buds on sucker stalks
3.2.1 Introduction
3.2.2 Methods
3.2.2.1 Experiment 1, plant growth and experimental design
3.2.2.2 Experiment 2, plant growth and experimental design
3.2.2.3 Statistical analysis

3.2.3 Results	56
3.2.3.1 Experiment 1	56
3.2.3.1 Experiment 2	59
3.2.4 Discussion	65
Chapter 4. Comparison of gene expression in stem tissue of sucker and 'norma	ıl' stalks
	68
4.1 Introduction	68
4.2 Methods	69
4.2.1 Sampling	69
4.2.2 RNA extraction	70
4.2.3 Spectrophotometric determination of RNA concentration	71
4.2.4 RNA clean-up/preparation	
4.2.5 Labelling of the probes	
4.2.6 Hybridisation of microarrays	
4.2.7 Statistical analysis	
4.3 Results	
4.4 Discussion	80
Chapter 5. The relationship between suckers and main stems	83
5.1 Is sucrose lost from the main stalk to support sucker growth?	83
5.1.1 Introduction	83
5.1.2 Methods	88
5.1.2.1 Treatments and sampling	88
5.1.2.2 Sugar extraction and analysis	90
5.1.2.3 Statistical analysis	
5.1.3 Results	92

.

5.1.4 Discussion
5.2 Morphology of suckers after the detachment of the parent stalk 100
5.2.1 Introduction
5.2.2 Methods 101
5.2.2.1 Plant growth and experimental design 101
5.2.2.2 Statistical analysis
5.2.3 Results 102
5.2.3.1 Experiment 1 102
5.2.3.2 Experiment 2 106
5.2.4 Discussion 110

# Part C: Putative environmental factors affecting sucker

formation	
Chapter 6. Nitrogen	
6.1 Introduction	
6.2 Methods	
6.2.1 Effect of a late nitrogen application on suckering in cultiv	ar Q152 at Tully
•••••	
6.2.1.1 Location and experimental design	115
6.2.1.2 Treatments	
6.2.1.3 Sampling	117
6.2.1.4 Soil nitrate-N analysis	117
6.2.1.5 Statistical analysis	
6.2.2 Effect of a late nitrogen application on a strongly and a we	eakly suckering
cultivar	

6.2.2.1 Location and experimental design
6.2.2.2 Treatments 120
6.2.2.3 Sampling 120
6.2.2.4 Soil N analysis 121
6.2.2.5 Statistical analysis
6.3 Results 122
6.3.1 Effect of a late nitrogen application on suckering in cultivar Q152 in Tully
6.3.2 Effect of a late nitrogen application on a high and a low suckering cultivar
6.4 Discussion128
6.4.1 Effect of a late nitrogen application on suckering in cultivar Q152 in Tully
6.4.2 Effect of late nitrogen application on a strongly and a weakly suckering
cultivar
Chapter 7. Light
7.1 Manipulation of the light in the outside row of sugarcane
7.1.1 Introduction
7.1.2 Methods
7.1.2.1 Experimental design
7.1.2.2 Sucker counts
7.1.2.3 Light measurements
7.1.2.4 Temperature measurements
7.1.2.5 Statistical analysis
7.1.3 Results 140

7.1.3.1 Sucker numbers	140
7.1.3.2 Light measurements	144
7.1.3.3 Temperature measurements	148
7.1.4 Discussion	148
7.2 Trash stripping and its influence on suckering	153
7.2.1 Methods	153
7.2.1.1 Experimental design and data collection	153
7.2.1.2 Statistical analysis	155
7.2.2 Results	155
7.2.2.1 Sucker numbers	155
7.2.2.2 Light measurements	158
7.2.3 Discussion	159
7.3 The effect of light quality on suckering in sugarcane	162
7.3.1 Introduction	162
7.3.2 Methods	162
7.3.2.1 Plant growth	162
7.3.2.2 Manipulation of red/far-red ratio and PAR	163
7.3.2.3 Experimental design and sampling	164
7.3.2.4 Light measurements	166
7.3.2.5 Statistical analysis	167
7.3.3 Results	168
7.3.3.1 Stalk numbers	168
7.3.3.2 Stalk morphology	169
7.3.3.3 Light measurements	172
7.3.4 Discussion	173

.

7.3.5 Summary	76
Chapter 8. The interaction of environmental stimuli	78
8.1 Introduction	78
8.2 Methods 17	79
8.2.1 Treatments and experiment design 17	79
8.2.2 Stalk counts 18	30
8.2.3 Soil nitrogen analysis	31
8.2.4 Light measurements 18	31
8.2.5 Statistical analysis 18	32
8.3 Results	33
8.3.1 Plant crop	33
8.3.1.1 Sucker numbers 18	3
8.3.1.2 Soil nitrogen	7
8.3.1.3 Light measurements 19	0
8.3.2 Ratoon Crop 19	3
8.3.2.1 Sucker numbers 19	3
8.3.2.2 Soil nitrogen 190	6
8.3.2.3 Light measurements	7
8.4 Discussion	0
Part D: Discussion	6
Chapter 9. Conclusions and implications for plant improvement and future work 207	7
9.1 The biology of sugarcane suckers	7
9.2 Environmental factors affecting suckering	2
9.2.1 Nitrogen	2
9.2.2 Light	5

9.2.3 Moisture	216
9.2.4 Temperature and other factors	217
9.2.5 Interaction of environmental stimuli	218
9.2.6 Perception of environmental stimuli	219
9.3 Implications for crop improvement	222
9.3.1 Agronomy and crop management	222
9.3.1.1 Adapting practices to minimise suckering	222
9.3.1.2 Better matching the crop to the production environment	. 223
9.3.2 Plant breeding and cultivar selection	. 224
9.3.2.1 Structuring an effective test environment	. 225
9.4 Priorities for further research	. 228
9.5 Concluding remarks	. 231
References	. 232
Appendices	. 255

#### **LIST OF FIGURES**

Figure 1.1 Yearly average CCS for the Mulgrave district (1903-1998). Redrawn from **Figure 1.2** Number of suckers ( $\bigcirc$ ) and main stalks ( $\bigcirc$ ) present in a crop of cultivar 32-Figure 2.3 Sugarcane agricultural regions in North-eastern Australia indicating the wet tropics region and the Mulgrave Mill discussed in Chapter 1 (data from the Queensland Figure 3.1 Leaf length (a), leaf maximum breadth (b) and leaf length to breadth ratio (c) for suckers  $\bullet$ , ration stalks  $\mathbf{\nabla}$  and plant cane stalks  $\bigcirc$ . Error bars represent the standard error of the mean, and are shown where they are larger than the size of the Figure 3.2 Leaf sheath length for suckers  $\bullet$ , ration stalks  $\nabla$  and plant cane stalks  $\bigcirc$ . Error bars represent the standard error of the mean. Note y axis does not start at 0..... 41 Figure 3.3 Leaf area of suckers  $\bullet$ , ration stalks  $\vee$  and plant cane stalks  $\bigcirc$ . Error bars 

**Figure 3.16** Leaf length (a), leaf maximum breadth (b) and leaf length to breadth ratio (c) for shoots of cultivar Q117 grown from buds taken from suckers ( $\bullet$ ) and normal

**Figure 3.18** Leaf length (a), leaf maximum breadth (b) and leaf length to breadth ratio (c) for shoots of cultivar Q152 grown from buds taken from suckers ( $\bullet$ ) and normal stalks ( $\bigcirc$ ). Error bars represent + the standard error of the mean and are shown when they are larger than the size of the symbol. \* indicates a significant difference (p < 0.05) following single factor ANOVA. 63

**Figure 4.1** A single block on a microarray slide following hybridisation with RNA of two tissues labelled with red and green fluorescence. Each spot represents a different gene. Note the number of spots with green fluorescence at the bottom of the block..... 75

**Figure 6.1**. Experimental design for the late application of nitrogen to cultivar Q152 in Tully. Three treatments (70 kg N/ha in May, June or July 1999) and a control were established. All plots received 150 kg N/ha following ratooning on 4<sup>th</sup> October 1998.

**Figure 6.2**. Experimental design and plot layout for late nitrogen application to a strongly and weakly suckering cultivar. Seven treatments were initiated: 35 kg N /ha and 70 kg N/ha was added to different plots in May, June and July, as well as a control, which received no additional nitrogen. The figure depicts one of five replicate blocks.

Figure 7.3 Effect of shading the outside row of cane on (a) air and (b) soil temperature
as measured by thermocouples at the Q152 site in Tully. Treatments were: • Control
(T5) O Side shade (T1); and ► Outside temperature. Average of 22 days. Error bars
represent LSD (p < 0.05)

Figure 7.4 Stalks with their trash removed, Tully 2000
Figure 7.5 Sugarcane plants growing in the glasshouse. The stalks were shaded with black shade cloth and clear cellophane, green shade cloth and green cellophane or an unshaded control
Figure 7.6 Leaf dewlap height above ground. Treatments were: ■ Low PAR high ratio; ■ High PAR high ratio; and ■ Low PAR low ratio. Error bars represent the standard error of the mean
Figure 7.7 Leaf length of suckers grown under different light environments. Treatments were: ■ Low PAR high ratio; ■ High PAR high ratio; and ■ Low PAR low ratio. Error bars represent the standard error of the mean
Figure 9.1 The morphology of sugarcane suckers and factors that may affect it. Text in bold indicates evidence that was generated in this thesis
<b>Figure 9.2</b> A model of the environmental stimuli for suckering in sugarcane. Text in bold indicates where evidence has been generated in this thesis
<b>Figure 9.3</b> Sucker number in the Tully (a) and Mulgrave (b) regions for five cultivars with their trash removed (■) and trash present (■). Error bars represent + the standard error of the mean

.

.

#### **LIST OF TABLES**

<b>Table 3.1</b> Mean leaf length to breadth ratio for shoots grown from sucker and normalstalk buds of five ages. Means followed by the same letter are not significantly different $(p > 0.05)$ .59
<b>Table 3.2</b> Germination of twenty single-eye sets of cultivars Q117, Q138 and Q152 taken from sucker and normal stalk buds of three ages
<b>Table 3.3</b> Mean leaf length to breadth ratio for shoots grown from sucker and normalstalk buds of three ages. Means followed by the same letter are not significantlydifferent ( $p > 0.05$ )
<b>Table 3.4</b> The number of fully expended leaves over time for shoots grown from budstaken from suckers and normal stalks. Means followed by the same letter are notsignificantly different ( $p > 0.05$ ).65
<b>Table 4.1</b> RNA concentrations of extracts taken from sucker stalk apices and young plant cane apices.       72
<b>Table 4.2</b> Differentially expressed genes in the apex tissue of sucker stalks compared to young plant cane stalks. The genes listed were found to be differentially expressed on both slides where sucker tissue was compared to the control
<b>Table 4.3</b> Differentially expressed genes in the apex tissue of young cane stalks compared to the control. The genes listed were found to be differentially expressed on both slides where the young cane stem tissue was compared to the control
<b>Table 4.4</b> Genes found to be differentially expressed on all slides, irrespective of tissues being compared.         79
<b>Table 4.5</b> Differentially expressed genes in the apex tissue of sucker stalks compared to young plant cane stalks following the removal of 'bad' genes. The genes listed were found to be differentially expressed on both slides where sucker tissue was compared to the control
<b>Table 5.1</b> Sucrose concentration of stalks (standard error in brackets) of cultivar Q152 which did not have an attached sucker, those with an attached sucker, those with an

**Table 6.1** Sucker number in cultivar Q152 in Tully following the addition of 70 kgN/ha on 10<sup>th</sup> May 1999, 8<sup>th</sup> June 1999 and 20<sup>th</sup> July 1999. Means followed by the sameletter are not significantly different (p > 0.05).122

**Table 6.2.** Sucker number, fresh mass and average fresh mass per sucker at the finalsampling (17<sup>th</sup> September 1999, day 131) of cultivar Q152 in Tully. Data represent anaverage of three replicates from row 2 (half total plot).123

**Table 6.3** Soil nitrate-N concentration (mg g<sup>-1</sup> dry weight) following the application of 70 kg N/ha on 10<sup>th</sup> May 1999, 8<sup>th</sup> June 1999 and 20<sup>th</sup> July 1999 to cultivar Q152 in Tully. Means followed by the same letter are not significantly different (p > 0.05).... 124

**Table 6.5**. Sucker number per plot following the late application of nitrogen to cultivarsQ152 and Q181 on 17<sup>th</sup> May 2000 and 28<sup>th</sup> June 2000.126

**Table 6.6** Orthogonal comparisons between means for sucker number data taken on the26<sup>th</sup> July 2000.127

**Table 6.7** Soil nitrate-N and ammonium-N following the additional application ofnitrogen at three rates. Means followed by the same letter are not significantly different(p > 0.05).128

**Table 7.2** Sucker number per metre appearing with time following the shading of the outside row of cane, cultivars Q138 and Q152, at Tully. Treatments were: Side shade (T1); Stalk shade (T2); Stalk clear (T4); Node shade (T3); Node clear (T4) and Control (T5). Means followed by the same letter are not significantly different (p > 0.05). .... 141

**Table 7.3** Sucker number per metre appearing with time following the shading of the outside row of cane, cultivars Q138 and Q152, at Babinda. Treatments were: Side shade (T1); Stalk shade (T2); Stalk clear (T4); Node shade (T3); Node clear (T4) and Control (T5). Means followed by the same letter are not significantly different (p > 0.05). .... 142

 Table 7.5 Mean sucker number per plot (5 m of row) in rows one (control plots), three

 and five at Tully and Babinda.

**Table 7.6** Measurements of PAR as a proportion of sunlight for cultivars Q138 andQ152 at the Tully, Babinda and Mulgrave sites. Measurements were taken at 10 cm and100 cm above ground on the outside of the crop and in the inter-row space betweenrows 1 and 2 in the inside of the crop. Means followed by the same letter are notsignificantly different (p > 0.05).145

**Table 7.7** Mean red/far-red ratio of light following the shading of the outside row ofsugarcane. Means followed by the same letter are not significantly different (p > 0.05).146

Table 7.8 Mean red/far-red ratio of sunlight and that of light passing through sha	ıde
cloth, dry leaf sheath and green leaf $(n = 4)$ . Means followed by the same letter a	re not
significantly different (p > 0.05).	146

**Table 7.9** Dates of crop planting, nitrogen application, and the application of leaf trashremoval treatments, in BSES experiments at Tully and Mulgrave involving fivesugarcane cultivars.154

Table 7.11 Paired t-test of trash removed vs trash present at Mulgrave and Tully. .... 157

**Table 7.12** Differences between trash removed (rem) and trash present for five cultivars at the Mulgrave site on two dates using paired t-tests.

 158

**Table 7.13** Proportion of light reaching stalk bases in the trash removed and trashpresent subplots at Mulgrave and Tully. Means followed by the same letter are notsignificantly different (p > 0.05).159

**Table 7.15** Glasshouse temperature settings and the mean air temperatures (duration of the experiment) within the glasshouse compartment in which the plants were grown. 166

**Table 7.17** Stalk numbers, following the exposure to shading treatments using shadecloth and cellophane designed to affect the quality and quantity of light reaching thelower parts of the plant on the 4<sup>th</sup> September 2001.168

 **Table 8.3** Significant interaction effects on number of suckers in the plant crop 331 and 392 DAP. No interaction effects were found to be significant at the earlier sucker counts. Means followed by the same letter are not significantly different (p > 0.05).. 185

Table 8.6 Soil ammonium-N (mg g <sup>-1</sup> dry weight) 231, 286, 307, 342 and	1 384 DAP
following the application of nitrogen at three rates. Means followed by t	he same letter
are not significantly different (p > 0.05).	

**Table 8.7** Red/far-red ratio of light beneath the canopy of sugarcane grown at threestool densities, 244 and 302 DAP. Means followed by the same letter are notsignificantly different (p > 0.05).191

**Table 8.8** Photosynthetic active radiation (PAR) measured beneath the canopy of asugarcane crop grown at three stool spacings 302 DAP. Means followed by the sameletter are not significantly different (p > 0.05).192

**Table 8.10** Significant interaction effects on sucker number in the ratoon crop 181, 245,287 and 384 days after ratooning. Means followed by the same letter are notsignificantly different (p > 0.05).195

**Table 8.12** Red/far-red ratio of light beneath the crop canopy taken 195, 243, 298 and368 days after ratooning. Means followed by the same letter are not significantlydifferent (p > 0.05).198

**Table 8.14** Differences in sucker numbers (at final count) between the plant and ration crops. Means followed by the same letter are not significantly different (p > 0.05).... 200

### **STATEMENT ON SOURCES**

#### **DECLARATION**

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

5/01/03

**Barry Salter**