TABLE OF CONTENTS

SUGAR INDUSTRY RESEARCH INSTITUTE

Dr Earle Roberts - Director of Research

CENTRAL SERVICES

ADMINISTRATIVE SERVICES

K. O'Gilvie	Administrative Manager
J. Seaton	Executive Secretary
A. Fearon	Accounting Clerk
D. Hepburn	Clerk/Typist
C. Johnson	Driver
V. Blake	Custodian
D. Baker	Office Helper
J. Vassell	Secretary*
O. Valentine	Secretary
M. Francis	Driver
E. Spencer	General Assistant
E. Lurch	Office Assistant
D. Gowan	Library Clerk
D. Gardner	Typist/Receptionist*
C. Newman	Typist/Receptionist

CHEMISTRY LABORATORY

M. Wilson Ph.D.	Head of Department
A. Lawson	Laboratory Supervisor
Y. Berry	Laboratory Analyst**
M. McDonald	Laboratory Analyst
G. Allen	Laboratory Analyst
J. Saunches	Laboratory Assistant
O. Lurch	General Assistant
B. Morris	Laboratory Assistant
S. Latchman	Laboratory Analyst
M. Richards	Laboratory Analyst

ECONOMICS & STATISTICS

C. Woolery	Head of Department
V. Smith	Snr. Statistical Clerk
N. Kerr	Statistical Clerk

INFORMATION SYSTEMS

O. Brown	Head of Department
M. Williams	Programmer/Analyst*
D. McHayle	Programmer/Analyst
B. Williams	Information Proc. Officer
D. Shady	Programmer

AGRICULTURAL SERVICES DIVISION

Mr Trevor Falloon - Agricultural Services Manager

EXTENSION

D. Little	Head of Department
M. Curtis	Snr. Area Agronomist
P. Wright	Snr. Area Agronomist
E. Henry	Area Agronomist
P. White	Area Agronomist
D. Golding	Area Agronomist
J. Fearon	Area Agronomist
M. Prince	Area Agronomist
W. Fray	Area Agronomist
W. Senior	Snr. Extension Officer*
C. Spencer	Extension Officer

ENGINEERING

L. White	Head of Department
K. Chandon	Agricultural Engineer**
L. Pinnock	Field Officer
K. Grant	Asst. Field Officer
C. Brown	Asst. Field Officer
C. Lawson	Farm Manager
L. Agra	Consultant*

AGRONOMY

M. Bennett-Easy	Head of Department
C. Fearon	Nutrition Agronomist
M. Lewis	Physiologist
U. Green	Agronomist
K. McPherson	Snr. Field Officer
C. Coleman	Field Assistant
R. Dixon	Asst. Field Officer
O. Wright	Field Assistant
D. Wright	Field Officer
L. Collins	Variety Assistant*

ENTOMOLOGY

T. Falloon	Head of Department	C. McNeil	Laboratory Technician
A. Clarke	Laboratory Technician		

FACTORY SERVICES DIVISION

Mr Joshua Jaddoo - Factory Services Manager

ENGINEERING

M. Christopher	Supervisor - Instrumentation	R. Lee	Mechanic
B. Wilson	Junior Engineer	P. Ellis	Machinist
A. Lyle	Mechanical Engineer Tech.	W. Morgan	Workshop Assistant
A. James	Senior. Instrument Assistant		
J. Williams	Instrument Technician	**SUGAR TECHNOLOGY**	
S. Watson	Mechanic	E. Manning	Research Technologist
		S. Roman	Snr. Analytical Techn.

* - Left during the year

** - On study leave

1 PERSONNEL AND TRAINING

1.1 STAFF

Overseas Visits

Messrs. Trevor Falloon, Clarence Fearon, Michael Prince, Bernard Wilson and Cecil Woolery attended the WIST Conference in Trinidad from April 23-27, 2001.

Mr. Marrington McDonald attended a course of study in Applied Analytical Chemistry - Basic Water Analysis/Wastewater at the Hach Technical Training Center, Loveland, Colorado April 16-18, 2001.

Mr. Uriel Green attended a training course sponsored by the Government of Japan on "Soil Diagnosis and Environmental Conservation" at the Obihiro University of Agriculture and Veterinary Medicine, Obihiro, Japan from May 21 to August 18, 2001.

Mrs. Manning attended the Raw Sugar Manufacturer's Institute - Thibodaux, Louisiana from June 18 - 28, 2001.

Mr. Joseph Williams attending a training course in "Measuring and Controlling Instruments" at the Instrumentation, System and Automation Society, North Carolina from August 20-24, 2001.

Messrs. E. Roberts, T. Falloon, J. Jaddoo, D. Little and Miss P. Wright attended the ISSCT Conference in Australia, September 16-21, 2001.

Arrivals

Mrs. Olive Valentine joined the Institute on December 17, 2001 as Secretary for the Factory Services Division.

Departures

The following persons departed the Institute during 2001:

Mark Williams	Programmer
Washington Senior	Extension Officer
Denise Gardner	Receptionist/Telephone Operator
Lloyd Collins	Variety Assistant
Luis Agra	Consultant
Janet Vassell	Secretary (opted for redundancy)

Promotion

Mr. Derrick Wright was promoted to the position of Senior Field Officer on April 1, 2001.

Technical Papers

Papers presented by members of staff at the 64th Annual Conference of the Jamaica Association of Sugar Technologists (JAST), held at the Renaissance Jamaica Grande Hotel on November 8-9 2001.

"Review of the 2000/2001 Sugar Crop" (D. Little/J. Jaddoo)

"Current Trends in Sugarcane Ripening" (M. Lewis)

"Variety Change and Diversity in Jamaica - 2001" (M. Bennett-Easy/K. McPherson)

"Potential for Improved Sugarcane Yields with Filter Cake and Poultry Manure" (C. Fearon)

"An Overview of the Productivity Improvement Approaches used in Farming Systems in Tokachi, Japan (U. Green)

"Irrigation Water Situation as it Affects Sugarcane Production and productivity in Clarendon" (J. Fearon/D/ Golding)

"Brevity - Plants vs Ratoons: Lessons for Crop Improvement" (M. Bennett-Easy)

"Drip Irrigation - A Farmer's Early Experiences" (D. Stanford)

"Perspective on Harvesting Costs and Implications for Farm Viability" (C. Woolery)

"Report on the 24th ISSCT Congress" (T. Falloon/J. Jaddoo)

"Potential for Geographic Information System (GIS) in the Jamaica Sugar Industry" (L. White)

"Octapol as a Replacement for Lead Subacetate in the Polarimetric Measurement of Cane Juice Part II" (M. Wilson/M. McDonald/S. Roman)

"A Method for Rapid Determination of Ash in Raw Sugar Factory Products" (S. Latchman/M.Wilson)

"A Tribological Study on the Influence of Cast Iron Micro-structure during Squeezing of Prepared Cane" (B. Wilson/G. Oliver/T. Khan)

Presentations by SIRI personnel to the West Indies Sugar Technologists' Conference in Trinidad, April, 2001:

"Evaluating the classical approach to biological control of the sugar cane stalk borer, *Diatraea saccharalis* F., by use of *Cotesia flavipes* (Cameron) in Jamaica (Trevor Falloon)

"An update of the Disease Status of Jamaican Sugar Cane (Trevor Falloon)

"Investigations into Leaf Nutrient Adequacies in Jamaica" (Clarence G. Fearon)

"Training to Improve Cane Quality in Jamaica's Wet East Ecological Zone" (Michael Prince)

"Cost Movements of Key Inputs and implications for Farm Viability in the Jamaican Sugar Industry" (Cecil Woolery)"

An analysis of factors influencing sugar yields in Jamaica" (Paulette Wright)

"Preventative Maintenance Practices - Its Effectiveness (Bernard Wilson)

"Cane Payment System - The Jamaican Experence" (J. Jaddoo)

"Polarimetric measurement of cane juice using Non-toxic Clarifying Reagents" (Dr Maureen Wilson)

Presentations to the Congress of the ISSCT, Brisbane Australia, in September 2001 were:

A paper, "Evaluation of the Biological Control Programme against Sugar Cane Stalk Borer, *Diatraea saccharalis* F., after

two Decades of Field Establishment of *Cotesia Flavipes* (Cameron) in Jamaica" (Trevor Falloon)

A poster presentation, "Factors affecting cane quality in Jamaica" (P. Wright and D. Little)

A presentation, "Benchmarking process losses to core constants" (J. Jaddoo) as part of a workshop on Performance Indicators in Processing Operations.

1.2 TRAINING

Mr. Andrew Lyle attended a comprehensive training course for Energy Managers at the Jamaica Public Service Company, March 12-16, 2001.

Dr. Maureen Wilson attended a Seminar presented by the Bureau of Standards entitled, "Strategies to Promote International Competitiveness." This was held on August 28, 2001 at the Jamaica Conference Centre.The CURISA 2001 Caribbean GIS Conference held on September 9-12, 2001 at the Wyndham Rosehall, Montego Bay was attended by Mr. Lancelot White.

Miss Janice Seaton attended the Annual Conference & Education Forum of the Jamaica Association of Secretaries and Administrative Professionals held at the Renaissance Jamaica Grande Resort, October 3-5, 2001.

The S.I.A./S.I.R.I summer training programme began on July 16, 2001 and was completed on August 17, 2001. Five (5) courses were held in addition to a computer course for Factory Inspectors.

The courses were put on in collaboration with UTECH, U.W.I and HEART with participants attending three locations, namely: the campuses of the two universities and of the V.T.D.I. The instructors included lecturers from the universities, V.T.D.I., S.I.R.I.staff, Industry Consultants and Factory personnel (from **Appleton**, **Worthy Park**, **Bernard Lodge** and **St. Thomas Sugar Company**).

A total of 70 persons participated in the programme. Information on the courses was also circulated to organizations within the Sugar Association of the Caribbean but, although there were inquiries, there were no participants from the other islands. The courses were satisfactorily conducted at all three locations.

The delegations were as follows:

Factory	No. of Participants
Frome	11
Monymusk	10
Bernard Lodge	11
Worthy Park	8
Appleton	8
St. Thomas Sugar	5
Long Pond	nil
Hampden	2
SIRI	6
SIA	9
Total	70

Registration in the courses was as follows:

Course	No. of Participants
Preventative Maintenance	16
Introduction to Computer Aided Design	12
Electric Power Generation & Distribution	7
Sugar Technology	15
Fundamentals of Industrial Instrumentation	11
Advanced Microsoft Excel	9
Total	70

Bernard Lodge, **Appleton** and **St. Thomas Sugar Company** participated in all the courses. **Frome**, **Worthy Park** and **Monymusk** participated in four of the five courses.

Long Pond and **Hampden** crops were still in progress during the period the courses were held. **Long Pond** did not participate in any of the courses while **Hampden** participated in one , that on Sugar Technology.

Evaluation

The majority of participants evaluated the courses as being very helpful and thought they would enhance their performance on the job. The subject areas covered were thought to be adequate and the instructions delivered at the correct level with a good balance between theory and practice. There was loss of class time at UTECH due to frequent power outages as a consequence of JPS load shedding. However, participants were still able to accomplish a significant amount of work.

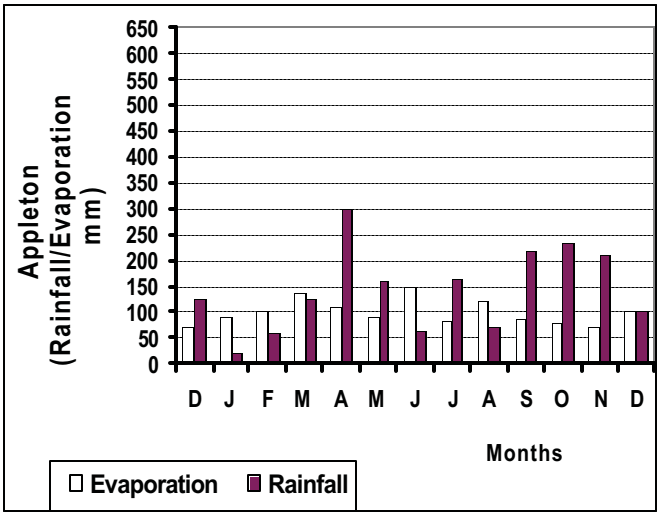
1.3 VISITORS

Visitors to the Institute included Dr. Cecil Goodridge from the Coffee Industry Board; Mr. Dave Hutton from UWI, Mona and Miss Joan Critchlow, Messrs. Winston Lawrence and Professor Charles McDavid, Dean of the Faculty of Agriculture & Natural Sciences, UWI, St. Augustine.

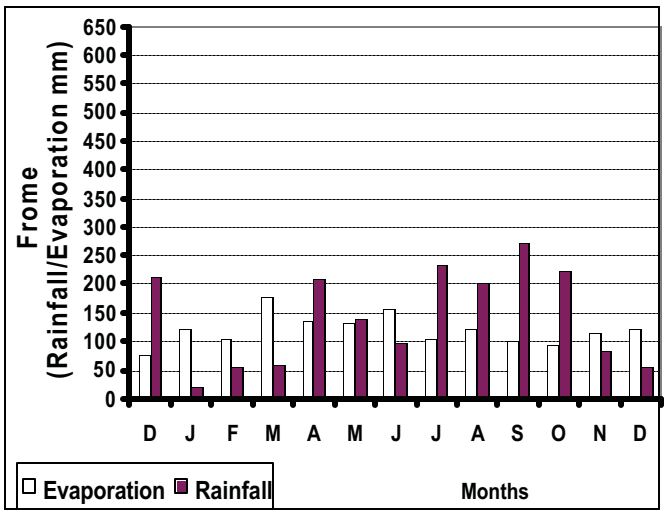
2 WEATHER

On a whole, the industry received very close to average annual rainfall during 2001, End Table 3. Thus the Irrigated areas received 861 mm of rainfall as against a 30-year mean of 853 mm. Similarly, **Tropicana** in the Wet East received 1738 mm as against a long term mean of 1735 mm, while the Central Uplands recorded 1554 against its mean annual total of 1511. However the North Coast area received some 25% more than its mean annual rain, primarily due to an exceptionally wet January when 298 mm, resulting in severe flooding, were recorded. Flooding was particularly severe at **Long Pond** which received 454 mm. Unlike 2000, when the island was gripped by a *la niña* drought for the first half of the year, seasonal patterns were more or less maintained in all ecological areas. In the Irrigated areas, for instance, there was the traditional dry first Quarter and the bulk of the rain (just under 60%) occurred with the second rainy season starting in October.

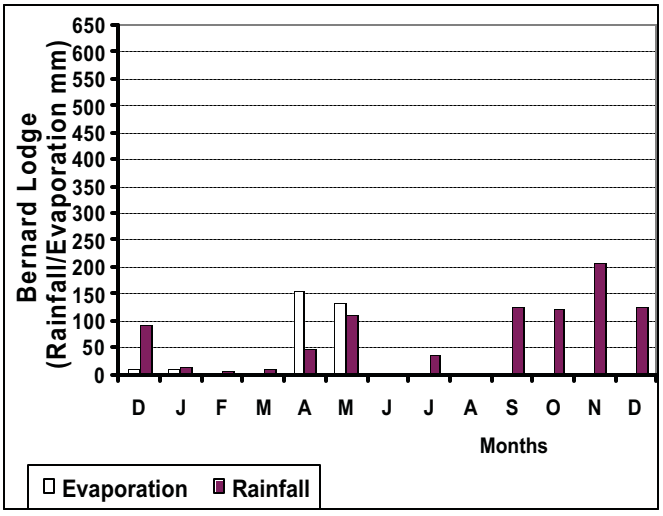
Fig. 2.1: Water Balance Data - December 2000 to December 2001



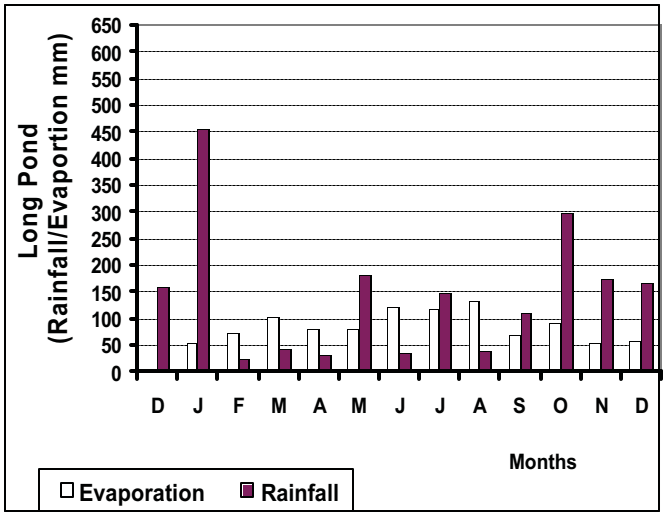
Appleton



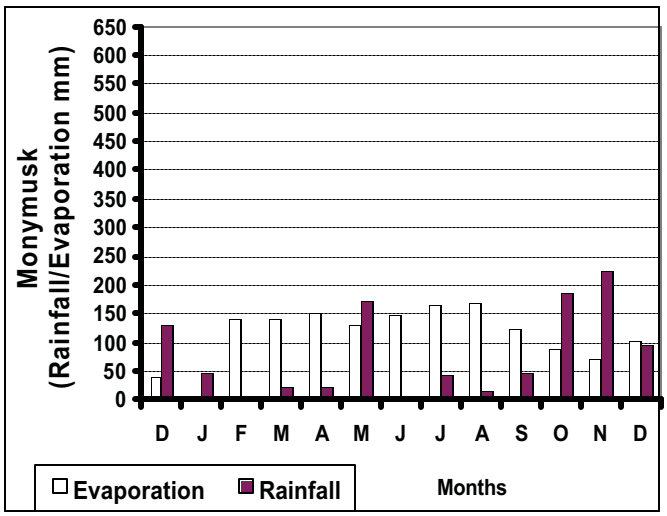
Frome



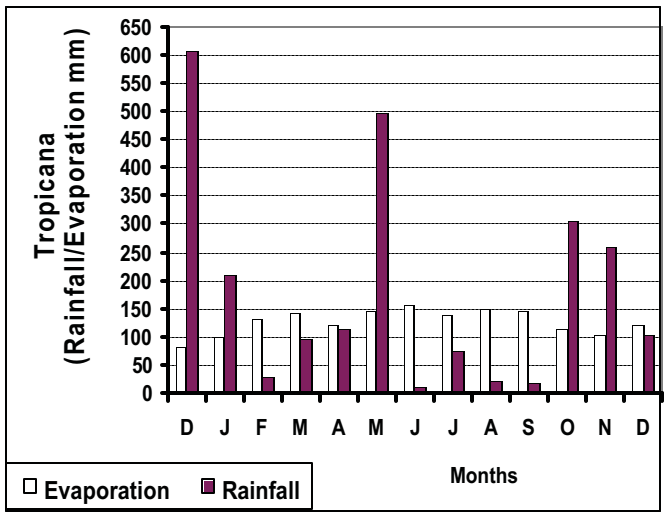
Bernard Lodge



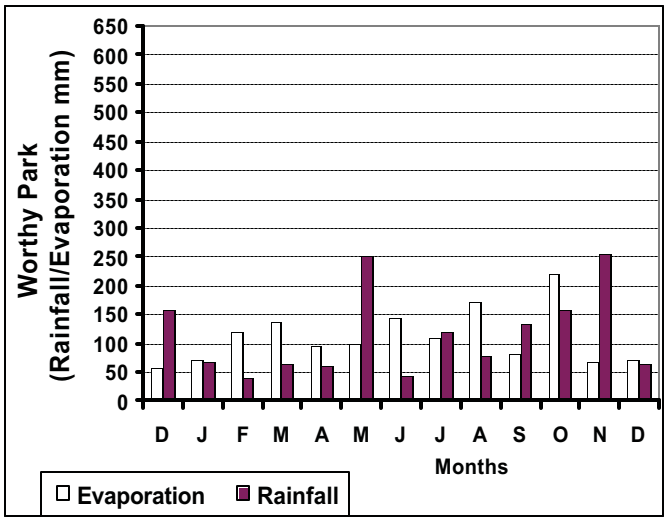
Long Pond



Monymusk



Tropicana



Worthy Park

3 CANE AGRONOMY

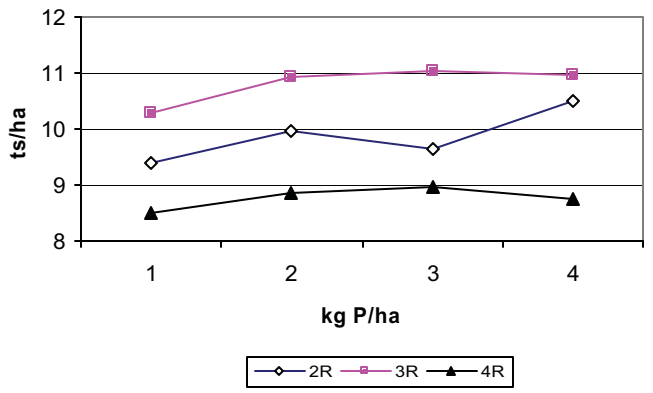
3.1 SUGARCANE NUTRITION

Phosphorus in Ratoons

Cane planted in an experiment on Carron Hall Clay at **Long Pond** responded positively to additional dressings of phosphorus at the second ratoon stage, where a significant yield increase of 1.1 ts/ha was recorded from 65 kg P/ha, compared with untreated plots, *Fig. 3.1*. However, there was no significant yield increase with added phosphorus in 3rd and 4th ratoons. Carron Hall Clay is noted for its phosphorus deficiency. This study, which commenced in 1996 with a blanket application of 44 kg P/ha at planting, followed by varied P dressings in 2nd and 3rd ratoons, demonstrates that additional phosphorus may not be necessary each year.

Growers should always apply phosphorus at planting on this soil and may follow with a further dressing at 2nd ratoons, at rates recommended by SIRI. Leaf analyses at each crop cycle will indicate whether and by how much further dressings may be required.

Fig. 3.1: Mean yields of 4 varieties to P dressings on Carron Hall Clay



Use of Manures

To measure the impact of poultry manure and composted filter cake on cane yield, a trial was started at the SIRI experiment farm at Springfield, in the Irrigated Plains, three years ago. The first applications were made at the first ratoon stage where yield increase of 17 tc/ha and 2.23 ts/ha were recorded from use of 6 t/ha poultry manure in combination with 80% of standard dosage of inorganic fertilizer, compared with the standard only (615 kg/ha 17-0-17/ha), *Table 3.1*.

Reducing the dosage of standard inorganic fertilizer dressing to 45% while adding 6 t/ha poultry manure resulted in inadequate nutrition and a yield of just 5.65 ts/ha, which was similar to yield in plots given standard treatment. Despite unimpressive yields in general, the improvements with added poultry manure point to the importance of organic matter in cane growth. Overall yield in the experiment was low because of inadequate irrigation. The field received only 5 irrigations with total rainfall of 1047 mm. This rainfall was poorly distributed, with 973 mm (93%) obtained in the first 5 months, resulting in severe moisture stress during the later growing period.

Filter cake and poultry manure are valuable resources which some growers could readily access to replenish soil organic matter. Apart from the high organic matter content of filter cake and poultry manure, *Table 3.2*, the nutrient contents are appreciable. The relatively high nitrogen and potash in poultry manure and the phosphorus and calcium in filter cake make them valuable supplements in sugar cane nutrition. Levels of N, P and K are only a fraction of those in inorganic fertilizers, so they should never be seen as total substitutes. It is the 30-60% organic matter present in these

Table 3.1: Yields of first ratoon BJ82119 in response to combinations of inorganic fertilizer, poultry manure and composted filter cake at SIRI Experiment Farm, Monymusk

Treatments	tc/ha	JRCS	ts/ha
615 kg/ha 17-0-17 (Standard)	47.99	12.76	6.10
80% Standard + 6 t/ha PM	65.72	12.73	8.33
45% Standard + 6 t/ha PM	44.75	12.66	5.65
45% Standard + 6 t/ha CFC	33.86	11.56	3.91
45% Standard + 3 t/ha PM +3 t/ha CFC	45.09	12.98	5.82
SED	1.18	0.71	0.27
$LSD_{0.05}$	2.46	1.48	0.57

PM.... Poultry Manure

CFC.Composted Filter Cake

Table 3.2: Composition of Filter Cake and Poultry manure at various stages of decomposition

	pH	% O.M.	%N	%P	%K	%Ca	%Mg
Fresh Poultry Manure	8.10	57.79	2.87	0.48	2.90	0.30	0.24
Stock-piled Poultry Manure	6.88	61.97	3.29	0.60	4.40	0.36	0.50
Fresh Filter Cake	6.13	30.96	0.98	2.18	0.53	4.00	0.68
Composted Filter Cake	7.32	34.91	1.91	2.66	0.45	4.00	0.80

O.M. - Organic Matter

manures that is mainly responsible for the boost in yields accompanying their use.

Further organic manures were applied to the **Springfield** trial at the 3rd ratoon stage. Where poultry manure was added, yields were significantly higher (66.08 tc/ha and 8.58 ts/ha) than in plots receiving increased dosages of inorganic fertilizer (58.81 tc/ha and 7.81 ts/ha), *Table 3.3*. Maximum cane (72.81 t/ha) and sugar yields (10.04 t/ha) were obtained with standard dosage of inorganic fertilizer plus combinations of poultry manure and composted filter cake.

Usually a grower would use one or the other source of manure. However, this trial showed that combining composed filter cake and poultry manure and applying in addition to standard dosage of inorganic fertilizer could actually be of positive value. Higher yields so obtained could be a result of the nitrogen and potash in poultry manure complementing the relatively high phosphate and calcium of filter cake, *Table 3.3*.

Rainfall (713 mm) during the growing period was much less than adequate but was fairly well distributed, with 395 mm (55%) occurring during the first 5 months. Unfortunately, there was insufficient irrigation to fully compensate for the lack of rainfall, as only 6 wetting cycles were recorded. This again contributed to the less than satisfactory overall yield.

Laboratory analyses on the soil in this trial, after harvesting the crop, showed improved levels of organic matter and other nutrients as a result of treatment with the organic manures.

Growers are, however, faced with the challenges of labour shortage and the unpleasantness of handling, which often restrict use of manures. These problems can be overcome by mechanization which SIRI sought to encourage by on-farm demonstrations of a manure spreader, with a front-end loader used in filling the bin.

Distillers Waste Application to Fields

Appleton estate has embarked on commercial field application of distillers waste, or dunder, known for its high potassium content as well as fair quantities of secondary and micro-nutrients useful for cane growth. Distillers waste is thought, however, to cause deterioration in soil properties

Table 3.3: Yield of 3rd ratoon BJ82119 in response to combinations of inorganic fertilizer, poultry manure and composted filter cake applied over two crops, at Springfield

Treatments	tc/ha	JRCS	ts/ha
740 kg/ha 17-0-17	58.81	13.33	7.81
615 kg/ha 17-0-17 + 3.5t/ha PM	61.36	13.06	7.98
615 kg/ha 17-0-17 + 3.5t/ha PM + 4 t/ha CFC	72.81	13.82	10.04
400 kg/ha 17-0-17 + 8.5t/ha PM	66.08	13.00	8.58
400 kg/ha 17-0-17 + 7.5t/ha PM + 6 t/ha CFC	62.44	14.17	8.82
SED	1.09	0.29	0.22
$LSD_{0.05}$	2.88	0.61	0.46

PM ... Poultry Manure

CFC....Composted Filter Cake

Table 3.4: Reserves of organic matter, available phosphate and potash in soil following harvest of manure treated plots, 2nd ratoon BJ82119, SIRI Farm, Monymusk

Treatments	% Organic Matter	ppm P_2O_5	ppm K_2O
740 kg/ha 17-0-17 (Control)	2.05	55.50	263.75
615 kg/ha 17-0-17 + 3.5 t/ha PM	2.15	65.75	276.50
615 kg/ha 17-0-17 + 3.5 t/ha PM + 4 t/ha CFC	2.61	101.50	267.75
400 kg/ha 17-0-17 + 8.5 t/ha PM	2.89	109.50	332.75
400 kg/ha 17-0-17 + 7.5 t/ha PM + 6 t/ha CFC	2.25	101.75	238.00
SED	0.07	7.53	19.37
$LSD_{0.05}$	0.16	16.04	41.27

Table 3.5: Soil chemical properties following application of distillers waste on Vauxhall Clay Loam

Treatments	pH	E.C x 10^6	ppm Na	%N	ppm P_2O5	ppm K_2O	ppm Fe	ppm Cu	ppm Zn
105 kg N/ha	4.72	120	38	0.24	94	102	95	5	2
105 kg N/ha + 340 t/ha D.W.	4.40	119	36	0.24	108	90	130	4.87	1.75
105 kg N/ha + 416 t/ha D.W.	4.39	121	33	0.23	101	79	99	4.75	2.25
SED	0.18	5.32	2.47	0.01	18.33	14.16	15.06	0.71	0.39
$LSD_{0.05}$	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	31.17	N.S.	N.S.

with repeated application and so SIRI is assessing long term effects on a particular soil type, Vauxhall Clay Loam, at **Windsor** farm.

In the first year of study the fields were reaped before the scheduled 12 months and yields were not taken. Meanwhile, soil analyses showed significantly ($p < 0.05$) higher iron content in soils treated with distillers wastes compared to the untreated control, *Table 3.5*. At the same time, there was no significant change in soil pH, electrical conductivity, sodium or nutrient content.

Gypsum Trial

The assessment of gypsum as an ameliorant for saline soils was undertaken on Caymanas Clay Loam at **Caymanas** estate. Gypsum was soil incorporated before planting variety BJ82102 in 1997. Evaluations were done in plant cane in 1998 and in subsequent ratoons in 1999 and 2001.

At the 3rd ratoon stage in 2001 there was an increase of just over 2 tc/ha with gypsum applied at 1.5 t/ha compared with the untreated control, *Table 3.6*. An increase of 5 tc/ha over the control was obtained with a dressing of 3 tonnes gypsum/ha. JRCS remained statistically similar with gypsum additions.

Table 3.6: Yields of 3rd ratoon BJ82102 with standard fertilizer dressing in addition to gypsum, on Caymanas Clay Loam, Caymanas

Treatments	tc/ha	JRCS	ts/ha
Standard Fertilizer (600 kg/ha 17-0-17)	77.93	11.58	8.99
Standard + 1.5 t/ha Gypsum**	80.36	12.29	9.85
Standard + 3 t/ha Gypsum*	82.94	11.50	9.50
Standard + 5 t/ha Gypsum**	81.22	11.46	9.25
SED	1.00	0.35	0.30
$LSD_{0.05}$	2.12	N.S	N.S.

** Gypsum applied in 1997

* Gypsum applied in 2000

Secondary and Micro-nutrients

Experiments laid out in rain-fed and irrigated areas to investigate the benefits of secondary and micro-nutrient application failed to yield positive results. Renewed interest was generated in secondary and micro-nutrient investigations with the need to boost cane and sugar yields.

Soil Analyses

Soils planted to sugarcane showed magnesium deficiencies in Wallens Clay and Four Paths Loam, *Table 3.7*. All soils, except Pennants Clay Loam and Cashew Clay Loam tended to show inadequate levels of zinc. Copper was found to be inadequate in Pennants Clay Loam and Four Paths Loam. Most soils were at best only marginal in levels of boron.

Formal trials evaluating magnesium, zinc and copper were in progress at **Frome**. In the past secondary and micro-nutrient

Table 3.7: Secondary and micro-nutrients (ppm) in random soil samples - composites of 0-15cm depths

Soil Name	Estate	Ca	Mg	Si	Zn	Cu	Mn	Fe	B
Pennants Clay Loam	Frome	1100	250	205	1	2	45	174	0.4
Wallens Clay	Frome	5100	35	154	2	4	23	22	0.4
Holland Clay	Holland Farm	4000	128	143	2	3	13	52	0.4
Four Paths Clay	Holland Farm	4700	145	147	1	3	14	63	0.5
Four Paths Loam	Holland Farm	2775	38	79	1	2	12	81	0.6
Cashew Clay Loam	Appleton	6050	208	58	4	4	36	48	0.6
Lluidas Gravelly Loam	Worthy Park	3250	313	131	3	3	155	60	0.4
Pennants Clay Loam	Worthy Park	1300	300	95	4	2	173	40	0.3
Adequacies		500-100	80-132	10-30	4-8	3-15	10-40	10-65	0.5-1.5

Table 3.8: Mean secondary and micro-nutrients in leaf samples submitted from Appleton Estate

Farms	No. of Fields	Ca	ppm %Mg	%Fe	Zn	Cu	Mn	B
Raheen	113	0.64	0.12	136	46	6.0	105	30
Appleton	34	0.51	0.16	235	21	13	89	11
Holland	67	0.46	0.11	88	20	5	37	18
Adequacy levels		0.18-0.26	0.06-0.15	15-30	10-15	4-12	15-20	1-10

deficiencies when corrected, at various sites within the industry, have not produced economic yield responses.

Leaf Analyses

Laboratory analysis of leaf samples from **Appleton** for secondary and micro-nutrients revealed satisfactory levels of calcium, magnesium, iron and manganese in113 fields tested at **Raheen** and 34 at **Appleton** farm, *Table 3.8*. However, at **Holland** magnesium deficiency was found in 9% of fields sampled. Zinc was below adequate levels in 11% of fields at **Raheen** and boron inadequate in 11% and 4% of fields at **Raheen** and **Holland**, respectively. Some 10% of fields at **Holland** recorded manganese deficiencies. Copper inadequacies were surprisingly high with 26% of fields deficient at Raheen and 45% at **Holland**. The high nitrogen fertilizer regime adopted by the farms and which on occasions is applied without phosphorus and potash is considered a recipe for unbalanced micro-nutrient uptake. The Institute sought to address this concern through fertilizer advisory bulletins.

Fertigation Trial

Applications of major nutrients via drip tubes are routinely made to sugarcane in sections of **Springvale** farm, Trelawny. Low levels of magnesium and copper in the major soil of the area, Brysons Clay Loam, suggest the addition of these may be beneficial under growing conditions where moisture is not limiting.

A fertigation trial was therefore established to examine whether added magnesium and copper as well as higher nitrogen dosages would increase yield. A statistically higher cane tonnage, 24 tc/ha greater than with standard dosage, was recorded with 5 kg Cu/ha in addition to combinations of nitrogen, phosphorus, potassium and magnesium, *Table 3.9*. Magnesium addition did not increase yields of cane or sugar. The grower was encouraged to apply copper in the fertigation schedule while additional investigations were carried out with magnesium.

Table 3.9: Cane yield at Springvale from fertigation with various dosages of nutrients

kg N/ha	kg P/ha	kg K/ha	kg Mg/ha	kg Cu/ha	tc/ha	JRCS	ts/ha
100	43	100	0	0	103.96	5.32	5.50
125	43	100	0	0	107.34	5.20	5.54
125	43	100	10	0	105.87	4.98	5.22
125	43	100	10	5	130.63	5.10	6.61
				SED	2.70	0.15	0.16
				$LSD_{0.05}$	5.57	N.S	0.33

3.2 ANALYTICAL LABORATORY

Introduction

The laboratory completed 24 700 analyses for the year 2001, including over 1 000 for research purposes. Samples analysed were classified as foliar, soil, wastewater, irrigation water, sugars, molasses, cane juice, fertilizer and compost. Analyses were conducted for parameters such as brix, pol, reducing sugars, dextran, whole raw and affined colour, suspended solids, micro and macro-nutrients, total dissolved salts, biochemical oxygen demand (BOD), and chemical oxygen demand (COD).

In addition, the laboratory successfully supervised several very important projects for the industry and conducted training sessions for core laboratory workers and other industry personnel. Several core laboratory audits and three collaborative tests of cane samples were carried out between core labs.

Evaluation of Laboratory Methods

The laboratory continued to participate in the plant tissue and soil material exchange programmes conducted by Wageningen University of the Netherlands in an effort to maintain precision and accuracy in analytical techniques. In the analysis of plant material, improvements were noted in the analysis for calcium, magnesium and iron as there was a greater level of acceptability of these results over the previous year.

Improvements were recorded in analysing for elements extracted by calcium chloride solution which is a fairly new solvent in use, as the laboratory maintained its usual high standards in soil analyses.

The Laboratory also participated in collaborative testing of raw sugar for pol and moisture organised by the Sugar Association of London. Statistical analysis showed that the results obtained by SIRI were not significantly different from those obtained by the other participants.

Sugar Quality 2000/2001

The industry-wide average sugar quality produced in 2000/01 was not as good as in previous year. Specifications for dextran and reducing sugars, parameters of importance to refiners, were not met. The safety factor was within the specifications for all factories. However, pol was of satisfactory standard, averaging 98.08° for the crop.

Molasses Analysis

Although there was room for improvement, results obtained from analyses of molasses showed that sugar recovery had improved at most factories over the previous year.

Wastewater Analyses

The results of analyses, routinely done on wastewater collected during the year, showed biochemical oxygen demand (BOD) and chemical oxygen demand (COD) at generally much too high levels. Other parameters only sometimes exceeded limits set by the Natural Resources Conservation Authority (NRCA) for wastewater from factories. Nitrates and sulphates were usually within the specifications and oils were usually not found. Some parameters were influenced by specific activities at the factories. For example, high pH and phosphate levels often indicated cleaning. A new BOD incubator and a BODTrak apparatus were acquired facilitating greater degrees of accuracy in analyses.

Irrigation Water Quality

There was no statistically significant change in the salinity and Sodium Absorption Ratio (SAR) of the water samples from wells analysed for the period under review (*Table 3.10*).

Table 3.10: Results of water analysis 1997 - 2001

Year	No. of samples	pH	EC mhos/cm	SAR
1997	1 086	7.43	1625	4.22
1998	603	7.28	1655	4.05
1999	518	7.51	1658	4.06
2000	733	7.60	1661	3.97
2001	101	7.81	1556	3.37

Replacement for lead subacetate in polarimetry of cane juice

During the course of the year, SIRI recommended Octapol, a non-toxic reagent, as a cost-effective substitute for lead sub-acetate used as a clarifying agent in polarimetric measurements of cane juice in core laboratories. Measurements using Octapol generally gave readings slightly lower than those obtained with lead subacetate. After an appropriate statistical study involving 5836 juice samples, giving a correlation coefficient of 0.9940, a correction factor was applied. The average pol value obtained with lead sub-acetate was 61.47° compared with 60.82° for Octapol. Polarization measurements were carried out at 589 nm.

Polarisation of raw sugars

For sugar pol determination, a comparison was also made between use of Octapol and lead subacetate. Octapol was found to be a good substitute, as the filtered sugar solution was sufficiently clear to facilitate readings. Pol values were not statistically different using the two methods. However, the use of NIR to analyse for sugar pol was not as successful as was hoped. The recommended grade filter aid was identified towards the end of the year for further trials in the 2001/02 crop.

Dextran In Cane Juice Using NIR Technology

In a collaborative effort between S.I.R.I, Westminister University, England and Optical Activity, England, NIR technology was being tested for analysis of dextran in cane juice. This method is based on polarimetric differences between measurements for control (raw juice sample) and a test (enzyme hydrolysed juice sample). The project was a success and this technology is now commercially available.

Phosphate determination methods

Investigations continued into establishing correlations between use of 0.01M calcium chloride and Truog in measuring phosphate concentrations in soils and the relationship with foliar concentrations.

Studies continued on the correlation between conductometric values of sugar and molasses solutions and gravimetric determination of sulphated ash residues as a more convenient, less time-consuming method of determining inorganic constituents in these solutions

Reducing Sugar Analysis

Prior to the start of the crop a decision was taken to conduct reducing sugar analyses by use of the method developed by the Berlin Institute. This was due to the fact that the previously used Lane-Eynon method was downgraded from an official to a tentative status by ICUMSA. Also, Markan Laboratories routinely uses the Berlin method to analyse sugar shipped from Jamaica. Thus allowing for meaningful comparisons of results from the two labs to be made.

However, the Berlin Method has not been fully sanctioned by ICUMSA, which has instead recognised the Luff-Schoorl method. Investigations into use of the latter for molasses analysis have begun at SIRI's Central Laboratory. This method is fairly complex and these investigations will continue in the upcoming crop with a view to establishing its suitability for routine work.

A total of 20 molasses samples were received from Australia for reducing sugar and total reducing sugar analysis as part of the work being done by the GS 4 ICUMSA committee for the meeting set for June 2002.

4 CROP PROTECTION

4.1 ENTOMOLOGY

Sugar cane stalk borer (*Diatraea saccharalis*)

The annual stalk borer damage survey covered a broader area of the industry in 2001 as an attempt was made to include more farms outside of the traditional areas of high borer infestation. Area sampled was therefore widened from the dry southern plains of Clarendon and St. Catherine, to encompass farms in the northern Clarendon hills and Trelawny. This was triggered in part by reports of high borer damage levels at **Lucky Valley** farm in northern Clarendon. A further reason was the discovery in 1999/00 that field populations of the imported parasite, *Cotesia flavipes*, had dwindled to insignificance. So field surveys were also carried out at **Hampden** and **Long Pond**.

The survey again found damage levels to be quite high at **Monymusk** and **Long Pond**, at 13.9 and 11% of internodes respectively. The other areas, **Bernard Lodge**, **New Yarmouth**, **Lucky Valley** and **Hampden**, were in a more acceptable range of 6.8-7.5% internodes damaged. Even these lower levels are however somewhat above the internationally accepted economic damage threshold of 5%.

Variety susceptibility

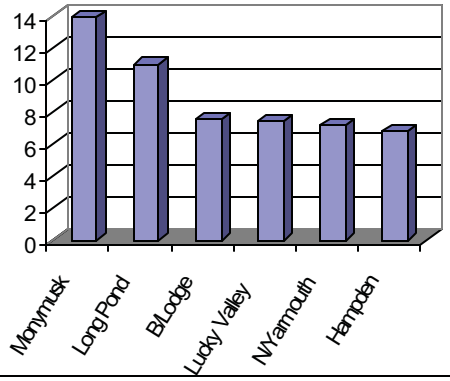
In the survey, a total of 17 commercial varieties were sampled. Some, such as BJ78100, CR67400, BJ7314, BJ84124 and BJ7230 were peculiar to some estates and so any analysis of relative susceptibility would be limited by non-uniform distribution. When examined, the more widely distributed varieties, such as BJ7504 and BJ82119, show great variability in damage between estates. BJ7504 for instance recorded a high average of 18.3% internode damage at **Monymusk** as against 7.4% at **Hampden**, *Table 4.1*. While there was just 1.0% internode damage in BJ82119 at **Lucky Valley**, that variety showed 10.7% damage at **New Yarmouth**, *Table 4.1*. This variation tends to support the view that location has a much stronger influence than variety on damage levels.

Similar variation is often found even within an estate. For instance, Farm 1 at **Monymusk** was found to be generally less affected by the borer, 8.7%, than was Farm 3 where 17.0% of internodes were bored overall. Thus, BJ7504 in a field, Russell Piece, on Farm 1 recorded 9.1% damage but the same variety in Lennon 1A on Farm 3 showed all of 31% internodes bored, *Table 4.2*.

Biological Control

With borer damage still unacceptably high in some locations and field populations of the imported parasite, *Cotesia flavipes*, at such low levels, the biological control programme was restarted in 2001 with importation of a batch of nine

Fig. 4.1: Percent cane internodes bored by stalk borer in areas sampled, 2001 survey



cocoon masses of *C. flavipes*, from Barbados. Although two of these masses produced only males, there were enough females in the others to start a laboratory colony from which there was multiplication and releases at **New Yarmouth**, **Monymusk** and **Lucky Valley**. However periodic field collections, gave no indication of fresh establishment so the effort of rearing/release will continue. Native parasite, *Lixophaga diatraeae*, remained the dominant species in fields with occasional appearances of *Agathis stigmaterus*. All told, field parasitism was down to under 20% as against 37% when *Cotesia* played a significant role in the mid 1980's.

Adult canefly and nymphs

Table 4.1: Variation in average % internode damage within leading varieties among estates sampled

Estate	BJ7504	BJ82102	BJ82119	BJ8226	UCW5465
Monymusk	18.3	9.0	2.6	7.5	13.6
N/Yarmouth	9.1	2.3	10.7	3.6	n/a
L/Valley	n/a	n/a	1.0	n/a	n/a
B/Lodge	13.0	4.4	8.9	6.9	9.0
Hampden	7.4	n/a	n/a	4.6	7.0

Table 4.2: Variations in internodes damaged within varieties at different locations at Monymusk

Farm	Field	Variety	Cycle	Internodes Bored (%)
Farm 1	Dea Bought	BJ7015	Plant	11.7
	Spring Head 36A	BJ7504	5 Ratoon	10.8
	Spring Head 38	BJ8226	1 Ratoon	5.3
	Russel Pce	BJ7504	Plant	9.1
	Milk Spring 8	BJ8226	1 Ratoon	2.8
	Top Common 2A	BJ7504	2 Ratoon	16.4
	Sec 5A	BJ82119	1 Ratoon	2.6
	Riverside 4	BJ8226	1 Ratoon	9.2
Sub-Total				**8.7**
Farm 2	Paradise 19	BJ7015	19 Ratoon	15.9
	Paradise 18	BJ7504	6 Ratoon	19.2
	Paradise 16	BJ7504	2 Ratoon	22.6
	Exeter 2	BJ7504	6 Ratoon	21.2
	Exeter 4	BJ7015	3 Ratoon	16.9
	Exeter 7	BJ8226/ BJ82119	1 Ratoon	8.7
	Exeter 31	BJ8226	2 Ratoon	11.6
	Exeter 10	Mixed	5 Ratoon	18.4
Sub-Total				**16.8**
Farm 3	Ballinda 1	BJ7504	2 Ratoon	16.2
	Lennon 1	Mixed	2 Ratoon	29.1
	Lennon 1A	BJ7504	2 Ratoon	31.7
	Smith Pce	BJ7504	Plant	18.2
	Canal Pce 2	UCW5465	2 Ratoon	10.7
	Canal Pce 2A	UCW5465	2 Ratoon	12.0
	Dry River 4	BJ82102	1 Ratoon	9.2
	Dry River 5	BJ82102	1 Ratoon	8.8
Sub-Total				**17.0**
Grand Total				**13.9**

Canefly, *Saccharosydne saccharivora*

As in 2000, there was again a minor outbreak of caneflies at **Holland**. The infestation was monitored until June, at which time a decision was taken to bring it under control with an aerial spraying. The operation was properly timed and executed resulting in satisfactory control on the over 200 ha affected. Elsewhere, although there were minor outbreaks, notably at **Bernard Lodge** and **New Yarmouth**, it was not considered necessary to apply chemical control measures and populations eventually dwindled under the pressure of natural control. Towards the end of the year an infestation was being monitored in the Mid-Clarendon/St. Jago area.

4.2 WEED CONTROL

The Institute continued to emphasise pre-emergent chemical treatment as the preferred practice in weed control within the Sugar Industry. The newest additions to the list of chemicals suitable for this purpose were Command (clomazone) 480, at 2 L/ha and Dual 960 (metolachlor) at 1.5 L/ha each applied with Atranex 500 (atrazine) at 2 L/ha. These herbicides produce clean fields when used at recommended rates, and in the presence of adequate soil moisture. Dual, however, was better than Command in fields where nutsedge posed a problem. This combination controlled all broadleaf weeds, even though hormone-type chemicals, to which broadleaf weeds are highly susceptible, were not included. During 2001, trials at **St. Thomas Sugar**, **Fred M. Jones Estate**, **Monymusk** and **Bernard Lodge** further confirmed these findings.

In circumstances where post-emergent control becomes necessary there are effective chemical combinations. For instance, it was shown that guinea grass control was achieved at **Lucky Valley** and **Look Out** in Upper Clarendon with applications of Velpar (1.5 L/ha) and Igran (4.0 L/ha) each with 1.5 L/ha of diuron 800. The cane was not damaged even though applications were made within stools and in fields where the perennial grass was well established. In other areas where pre-emergent control was good, spot spraying with a mixture of paraquat and diuron (Gramocil) at 1.0-1.5 L/ha gave satisfactory results.

Post-emergent sedge control was attempted at **Holland**, **Monymusk**, and **Lucky Valley** with an improved formulation of the sulfonylurea herbicide flazasulfuron (Katana). This product was also effective, but seemed to cause early stunting in the canes. Recovery occurred within 100 days and tended to be more rapid where growth conditions (nutrients, moisture) were optimal.

Sucrose Enhancement

During the 2000/01 crop year 2,893 ha of canes were ripened in the Jamaican Sugar Industry: 2821 ha commercially, and 72 ha experimentally.

Experimental applications used were sulfosate (Touchdown), 21.86 ha at **New Yarmouth**; Nutrient

Balancer (a mixture of molybdenum and boron), 9.68 ha at **Holland**; trinexapac (Moddus), 26.51 ha at **Raheen** (**Appleton**) and **Worthy Park**; and a mixture of paraffinic oil at 4 L/ha) as emulsion with 0.4 L/ha of fluazifop (Fusilade), 14.62 ha at **Raheen** and **Casa Marantha** (**Appleton**). A rate higher than the normal (800 ml/ha) of fluazifop was also applied at **Raheen** to hasten ripening to maintain the flow of canes of good quality, measured in terms of Jamaican Recoverable Cane Sugar (JRCS) to the factory.

Natural ripening was generally good at **Worthy Park** and **Raheen**, and poor at **New Yarmouth** and **St. Thomas Sugar Co.**, *Table 4.3*.Notwithstanding, ripeners enhanced quality in commercial applications by ~ 6% (9.81 vs 10.40 JRCS), *Tables 4.3 & 4.4*.

Methods of assessment of commercial applications were variable, depending on the approach of the particular estate, and inconsistent, especially in regard to how fields were designated 'control.' While results may be generally regarded as positive, too much reliability could not be placed on the magnitude of the extra sugar yield reported. The formal experiments, however, provide much more reliable data and is the main basis of this report.

The experimental results from use of sulfosate at **New Yarmouth** improved quality by more than 24%, *Table 4.5*, while **Fred M. Jones Estate** in St**.** Thomas reported a 32.5% increase from commercial use of Roundup in BJ7015, *Table 4.6* The relatively modest 4.1% increase from oil plus Fusilade at **Appleton** is nonetheless noteworthy, because the oil allowed for use of a lower dosage of ripener.

The more reliable data on trinexapac came from **Worthy Park** where 9.27% improvement in quality was recorded, *Table 4.6* All varieties treated in both commercial and experimental fields responded to treatment.

Table 4.3: Samples of cane quality in fields naturally ripened at estates applying ripeners

Area/Farm	Area samp. (ha)	Cane samp. (t)	Estimated Sugar (t)	JRCS
Frome	174.62	13,070.45	1,197.04	9.16
Holland	27.62	2,621.52	276.63	10.55
Appleton	84.90	6,859.43	761.69	11.10
Yarmouth	28.91	2,131.80	171.17	8.03
Worthy Park	16.54	1,397.17	165.79	11.87
St. Thomas	18.13	1,542.72	137.15	8.89
Sum/mean	**350.72**	**27,623.09**	**2,709.47**	**9.81**

Table 4.4: Cane quality in fields chemically ripened at various estate

Area/Farm	Area samp. (ha)	Cane samp. (t)	Estimated Sugar (t)	JRCS
Frome	307.37	19,473.22	1,874.79	9.63
Holland	387.09	29,238.87	2,873.14	9.83
Appleton	463.59	32,775.19	3,615.66	11.03
Yarmouth	134.67	9,479.56	945.38	9.97
Worthy Park	10.84	905.51	116.82	12.90
St. Thomas	144.10	11,546.90	1,332.31	11.54
Sum/mean	**1,447.66**	**103,419.25**	**10,758.10**	**10.40**

Table 4.5: Comparison of JRCS in samples of cane from fields ripened naturally (n) vs chemically ripened (c) according to treatment used at specific locations.

Chemical	n-JRCS	c-JRCS	Change	%Change
Oil + Fusilade (Appleton)	11.10	11.56	0.46	4.14
Touchdown (Yarmouth)	8.03	9.98	1.95	24.28

n-JRCS -JRCS of naturally ripened cane
c-JRCS -JRCS of cane chemically ripened

Table 4.6: Cane quality in varieties ripened naturally (n) vs chemically ripened (c) at various locations

Chemical	n-JRCS	c-JRCS	Change	%Change
		Roundup @1000 ml/ha		
Fred M. Jones BJ7452	9.00	10.48	1.48	16.44
Fred M. Jones BJ7015	8.80	11.66	2.86	32.50
Mean	**8.89**	**10.76**	**1.87**	**21.03**
Frome BJ7504	8.94	9.51	0.57	6.38
Frome BJ7015	8.34	8.96	0.62	7.43
Frome - BJ8226	9.69	10.15	0.46	4.75
Mean	**8.98**	**9.49**	**0.51**	**5.68**
		Roundup @ 800 ml/ha		
Worthy Park - BJ82156	11.60	12.20	0.60	5.17
Worthy Park - BJ7504	12.12	12.80	0.68	5.61
Mean	11.80	12.47	0.67	5.68
		Moddus @ 800 ml/ha		
Worthy Park - BJ82119	11.71	13.25	1.54	13.15
Worthy Park - BJ82156	11.60	12.55	0.95	8.19
Worthy Park - BJ8226	12.53	12.94	0.41	3.27
Worthy Park - BJ7504	12.12	13.09	0.97	8.00
Mean	**11.87**	**12.97**	**1.10**	**9.27**

5 AGRICULTURAL ENGINEERING

5.1 DRIP IRRIGATION

Pineapple Row Planting

Efforts to find means of reducing establishment costs of subsurface drip irrigation have centred around the so-called pineapple row planting of cane so that one drip tube line may simultaneously wet two cane rows. A 2.47 ha field block was laid out in this style at **Springfield** on the SIRI experiment farm in 1999. With this configuration the main concerns were that the pineapple rows would possibly not receive enough water for satisfactory growth and that field machinery would do damage to cane rows during cultivation and harvesting. In an effort to reduce effect of the latter, it was decided to establish the field in a flat bed culture so that during harvest at least, when driving atop rows would be inescapable, damage by cane loader and truck would be minimized.

After two years, the challenge posed by the inter-row cultivation was still not overcome, but the failure to do this seems not to have impacted severely on yield which at first ratoon was of the order 82 tc/ha. However the irregular row spacing was of little consequence with fertilizer applied by fertigation and with reduced need for weed control, given the sub-surface water application and early canopy formation. Manual harvesting proved to be quite simple with minimal observable row damage. A fair degree of lodging was encountered. BJ7548 is normally a relatively erect variety so the observed lodging could have been a result of reduced rooting depth created by the flat culture.

While pineapple row spacing has not produced an increase in cane yield on this clay soil, the results suggest that the savings incurred from halving the length of tubes purchased in installation would make this practice economically advantageous to the grower.

Other Drip Trials

Field #1241 at **Springfield**, divided into two sections, was laid out under drip irrigation 5 - 6 years ago. The first section was to compare two tube types, one of which performed so badly, it had to be replaced by the other after two crops. The second section was to support a museum plot of sugar cane varieties. Because that museum plot contained a mix of varieties, some of foreign origin and several poorly adapted, yield has been relatively poor. Furthermore as the site was laid out for easy viewing and comparison of each variety, there was much wasted space around each plot. These factors largely account for the relative low yield in the museum plot, 63 tc/ha compared with 89 tc/ha in the other section during the 2001 harvest.

Both sections however demonstrate a satisfactory hardiness and longevity of the Netafim tube type. This is of fairly rigid walls with apertures at 60cm intervals. With the tubes buried, damage during harvesting has been minimal and maintenance requirements relatively low.

Drip Tube Comparisons

In another field block at Springfield, Netafim, Ro-drip and T-Tape brands of tubes are being compared. Although attempts were made to deliver the same quantity of water through each tube type, the T-Tape brand received 138 mm less than the others at the end of the period, *Figs. 5.1,5.2 & 5.3*. The deficit of 150 mm for April was largely by design and in accordance with plans for harvesting in May. A net surplus of 428 mm occurred for the Netafim and Ro-Drip tubes whereas that for the T-Tape brand was 281 mm.

The average yield for all three treatments was 57 tc/ha and was considered low. This was ascribed to relatively poor physical soil characteristics and the use of a variety BJ82119, which has proven to be poorly adapted. There was no significant yield difference among treatments.

Fig. 5.1: Water balance for field 1270A netafim tubes

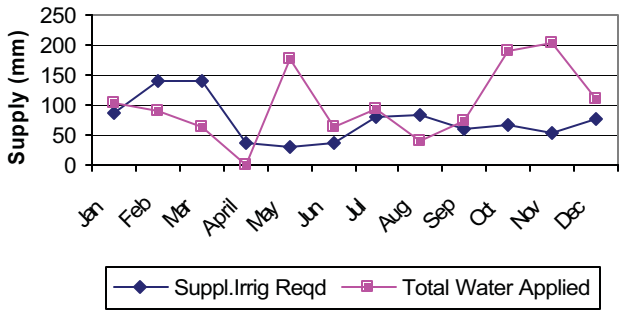
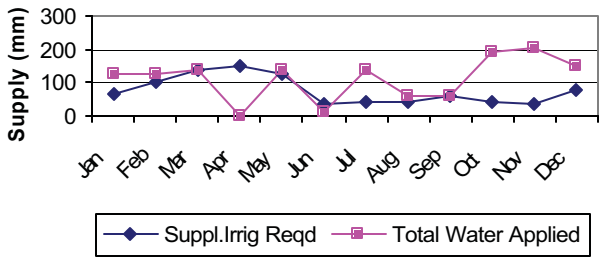


Fig. 5.2: Water balance for field 1270B US - (Ro-drip) tubes



Demonstration Plot

The 3.7 ha pineapple row joint SIRI/Farmer demonstration plot at Block A, **Bernard Lodge**, originally slated to be reaped as seed cane, was eventually sold to the factory at a yield ranging from 105 tc/ha, wet by T-Tape, to 135 tc/ha, wet by Netafim cylindrical tubes. An adjacent field under sprinkler irrigation, planted at the same time to the same variety, UCW5465, yielded just 79 tc/ha. This drip-irrigated plot was also planted in a flatbed culture which facilitated easy loader movement during harvesting.

The relatively satisfactory yield should also be seen against a background of withdrawal of water at the 7-month growth stage in anticipation of harvest as seed cane. Regrowth after harvest has been prolific while substantial supplying had to be undertaken in the adjacent sprinkler irrigated fields.

With planned harvesting of the crop for seed cane purposes, the irrigation was scaled down on several occasions during February and March. There was thus a deficit of 8 mm during February and 99 mm during March. Irrigation ceased during the commencement of the drying-off period in April. This is reflected as a net deficit of 129 mm. This increased to 152 mm during May and 258 mm in June, *Fig 5.4*. The crop therefore underwent both unscheduled and scheduled moisture stress during most of that period.

The flat bed culture served its purpose of facilitating easy movement of harvesting machinery and equipment. The JRCS of 10.39 obtained was below the 10.76 All suppliers average at Bernard Lodge estate.

Center Pivot Irrigation

New Yarmouth estate installed the first centre pivot sprinkler irrigation system in the Jamaican sugar industry in February 2001. Growth was so encouraging that by the end of the year, three additional systems were installed, replacing traditional furrow irrigation systems.

The centre pivots were all electrically driven, spanning in excess of 460 m. The systems capacities were based on the maximum expected evapo-transpiration of 8 mm per day and offered the possibility of chemigation - application of chemicals such as fertilizers and ripeners to the crop.

Despite teething problems, such as drive wheels becoming bogged down occasionally and appearance of cracks in supporting members, the technology opened new possibilities for dramatically increased yields. It was felt that initial difficulties could be overcome by better preparation of the paths through which the wheels must travel. A study of application rates and water use efficiencies was underway.

Traveling Hose Reels

An evaluation of the costs of operating the newly acquired Traveling Sprinkler (Hose Reel) was done at **Bernard Lodge**. Measurements were taken of the volume flow and the NIC water charges per month from which an average hourly cost

Fig. 5.3: Water balance for field 1270C T-tape tubes

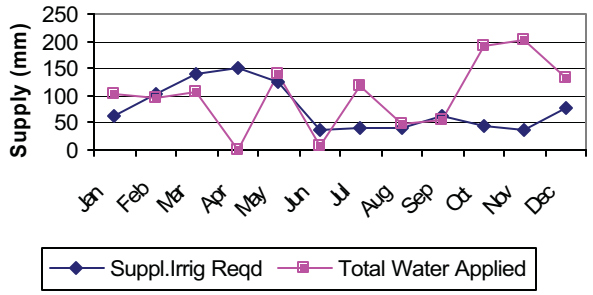
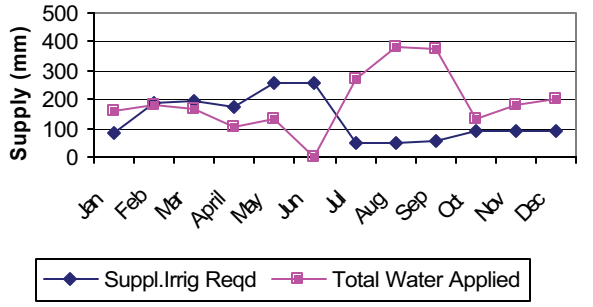


Fig. 5.4: Lot 10 Block A pineapple row drip demonstration plot - B/Lodge



of $54.0 was determined. Information on the acquisition and maintenance costs of the equipment as well as that for fuel and supervision were included. When added to the tractor operating cost of $583 per hour, a grand total Owning and Operating Cost of $637/hr was deduced.

The resulting cost of $9, 442 per hectare per annum is considered quite reasonable when compared with flood irrigation with average costs of $12, 000 per hectare per annum.

Mist Blower Modification and Calibration

The modification of a STIHL SR 400 Mist Blower with a 2.5 hp engine for ground application of chemicals for sugar cane ripening was accomplished with the installation of a small submersible pump capable of delivering 12 L/m. Further modification was done by extending the discharge tube for delivery of the liquid at heights of 3 - 4 meters above ground level prior to dispersing and atomizing. Delivery at higher levels was also possible. This modification was necessary since the standard equipment was set for delivering at approximately 1 m, above ground level.

Subsequent to an in-house calibration, an evaluation was done at the SIRI experiment Farm, **Springfield**. An average delivery rate of 9.9 L/m was obtained during the first phase. With an average walking speed of 5.6 km/h, there was an application potential of up to 265 L/ha delivering over a horizontal swath of 4 m. The field capacity was found to be as high as 4 ha/h when adequate provision was made for refilling of the tank.

The system was later improved by replacing the previous pump with one of 18 L/m capacity. This should cover 5 rows, resulting in a 66% increase in field efficiency. Further evaluation and testing will be undertaken during the 2002 crop.

Farmers - Lobby Group

During the year, the Farmers Lobby Group reconvened to address the proposed 36% increase in water charges by the National Irrigation Commission. The Lobby Group made representations leading to a lower level of 7.5% increase being applied. The Office of Utilities Regulations established a rate of $2.52 per cubic yard for agricultural customers, irrespective of farm size, a rate which maintains an element of Government subsidy.

The OUR also set a target of at least 70% conveyance efficiency which the NIC was expected to achieve by the end of the 2004/05 fiscal period and which would be taken into account in its calculation of water charges.

6 VARIETY IMPROVEMENT

6.1 FUZZ AND SEEDLINGS

Fuzz from the Cane Breeding Station, representing 214 crosses, yielded approximately 48 000 seedlings when germinated and potted. Included amongst the crosses were 13 families selected exclusively for high quality but whose yield potentials and adaptation to local conditions were yet to be established. These will be closely monitored and the best adapted returned to the Breeding Station for infusion in the regular breeding programme. This is in accordance with the efforts to generate varieties of superior sucrose yielding capacity for the local industry.

Distribution and Trends

BJ7504 remained the leading variety in cultivation for the fourth consecutive year, occupying 31% of cane area. *Fig 6.1 (page 18)*. Because of its high cane yielding characteristic, BJ7504 remained popular with growers, despite recommendations to replace it with economically more profitable varieties of greater sucrose yielding potential. BJ7015 decreased from 18% in 2000 to 13% in 2001, but remained the second most widely grown variety. Other prominent varieties, BJ7465 (9%), BJ82119 (6%), BJ8226 (6%) and BJ7627 (6%), showed only minor changes in distribution, as replanting remained depressed over the last two years. UCW5465 lost some ground in the irrigated area while there was decreasing use of BJ7230 at **Worthy Park** because of an increasing incidence of smut. BJ7314 (1%) remained the most important variety grown at Tropicana. At **Monymusk** BJ82102 was most widely propagated during the year.

Trend

In the western region, particularly at **Frome**, there was renewed interest in propagating the high quality BJ7627, especially on the peat soils. Newer varieties promoted in the area were BJ8252 and BJ7938. Special effort was made to establish nurseries of BJ82156, an erect, productive variety, particularly suited for mechanical harvesting.

Long Pond and **Bernard Lodge** were leaders in propagating BJ78100, which was formally released to the industry during the year. This was also the main variety in the replanting programme at **Hampden**. At **Tropicana**, BJ7314 remained most prominent, while there was increased use of this variety in areas such as **Appleton** and **New Yarmouth** with the implementation of improved irrigation systems. BJ8252 was undergoing propagation at **Frome**, **Appleton**, **Holland** and **Worthy Park**.

6.2 PRODUCTIVITY OF COMMERCIAL VARIETIES

In the western region, BJ8252 was the most productive variety averaging 100 tc/ha, or over 0.75 tc/ha/mo, (on a small area) at **Frome**, followed by BJ7465 (87 tc/ha and 0.75 ts/ha/mo). At **Appleton** BJ7314 (81 tc/ha and 0.79 ts/ha/mo) and BJ82156 (86 tc/ha and 0.78 ts/ha/mo) were the outstanding performers. The best performers at **Worthy Park** were BJ7262 (88 tc/ha and 0.82 ts/ha/mo), BJ7504 (83 tc/ha and 0.79 ts/ha/mo) and BJ82156 (81 tc/ha and 0.80 ts/ha/mo).

BJ78100 bud

BJ7938 bud

Table 6.1: Best Performers in Experiments - 2001, results presented as % of standards

Varieties	% Standard cane Yield	% of Standard JRCS	%of Standard Sugar/ha
BJ8532	115	109	128
BJ8534	106	112	123
BJ8708	100	108	109
BJ8723	102	104	109
BJ8783	132	112	152
BJ9036	100	106	106
BJ9037	93	113	104
BJ9086	109	110	126
BJ9127	106	106	111
BJ9138	117	106	124
BJ9146	112	102	117
BJ9164	112	104	117
BJ9167	133	106	141
BJ9186	93	110	105
BJ91292	117	111	130
BJ9112	98	106	104
BJ9134	139	107	145
BJ9243	101	109	109
BJ9250	109	94	102
BJ91117	92	109	100
Standards	**tc/ha**	**JRCS**	**ts/ha**
BJ7015	68.55	14.15	9.58
BJ7504	94.30	13.45	12.75
BJ7465	72.89	14.80	10.73
BJ82119	87.29	13.94	11.54
Mean	**80.75**	**14.08**	**11.54**

At **Cambria**, BJ7627 was ranked first in quality, measured in terms Jamaican Recoverable Cane Sugar (JRCS). The cane yield however, was very depressed. The best variety at **Bernard Lodge** was BJ82102 (69 tc/ha and 0.54 ts/ha/mo) while at **New Yarmouth** BJ7465 (90 tc/ha & 0.77 ts/ha/mo) and BJ8226 (79 tc/ha & 0.71 ts/ha/mo) outperformed other varieties. More productive varieties at **Long Pond** were BJ78100 (90 tc/ha & 0.68 ts/ha/mo) and BJ82156 (66 tc/ha & 0.54 ts/ha/mo). At **Tropicana** the most outstanding varieties at were BJ7314 and BJ7465. The outstanding performer, ranking first in yield and juice quality, at **Monymusk**, was BJ7548 (96.44 tc/ha & 0.95 ts/ha/mo).

6.3 YIELD TRIALS - EXPERIMENTS REAPED

During the 2001 crop, 11 yield trials were successfully reaped. Two were lost (burnt and reaped without prior notification to the Institute). Trials from which data were obtained belonged to the BJ85, BJ86, BJ87, BJ88, BJ90, BJ91 and BJ92 series. The outstanding performers are listed in *Table 6.1*. Top performers, BJ8532, BJ8534 and BJ8783 were placed in observation nurseries for further evaluation in preparation for being advanced to the semi-commercial stage. The others will undergo evaluation for another year.

6.4 SELECTION IN EARLY STAGE NURSERIES

Stage I (BJ2002)

Family selection was applied in Stage I nurseries, comprising some 48 000 clones, located in the Irrigated (**Monymusk**) and Rain-fed (**Frome**) areas. A total of 2 500 clones were advanced to Stage II nurseries, planted at **Monymusk**.

Stage II Nurseries (BJ2001)

Selections in Stage II nurseries at **Monymusk** yielded 400 clones which were advanced to the Stage III nurseries at **Frome** and **Monymusk**.

Stage III Nurseries (BJ2000 & BJ99)

Brix readings and visual assessment of agricultural features were noted in Stage III nurseries at **Frome** and **Holland**.

Drought Tolerance Tests

Four commercial varieties, BJ78100, BJ7548, J9501 and UCW5465, were compared for drought tolerance in a glasshouse test. UCW5465, which has proven drought tolerance, was used as the standard against which the others were judged. BJ7548 was last to show evidence of wilting. BJ78100 was the second most tolerant while J9501 was least tolerant to a reduced moisture regime.

Effect of staling on Germination

A glasshouse pot test was done to determine the effect of delays between cutting and planting of single-eyed cuttings of four varieties: BJ8859, BJ9086, BJ7938 and J9501. The results showed that all varieties exhibited satisfactory germination up until four days after cutting with marked decrease thereafter. J9501 failed to germinate at five days while BJ7938 grew satisfactorily for up to eight days of staling.

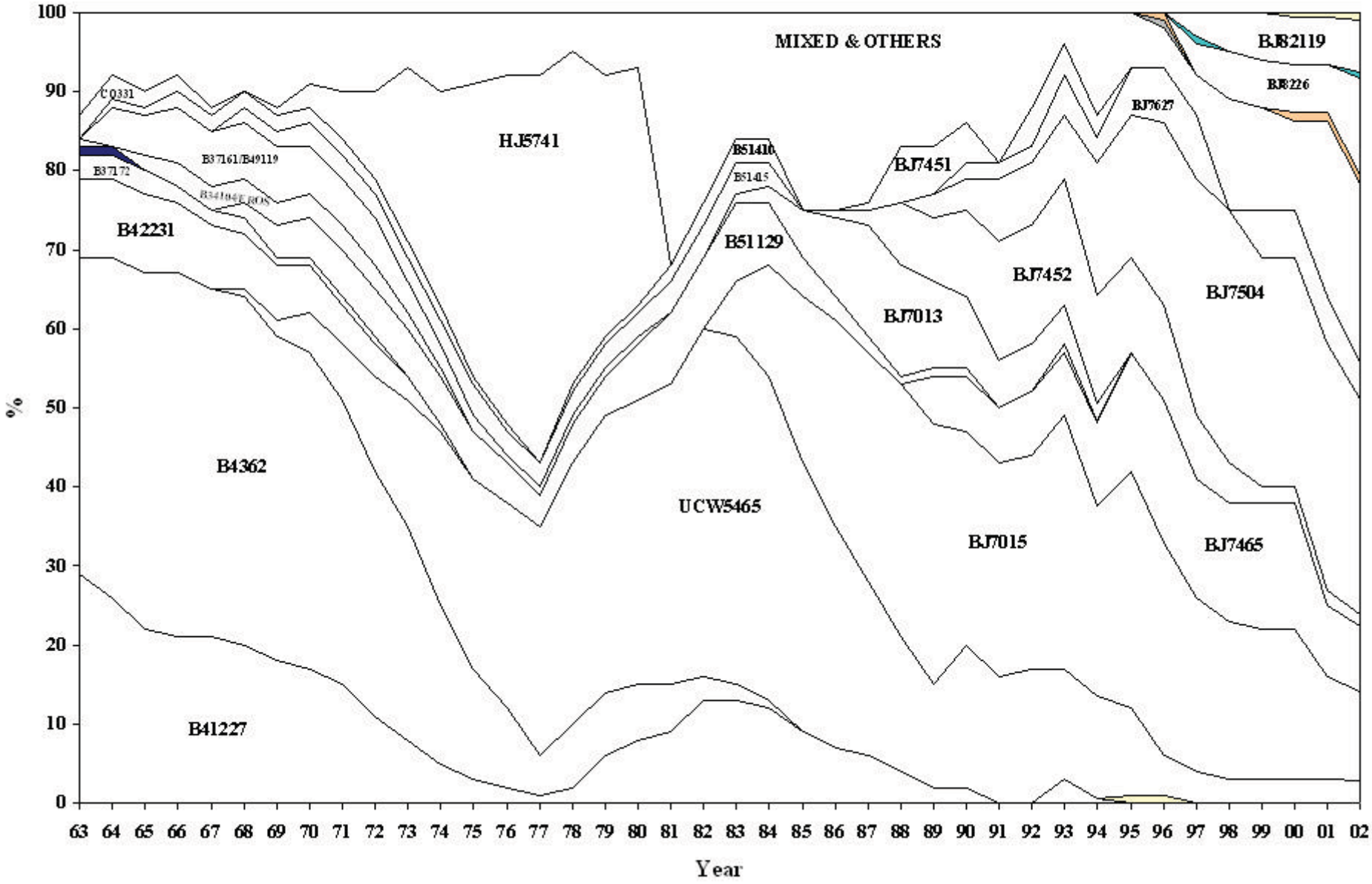
Selection For High Sucrose Content

Since 1997 the Institute has adopted family selection in Stage I nurseries as a means of increasing the chance of selecting clones with high sucrose content, in response to the industry's demand for varieties of higher quality. As brix tends to be a family trait, then eliminating families with lower brix at an earlier stage and focusing on those with higher brix results by Stages II and III in populations with mean brixes higher than would otherwise be obtained.

Release of New Varieties

With the formal release of BJ78100 and BJ7938 during the year, several growers obtained samples to establish nurseries and in some cases commercial plots at a number of locations throughout the industry. Prior to this, these varieties were found mainly in the arid plains of St. Catherine and Clarendon.

Fig 6.1 Percentage area under different varieties, 1963 - 2002



7 ECONOMICS & MANAGEMENT

7.1 CANE PRICE AND PROFITABILITY

Despite a reduction of only 2.15% in the price of sugar, average cane price fell by over 17% in 2001 from the previous year's value, largely as a result of lower average quality of cane as tested at the core laboratories. Jamaican Recoverable Cane Sugar (JRCS) in fact fell from 11.22 in 2000 to 10.10 in 2001. Reductions in the value of cane ranged from $76/tc at **Hampden** to $322/tc at **Tropicana**, *Table 7.1.*

Table 7.1: Comparison of Cane Price by Factory areas, 2000 vs 2001

	$/tonne cane			%
Factory	**2000**	**2001**	**Diff.**	**ReductIon**
Frome	1 215.77	957.52	(258.25)	21.24
Monymusk	1 401.53	1 211.63	(189.90)	13.55
B/Lodge	1 248.09	1 095.80	(152.29)	12.2
Long Pond	1 252.38	975.81	(276.57)	22.08
Appleton	1 195.77	1 063.28	(132.49)	11.08
Worthy Park	1 585.61	1 264.46	(321.15)	20.25
Hampden	1 228.07	1 151.56	(76.51)	6.23
Tropicana	1 348.70	1 026.80	(321.90)	23.87
Average	**1300.04**	**1069.68**	**(230.36)**	**17.72**

A study was conducted to measure the profitability of cane growing in different areas of the Industry in 2001. Assumptions were: a 13% interest rate, 3-year payback period and borrowing representing 80% of estimated establishment cost. Expected yields used in the study averaged 80 and 75 tc/ha over a six-year period in Irrigated and Rain-fed areas, respectively. The JRCS of 10.94 and 10.26 actually achieved in the 2001 crop at **Monymusk** and **Bernard Lodge** respectively, were used in the assessments at these factories and the 9.44 achieved at **Frome** applied to Rain-fed areas.

7.2 IRRIGATED AREAS

The analyses showed that cane growing in the Irrigated areas could be profitable at the 2001 sugar price of $18 697/t at yields of 80 tc/ha and JRCS of 10.94. However, annual returns would not be positive throughout the life of a particular field, *Table 7.2*. For instance, a return of $18 701.78/ha in the first year would be followed by a negative return of $2047.62 in the second. Thereafter there are positive returns for the remainder of the investment period. Where an additional loan is required for ratoon maintenance the same pattern of cash flow is observed, though net returns are reduced by interest charges.

Table 7.2: Estimated Net Returns/hectare, 2001 - Irrigated Areas

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
	Plant	**1 R**	**2 R**	**3 R**	**4 R**	**5 R**
Production cost ($/ha)	112 879	76 279	76 279	73 909	71 538	69 168
Yield (tc/ha)	80	85	85	80	75	70
Cost/tonne	978	1 236	1 201	924	954	988
Cane price of $1212/t, Monymusk (@ JRCS of 10.94)						
Annual Returns/ha	18 702	-2 048	9 233	23 051	19 362	18 702
Cumulative	18 702	16 654	25 887	48 938	68 300	83 972
Cane price of $1 096/t, Bernard Lodge (@ JRCS of 10.26						
Annual Returns/ha	9 422	-11 908	-8 937	13 771	10 662	7 552

At the lower JRCS of 10.26 obtained at **Bernard Lodge** (giving a cane price of $1096/t), cane growing in the Irrigated areas would be only marginally profitable. While a positive return is realized in Year 1, this is followed by two years of negative returns. Thus reasonable profits demand not only high cane yield but also high JRCS.

7.3 RAIN-FED AREAS

Using **Frome's** cane price of $958/t (JRCS of 9.44) and a projected average yield of 75 tc/ha to represent the Rain-fed areas, a marginal level of profitability is achieved, *Table 7.3*. Cash flow is positive at plant cane, negative for the next two years and positive for the remainder of the six-year cycle.

Table 7.3: Net Returns/hectare, 2001, Rain-fed Areas

	Year1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
	Plants	**01R**	**02R**	**03R**	**04R**	**05R**
Production cost ($/ha)	98 392	57 073	57073	54 867	52 661	50 455
Yield (tc/ha)	75	80	80	75	70	65
Cost/tonne cane	910	1 028	996	731	752	776
@ $958/tc (JRCS 9.44)						
Annual Returns/ha	3 626	-5 616	-3 017	16 983	14 399	11 815
Cumulative	3 626	-1 990	-5 008	11 975	26 374	38 189

There is obvious potential for greater profitability with better JRCS. However actual cane yields in Rain-fed areas were generally below 75 tc/ha. Hence there is need to increase yields if higher profits are to be realized.

7.4 COST OF PRODUCTION - 2000

The 2000 survey of cost of cane production was based on a smaller than usual sample size of 77 growers, including only 4 of the island's 8 traditional estates. Data was nonetheless drawn from the six ecological regions and included farms from less than 1 ha to large estates of over 5 000 ha in size, representing 13 798 ha, or 38.53% of area reaped, and 817 934 tonnes cane, or 40.12% of cane harvested for the 2000 crop.

Table 7.4: Comparison of cost per hectare by operations performed, 1999 and 2000

Operation	1999 Cost/ha*	% Total	2000 Cost/ha*	% Total	% Change
Land Prep. & Planting	42 492.64	8.46	38 390.47	7.00	(9.65)
Cultivation	25 989.55	32.79	29 706.73	37.00	14.30
Harvesting	22 649.43	28.58	20 352.83	25.00	(10.14)
Overheads	23 913.63	30.17	25 000.48	31.00	4.54
Total	**79 253.05**	**100.00**	**79 695.17**	**100.00**	**0.56**

**Note: The entries in these columns cannot be added to get the cost since the Land Preparation and Planting figures do not relate to the entire area. The percentage figure can be added directly.*

The national average cost of cane production including harvesting was estimated to be $79 695.17/ha and $1344.40/tc, *Table 7.4*. On a per hectare basis, cultivation cost represented roughly 37%, overheads 31%, and harvesting, over 25% of total cost. There was an increase of less than 1% in total production cost over 1999 levels. When comparisons were made on a per tonne cane basis, cost rose sharply by 12.1%, because of a drop in yield, *Table 7.5*.

Some farms, faced with cash flow problems, showed significant cost reductions but at the expense of inputs. There was evidence of less expenditure on some cultivation practices, including fertilizing and irrigating.

Table 7.5: Comparison of cost of operations, 1999 vs 2000

Operations	1999 Cost/t*	2000 Cost/t*	% Change
Land preparation	568.44	581.12	2.23
Cultivation	393.20	501.14	27.45
Harvesting	342.67	343.34	0.20
Overheads	361.79	421.74	16.57
Total	**1 199.04**	**1 344.40**	**12.12**

**Note: The entries in these columns cannot be added to get the cost since the Land Preparation and Planting figures do not relate to the entire area. The percentage figure can be added directly*

Target Cost

In 2000, the Institute developed and circulated for the first time Target Costs, representing reasonable rates for conducting farm operations, among growers throughout the Industry. Random checks showed that these targets were achieved by some growers. Target costs for the Irrigated and Rain-fed areas were set at $72 539 and $61 912/ha, respectively.

With cost of certain inputs increasing in 2001, growers would need to modify approaches in order to meet target costs in 2002. For instance, Irrigated areas must contend with a 10-11% increase in water rates and the Industry as a whole with a 7% increase in union-negotiated wages. As a consequence target costs for 2002 were adjusted to $81 461/ha for Irrigated and $64 750/ha for Rain-fed areas.

Cane Yield Survey - 2001

The 2001 cane yield survey showed ts/ha varying between 5.36 at **Tropicana** and 9.62 at **Cambria**, *Table 7.6*. It is generally accepted that to be profitable, Rain-fed areas should achieve at least 7.5 ts/ha, and Irrigated areas 8 and above. Examination of sugar yield for the five year period 1997 - 2001 show estates such as **Frome**, **Long Pond** and **Bernard Lodge** frequently producing below 7.5 ts/ha.

Table 7.6: Tonnes theoretical 96° sugar per hectare by estates/farm, 1997-2001

Estates/Farms	1997	1998	1999	2000	2001
Appleton	8.54	6.57	6.70	5.54	8.00
Bernard Lodge	7.20	5.98	6.07	6.54	7.01
Cambria	11.75	9.99	9.96	9.67	9.62
Frome	7.14	7.16	6.21	6.08	7.63
Long Pond	7.54	5.33	5.44	7.17	5.36
Newton Cane Farms	6.17	-	6.86	6.22	7.44
Worthy Park	10.77	10.93	9.87	7.17	9.48
Tropicana	8.53	6.29	6.32	7.98	7.76

- Data not available

On the other hand, **Worthy Park** and **Cambria** regularly produce at above 9 and sometimes over 10 ts/ha. Following three consecutive years of below 7.00 ts/ha, **Appleton** improved to 8.00 ts/ha in 2001. However this was still short of the 8.54 achieved in 1997.

The survey is detailed in tables at the back of this report.

Cane Growing as a Profitable Business

A series of seminars on Cane Growing as a Profitable Business was held in all factory areas in 2000 highlighting a proposed change to the cane payment formula, a quality-based harvesting incentive system and target cost of production.

The break-even principle was presented as one management tool that growers could apply in determining profitability. Using production cost and average cane price specific to the respective area, the principle was used to determine yields required to break-even (i.e. cover production cost).

Breakeven yields

Breakeven yield for Rain-fed areas, using **Frome**'s price of $1216/t cane in 2000, was determined at 55 tc/ha, *Table 7.7*, over an investment period of six crops (plant cane and five ratoons). At the price of $968/tc for the 2001 crop, the yield requirement is increased to 70 tc/ha.

Breakeven yield for Irrigated areas using the $1 401.53/t cane achieved at **Monymusk** for the 2000 crop, was determined at an average of 59 tc/ha, *Table 7.8*. However the yield requirement rose significantly to 69 tc/ha at the reduced price of $1 212/t obtained in the 2001 crop

Table 7.7: Breakeven Yields @ 2000 & 2001 Cane prices - Rain-fed areas

	Plant	1R	2R	3R	4R	5R	Total	Avg.
Cane Price*	**Break-even Yields**							
@ $1 216/t (2000 crop)	59	71	68	47	45	43	332	55
@ $958/t (2001 crop)	71	86	83	57	55	55	420	70

*Frome

Table 7.8: Breakeven yields @ 2000 & 2001 Cane Prices - Irrigated areas

	Plant	1R	2R	3R	4R	5R	Total	Avg.
Cane Price*	**Break-even Yields**							
@ $1 402/t (2000 crop)	56	75	73	53	51	49	356	59
@ $1 212/t (2001 crop)	66	87	85	60	58	69	412	69

*Monymusk

8 AGRICULTURAL PRODUCTION & EXTENSION SERVICES

8.1 CANE PRODUCTION

Despite a 10% increase in cane production to 2,237,176 t, sugar production fell by 5.5% to 204,968 t (96°) in 2001 compared with the previous crop. The increased cane yield was largely due to favourable weather during the growing season. Unsatisfactory weather for cane ripening contributed to relatively poor conversion to sugar of 10.91 tc/ts as against the 9.37 in the previous crop, *Table 8.1.*

Cane yields increased by 12.6%, from 56.9 tc/ha to 64.1 tc/ha. On a factory area basis, lowest yield of 41.5 tc/ha was registered among **Long Pond** farmers and highest of 79.6 tc/ha at **Worthy Park** estate, *Fig. 8.1.*

Reasonable cane productivity was obtained primarily in the **Worthy Park**, **Frome**, **St Thomas Sugar Co** and **Appleton** areas, *Fig. 8.2.* **Frome**, in fact, increased cane production by 173,597 tonnes while other areas fell well below average. Low levels of replanting and deficiencies in crop husbandry were main factors responsible for low overall productivity.

Fig. 8.1: Sugar cane productivity, 2001

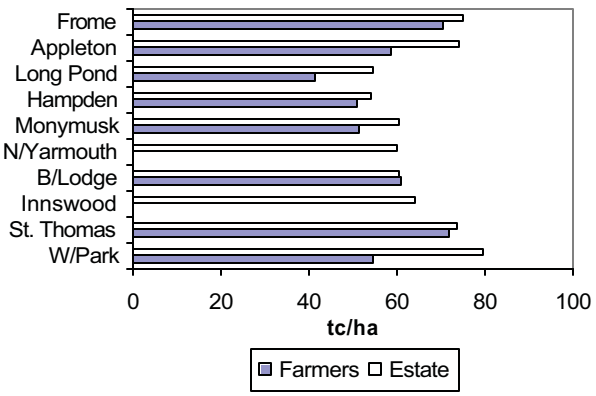


Fig. 8.2: Deviation from island average - 64.1 tc/ha

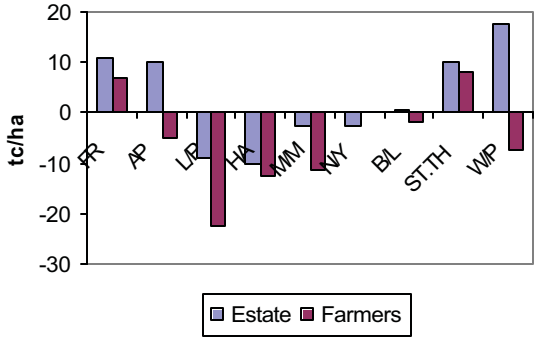


Table 8.1: Production and Productivity 2000 and 2001

		2001	2000
Cane Area (ha)		40 779	44 685
Area Harvested	Estates	17 258	19 420
	Farmers	15 743	16 404
	Total	**35 002**	**35 824**
Cane Harvested	Estates	129 708	1 158 032
	Farmers	947 429	880 538
	Total	**2 243 137**	**2 038 570**
Productivity (Cane t/ha)			
	Estates	67.30	59.60
	Farmers	60.20	53.70
	Total	**64.10**	**56.90**
Sugar ts/ha		5.86	6.05
Sugar Production			
Cane Milled (t)		2 237 176	2 031 667
Sugar Produced (t)		204 968	216 869
tc/ts		10.91	9.37
JRCS		10.10	11.22
Fibre % Cane (Core)			16.48

Replanting

The Extension Department provided technical assistance to growers and monitored fields developed under the replanting loan programme administered by the Development Bank of Jamaica, Peoples Cooperative Bank and Jamaica Cane Product Sales. The programme however, fell short of expectations as only 590 of the recommended 1243 ha received funding for establishment. By the end of the planting season only 2 831 ha, or just 6.3% of total cane area (38% of target), was planted *Table 8.2* . Estates replanted 45% of their farms, while farmers achieved 30%.

Faced with the difficulty of accessing funds through the normal channels, growers in the **Raymonds** area of Clarendon entered into an arrangement with tillage contractors who provided resources for developing approximately 90% of the 50 ha replanted in that zone. Credit was made available for 35 months and covered fertilizer, herbicide, seed cane and irrigation water cost.

At Springvale, J9501, BJ78100 and BJ7938 were all planted in expansion nurseries. Nurseries of BJ78100 and BJ7938 were established at **Bryan Chin**, **Kenneth James** and **Lincoln Bell**'**s** holdings

Table 8.2: Hectares Replanted to October 31, 2001

Areas	Estates	Farmers			
	ha.	16%	ha	16%	Total
	Planted	Target	Planted	Target	Planted
Frome	318	882	275	1 113	593
Clarendon	434	917	227	480	661
B/Lodge	357	736	55	522	412
Long Pond	111	271	61	231	172
St. Thomas	74	193	153	217	227
Appleton	246	409	186	413	432
Worthy Park	109	162	132	421	241
Hampden	74	246	19	241	93
Total	**1 723**	**3 816**	**1 108**	**3 638**	**2 831**

Assistance was given in the establishment of Extension Nurseries at **Cambria** and **Worthy Park** farms. Varieties planted were BJ8252, BJ8859, BJ7938, J9501, BJ9186, and J8808.

To provide seed stock of recently released BJ78100 for growers in St Catherine, this variety was included in the **McNie** nursery and necessary cultural practices carried out.

Similar variety propagation nurseries set up and monitored in St Elizabeth included those at **Bagdale Mountain**, **Boxx**, **MooPen**, **Six House**, **Dobber** and **Appleton**.

Fertilizer Programme

A total of 32 343 hectares was fertilized up to the end of October 2001 (*Table 8.3*). This represented 92% of the total area harvested and some 2 200 hectares less than fertilized in crop year 2000.

Table 8.3: Hectares Fertilized, 2001

Areas	Estates	Farmers	Total
Frome	4 948	4 773	9 721
St. Elizabeth	2 487	1 161	3 648
Long Pond	874	787	1 661
Hampden	360	572	932
Clarendon	5 027	2 213	7 240
St. Catherine	3 340	761	4 101
St. Thomas	876	853	1 729
Worthy Park	1 004	2 207	3 211
Total	**18 916**	**13 327**	**32 343**

Training

Training of personnel directly involved in harvesting was carried out prior to the start of crop in all but the Dry North Coast area. Participants included contractors, cane cutters, grab loader operators, and cane growers. Follow-up monitoring in the Clarendon area indicated a noticeable effort, on the part of some, to do the recommended exclusion of extraneous matter, such as tops and young and rotten canes, from cane loads going to the factory. Loader operators attempted to correct undesirable practices while contractors put out extra effort to deliver fresh canes.

A seminar convened in the arid southern belt reinforced the need for good management of irrigation water, especially in light of increasing water costs. The occasion was also used to fully explain the billing system so that growers would better appreciate how water cost was derived. Emphasis was on improved water use efficiency to reduce cost and increase yield.

A group of growers were taken on a tour of SIRI's **Springfield** Experiment Farm where they were shown various projects being developed. More particularly, they were shown the attendant results of carrying out recommended practices. They were encouraged to adopt relevant practices on their own farms.

At the start of crop in the Wet West, growers delivering cane with JRCS below 7 were targeted for special attention and training towards achieving better quality. Early results of training towards better harvesting practices were positive, particularly in St Catherine, but later rains caused a sharp drop in quality.

With the delayed start of crop in the North Coast area, growers, for the most part, were delivering canes older than 12 months when deterioration in quality had set in. In attempts to maximise earnings under these circumstances, Extension demonstrated in particular the value of removing suckers, which, at levels of up to 4% of cane weight, were found to be the principal cause of reduced cane quality. With this as the major focus, two field days were held for growers in the area. In addition cane loads were stripped at the **Long Pond** factory, extraneous matter removed and the improvement in quality (measured in terms of JRCS) demonstrated. To further illustrate what needed to be done at the farm level, demonstrations were held in the **Fontabelle**, **Hampstead** and **Hyde** areas removing and weighing suckers and other extraneous matter from cane piles, then noting the sharp increase when such canes were core sampled at the factory gate.

In addition, there was a series of 2-day Tractor Care Workshops for tractor, grab loader and harvester operators at **Frome**, **Bernard Lodge** and **Appleton**, all during the out-of-crop period. Some 180 persons participated in the programme which focussed on the following:

- Fundamentals of tractor operation
- Care of equipment
- General safety
- Recognising defects
- Performance maintenance
- Hydraulic system
- Operating on various terrains

Industry Seminars

Greatest training emphasis was on reaping. However, training also covered wider aspects of cane agriculture. Under the theme "Sugar as a Profitable Business" a series of seminars were held across the industry. These included presentations of a proposal to change the cane payment formula so that the supplier of better quality cane would receive the full payment commensurate with that quality. Also a scheme was presented that would provide an incentive for the harvesting team that supplied better quality cane. By the harvesting team seeking to so increase its earnings, the grower would simultaneously receive a net increase in payment for cane supplied. There was considerable focus on cost of cane production as growers were introduced to systems of record keeping and given a set of target costs. Simple accounting methods were also promoted by which growers would track profitability of operations.

Irrigation

The Industry took a major step towards increased efficiency in 2001 with the first commercial installation of a centre pivot irrigation system at **New Yarmouth**. The initial system, covering 74 ha, was set up in February. By August, with early indications of superior cane growth, the estate was about to install two additional systems and was contemplating whole-scale conversion of the farm from the traditional furrow irrigation.

At **New Yarmouth's** request, growth stations were set up to measure cane growth under centre pivot. Every attempt was made to select field sites which were as similar as possible in all respects so that the only variable would be the method of application of irrigation water. The best location turned out to be a field, Section 49, which was partially covered by centre pivot and the rest furrow irrigated. Growth stations were set up in the respective sections. This ensured that comparisons were made within the same variety, BJ8226, at the same age, in the same cycle (1st ratoons), on the same soil type (clay loam) and in the very same field. Locations with largely similar plant densities were also chosen. The sites were established in June. In addition, growth stations were set up in another 1st ratoon field (Section 1) of BJ8226 which was 2 months younger and outside of the centre pivot area, but on fairly similar soil type.

Table 8.4: Measurement of growth parameters in approximately 9 month old first ratoon BJ8226 in areas under Centre Pivot versus furrow irrigation, New Yarmouth

Growth parameter	Centre Pivot	Furrow irrigated	Furrow irrigated
	Section 49	Section 49	Section 1
Avg. Stalk height (cm)	78	64	65
Avg. Stalk diameter (cm)	2.9	2.7	2.7

At approximately 9 months of growth, stalks in centre pivot plots were 21% taller and 7% thicker, *Table 8.4*. There were no statistical differences in number of open leaves (9 per stalk in each plot). The combination of greater stalk length and diameter pointed to a possible 30% greater yield in the centre pivot irrigated sections, provided this growth differential was maintained until harvest.

High Density Planting

Many sugar industries are today exploring high density planting as a mechanism for increasing cane yield and reducing weed control cost. With erect stalks it becomes feasible to pack in more stalks per hectare without causing overcrowding thus increasing yield. Erect canes also tend to foster weed growth, as canopying is often delayed and relatively ineffective. The greater stalk population in high density planting tends to compensate for what would otherwise be a weak canopy. SIRI promotes high density planting especially in nursery cane plots and has tested it as a means of getting better yields in some drip irrigation experiments. Now **Worthy Park** is exploring it in commercial cane production. Using the very erect BJ82156 in a 5 ha field, **Worthy Park** plants two rows, 0.45 m (18 in) apart, on each bank. Performance is being compared with that from standard practice of single row banks, 1.8 m (6 ft) apart

Table 8.5: Growth parameters at 6 months, comparing single versus double rows per bank, plant cane BJ82156, at Worthy Park

Growth parameters	Double rows per bank	Single row per bank
Stalk height (cm)	168.4	153.4
No. of internodes	13.9	11.6
Stalk circumference	9.5	9.6
Avg no. of leaves	8.9	9.6
Avg no of fully formed stalks	10.7	8.6

Crop Care

Following successive years of low replanting, it is increasingly recognised that cane output can be sustained only by redoubled efforts in ratoon maintenance. Extension therefore devoted much time and effort in encouraging growers to carry out often neglected activities such as inter-row cultivation and to pay closer attention to timeliness of operations. The markedly improved cane growth noted in parts of **Windsor Park**, **Caymanas** and **Innswood**, for instance, could be mainly ascribed to the inter-row cultivation work carried out.

Field Population

It has long been recognised that a major factor behind recent low yields in the Industry is poor field population.

Table 8.6: Area planted in the Certified Seed Cane Project to Feb, 2001

Factory area	Area targeted (ha)	Area planted (ha)
Appleton	65	22.00
Bernard Lodge	85	65.75
Frome	160	166.07
Hampden	45	45.43
Long Pond		27.11
Monymusk	120	105.25
St. Thomas Sug Co	25	0.00
Worthy Park	20	20.83
Total	**520**	**452.44**

A sample survey conducted by Extension in Clarendon in 2001 showed stalk population to be 25-30% below satisfactory levels. Much effort was put into urging proper field population at planting and filling gaps that may develop later to boost earnings.

Certified Seed Cane

Just over 450 ha of certified seed cane was established under the first phase of the programme completed in 2001, *Table 8.6*. This was some 70 ha short of the target of 520 ha but, with a lack of demand for the product, given the sharply reduced commercial replanting programme, there was a temporary halt in expanding the seed cane project. In fact, very little of the certified seed cane produced found its way into replanting; most was left to mature and ended up being processed at the factory.

The main varieties produced in the respective areas under the programme were as follows:

Bog Walk BJ82119, BJ7627

Frome area BJ82156, BJ7938, BJ7355, BJ8252, BJ82119, BJ7465, BJ7555

Clarendon BJ82102, BJ82119

Hampden area BJ7938, BJ8226

Long Pond area BJ82156, BJ78100, BJ82119

Appleton and **Tropicana** did not participate in the first phase of the programme but were preparing to do so under the second.

Divested Lands

Lands divested from the Sugar Company of Jamaica to farmers at **Frome** and **Bernard Lodge** have seen mixed results since the transfer in 1995. The Bernard Lodge group has been beset by a variety of problems resulting in several growers going out of production and yields on remaining farms averaging just 65 tc/ha in 2001. Performance has been much better on the **Frome** farms which averaged 77 tc/ha, with the best farm achieving 95 tc/ha. Non-performing lands in the **Bernard Lodge** area were being repossessed for redistribution. A combined total of over 1000 ha was originally divested to **Bernard Lodge** growers. Of this total, cane was reaped from only 321 ha in 2001.

In an attempt to get the lands back into worthwhile production, Extension have been conducting discussions with the farmers, the NIBJ, the ABC and SCJ to put a sound development plan into place for the year 2001 – 2002.

8.2 SIRI EXPERIMENTAL FARM - SPRINGFIELD

During the year the prime objective of the SIRI Experiment Farm remained the production of seed cane to feed into the Certified Seed Cane project. However, another year of low commercial replanting resulted in little use of seed cane and much of the material was eventually sent to the **Monymusk** factory for processing. A total of 152.58 t of seed cane was distributed to estates and farmers across the Island for further expansion. The varieties distributed were primarily BJ9186 and J9501. Meanwhile, various field plots were engaged in experiments of various kinds: drip irrigation, reduced tillage, narrow row spacing, pineapple row spacing, nutrition, weed control and a number of variety trials.

A portion of the farm is supplied with water from a night storage dam through an open irrigation canal and the rest by pipeline, which opens into a canal. Neither was very reliable in a year when rainfall totalled just 766 mm and so the farm frequently underwent severe moisture stress. The zone served by the pipeline proved particularly prone to lock-offs and often experienced in excess of 30-day irrigation cycles, as against the desired 14-21 days. Roughly 70% of the rain received occurred in May, October and November. There were three months during which no rain fell. The outlook for the 2002 crop therefore was for a 10-15% yield drop.

In efforts to boost yields, special effort was made to apply poultry manure to most fields, using SIRI's newly acquired tractor-drawn manure spreader. Despite this and an adjustment in the fertilizer regime from 17-0-17 to 17-0-20, foliar analyses done at six months of growth revealed that, though the major elements - nitrogen, phosphorus and potassium - were often not deficient, very rarely did any achieve standard levels of adequacy. This was largely a result of the impact of moisture stress in inhibiting nutrient uptake.

Harvesting

Dry weather during the crop aided in the Farm's averaging an outstanding JRCS of 12.67 (range 10.77-14.02) from 2612.28 tonnes of cane harvested at an average of 74 tc/ha. The best performing varieties were BJ82156, BJ78100 and

BJ8897. The latter will be withdrawn from production due to smut susceptibility.

Planting

Working in conjunction with the Variety Department, new plots of BJ82156, BJ8252, BJ9186, BJ8708, BJ8532, BJ8859 and twenty six foreign varieties were established during the year. Ten of the foreign varieties were cut back for further propagation. The BJ8708 and BJ8532 were further extended on the farm and approximately one tonne of the latter was given to **Worthy Park**. In July a Stage I nursery of the BJ2003 series was planted.

Maturity Testing

Maturity testing conducted in order to determine sequence of harvesting during the crop revealed that BJ82156 is the earliest maturing cane, followed by BJ7465, showing top to bottom ratios of almost 1 at 12 months. Also, the highest hand refractometer brix readings (over 25 brix) were recorded in these two varieties.

Outreach

The Farm management in conjunction with the SIRI Extension team in Clarendon hosted two field days at the Farm during the crop, the first on October 30 and the second on December 4. Farmers, from south Clarendon, were shown application of recommended cultural practices and the resultant productivity. The expressions of appreciation were overwhelming.

9 INFORMATION SYSTEMS

Reinitialization and preparation of the Core Program were done at all factories between December and February. A similar procedure was carried out at **Worthy Park**, Ocho Rios and Marcus Garvey Drive sites where the Scale Program was in operation.

General trouble-shooting and modifications as per requests from the various factories were done on a continuous basis. Modifications were done to the core and lab programs to help ensure a smooth crop. Report printers were replaced at several locations while computer systems were upgraded or replaced at some sites. In-house computer systems were also upgraded or replaced as was deemed necessary. Testing of the updated Scalepro program, with a new graphical user interface (GUI), see Figure below, continued at the **Hampden** sugar factory and full implementation was done midway into the crop. Program fixes and modifications were done to most in-house databases and user support and training were given where necessary.

The following publications were completed or modified during the year:

Sugar Cane Magazines

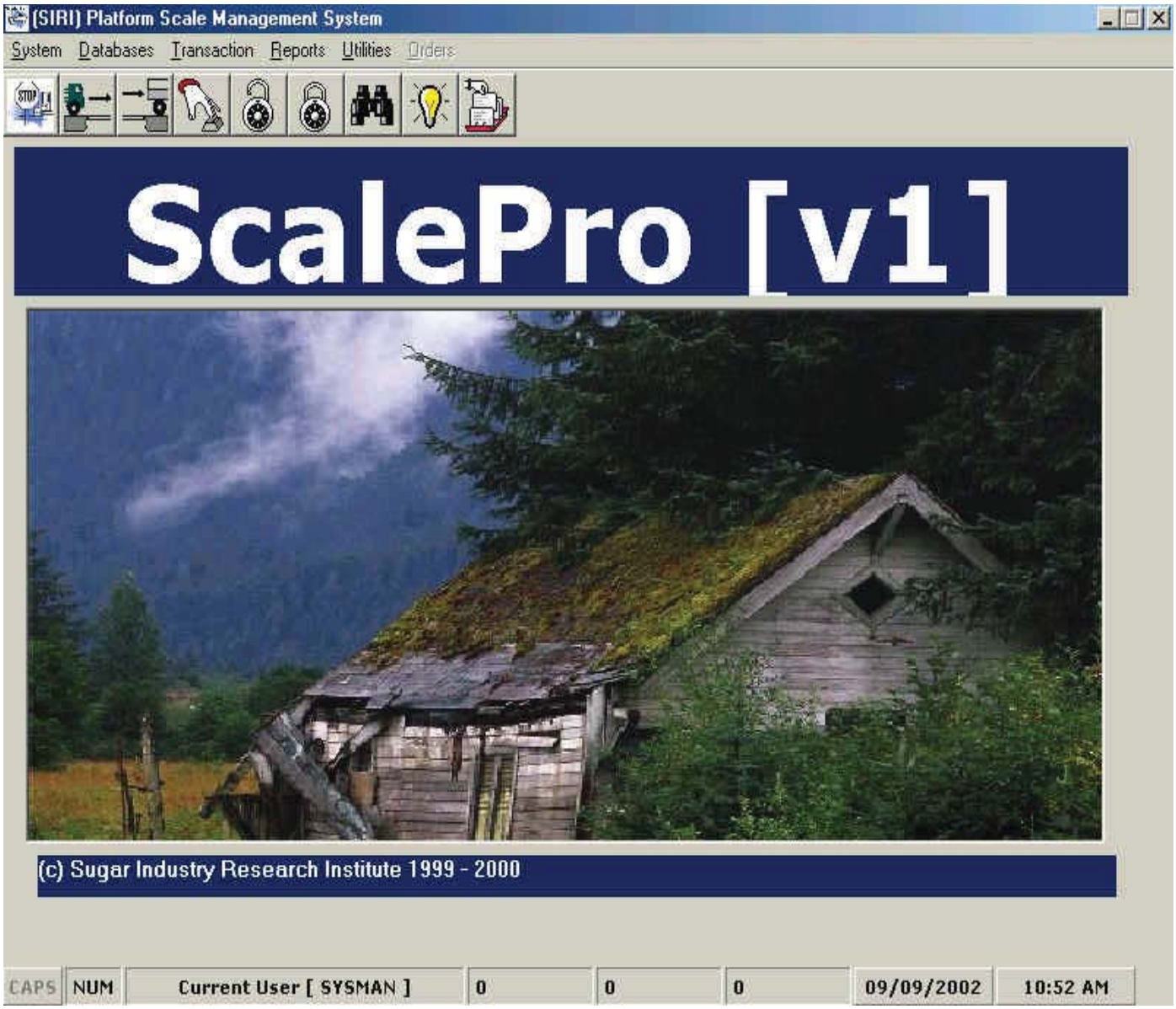
SIRI 2000 Annual Report

Cane Growing Manual

Weed Manual

The weekly Factory, Sugar, Molasses, Core Audit, Revenue and Cane Quality reports were compiled and disseminated during the crop period. General and technical support were given and slide presentations and drawings done for the annual JAST Conference.

The joint web site for the Sugar Industry Authority and the Sugar Industry Research Institute was launched in April. The URL for this site is *www.jamaicasugar.org*.



10 REVIEW OF FACTORY OPERATIONS

Cropping Time

This will be recorded as one of the longest harvesting periods with a span of 276 days, 52 days more than the previous crop. The very late start by most factories, with **Long Pond** delayed for as much as two months later than the 1999/2000 start, is the major reason. All factories had an extended cropping time, except **Long Pond** (*Table 10.1*).

Production

Although **Frome** and **Appleton** improved on their 1999/2000 overall sugar production by 12,530 tonnes (4,970 and 7,560 tonnes respectively), all other factories had a combined decline of 24,431 tonnes, resulting in a net decline of 11,901 tonnes. Of this amount, **Monymusk** and **Long Pond** are responsible for 9,688 tonnes and 6,633 respectively. While this is due largely to a decline in cane production, the tc/ts ratio was a major contributory factor, *Table 10.2*.

Efficiency Levels

The poor tc/ts ratio is a function of both cane quality and factory efficiency. As shown in *Table 10.3*, there was a decline in cane quality at all factories. Similarly, the FRI declined everywhere, except for **Worthy Park**. A major decline in JRCS, exceeding 1.29 units, was reported at four factories. The FRI declined significantly at **Frome**, **Monymusk**, **Bernard Lodge**, **Long Pond**, **Hampden** and **St. Thomas Sugar** to unacceptable levels, *Table 10.3*.

Table 10.1: Cropping Time

		Fro	M/M	B/L	L/P	App	W/P	Hamp	St. Thom	Span
2001	Start	14/12/00	25/2/01	23/1/01	28/4/01	27/12/00	17/1/01	26/3/01	17/1/01	
	Finish	16/6/01	8/7/01	18/7/01	31/8/01	10/6/01	21/6/01	18/8/01	18/6/01	
	No.of Days	184	134	176	126	155	156	146	152	276
2000	Start	6/12/99	30/1/00	14/1/00	25/2/00	8/12/99	5/1/00	23/2/00	25/1/00	
	Finish	6/4/00	29/5/00	25/5/00	19/7/00	24/4/00	3/6/00	1/7/00	2/6/00	
	No.of Days	123	121	133	143	139	151	130	130	224
Diff. In days (2001 vs. 2000)		61	13	43	-17	16	5	16	22	52

Table 10.2: Cane and Sugar Production (1999/2000 vs. 2000/2001production)

	1999/2000			2000/2001			Diff. In Production (2000/2001)	
	T. Cane	*Sugar	tc/ts	T. Cane	*Sugar	tc/ts	T. Cane	Sugar
Frome	576,684	59,108	9.76	745,269	64,078	11.63	168,585	4,970
Monymusk**	374,481	42,247	8.86	327,796	32,559	10.07	-46,685	-9,688
Bernard Lodge	279,657	29,325	9.54	314,405	28,191	11.15	34,748	-1,134
Long Pond	153,286	15,600	9.83	109,999	8,967	12.27	-43,287	-6,633
Appleton	227,115	23,375	9.72	325,724	30,935	10.52	98,609	7,560
Worthy Park	197,155	25,188	7.83	198,837	22,339	8.90	1,682	-2,849
Hampden	91,579	8,637	10.6	85,560	7,284	11.60	-6,019	-1,353
St. Thomas	131,710	13,389	9.84	129,586	10,615	12.21	-2,124	-2,774
Total/ Avg.	2,031,667	216,869	9.37	2,237,176	204,968	10.91	205,509	-11,901
Total % diff.							10.12	-5.49

* Including sugar to distillery

** Monymusk decline would be due to the increased loss of supplies from New Yarmouth

Table 10.3: Comparison of cane quality/FRI (1999/2000 vs. 2000/2001)

	1999/2000		2000/2001		Diff. in efficiency (2000/2001)	
	JRCS	FRI	JRCS	FRI	JRCS	FRI
Frome	10.73	95.52	9.44	91.14	-1.29	-4.28
Monymusk	11.80	95.78	10.94	91.83	-0.86	-3.95
B/Lodge	10.92	96.05	10.26	87.51	-0.66	-8.54
L/Pond	10.94	93.01	9.55	87.54	-1.39	-5.47
Appleton	10.62	97.10	10.06	95.25	-0.56	-1.85
W/Park	12.86	99.43	11.25	100.03	-1.61	0.60
Hampden	10.80	87.31	10.58	80.64	-0.22	-6.67
Tropicana	11.50	88.64	9.85	84.73	-1.65	-3.91
Total/Avg.	**11.22**	**95.19**	**10.10**	**91.17**	**-1.12**	**-4.02**

Quantifying Sugar Decline

The decline in cane production at four factories amounted to 51,434 tonnes. Using the tc/ts achieved, this shows a decline of 4,221 tonnes sugar (*Table 10.4*). The drop in JRCS below the island average at four factories was responsible for a short fall of 5,978 tonnes sugar and the failure to achieve the 91% minimum FRI resulted in a further loss of 3,200 tonnes, a cumulative loss of 13,399 tonnes sugar. Had the JRCS been maintained at 1999/2000 levels, production would have improved to 218,367 tonnes sugar or 14,798 tonnes above last crop, *Table 10.4*.

Cane and Sugar Production/productivity

Comparison of the corresponding period 2000/01 versus 1999/2000 shows that:-

a) Cane processed in 2000 was 205,509 tonnes more than in 2001. Daily throughput was 8,105 tonnes compared to 9,070 tonnes in 2000. The daily throughput was 10,486 tonnes in 1999. The productivity for the period 01/05/01 to 10/06/01, when all factories were in operation was 11,315 tonnes per day. This compares unfavourably with 17,046 tonnes per day in 2000 when all factories were in operation from 25/02/00 to 06/04/00.

b) Sugar produced decreased by 11,901 tonnes from the 2000 level. The daily production was at 743 tonnes compared to 968 in 2000 and 934 in 1999; the comparative daily production for the periods, as stated above were 973 and 1,800 tonnes respectively.

Cane Quality/Price per Tonne

The excellent cane quality (JRCS) of 11.22 experienced by all factories in 1999/2000 deteriorated by 1.12 in 2000/2001 with an average reported JRCS of 10.10.

As a result, the price per tonne cane showed a decline of $230.06 (or 17.72%) on average from the previous crop. The price decline ranged from $321.15 at **Worthy Park** to $76.51 at Hampden. It should be noted that the price of sugar decreased by $410.00 per tonne or 2.15%. Therefore, 97.85% of this reduced cane price was due to the drop in cane quality, *Table 10.5*.

Table 10.4: Quantifiable sugar decline due to inefficiencies in cane production/cane quality/factory efficiency 1999/2000 vs. 2000/2001

	Fall in cane prodn (t)	tc/ts	Related fall in sugar prodn.(t)	Fall in sugar production: Due to poor JRCS (ts)	Due to poor FRI (<91)	Total (t)
Frome	n/a	n/a	nil	4,919	nil	4,919
Monymusk	n/a	n/a	n/a	nil	nil	nil
B/Lodge	n/a	n/a	nil	nil	1,124	1,124
L/Pond	43,281	12.27	3,528	605	354	4,487
Appleton	n/a	n/a	nil	130	nil	130
W/Park	n/a	n/a	nil	nil	nil	nil
Hampden	6,019	11.60	519	nil	936	1,455
Tropicana	2,124	12.21	174	334	786	1,284
Total/Avg.	**51,424**	**12.18**	**4,221**	**5,978**	**3,200**	**13,399**

Standard Cane Quality/ Distribution of Proceeds

The standard JRCS for the 2001/02 crop will be the highest since 1993. The sharing of proceeds has been shifting consistently according to the performance of both sectors. Over the five years, the growers have twice exceeded the 62% standard share, i.e. in 2000 and 2001 crops.

The manufacturers have exceeded their 38% standard share three times - in 1998 and 1999. This was due less to high factory efficiency, than to the inefficiency of growers who failed to achieve their standard cane quality, *Table 10.6*.

Factory Operating/Downtime

Factory operating timefell from 70.61% in 1999/2000 to 62.31. Downtime. increased by 4% due to the poor state of factories, except at **Appleton** and **Worthy Park**.

Although non-factory down-time increased by only 0.6%, this remained high, in excess of 19%, of which 5.53% was due to the shortage of cane, *Table 10.7*.

Table 10.5: Comparison of JRCS/price per tonne (2000 vs 2001)

	1999/2000		2000/2001			
		$/tonne		$/tonne		Diff.
	JRCS	cane	JRCS	cane	$/tonne	%
Frome	10.73	1,215.77	9.44	957.52	-258.25	-21.24
Monymusk	11.80	1,401.53	10.91	1,211.63	-189.90	-12.55
B/Lodge	10.92	1,248.09	10.26	1,095.80	-152.29	-12.20
Long Pond	10.94	1,252.38	9.55	975.81	-276.57	-22.08
Appleton	10.62	1,195.77	10.07	1,063.28	-132.49	-11.08
W/Park	12.86	1,585.61	11.25	1,264.46	-321.15	-20.25
Hampden	10.80	1,228.07	10.58	1,151.56	-76.51	-6.23
Tropicana	11.50	1,348.70	9.85	1,026.80	-321.90	-23.87
Total/Avg.	11.22	1,299.74	10.10	1,069.68	-230.06	-17.72

Price/tonne sugar 1999/2000 @$19,107.00 & 2000/2001 @ $18,697.00 (2.15%)
Price/tonne sugar 1998/99 @$19,098.00 - $999.64/tonne cane @ 9.52 JRCS

Sugar Quality

With the introduction of **SIA** standards prior to the 1999/2000 crop, new thresholds for quality were set. For the 1999/2000 crop, there were significant improvements in all areas, when compared to the 1998/99 results (*Table 10.8*). While levels of polarisation and color for the 2001 crop were maintained, dextran increased by 146%.

Summary

The outturn of the 2000/2001 crop must be seen as very disappointing, with a significant downturn in cane production at four factories, very poor cane quality when compared to the 2000 crop, very poor factory efficiency (both in terms of recovery and time utilisation). Income decreased while cost of production escalated.

Notwithstanding the need for the provision of resources in a timely manner, cane quality has been established to be the most significant factor in maintaining productivity. When this falls, so does the industry's earnings, impacting negatively on the price of cane, factory efficiency and sugar quality.

To some exte.nt, the significant decline in cane quality of 10% may be a reflection of our inability to manage well under difficult operating conditions At the same time, the factories are in need of a vital injection of capital to maintain higher levels of efficiency.

Table 10.6: Comparison of the standard cane quality and distribution of proceeds (1997 - 2001)

	1997	1998	1999	2000	2001	2002
std. JRCS	**9.8970**	**9.9476**	**9.9154**	**9.8396**	**10.0422**	**10.1064**
$/tonne at std. JRCS	959.87	934.47	1,068.39	1,060.73	1,059.34	N/a
JRCS reported	10.4922	9.3166	9.5167	11.2159	10.0994	N/a
$/tonne	1,052.71	836.77	999.64	1,299.74	1,069.68	N/a
Diff. In $/tonne	92.84	-97.70	-68.75	239.01	10.34	N/a
Growers share	61.86	60.38	58.70	63.68	62.08	N/a
FRI reported	95.38	91.10	94.54	95.30	91.17	N/a
Factory Share	38.14	39.62	41.30	36.32	37.92	N/a

Table 10.7: Comparison of factory operating time/downtime/non-factory induced stoppages

	2000/2001 (final)			22/07/2000 (final)		
	Downtime			Downtime		
	Non-factory	Factory	Operating Time	Non-factory	Factory	Operating Time
Frome 1	15.13	19.74	65.13	22.27	12.11	69.84
Frome 2	12.71	21.56	65.73	19.70	8.93	75.69
Monymusk	21.97	10.88	67.15	11.81	9.51	83.25
Bernard Lodge	28.29	16.49	55.22	28.38	11.60	62.72
Long Pond	26.36	19.89	53.75	19.69	15.38	68.73
Appleton	25.44	23.44	51.12	14.38	24.59	64.78
Worthy Park	11.25	6.95	81.80	17.47	10.52	75.28
Hampden	19.05	2.27	78.68	18.96	2.94	83.58
Tropicana	12.89	44.87	42.24	14.93	36.32	51.77
Avgerage	**19.23**	**18.46**	**62.31**	**18.63**	**14.65**	**70.61**

Table 10.8: Comparison of sugar quality (1999 vs. 2001) - factory out-turn results

Year	Pol (%)	Moist (%)	Safety factor	Colour aff raw (IU)	Colour W. raw (IU)	Insol solids (mg/kg)	Dextran	Ash (%)	Reducing Sugars (%)
1999	97.64	0.63	0.27	1 498.32	4 567.29	602.77	386.25	0.45	1.10
SIA std	98.50	0.35	0.25	1 300.00	3 000.00	<500.00	<250.00	0.30	0.50
2000	98.13	0.54	0.29	1 348.79	4 113.57	620.59	154.01	0.41	1.06
2001	98.03	0.50	0.26	1 335.50	3 977.57	264.84	379.38	0.58	1.07

11 SUGAR TECHNOLOGY

Several new projects were undertaken during the year November 01, 2000 to October 31, 2001. These included a study of the use of Octapol, a proprietary clarifying reagent, as a possible replacement for lead subacetate, field trials on the determination of dextran in juice and process liquids by NIR spectrophotometry, an evaluation of the Berlin method for determining reducing sugars, a colour audit of **Worthy Park** sugar factory and a factory audit at **St. Thomas Sugar Company**.

Work also continued on other ongoing projects. These included the monitoring of core laboratory operations at all sugar factories, providing pre-harvesting training sessions for core laboratory personnel, monitoring, collection and analyses of factory effluents (wastewater).

Octapol Study

During the crop period 2000/2001, a study of the use of Octapol was conducted at all core laboratories. The aim of the study was to establish a correlation between polarization data obtained from juice samples clarified by lead subacetate and samples clarified by Octapol.The aim of the study was to obtain empirical evidence which could provide information on the feasibility of replacing lead subacetate with Octapol.

The study began with a visit to six factories in Louisiana, USA to observe the use of the new reagent and to get insights into the techniques employed in its usage. A visit was also made to the manufacturer of the reagent, Baddley Chemicals. Based on the observations made and the knowledge gained, the work to make the necessary change began in earnest.

At the end of the study, a total of 5,836 results with an acceptable level of standard deviation was obtained. A comparison of the data obtained is shown in *Table 11.1*.

A correction factor "equation" will be recommended to correct the Pol in juice by Octapol (X) to Pol by lead (Y). Where $Y=0.9972X+0.8175$

Dextran Field Trial

The second major project initiated during the year was the analysis of dextran in juice using NIR Technology. This was a collaborative effort between SIRI and Optical Activity, a UK-based firm which manufactures spectroscopic equipment. The project arose out of a study conducted by Miss Victoria Singleton, an employee of Optical Activity, who investigated and developed a method to determine dextran in cane juice. The method employs NIR technology and does not require the use of lead subacetate or any other clarifying agent. A specially designed proprietary software is used to generate results in parts per million/(ppm)dextran. SIRI's role in the project involved the provision of technical and logistical support. The Institute also co-ordinated and supervised the project during Miss Singleton's absence from the island.

The project was conducted over the period January 2001 to June 2001at the **Frome** Factory core laboratory and involved the analysis of over 600 samples. The results obtained showed that the method is capable of measuring dextran levels in cane juice but further work on the accuracy and reproducibility of the method is necessary and will be continued during the next year.

Table 11.1: Correlation between pol values obtained using Octapol and lead subacetate as clarifying agents.

Factory	Samples	Avg. Oct. pol	Avg. lead pol	Avg. diff.	R^2	Equation
Appleton	447	62.78	62.04	0.74	0.9848	Y=0.9953X+1.0538
Bernard Lodge	516	62.80	62.33	0.47	0.9953	Y=1.0053X+0.121
Frome	951	58.33	57.49	0.84	0.9855	Y=0.9984X+0.9282
Hampden	240	62.77	62.17	0.60	0.9928	Y=0.9880X+1.3535
Long Pond	1482	57.53	57.13	0.40	0.9984	Y=1.0002X+0.395
Monymusk	1001	62.17	67.46	0.55	0.9944	Y=0.998X+0.6815
ST. Thomas	609	60.45	59.20	1.25	0.9933	Y=0.9907X+1.7996
Worthy Park	590	63.54	62.97	0.57	0.9970	Y=1.0078X+0.0846
Industry Average	**5836**	**61.47**	**60.82**	**0.65**	**0.9940**	**Y=0.9972X+0.8175**

The method employs enzymes for the hydrolysis of the dextran present in the juice. A sample of the juice is analysed as the control and the hydrolysed juice is called the test. The machine then gives the dextran values. Some of these values are shown in *Table 11.2*.

Table 11.2: Dextran values generated using the NIR method for dextran analysis

Sample #	Control (Z)	Test (Z)	Dextran (ppm)
67648	59.01	55.58	3176
67651	58.62	62.26	395
67668	52.76	55.86	1985
67673	58.97	61.00	2176
67674	59.00	62.16	310
67692	50.51	53.80	1218
67706	43.53	47.24	295
67708	55.65	59.14	507
67753	45.59	50.30	482
67760	43.55	46.70	2316
67771	55.84	59.36	2073
67779	52.66	53.76	457
67788	75.57	79.38	253
67799	60.55	60.86	3119
67821	57.70	61.50	4635
67830	50.41	51.64	1562
67851	54.66	67.28	1779
65914	56.13	47.24	1718

Reducing Sugar Determination-Berlin/Luff-Schoorl Methods

Prior to the start of the crop, a decision was taken to conduct reducing sugar analyses using the method developed by the Berlin Institute. This was due to the fact that the previously used Lane-Eynon method was not recognized by ICUMSA. The status of the Berlin Method was more suitable. Also, the results received from Markan/Laboratories for shipment samples were more comparable with those obtained from the Berlin test, as this was the test used at that laboratory.

A more recent development is that the status of the Berlin Method has been downgraded and more recognition has been given to another method, the Luff-Schoorl method. Investigation of this method has begun at SIRI's Central Laboratory. Further investigations will continue in the upcoming year, with a view to establishing if reproducible results are obtainable and the suitability of the method for routine analysis.

Colour Audit at Worthy Park Sugar Factory

The above audit was started on Tuesday, June 05, 2001, with an overview of the methods of analysis for the determination of colour in various sugar products. This was done to ensure that the correct methods and calculations were used in previous work. Several tests for colour determination were carried out on crusher, mixed and clarified juices and syrup. This was done to observe the trend in colour formation. The results were also used to assess the efficiency of various stages of the process such as clarification.

Results

Sample	Brix	Colour (IU 420)
Crusher juice	14.64	16,569
Mixed juice	13.87	19,392
Clarified juice		17,549
Syrup		22,157

Observations/Inferences

Several observations/inferences were made:-

1. The crusher juice was derived from green cane only.
2. The mixed juice contained both green and burnt cane.
3. The colour obtained for clarified juice indicated that there may be a problem in clarification, as this value did not show the desired reduction from mixed juice.

Recommendation

The problem may require intensive work in order to be corrected in the long term. In the short term, it is recommended that continuous testing of the various juices, syrup and sugar be done for colour. Other parameters such as the pH of clarified juice and the levels of phenolics may require continuous monitoring. The quality of cane entering the mills must also be carefully assessed to reduce the entry of extraneous matter. A careful look must be given to the practice of remelting magma for usage as syrup or mixing A-grade sugar with sugar of less quality. This tends to increase invert levels, as the intermediate products such as magma are high in reducing sugars.

Wastewater Project

The routine collection and analyses of wastewater continued on a timely basis. A new BOD incubator and a BOD Trak apparatus were acquired. This meant that analyses were conducted with greater accuracy. Knowledge gained from a

course conducted at Hach Training Institute in Colorado was a tremendous asset in conducting these analysis.

Core Laboratory

The year began with the distribution of supplies and the conducting of formal training seminars at all of the core laboratories.

The training seminars served to re-sensitize core laboratory personnel about the importance of their job functions and to develop and improve their analytical skills. An interactive forum was utilized to facilitate feedback. Personnel were also informed about the decision to replace lead subacetate with Octapol as a clarifying agent and information about the product and its use was disseminated. An overview of the core laboratories' operations, as well as safety and security completed the areas addressed.

Core Audits

Core audits were conducted on a regular basis to ensure that the operations were conducted in a manner consistent with the stipulated guidelines. The different pieces of equipment and apparatus were checked and the calibration readings recorded. Audits were also done to identify aspects of the operations that needed maintenance, both extensive and routine. Generally, the findings revealed that the laboratories operated in the prescribed manner.

Factory Audit

One such audit was conducted at the **St. Thomas Sugar Company** due to the very poor F.R.I. reported. The investigations revealed excessive undetermined losses in process accounting for approximately 200 tonnes sugar. This was identified with poor process control in pH.

Collaborative Testing between core Laboratories

Three collaborative tests were carried out during the year. Analyses included pol, brix, fibre and JRCS determinations of canes from the same source distributed to all the laboratories. The analyses were carried out by all core laboratories on the same day at the same predetermined time. The results continue to show very good agreement between both the intra- and inter-laboratory results.

Ash Determination Using Conductivity Measurements

Investigations into the use of conductivity measurements to assess ash values in sugar and molasses samples were carried out. These results were compared with those obtained by gravimetric determinations. A report was presented at the November 2001 meeting of the Jamaica Association of Sugar Cane Technologists. The analysis of 164 sugar samples gave a coefficient of determination,R^2, of 0.6609 and 144 molasses samples gave R^2 0.8654. Average ash percent for molasses was 12.04 and 10.76 found by the conductivity and gravimetric methods respectively and for sugar 0.42 and 0.40.The results indicate that simple conductivity measurements can be used to predict levels of ash in Jamaican raw sugar samples, thereby reducing significantly the time taken for the analysis. However, the results obtained for molasses indicate that a similar conclusion is not yet possible and further work is required.

SCJ/SIRI/UWI Summer Project

Two students were employed under this project and the areas investigated were "A comparison of lead subacetate and Octapol in molasses clarification" and "Reducing sugar Analysis".

ENVIRONMENTAL

Concept Paper for Co-generation in Jamaica

In August 2000, the Institute was contacted by the United Nations Development Programme (UNDP) to develop a concept paper for the co-generation of steam and electricity using bagasse. This was based on a previous proposal that was submitted to the UNDP by SIRI for funding. The proposal (concept paper) was developed and sent to the UNDP for their approval. Meetings were held with the UNDP representative for Latin America and the Caribbean, and the proposal was accepted. The next step should have been the conducting of a feasibility study, which would have been done by Consultants of the UNDP along with local stakeholders. However, no further work was done due to the inability of the sugar industry to provide local counterpart funding for the project. This condition was a requirement of the UNDP.

Pollutant Release and Transfer Register (PRTR)

The National Environment and Planning Agency (NEPA), in collaboration with the Coastal Water Quality Improvement Project (CWIP) has developed a pilot project to develop a Pollutant Release and Transfer Register (PRTR). This register, which is a part of NEPA's corporate plan, is a catalog of the release and transfer of pollutants from varying facilities in Jamaica. The PRTR for Jamaica is expected to serve as a model for the English speaking Caribbean Basin countries. A PRTR Stakeholder Consultation and Review working group, comprising SIA/SIRI, NEPA, along with representatives from other stakeholders of the project, was formed to develop this pilot register. Six sectors have been included in this pilot register and are listed below:-

Tourism/Hotel - Negril Cabins Hotel

Sugar Industry - Sugar Company of Jamaica, Bernard Lodge Division

Sewerage Treatment - North Coast Wastewater Facility

Utility Company - National Water Commission

Cement Company - Caribbean Cement Company

Oil Refinery - Petrojam Refinery

The group met in July 2001 and discussed the functions that members were to perform. These functions included providing reports, views and comments on various documents. Over the period August to November 2001, a number of requests were made by Dr. Claude Davis, the Environment Consultant for the project, to provide information on the following:-

a) The exact location of the factory
b) Boiler sizes, types, fuel feed, emission control devices and the number of stacks
c) Oil storage tank dimensions, colour, oil use and sulphur content
d) Wastewater quality and flow rate
e) Number of employees at the factory
f) Sewerage disposal system

A preliminary PRTR report and a spreadsheet with the estimates were sent to each member of group for comment and review. The group was scheduled to meet in early December for review of the PRTR documents before it is published.

ENACT Waste Exchange Project

In August 2001, the Institute was contacted by Environmental Action Programme (ENACT) to participate in a Waste Exchange project. This project involved the creation of a website with databases of information posted by companies which were interested in trading their wastes. Letters were sent to factories, encouraging them to participate in such a venture. Only two factories however, showed interest. **Appleton** completed and sent in the relevant forms and information was obtained from **Frome** on the type of wastes that would be available for trading.

Wastewater Sampling & Analyses

As part of the agreement with the NRCA, now a part of NEPA (National Environment & Planning Agency), three sets of sampling were done at all factories. These were done at the beginning, ending and during the out-of-crop period.

The results of wastewater analyses done during the processing of sugar cane indicated that factories were still not in compliance with some of the published trade effluent standards. Parameters such as the BOD, COD, TSS, fecal coliform and total coliform far exceeded the stipulated standard at most of the factories. However, in most instances, parameters such as oil and grease, sulphate, pH and temperature were within acceptable limits.

Emergency Response Plan

Two factories, **Frome** and **Appleton** have received approval from the Office of Disaster Preparedness and Emergency Management (ODPEM) for their Emergency Response Plans (ERP). **Bernard Lodge**, **Monymusk** and **Worthy Park** are in the process of getting approval for their plans. **St. Thomas Sugar Company** has completed its Disaster Preparedness Plan and is in the process of completing its Fire Prevention and Evacuation Plan. Other factories such as **Hampden** and **Long Pond** are yet to complete their ERPs.

General achievements by Factory Level Committee

Of the eight sugar factories, only two have quantified, to a certain degree of accuracy, the amount of wastewater being emitted from their sites.

Five factories have developed and submitted flow diagrams of factory drains, including the wastewater sampling points.

Only two factories have done any serious investigation into their water supply and usage. **Worthy Park** has been practising the recycling and re-use of water throughout the factory. **Frome** is presently considering the installation of an automatic valve to control the washing of canes. This is with a view to reducing the use of raw water for cane washing and hence the amount of pollution reaching the Dutch Canal.

Most factories have in place an active health and safety committee which is working to improve the safety aspects of operations.

All factories have been providing NEPA with information on pollution control monitoring programmes.

As mentioned above, only two factories, **Frome** and **Appleton**, have received approval from the Office of Disaster Preparedness and Emergency Management (ODPEM) for their Emergency Response Plans.

12 ENGINEERING

12.1 INSTRUMENTATION

Truck Scales

All Fairbanks truck scales, except that at Ocho Rios were repaired, calibrated and then approved by the Bureau of Standards. The Servo Balans at Ocho Rios was repaired, calibrated and maintained each time a ship came into port. Other Servo Balans scales at the factories were also calibrated, along with bagging scales at **Tropicana**, **Bernard Lodge**, **Monymusk** and **Frome**. Spares were ordered and received for all bagging scales.

At **Bernard Lodge** the Fairbanks scale was upgraded with the installation of a more modern display unit and load cell system. This unit was installed at the end of crop, so as to avoid any disruptions in its trial period. Two platform weigh bridges can be operated by this one unit. So far, it is being tested with molasses trucks at the factory. Depending on the performance of this unit, another will be installed at Ocho Rios port.

During the 2001 crop, the maintenance of the Ocho Rios scale was taken over by Reynolds Mine Operators. This resulted in a very poor performance, resulting in a high demand on SIRI personnel to keep the system in operation.

Projects - Long Pond Servo Balans

Projects were completed at **Long Pond**, **Tropicana** and **Bernard Lodge**. The old Servo Balans at **Long Pond** was taken out of service and a new system installed. At **Long Pond** the combustion control was installed and commissioned during the crop.

St. Thomas Sugar-Cane Carriers Control

The control system for the cane carriers at **Tropicana** was completed and commissioned. Due to mechanical faults with the carriers and electrical problems with the motors driving the cane knives, the system did not accomplish its intended aim of maintaining a steady feed to the No.1 mill tandem. The motor driving the knives kept tripping out, which in turn stopped the carrier, obstructing the control system. Plans are in place to change the motor and replace the cane carrier.

Worthy Park - Factory Lab Interface System

A purity system was set up at **Worthy Park** factory laboratory, similar to the system at the core laboratory. A few repairs were done to the system polarimeter, refractometer and printer to maintain its operation.

12.2 MECHANICAL ENGINEERING

Non-destructive Testing

i) Laser alignment

This procedure was used at the **Appleton** sugar factory where the 2,000 kw generator and five other turbine driven machines were aligned. The two mill turbines at the **Worthy Park** sugar factory, were checked and aligned. Checks were done on the power house generator at **St.Thomas Sugar Compan**y.

ii) Dynamic balancing

Centrifugal baskets were balanced at **Worthy Park**, **St. Thomas Sugar Company** and **Appleton** factories. Boiler fans were balanced at **Frome**, **Monymusk**, **Bernard Lodge, Worthy Park**, **Appleton** and **St. Thomas Sugar Company**.

iii) Vibration Measurement and Analysis

Vibration surveys were carried out on a number of pieces of factory equipment at **Frome**, **Monymusk**, **Appleton**, **Worthy Park**, **Long Pond**, **St. Thomas Sugar Company** and **Bernard Lodge** factories. As vibration trends were established, reports were sent to factories showing areas of concern.

Vibration measurements and analyses were carried out on all low-grade baskets at **Frome** factory during the crop.

iv) Ultrasonic thickness measurement

Measurements using this procedure were carried out extensively at **Frome**, **Monymusk**, **Worthy Park** and **St.Thomas Sugar Company**.

Core Sampler Maintenance

All eleven core sampling stations operated well for the year. There was excessive downtime at the **Appleton** core sampler due to blockage and breakdown of two solenoid valves and a relief valve.

The No. 3 press at **Frome** broke down due to a damaged valve bank and a pump failure. All other units operated with minimal downtime for the crop.

Out-of-crop maintenance was started early at **Appleton**. The major work undertaken was the total rehabilitation of the shredder rotor. The hammers were stripped of old

welding, re-surfaced and rebuilt at the SIRI workshop.Three bearing tubes built at the SIRI workshop were used to replace worn or bent ones at the **Frome**, **Monymusk** and **Bernard Lodge** factories. Various other components from all factories were repaired at the SIRI workshop and returned to factories.

Structural maintenance including replacement of corroded metal structures, broken plyboards, chipping, priming and painting was done at **Frome**, **St. Thomas Sugar Company**, **Worthy Park**, **Appleton** and **Bernard Lodge**.

SIRI continued to procure and store spare parts for all core samplers. Metal cabinets were placed at some stations to ensure proper storage of items.

The out-of-crop maintenance for **Appleton**, **Worthy Park** and **Bernard Lodge** went very well and was nearing completion. Repairs were in progress at other factories.

Workshop

The workshop continued to be a main support for the core sampler maintenance. Repairs were done on press baskets, all hydraulic cylinders, rotor unions, hydraulic motors and other components from the core samplers and presses.

Aluminum boxes were being built to replace the board ones used by SIA Factory Inspectors to transport sugar samples from the factories to SIRI Central Laboratory. Several shredder drawers were fabricated from stainless steel to replace the original mild steel ones which had deteriorated. Repairs and fabrication of parts were carried out on machines for the Agricultural Division of SIRI during the year.

Mill Tribology Study

A study was started on the wear pattern of mill roller shells manufactured by Caribbean Casting and Engineering, in collaboration with UTECH and Caribbean Casting.

END TABLES

End Table 1 : Monthly Average Rainfall In Millimetres - 1999

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Group A													
Bernard Lodge	14	78	107	16	45	34	32	40	298	169	119	3	955
Innswood	27	61	181	8	15	21	57	30	291	202	121	12	1026
Monymusk	8	49	110	11	62	115	10	63	340	294	297	12	1371
New Yarmouth	2	95	168	7	77	151	69	62	331	346	274	4	1586
Mean	13	71	142	11	50	80	42	49	315	253	203	8	1235
30 Year Mean	30	33	37	57	107	62	37	83	110	151	85	38	830
Group B													
Appleton	61	116	212	162	335	182	107	127	411	184	202	16	2115
Frome	96	122	125	115	174	139	214	206	142	136	188	20	1677
Holland	62	46	65	92	97	291	188	86	239	152	113	0	1431
Mean	73	95	134	123	202	204	170	140	264	157	168	12	1741
30 Year Mean	55	73	86	133	241	145	152	200	179	232	107	47	1650
Group C													
Barnett	271	36	24	50	401	92	46	224	156	275	111	11	1697
Hampden	61	47	42	62	174	168	33	207	133	275	133	28	1363
Long Pond	81	89	79	62	65	120	91	220	192	146	163	84	1392
Mean	138	57	48	58	213	127	57	217	160	232	135.7	41	1484
30 Year Mean	77	76	52	72	148	108	74	105	142	147	119	93	1213
Group D													
Tropicana	115	67	56	0	252	114	43	161	247	543	515	16	2129
Mean	115	67	56	0	252	114	43	161	247	543	515	16	2129
30 Year Mean	105	93	62	62	170	121	118	160	184	246	259	121	1701
Group E													
United Estates	60	94	77	34	96	134	212	160	330	275	124	27	1623
Worthy Park	84	92	97	60	75	207	147	95	341	262	170	17	1647
Mean	72	93	87	47	86	171	180	128	336	269	147	22	1635
30 Year Mean	70	67	62	105	204	151	126	151	167	222	121	74	1520

* No Report Received
Nil - No Rainfall

End Table 2 : Monthly Average Rainfall In Millimetres - 2000

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Group A													
Bernard Lodge	5	11	21	13	78	22	18	48	188	67	17	92	580
Innswood	4	17	9	24	104	19	11	55	223	73	14	107	660
Monymusk	7	33	15	30	31	16	51	45	352	94	25	132	831
New Yarmouth	12	13	14	18	20	28	51	54	333	126	11	154	834
Mean	7	19	15	21	58	21	33	51	274	90	17	121	726.3
30 Year Mean	30	33	38	57	102	62	33	81	117	152	83	42	830
Group B													
Appleton	50	37	15	151	527	89	274	90	184	270	21	124	1832
Frome	13	54	26	91	276	169	201	171	145	154	58	213	1571
Holland	55	68	2	113	540	62	213	118	232	238	10	118	1769
Mean	39	53	14	118	448	107	229	126	187	221	30	152	1724
30 Year Mean	53	77	84	134	243	137	150	196	177	230	104	51	1636
Group C													
Barnett	44	20	-	26	158	49	46	104	329	149	16	280	1221
Hampden	39	37	10	42	171	83	66	109	398	158	52	296	1461
Long Pond	74	46	4	50	75	35	34	37	121	60	41	158	735
Mean	52	34	7	39	135	56	49	83	283	122	36	245	1141
30 Year Mean	73	74	50	73	149	107	71	105	146	147	114	100	1209
Group D													
Tropicana	34	6	31	7	160	36	84	92	305	49	252	607	1663
Mean	34	6	31	7	160	36	84	92	305	49	252	607	1663
30 Year Mean	101	92	62	102	176	116	113	149	188	243	256	139	1737
Group E													
United Estates	30	39	23	69	95	142	111	132	273	145	202	176	1437
Worthy Park	23	20	30	62	121	115	58	45	228	183	131	156	1172
Mean	27	30	27	66	108	129	85	89	251	164	167	166	1305
30 Year Mean	66	66	61	105	202	152	123	148	169	219	121	79	1511

* No Report Received
Nil - No Rainfall

End Table 3 : Monthly Average Rainfall In Millimetres - 2001

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Group A													
Bernard Lodge	12	5	11	46	108	2	35	1	124	120	206	126	796
Innswood	7	0	11	41	113	22	27	9	78	137	142	149	736
Monymusk	45	0	22	22	171	2	44	17	47	184	224	94	872
New Yarmouth	47	0	16	17	218	4	55	2	39	217	272	153	1040
Mean	28	1	15	32	153	8	40	7	72	165	211	131	861
30 Year Mean	31	33	38	58	106	62	34	81	119	158	88	45	853
Group B													
Appleton	21	59	125	300	160	62	163	73	215	234	207	100	1719
Frome	22	55	58	209	138	99	232	202	273	222	83	56	1649
Holland	57	57	60	151	126	59	156	63	146	182	154	89	1300
Mean	33	57	81	220	141	73	184	113	211	213	148	82	1556
30 Year Mean	53	76	84	137	232	134	148	193	178	227	106	52	1620
Group C													
Barnett	264	0	113	12	247	41	83	88	187	239	226	65	1565
Hampden	176	10	58	62	228	58	88	23	130	120	185	156	1294
Long Pond	454	24	43	33	182	35	146	37	111	297	173	168	1703
Mean	298	17	71	36	219	45	106	49	143	219	195	130	1526
30 Year Mean	82	70	51	70	153	105	72	100	146	148	113	104	1214
Group D													
Tropicana	210	30	95	113	496	10	76	23	19	306	258	102	1738
Mean	210	30	95	113	496	10	76	23	19	306	258	102	1738
30 Year Mean	108	90	62	103	191	116	113	139	181	246	246	140	1735
Group E													
United Estates	93	28	75	192	216	55	192	129	212	325	155	107	1779
Worthy Park	66	40	64	60	252	44	118	77	135	157	253	63	1329
Mean	80	34	70	126	234	50	155	103	174	241	204	85	1554
30 Year Mean	69	65	62	106	199	151	124	146	169	217	122	81	1511

* No Report Received
Nil - No Rainfall

End Table 4: Number of Days on which average precipitation exceeded 10 millimetres

	1999												2000												2001											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Group A																																				
Bernard Lodge	0	2	2	0	1	2	1	1	9	7	6	0	0	0	0	1	3	1	0	1	7	3	1	4	0	0	1	4	4	0	3	0	3	4	4	3
Innswood	1	1	4	0	1	0	4	1	10	7	6	1	0	1	0	1	4	1	1	2	7	3	0	4	0	-	1	2	5	1	3	0	3	4	5	4
Monymusk	0	0	4	0	1	2	0	2	6	8	9	1	0	2	1	1	1	1	1	1	11	2	2	3	1	-	1	0	4	0	2	1	2	8	6	3
New Yarmouth	0	4	5	0	1	3	4	2	3	2	1	1	0	0	0	0	0	0	0	0	12	4	2	6	3	-	2	2	10	0	4	0	3	10	7	5
Group B																																				
Appleton	2	3	8	4	12	7	4	5	15	4	6	0	2	0	0	8	19	3	7	2	11	8	0	2	0	2	3	12	6	2	7	3	9	8	9	3
Frome	4	2	4	5	7	4	8	7	4	5	5	0	0	2	0	3	8	7	11	4	4	5	1	5	1	2	2	9	6	3	7	9	10	5	5	2
Holland	3	2	4	3	4	8	6	5	7	7	6	1	3	4	0	6	15	1	7	6	10	10	1	4	2	2	1	8	2	2	6	3	7	9	7	6
Group C																																				
Barnett	4	1	1	1	9	4	3	8	8	10	6	0	1	0	L	0	5	2	3	4	12	5	0	6	6	-	2	0	8	2	4	6	11	8	4	0
Hampden	2	1	2	3	6	6	0	7	3	9	7	1	1	2	0	1	5	2	3	4	13	6	1	6	4	0	3	2	7	2	3	0	4	3	6	5
Long Pond	2	2	3	3	2	6	2	9	8	5	7	2	2	2	0	2	3	1	0	2	4	1	1	4	7	0	1	1	7	0	7	1	3	8	5	5
Group D																																				
Tropicana	5	3	1	-	8	4	2	4	6	13	9	1	1	0	1	2	2	1	2	3	10	1	5	11	3	0	3	5	2	0	2	0	0	8	5	3
Group E																																				
United Estate	2	1	3	2	4	6	7	4	11	9	4	1	0	1	1	2	4	6	4	4	8	4	5	4	2	1	2	5	7	1	6	6	10	8	5	4
Worthy Park	2	2	3	3	2	9	4	1	10	8	6	1	0	0	1	3	3	5	3	1	8	7	5	5	2	1	3	1	8	1	3	3	6	6	8	3

* No Report Received

CANE YIELD SURVEY

Table I: Cane production, 1992 - 2001

Crop Year	Total tonnes	% Increase or Decrease on Previous Crop	Tonnes Delivered by Factory Owned Estates	% Increase or Decrease on Previous Crop	Tonnes Delivered by Other Growers	% Increase or Decrease on Previous Crop	Cane Purchased by Factories % Total
1992	2 546 415	(7.77)	1 135 901	(13.33)	1 410 514	(1.18)	55
1993	2 701 440	6.09	1 145 918	0.88	1 555 521	10.28	58
1994	2 500 197	(7.45)	1 058 098	(7.66)	1 440 299	(7.41)	58
1995	2 328 308	(6.88)	1 246 048	17.76	1 082 260	(24.86)	46
1996	2 633 413	13.10	1 329 344	6.68	1 304 169	20.50	50
1997	2 422 966	(7.99)	1 138 831	(14.33)	1 284 134	(1.54)	53
1998	2 256 946	(6.85)	1 062 245	(6.72)	1 222 450	(4.80)	53
1999	2 306 835	2.21	1 115 279	4.99	1 203 761	(1.53)	52
2000	2 023 633	(12.28)	1 111 070	(0.38)	919 904	(23.58)	45
2001	2 237 176	10.55	1 288 923	16.01	948 253	3.08	42

Table II: Hectares reaped by estates/farm,1992 - 2001

Estates/Farms	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Appleton	1 374	1 531	1 420	1 053	1 267	1 185	539	1 287	1 214	1365
Bernard Lodge	1 639	1 887	1 533	2 479	3 200	3 538	3 700	3 891	3 621	3746
Cambria	124	120	119	118	152	214	222	229	240	264
Frome	5 467	5 532	4 766	5 323	4 524	4 947	4 948	4 832	4 807	4710
Hampden	821	858	734	728	629	789	701	470	-	604
Innswood*	-	1 898	-	*	*	*	*	*	*	*
Long Pond	1 363	1 367	1 104	1 398	1 346	1 461	1 439	1 438	1 447	1088
Monymusk	4 146	3 930	3 575	3 265	3 286	4 313	3 841	3 592	3 508	3637
New Yarmouth	-	1 683	1 543	1 780	1 417	1 149	1 580	1 453	1 644	1518
Newton Cane Farms	447	430	299	589	646	591	175	805	936	815
Retreat	410	371	370	284	342	292	-	-	-	-
Tropicana	1 375	1 079	1 016	1 214	899	753	626	862	904	827
Worthy Park	685	711	712	711	742	799	863	907	937	971
Total	17 851	21 397	17 191	18 942	18 450	20 031	18 634	19 767	19 257	19 545

- Data not available

**Data incorporated in Bernard Lodge figures for years 1996 - 2001*

Table III: Tonnes cane per hectare by estates/farms, 1992 - 2001

Estates/Farms	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Appleton	75.66	65.10	68.61	70.76	72.54	74.16	69.12	75.61	47.03	71.85
Bernard Lodge	58.25	61.96	46.27	58.08	75.71	65.15	62.96	63.18	57.60	64.58
Cambria	79.84	94.87	79.46	77.17	81.86	98.13	90.20	84.96	74.52	83.39
Frome	69.24	66.94	74.61	69.49	70.72	67.59	70.65	64.27	54.63	77.20
Hampden	63.37	67.89	66.82	54.24	71.98	63.31	54.04	62.44	-	48.43
Innswood*	-	76.31	-	*	*	*	*	*	*	
Long Pond	63.12	69.36	76.81	55.51	68.58	63.82	51.04	53.07	63.04	54.72
Monymusk	56.77	59.40	57.95	62.41	63.47	53.36	49.67	61.45	60.25	56.47
New Yarmouth	-	72.16	77.48	69.16	62.94	56.20	67.47	59.47	58.92	62.21
Newton Cane Farms	92.60	58.12	53.24	55.60	81.21	72.33	72.39	91.72	55.69	73.73
Retreat	65.39	71.43	79.30	66.13	84.21	71.32	-	-	-	-
Tropicana	66.03	71.97	86.95	73.91	85.55	75.18	55.43	57.83	62.47	71.49
Worthy Park	66.48	111.15	81.20	77.37	97.54	84.35	96.81	83.96	81.49	79.66
Total	64.14	67.51	68.88	65.13	72.23	64.86	63.33	65.05	59.42	67.07

- Data not available

**Data incorporated in Bernard Lodge figures for years 1996 - 2001*

Table IV: Average tc/t 96°s by estates/farms, 1997 - 2001

	1997		1998		1999		2000		2001	
Estates/Farms	tc/t 96°s	JRCS	tc/t 96°s	JRCS	tc/t 96°s	JRCS	tc/t 96°s	JRCS	tc/t 96°s	JRCS
Appleton	8.67	11.53	10.88	9.19	11.29	8.86	8.5	11.76	8.98	11.14
Bernard Lodge	9.04	11.06	10.61	9.43	10.40	9.62	8.81	11.35	9.27	10.79
Cambria	8.35	11.98	9.03	11.07	8.53	11.72	7.71	12.97	8.67	11.53
Frome	9.67	10.34	10.42	9.60	10.40	9.62	9.03	11.07	10.14	9.86
Hampden	8.41	11.89	10.77	9.29	-	-	-	-	9.80	10.20
Long Pond	8.47	11.81	9.57	10.45	9.75	10.26	8.79	11.38	10.21	9.79
Monymusk	9.14	10.94	10.90	9.17	10.35	9.66	8.65	11.56	8.82	11.34
Newton Cane Farms	9.75	10.26	10.95	9.13	13.35	7.49	10.22	9.78	9.91	10.09
New Yarmouth	9.23	10.83	-	-	-	-	8.30	12.05	9.27	10.79
Tropicana	8.81	11.35	10.58	9.45	9.21	10.86	8.03	12.45	9.21	10.86
Worthy Park	7.83	12.77	8.86	11.29	8.51	11.75	7.17	13.95	8.4	11.90
Average	8.99	11.12	10.26	9.75	10.31	9.70	8.6	11.63	9.41	10.63

- Data not available
** Includes data for Caymanas & Innswood for years 1997 - 2001*
Note: tc/t 96°s - tonnes cane per tonne 96° sugar JRCS - Jamaica Recoverable Cane Sugar

Table V: Tonnes theoretical 96° sugar per hectare by estates/farm, 1997 - 2001

Estates/Farms	1997	1998	1999	2000	2001
Appleton	8.54	6.57	6.70	5.54	8.00
Bernard Lodge*	7.20	5.98	6.07	6.54	6.96
Cambria	11.75	9.99	9.96	9.67	9.64
Frome	7.14	7.16	6.21	6.08	7.61
Hampden	7.54	4.95	-	-	4.94
Long Pond	7.54	5.33	5.44	7.17	5.36
Monymusk	5.82	4.54	5.98	6.97	6.40
Newton Cane Farms	6.17	-	6.86	6.22	7.44
New Yarmouth	7.41	6.60	-	7.1	6.71
Tropicana	8.53	6.29	6.32	7.98	7.76
Worthy Park	10.77	10.93	9.87	7.17	9.48
Average	7.21	6.32	6.38	6.86	7.13

- Data not available
** Includes data for Caymanas & Innswood for years 1997 - 2000*

Table VI: Tonnes theoretical 96° sugar per hectare per month by estates/farms, 1997 - 2001

Estates/Farms	1997			1998			1999			2000			2001		
Appleton	0.65	(110)	108*	0.46	(90)	82*	0.39	(78)	46*	0.52	(85)	93*	0.62	(113)	105*
Frome	0.59	(100)	98*	0.58	(114)	104*	0.51	(102)	111*	0.56	(100)	92*	0.58	(105)	98*
Newton Cane Farms	0.56	(95)	93*	0.43	(84)	77*	0.35	(70)	76*	0.56	(100)	92*	0.62	(113)	105*
Wet West	0.60			0.56			0.46			0.56			0.59		
Hampden	0.63	(107)	102*	0.40	(78)	95*	-	-	-	-	-	-	0.37	(67)	97.4*
Long Pond	0.61	(103)	98*	0.43	(84)	102*	0.46	(92)	100*	0.54	(89)	100*	0.39	(71)	103*
Dry North Coast	0.62			0.43			0.46			0.54			0.38		
Tropicana	0.65	(110)	100*	0.49	(96)	100*	0.57	(114)	100*	0.64	(105)	98*	0.64	(116)	100*
Wet East	0.65			0.49			0.57			0.65			0.64		
Bernard Lodge**	0.63	(107)	117*	0.51	(100)	116*	0.50	(100)	100*	0.59	(97)	97*	0.53	(96)	104*
Monymusk	0.47	(80)	87*	0.36	(50)	82*	0.50	(100)	100*	0.60	(98)	98*	0.48	(87)	94*
New Yarmouth	0.52	(88)	96*	-			-			0.66	(108)	108*	0.55	(100)	108*
Irrigated	0.54			0.44			0.50			0.61			0.51		
Cambria	0.95	(161)	99*	0.81	(159)	93*	0.85	(170)	97*	0.90	(148)	94*	0.79	(144)	101*
Worthy Park	0.96	(163)	100*	0.89	(174)	102*	0.89	(178)	101*	0.97	(159)	101*	0.77	(140)	99*
Central	0.96			0.87			0.88			0.96			0.78		
Average	0.59			0.51			0.50			0.61			0.55		

Figures in brackets = tonnes theoretical sugar per hectare per month expressed as a percentage of the island's average in the same year

*Figures marked with * = tonnes theoretical sugar per hectare per month expressed as a percentage for the ecological area in the same year*

- Data not available

*** Includes data for Caymanas & Innswood for years 1997-2001*

Table VII: Percent hectarage reaped under respective varieties, 1997 - 2001

	BJ8226					BJ7015					BJ7627					BJ7465					BJ7504					BJ7452					UCW5465					BJ82119					Mixed & Others				
Estates/Farms	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01
Appleton		9	11	3	9	+	+	+	14	9	12	11	6	1	4	14	+	+	13	7	+	+	+	10	8	+	3	2	*	1	+	+	+	+	+		18	17	6	12	74	59	72	53	43
Frome		39	58	10	16	34	6	+	23	20	+	+	+	2	1	11	17	28	7	10	20	23	+	44	35	+	+	+	4	1	+	+	+	+	+		13	10	3	7	35	2	4	7	+
Newton Cane Farms		+	+	12	10	25	+	+	3	2	+	57	+	6	6	23	+	+	12	6	+	+	+	31	29	+	+	+	4	4	+	+	+	+	+		+	+	7	13	52	43	100	25	24
Retreat		-	-	-	-	100	-	-	-	-	+	-	-	-	-	+	-	-	-		+	-	-	-	-	-	-	-	-	-	+	+	-	-	-		-	-		-	+	-	-	-	-
Wet West		23	31	9	14	33	3	+	19	16	*	14	+	2	2	11	9	12	9	9	18	12	+	36	29	+	1	+	4	1	+	+	+	+	+		12	14	4	8	38	26	42	17	12
Hampden		13	18	-	8	7	11	11	-	8	4	+	20	-	5	+	17	19	-	11	18	22	7	-	40	4	+	+	-	3	+	+	+	-	1		+	+	-	1	67	37	26	-	13
Long Pond		6	22	6	7	42	22	19	22	22	1	3	+	*	+	3	11	4	2	1	25	21	10	39	40	11	32	22	18	15	+	+	+	+	+		+	7	2	3	18	11	16	11	11
Dry North Coast		8	21	6	8	26	18	16	22	17	2	2	6	*	2	2	13	8	2	5	31	22	9	39	40	8	20	16	18	10	+	+	+	+	*		+	5	2	2	40	7	19	11	11
Bernard Lodge**		9	43	21	20	+	+	2	1	1	12	6	6	6	5	30	1	4	12	10	14	31	7	16	15	+	1	1	+	+	12	11	10	10	9		1	+	1	1	32	40	27	33	29
Monymusk		2	6	5	6	32	17	18	19	17	+	5	2	3	3	15	2	+	7	5	36	65	57	45	41	+	+	+	*	*	8	5	5	6	6		1	2	3	7	9	3	10	12	10
New Yarmouth		2	2	7	11	31	3	+	8	6	28	14	15	14	13	+	2	+	2	2	10	2	+	19	16	+	+	+	+	+	+	+	+	+	+		50	40	21	18	59	27	43	29	32
Irrigated		5	22	12	13	19	9	9	9	8	7	6	5	6	6	20	2	2	8	7	25	43	29	28	26	+	*	*	*	*	9	7	7	6	6		7	5	6	6	20	21	21	25	21
Tropicana		2	+	+	+	10	+	+	15	12	+	+	27	2	3	+	+	13	26	27	+	+	+	5	4	+	+	+	2	1	7	+	3	2	*		+	+	2	3	74	+	57	46	23
Wet East		2	+	+	+	10	+	+	15	12	+	+	27	2	3	+	+	13	26	27	+	+	+	5	4	+	+	+	2	1	7	+	3	2	*		+	+	2	3	74	+	57	46	23
Cambria		+	+	13	12	+	+	+	+	+	60	90	29	34	37	8	+	+	21	19	10	+	+	8	8	+	+	+	7	6	+	+	+	+	+		+	71	5	8	22	10	+	12	10
Worthy Park		21	36	18	16	+	+	+	*	*	4	7	+	12	12	+	+	+	1	1	32	16	4	30	31	6	+	+	*	+	+	+	+	*	+		10	11	5	8	58	46	48	34	32
Central		21	33	17	15	+	+	+	*	*	22	9	3	17	17	2	+	+	5	5	32	16	4	25	26	4	+	+	2	1	+	+	+	*	+		10	17	5	7	47	44	44	29	29
Island Average		8	22	10	12	21	8	9	13	11	6	7	5	5	5	16	3	3	9	8	23	36	23	31	27	1	*	2	3	2	7	6	5	3	3		8	6	5	6	27	25	23	21	26

+ No entry in this category

** Less than 1 percent*

- Data not available

*** Includes data for Caymanas & Innswood for years 1996 -2001*

Table VIII: Percent of plant cane hectarage devoted to each variety in ecological zones, 1997 - 2001

	BJ8226					BJ7015					BJ7627					BJ7465					BJ7504					BJ7452					UCW5465					BJ82119					Mixed & Others				
Estates/Farms	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01	97	98	99	00	01
Appleton	+	1	2	+	20	24	12	16	5	5	1	2	2	+	10	14	13	16	+	+	8	10	12	+	+	3	*	1	+	+	+	+	+	+	+	3	3	14	24	50	59	47	81	41
Frome	+	5	6	9	6	23	23	22	29	12	1	2	2	2	5	5	5	5	30	1	54	53	52	5	13	4	5	6	+	6	+	+	+	+	+	+	3	2	1	15	13	4	5	24	42
Newton Cane Farms	+	12	13	+	+	3	5	4	+	+	2	21	6	+	+	33	11	19	+	5	44	15	40	+	+	10	7	4	+	+	+	+	+	+	+	5	4	34	43	8	24	10	66	52
Retreat	-	-	-	-	-	66	-	-	-	-	4	-	-	-	-	4	-	-	-	-	17	-	-	-	-	2	-	-	-	-	3	+	-	-	-	-	-	-			4	-	-	-	-
Wet West	+	5	6	4	11	24	21	19	13	8	1	3	2	1	7	9	6	9	13	1	44	47	43	2	6	5	5	5	+	3	*	+	+	+	+	2	3	16	22	17	20	14	45	42
Hampden	+	1	8	-	12	15	11	10	-	8	4	5	6	-	3	10	6	7	-	22	32	31	27		36	14	14	10	-	3	+	+	1	-	+	+	+	*	-	+	25	32	29	-	16
Long Pond	+	*	4	18	+	23	22	19	35	47	*	*	*	+	+	3	4	4	+	+	42	42	39	38	24	22	23	24	2	7	+	+	+	+	+	+	1	4	13	10	9	8	3	9
Dry North Coast	+	1	5	18	7	20	18	17	35	23	1	2	2	+	2	6	4	5	+	13	38	39	36	38	32	19	20	21	2	5	+	+	*	+	+	+	+	1	4	5	16	16	13	3	13
Bernard Lodge**	+	3	13	44	1	6	4	1	+	2	8	6	5	1	4	32	27	19	*	10	15	18	18	2	4	3	1	1	+	+	19	16	13	4	8	+	*	*	3	+	15	25	29	46	71
Monymusk	+	*	2	22	8	31	25	21	17	13	+	1	2	7	6	17	14	10	+	+	26	40	50	2	20	1	*	*	+	+	14	10	7	6	11	+	*	1	19	19	11	10	9	27	23
New Yarmouth	+	1	2	24	29	19	11	12	+	+	13	12	14	16	+	4	6	3	+	+	42	35	28	2	+	+	+	+	+	+	+	+	+	+	+	+	13	19	31	+	22	25	22	27	71
Irrigated	+	2	7	31	7	19	14	11	7	7	5	5	5	7	5	21	18	13	*	4	24	30	32	2	11	1	1	*	+	+	14	11	8	4	9	+	2	4	15	10	15	19	20	66	47
Tropicana	+	+	+	+	+	18	18	20	+	+	+	+	1	+	13	28	26	24	5	25	5	6	6	+	+	5	5	2	+	+	4	4	4	+	+	+	3	3	6	+	34	38	39	89	62
Wet East	+	+	+	+	+	18	18	20	+	+	+	+	1	+	13	28	26	24	5	25	5	6	6	+	+	5	5	2	+	+	4	4	4	+	+	+	3	3	6	+	34	38	39	89	62
Cambria	+	14	14	+	+	1	+	+	+	+	32	34	34	39	49	23	22	22	+	+	8	9	8	+	7	8	8	7	+	+	+	+	+	+	+	+	3	42	37	28	23	12	19	7
Worthy Park	+	15	18	+	+	1	*	*	+	+	14	14	12	22	15	4	2	2	+	+	31	31	29	22	32	4	1	1	+	+	1	+	*	+	+	+	4	5	10	25	45	37	33	46	28
Central	+	15	17	+	+	1	*	*	+	+	18	18	16	25	22	8	7	6	+	+	26	27	25	18	26	5	3	2	+	+	1	+	*	+	+	3	4	15	28	41	27	29	42	24
Island Average	+	3	7	22	8	20	15	14	10	8	4	5	4	5	6	15	12	11	3	4	32	35	35	5	12	5	4	4	*	1	7	6	4	3	4	+	2	3	14	14	16	17	19	40	43

+ No entry in this category

** Less than 1 percent*

- Data not available

*** Includes data for Caymanas & Innswood for years 1996 -2001*

Table IX: Tonnes cane per hectare per variety by estates/farms in each ecological group, 2001

Estates/Farms	BJ7627	BJ8226	BJ7015	BJ7465	BJ7504	BJ82119	BJ7452	UCW5465	Mixed	Weighted Avg.
Appleton	37.47	61.05	49.95	42.66	45.33	46.46	42.24	+	47.28	47.03
Frome	51.74	45.97	55.12	55.18	57.87	44.04	54.28	+	52.06	54.63
Newton Cane Farms	51.42	60.94	55.22	41.47	56.16	68.47	53.11	+	57.80	55.69
Retreat	-	-	-	-	-	-	-	-	-	-
Wet West*	50.57	49.50	54.51	48.14	57.06	50.40	53.87	-	50.02	53.45
Hampden	-	-	-	-	-	-	-	-	-	-
Long Pond	27.29	67.17	59.44	60.04	68.30	72.00	58.44	+	56.13	63.04
Dry North Coast*	27.29	67.17	59.44	60.04	68.30	72.00	58.44	+	56.13	63.04
Bernard Lodge**	61.75	61.26	63.02	61.55	63.43	72.18	+	62.56	67.23	64.58
Monymusk	65.80	56.33	58.20	52.84	53.92	58.96	67.07	56.88	55.29	56.47
New Yarmouth	53.42	56.67	55.53	88.69	73.16	58.10	+	+	64.29	62.21
Irrigated*	59.62	59.62	58.00	60.09	58.35	59.08	67.07	60.16	64.73	60.86
Tropicana	69.01	+	79.53	64.63	63.69	63.39	80.15	57.99	69.37	71.49
Wet East*	69.01	+	79.53	64.63	63.69	63.39	80.15	57.99	69.37	71.49
Cambria	78.93	80.33	+	91.75	86.75	73.07	99.12	+	82.84	83.39
Worthy Park	75.67	74.55	102.10	74.14	83.03	79.51	+	+	79.82	79.66
Central*	77.16	75.53	102.10	88.73	83.26	78.02	99.12	+	80.22	80.46
Island Average	60.37	56.08	57.62	53.18	60.95	58.18	57.21	59.62	68.18	67.07

+ No entry in this category
- Data not available
** Regional Averages*
*** Includes data for Caymanas & Innswood*

Table X: Tonnes cane per tonne 96° sugar per variety by estates/farms in each ecological group, 2001

Estates/Farms	BJ7627	BJ8226	BJ7015	BJ7465	BJ7504	BJ82119	BJ7452	UCW5465	Mixed	Weighted Avg.
Appleton	8.76	9.59	8.97	9.14	9.15	8.60	9.87	+	8.88	8.98
Frome	9.14	10.24	10.45	9.65	10.29	9.62	10.08	+	9.98	10.14
Newton Cane Farms	9.86	10.36	11.19	9.39	10.11	9.77	9.57	+	9.54	9.91
Retreat	-	-	-	-	-	-	-	-	-	-
Wet West*	9.25	10.14	10.27	9.56	10.21	9.36	9.91	+	9.38	9.88
Hampden	10.47	10.29	10.04	10.15	9.33	11.10	10.10	9.01	10.13	9.80
Long Pond	+	10.28	10.07	9.61	10.18	11.39	10.09	+	10.49	10.21
Dry North Coast*	10.47	10.28	10.07	10.06	9.87	11.36	10.09	9.01	10.32	10.07
Bernard Lodge**	8.87	9.18	9.68	9.19	10.07	9.47	+	9.62	8.99	9.27
Monymusk	8.18	8.95	8.99	8.12	9.18	8.09	9.21	8.45	8.58	8.82
New Yarmouth	9.00	9.08	9.72	9.19	9.74	8.90	+	+	9.26	9.27
Irrigated*	8.72	9.12	9.09	8.85	9.48	8.54	9.21	9.12	8.99	9.10
Tropicana	8.72	+	9.86	9.56	10.84	8.79	8.67	8.36	8.98	9.21
Wet East*	8.72	+	9.86	9.56	10.84	8.79	8.67	8.36	8.98	9.21
Cambria	8.14	8.99	+	9.03	8.82	8.82	9.51	+	8.71	8.67
Worthy Park	8.19	8.61	8.49	8.59	8.67	8.13	+	+	8.19	8.40
Central*	8.17	8.68	8.49	8.97	8.68	8.27	9.51	+	8.26	8.46
Island Average	8.67	9.53	9.84	9.32	9.77	8.97	9.89	9.11	9.11	9.41

- Data not available
+ No entry in this category
** Regional Averages*
*** Includes data for Caymanas & Innswood*

Table XI: Tonnes 96° sugar per hectare for each variety by estates/farms in each ecological group, 2001

Estates/Farms	BJ7627	BJ8226	BJ7015	BJ7465	BJ7504	BJ82119	BJ7452	UCW5465	Mixed	Weighted Avg.
Appleton	8.00	7.74	8.64	8.03	7.68	7.91	6.85	+	8.26	8.00
Frome	7.43	6.73	7.05	9.08	7.74	7.47	7.54	+	7.92	7.61
Newton Cane Farms	7.67	5.58	6.05	7.53	7.87	8.01	6.07	+	7.49	7.44
Retreat	-	-	-	-	-	-	-	-	-	-
Wet West*	7.74	6.78	7.21	8.79	7.76	7.69	6.99	+	8.04	7.67
Hampden	4.00	4.09	4.37	5.75	5.40	2.09	4.55	2.65	4.69	4.94
Long Pond	+	5.87	5.61	5.90	5.24	5.88	4.83	+	5.41	5.36
Dry North Coast*	4.00	5.17	5.40	5.78	5.30	5.04	4.80	2.65	5.04	5.21
Bernard Lodge**	6.96	6.67	6.51	6.70	6.30	7.62	+	6.50	7.48	6.96
Monymusk	8.04	6.30	6.48	6.51	5.87	7.29	7.28	6.73	6.45	6.40
New Yarmouth	5.94	6.24	5.71	9.65	7.51	6.92	+	+	6.94	6.71
Irrigated*	6.84	6.54	6.38	6.79	6.15	6.92	5.79	6.60	7.20	6.69
Tropicana	7.92	+	8.07	6.76	5.87	7.21	9.25	6.94	7.73	7.76
Wet East*	7.92	+	8.07	6.76	5.87	7.21	9.25	6.94	7.73	7.76
Cambria	9.69	8.94	+	10.16	9.84	8.28	10.42	+	9.51	9.62
Worthy Park	9.24	8.66	12.02	8.63	9.58	9.78	+	+	9.74	9.48
Central*	9.44	8.70	12.02	9.89	9.60	9.43	10.42	+	9.71	9.51
Island Average	7.50	6.73	6.74	7.64	6.85	7.39	5.94	6.54	7.49	7.13

+ No entry in this category
- Data not available
** Regional Averages*
*** Includes data for Caymanas & Innswood*

Table XII: Tonnes 96° sugar per hectare per month for each variety by estates/farms in each ecological group, 2001

Estates/Farms	BJ7627	BJ8226	BJ7015	BJ7465	BJ7504	BJ82119	BJ7452	UCW5465	Mixed	Weighted Average
Appleton	0.57	0.58	0.69	0.66	0.60	0.61	0.53	+	0.63	0.62
Frome	0.57	0.52	0.54	0.70	0.59	0.56	0.58	+	0.59	0.58
Newton Cane Farms	0.61	0.46	0.51	0.62	0.65	0.67	0.50	+	0.65	0.62
Retreat	-	-	-	-	-	-	-	-	-	-
Wet West*	0.58	0.52	0.55	0.69	0.60	0.59	0.55	+	0.62	0.59
Hampden	0.28	0.32	0.31	0.41	0.41	0.15	0.31	0.25	0.35	0.37
Long Pond	+	0.43	0.41	0.44	0.38	0.38	0.36	+	0.40	0.39
Dry North Coast*	0.28	0.39	0.39	0.42	0.39	0.33	0.35	0.25	0.38	0.38
Bernard Lodge**	0.55	0.51	0.50	0.52	0.49	0.60	+	0.51	0.57	0.53
Monymusk	0.60	0.50	0.49	0.49	0.45	0.52	0.55	0.52	0.48	0.48
New Yarmouth	0.48	0.51	0.47	0.76	0.63	0.53	+	+	0.58	0.55
Irrigated*	0.53	0.50	0.48	0.52	0.48	0.53	0.55	0.51	0.56	0.51
Tropicana	0.75	+	0.68	0.54	0.50	0.61	1.08	0.61	0.64	0.64
Wet East*	0.75	+	0.68	0.54	0.50	0.61	1.08	0.61	0.64	0.64
Cambria	0.82	0.68	+	0.84	0.78	0.71	0.83	+	0.75	0.79
Worthy Park	0.76	0.71	0.88	0.70	0.79	0.79	+	+	0.79	0.77
Central*	0.78	0.71	0.88	0.81	0.79	0.77	0.83	+	0.78	0.78
Island Average	0.59	0.52	0.57	0.58	0.53	0.57	0.45	0.51	0.58	0.55

+ No entry in this category
- Data not available
** Regional Averages*
*** Includes data for Caymanas & Innswood*

Table XIII: Comparison of varieties showing yields expressed as a percentage of BJ7015 - crop 2001

	BJ7015	BJ8226	BJ7504	BJ7452	UCW5465	BJ7465	BJ7627	BJ82119
Tonnes cane per	4.98 (100)	4.95 (99)						
hectare/month	5.05 (100)		5.16 (102)					
	5.07 (100)			4.46 (88)				
	4.55 (100)				4.66 (102)			
	5.05 (100)					5.53 (110)		
	5.17 (100)						5.13 (99)	
	5.05 (100)							5.09 (101)
Tonnes sugar per	0.50 (100)	0.52 (104)						
hectare/month	0.51 (100)		0.53 (104)					
	0.51 (100)			0.45 (88)				
	0.49 (100)				0.51 (104)			
	0.51 (100)					0.59 (116)		
	0.52 (100)						0.59 (113)	
	0.51 (100)							0.57 (112)
Tonnes cane/tonne sugar	9.84 (100)	9.53 (97)						
	9.84 (100)		9.77 (99)					
	9.85 (100)			9.89 (100)				
	9.18 (100)				9.11 (99)			
	9.84 (100)					9.32 (95)		
	9.82 (100)						8.67 (88)	
	9.84 (100)							8.97 (91)

Table XIV: Tonnes cane per hectare for estates/farms by cane class in each ecological group, 2001

Estates/Farms	Fall Plants	Spring Plants	Stand Over	First Ratoon	Second Ratoon	Third Ratoon	Old Cane	Weighted Avg.
Appleton	53.87	59.67	+	73.07	67.88	52.89	+	65.89
Frome	+	75.63	+	94.44	76.84	66.23	74.66	77.20
Newton Cane Farms	39.04	76.19	+	78.72	70.33	66.87	76.18	73.73
Retreat	-	-	-	-	-	-	-	-
Wet West	44.93	74.55	+	90.25	75.98	66.17	74.85	76.45
Hampden	73.23	69.61	+	50.47	48.99	42.87	40.29	48.43
Long Pond	85.99	73.16	+	64.40	54.35	51.31	50.72	54.72
Dry North Coast*	77.01	71.33	+	58.68	53.05	47.17	47.64	52.47
Bernard Lodge**	82.44	72.91	85.71	67.98	60.18	61.84	62.13	64.58
Monymusk	+	67.36	58.62	57.38	54.63	53.77	53.47	56.47
New Yarmouth	+	53.12	+	63.67	54.95	61.18	66.23	62.21
Irrigated	82.44	67.96	77.56	63.05	57.18	58.43	59.61	60.86
Tropicana	76.35	106.09	+	81.81	64.45	64.99	67.59	71.49
Wet East	76.35	106.09	+	81.81	64.45	64.99	67.59	71.49
Cambria	+	76.22	+	90.01	58.80	88.40	84.53	83.39
Worthy Park	+	92.04	+	92.28	73.69	78.51	78.01	79.66
Central	+	88.77	+	91.74	72.46	78.74	79.81	80.46
Island Average	73.58	71.78	77.56	73.95	63.03	60.76	66.20	66.70

+ No entry in this category
- Data not available
*** Includes data for Caymanas & Innswood*

Table XV: Tonnes cane per tonne 96° sugar for estates/farms by cane class in each ecological group, 2001

Estates/Farms	Fall Plants	Spring Plants	Stand Over	First Ratoon	Second Ratoon	Third Ratoon	Old Cane	Weighted Avg.
Appleton	8.42	10.32	+	8.73	9.02	9.82	+	9.13
Frome	+	9.55	+	10.01	9.94	9.69	10.42	10.14
Newton Cane Farms	10.49	10.02	+	9.39	10.04	10.14	10.03	9.91
Retreat	-	-	-	-	-	-	-	-
Wet West	9.39	9.66	+	9.83	9.93	9.80	10.37	10.09
Hampden	10.51	9.41	+	9.79	9.41	10.24	9.58	9.80
Long Pond	9.64	10.13	+	10.24	10.65	10.19	10.11	10.21
Dry North Coast*	10.21	9.75	+	10.07	10.35	10.21	9.97	10.07
Bernard Lodge**	8.34	9.52	8.92	9.27	9.21	9.31	9.32	9.27
Monymusk	+	9.01	8.25	8.62	8.97	8.95	8.68	8.82
New Yarmouth	+	9.03	+	9.03	9.24	9.10	9.45	9.27
Irrigated	8.34	9.21	8.75	8.99	9.12	9.14	9.11	9.10
Tropicana	8.86	9.70	+	9.14	8.84	8.64	9.24	9.21
Wet East	8.86	9.70	+	9.14	8.84	8.64	9.24	9.21
Cambria	+	8.68	+	7.98	9.92	8.47	8.70	8.67
Worthy Park	+	8.66	+	8.74	8.55	8.10	8.39	8.40
Central	+	8.66	+	8.55	8.63	8.10	8.48	8.46
Island Average	9.40	9.31	8.75	9.39	9.45	9.24	9.56	9.44

+ No entry in this category
- Data not available
*** Includes data for Caymanas & Innswood*

Table XVI: Tonnes theoretical 96° sugar per hectare for estates/farms by cane class in each ecological group, 2001

Estates/Farms	Fall Plants	Spring Plants	Stand Over	First Ratoon	Second Ratoon	Third Ratoon	Old Cane	Weighted Avg.
Appleton	6.40	5.78	+	8.37	7.53	5.38	+	7.22
Frome	+	7.92	+	9.44	7.73	6.84	7.17	7.61
Newton Cane Farms	3.72	7.61	+	8.39	7.01	6.60	7.59	7.44
Retreat	-	-	-	-	-	-	-	-
Wet West	4.79	7.72	+	9.18	7.65	6.75	7.72	7.58
Hampden	6.97	7.40	+	5.16	5.21	4.19	4.20	4.94
Long Pond	8.92	7.22	+	6.29	5.10	5.04	5.02	5.36
Dry North Coast*	7.54	7.31	+	5.83	5.13	4.62	4.78	5.21
Bernard Lodge**	9.88	7.66	9.61	7.33	6.53	6.64	6.67	6.96
Monymusk	+	7.48	7.11	6.65	6.09	6.01	6.16	6.40
New Yarmouth	+	5.88	+	7.05	5.95	6.72	7.01	6.71
Irrigated	9.88	7.38	8.86	7.02	6.27	6.39	6.55	6.69
Tropicana	8.62	10.94	+	8.95	7.29	7.52	7.32	7.76
Wet East	8.62	10.94	+	8.95	7.29	7.52	7.32	7.76
Cambria	+	8.78	+	11.28	5.93	10.44	9.71	9.62
Worthy Park	+	10.63	+	10.56	8.62	9.70	9.29	9.48
Central	+	10.25	+	10.73	8.39	9.71	9.41	9.51
Island Average	7.82	7.71	8.86	7.87	6.67	6.57	6.93	7.07

+ No entry in this category
- Data not available
*** Includes data for Caymanas & Innswood*

Table XVII: Tonnes theoretical 96° sugar per hectare per month for estates/farms by cane class in each ecological group, 2001

Estates/Farms	Fall Plants	Spring Plants	Stand Over	First Ratoon	Second Ratoon	Third Ratoon	Old Cane	Weighted Avg.
Appleton	0.41	0.40	+	0.68	0.57	0.48	+	0.55
Frome	+	0.61	+	0.72	0.60	0.52	0.54	0.58
Newton Cane Farms	0.44	0.61	+	0.72	0.56	0.54	0.62	0.62
Retreat	-	-	-	-	-	-	-	-
Wet West	0.42	0.59	+	0.72	0.59	0.53	0.55	0.58
Hampden	0.42	0.55	+	0.40	0.42	0.31	0.33	0.37
Long Pond	0.44	0.48	+	0.49	0.38	0.37	0.37	0.39
Dry North Coast*	0.43	0.51	+	0.45	0.39	0.34	0.36	0.38
Bernard Lodge**	0.68	0.58	0.49	0.58	0.51	0.52	0.52	0.53
Monymusk	+	0.54	0.34	0.53	0.47	0.46	0.47	0.48
New Yarmouth	+	0.48	+	0.58	0.49	0.54	0.58	0.55
Irrigated	0.68	0.55	0.44	0.56	0.49	0.50	0.51	0.51
Tropicana	0.49	0.94	+	0.71	0.66	0.66	0.61	0.64
Wet East	0.49	0.94	+	0.71	0.66	0.66	0.61	0.64
Cambria	+	0.84	+	0.99	0.48	0.85	0.78	0.79
Worthy Park	+	0.85	+	0.86	0.70	0.79	0.76	0.77
Central	+	0.84	+	0.89	0.68	0.79	0.77	0.78
Island Average	0.50	0.58	0.44	0.62	0.52	0.51	0.54	0.55

+ No entry in this category
- Data not available
** *Includes data for Caymanas & Innswood*

Table XVIII: Percent hectares reaped by cane class for estates/farms and ecological group & average growth in months, 2001

Estates/Farms	Fall Plants	Spring Plants	Stand Over	First Ratoon	Second Ratoon	Third Ratoon	Old Cane	Avg. Length of Growth (Mths.)
Appleton	8	25	+	44	16	7	+	13.20
Frome	+	7	+	14	18	9	52	13.14
Newton Cane Farms	2	8	+	20	12	17	41	12.05
Retreat	-	-	-	-	-	-	-	-
Wet West	*	7	+	16	17	10	50	12.98
Hampden	10	7	+	15	11	17	40	13.39
Long Pond	2	3	+	12	19	10	54	13.69
Dry North Coast*	5	5	+	13	16	12	49	13.59
Bernard Lodge**	1	11	3	13	22	18	32	13.11
Monymusk	+	15	1	13	20	16	35	13.22
New Yarmouth	+	7	+	18	18	12	45	12.17
Irrigated	1	12	2	14	21	16	34	12.99
Tropicana	+	4	+	17	4	3	72	12.06
Wet East	+	4	+	17	4	3	72	12.06
Cambria	+	8	+	7	4	2	79	12.23
Worthy Park	+	8	+	6	11	18	57	12.27
Central	+	8	+	6	9	14	63	12.26
Island Average	1	9	1	14	18	13	44	
Average age (mths.)	15.69	13.23	20.04	12.67	12.83	12.86	12.86	12.95

- Data not available
+ No entry in this category
** Less than 1%*
*** Includes data for Caymanas & Innswood*

Table XIX: Hectares fertilized as a % of total hectares reaped - plants and ratoons, 1997 - 2001

Ecological Groups	Year	Nitrogen		Phosphate		Potash	
		Plants	Ratoons	Plants	Ratoons	Plants	Ratoons
		%	%	%	%	%	%
Wet West	1997	91	94	77	85	77	94
Dry North Coast		97	99	93	36	93	99
Irrigated		70	741	19	33	19	49
Wet East		38	91	8	43	8	91
Central		100	100	89	20	89	100
Wet West	1998	96	94	96	86	96	94
Dry North Coast		71	85	61	21	61	85
Irrigated		-	-	-	-	-	-
Wet East		0	97	0	35	0	97
Central		100	100	94	29	94	100
Wet West	1999	67	95	63	85	63	95
Dry North Coast		67	74	54	13	54	74
Irrigated		72	68	46	12	46	48
Wet East		100	98	100	21	100	98
Central		100	100	62	21	62	100
Wet West	2000	95	96	84	87	84	96
Dry North Coast		100	98	100	20	100	98
Irrigated		80	74	47	16	47	56
Wet East		100	96	9	43	9	96
Central		100	99	92	20	92	99
Wet West	2001	95	94	69	55	69	88
Dry North Coast		46	75	39	22	39	75
Irrigated		86	96	22	21	22	84
Wet East		100	97	0	15	0	97
Central		100	99	59	21	59	99

- Data not available

Table XX: Percent hectares fertilized with N, P, K by cane class, 1997 - 2001

Fertilizer	Year	Fall Plants	Spring Plants	First Ratoons	Second Ratoons	Third Ratoons	Old Cane	Mean
		%	%	%	%	%	%	%
Nitrogen	1997	42	81	83	88	87	88	85
	1998	72	47	57	60	69	78	65
	1999	48	74	76	83	80	84	81
	2000	79	87	82	87	85	92	87
	2001	58	93	94	91	93	93	93
Phosphate	1997	40	41	54	48	58	53	51
	1998	72	41	33	40	42	51	43
	1999	33	50	21	37	43	47	42
	2000	41	61	41	40	39	52	46
	2001	24	44	36	41	29	31	34
Potash	1997	42	59	66	76	77	82	73
	1998	72	45	54	59	69	78	64
	1999	36	70	59	70	72	80	73
	2000	79	83	70	80	76	86	79
	2001	32	91	86	85	87	85	85

Table XXI: Average N, P, K, Applications (kg) per hectare for plants and ratoons by ecological groups, 1997 - 2001

		1997			1998			1999			2000			2001		
		N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
Wet West	Plants	89	55	99	97	75	101	92	67	96	75	90	75	108	92	104
	Ratoons	98	56	106	92	58	102	94	57	103	94	56	104	113	60	86
Dry North Coast	Plants	88	68	94	83	69	88	74	81	75	77	78	79	82	75	85
	Ratoons	91	61	95	88	58	91	83	42	86	83	50	85	84	46	86
Irrigated	Plants	101	55	94	-	-	-	86	90	74	102	82	87	108	83	105
	Ratoons	102	65	92	-	-	-	102	51	100	116	62	96	119	60	108
Wet East	Plants	50	136	51	+	+	+	96	86	100	61	19	64	113	0	114
	Ratoons	121	86	30	95	42	98	106	52	110	77	38	85	86	38	89
Central	Plants	110	69	159	108	56	145	114	59	154	128	63	170	119	47	157
	Ratoons	114	54	151	110	32	114	117	24	154	112	20	148	103	20	135

- *Data not available*
+ *No Entry in this category*

Table XXII: Fertilizer used for each cane class for farms sampled - crop 2001

	Nitrogen				Phosphate				Potash			
	Hectares Fertilized	Tonnes Used	Mean kg/ha	% Total ha Fertilized	Hectares Fertilized	Tonnes Used	Mean kg/ha	% Total ha Fertilized	Hectares Fertilized	Tonnes Used	Mean kg/ha	% Total ha Fertilized
Fall Plants	95	7.98	83.94	58	39	3.09	78.56	24	53	3.94	72.97	32
Spring Plants	1,836	201.84	109.93	93	867	74.93	86.38	44	1,784	194.53	109.03	91
Stand Over Plants	68	5.94	87.27	39	4	0.07	17.28	2	61	5.44	88.83	35
First Ratoons	2,648	310.40	117.22	94	1,032	62.32	60.38	36	2,440	268.39	109.96	86
Second Ratoons	3,215	359.30	111.76	91	1,303	78.28	60.04	41	2,975	322.02	108.22	85
Third Ratoons	2,350	268.86	114.39	93	748	43.60	58.23	29	2,197	240.04	109.23	87
Old Ratoons	7,955	875.25	110.02	93	2,703	147.88	54.71	24	7,265	771.25	106.15	85
Total/Average	18,195	2,031.56	111.65	93	6,706	410.93	61.27	34	16,806	1,807.33	107.54	85