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SUGAR INDUSTRY RESEARCH INSTITUTE

Dr. Earle Roberts - Director of Research

CENTRAL SERVICES

ADMINISTRATIVE SERVICES

K. O'Gilvie	Office 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
D. Brown*	Driver
M. Francis	Driver
G. Townsend*	Office Helper
E. Spencer	General Assistant
Y. Lurch	Office Assistant
D. Gowans	Library Clerk
D. Gardner	Typist/Receptionist

CHEMISTRY LABORATORY

M. Wilson Ph.D.	Chemist/Lab Manager
A. Lawson	Supervisor
Y. Berry	Laboratory Analyst
E. Harris	Laboratory Analyst
M. McDonald	Laboratory Analyst
G. Allen	Laboratory Analyst
J. Saunches	Laboratory Assistant
O. Lurch	General Assistant
B. Morris	Laboratory Assistant

ECONOMICS & STATISTICS

C. Woolery	Agri. Economist
V. Smith	Snr. Statistical Clerk
N. Kerr	Statistical Clerk

INFORMATION SYSTEMS

O. Brown	Head - Computing
M. Williams	Programmer/Analyst
D. McHayle	Programmer/Analyst
B. Williams	Information Proc. Officer
W. Edwards*	Computer Analyst
L. Lewis*	Data Processor
V. Morris*	Programmer/Analyst

AGRICULTURAL SERVICES DEPARTMENT

Mr. Trevor Falloon - Agricultural Services Manager

EXTENSION

D. Little	Head - Extension Services
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	Extension Officer
L. Robinson**	Extension Officer

ENGINEERING

L. White	Snr. Agricultural Engineer
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, Variety Dept.
C. Fearon	Nutrition Agronomist
M. Lewis	Physiologist
S. Mitchell*	Biotechnologist
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

FACTORY SERVICES DEPARTMENT

Mr. Joshua Jaddoo - Factory Services Manager

ENGINEERING

M. Christopher	Sup - Instrument
B. Wilson	Junior Engineer
G. Bent*	Energy Technologist
J. Williams*	Instrument Technician
A. Lyle**	Mechanical Engineer Tech.
A. James	Snr. Technical Assistant
S. Watson	Mechanic
R. Lee	Mechanic
A. Hinds*	Welder/Mechanic
P. Ellis	Machinist
W. Morgan	Workshop Assistant

SUGAR TECHNOLOGY

L. Brown*	Snr. Sugar Technologist
A. Welsh*	Assistant Chemist
D. Lewis*	Research Technologist
E. Manning	Research Technologist
S. Roman	Snr. Analytical Techn.
D. Shady**	Technical Assistant

* - Left during the year

** - On study leave

1 PERSONNEL AND TRAINING

1.1 STAFF

Overseas Visits

Messrs. Trevor Falloon, Acting Director of Research and Joshua Jaddoo, Manager - Factory Services Division, attended the semi-annual meeting of the SAC Technologists Committee held in Barbados April 6 - 8, 1999.

Arrivals

Mrs. Elaine Manning joined the Factory Services Division as Research Technologist/Environmentalist on January 3, 1999; Mr. Orville Wright joined the Variety Improvement Department as Assistant Field Officer on March 1, 1999; Mr. Eugene Harris and Ms. Barbara Morris joined the Chemistry Laboratory on March 8, 1999 and May 10, 1999 as Laboratory Technician and Laboratory Assistant respectively.

Departures

Mrs. Sylvia Mitchell left the Institute on June 16, 1999, while the following members of the Factory Services Division opted for redundancy, following the transfer of Factory Services operations from Bernard Lodge to Mandeville:

George Bent - Energy Techn.- 31/8/99

Derrick Brown - Driver- 31/8/99

Ludlow Brown - Sugar Techn.- 31/8/99

Warren Edwards - Programmer/Analyst - 31/8/99

Anthony Hinds - Welder/Mech. - 31/5/99

Donna Lewis - Research Techn. - 31/8/99

Lorna Lewis - Data Processor - 31/5/99

Varden Morris - Programmer/Analyst - 17/9/99

Georgia Townsend - Office Asst- 31/8/99

Alaric Welsh - Asst. Chemist - 31/5/99

Junior Williams - Instru. Tech. - 31/5/99

Promotion

The following promotions were made during the year:

Name	New Position
Sydney Roman	Snr. Analytical Technician
Beverley Williams	Information Processing Officer
Anthony James	Jnr. Engineer

Technical Papers

Papers presented by members of staff at the 62nd Annual Conference of the Jamaica Association of Sugar Technologists (JAST), held at the Renaissance Jamaica Grande Hotel on November 4-5, 1999:

- "Review of the 1998/99 Sugar Crop" (D. Little/J. Jaddoo).
- "An Update of the Disease Status of Jamaican Sugar Cane" (T. Falloon).
- "Assessment of the Impact of Cane Price/Replanting on Cane Production & Productivity" (C. Woolery).
- "Effect of Month of Reaping on the Subsequent Yield of Sugar Cane" (O. Brown).
- "Influence of Temperature and Rainfall on Sugar Yield at Frome" (P. Wright).
- "Soils Planted to Sugar Cane in Jamaica and Annual Fertilizer Requirements" (C. Fearon).
- "Harvesting Standover Canes - the Appleton Experience" (P. Wright/I. Ebanks/Mr. H. Wright).
- "Reduced Tillage - Improving Tillage Technology" (L. Agra/K. Chandon).
- "Monitoring Wells at Monymusk" (M. Wilson).
- "Reducing the Cost of Drip Irrigation with Pineapple Row Spacing" (L. White).
- "Arresting the Decline in Sugar Cane Production in Clarendon" (D. Golding/J. Fearon).

Visitors

Visitors to the Institute during the year included Sr. Carlos de la Incera of the University of Havana, Cuba; Sr. A. Hechavarria of Tecnoazucar, Cuba; Dr. Richard Rodman and Dr. Fred Perry of Warren Wilson College, North Carolina, Messrs. Gladstone Barrett, Axel Bohme and Juan Monget of FAO Kingston and Barbados respectively; Sr. Tomas Salvador of Monsanto, Puerto Rico; Messrs. Harold Morgan and Dalton Brown of Antilles Chemical Co., Kingston; Sr. Peter Alfred of InterCaribe Ltd., Kingston; Mr. Jorge Abreu of GIMAC-SIME, Cuba.

1.2 TRAINING

Ms. Denise Gardner attended a Workshop, "Telephone Techniques & Customer Relations" at JAMPRO, January 18-22, 1999.

Ms. Janice Seaton attended a Workshop, "Payroll Management" at JAMPRO , January 26-29, 1999.

Mr. Anthony James attended a training course on "Service and Repairs to Optical Activity Polarimeter at Optical Activty", England, May 20 - 21, 1999

Mr. Sydney Roman attended the Raw Sugar Manufacturer's Institute in New Orleans, June 21 - July 1, 1999.

Ms. Beverley Williams completed a Diploma course in Computer Technician and Repairs at Computer Professionals Ltd., July - August 1999.

Mrs. Geneveve Allen attended a Workshop on Basic Techniques in Plant Biotechnology and Molecular Biology, hosted by the Biotechnology Centre, UWI - Mona, August 17 - 19, 1999.

Ms. Veronica Smith and Ms. Nesta Kerr completed a Microsoft Access Course at Vector Technology Institute in August 1999.

Ms. Janice Seaton and Mrs. Geneveve Allen completed a one year Diploma in Office Automation at Vector Technology Institute in September 1999.

Ms. Yvette Berry completed a three months Diploma course at Computer Professionals Ltd. on Office Technology in September 1999.

Mrs. Elaine Manning attended a Seminar, "The Anaerobic Technology and its use in the Treatment of Domestic Wastewater" organized by the Scientific Research Council on September 28, 1999 at the Hotel Four Season.

Dr. Maureen Wilson, Mr. Marrington McDonald and Mr. Lancelot White attended a three-day workshop, "Planning Effective Meetings" at the Management Institute for National Development in October 1999.

Mrs. Elaine Manning and Mr. Marrington McDonald attended a seminar, "Prospects of Biotechnology & Biodiversity for the Caribbean Agro Industry", November 29-30, 1999 at UWI, Mona.

Messrs. M. Easy and K. Chandon attended a three-day workshop in, "Team Building" at the Management Institute for National Development in December 1999.

Factory personnel at **Hampden** were given training in specific laboratory analyses.

The UWI work/study programme commenced in June and was for a duriation of eight weeks. Two students, who planned to pursue a course in sugar cane processing, were assigned separate projects in polarization measurements.

The annual summer course programme was planned and comprised of five courses covering the laboratory, maintenance of machinery and processing. The courses were held during the month of August at Utech and VTDI. Seventy-nine participants attended this programme.

The SIA Factory Inspector's course was an introduction to the micro computer. It included the generation of factory and core reports. The course was for a duration of two weeks in August and was held at Utech.

Presentations were made at pre-crop seminars at **Tropicana** and **Hampden**. The areas of factory operation which had the potential for being improved during the coming crop were analysed along with their performance over previous crops. Suggestions were made as to how some of the problems could be overcome.

The course on Sugar Technology at the U.W.I. included a field trip to **Bernard Lodge** sugar factory and on-site lectures. The course was completed in April 1999. Twenty-five students, who were all in their final year of the BSc programme, participated in the course.

2 WEATHER

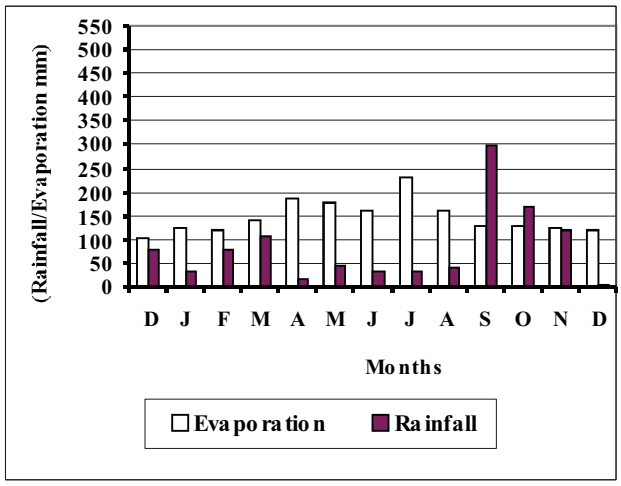
With *La Niña* continuing to be the dominant influence in 1999, the industry experienced wetter than normal weather throughout most of the year, *End Table 3*. Irrigated areas, represented by **Bernard Lodge, Innswood, Monymusk** and **New Yarmouth**, profited most as precipitation was almost 50% above the 30 year mean. The September to November period, when rainfall totals were some 122% above the mean, was when most of the excess was recorded. In all of the earlier months evaporation exceeded rainfall in this zone, *Fig 2.1*.

In the Wet West (**Frome, Appleton**), rainfall was relatively well distributed with the mean exceeded in seven months, *End Table 3*. Unfortunately, three of those months were January, February and March - the height of the harvesting season. At **Worthy Park**, in the Central Uplands, rainfall was equal to or greater than evaporation in 10 of the 13-month period represented in *Fig 2.1*.

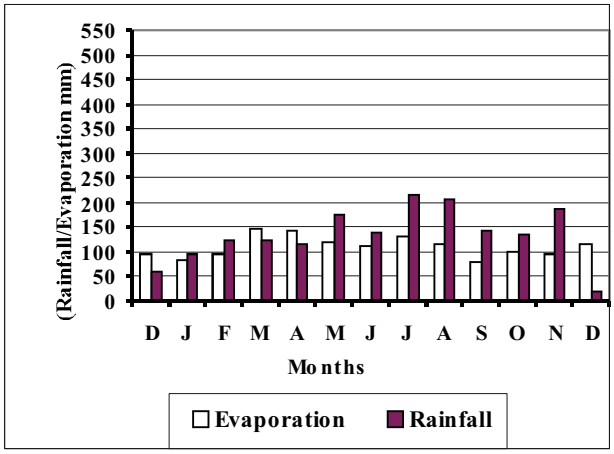
All areas experienced a dramatic reduction in rainfall in December, 1999. Lowest shortfall was in the dry North Coast (**Long Pond, Hampden, Barnett**) which received a half of normal rainfall. At the other extreme, **Tropicana**, in the Wet East, received only one seventh its average precipitation.

Monymusk recorded just 19 rainy days (when rainfall exceeded 10 mm) in the *El Niño* drought year, 1997, but 33 in the *La Niña* influenced 1999, *End Table 4*.

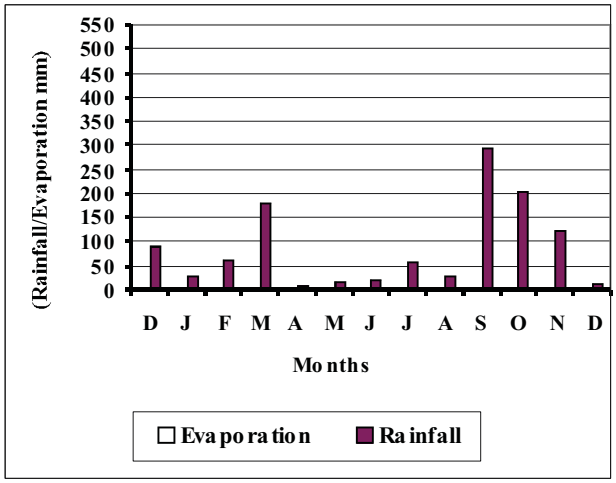
Fig. 2.1: Water Balance Data - December 1998 to December 1999



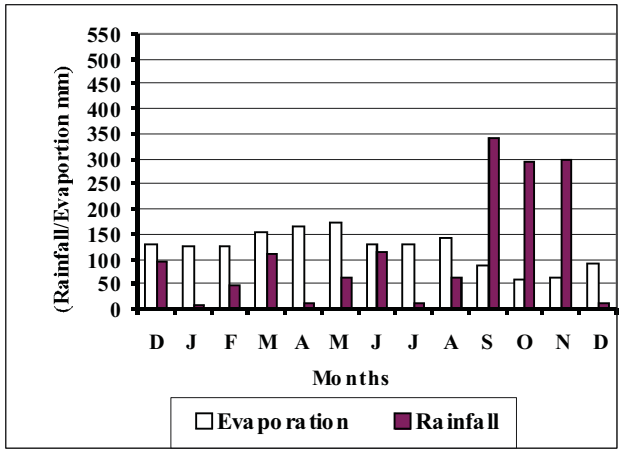
Bernard Lodge



Frome

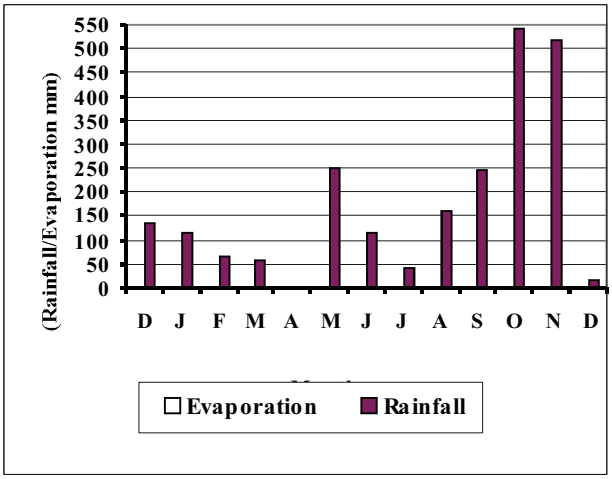


Innswood

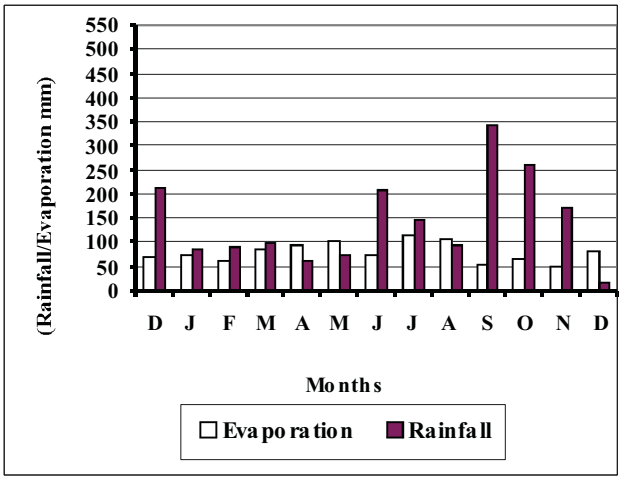


Monymusk

Fig. 2.1: Water Balance Data, Cont'd



Tropicana



Worthy Park

3 CANE AGRONOMY

3.1 NUTRITION

Fertilizer Usage

A total of 18 754 t of fertilizer, the lowest quantity since 1994 and consisting mainly of 17-0-17, 16-9-18 and 14-28-14, was purchased by the Industry in 1998, Fig. 3.1. With 44 627 ha under sugar cane and recommended fertilizer rates varying from 500-680 kg/ha, the quantity purchased reflected a 24% shortfall from the annual requirement of some 24 600 t.

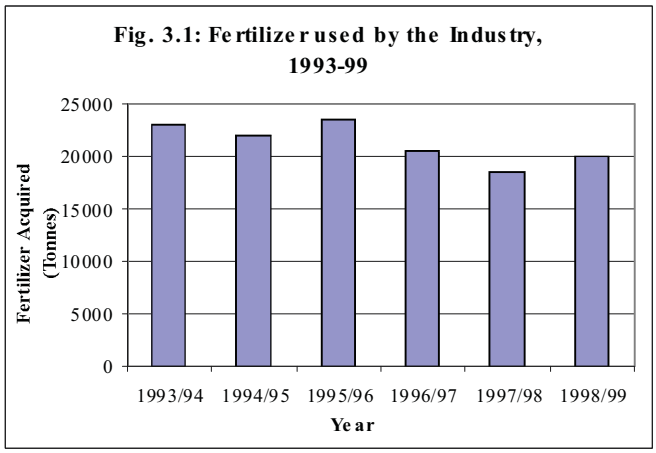
Reduced income from a depressed sugarcane price coupled with high fertilizer cost contributed to lower demand. Growers were advised that, despite these challenges, fertilizer inputs should not be withheld. Routine soil and leaf analyses should be pursued as these would determine nutrient requirements for cost effective fertilizer practices.

Nutrition Monitoring

Assessment of the nitrogen, phosphorus and potash status of ratoon fields was carried out at **Tropicana, Frome, Appleton, Worthy Park, Cambria, Wallens** and **SIRI Experimental Farm.** At 5 months, levels of adequacy measured at the third visible dewlap (TVD) leaf have been established for N at 1.55% and above, P_2O_5 at 0.40% and above and K_2O at 1.26% and above.

Nitrogen

Nitrogen adequacies ranged from 52% of fields sampled at **Tropicana**, to 100% at **Wallens**, *Table 3.1.* Nitrogen inadequacies at **Tropicana** were attributed to reduced fertilizer usage as the Estate, faced with financial constraints, applied less than the 95 kg N/ha recommended for ratoons. At **Frome**, there was adequate nitrogen in 68% of fields sampled.



The nitrogen status was adequate in 84-100% of fields at **Worthy Park, Cambria** and **Wallens**. Applications of filter cake at **Appleton** and **Worthy Park** and poultry manure at **Cambria** appeared to enhance nitrogen uptake.

Phosphorus

Levels of Phosphorus in soil were adequate in 85% of fields at **SIRI Experimental Farm** and 100% at **Wallens**. Even without applications, fields at **Tropicana, Worthy Park** and **SIRI Experimental Farm** showed relatively low incidences of shortages.

Potash

There was also adequate soil potash in 92% and 93% of fields at **Worthy Park** and **Appleton**, respectively. However, at **Wallens**, **Cambria** , **SIRI's farm**, **Tropicana** and **Frome** only 50-74% of fields were adequately supplied.

Varieties x Phosphorus

Investigations at Hyde Hall, **Long Pond** to evaluate the effect of added phosphorus on yield of different varieties showed no significant differences ($p>.05$) in the response of BJ7015, BJ8226, BJ82119 and BJ7548 harvested as second ratoons. However, there were significant yield increases with phosphorus dressings in all varieties, *Table 3.2.* An increase in sugar yield of 1.1 ts/ha was obtained at 150 kg/ha P_2O_5, mainly as a consequence of improved JRCS.

At 5 months, acceptable levels of foliar phosphorus were found even in control plots. Greater uptake occurred where phosphorus was applied.

Table 3.1: Nitrogen, phosphorus and potash status in ratoons, leaf samples taken at 5 - months in 1999

Estate/Farms	No. of Fields	Adequacies % N	% P_2O_5	% K_2O
Tropicana	113	52	99	61
Frome	46	68	98	74
Appleton	102	70	92	93
Worthy Park	73	84	96	92
Cambria	61	98	100	55
Wallens	18	100	100	50
SIRI Farm	14	78	85	71

Composting

Composting continued under the project funded mainly by the Canadian International Development Agency (CIDA) through the local sub-project, Soil Nutrients for Agricultural Productivity (SNAP). The composting area at **Bernard Lodge** was extended to accommodate 10 longer windrows containing approximately170 t of filter cake. However, turning by the CERES713-X machine was not achieved due to difficulties in obtaining tractor services. To solve this problem, a Ford 6610 tractor, in disrepair, was acquired for reconditioning with the hope of avoiding further delays but repairs were not completed until mid-December.

With the home gardener being an important part of the target market, trials were conducted testing the response of cabbage to previously made compost. Positive yield response was obtained at rates of 10 t/ha in addition to roughly 50% standard inorganic fertilizer. Consumers, using the product mainly on ornamentals and vegetable crops, reacted favourably in market tests.

The nutrient content of composted filter cake was for the most part, comparable to that of filter cake plus bagasse, *Table 3.3*. With bagasse added, nutrient levels tended to be slightly lower. However, composted filter cake plus bagasse had greater consumer appeal because of the apparent higher organic matter content.

Variety x Fertilizer Trial

An observational trial assessing the responses of BJ7015 and BJ7465 to fertilizer dressings on the peat soil at East Polder, **Frome**, indicated highest sugar recovery, 7.66 ts/ha, with heavier dosages for the relatively high sucrose variety, BJ7465, harvested at 10 months, *Table 3.4*. BJ7015, the moderate sucrose variety, did not show a positive response on increasing dosages.

Higher sucrose content, as indicated by a JRCS of 10.22%, obtained for BJ7465 at the higher dosage, *Table 3.5*, was largely responsible for the increased sugar recovery.

Zinc Nutrition

There was no significant response in cane and sugar yields of BJ7627 and BJ82119 to applications of zinc sulphate at 0, 25 and 50 kg/ha at the SIRI Experimental Farm, Springfield. The trial, now reaped for the third consecutive year on the alkaline (pH 8.2) Agualta clay soil, is yet to show any economic response as leaf samples taken at 5 months (TVD) from treated and untreated plots contained more than critical levels (12 ppm) of zinc.

Table : 3.2 Mean response of 4 varieties, reaped as 2nd ratoons , to phosphorus dressings at Hyde Hall, Long Pond

kg/ha P_2O_5	% P_2O_5 (TVD)	tc/ha	JRCS	ts/ha
0	0.46	76.68	12.34	9.39
30	0.49	80.07	12.62	9.96
60	0.47	80.35	12.19	9.65
150	0.47	81.26	13.01	10.49
SED	0.01	1.10	0.36	0.31
LSD .05	N.S.	2.27	0.74	0.63

Table 3.3: Mean nutrient contents of compost produced at Bernard Lodge

Compost parent material	Percent N	P_2O_5	K_2O	Ca	Mg	ppm Mn	Zn	Fe	Cu
Filter Cake	1.15	6.12	0.68	0.65	0.57	57	86	26	34
Filter Cake + Bagasse	1.16	5.10	0.62	0.45	0.58	58	82	25	31

Table 3.4: Yields in response to varying fertilizer dressings for two varieties harvested at 10 months, East Polder, Frome.

kg/ha N	P_2O_5	K_2O	BJ7015 tc/ha	ts/ha	BJ7465 tc/ha	ts/ha
28	73	112	80.52	6.52	69.85	6.15
70	73	112	68.04	5.69	81.46	7.04
84	84	84	73.1	6.31	70.52	5.86
102	102	102	79.85	6.32	75.09	7.67

Table 3.5: Cane quality (JRCS) of 10 month-old plant canes, BJ7015 and BJ7465, in response to fertilizer dressings, East Polder, Frome

kg/ha N	P_20_5	K_20	BJ7015	BJ7465
28	73	112	8.01	8.81
70	73	112	8.37	8.65
84	84	84	8.64	8.31
102	102	102	7.92	10.22

3.2 ANALYTICAL LABORATORY

The laboratory completed 25 954 determinations during 1999, *Table 3.6.* This was below normal expectations of approximately 40,000 per annum and was due mainly to a decline in the numbers of soil and leaf samples received for analysis.

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. Over 230 laboratories in 63 countries participated in the plant tissue exchange and over 300 laboratories in 74 countries in the soil material exchange.

Plant Tissue

During the year, 36 plant tissue samples were received for analysis of eleven parameters. There was a 78% acceptance of the results i.e. those falling within ± 2 standard deviations (SD) of the mean. Improvements

Table 3.6. Laboratory report for the year beginning Jan 4 and ending Dec 31 1999

Analyses	Leaf	Soil	Cane Juice	Water	Sugar	Molasses	Compost	Fertilizer	Total
Organic Matter		69					10		79
Nitrogen	950	567	62				15	10	1604
Phosphate	922	1363	62				21	7	2375
Potash	922	1341	62	514			21	8	2868
pH		1285		516			10		1811
Sodium		1217		514					1731
Calcium	239	1225		516			16		1996
Magnesium	257	1250		516			16		2039
Chloride		36		514					550
Brix			360			355			715
Pol			360		2254	167			2781
Sucrose			16	8		46			70
Reducing Sugars			16	8	278	46			348
Electrical Conductivity		53		516					569
% Moisure		36			2185		6		2227
Ash					352	169			521
CEC		52							52
Mechanical Analysis		30							30
Carbonate		4		514					518
Bicarbonate				514					514
Micro-nutrients	664	356					12		1032
Grain Size					213				213
Insoluble solids					367				367
Colour					638				638
Dextran					302				302
Calcium Carbonate		4							4
Total	**3954**	**8888**	**938**	**4650**	**6589**	**783**	**127**	**25**	**25954**

in the analyses for calcium, magnesium and iron were reflected in increasing levels of acceptability of these results. There was less than desired precision in determining levels of manganese, but this should improve when a new lamp is obtained.

Soil Sample Exchange Programme

Levels of accuracy and precision were maintained in analysing soil as, from 16 samples, tests for some parameters yielded 100% acceptable results. However there needs to be improvements in the analyses for elements extracted by calcium chloride solution.

Collaborative Testing of Raw Sugar

The Laboratory participated in the collaborative testing of raw sugar for pol and moisture organised by the Sugar Association of London. Results obtained by SIRI were not significantly different from the average results obtained by all participants.

Sugar Quality 1997/98

The industry-wide average sugar quality was good with the specifications for the different parameters being met or exceeded in all cases except for dextran and reducing sugars. However the value for dextran was far below that obtained for the previous year. The safety factor was within the specification for all factories, except for **Bernard Lodge**. There was nonetheless room for improvement.

Local Sugar

The values for pol of local sugar were above the minimum specification and all factories, except **Bernard Lodge**, made drier sugar than specifications demanded. However colour achieved was extremely poor with none of the factories meeting specifications. Insoluble solids were acceptable, except at **Appleton**, where an additional screen might be needed to trap impurities.

Export Sugar

Values for pol were above the requirements and all, except **Bernard Lodge** and **Tropicana**, bettered

Table 3.7: Sugar Quality Results for the crop 1998-1999 - Local

Specifications		**97.00°**	**0.70**	**3000**		
Factories	**Weight (tonnes)**	**Pol°**	**% Moisture**	**Whole Raw Colour IU**	**Insoluble Solids mg/kg**	**% Ash**
Appleton	174.00	98.03	0.55	4 817.41	1 215.00	0.38
Bernard Lodge	6 800.00	97.30	0.86	4 689.33	205.59	0.57
Tropicana	2 211.25	97.88	0.62	3 816.67	410.48	0.38
Frome	7 650.30	98.23	0.41	3 429.54	385.74	0.32
Monymusk	8 260.00	98.95	0.25	3 246.05	581.79	0.31
Total/Avg	**25 095.55**	**98.20**	**0.49**	**3 733.38**	**413.89**	**0.39**

Table 3.8: Sugar Quality Results for the crop 1998-1999 - Export

Specifications		**96.00°**	**0.70**	**800 - 1500**	**3000 - 6000**		**22 - 52**	**250.00**		**0.70**
Factories	**Weight (tonnes)**	**Pol°**	**% Moist**	**Affined Colour IU**	**Whole Raw Colour IU**	**Insoluble Solids mg/kg**	**Grain Size 28 mesh (T)**	**Dextran MAU**	**% Ash**	**% Reducing Sugars**
Appleton	19 802.86	96.38	0.72	1 828.46	4 582.89	1 627.67	36.71	363.12	0.45	1.05
B/Lodge	23 682.52	97.37	0.86	1 451.95	4 620.15	224.58	39.81	233.62	0.57	1.02
Tropicana	7 030.50	97.27	0.80	1 427.45	4 684.86	674.60	37.84	301.95	0.49	1.14
Frome	50 562.28	97.71	0.56	1 274.52	3 719.13	340.20	34.71	740.16	0.34	1.19
Hampden	7 431.28	97.26	0.74	1 704.43	4 846.91	542.66	21.25	502.10	0.47	1.13
Long Pond	12 200.33	96.94	0.68	1 866.63	5 986.04	1 309.81	30.01	272.36	0.52	1.22
Monymusk	31 129.83	98.26	0.43	1 459.42	4 326.83	624.62	28.85	154.79	0.43	0.99
Worthy Park	22 639.30	97.54	0.64	1 564.34	5 834.45	274.04	13.18	124.63	0.52	1.07
Tot. & Avg.	**174 478.90**	**97.64**	**0.63**	**1 498.32**	**4 567.29**	**602.77**	**31.04**	**386.25**	**0.45**	**1.10**

specifications for dryness. All factories met the specifications for whole raw colour but **Appleton, Hampden** and **Long Pond** failed the test for affined colour. The requirement for grain size was met, that for reducing sugars not met and **Monymusk, Worthy Park, Bernard Lodge** and **Long Pond** met specifications for dextran.

Molasses Analysis

The results obtained for the analyses of molasses showed that sugar recovery could be further improved at the factories, *Table 3.9*. However there was considerable improvement in molasses exhaustion when compared with data from the previous year.

Table 3.9: Molasses Report for the crop 1998/99

	Hydrometer		Refractometer			
Factory	**Brix**	**Purity**	**Brix**	**Purity**	**Pol°**	**Ash**
Appleton	83.96	35.45	80.28	36.69	29.94	9.63
Frome	85.73	31.31	83.42	32.89	27.40	7.48
Hampden	83.70	37.26	80.54	39.49	31.78	10.13
Long Pond	81.08	32.15	78.75	33.99	26.75	9.67
Monymusk	88.04	33.09	82.57	36.59	29.18	12.26
B/Lodge	89.67	34.17	83.38	37.39	31.12	12.59
Tropicana	83.13	34.15	74.82	36.23	28.54	9.26
W/Park	83.20	31.09	78.10	33.68	26.10	12.05
Avg.	**85.85**	**32.89**	**81.81**	**35.22**	**28.66**	**10.13**

Table 3.10: Results of wastewater analyses during the crop

Date	**Factory**	**BOD mg/L**	**COD mg/L**	**SO_4^{2-} mg/L**	**NO_3^- mg/L**	**PO_4^{3-} mg/L**	**Oils mg/L**	**Alkalinity mg/L**	**TSS mg/L**	**Cond. µΩ/cm**	**pH**
NRCA Standards											
December 1994		< 30	< 100	250	5	5	10		50		6.5-8.5
27/5/99	Worthy Park	120	186	9	20	2	0	184	11	363	7.94
1/6/99	Frome	160	200	17	0	208	0	156	38	854	6.58
1/6/99	Appleton 1	60	80	8	0	193	0	160	8	320	7.80
1/6/99	Appleton 2	180	452	16	12	6	0	130	28	364	7.69
7/6/99	Tropicana 1	-	96	12	-	0	0	-	9	134	
7/6/99	Tropicana 2	280	724	12	-	199	0	-	32	104	
10/6/99	Long Pond	1 000	1 880	35	4	182	13	88	74	463	6.57
10/6/99	Hampden	300	752	33	2	41	0	238	86	701	6.66
16/6/99	B/Lodge	1 800	1 639	63	6	206	3	154	910	1 426	7.72
16/6/99	Bernard Lodge	1400	891	42	0	7	3	220	1 050	1 307	7.08
16/6/99	Monymusk 1	800	1 356	60	0	9	1	222	930	1 485	7.03
16/6/99	Monymusk 2	1 000	1 569	57	1	174	2	234	1 680	1 228	7.43

Table 3.11: Results of wastewater analyses during out-of-crop

Date	**Factory**	**BOD mg/L**	**COD mg/L**	**SO_4^{2-} mg/L**	**NO_3^- mg/L**	**PO_4^{3-} mg/L**	**Oils mg/L**	**Alkalinity mg/L**	**TSS mg/L**	**Cond. /cm**	**pH**
NRCA Standards											
December 1994		< 30	< 100	250	5	5	10		50		6.5-8.5
27/9/99	M/musk 1	40	70	72	7	0	0	438	2308	77	10.50
27/9/99	M/musk 2		6	45	20	1	0	318	240	1232	7.59
27/9/99	Bernard Lodge 1	0	0	33	6	0	0	270	100	1353	7.20
27/9/99	Frome	0	0	19	10	3	0	186	180	835	8.57
27/9/99	Worthy Park	35	46	29	1	5	1	132	250	340	7.79
7/10/99	Appleton 1	0	0	0	3	1	0	172	20	1264	8.10
7/10/99	Appleton 2	0	0	0	3	1	0	178	25	1367	8.20
7/10/99	Long Pond	400	721	51	3	151	22	346	440	1085	8.76
7/10/99	Hampden	-	154	16	2	163	2	276	130	628	7.57
15/10/99	Tropicana	-	192	7	0	48	2	222	320	547	7.87

Wastewater Analyses

The pH was usually only exceeded when there were cleaning activities at the factories. Sulphates were usually within the specifications and oils were often not found. Total dissolved solids, usually low, was found to increase in out-of-crop and could indicate cleaning activities.

Table 3.12: Results of water analyses from Monymusk

Month	Jan	Feb	Mar	Apr	Jul	Aug
No. of samples	86	85	71	71	80	89
EC dS/m	1550	1556	1574	1541	1769	1579
pH	7.68	7.50	7.94	7.54	7.46	7.54
SAR	3.84	3.59	3.72	3.56	3.93	3.64

Irrigation Water Quality

There was no statistically significant change in the salinity and SAR of water samples analysed for the period January to August, *Table 3.12.*

Training

A student from the College of Agriculture, Science and Education (CASE) was trained for ten weeks in the analyses of plant tissue, soil, sugar and water samples.

4 CROP PROTECTION

4.1 ENTOMOLOGY

Stalk Borer Damage

The annual survey of stalk borer damage was conducted at **Monymusk**, **Bernard Lodge** (including **Innswood**), **New Yarmouth** and **Holland**. Damage levels were found to be relatively moderate, averaging 7.2% of internodes, for the areas sampled. **Monymusk** recorded highest levels, 7.9%, *Table 4.1*.

Lowest damage, 5.5%, was recorded at **Holland** which would be just at about the economic damage threshold. In former years the Irrigated areas tended to exceed 10% internode damage so this result could be viewed as an indication that the borer is being kept in check

Variety susceptibility

There was a fairly consistent tendency for BJ7504 to show higher stalk damage levels than other varieties on most estates sampled, *Fig. 4.1 - 4.3.* This was contrary to previous observations in which variety appeared to play a secondary role with location seemingly having the greatest influence on damage levels.

New Yarmouth, for instance showed nearly 11% damage in BJ7504; BJ7015 was at approximately 7% while others, BJ7938, BJ82119 and BJ7627 were at or below 5%.

At **Bernard Lodge**, BJ7504 stood out as the only variety experiencing as much as 9% internode damage. All others were in the range of 6% or less.

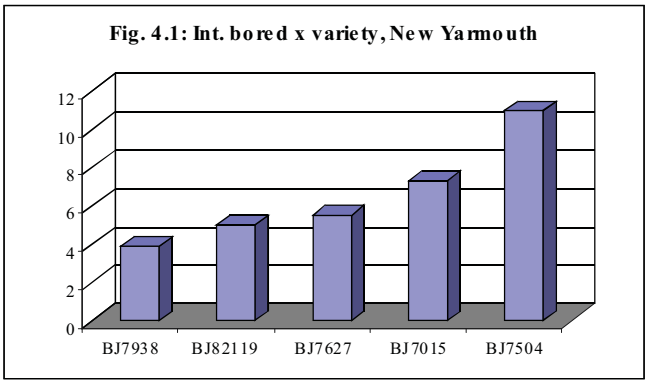
BJ7548 experienced 10% internode damage at **Monymusk** but was nonetheless outstripped by BJ7504 at near12%. In contrast, five varieties, BJ82102, BJ7627, BJ7465, BJ8226 and UCW5465 recorded less than 5% damage.

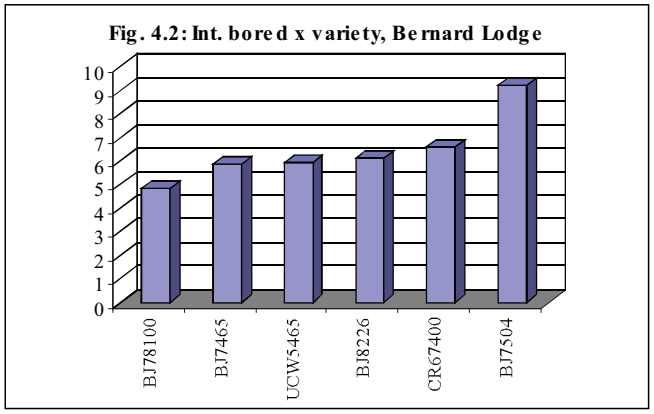
At **Holland**, even with the smaller sample size, the trend towards higher levels of damage in BJ7504 was maintained. The consistently high damage level could be a contributor to the relatively poor juice quality that characterises that variety.

Stalk borer damage has therefore been relatively stable over the last few years, though the desired reduction to below economic damage threshold has not been achieved in the Irrigated areas. Establishment of imported parasitoid, Cotesia flavipes, would appear to have brought only limited success.

Other Pests

Minor incidences of the canefly were noted at a few locations. None was sufficient to warrant chemical control measures. At **Bernard Lodge**, for instance, a flare up was observed towards the end of July but disappeared as the cane matured.





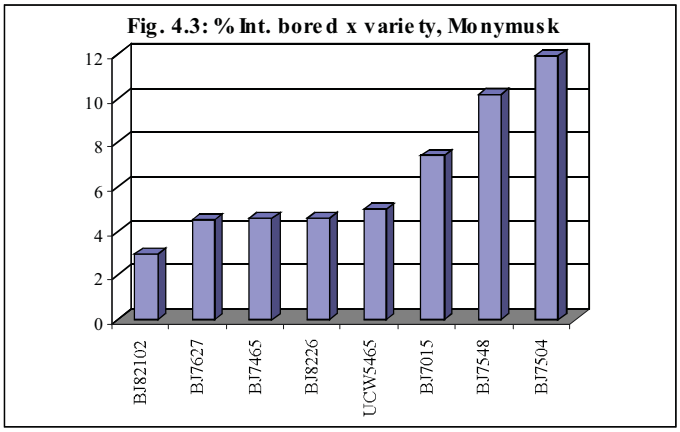


Table 4.1. Sugar cane stalk borer damage survey, 1999

Estate/Farm	Field	Area (ha)	Variety	Class	Total internodes	Total bored	% Int. bored	% Stalk bored
New Yarmouth								
Farm 1	#87	3.57	BJ7627	1st	1944	62	3.19	31
	#93	1.84	BJ7627	1st	1964	70	3.56	40
	#75	5.87	BJ7627	3rd	1432	52	3.63	28
	#19	9.45	BJ82119	2nd	1955	104	5.32	48
	#41	5.41	BJ7015	4th	1925	106	5.51	47
	#40	3.46	BJ7015	3rd	2081	205	9.85	72
	#16	9.43	BJ7504	5th	2101	230	10.95	78
	#49	5.48	BJ7504	5th	1942	238	12.26	77
					15344	**1067**	**6.95**	**53**
Farm 2	#34	3.54	BJ7938	3rd	2030	79	3.89	39
	#35	2.23	BJ82119	2nd	1915	85	4.44	48
	#32	6.17	BJ7015	2nd	2012	91	4.52	53
	#12	6.89	BJ7015	2nd	1982	177	8.93	69
	#20	6.84	BJ7504	3rd	2024	183	9.04	73
	#44	5.57	BJ7504	2nd	1960	208	10.61	72
	#38	3.85	BJ7627	2nd	1926	226	11.73	88
	#43	6.28	BJ7504	2nd	1914	244	12.75	83
					15763	**1293**	**8.20**	**66**
						31107	**2360**	**7.59**
Monymusk								
Bog	Tambrin Tree	3.45	BJ7267	2nd	2251	94	4.18	47
	Great House 6	8.00	UCW5465		2018	125	6.19	63
	Cow Pen	6.40	BJ7465	2nd	1929	140	7.26	54
	Golf Course	6.38	BJ7548	2nd	2151	219	10.18	85
	Clay Hole 4	7.00	BJ7504	Plant	2130	269	12.63	83
	Irene	3.24	BJ7504	1st	2167	276	12.74	82
	Big River Side	8.21	BJ7504	Plant	2278	328	14.40	89
	Road Piece	13.00	BJ7504	1st	2224	365	16.41	93
					17148	**1816**	**10.59**	**74**
Exeter	Harryville 1	13.50	BJ7465	3rd	2081	41	1.97	25
	#55	15.00	BJ7465	1st	2078	86	4.14	43
	#41	14.50	BJ7015	1st	2087	128	6.13	55
	Paradise 19	3.64	BJ7015	17th	2028	148	7.30	69
	#560	13.00	BJ7504	1st	2424	184	7.59	85
	Lewis Piece 1	6.07	BJ7504	4th	2197	181	8.24	62
	#12	12.25	BJ7015	1st	2139	209	9.77	76
	#47	8.09	BJ7504	2nd	2317	255	11.01	81
					17351	**1232**	**7.10**	**62**

Cont'd **Table 4.1. Sugar cane stalk borer damage survey, 1999**

Estate/Farm	Field	Area (ha)	Variety	Class	Total internodes	Total bored	% Int. bored	% Stalk bored
Greenwich	Beel	2.43	BJ82102	Plant	1907	60	3.15	37
	Mid Hutchins 1A	2.20	UCW5465	2nd	1954	73	3.74	43
	Mid Hutchins 1	4.05	UCW5465	2nd	1849	81	4.38	41
	Poor Man 2	2.63	BJ8226	Plant	2062	92	4.46	42
	Boothe Gully 1	1.42	BJ7627	1st	1876	85	4.53	41
	Cherry Fee 1A	5.67	BJ7015	4th	2098	126	6.01	60
	Laing Piece 2	3.24	BJ7015	Plant	1804	127	7.04	69
	Riverside 1	4.05	BJ7504	1st	2262	288	12.73	76
					15812	**932**	**5.89**	**51**
					50311	**3980**	**7.91**	
Farm 2	#590	14.50	BJ8226	S\P	1993	32	1.61	20
	#503	10.25	BJ7465	7th	2256	138	6.12	49
	#578	10.00	BJ7465	3P	2069	140	6.77	55
	#741	3.25	BJ7504	2nd	2289	174	7.60	66
Bernard Lodge								
Innswood	#736	10.00	BJ7504	3rd	2205	174	7.89	59
	#703	8.00	UCW5465	S\P	2246	220	9.80	77
	#736	10.00	BJ7504	3rd	2029	218	10.74	78
	#706	7.00	BJ8226	2nd	2610	365	13.98	93
					17697	**1461**	**8.26**	**62**
Innswood	#8	5.67	UCW5465	3rd	2144	103	4.80	48
Farm 1	#418	6.48	BJ7465	3rd	2221	113	5.09	57
	#78	3.95	BJ8226	5P	2714	143	5.27	67
	#427A	6.27	BJ7465	4th	2472	149	6.03	60
	#76	5.67	BJ8226	SP	2456	178	7.25	54
	#405A	6.07	UCW5465	3rd	2387	183	7.67	75
	#434A	4.65	BJ7504	4th	2428	210	8.65	68
	#107	9.51	BJ7504	2nd	2585	285	11.03	81
					19407	**1364**	**7.03**	**64**
Salt Pond	#53B	3.93	UCW5465	1st	1893	77	4.07	36
	#45	6.84	BJ8226	SP	2109	88	4.17	45
	#6	11.98	BJ78100	3rd	1983	94	4.74	46
	#39	4.21	BJ8226	SP	1916	93	4.85	48
	#38	3.84	BJ78100	SP	1885	97	5.15	54
	#3	12.14	UCW5465	1st	1947	115	5.91	50
	#40B	4.86	UCW5465	2nd	2028	120	5.92	46
	#30J	2.23	CR67400	SP	2105	140	6.65	57
					15866	**824**	**5.19**	**48**
					52970	**3649**	**6.89**	
Appleton								
Holland	#132	6.27	BJ7627	1st	2079	85	4.09	41
	#33	3.24	BJ7465	6th	2239	92	4.11	41
	#133	5.38	BJ7627	1st	1989	83	4.17	38
	#11	3.01	BJ7504	8th	2935	141	4.80	49
	#22	2.36	BJ7504	9th	2295	148	6.45	58
	#53	4.45	BJ7465	7th	2204	150	6.81	50
	#12	1.75	BJ7504	8th	2431	166	6.83	61
	#35	2.76	BJ7465	6th	2239	155	6.92	56
					18411	1020	5.54	49
					152799	**11009**	**7.2049**	

4.2 WEED CONTROL

With growers responding positively to the drive to adopt the pre-emergent approach, the quality of weed control improved noticeably throughout the Industry during the 1999 growing season. This was particularly pronounced on the Irrigated Plains.

Herbicide Trials

Weed control efficacy studies were conducted at **Frome, Retreat, Long Pond, Tropicana, Monymusk, Bernard Lodge, Lucky Valley,** and **Worthy Park** with metolachlor (Dual), metribuzin (Sencor), clomazone (Command), flazasulfuron (SL-160/Katana), and a preparation of 2,4-D+dicamba (Weedmaster). All chemicals were not applied at each location. The treatment combinations used with clomazone and metolachlor produced impressive results, while those tests using metribuzin were less effective.

At most locations, metalochlor at 1.5 L/ha used in combination with terbutryn at 3 L/ha, ametryn, atrazine, or ametryn/atrazine at 2 kg/ha, or diuron at 2 kg/ha produced >90% control of existing weeds for periods exceeding 70 days.

Clomazone performed well at 2 L/ha when used in combination with atrazine at 2 kg/ha, 2,4-D/dicamba at 1.25 L/ha, or with diuron at 1.5 kg/ha. At all locations, treatments containing atrazine sustained the lowest weed populations.

Flazasulfuron was applied post emergent at 150 g/ha, 200 g/ha and 300 g/ha alone, as well as at 150 g/ha with 1.5 kg/ha diuron and ametryn as separate treatments for sedge control. The efficacy level of flazasulfuron was greater when applied as stand alone, but phytotoxicity, in the form of bleached spots and pronounced stunting of shoots, was evident in young canes <50 days post germination. Signs of recovery of shoots was evident by 100 days. The relative cane and sugar yields per treatment plot will determine more precisely, the effects of stunting and bleaching on the crop.

Training

During the crop year, a number of workers and staff were trained in various aspects of weed control. Personnel included field staff and spraymen on Wray & Nephew farms in St. Elizabeth, farmers in the **Long Pond** and **Frome** areas, and technical and field staff at the All Island Jamaica Cane Farmer's Association. The main foci of the training were handling, measuring, mixing, and application of herbicides. Target groups included spraymen, farmers, and field overseers and AIJCFA's staff. Other areas addressed were storage, retailing, transporting, and potential hazards of agro chemicals as well as the evaluation of weed control programmes.

Database

To add to the store of data accessible on the SIRI Intranet, an information database comprised of note files on various topics relating to weed control and sucrose enhancement was posted on the physiology section of the Agronomy web page. The information database was in ongoing reorganisation to achieve the best layout.

SUCROSE ENHANCEMENT

New Formulation

A new formulation of glyphosate (Roundup Ultra) was applied to 49 ha at Meylersfield farm at **Frome**. Although the percentage sucrose tended to be greater for canes treated (vs untreated) with the new formulation (10.06 v 9.2), the results were not statistically significant.

Table 4.2: Area (ha) treated with various sucrose enhancers on respective farms, 1998/1999

Farm/chemical	glyphosate	fluazifop	sulfosate	sethoxydim	Totals
Frome	705.72				705.72
Long Pond		312.66		24.71	337.37
Tropicana	188.23				188.23
Worthy Park	19.62	4.90		21.84	46.36
Holland		333.25	90.56		423.81
Estates' Total	**913.57**	**650.81**	**90.56**	**46.55**	**995.77**
Barham Farm	24.30				24.30
Galloway	26.33				26.33
F. M. Jones Est	27.97				27.97
Golden Downs	14.59				14.59
Windsor	32.40				32.40
Farmers' Total	**125.59**	**0.00**	**0.00**	**0.00**	**125.59**
Grand Total	**1 039.16**	**650.81**	**90.56**	**46.55**	**1 827.08**

Commercial Application

Sucrose enhancers were applied to 3 020 ha on estate farms at **Frome, Holland, Bernard Lodge, Worthy Park, Tropicana,** and **Long Pond**, *Tables 4.2-4.4.* Smaller areas were treated on independent farms in the **Tropicana, Frome**, and **Bernard Lodge** areas. The bulk of the chemical used was glyphosate (Roundup and Glyphos AG-41) followed by fluazifop (Fusilade).

At **Holland, Long Pond** and **Worthy Park** farms, test quantities of sethoxydim (Nabu) were applied, in addition to sulfosate (Touchdown), at **Holland/Appleton** for the third year. Unfortunately, data on the performance was not available from some major estates, including **Bernard Lodge** which treated over 1 300 ha.

Table 4.3: Productivity indicators for fields not ripener treated during the 1998/1999 Crop.

Area	ha	cane	tc/ha	mean JRCS	Sugar	ts/ha
Frome	157.47	11 472.14	72.85	9.46	1 085.26	6.89
Tropicana	91.20	6 336.84	69.48	8.89	563.27	6.18
W/Park	18.25	1 474.40	80.79	12.25	178.28	9.77
Sum/mean	**266.92**	**19 283.38**	**72.24**	**9.47**	**1 826.81**	**6.84**

Table 4.4: Productivity indicators for fields chemically ripened during the 1998/1999 crop.

Area	ha	cane	tc/ha	mean JRCS	Sugar	ts/ha
Frome	705.72	52 462.93	74.34	10.23	5 296.88	7.51
Tropicana	199.77	13 707.90	68.62	11.19	1 533.75	7.68
W/Park	46.36	4 498.30	97.03	12.53	572.16	12.34
Sum/mean	**951.85**	**70 669.13**	**74.24**	**10.48**	**7 402.79**	**7.78**

5 AGRICULTURAL ENGINEERING

5.1 IRRIGATION AND DRAINAGE

Pineapple Row-Spacing Trial

The main disadvantage of drip irrigation is its high installation cost. A variation of the technique, the Pineapple Row Spacing System, permits wetting of two cane rows with each drip tube, thus substantially reducing tubing required over a given area. A 3 ha trial using this system was established at the **SIRI Eperimental Farm** at Springfield during the first quarter of 1999. This layout consists of two narrowly spaced cane rows alternating with wider inter- rows. Drip tubes are placed in the center of the narrow rows as practiced in Hawaii and Mauritius, *Fig 5.1*. Spacing was varied in order to establish the configuration that would bring greatest economic returns. In efforts to minimize problems of harvesting where equipment wheelbase would no longer fit inter-row spaces, a flat bed culture was established with the understanding that the wheels of harvesting equipment would be forced to drive over some rows.

Three replicates with various row spacings, *Table 5.1*, with treatment D, the standard, being the control were laid down.

The tubes were buried at approximately 25 cm depth using a drip tube pipe layer subsequent to the placement of the seed pieces within the planting furrows. Covering proved challenging, but was effected using a disc ridger modified by the removal of the two outermost discs. The furrows for laying the drip tubes was created by opening the original mound with a furrow opener mounted on the toolbar of the disc ridger.

In the least expensive method, Treatment A, where tubes were most widely spaced, tube installation was estimated at a cost of J$89 040 (US $2 225) per ha, or 55 % of the standard cost.

Water application (Irrigation + Rainfall), using the Water Budgeting Method, was designed to just compensate for evapotranspiration. This regime was in place for the first five months of the project, *Fig. 5.2*, but excessive rainfall of 307 and 302 mm in September and November respectively, made irrigation unnecessary.

Vigorous early growth, followed by strong winds and rains in the latter part of November resulted in extensive lodging, which was thought to be due partly to the flat bed culture.

The first signs of an inadequacy in water supply emerged during December when evapotranspiration exceeded irrigation by approximately 34 mm.

Other Drip Trials

The drip trial in field 1241B entered its 3rd ratoon stage after a harvest yielding 76tc/ha at Springfield. Laid out initially with Tyvek and Netafim tubes, the former was entirely replaced by the latter after the first harvest, by which time a combination of tube damage by insects and by burning and chopping during harvest had reduced the Tyvek to uselessness. The Netafim tubes have proven to be sturdy, withstanding the rigours of cane cultivation with relatively little need for repairs. Yields obtained, 76 tc/ha, are not considered adequate for drip irrigation, confirming the unsuitability of drip irrigation for heavy clay soils. The other field under drip, the Museum Plot (1241A), was into its 2nd ratoon. The yield from this field was 78 tc/ha. The corresponding JRCS values were 9.64 and 10.66 for Field 1241A and 1241B respectively. The difference in JRCS is not thought to be a function of tube type, but

Fig. 1: Cross section of pineapple row spacing treatments

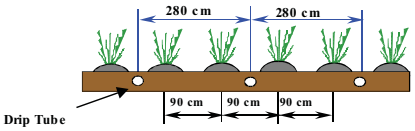
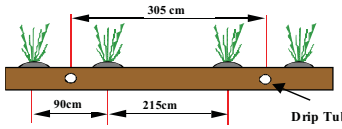
Treatment	Cross Section
B	
A	

Table 5.1: Drip tube spacings, row and drip tube lengths and costs in Springfield trial

Treatments	Spacings (cm) Tube	Cane Row	Plant row length (m/ha)	Drip Tube length (m/ha)	Drip Tube cost/ha J ($)	% of standard cost/ha
A	305	90	6 515	3 257	89 040	55
B	280	90	7 240	3 620	98 898	60
D (control)	167	167	5 926	5 926	162 000	100

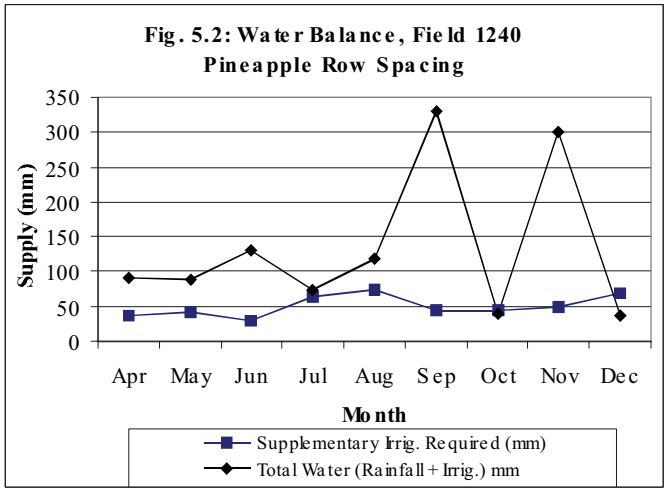
could reflect a soil moisture gradient. Both fields were wet during the nighttime when water demand from the supplying pipeline was lowest. Water balance during the growing period is shown graphically in *Figs 5.3 and 5.4.*

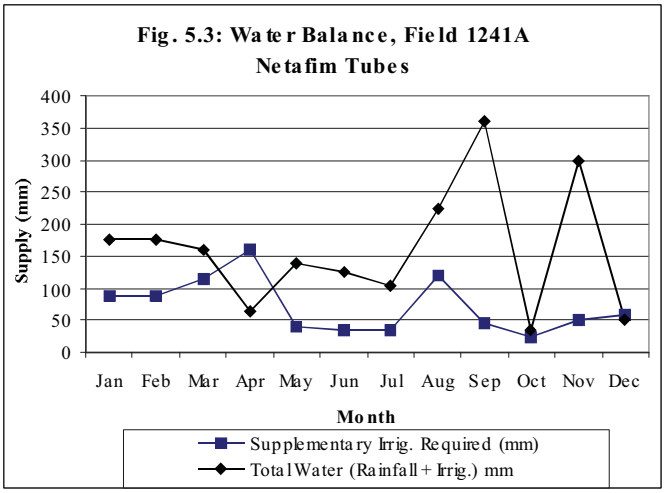
Drip Tubes Comparison

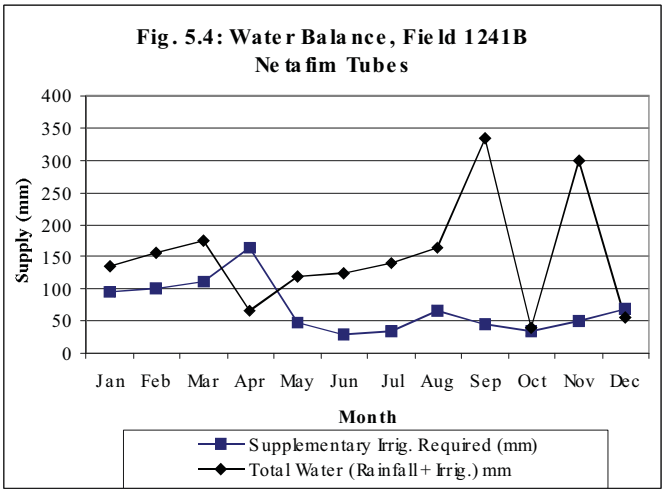
Comparison between the Netafim, Ro-Drip and T-Tape tube brands was studied in Fields 1270a, 1270b and 1270c respectively. There was no identifiable stress at most of these locations during the period. The only exceptions occurred during April and December when the rainfall was 7 mm and nil respectively.

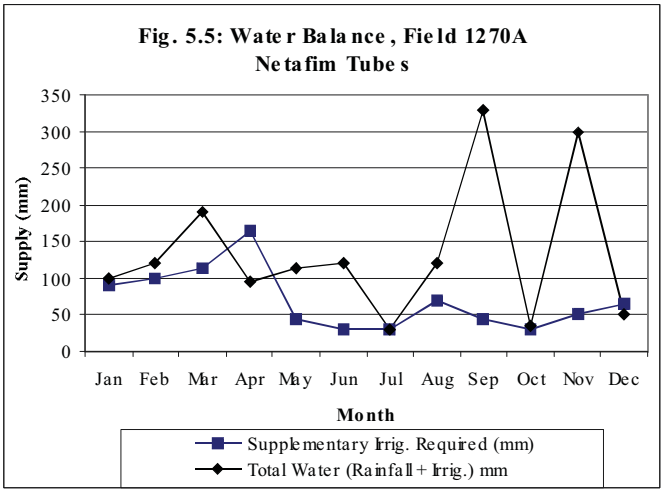
All three brands of tubes performed satisfactorily with little need for repairs. The quantity of water supplied was comparable in each case, *Figs 5.5 , 5.6 and 5.7.* The evaporative demand, varying between 166 - 174 mm during April - May at this mature stage of the crop would normally necessitate in excess of 160 mm of moisture for maintaining normal crop growth.

Water was deliberately withheld in anticipation of harvesting during June but 119 mm of rainfall during this month was less than helpful, *Figs 5.5, 5.6 and 5.7.*









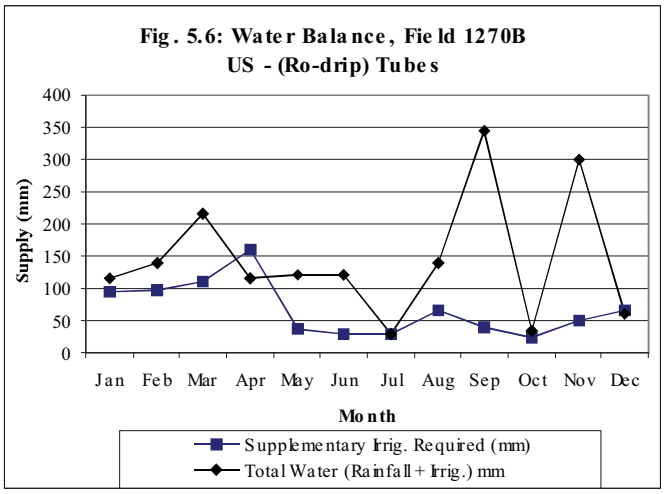


Table 5.2: Yield comparison, various drip tube types, Field 1270

Treatment	Yields (tc/ha) Mean
Netafim	64.51
Ro Drip	62.23
T- Tape	66.80
Sd =7.7	Probability of treatments being equal = 0.59

Consequently, harvesting planned for June had to be rescheduled for July.

There were no significant differences in yields. The data obtained from the various tube types are shown , *Table 5.2.*

Reduced Tillage Trial - Phoenix Park, Bernard Lodge

The strip tillage experiment, laid down in 1996 at Phoenix Park, **Bernard Lodge**, showed no significant differences between treatments described in earlier reports and that undertaken in 1999. The sequence of operations was:

- Following burnt cane harvesting, sprouts were allowed to grow to 25-30 cm;
- A tractor drawn sub-soiler was then used to till the furrow between the old banks
- Another pass was made with the furrowing tool to break clods;
- Seed cane was then laid and covered by a disc ridger;
- The field was then immediately sprinkler irrigated;
- The old foliage was sprayed with Roundup at 4.5 L/ha approximately 3 weeks after irrigation;
- Disc ridgers were used to convert old banks to new furrows.

Standard practice consisted of: ripping x 2, ploughing x 2, harrowing x 1 and furrowing x1, all conducted over the entire surface area.

There were no significant differences at the 5% level between treatments, *Table 5.3.* It is perhaps noteworthy that reduced tillage did not result in any lowering of yields even at this 2nd ratoon stage.

Central Harvesting

SIRI, with support from the Cane Farming Department at **Frome** Estate, undertook an equipment and manpower inventory in order to assist the process of setting up a Centrally Managed Harvesting System to serve the **Frome** factory area. The quantity, physical condition and distribution of various pieces of equipment, their capacities and functions, were ascertained. Only those considered reliable and serviceable were listed.

The survey showed that there was sufficient reliable equipment within the area, with the exception of an estimated need for 11 trucks during 2000 and another 12 during 2001. Some of these are required for use by roving cane cutter gangs. This shortfall could be decreased, however, if the excess of road haulage tractors and carts were used to substitute for trucks in haulage. It was estimated that there was an excess of some 250 carts of greater than 9 tonnes capacity, over 40 of less than 9 tonnes, 20 loaders, 100 road haulage tractors and 6 infield haulage tractors in the area.

Hilly areas would be better served with the acquisition of 2 Bell Loaders.

The survey also indicated a manpower sufficiency, but the need for training especially, of loader operators was evident.

In the first few weeks of operating the Central Harvesting system in December, in excess of 60 % of all cane was delivered within 24 hours of harvesting. Dextrans were at acceptable low levels and JRCS values often exceeded 9.6. Smooth factory operations, dry weather and low temperatures also contributed to the successful implementation of the system. However, a

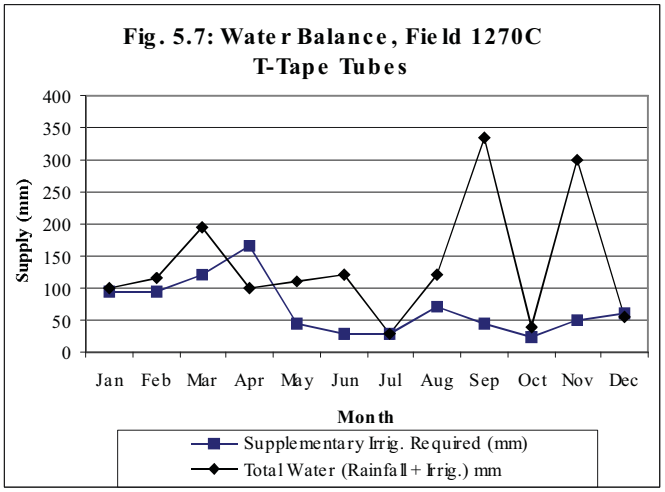


Table 5.3: Tillage Investigation, Phoenix Park, Bernard Lodge

	Yield (tc/ha)	
Replicates	**Reduced Tillage**	**Standard Practice**
1	91.40	64.66
2	68.04	55.25
3	41.79	79.80
4	58.50	42.94
5	66.18	65.76
Totals	**325.91**	**308.41**
Mean tc/ha	**65.18**	**61.68**

s.d15.21

P(treatments being equal) = 0.77

high incidence of unplanned fires threatened its stability.

5.2 AGRICULTURAL MACHINERY

Push Piler modification

Cane loaders were tested to determine the efficiency of push-piler modifications, introduced in the last year, in reducing the extraneous matter content in loads. Observations revealed the main factors affecting operations were:

- Positioning of the push-piler with respect to the centre of the inter-row space and the cane loader wheel;
- Weight distribution and the relative position to the horizontal of the push-piler;
- The extent of pushing practised by the operator;
- Degree of consistency in width of the inter-row space.

In addition, operators were often seen unnecessarily driving across rows, resulting in the partial destruction of banks and inclusion of soil and roots in the pile.

Frome was selected for a comparative study between the modified and the unmodified push piler. Two unmodified Cameco Loaders were compared with a modified Cameco Loader in the same field and at the same time. There was no significant difference in JRCS but there was 46% less sediment in loads from the modified push piler.

The Agricultural Engineering and Extension Departments collaborated to conduct an intensive training of the cane loader operators, contractors and supervisors to foster harvesting practices that would result in better cane quality.

The Department gave assistance to a farmer in the **New Yarmouth** area by centering the push piler with respect to the tractor wheel. Design specifications for the modified push piler were given to **SCJ-Monymusk** to rebuild a group of Cameco push pilers, *Fig. 5.8*.

Table 5.4: Pre-harvest classification of field, reaped burnt, at Appleton and Holland

	Combine Harvested Fields			Manually cut
	Appleton	Holland		Appleton
		Field 141	Field 146	
Estimated Yields (t/ha)	100	75	80	85
Variety	BJ82119	BJ7015	BJ7015 BJ82119	BJ7015
Age (months)	18	20	20	23
Cycle	Plant S/O	2R S/O	2R S/O	11R S/O
Trash Habit	Loose	Loose	Loose	Loose
Degree of Recumbent canes	>85%	>85%	>85%	>85%
Field condition	Dry	Wet	Wet	Dry

Table 5.5: Extraneous matter content of cane samples from Austoft combine, at Worthy Park, and the Cameco, at Holland

Component of sample	Worthy Park (%)	Holland (%)
Billets	83	81
Mince	1	0
Tops	10	6
Soil and Trash	6	13
Total	**17**	**19**

Harvesting Assessment - Stand Over Cane

Harvesting assessment was conducted on Cameco and Austoft combine harvesters at **Holland**, **Appleton** and **Worthy Park**, and on manual cutting at **Appleton**. The main focus was on extraneous matter content of loads and the losses in the field. The fields at **Appleton** and **Holland** were in "stand over" cane with yields estimated between 75 and 100 tc/ha, *Table 5.4*.

Extraneous Matter Content

Comparing extraneous matter content of canes produced by the Austoft chopper harvesters at **Worthy Park** and **Holland**, five cane samples were taken directly from the combines (without loading into the trailer). Millable canes, leaves, trash and mince were separated and weighed to determine the quantity of each component in the sample. The millable cane comprised from 81-83% of the samples, *Table 5.5.* Extraneous matter content was therefore at roughly equivalent proportions at the two locations but the soil and trash content was appreciably higher in the **Holland** operation (13% as against 6% at **Worthy Park**).

At **Worthy Park**, tops were approximately 60% of the extraneous matter. This was as a result of uneven stalk height, even though the variety, BJ82156, was considered suitable for mechanical harvesting.

Quality of Billets

Billets were categorised into, sound, damaged and mutilated depending on the degree of damage observed. "Sound" describes billets that were cut clean and distinct at both ends. "Damaged" billets showed

pealing at the ends while those described as "mutilated" were squashed, split or broken into fragments. The average sound billets for **Worthy Park** was about 81%; damaged was 13%. At **Holland**, billet quality was relatively poor with sound billets averaging only 53%, and damaged 35%.

A high percentage (>80%) of the sound billets showed the type of clean cut that indicated sharp chopper blades at **Worthy Park**. A high percentage of damaged and mutilated billets (>20%) is often an indication of unsharpened blades and, in some cases, improper harvester travel speed.

An assessment was also made of the proportion of billets of various diameters and the lengths produced by the choppers. A satisfactory proportion of Worthy Park's billets were fairly uniform in length with some 85% of more than 200 mm while 82% were of diameters within 25-30 mm. There was lower uniformity at **Holland** where 71% of billets were more than 200 mm long and 85% had diameters within 25-35 mm. While billet diameter is a function of variety, billet length distribution is a measure of machine efficiency.

Field Loss

Randomly selected plots were marked off in fields harvested by various methods, for assessment of field loss. Each plot was searched for billets, whole stalks and stumps. In the case of the manual system, additional categories were uncut canes and canes cut but not loaded. Losses in the combine-harvested fields were 15.5 tc/ha for **Appleton**, 8.3 tc/ha at **Holland** and 2.6 tc/ha at **Worthy Park.** The manual system at **Appleton** had a loss of 13.5 t/ha, *Table 5.6*.

Operating in heavily lodged "stand over" BJ7015 & BJ82119 cane at **Appleton** and **Holland**, some 69 to 75% of loss was in the form of stalks the machine failed to gather. In contrast, the upright stand of BJ82156 at **Worthy Park** allowed for full collection of stalks. Lack of the co-ordination between the harvester and infield tractor-trailer operators resulted in loss of billets at **Appleton**. At **Holland** there was good co-ordination.

The quantity of uncollected stalks in the manual harvesting at **Appleton** was estimated at 9 tc/ha. A further 2.5 tc/ha was uncut to give overall a most inefficient picture for this operation. A lack of thoroughness by the cutters in recumbent cane left many stalks uncut at the base, while some stalks were base-cut but left hidden under trash. All systems resulted in roughly equal loss, 2 tc/ha, in stumps.

Table 5.6: Field loss during harvesting - Appleton, Holland and Worthy Park

	Combine Harvested Fields						Manually cut	
Losses	**Appleton**		**Holland**		**Worthy Park**		**Appleton**	
	tc/ha	**%**	**tc/ha**	**%**	**tc/ha**	**%**	**tc/ha**	**%**
Billets	2.7	17	0.0		0.7	26	-	
Stalk	10.6	69	6.2	75	0.0		9.0	67
Uncut Canes	-		-		0.0		2.5	18
Stumps	2.2	14	2.1	25	1.9	73	2.0	15
Total	**15.5**		**8.3**		**2.6**		**13.5**	

Harvesting cost

Three loaders were assessed for fuel consumption as part of an attempt to ascertain the real cost of manual harvesting. Time & motion studies were done to investigate the time taken for each activity. Observations were made on equipment operated by Mid Clarendon Agro and Earlston Ltd from Clarendon and Winchester Ltd. from the Wet West area. Contractors in the Clarendon area used loaders and trucks while those in the Wet West used loaders along with tractors and trailers for infield loading.

The Cameco loaders consumed more fuel per hour because of the greater engine size than did the Massey Ferguson, *Table 5.7*. Cane loaded per litre of fuel was however not appreciably greater for the Massey Ferguson loader because of inefficiencies in the system - time spent awaiting return of empty carts, quantity of cane available for loading etc, *Table 5.8*.

Assuming that the loaders consumed fuel at the same rate for all operations, then it follows that the time spent with engine running is directly proportional to the fuel used. For example, Earlston Ltd. Farm showed that 75% of the time was spent loading, thus 75% of the fuel was used for this operation. The loader at Winchester Ltd. spent 66% of observation time awaiting return of carts during all of which the engine continued running.

Varying harvesting conditions contributed to different field efficiencies. The Mid-Clarendon Group showed fuel consumption similar to that of both Pomaire and Rhoden's farms. However, there was a difference of 9% of total

Table 5.7. Fuel consumption with respect to time and tonnes of cane loaded by different loaders on different farms

Contractor	**Farm**	**Loader**	**Litre/ hr**	**tc/L**
Winchester Ltd.	Winchester Ltd	Massy Ferguson	2.5	2.7
Mid Clarendon Agro	Pomaire Farms	Cameco SP1800B	12.0	1.0
Mid Clarendon Agro	Egbert Rhoden	Cameco SP1800B	12.0	2.5
Earlston Ltd.	Boysie Morris	Cameco SP1800B	18.8	1.6

loading time. This was attributed to differences in field layout and conditions. Rhoden's Farm was fairly flat while Pomaire's was undulating and tended to restrict the movement of infield trucks. The loader therefore did most of the traveling, thus recording a high 31% for traveling along the rows, *Table 5.8*.

At Boysie Morris' Farm the field was fairly flat and there was relatively good co-ordination between loader and truck operators. Nonetheless, 15% of time was recorded traveling with and without load. Trucks and loaders actually spent more time traveling after trucks were loaded to their carrying capacities, in additional efforts to overload, than in initial period of loading. Average loading time for 14 tonnes cane was about 40 minutes. To load an additional 4 tonnes, it took an extra 40 minutes. Overloading was therefore clearly a waste of time, fuel and money.

The tractor/trailer combination tended to be far more efficient. For example, at Winchester Ltd, only 6% of time was spent traveling with or without load.

Other traveling included activities not recommended, such as pushing trailer through wet areas and using the grab to cover trenches with soil and trash to facilitate movement of the trucks and trailers.

Data obtained showed that an infield tractor/trailer arrangement was more efficient than tractor/trucks and that field layout and conditions were important factors in harvesting efficiency. Information on fuel consumption by the various systems was passed on to the Economics Department for inclusion in the determination of harvesting cost.

Reduced Tillage Projects

SIRI Spring Field Farms

The Reduced Tillage Machine (RTM 1.5) was connected to a high clearance Fiat 80-66 for a 1.2 ha trial at the SIRI Experiment Farm at Springfield. Travel speed was approximately 3.5 Km/h, with a Field Capacity of 0.5 ha/h. The tractor ran in the inter-row space as the machine worked the ridges.

The field was prepared as follows:

- One pass of RTM 1.5 along the previous banks (Ridge Tillage) that destroyed roughly 70 % of the old stools.
- One pass of RTM 1.5 + Furrow Opener along the previously tilled rows.
- Application of fertiliser with the use of a Bonel B50 at a rate of 375 kg/ha
- Planting and covering
- Application of herbicides four days after planting

Tropicana

At **Tropicana**, the RTM 1.5 was connected to a John Deere 4250 in a contour tillage trial of approximately 1 ha. The objective was to reduce the level of soil erosion by farming along contours as against common practice of drawing furrows up and down slopes.

The operation was estimated to reduce establishment cost by approximately 60%. However, the operation had to be restricted to slopes which permitted safe operation, given the tractors wheel base and centre of gravity. Unfortunately, inadequate weed control and uneven cane growth led to the field being abandoned shortly after 6 months, *Fig. 5.9*.

Lloyds & Belmont Farms

Towards the end of the year a reduced tillage trial was done at Lloyds & Belmont Farms, Guanaboa Vale, in collaboration with the Pathology Task Force. Half of the selected field was prepared in the inter-row spaces and the other on the ridge (Ridge Tillage). Several different varieties were planted based on a pathologist's recommendation.

Table 5.8: Time in minutes (min) spent by different loaders carrying out various operations

Operations	Winchester Ltd.		Pomaire Farm		Rhoden's Farm		Earlston Ltd.	
	Min	%	Min	%	Min	%	Min	%
Loading	58.4	25	70.6	63	131.7	72	98.2	75
Travelling with/Without load	13.3	6	34.9	31	22.5	13	19.8	15
Technological Stoppages			6.4	4				
Technical Failure						10.0	7	
Other Travelling	6.3	3	3.5	3				
Rest Time					6.3	4		
Other Stoppages	154.3	66	3.1	3	12.7	7	4.3	3

Mechanical Fertilizer Application at Worthy Park

The Bonel model # B58, *Fig. 5.10*, owned by **Worthy Park**, consists of four coulters that cut the soil and bury fertilizer in a band at the sides of each row. Fertilizer is applied to two rows at each pass. Application rates are achieved by changing the size of the sprockets on the ground, or drive, wheel. A trial was done to determine whether by burying the fertilizer, as opposed to broadcasting, a lower application rate would be effective. The trial was done in two fields at different rates and depths, using the recommended rate of 680 kg/ha as a standard. For one field the treatments were:

- Standard rate (9680 kg/ha) applied 10 cm deep;
- Standard rate at 15 cm deep;
- 80% of Standard applied 10 cm deep;
- 80% of Standard at 15 cm deep;
- Broadcasting Standard rate with a Vicon.

The plot size was 12 rows by the length of the field.

Treatments in another field were:

- 815 kg/ha at 12 cm deep;
- 495 kg/ha at 12 cm deep;
- 430 kg/ha at 12 cm deep;
- Broadcasting with a Vicon at 680 kg/ha.

The plot size was 24 rows by the length of the field.

Mud Spreader Modification

Long Pond acquired a **New Holland** 3 106 mud spreader capable of applying material in bands up to 10m wide, *Fig. 5.11*. SIRI's Agricultural Engineering department was given the task to design a modification and the dealer of the machine consented to do the fabrication that would allow for application of filter cake just to the planting furrow. Filter cake so applied would aid germination and improve soil structure. The modification, *Fig. 5.12*, consisted of a special device, to dispense the filter cake in a narrow band over the cane seed in one furrow at each pass.

Results showed that distribution was uneven as the filter cake, from the previous crop, had become relatively dry, which did not facilitate a steady flow. The addition of water to the bin reduced this drawback.

The machine applied the filter cake in bands up to 70 cm wide and 10 cm thick, *Fig. 5.13*. These rates may be varied by adjusting the opening of the lateral gate, machine travel speed and rotor speed.

Other Activities

A Bonel Fertilizer spreader, given to SIRI by the SCJ-**Monymusk**, was repaired and used on the Experiment Farm at Springfield as well as on farmers' holdings in Mid-Clarendon, by special arrangements.

Fig. 5.8: Modified Push Piler

Fig. 5.9: Contour Tillage at Tropicana

Fig. 5.10: Bonel Fertiliser Applicator at Worthy Park

Fig. 5.11: Mud Spreader dispensing material up to band of 10m

Fig. 5.12: Mud Spreader with modification

Fig. 5.13: After modification - filter cake covering seed material

6 VARIETY IMPROVEMENT

6.1 FUZZ AND SEEDLING PRODUCTION

Fuzz for the BJ2000 series arrived on February 9, 1999, approximately a month later than normal, and was kept un-refrigerated in Quarantine for four days. Nonetheless, germination was satisfactory yielding 52 000 seedlings, which was a significant increase over the 37 000 produced in 1998, *Table 6.1*, though short of 1997 production level of over 62 000. A minor incident of seedling blight, affecting two crosses, was contained by timely fungicidal treatment while an insecticide application was done to control potentially damaging thrips and cutworm populations.

6.2 COMMERCIAL

BJ7504, despite displaying a propensity to lodge and sucker late in crop with adverse effect on juice quality, continued to be the most widely grown variety occupying 29% of the reported area, *Fig 6.1.* The next most popular variety was B7015, which was planted to 19% of the cane area. BJ7465 (16%) remained in third position. **Frome** estate showed an increase in BJ7465, considered one of the varieties better adapted to mechanical harvesting. This in fact marked a reversal as the estate had suspended planting this variety in 1995 because of complaints by cane cutters about rind hardness. The area planted to BJ8226 (6%) remained stable although yields fell below projection in the Irrigated and **Frome** areas due to unsatisfactory ratooning. At Barnett the variety showed high levels of smut, which together with similar concerns at Frome, led to the Industry being cautioned about too rapid expansion. Area planted to BJ82119 was also at 6%, though there were concerns over its productivity at some locations. UCW5465 (3%) remained an important variety at **Monymusk** and **Bernard Lodge**. Meanwhile, BJ7452 (2%), grown primarily at **Frome** and **Long Pond**, declined further in importance during the year.

BJ8252, BJ7938 and BJ82102 were the main varieties undergoing commercial expansion. Planting of BJ7555 increased only in Rain-fed areas. A number of other varieties were being expanded in nurseries in 1999.

6.3 TRENDS

Wet West

There was a preponderance of BJ7504 in the Wet West, particularly at **Frome**, *Table 6.2*, where it occupied 35% of cane area. In the **Holland/Appleton** zone, area under BJ7504 was being reduced while BJ7015 (20%) and BJ8226 (17%) were the second and third most important varieties, respectively. BJ8226 was likely to be reduced significantly at **Frome** because of high smut levels and unsatisfactory yields during the 1999 crop. BJ7465 (12%) was earmarked for continued expansion because of its inherent good juice quality and suitability for mechanical harvesting. BJ8252 (2.4%) and BJ7938 (2.4%) were undergoing accelerated expansion. Good vigour, erect growth habit and self-trashing characteristics made them very well adapted for mechanical harvesting. At **Holland** and **Appleton** BJ82119 was planted to 9.4% and 7.1% of cane area, respectively. Despite its intrinsic good juice quality, BJ7627 was being gradually replaced by others with more vigorous growth.

Irrigated Area

Minimal replanting resulted in very little shift in the relative positions of varieties grown in the Irrigated area. At **Bernard Lodge** the most widely grown were BJ7465 (20%), UCW5465 (14%) and BJ7504 (10%). Others of importance were BJ8226 (11%), BJ7627 (10%), BJ78100 (7%) and CR67400 (5%). The estate decided to discontinue further extension of BJ8226 because of its reported susceptibility to smut and relatively poor yields in the 1999 crop. There was a trend towards increasing the area planted to newer varieties such BJ82119, BJ7938 and BJ82102.

Table 6.1: Number of Seedlings Planted (x 000) for Period 1995 - 1999

Year	1995	1996	1997	1998	1999
# of seedlings	54	41	62	37	52

Table 6.2: Distribution of Varieties in Wet West for Period 1997-1999

Variety	1997 (%)	1998 (%)	1999 (%)
BJ7504	41	35	35
BJ7015	16	14	20
BJ7465	12	11	12
BJ7452	11	9	2.4
BJ7627	5	6	3
BJ8226	10	12	17
BJ82119	5	6	6.1

At **Monymusk** BJ7504 (40%), BJ7015 (20%) and UCW5465 (8%) were the dominant varieties. Nurseries of BJ82119 and BJ82102 were expanded to provide seed cane for the commercial planting programme. At **New Yarmouth**, although still occupying first place, BJ7504 (28%) was undergoing a reduction in area occupied. BJ82119 and BJ7627 were second and third respectively. BJ7938 and BJ8252 were being rapidly expanded, the latter appearing to be tolerant to salinity and heavy clays characteristic of the area. There was marginal extension of BJ82156 and BJ7555 on farms in the Rhymesbury area.

Dry North Coast

With the future of **Long Pond** and **Hampden** uncertain, there was reduced investment in sugar cane cultivation. At **Hampden** crop care was reduced to where several cane fields were totally overrun by guinea grass and other weeds. In the face of all this, the variety position remained unchanged with BJ7504 (42%) remaining the major variety and BJ7015 (12%) in second place. The class "Mixed" occupied 30% of cane area. Others of lesser importance were BJ8226, BJ7465 and BJ7452.

The preeminent varieties at **Long Pond** were BJ7504, BJ7015, BJ7465 and BJ7452. There was marginal extension of BJ7548, BJ8226 and BJ82119.

St Thomas-Ye-Vale

BJ7504 remained the most popular variety in St Thomas-Ye-Vale because of its high yielding capability. At **Worthy Park** BJ7504 (29%) was the main variety grown and its productivity of 0.93 ts/ha/mo was of the same order as BJ7230 (0.94 ts/ha/mo) in 1999 crop, *Table 6.5*. The second most widely grown was BJ8226 (17.8%) while BJ7627 (11.7%) was declining. Area occupied by BJ82156 (12%) increased significantly over the previous year. At **Cambria** BJ7465, BJ7627, BJ7452 and BJ82156 were the principal commercial varieties while the varieties undergoing multiplication were BJ8252 and BJ7938.

Wet East

BJ7314 (18%) continued to increase in importance in the Wet East, particularly at **Tropicana**. Area planted to BJ7465 (25%) declined from the 1998 level of 29%. B51129 (12%) showed increased popularity because of its early maturing characteristic and good juice quality. There was marginal extension of BJ82132, BJ82119, BJ8207 BJ7555 and BJ82156 while UCW5465 and D14146 declined further in importance.

On Fred M. Jones estate the leading varieties were BJ7015, BJ7452 and BJ7465. Nurseries of BJ82156, BJ82102, BJ8226 and BJ7314 were established on other private farms in the area.

6.4 VARIETY PERFORMANCE

The best performing varieties overall were BJ7627, BJ8226, BJ7465, BJ7938 and BJ7504. At **Frome** the most productive varieties were BJ7555, BJ7627, BJ7938, and BJ7465, *Table 6.3*. The overall level of performance was however, below that of 1998. When the cane price formula was employed to rank the varieties on the basis of earnings, *Table 6.4*, BJ7938, BJ7555 and BJ7627 emerged as the most profitable.

At **Monymusk** the best performers were BJ7548, BJ7627, UCW5465 and BJ7465 and at **Bernard Lodge**, BJ78100 and CR67400. BJ78100 appeared to be salinity tolerant, displayed good vigour during drought and could be used to replace UCW5465 in some areas. Outstanding performers at **Worthy Park** were BJ7015, BJ7064, BJ7230, BJ7504, BJ7627 and BJ82119, *Table 6.5*.

Table 6.3: Productivity in ts/ha/mo at Frome

Variety	ts/ha/ mo
BJ7555	0.61
BJ7627	0.59
BJ7938	0.58
BJ82119	0.55
BJ7465	0.54

Table 6.4: Ranking of varieties based on yield, quality and earnings at Frome

Rank	Yield	Quality	Earning
1	BJ7555	BJ7938	BJ7938
2	BJ7627	BJ82119	BJ7555
3	BJ7465	BJ7465	BJ7627
4	BJ7504	BJ7627	BJ7465
5	BJ7938	BJ7504	BJ82119
6	BJ82119	BJ7555	BJ7504

Table 6.5: Productivity of varieties in ts/ ha/mo at Worthy Park

Variety	ts/ha/ mo
BJ7064	0.95
BJ7015	0.93
BJ7230	0.94
BJ7504	0.93
BJ7627	0.93
BJ82119	0.92

BJ7064, not widely grown in other areas, continued to be a very good producer at **Worthy Park**. It is an erect free trashing variety suitable for mechanical harvesting. BJ7314 continued to perform well at **Tropicana** by virtue of excellent juice quality and moderate cane yield. Other good performers were BJ7465, UCW5465 and B51129.

6.5 YIELD TRIALS

Experiment Reaped

Of eight yield trials in place during 1999, six were successfully reaped, one each at **Frome, Long Pond, New Yarmouth, Monymusk** and two at **Worthy Park**, all during the first Quarter. Two were burnt by unscheduled fires and reaped without the Institute being able to garner any information. The loss of variety trials, especially at **Frome**, has been of major concern for the past three years. This imposes very severe constraints on the timely release of new varieties by extending the period for evaluation.

In the trial reaped at **Long Pond**, BJ8811, *Table 6.6*, was outstanding, exceeding the level of the standard, BJ7015, in all parameters examined. Other promising varieties were BJ8879, BJ88104 and BJ8859.

On the basis of their performances seven varieties were selected for further evaluation at the Final Trial stage. These were: BJ8811, BJ8897, BJ88104, BJ8859, BJ8855, BT72482 and BJ8841.

BJ8783, *Table 6.7*, was the most outstanding variety in the Final Trial reaped at **Monymusk** significantly bettering the standard, BJ7015, in both tc/ha and ts/ha. Consequently it was ranked first in Economic Sugar Index (ESI). BJ8532 and BJ8770 were second and third respectively in performance. The trial will be further assessed in ratoon stages.

Table 6.6: Results of promising varieties in 18x3 Lattice Trial at Hampshire, Long Pond. Yields expressed relative to BJ7015 (=100)**

Variety	tc/ha	% sucrose	ts/ha	ESI
J8808	52.09	12.61	6.51	110
BJ8841	57.49	12.63	7.25	123
BJ8855	57.4	13.69	7.79	138
BJ8859	61.54	13.21	8.17	143
BJ8872	43.32	13.04	5.81	102
BJ8897	56.77	14.58	8.25	152
BJ88104	62.62	13.31	8.34	146
BT74238	58.03	12.82	7.44	128
BJ8874	48.67	12.48	6.07	102
BJ8820	51.19	13.11	6.64	115

Table 6.7: Results of 4x9 Final Trial at Morelands, Frome. Yields expressed relative BJ7015 (=100)

Variety	tc/ha	% sucrose	ts/ha	ESI
BJ8776	72.23	15.5	11.09	101
BJ8532	96.96	15.54	15.08	138
BJ8783	118.47	15.29	18.19	165
BJ8534	76.13	15.79	12.04	111
BJ8770	83.81	15.59	13.11	120
BJ8708	83.87	14.02	11.71	101

Table 6.8: Results of best performers in 18x3 Lattice Trial at Farm 5, New Yarmouth. Yields expressed relative to BJ7465 (=100)

Variety	tc/ha	% sucrose	ts/ha	ESI
BJ9165	70.74	13.4	9.34	109
BJ9142	77.06	12.4	10.93	133
BJ9192	83.43	13.01	11.26	134
BJ9138	92.68	11.55	12.57	150
BJ9146	92.04	13.81	11.61	132
BJ9112	83.96	12.59	10.96	128
BJ9167	99.92	14.2	12.93	150
BJ9164	72.35	11.59	9.04	102
BJ9184	72.73	12.95	9.82	117
J9101	81.88	14.61	11.9	147
BJ9127	82.71	12.5	11.74	143
BJ9168	75.45	13.77	9.49	108

Table 6.9: Promising Varieties in 9x4 final at Georges Plain, Frome. Yield expressed relative to BJ7015 (=100)

Variety	tc/ha	% sucrose	ts/ha	ESI
BJ8756	72.28	9.84	13.52	118
BJ8710	86.51	10.48	12.16	117
BJ8783	80.24	9.32	11.59	101

The most promising varieties in the trial reaped at New Yarmouth were BJ9138, BJ9167 and J9101, *Table 6.8*, exceeding the standard in all parameters examined. The first ratoon evaluation will be in year 2000.

In the trial reaped at Georges Plain, **Frome**, BJ8756 BJ8710 and BJ8783 displayed higher ESI than the standard, BJ7452, *Table 6.9*. There were six others that were promising from the standpoint of higher tc/ha, but no conclusions could be drawn in view of limited experimental results. This trial will be next assessed in the third ratoon stage.

The best performers in the trial reaped at Craddock, **Worthy Park** were J8803, BJ8841 and BJ88104, outperforming the standard, BJ8226, in tc/ha and ts/ha, *Table 6.10*.

Table 6.10: Results of promising varieties in 4x9 at Craddock, Worthy Park. Yields expressed relative to BJ8226 (=100)

Variety	tc/ha	% sucrose	ts/ha	ESI
BJ8859	86.15	14.49	12.42	112
BJ8874	90.84	13.57	12.51	110
BJ88104	86.27	14.84	12.9	118
BJ8897	86.47	14.56	12.65	117
BJ8841	91.28	14.18	13.86	122
J8803	98.61	13.36	13.07	124
BJ8226	81.64	13.89	11..35	100*
BJ7555	89.78	3.56	112.13	-

Table 6.11: Results of (9x4) foreign variety trial at Swamp # 2, Worthy Park. Yield expressed relative to BJ82156

Variety	tc/ha	% sucrose	ts/ha	ESI
B83131	62.26	14.12	8.78	102
DB7869	49.28	14.08	6.94	80
R570	68.09	12.92	8.79	97
B84557	55.72	14.08	7.84	91
DB73419	50.47	14.22	7.18	84
B83701	54.78	14.63	8.02	95
B79118	57.23	10.39	5.95	56
BJ8226	58.42	14.12	8.25	96
BJ82156	60.01	14.26	8.57	100**

The foreign varieties reaped in the trial at Swamp # 2, **Worthy Park**, were no better than the standard, BJ82156, *Table 6.11*.

Early Selection Stages

Stage I - BJ00

Selection from the Stage I nursery at **New Yarmouth**, produced over 1500 clones for elevation to Stage II. The other nursery of some 25 000 clones at St Jago was completely destroyed by cattle, thereby denying the Industry the potential benefits.

Stage II - BJ99

Selection from the Stage II nurseries at **Frome** and **New Yarmouth** produced 800 clones, which were promoted to Stage III.

Stage III - BJ98 and BJ97

Two Stage III nurseries were assessed and reaped as plant canes at **Frome**. These yielded a number of promising varieties, which will be further evaluated in the ratoon crop. Those that merit selection in the ratoon crop will be planted in holding nurseries for distribution to all ecological areas.

6.6 PLANTING OF NURSERIES

Stage I - BJ2001 series

Two Stage I nurseries were planted, one each at **Monymusk** and **Innswood**. Both grew satisfactorily and were well established when that at **Monymusk**, containing 30 000 genotypes, was completely ravished by cattle.

Stage II - BJ2000 series

The Stage II nurseries, comprising the 1 500 clones selected from Stage I at **New Yarmouth**, were planted on clay soils at **Holland** and **Frome**.

Stage III- BJ99 - series

After a late start due to unavailability of suitable land, Stage III nurseries were established at **Holland, Frome** and **Monymusk**. Another planned for **Long Pond** was abandoned.

6.7 EXPERIMENTS PLANTED

Lattice Trials: BJ86, BJ90 and BJ91 Three Lattice Trials, two at **Worthy Park** and one at **Tropicana**, were planted during theyear. Another scheduled for **Long Pond** was deferred to the 1999-2000 planting season.

Table 6.12: Variety Recommendations for harvesting periods and soil types

Area	Harvesting Period	Light Soils	Clay Loams	Clays
Westmore-	Early	BJ7555	BJ7452	BJ7465
land &		BJ7465	BJ7015	BJ7452
Hanover		BJ7015	BJ7555	BJ8252
		BJ7314		BJ7555
				BJ7015
	Middle	BJ7504	BJ7555	BJ7504
		BJ7015	BJ7627	BJ7015
		BJ7555	BJ7015	BJ7938
			BJ7938	BJ82119
			BJ82119	BJ7627
	Late	BJ7627	BJ7627	BJ82119
			BJ82119	BJ7627
Irrigated	Early	BJ7465	BJ7015	BJ7465
Clarendon &		BJ7015	BJ7555	BJ8252
St. Catherine		BJ7555	BJ7627	BJ7555
Plain		BJ7938	BJ82102	BJ82119
		BJ82102	BJ7465	BJ82102
		BJ7627	BJ8252	BJ8252
		BJ7262		UCW5465
				BJ7015
	Middle	BJ82119	BJ82119	BJ7504
		BJ7548	BJ7548	BJ7627
		BJ82102	BJ82102	BJ7548
		BJ7555	BJ7555	BJ82102
		BJ78100	BJ78100	BJ7555
			BJ8252	BJ8252
	Late	BJ7627	BJ7627	BJ7627
Upper	Early	BJ7555	BJ7555	BJ7555
St. Catherine		BJ7015	BJ7015	BJ7465
& Upper		BJ7465	BJ82156	BJ7015
Clarendon		BJ7314	BJ7314	BJ7314
		BJ82156	BJ7627	BJ7627
		BJ7627	BJ7504	BJ7504
	Middle	BJ7555	BJ7555	BJ7555
		BJ7465	BJ7015	BJ7462
		BJ82119	BJ82119	BJ82119
		BJ7262	BJ7262	BJ82156
		BJ82156	BJ82156	
	Late	BJ7627	BJ7627	BJ7627

Table 6.12: Cont'd

Area	Harvesting Period	Light Soils	Clay Loams	Clays
St. Thomas	Early	N/A	BJ7314	BJ7465
			BJ7555	BJ7555
			BJ7452	BJ7452
			BJ82156	BJ7627
			BJ7627	BJ7015
	Middle	BJ7555	BJ7627	BJ7627
		BJ82119	BJ7555	BJ7555
		BJ8207	BJ82119	BJ8207
		BJ82156	BJ7627	BJ7015
				BJ82119
	Late	BJ7627	BJ7627	BJ7627
		BJ82119	BJ82119	BJ82119
Trelawny	Early	BJ7465	BJ82156	BJ7465
St. James		BJ82119	BJ7015	BJ82156
& St. Ann		BJ82156	BJ7504	BJ7504
		BJ7504	BJ7465	BJ7465
		BJ7465	BJ8252	
		BJ8252	BJ82102	
	Middle	BJ82119	BJ7627	BJ7627
		BJ7504	BJ82156	BJ7504
		BJ82156	BJ82119	BJ82156
				BJ7015
	Late	BJ7627	BJ7627	BJ7627
				BJ7015
St. Elizabeth	Early	BJ7015	BJ7015	BJ7015
		BJ7314	BJ82102	BJ82102
		BJ82102	BJ7465	BJ7465
		BJ7938	BJ7938	BJ7938
		BJ7555		
	Middle	BJ7252	BJ7627	BJ7627
		BJ82119	BJ7465	BJ7465
		BJ82102	BJ8252	BJ7938
		BJ7465		BJ8252
		BJ8252		
		BJ7627		
		BJ82156		
	Late	BJ7465	BJ7627	BJ7465
		BJ7627	BJ7465	BJ7627
		BJ7314	BJ7314	BJ7314

Final Trials: BJ88 and BJ90

Five Final Trials were scheduled but because of drought, those for **Hampden** and **Long Pond** had to be cancelled. Eventually, only two trials were established, one at **Worthy Park**, the other at **Tropicana**.

Miscellaneous Nurseries

Lattice propagation nurseries of the BJ92 series and Foreign varieties were planted at **Worthy Park** and **Frome**.

Planting Recommendations

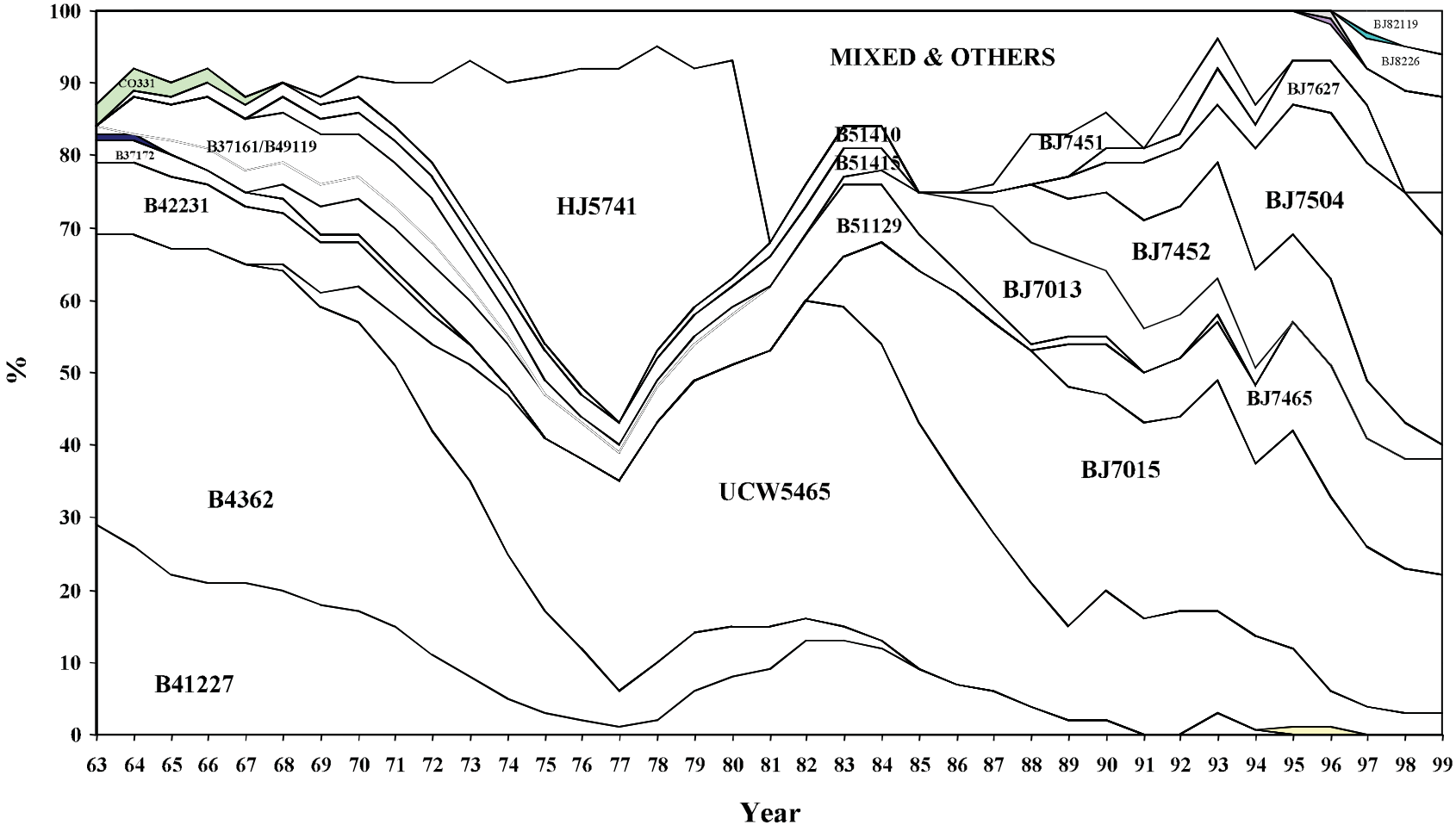
Current planting and reaping, recommendations are presented in *Table 6.12*. It should be noted that BJ8226 will not be recommended for the Irrigated area because of relatively poor performance.

6.8 VARIETY EXCHANGE

Exports

Thirty varieties of the BJ93 series were exported to the Cane Breeding Station in Barbados for use as parents in the cross breeding programme.

Fig. 6.1 Percentage hectarage under different varieties, 1963 - 1999



7 ECONOMICS & STATISTICS UNIT

7.1 PROFITABILITY STUDIES

Following three successive years of depressed sugar price, the diminishing viability of cane growing, especially in the irrigated areas, remained a matter of primary concern. The announced price of $17 500/ts at the start of the 1999 crop, later adjusted to $19 098, did not change this general outlook. Average price per tonne cane of $941.59 was, for the most part, below production cost. Even suppliers in the **Worthy Park** area who earned in excess of $1 000/tc would have been struggling to remain viable.

Irrigated Areas

Cost/price analyses strongly indicated that at the prevailing sugar price, cane growing in irrigated areas was largely unprofitable. This was compounded by farmers having received a loan in 1997of $400/tc, to be repaid in three years. Given the generally weak cash flow position of farmers, the Industry undertook to collect only $80/tc (approximately) during the 1998 crop, instead of the $174/tc earlier contemplated. Even at this reduced repayment rate, cash flow was still negative for many growers.

Analyses showed that profits would be marginal even at a sugar price of $19 622/tonne. Indeed, many growers would not approach viability until a sugar price closer to $20 500 could be paid.

Rain-fed Areas

The rain-fed areas have always had a comparative advantage over irrigated areas as the crop can be successfully grown without 'high cost' irrigation water. Analyses showed that rain-fed farms could be viable at an average yield of approximately 5-7 tonnes below that of irrigated areas.

Parameters used in carrying out the analyses included:

Parameters	Irrigated ($/ha)	Rain-fed ($/ha)
Establishment Cost/ha (incl. Sup. & Cont.)	71,470.00	60,004.00
Replanting Loan (80% of above cost)	57,176.00	48,004.00
JRCS	10.20	10.00
Interest Rate (%)	13	13
Payback Period (Yrs.)	3	3
Industry Loan (1)	4,640.00*	5,040.00**
*58 tonnes @ $80/tonne	**62 tonnes @ $80/tonne	

These parameters are not typical of the large estates which usually have high overhead costs associated with real estate and administrative costs.

7.2 COST OF CANE PRODUCTION - 1998

The 1998 cost of cane production survey showed an average national cost of $83 205/ha, down by 11.29% compared with the 1997 cost of $93 797. Cost/tc fell correspondingly from $1 443 to $1 242. A 40% reduction in administrative costs was mainly responsible for this decrease. However, three of eight major estates, notable high cost operators, did not supply information for this survey. Material costs also declined by roughly 10%. While this may appear to signal the start of a welcome trend, there was unfortunately evidence of reduced expenditure on essential inputs such as herbicides, fertilizers and irrigation water. Equipment costs also declined by close to 4%.

Percentage Share - Major Inputs

An examination of major inputs for the 1994-98 period shows Labour increasing from 16.50% of total cost in 1997, to roughly 21% in 1998, *Table 7.1.* However, this sharp increase only restored Labour to the relative position held in 1994. Equipment cost also exhibited a similar pattern, being responsible for close to 27% in both 1994 and 1998, with reduced shares in the intervening years.

Farm Size and Cost

As in previous studies, the 1998 survey showed cost increasing with farm size, *Table 7.2*. Small farms (<20 ha) produced at an average cost of $61 246/ha, increasing to $67 683/ha for small-medium sized

Table 7.1: Percentage share of total cost - selective inputs 1994 - 1998

Inputs	1994	1995	1996	1997	1998
Labour	20.99	17.5	19.59	16.58	20.72
Material	13.74	16.85	18.03	16.82	17.24
Equipment	26.55	21.75	23.65	24.36	26.77
Admin.	31.23	35.04	31.41	38.11	25.93

Table 7.2: Average cost per ha and per tonne by farm size, 1998

Size of Farm (ha)	Average cost ($/ha)	Average Cost ($/tc)
Under 20	61 246.07	978.13
20 - <200	67 682.97	1 121.14
200 - <1000	70 724.52	740.89
1000 and over	83 826.48	1 324.56

farms (20 - <200 ha); and $70 724/ha for medium-large farms (200 -<1000 ha). Large farms (1000 ha and over) had the highest cost of $83 826/ha.

However high cost/ha does not necessarily imply high cost/tc, as medium-large farms with the third highest cost/ha had the lowest cost/tc of $741, mainly as a function of higher cane yield.

Yield and Cost

Yield in relation to cost provides a reliable indicator of the level of productivity attained and is therefore an excellent measure of efficiency. For the 1998 crop, cost/tc at yields under 63 tc/ha was twice as high as at yields of 85 tc/ha and over, that is, over $1 600/tc compared with roughly $750/tc, *Table 7.3.* Small farms provided an exception to this relationship, in that, although generally low yielding, they also tended to be low cost producers by virtue of less input usage and very little overheads.

The inverse relationship between yield and cost is of special significance in that it indicates clearly that one sure way to enhance the economic viability of the industry is to increase yields.

Table 7.3: Average cost/tc by yield category - 1995 - 1998

Category tc/ha	1994	1995	1996	1997	1998
			Cost/tc ($)		
Under 63	859.12	1 312.92	913.70	1 755.83	1 635.69
64 - 74	777.00	912.35	1 193.29	1 369.13	862.19
75 - 84	504.66	727.23	1 011.46	1 000.06	983.89
85 & over	725.80	523.71	759.99	1 122.26	749.96

Table 7.4: Contractors harvesting cost in relation to cane price 1996 vs 1999

Factory Area	1996 Cane Price($)	1996 *H/rate ($)	1996 %	1999 Cane Price ($)	1999 H/rate* ($)	1999 %
Appleton	1 094.00	287.00	26.00	784.06	363.00	46.00
Tropicana	994.52	401.00	40.00	1061.70	395.00	37.00
Frome	979.35	340.00	35.00	902.98	361-381	42.00
Long Pond	1 012.87	338.00	33.00	980.70	395.00	42.00
Worthy Park	1 447.04	396.00	27.00	1205.10	550.00	46.00
B/Lodge	1 187.96	383.00	32.00	939.16	405.00	43.00
Monymusk	1 248.00	389.40	31.21	921.49	387.00	42.00

* Harvesting Rate

7.3 HARVESTING RATES - 1999

Increasing harvesting rates relative to cane price continued to be of great concern to growers. Consequent to a 10% union-negotiated wage increase, there were at least marginal increases in harvesting costs across the industry in 1999. Basic cutting rate increased by $9/tc, from roughly $87 to $96/tc. However, such rates were obtained mainly on some estates and large farms. Even so, there were often other performance related monetary incentives, ranging, in one instance, from $19.56 to $55.50/tc. In other cases, cutting rate was a composite or average of both normal and premium rates.

Areas such as **Frome** and Mid-Clarendon registered more than marginal increases in harvesting rates reflecting increases in all aspects of the operation, T*able 7.4.* At **Frome**, rates went from $330 to $368/tc roughly and in Mid-Clarendon, from $355 to $387/tc varying with distances from the factory.

At **Appleton**, for instance, from over $1 000/tonne in 1996, cane price fell to $784 in 1999, a 28% decrease, *Table 7.4*. During the same period, harvesting rates moved from roughly $287 to $363/tc, an increase of 26%.

In Mid-Clarendon from a high of $1187/tc in 1996, cane price fell to $939.00 in 1999. Meanwhile harvesting rates in 1999 were reduced to roughly the same levels as prevailed in 1996, $387/tc, after reaching a high of over $425/tc in 1997.

Harvesting cost, on average, represented 42-46% of cane price across the industry in 1999. The corresponding percentages, in 1996, ranged from 26% to 40%.

Cutting Rate

An examination showed basic or union negotiated cane cutting rates ranging between 3 and 6% of cane price for the period 1990-1996.Since 1997 cutting costs rose above 7% increasing to 10% by 1999, more as a direct consequence of significant reductions in cane price than a result of rate increases. However when the actual costs associated with cane cutting

are considered, they may well represent as much as 15% or more of cane price.

Harvesting Rate Determination

In an effort to determine the actual cost of harvesting and to provide a basis for future rate determinations, a study was undertaken by the Economics and Engineering Departments on behalf of the **Mid-Clarendon Co-op**. This involved a detailed survey of costs associated with the growing and harvesting of sugar cane in the area, inclusive of recommendations for improved performance and cost reduction where possible. Although the study was to be continued, the early results were used as a guide for rate determination for the 2000 crop.

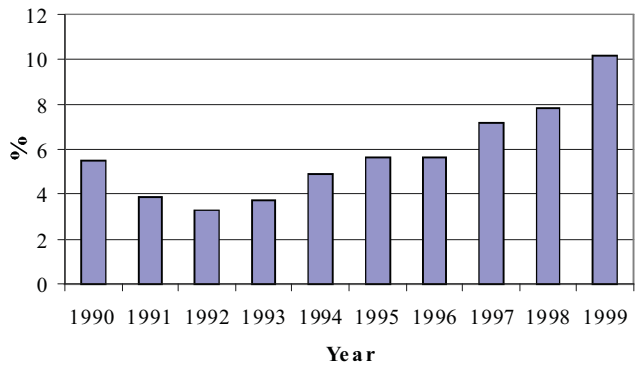
7.4 CANE YIELD SURVEY

The cane yield survey is an annual project designed to provide information on production and productivity, in addition to information on hectares in cane, tonnes cane produced, fertilizer and water use etc within the sugar cane industry. Data obtained are used to monitor variety performance, determine sugar production per hectare per month and to derive other indices of productivity. The data are presented in Appendices at the end of the report.

Table 7.5: Yield decline by cane class-selected estates

Year	Spring Plant	First Ratoon	Second Ratoon	Accum. Decline
		tc/ha		
Estate A				
1990	87.06	75.67	66.70	-31.75
1992	62.45	129.90	81.82	86.82
1993	119.80	88.97	80.40	-70.23
1995	72.87	99.21	88.91	42.38
1996	63.09	99.21	104.54	77.57
1997	63.09	105.82	82.36	62.00
Estate B				
1992	80.33	110.07	79.22	28.63
1993	104.11	93.79	78.70	-35.73
1995	70.36	92.71	100.57	52.56
1996	94.27	92.71	87.49	-8.34
1997	94.27	100.15	74.97	-13.42

Fig. 7.1: Basic cutting rate %cane price,1990-99



The survey continued to show significant decline in ratoon yields, particularly at the first and second ratoon stages.

At a particular estate (A), for instance, *Table 7.6*, the decline in yield between plant cane and second ratoons was approximately 70 tc/ha. At another, plant fields which yielded an average of 104.00 tc/ha slipped to roughly 79 tc/ha by second ratoons. However there were many instances of first and second ratoons out-yielding plant cane as would normally be expected.

Estimated loss to the Industry could exceed 200-250 000 tc since first and second ratoons usually comprised 8-10,000 ha, or 20-25% of area harvested. Reversal of this trend could generate an additional 18-22,000 tonnes sugar and much needed revenue for the industry.

Eonomic Analyses

The department continued to carry out economic and financial analyses on behalf of the wider industry. One such exercise involved the Field operations of the **Frome, Monymusk** and **Bernard Lodge** estates. This exercise was carried out on behalf of the Sugar Company of Jamaica, (SCJ) and sought to identify reasons for above-normal expenses, as well as to recommend measures aimed at increasing levels of efficiency and, by extension, viability of the enterprise.

8 AGRICULTURAL PRODUCTION & EXTENSION SERVICES

8.1 CANE PRODUCTION

A total of 2 326 051 tonnes cane (tc) was harvested from 37 718 ha, 85% of the reported cane area and 96% of the area estimated for reaping, *Table 8.1.* An estimated 64 000 tc was left unreaped which puts total cane production for the 1998/99 crop at 2 390 000 tonnes or within 4% of the estimated yield of 2 482 000 t.

Cane milled was 2 317 654 t, producing 204 634 t 96 sugar at a ratio of 11.33 tc/ts. Sugar production increased by 17 654 t over the previous crop, while cane harvested increased by 41 000t or 2%.

Cane yields averaged 61.7 tc/ha which was marginally lower than the 63.5 tc/ha obtained in the previous year, *Table 8.1*, but well below the desired yield of over 70 tc/ha required to boost cane production.

Cane yields ranged from 46 tc/ha for **Clarendon** farmers to 84 tc/ha at **Worthy Park. Appleton** averaged 81 tc/ha, reaping a substantial portion of standover canes.

The performance of the Industry over the last 5 years, *Table 8.2,* is characterised by failure to sustain or improve production to desired levels. The accumulated effect of low levels of annual replanting has been a major factor. Low earnings and an inability to adequately finance operations have been the main reasons for low replanting.

Table 8.1: Cane Production, 1999 vs 1998

Category	Area Reaped (ha)	Tonnes Reaped	tc/ha 1999	tc/ha 1998
Estates	19 568	1 297 609	66.3	65.1
Farmers	18 150	1 028 442	56.7	62.0
Total	**37 718**	**2 326 051**	**61.7**	**63.5**

Table 8.2. Cane and sugar production 1995-1999

Years	Cane Area	Area Harvested(ha)	Cane (t)	tc/ha	Sugar (t)	tc/ts	ts/ha
1995	46 665	39 580	2 325 592	59	212 476	11.00	5.35
1996	47 664	38 672	2 643 212	68	239 192	11.05	6.18
1997	47 440	39 582	2 487 783	63	237 332	10.22	6.15
1998	46 250	35 962	2 285 090	64	186 978	12.20	5.20
1999	44 627	37 718	2 326 051	62	204 634	11.33	5.45
Avg.	**46 529**	**38 303**	**2 413 546**	**63**	**216 122**	**11.17**	**5.64**

Cane Quality

JRCS values, as measured by the core sampler, improved marginally, from 9.29 in 1998 to 9.49. The sugar conversion ratio also improved from 12.20 to 11.33 tc/t96s. *Table 8.3 and Fig. 8.1* show the correspding values of cane quality for period 1995 - 1999. One of the main thrusts of the Extension Service was to guide the Industry towards better quality cane deliveries.

Replant Programme

A new loan programme funded by the Agricultural Credit Bank (ACB) and the People's Cooperative Bank (PCB) was introduced to the Industry in January 1999. This was intended to facilitate replanting by providing loans to cover 80% of establishment cost.

Up to the end of October 1999 only 1 000 ha approximately received funding from recommended applications totalling 2 650 ha, as many applicants failed to provide satisfactory collateral to the PCB. Total area replanted was 4 420 ha, representing 57% of the 7 700 ha targeted for the year, *Table 8.4.*

The estates replanted 78% of target while farmers achieved a mere 36%.

During 1999 several activities were conducted to improve cane quality thereby increasing earnings to cane growers. This was of paramount importance as cane husbandry to the succeeding crop depends on the levels of earnings at 1st advance payment for cane. To this end field visits were increased, field tests conducted and several meetings and discussions held to address cane quality problems. The result was an overall 0.2 JRCS improvement in cane quality for the Industry. However, 1-2 JRCS percentage points were observed in instances when the harvesting operations were well managed and field activities better supervised. It is hoped that these gains can be expanded to a larger number of growers.

About 50% available man hours was devoted to giving technical assistance to the new replanting loan programme. This was necessary as the first step towards improving

cane production. This included feasibility study, guiding farm plans, recommendation of agronomic practices and monitoring loan disbursements. Efforts were frustrated however as only about one-third of total application benefitted from the programme.

Nutrition Management

The programme of soil and leaf sampling continued as the basis for fertilizer recommendations to growers. Up to October 31, 1999, area fertilised totalled 30 646 ha, representing 81% of area harvested, *Table 8.5*. This shortfall is expected to have negative effects on cane yields for the 1999/2000 crop.

Seminars

A seminar was held to examine concerns raised of possible cane disease threats to the Industry. Entitled, "Cane Production and Disease Situation in Jamaica," the seminar covered a historic perspective of Cane Production in Jamaica 1961-1999, the Breeding Programme at West Indies Central Sugar Cane Breeding Station, Barbados, Performance and Development of Varieties in Jamaica, Pathologist Reports, Cane Farmers' Experiences, Sugar Cane Root Systems and the Economic Importance of Sugar Cane Diseases in Jamaica. Some 180 persons from a wide cross section of the Sugar Industry as well as non-industry persons attended, *Fig. 8.2*.

The conclusion was that there was a localised condition to be addressed on particular farms, including agronomic practices and suitability of sugar cane varieties, but there was no support for the view that there was a major disease threatening the Industry.

The need to improve cane production in the **Frome** area was addressed in a seminar on Cane Production and Profitability held in September. Matters addressed included Cane Quality and Payment, Sugar Cane Varieties for increased production and Fertilizer Management.

Cane Loading

Equipment operators involved in cane harvesting received training in grab loading techniques. Training took the form of practical workshops and field

Table 8.3: Cane Quality (tc/ts, JRCS, Pol % Cane, Fibre % Cane 1995-1999

	1995	1996	1997	1998	1999
Tc/T96s (Fact)	11.16	11.26	10.22	12.20	11.33
JRCS (C)	10.05	9.82	10.49	9.29	9.49
Pol % Cane (C)	11.57	11.36	12.09	10.88	11.00
Fibre % Cane (C)	16.11	16.26	16.41	16.80	16.77

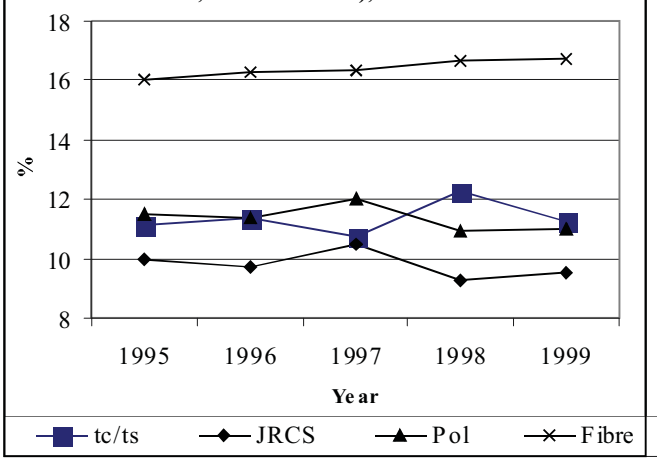
Table 8.4:Area replanted (ha) to October 1999

	Estates		Farmers		Total
Area	**Area (ha)**	**16%**	**Area (ha)**	**16%**	**Planted**
Frome	763	906	702	1 170	1 465
Monymusk/	519	677	105	588	948
N/Yarmouth	324	318			
B/Lodge	660	736	140	522	800
Long Pond	143	273	90	244	233
Tropicana	118	191	132	232	250
Appleton	348	393	88	367	436
Worthy Park	45	144	63	395	108
Hampden	126	280	54	272	180
Total	**3 046**	**3 918**	**1 374**	**3 790**	**4 420**

Table 8.5: Area (ha) Fertilized throughout the Industry, 1999

Area	**Estate**	**Farmers**	**Total**
Frome	5 061	4 723	9 784
Monymusk	3 456	1 320	4 776
Bernard Lodge	4 160	1 007	5 167
Long Pond	1 279	870	2 149
Tropicana	738	790	1 528
Appleton	2 210	1 190	3 400
Worthy Park	945	1 748	2 693
Hampden	429	720	1 149
Total	**18 278**	**12 368**	**30 646**

Fig. 8.1: Cane quality (tc/ts, JRCS, pol % cane, fibre %cane), 1995 - 1999



demonstrations at **Frome, Appleton, Bernard Lodge** and Mid-Clarendon. Some 150 operators and contractors participated.

Information

The Radio Programme "Raising Cane" continued to inform the Industry on various aspects of sugar cane production. Aired on Tuesdays at 5:45 a.m. on RJR and Thursdays at 10:15 a.m. on KLAS FM, the programme received sponsorship from Agricultural Chemicals Plant.

8.2 ST. CATHERINE

Cane farming in St. Catherine during 1999 was marked by reduced area harvested, lower cane production but a marginal increase in cane productivity, higher sugar production and low replanting levels, *Table 8.6.*

Table 8.6. Productivity data in St. Catherine, 1998 and 1999

	1999	1998
Area harvested (ha)	5 158.41	5 403.50
Cane harvested (t)	333 064.00	340 911.59
tc/ha	63.37	63.07
Sugar (t)	31 235	29 500.93
JRCS	9.49	9.03
tc/ts	10.93	12.08

Fig. 8.2: Participants in a cane production and disease situation seminar in Mandeville

At the start of the year, the main thrust of the Extension programme was to help farmers to improve productivity and cane quality, through better planting, cultivating and harvesting techniques. Attention was however diverted by a need to investigate reports of a series of diseases (Yellow Leaf Syndrome, Apex Rot, Red Stripe/Top Rot and various root pathogens) purportedly affecting the Sugar Industry.

Maturity Testing

A maturity testing programme, targeting 30% of the cane area reaped, was initiated prior to the start of the crop. Approximately 2 609 ha were tested at least once and 663 ha twice. Testing was widespread but the bulk was conducted over the 1506 ha at Bernard Lodge, Caymanas and Innswood where chemical ripening was done. Training, to increase the competence of farmers in sampling, was done in seven locations and benefitted 58 farmers.

Cane Quality

As part of the programme to improve cane quality, three meetings were held with field supervisors, harvesting teams and grab loader operators (a total of 73 persons). Frequent follow up visits were made on field operations and improvements were noted. A number of areas of inefficiency were also observed: over-manning levels, over-stocking of trailers, too many trailers, poor cutting techniques, excessive travelling by loaders as trucks often failed to move in tandem as well as excessive trafficking across cane banks by loaders and trucks. Despite efforts, there was much room for improvement so this exercise will continue into 2000.

A cane quality seminar, in addition to regular Monday morning sessions at the local SIRI Library, frequent farm visits, eight hours per week devoted to cane quality monitoring and the Harvesting Committee Meetings were avenues used to encourage good cane quality. The result was marginally improved JRCS values in 1999 (9.49 JRCS at the Mill).

Daily core lab reports were used to identify problem suppliers who were then targeted and assisted, through discussions and field visits, to improve harvesting.

Ripener Programme

Although chemical ripening was discussed on 16 farms, totalling 2 312 ha, only five farms did application. Extension worked in the areas of field screening and selection, blocking of fields, sampling of treated fields, monitoring and data collection from harvested fields. There were overall net benefits from these applications, details of which are given elsewhere in this report.

Table 8.7 . Growth station data from fields at Caymanas, harvested for seed cane at 6 months

Growth Period	Sept - Mar	Mar - Sept	Sept - Mar	Mar - Sept
Stations	1	1	2	2
Variety	BJ7452	BJ7452	BJ7452	BJ7452
Cycle	4 Ratoon	4 Ratoon	2 Ratoon	2 Ratoon
Row Space	1.5 m	1.5 m	1.5 m	1.5 m
Millable Stalk (m)	10		9	11
Prop. No Stalk (m)	17	19	16	19
Stalk Length (cm)	130	158	131	162
Length of Internode (cm)	13	15.90	12.6	15.70
Stalk weight (kg)	1.21	1.41	1.13	1.22
Actual tc/ha	74.1	92.62	69.1	87.09

Cane Development

The extension service made a number of investigations into land tenure, irrigation system, land divestment and the loan programme as they affected replanting and submitted reports to the relevant authorities. These efforts had very little impact on the replanting programme. Efforts to support the loan scheme - the development of 65 farm plans for 1006 ha and the submission of applications for loans valued at $72,276,204 - brought minimal results as only funds for planting of 57.57 ha were obtained by growers.

Most cane seed produced from eight designated nurseries, comprising some 40 ha, was not utilised. Among the varieties produced were BJ8226, BJ82119, BJ78100, BJ7452, BJ75102. Participating farms were Shaw/Standford, F. Thompson, C. Fearon, Sunshine Farm, Bartleys Farm, R. Dale, M. Sturridge, T. McCalla, and Fray's Enterprise.

Disease Conditions

In response to reports of various disease outbreaks in the Industry, extension participated in surveys of 700 and 1 922 ha of plant and ratoon canes, respectively, at **Old Harbour Estate, Windsor Park, Gaunaboa Vale, Caymanas, Innswood and Bernard Lodge.** Apart from smut and various leaf fungal diseases, nothing of any consequence was detected. With reports of BJ8226 showing relatively high levels of smut at certain locations in the Industry, growers were advised to suspend planting of this variety. Experimental plots were established at Lloyds & Belmont in efforts to investigate various approaches to increasing yield.

Tillage Investigations

A trial reducing the number of land preparation operations from the traditional six to five and four in different plots, was conducted at the Sunshine farm. Harvested at 11 months, the plots given six passes yielded 27% more than those given five. However, weed control tended to be most difficult in plots of six passes.

Observations at other locations suggested that degree of success using reduced tillage was strongly influenced by soil type and the existing state of weed cover. During the year, studies were made at Windsor Park, Old Harbour Estates and Gaunaboa Vale employing various reduced tillage techniques. It was observed that plants tended to be less thrifty and weed populations increased to unmanageable levels under certain conditions.

Weed Control

Extension conducted 15 weed control demonstrations involving 134 persons, during the year. Despite this, herbicide applications were generally late in practice. Recognising that lack of timeliness was often a consequence of delays in obtaining chemicals, plans were made to acquire more adequate storage in the area for 2000. There was some success in getting farmers to adopt pre-emergence application, as of the 139 ha planted, 79.5 ha were so treated. Generally, Herbadox 2.5L/ha and Gesapax Combi 1.5L/ha applied as pre-emergence gave six to more than eight weeks of control.

Nutrition

Fertilizer recommendations were given to 62 farmers and nine groups for some 232 fields, based on 114 soil samples and 89 leaf samples. Surveys indicated that most farmers applied less than the recommended dosages and on a very untimely basis. At Sunshine Farms demonstration plots to highlight the proper use

of fertilizer were severely damaged by cattle and had to be abandoned.

Ratoon Management

Inter-row cultivation was emphasised with practical demonstrations at Windsor Park, Half Way Tree (at two locations) and Gaunaboa Vale. In response to this effort, approximately 672 ha were treated with at least one form of inter-row activity on farmers' holdings.

Other Activities

Data collection in the 1999 Cost of Production Survey was facilitated by arrangement with 27 farmers. Also, Cane Yield Survey data was collected from 16 farms. Extension officers attended routine Harvesting Committee Meetings, 20 farmers' group meetings and 23 Loan Committee meetings. Work continued with the Government Divested farms. A crop estimate for year 2000 was developed in which an area of 5 158 ha was estimated to yield 335 536 tc at 65.88 tc/ha and an additional 8 000 - 10 000 tonnes cane seed.

The seed cane nursery at 47D Salt Pond was destroyed by fire. Plans were afoot to set up a new nursery at **Bernard Lodge**.

Growth Stations

Growth Station data collected from two fields harvested for seed cane allowed for quick comparison between predicted and actual yields. Cane husbandry was good at both locations. Fields were previously cut for seed cane and the trash blanket suppressed weed growth. Fertilizer was 500 kg/ha of Sulphate of Ammonia.

Predictions in the past were made at 6 months of growth for 12 month old cane. In this instance when canes were reaped at 6 months, predictions were 9-12% above actual, suggesting that insufficient allowance was made for the loss of growing time, *Table 8.7*. An interesting observation was that fields beginning the growing cycle in spring were higher yielding than those beginning in fall.

8.3 CLARENDON

Despite an increase in productivity at **Monymusk** from 54 to 64 tc/ha, cane yields actually declined by 4% in Southern Clarendon, as other farms, notably **New Yarmouth** which fell from 68 to 57 tc/ha, registered declines. **Monymusk's** productivity increase resulted from the concentration of production on areas with sufficient irrigation water. **New Yarmouth's** productivity fell because, in an attempt to reestablish an appropriate reaping cycle, significant areas were reaped as early as 10.5 months. Farmers' productivity decline stemmed mainly from a lack of adequate financing, high cost of irrigation water, and rampant cattle damage.

Cane quality was also disappointing with an average JRCS of 9.29 for **Monymusk**, 9.26 for **New Yarmouth**

Table 8.8: Hectares planted, Clarendon, 1999

Grower	New Land	Replanted	Total
Monymusk	-	519	519
New Yarmouth	-	323.99	323.99
Farmers	5	100.25	105.25
Total	**5**	**943.24**	**948.24**

Table 8.9: Varieties Planted, Clarendon 1999

Varieties	M/musk	N/Yarmouth	Farmers	Total
BJ7015	31	7.00	13.77	51.77
BJ7465	29	-	-	29.00
BJ7504	27	4.50	9.00	40.50
BJ7627	64	30.50	18.00	112.50
BJ82119	118	125.00	25.00	268.00
BJ8226	148	56.00	14.48	218.48
BJ82102	67	68.00	21.00	156.00
BJ82156	35	32.99	4.00	71.99
Total	**519**	**323.99**	**105.25**	**948.24**

Table 8.10: Area (ha) fertilized during the year

Location	Ratoon	Plant	Total
Monymusk	1 386	133	1519
New Yarmouth	998	102	1100
Farmers	1 275	45	1320
Total	**3 659**	**280**	**3939**

Table 8.11: Area herbicide treated, Clarendon, 1999

Location	Ratoon	Plant	Total
Monymusk	1 289	206	1 495
New Yarmouth	1 009	120	1 129
Farmers	1 095	75	1 170
Total	**3 393**	**401**	**3 794**

Table 8.12: Core report on manual and mechanically harvested cane, Clarendon

	Tonnes	Brix	Purity	Pol	Fibre	JRCS
Monymusk (Mechanical)	11029.95	16.88	81.22	10.59	17.84	8.74
Monymusk (Manual)	203575.38	17.13	82.17	10.81	18.25	9.04
N/Yarmouth (Mechanical)	64197.60	16.72	82.18	13.74	18.14	8.98
N/Yarmouth (Manual)	28296.88	17.73	83.45	11.42	18.04	9.84
Other growers	142097.36	17.90	82.79	11.44	17.98	9.81
Total/Avg	**449147.17**	**17.34**	**82.35**	**11.00**	**18.12**	**9.39**

Table 8.13: Ranking of Harvesting Contractors in accordance with performance, Clarendon, 1999

Name	Points	Positions
Sewell	89.8	1st
Duckworth	89.1	2nd
Asher & Tomlinson	88.3	3rd
Chin	88	4th
Garcia	86.7	5th
Mid Clarendon Agro. Ltd.	86.3	6th
Earlston	84.3	7th

and 9.88 for farmers, although this represented an overall improvement of 0.5 JRCS over the previous crop.

Harvesting

The Extension team guided harvesting by organizing the following activities:

- Seminar/Field Day with cane cutters to discuss the impact of their performance on the quality of cane delivered to the factory;
- Training of grab operators to improve performance as well as to prevent the destruction of fields during cane loading operations;
- Seminars with Contractors to discuss cane harvesting practices and costs;
- Determining fuel consumption of three grab loaders in collaboration with the Engineering Department, SIRI;
- Conducting time and motion studies on several trucks, grab loaders and tractors in collaboration with the Engineering Department, SIRI;

Table 8.14. Delivery profile of cane farmers, 1998-99

Time Range (hr)	%	Comments
12-24	25.50	Low tonnage on 1st day
24-48	31.25	
48-72	42.00	Too high on third day
>72	1.25	Needs to be eliminated
	100%	

- Comparing the quality of canes reaped by mechanical and manual means
- Maturity testing on some 1 078 ha;
- Cane quality assessment and delivery profile monitoring
- Investigating high sediments and fibre levels;
- Assessing Harvesting Contractors;
- Reorganizing Contractor operations.

Replanting

Monymusk replanted 519 ha, or 15% of its total area, while farmers replanted 429.24 ha or 10% of their cane area (**New Yarmouth** accounted for 75% of this), *Table 8.8.* Together this represented a 15% decrease from the previous year. The main varieties planted were BJ8226, BJ7627 and BJ82156, *Table 8.9.* The Extension team assisted growers in replanting by coordinating the following exercises:

- Soil sampling and fertilizer recommendations for 62 ha;
- Land preparation evaluation of 22 ha;
- Field layout and furrow orientation of 16 ha;
- Recommending, sourcing and evaluation of 280 t of cane seed of recommend varieties ;
- Making available 60 t of cane seed for SIRI's Nursery;
- Assisting in preparing loan applications for 98 farmers;
- Germination evaluation on 12 ha;
- Conducting field day/demonstration to highlight recommended practices.

Recommendations were also given on proper inter-row cultivation and weed control methods.

Nursery Update

A total of 330 t of canes was produced by the Extension Nurseries. However, only 20% was used for planting. The bulk was sent to the factory for processing, as there was low demand for seed cane. Production from the nurseries was as follows:

- Comfort (0.4 ha producing 25 tonnes)
- B.M.T. (4.86 ha producing 270 tonnes)
- Trout Hall (0.4 ha producing 30 tonnes)

The nursery at B.M.T. was closed and returned to the owner while the other two were maintained.

Crop Care

Fertilizer Application was limited to just some 50% of area reaped, *Table 8.10*. A band spreader was made available to growers by SIRI's Agricultural Engineering Department, in an effort to improve application efficiency.

Chemical weed control was carried out on only 40% of the area reaped, *Table 8.11*.

The quantity of available irrigation water was again insufficient primarily because canals were in need of repair. Growers received on average, 35% of the water required. Together with reduced weed control and fertilizer use, there was continued decline in cane husbandry, particularly on smaller farms, despite Extension efforts. The Extension team confronted these problems by conducting field days and demonstrations.

Increasing cattle damage necessitated much supplying. In many cases this was unsuccessful due to lack of irrigation water and lateness in execution.

SIRI/ARC Project

In conjunction with, and encouraged by the Agricultural Reconstruction Company, a project was started with two growers to investigate whether with good management and all necessary inputs supplied, cane growing could be viable in the Irrigated area.

The project got underway without the expected loan support from the Agricultural Credit Bank.

Mechanical/Manual Harvesting

Monymusk harvested 11 030 of its 214 605 tonnes of canes by combine harvesters, the rest by traditional hand cutting followed by mechanical loading. At **New Yarmouth** 64 197 of the total 92 494 tonnes were combine harvested.

The quality of chopper harvested cane at **Monymusk** was only 0.3 JRCS points lower than that from traditional methods, *Table 8.12*. A much larger difference of 0.86 was registered at New Yarmouth. Fibre levels were relatively high, 17-18%, in both areas, irrespective of the harvesting method used.

Harvesting Contractor Assessment

Seminars were convened for Contractors and their employees, to sensitize them to the desired aims and objectives during harvesting. Much emphasis was placed on cane quality. In efforts to improve harvesting efficiency, the 13 Contractors serving the area were consolidated into seven individual units.

A representative team of assessors, including Extension Officers, made observations and ranked the various Contractors according to performance, *Table 8.13*, as was done in the previous crop. Best performance was by Sewell; but the differences between Contractors were much less than in the previous year, as there was a general improvement in standards. There was still room for improvement, particularly in the proportion of canes delivered on the first day, *Table 8.14*, stumping, scrapping and spillage in transit.

8.4 ST. THOMAS-YE-VALE

Harvest Management

Extension attempted, through a series of group meetings, to address the problem of slow deliveries of farmers cane from the hilly terrain from which **Worthy**

Table 8.15: Loan approval/disbursement - 1999 St. Thomas-Ye-Vale

Area	No. of Applications	FCC Recommended	P.C. Bank Approved	Value $
W/Park	32	28	14	2 185 900
Bog Walk	32	14	3	2 443 440
Total	**64**	**42**	**17**	**4 629 340**

Table 8.16: Loan Profile for Worthy Park and Bog Walk areas

	Area (ha)	Value (M$)	Area Approved	Sum ($) Approved	Sum ($) Disbursed
W/Park	66	6.80	21	1 285 900	861 900
Bog Walk	57	4.68	28	1 243 440	800 000
Total	**123**	**11.48**	**49**	**2 529 340**	**1 661 900**

Park received much of its supplies. Despite these efforts, there was no marked improvement as the process of transporting canes on donkey back to roadsides, followed by hand loading to trucks, proved inherently slow.

Cane quality, and hence price, were however relatively good as growers, encouraged by the Area Agronomist, delivered cane which was largely free of extraneous matter. Extension further assisted farmers by conducting pre-harvest maturity testing on some 1 137 ha, of which 235 ha (21%) were on small holdings.

Replanting

Replanting fell well below desired levels as, of 64 applications received covering 123 ha, 47 were recommended by the Factory Credit Committee but only 17 (representing 49 ha) were approved by the P.C. Banks, *Tables 8.15 & 8.16*. Most farmers were unable to produce satisfactory collateral to satisfy P.C. Banks' requirements. Furthermore, disbursement of funds tended to be late, thus adversely affecting the timeliness of operations. Only 65% of overall target was achieved, with **Worthy Park** completing 82% of its target.

Two equipment loans, valued at $2,100,000 were included in the approved applications.

A few farmers were able to carry out replanting from their own resources. Progressive farmers added poultry or other organic manures, to low producing fields, thus prolonging economic ratooning.

Crop Nutrition

Fertilizer usage showed improvement over the previous year with 2 644 ha fertilized representing 84% of area reaped. Some 93 ha of new cane lands were fertilized. Bog Walk group farmers lagged behind others as they sometimes failed to receive fertilizer, or it arrived too late for efficient use.

Fertilizer recommendations were given to growers based on 513 soil and 233 leaf samples submitted for nutrient analysis.

Weed Control

Extension made considerable effort, without success, to assist farmers on small holdings in obtaining herbicides. Consequently, while **Worthy Park** and large farms maintained excellent weed control from their own resources, control on group farmers' holdings was considered only 40% satisfactory.

This, along with the inadequate fertilizer usage, should be reflected in low cane yields in the next crop, especially on the Bog Walk group farms.

Tissue Cultured Plants

A total of 223 tissue cultured plants,177 of BJ7555 and 46 of BJ81256 were planted at **Cambria Farms** in May 1999. With early growth affected by drought, 109 of the BJ7555 stools showed smut. After smut roguing, the BJ7555 was extended at **Wallens**.

Diseases

Following reports of observation of Yellow Leaf Syndrome (YLS) elsewhere in the Industry, a survey was carried out to determine to what extent St. Thomas-Ye-Vale might have been affected. Symptoms were found on BJ82102, BJ7230, BJ7555, BJ8226 and B49119 and to a lesser degree on BJ7465 and BJ82119. The typical yellowing of the mid-ribs was observed mainly in mature cane and did not appear to be causing economic loss.

Nurseries

Two nurseries of BJ8252, BJ7938 and BJ7555 were planted and monitored at **Wallens** with a view to further extension in the area.

At **Worthy Park**, the BJ90, BJ86 and BJ88 series were monitored for growth abnormalities. These trials were also affected by the drought, and showed retarded growth.

The Extension-operated McNie nursery (0.74 ha) was reaped and 52 tonnes of cane seed sold to growers. Necessary field practices were carried out.

8.5 DRY NORTH COAST

Cane Quality

During the crop, the Extension Department placed much emphasis on improving cane quality. Monitoring of the harvesting process to ensure maintenance of standards was one of the main planks. In addition, assistance was given in maturity testing of fields. Test results were used by the Cane Farming Department as a basis for issuing orders. Field demonstrations were conducted to show how best to prepare cane loads free of extraneous matter (XM) (i.e. suckers, tops, mineral matter) for delivery to the factories. At Russell's farm, for instance, by careful removal of XM, JRCS was improved from 10.75 to 11.53, *Table 8.17*.

Variety Expansion Nurseries

Plantlets from the tissue culture lab were used, by Extension, to establish a small variety expansion nursery of BJ7555 at **Hampden**. This was closely monitored for expansion in the Springvale and Group 6

areas. Also, at Windsor, a 2 ha nursery of BJ82119 was planted. This will be used for expansion in the **Long** Pond area. Other nursery plots, of 2.83 and 3.24 ha, were established with BJ8226 on Menzies and Dalrymple's farms respectively. However in light of concerns elsewhere about smut susceptibility, BJ8226 will be used for limited expansion with careful observation.

Replanting Programme

The replanting programme progressed slowly throughout the year as many growers were unable to provide satisfactory collateral to secure loans from the PC Banks. Delays between application and disbursal of loans frequently stretched beyond three months. In the end only some 30% of area submitted for development was actually planted, *Table 8.18*.

The majority of the $9 026 469 disbursed actually became available only in the last three months of the year and so severely hampered the programme.

Meanwhile, applications were made for 3 Bell loaders by contractors in the Hampden area. Two were recommended and one deferred. Disbursements for the two totalled $3 658 000.

Weed Control

To investigate whether the yellowing of cane foliage following application of Merlin, a pre-emergence herbicide, had adverse effects on cane growth, a trial was laid down at Richmond Farms in October 1998. For comparison, adjacent plots were treated with Gesapax combi and diuron (all with Actril Ds added for broadleaf control). Growth parameters measured showed no significant differences after five months, *Table 8.19*. Merlin, used at the recommended rate of 150gm/ha, therefore seemed to have no greater adverse effect on cane growth, than other chemicals in the trial.

Weed control demonstrations were conducted at Silvera's holding in Brompton, Dalrymple's at Hyde, McLauren's at Dromily and at Brown's in Bunker's Hill. Over 84 weed control advisories were done for farmers during the year.

Diseases

Yellow Leaf Syndrome (YLS), reported in the Caribbean during the last decade, was first recorded in Jamaica when the Manager of Richmond Farms took note of its presence in his cane fields in January 1999.

Symptoms of YLS appear mainly in maturing cane and comprise a yellowing of leaf midribs (the sap from which is sweet to the taste), eventual dieback of leaf tips and, in extreme cases, a bunching of leaves towards the top of the stalks. The main variety affected at Richmond was BJ7452, though symptoms could be seen on others. The discovery and confirmation of the condition led to a survey of other farms which revealed its presence at **Long Pond, Hampden, Barnett, Hyde** etc, *Table 8.20*.

Investigations by the Institute suggested that YLS, perhaps because of its late appearance in the growth cycle, tends to have no measurable effect on yield. There appeared to be a lack of consensus among

Table 8.17: Quality parameters in specially cleaned cane load, BJ7504, compared with farmer's traditional practice, control, Russell's Farm.

	Brix	Pol	Purity	% Fibre	JRCS	tc/ts
Treated	16.7	14.86	88.98	12.84	11.53	8.67
Control	16.2	13.94	86.05	12.28	10.75	9.30

Table 8.18: The Sugar Industry Loan Support Programme, Trelawny, 1999

Applications received at factories	208
Area submitted for development (ha)	588
Applications sent to Factory Credit Committee (FCC)	155
Applications recommended by FCC	154
Area planted under the programme (ha)	173
Disbursement	$9 026 469

Table 8.19: Cane growth parameters after 5 months in plots treated with various herbicides, plant cane, BJ8226 Small Walk, Richmond Farms Ltd.

	Treatment		
	1	2	3
Stalks/ha	57 246	48 034	46 718
Tillers/ha	20 398	24 346	26 320
Stalk diameter (cm)	10.37	9.35	8.87
# of leaves/plant	5.86	5.6	7.00
# of internodes	18	16.6	17.20
Stalk length (cm)	226	203	230

Treatment 1 - Merlin 150 g/ha + actril Ds 1 L/ha + diuron, 2 L/ha.

Treatment 2 - Gesapax combi 6 L/ha + Actril Ds 1 L/ha

Treatment 3- diuron 6 L/ha + actril Ds 1 L/ha

international sugar cane pathologists on whether it merited being classified as a disease.

There was intense search for explanations to the cause of low yields at Richmond, in particular, and Barnett, although the latter had cutback on fertilizing, weed control and other agronomic practices. Suggestions by the Institute of mechanical damage as a source of the problem at Richmond were rejected, and a former Director and Deputy Director of the Institute were invited to do an assessment. They concluded that the pattern of low yields was inconsistent with a disease effect and pointed to agronomic practices, resulting in sparse field populations. This was followed by a series of pathological studies by local and foreign experts, mostly funded by the farm.

Certain dead stalks among the field population, a perennial common sight in cane fields, were given the label "Apex Rot" by one pathologist. No known pathogen was however associated with this condition. Attempts to spread, or conversely to suppress, it have never been successful elsewhere. Another pathologist suggested that root pathogens such as *Pythium* and/or *Fusarium* spp. could be a factor in low yields, though often these only rise to become problems under conditions of poor drainage.

Difficulties in determining the true nature of the problem were compounded by the cessation of routine agronomic practices on the farms.

On the recommendation of a Task Force established by the Ministry of Agriculture, some field studies were laid down at Richmond Farm to compare agronomic practices in the first instance. This included the following:

- three fields were selected;
- plots were laid out in a randomised block design;
- plots of 0.4 ha were treated for comparison with untreated plots (control);
- in each field, treatments were replicated four times.

Treatments were:

- application of fertilizer 16-9-18 at a rate of 500 kg/ha;
- inter-row chiselling, moulding and weed control using diuron + gramoxone.

After several months of monitoring these plots which showed marked difference between treated and untreated plots yield data were lost due to premature reaping.

Smut

BJ8226, which prior to this appeared reasonably tolerant, showed high levels of smut infection at Barnett. A farm visit revealed a severe outbreak in a water-logged field (though typically smut outbreaks are induced by dry conditions).

Elsewhere on the farm on better drained soils, BJ8226 was growing normally. The grower was therefore advised to drain the area. Follow up visits, showed the outbreak subsiding and the field appeared reasonably productive.

Sucrose Enhancer

Assistance was given to **Long Pond** with the selection and sampling of fields to be ripener treated. Personnel were also trained on sampling procedure. Fields totalling 337 ha were selected, sampled and treated with Fusilade.

Table 8.20: Survey of areas showing YLS and other disorders, Dry North Coast

Area	Predominant Variety	Avg. Age (mth)	Cycle	DiseaseCondition Observed
Richmond	BJ7452/BJ7465	9	All	YLS, pokkah boeng leaf scald, smut*
L/Pond Est.	BJ7452/BJ7015	9-12	All	YLS, pokkah boeng eye spot
Hampden Est.	BJ7452/BJ7465/BJ7504		All	YLS, rust leaf scald pokkah boeng
Barnett Est.	BJ82119/BJ8226/BJ7452	9-12	All	YLS pokkah boeng smut*
Springvale	BJ8226/BJ82119/BJ7465	9-12	All	YLS pokkah boeng smut* pineapple**
Hyde	BJ7504	9-12	All	YLS
Bidiford	BJ7452	9-12	All	YLS

* on variety BJ8226

** on variety BJ8226

8.6 WETWEST

With nearly 60% of harvesting in the Appleton area comprising canes stood over from the previous crop, Extension placed much emphasis on assisting growers to employ appropriate harvesting practices to avoid poor quality. Most attempted to follow recommendations but were handicapped by the difficulties of harvesting under wet conditions for much of the crop. The Extension effort concentrated on the removal of suckers, trash, dead and rotten canes by the cutters. In addition, loader operators were encouraged to avoid pushing in order to reduce the quantity of mud and extraneous matter sent to the factory.

Aided by the high quantity of "stand overs," cane yields were at relatively high levels, particularly at Holland and Casa Marantha where the average was 96 tc/ha, *Table 8.21*.

SIRI's Engineering department was asked to assess the chopper harvesters' handling of "stand over" canes. The preliminary report indicated that harvesters were leaving up to 13 tc/ha in the fields. Examination of manual cutting showed the main problem to be high stumping and whole canes left in the field.

The introduction of manual cutting at Holland towards the end of the crop, saw an increase in JRCS of 2 points from the same field in some cases. Also, canes reaped in the cane cutters competition at Appleton gave JRCS as high as12.37 JRCS while other areas of the field reaped in normal fashion was as low as 9.89. This suggested that with increased supervision and delivery within 24 hours cane quality could be improved substantially.

Replanting

Growers were encouraged to plant high sucrose varieties such as BJ7627, BJ8207, BJ8226, BJ82119, BJ82102, BJ8252, BJ7314 and BJ7938 and replace high levels of the relatively low sucrose BJ7504. The estate made small quantities of BJ82102, BJ8252, BJ7314, BJ7938 and BJ8231 available to farmers for variety improvement within the area. Only 369 ha, which represented approximately 50% of the target, was replanted, with the estate responsible for 272 ha, *Table 8.22*. Of the 369 ha, 40% was planted to BJ82119 and BJ8226.

Loan Programme

Extension provided technical support to the newly instituted loan programme, sitting on fortnightly meetings of the Factory Credit Committee, preparing farm development plans, assessing quality of work done etc. Release of funds to growers was extremely slow as farmers failed to convince the PC Banks of their credit worthiness.

Table 8.21: Production data for Appleton area, June 1999

Area	Area reaped	Cane reaped (t)	tc/ha
Appleton Estate	1 090	85 767	79
Appleton Farmers	1 131	77 809	69
Holland &Casa	886	85 334	96
Total	**3 107**	**248 910**	**80**

Table 8.22: Area replanted (ha), Appleton area, 1999

Area	Target	New Area	Replanted	Total
Appleton Estate	240	-	122	122
Appleton Farmers	250	22.95	73	76
Holland &Casa	201	-	151	151
Total	**691**	**22.95**	**346**	**369**

Crop Nutrition

Low JRCS and consequently low cane price, particularly at beginning of the crop, was a deterrent to prompt purchasing of fertilizer. As first payment improved, with the progress of the crop, more farmers responded positively to fertilizer recommendations.

Due to the low JRCS and reduced yields observed in the previous crop, the decision was taken to submit soil samples to the SIRI laboratory for all new areas to be established in canes. As a result the Nutrition Agronomist recommended the use of 17-0-20 and 17-9-20 to address problems of low potash observed in the Elim and Bogue areas especially.

Drainage

Growers in the Elim, Braes River and Barton Isle areas, though positively disposed to recommendations to address drainage, experienced considerable difficulties in relieving fields of excess water as the main waterway beyond the dyke, was in need of dredging. This was brought to the attention of the relevant authorities who gave assurance that the matter would be dealt with before the start of the next crop.

Pests and Diseases

An outbreak of the leaf roller caterpillar, resulting in the drying up of leaf tips, occurred over a wide area of Westmoreland and St. Elizabeth. The attack was over

within a few weeks and there seemed to be no lasting effect. A number of fields, especially those experiencing stress, showed evidence of smut. Pokkah Boeng and various leaf spots were also observed.

Although some growers worked tirelessly to reduce cattle damage, even to the extent of placing wire fencing around fields, these animals continued to wreak havoc in the Elim area. It was feared that more areas would be taken out of cane production because of persistent cattle damage.

Weed Control

In a drive to improve standards of weed control, the Specialist was invited to the area to conduct training in identification of the various weed species and the most cost effective methods of control. The value of good weed control was emphasized and the weed control sequence for plant and ratoon canes as well as the chemical options were given in writing for Suefran, Dobber and Stoney Hurst farms. An integrated approach in controlling the weeds was encouraged.

Spray men were instructed in the correct application methods, while the hazards of improper use of chemicals were outlined. They, along with growers, were also advised of how to minimise environmental risks. Cases of phytotoxicity observed, were discussed with a view to avoiding recurrence.

Other Activities

Extension personnel participated in the Elim School Expo in April. On display were, among other things, the various varieties recommended for the area and information on the effect of high fibre levels on JRCS. During sugar week a lecture on the importance of sugar to the economy was also conducted. Assistance was given to the school for their mock interviews.

8.7 WET EAST

Extension followed up on programmes initiated in 1998 designed to:

- increase cane productivity and production
- control harvest and cane quality
- improve profitability

Special Projects

As special projects, the Hamilton and Rosselle farms have shown increasing yields over the last three years, *Table 8.23*, and could therefore be considered models for others to follow. On the other hand, Morant and Flynn farms were unfortunately abandoned. In mid-November 1999 eight additional farms namely; Stephens, Thomas, Bell, Hylton, Peckoo, Taylor, Johnson and Belvedere were selected for close working relationships. These were chosen on the basis of their lowering productivity.

Deliveries from certain fields, Pond Pasture, Baileys Piece, Dam, Georgia, Golden Valley and Buckingham were assessed and evaluated for quality, *Table 8.24.* As a result, it was recommended for both Duckenfield and Serge Island regions, that greater efforts be made to ensure better topping as well as removal of suckers and debris from loads.

Emphasis in the Serge Island group of Taylor, Hylton, Belvedere and Rosselle will be on cane productivity levels, whereas the Duckenfield group of Peckoo, Stephens, Bell and Thomas will focus on both productivity and cane quality.

Cane Quality Management

An estimated 40% of farmers carried out recommended harvesting practices of low stumping, proper topping, sucker and debris removal, proper loading, prompt delivery, while reducing infield traffic. Approximately a further 40% attempted to effect these recommendations, with varying degrees of success. Despite efforts, the remainder still fell well short of acceptable practice.

Activities to enhance quality included:

- chemical ripening;
- construction and maintenance of drains;
- planting high sucrose varieties;
- maturity testing;
- monitoring of harvest.

Not enough farmers participated fully in these activities. Plans were to bring more farmers into this programme for 2000.

Replanting

The region replanted nearly 50% of target with **Tropicana** accounting for almost 100 of the 250 ha established, *Table 8.25*. To facilitate the ACB replanting Loan Programme, extension provided the usual technical support.

A seminar/workshop on plant cane management was held in Duckenfield and Georgia to facilitate growers in the respective areas. A field demonstration was held in mid-April. The growers from Fairfield, Rocky Point, Pond Pasture, Bailey's Piece, Barking Lodge and Cheswick were also addressed on planning a replanting programme.

Crop Protection

In response to reports of disease concerns elsewhere in the Industry, in mid-March farmers holdings were inspected for growth abnormalities, or pest problems of any kind. Observations were that regrowth of

Table 8.23: Production data for special project farms, West East, 1996-99

	1996				1997				1998				1999			
Growers	Area Reaped (ha)	Cane Delivered (t)	tc/ha	JRCS	Area Reaped (ha)	Cane Delivered (t)	tc/ha	JRC	Area Reaped (ha)	Cane Delivered (t)	tc/ha	JRC	Area Reaped (ha)	Cane Delivered (t)	tc/ha	JRCS
Rosselle	47.6	2668	55.7	10.4	46	2666	57.2	10.5	48.3	2845	58.9	10.2	37.5	2323	63.1	10.6
Hamilton	22.0	1455	66.2	9.8	3.2	218	68.1	12.2	20	1310	65.5	10.5	23	1529	66.4	10.4
Stephens	3.5	234	66.8	9.15	3	194	64.6	9.1	4	254	63.5	9.4	4.5	269	59.7	9.2
Bell	1.2	80	66.6	10.2	-	-	-	-	.45	27.1	60.2	9.4	0.6	35	58.3	8.99
Thomas	4.5	305	67.7	10.3	-	-	-	-	3.5	220	62.8	9.8	4.0	213	53	9.5
Hylton	8.0	470	58.7	11.2	-	-	-	-	7	375	53.5	12.2	7.0	340	48.5	11.2
Peckoo	-	-	-	-	-	-	-	-	2.8	172	61.4	10	1.7	101	59.4	9.3
Taylor	-	-	-	-	-	-	-	-	1.3	64	49.2	11.2	1.2	54	45	10.8
Belvedere	40.0	2512	61.9	10.6	22	1233	62.5	11.0	33	1695	51	10.7	16	557	34.8	10.8
Whynn	7.0	460	65.7	9.7	-	-	-	-	8	470	58.7	9.4	8	411	51.3	9.2

Table 8.24: Cane quality assessment data, Wet East 1999

Areas	Sample Weight (t)	% Mature Cane	Avg. JRCS	% Tops	% Sucker	% Thrash	% Dead cane	% Intermediate aged cane	Avg. JRCS
Duckenfield									
Pond Pasture	3	84	9.7	4	6	2	2	2	9.2
Bailey's Piece	3	81	9.4	4	7	2	2	4	9.0
Dam	3	82	9.3	3	8	2	2	3	8.9
Serge Island									
Georgia	4	87	12.0	3	5	1	1	3	11.2
Golden Valley	3	83	10.9	4	6	2	2	3	10.4
Buckingham	3	82	10.6	4	6	2	2	4	10.0

harvested fields was excellent and canes to be harvested appeared healthy.

Pest populations were at minimal levels and insect damage levels were tolerable. In late November a plot of BJ8207 was showing signs of rust. This was being monitored so that decisions could be taken towards its further use, depending on severity of impact. A small outbreak of the canefly (in two fields) was controlled by application of malathion.

Weed Control

Training on proper use of herbicides, with emphasis on pre-emergence applications, was conducted with Group farmers in Bath, Middleton, White Hall, Baileys Piece, Pond Pasture, Rocky Point, Duckenfield and Cheswick.

Farmers were given recommendations on:

- applying appropriate pre-emergence herbicides;
- use of appropriate nozzles;
- use of protective clothing;
- use of stickers with post-emergence applications;
- appropriate use of post emergence herbicides.

Approximately 80% of farmers followed these recommendations.

Varieties

Main varieties planted were BJ7627, BJ7314, BJ7465, BJ7452 and BJ8207 which together comprised approximately 200 of the 250 ha replanted. Recently recommended BJ7555 and BJ7938 were being expanded with establishment of nurseries.

Table 8.25: Area replanted (ha), Wet East, 1999

Growers	Planted Fields	Replanted Fields	Total
Tropicana Est		105	105
F.M. Jones	28	36	64
Large Farmers		45	45
Small Farmers		36	36
Total	**28**	**222**	**250**

Crop Nutrition

Fertilizer applications to some 1 300 ha were completed by the end of August. A total of 150 foliar and 60 soil samples were submitted to the Central Lab to determine nutrient status during the crop year. Growers in the Danvers Pen, Petersfield and Buckingham areas received training in collection and preparation of leaf/soil samples.

A demonstration was held in Seaforth to facilitate the proper use of fertilizer, growers in the Serge Islands and Leith Hall also benefited from the exercise.

Other Extension Activities included:

- pre-crop seminar at Orange Walk in January 1999;
- cost of production survey among15 growers;
- a seminar involving the Economics Dept. on cost of producing cane;
- a field day involving the Engineering Dept. on machine/equipment use during harvesting;
- participating in Engineering's demonstration of reduce tillage.

Table 8.26: Area planted (ha) to different varieties during 1999, Wet East

Varieties	Farmers	Tropicana	Total
BJ7465	20	16	36
BJ7314	12	25	37
BJ7627	34	20	54
BJ7452	48	-	48
BJ8207	-	34	34
BJ82156	2	2	4
BJ82119	-	3	3
Others	29	5	34
Total	**145**	**105**	**250**

9 INFORMATION SYSTEMS

9.1 AGRICULTURAL DIVISION

Reinitialization and preparation of the Core Program for the 1998/99 sugar crop were effected at six factories between January and February 1999. By November/December in preparation for the start of the 1999/2000 crop at **Appleton** and **Frome**, a similar exercise was carried out. 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. Testing of the Scalepro program continued at the **Hampden** Factory with a view to full implementation during the next sugar crop. Sections of the Core program were modified to prevent a numeric overflow' error occurring when data was missing from the input file. Program fixes and modifications were done to most in-house databases and user support and training were provided where necessary.

Following the evaluation of the two programming softwares, Visual FoxPro and Visual BASIC, the decision was taken to rewrite and upgrade the ScalePro program using Visual BASIC. The Core Interface or Data Capture program was also rewritten in Visual BASIC. Work was also started on rewriting the Laboratory program, previously written in GWBASIC, using Visual FoxPro.

Investigations were carried out on all software developed in-house to test their readiness for the year 2000. The Cane Yield Survey (CYS) program was updated to enable it to cope effectively with the century change. An interface program was developed to enable two-way data transfer between the Core and CYS programs and the Field Inventory program. Data in spreadsheet format was also converted for use in the Field Inventory program. Modifications were also done to the Laboratory program. Weekly transfer of data was made from the Lab and Library databases to the Intranet.

The Cane Yield Survey program was demonstrated at three large farms following requests from the owners/operators. It should serve as a replacement for an older program at one farm, but implementation was placed on hold since an accounts section, present in the older program, was not yet activated in the CYS program. Installation was done at the other two locations.

A request was made from a farm for an Equipment Management Control program. A program that was developed by the Institute sometime ago was demonstrated and left for further evaluation and possible additions/modifications.

The Factory Reporting system, implemented in an old DOS version of Quattro Pro, was recreated using a recent version of Microsoft Excel. Following parallel runs to ensure correct conversion, the older program was replaced. Modifications were also made to the FoxPro Factory Reporting System.

With the closure of the Information Systems section of the Factory Services Division, time was spent in the training of existing staff to fill the void. Maintenance of all programs, Scale, Core, etc., was transferred to the Mandeville office.

Work continued on the Institute's Intranet with most departments represented and access possible from most workstations. The Library database was also integrated into the Intranet thus enabling users to search for articles from their desks.

Statistical Analysis

A one-way analysis of variance (ANOVA), with cane yield as the dependent variable and month of reaping as a factor, was done to determine if time of reaping had any effect on subsequent cane yields. The ANOVA showed a statistically significant difference between the mean yield from one month to another at the 99% confidence level. The all-island analysis showed that cane reaped between December and March maintained an average yield above 65 tc/ha (*see Fig. 9.1 - 9.3)*, with lower yields in subsequent months. There was rapid decline in cane yield from an average of above 77 tc/ha in December to just above 65 tc/ha in March. This picture was slightly different when the rain-fed and irrigated areas were examined separately.

9.2 FACTORY DIVISION

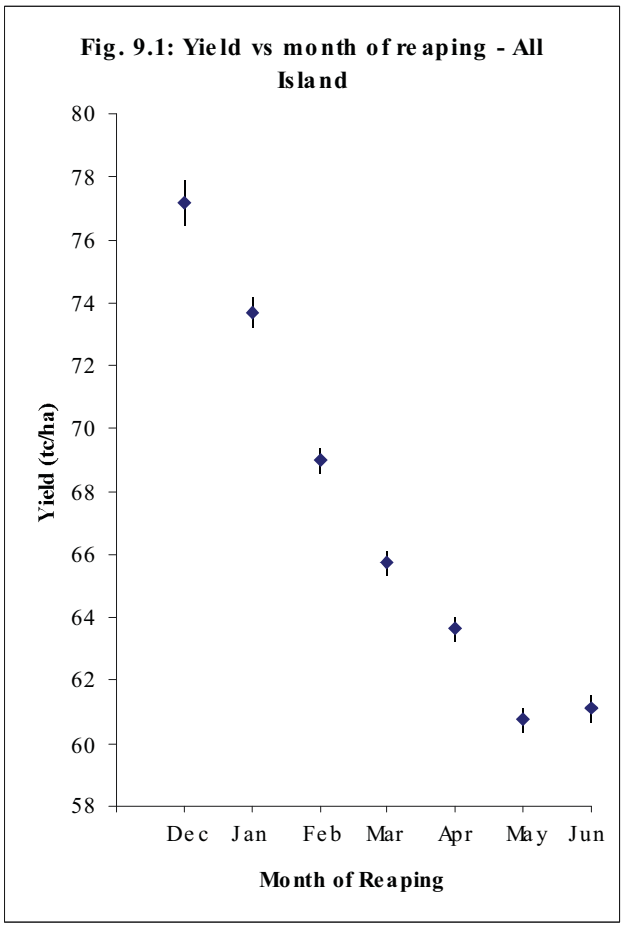
Core Interface

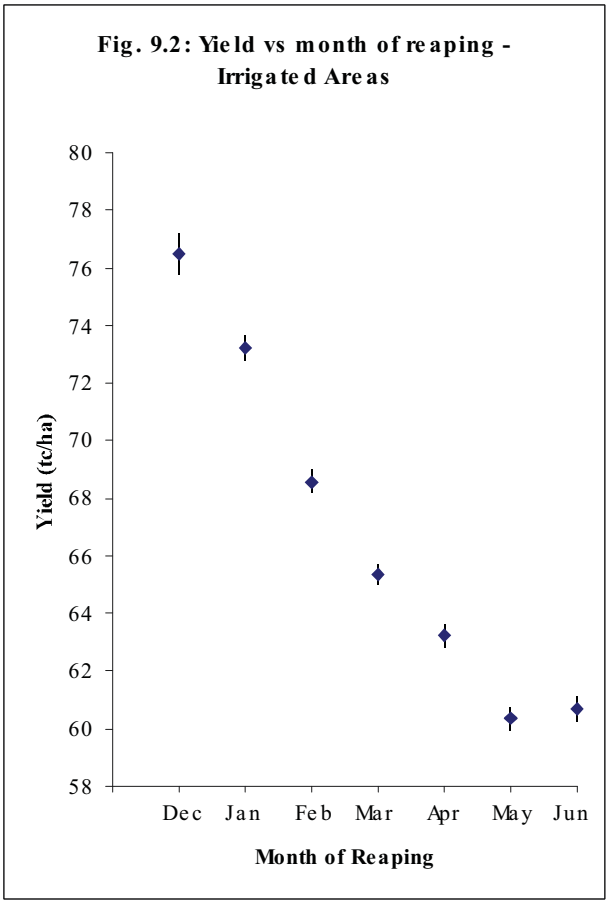
The core interface programme was installed at **Appleton, Worthy Park** and **Hampden**. Out- standing factories were **Monymusk, Bernard Lodge, Tropicana** and **Long Pond**.

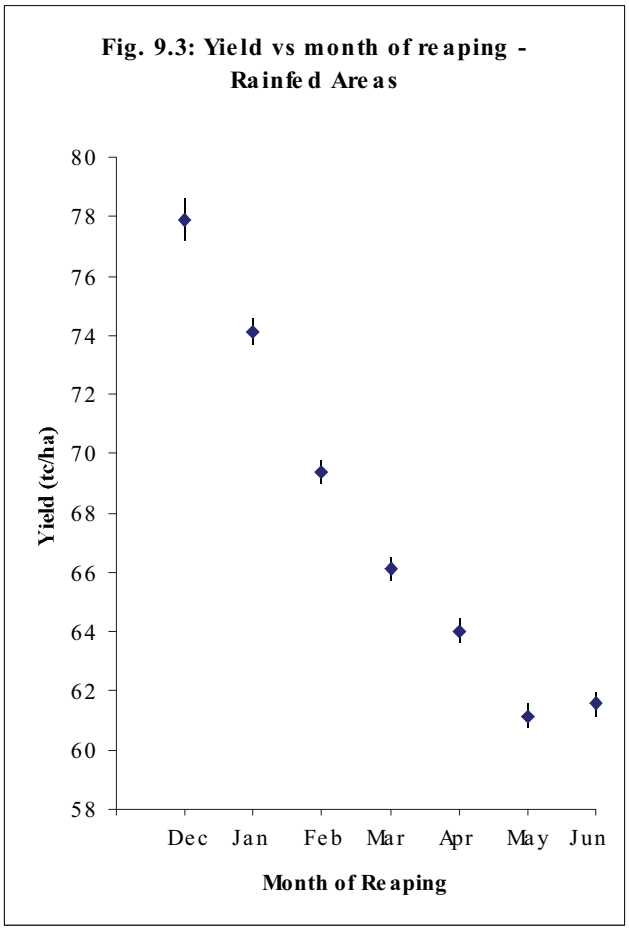
Three factories need the Windows 95 Operating System to be installed. This will first be installed at **Bernard Lodge.**

Work is currently on a new programme in Visual basic, a windows-based programme that will supersede and enhance the current system.

This programme is presently undergoing testing at **Tropicana** and **Worthy Park** and data is being







collected, however, it is still being modified to better meet the needs of the core laboratory.

Scale Pro

A trial copy of Scale Pro had been used for testing at **Hampden**. Some of the features requested by **Hampden** were not available and were added. This factory did not start using this programme as their scale house was not in a satisfactory condition to accept the computer and printer.

This is presently about twenty percent completed. The challenge now is to learn more about the database aspects of Visual basic in order to design a well structured database management system (DBMS) to produce the required reports from the input data.

Agris

The weight capturing module written in 1998 for Appleton was lost when the hard drive on the computer failed. Some time was spent re-writing and testing the module at **Appleton**. The module was completed and tested satisfactory at this factory on March 09, 1999. However, not all the modules in the

Agris programme tested successfully, these will therefore need modification. **Appleton** will require assistance in the programming of the scale and linking Agris to the scale after all modifications have been completed.

Core Programme

Re-initialization and preparation for the 1998/99 crop were done at **Worthy Park, Appleton, Bernard Lodge, Frome, Long Pond, Hampden**, and **Tropicana**. General troubleshooting and minor modifications were dealt with on a regular basis as a result of calls made to the SIRI office. These requests were very frequent for the months of January to February, since the factories were resuming operations.

Total Cane Quality/FRI Report

This report has been developed to allow comparisons between sub-standard and regular cane. This report will contain both weekly and crop to date information on tonnages and analysis figures. A summary of the true FRI will also be presented to reflect the effect of the sub-standard cane. This report has been installed at all the factories and the core laboratory personnel should be able to generate this on a weekly basis.

Factory Laboratory Report

This programme is now in its final stages of development where testing will be done at various factories over the next four weeks.

10 REVIEW OF FACTORY OPERATIONS

Cropping Time

The 1998/99 season began at **Appleton** on December 15, 1998 and ended at **Monymusk** on July 21, 1999. It lasted 225 days compared to 253 for the previous one. All factories contributed to the reduced cropping time, except **Appleton** which went back to a regular schedule.

The overall improvement was 28 days - this ranged from 1 day at **Monymusk** to 29 days at **Frome**. For **Hampden**, the reduction of 24 days was due to problems, which forced the factory to cease operations prematurely (*Table 10.1*).

Cane and Sugar Production

Considering the heavy rainfall during the harvesting season of the previous crop, the amount of cane produced was very disappointing. Although there were some improvements in the quality, the increase of 17,656 tonnes of sugar or 9.44% over 1997/98 was unsatisfactory (*Table 10.2)*.

The increase in cane milled and sugar produced over 1997/98 is not an improvement as the 1997/98 crop was the most abnormal for several decades with an overall decline of 50,354.00 tonnes or 21.22% sugar less than the 1996/97 production. Comparisons therefore for a review can only be made with the 1995/96 or 1996/97 crop. The 1996/97 data will be used as comparison for this review, as the industry realised one of its best years of operation with respect to:

- production of 237,331 tonnes sugar;
- highest cane quality of 10.49 JRCS;
- lowest tc/ts ratio of 10.17 since 1987 ;
- highest productivity tonnes sugar per day of 923 since 1979;
- highest FRI (reported) of 95.38; and
- highest factory operating time in 5 years at 67.79%.

Cane Production

The net difference for 1998/99 is 108,250 below 1996/97, this is actually 154,468 when the positive differences for **Appleton** and **Worthy Park** are excluded, moving the percentage decline from 4.46 to 6.37. When we consider the improvements for **Frome**, **Bernard Lodge, Worthy Park** and **Tropicana** in 1997/98 over 1996/97, these four factories accounted for a shortfall of 126,877 tonnes of cane with 90,429, 14,923, 18,413 and 3,112 tonnes respectively. Decline in cane production at **Monymusk** and **Long Pond** is moving at about the same pace, while the decline at **Hampden** could be due to cane left unreaped. The apparent improvement at **Appleton** cannot be assessed properly due to the amount of standover cane harvested *(Table 10.3)*.

Sugar Production

The decline in sugar production of 13.78% below 1996/97 was not proportional to that of cane (4.46%) due primarily to the decline in the JRCS and the tc/ts when compared to the 1996/97 levels. There cannot be any comfort in the increase in sugar of 17,656 tonnes or 9.44% over 1997/98, as only when the industry exceeds 240,000 tonnes that any sign of real growth will begin. Had there not been such an abnormal crop at **Appleton**

Table 10.1: Comparison of cropping time 1998/99 vs. 1997/98

	Starting Date		No. of days	
Factories	**1998/99**	**1997/98**	**1998/99**	**Diff**
Frome	16/12/98	211	182	(29)
M/Musk	24/01/99	180	179	(1)
B/Lodge	20/01/99	182	162	(20)
L/Pond	08/02/99	160	147	(13)
Tropicana	01/02/99	127	133	(6)
Appleton	15/12/98	100	208	108
W/Park	05/01/99	187	173	(14)
Hampden	03/02/99	163	139	(24)
Span		253	225	(28)

Table 10.2: Comparison of sugar production (1991/ 99)

Year	*t96 Sugar	tc/ts
1990/91	239 552	11.56
1991/92	224 656	11.31
1992/93	225 776	11.94
1993/94	222 758	11.27
1994/95	212 476	11.00
1995/96	239 192	11.05
1996/97	237 331	10.17
1997/98	186 978	12.20
1998/99	204 634	11.41

*Including sugar to distillery

Table 10.3: Comparison of the 1996/97, 1997/98 & 1998/99 cane milled

	1996/97 production	1997/98 production		1998/99 production		
Factories	**T. Cane**	**Cane**	**Diff (`97 -`98)**	**Cane**	**Diff (`97 - `99)**	**Diff(`98 - `99)**
Frome	761,189	785,126	23937	694,697	(66492)	(90429)
M/Musk	486,489	463,683	(22806)	454,738	(31751)	N/A
B/Lodge	355,512	356,309	797	341,386	(14126)	(14,923)
L/Pond	154,286	141,213	(13073)	142,165	(12121)	N/A
Appleton	230,908	94,351	(136557)	265,265	34357	N/A
W/Park	195,657	225,931	30274	207,518	11861	(18413)
Hampden	129,193	99,622	(29571)	99,609	(29584)	N/A
Tropicana	112,670	115,388	2718	112,276	(394)	(3112)
Total/Avg	**2,425,904**	**2,281,623**	**(144281) (Net)**	**2,317,654 (net)**	**(108250)**	**(126,877)**
Actual diff			**(202007)**		**(154468)**	**(126,877)**

in 1997/98, at least 200,000 tonnes of sugar would have been realised.

Tropicana is the only factory reporting a 25-tonne increase over 1996/97. **Monymusk, Bernard Lodge** and **Long Pond** have made some ground, while **Frome, Appleton, Worthy Park** and **Hampden** have slipped further (*Table 10.4*).

TC/TS Ratio

There has been an improvement of 7.13% over 1997/98 compared to a 2.42% improvement in the cane quality (JRCS). The additional improvement is due to the increase in the Factory Recovery Index. Only **Tropicana** showed a slight improvement (12.02), compared to the figure of 12.09 for 1996/97 (*Table 10.5*).

Factory Throughput

The tonnes sugar produced per day is dependent on the tonnes cane milled and the quality. Overall existing capacity is 19,950 tonnes cane per day, (allowing for 85% operating time). Ranging from 1,200 tonnes at **Hampden** to 5,800 at **Frome**. The current level of 13,466 tonnes represents only 67.48% of capacity, ranging from 59.75% at **Hampden** to 79.93% at **Worthy Park** *(Table 10.6)* with approximately 32.52% of

Table 10.4: Comparison of the 1996/97, 1997/98 & 1998/99 sugar production

Factories	**1996/97 Production Sugar**	**1997/98 Production Sugar**	**Diff Sugar (t) 1997 - 98**	**1998/99 Production Sugar**	**Diff 1997 - 99**
Frome	70,896	61,450	(9,446.00)	59,420	(11476)
M/Musk	48,409	37,680	(10,729.00)	40,780	(7629)
B/Lodge	35,341	29,501	(5,840)	31,235	(4106)
L/Pond	15,802	12,173	(3,629.00)	12,345	(3457)
Appleton	21,195	6,043	(15,152.00)	20,504	(691)
W/Park	23,826	24,772	946.00	23,163	(663)
Hampden	12,546	7,290	(5,256.00)	7,845	(4701)
Tropicana	9,317	8,069	(1,248.00)	9,342	25
Total/Avg	***237,332**	***186,978**	**(50,354.00)**	**204,634**	**(32,698)**

*Including sugar to distillery

Table 10.5: TC/TS ratio

Factory	**1996/97 Production tc/ts**	**1997/98 Production tc/ts**	**1998/99 Production tc/ts**
Frome	10.74	12.78	11.69
M/Musk	10.05	12.31	11.15
B/Lodge	10.06	12.08	10.93
L/Pond	9.76	11.60	11.52
Appleton	10.89	15.61	12.94
W/Park	8.21	9.12	8.96
Hampden	10.30	13.67	12.70
Tropicana	12.09	14.30	12.02
Total/Avg.	**10.22**	**12.20**	**11.33**

capacity idle, production cost must of necessity, be correspondingly high.

Factory Operating Time

The low factory capacity utilization is due to the operating time % net available time which averaged 63.48% compared to 67.79% in 1996/97 and 61.02% in 1998, with **Worthy Park** at 77.38 and **Monymusk** 68.40 compared to 87.20 and 67.57 respectively in 1996/97. All other factories are below 66%.

Non-factory downtime has been excessive at all factories, being highest at **Appleton**. Factory downtime is also unacceptable on average, with **Worthy Park** being the lowest (3.10%)and **Tropicana** and **Hampden** above 26% (*Table 10.7*). As a result of this excessive downtime, cropping time is being extended by at least twenty-five (25) days per year.

Cane Quality - JRCS

The cane quality, although very disappointing, showed marginal improvement at all factories except **Long Pond**, with an average difference of 0.23 JRCS above 1997/98, but significantly below the 1996/97 crop when this peaked at 10.49. Only **Tropicana** showed a similar trend to the 1996/97 level (*Table 10.8*).

Price of Cane

Due to the poor quality, the price of cane was reduced by $53.20 or 5.05% per tonne on average below 1996/97. Two factories (**Frome** and **Tropicana**) showed an improvement of $11.25 and $59.60 respectively. All others showed a negative earning, although there was an increase of $2428.00 per tonne sugar, which is 14.28% over 1996/97 (*Table 10.9*).

Table 10.6: Factory throughput 1996/97 vs. 1998/99

	Tonnes cane per day				Tonnes sugar/day	
Factory	**1996/97**	**1998/99**	**Capacity**	**% capacity**	**1996/97**	**1998/99**
Frome	4,160	3,817	5,800	65.81	387.41	281.61
M/Musk	2,749	2,540	3,600	70.56	273.50	226.56
B/Lodge	2,008	2,107	3,000	70.23	200.00	192.80
L/Pond	982	967	1,500	64.47	100.65	84.00
Appl	1,017	1,275	2,000	63.75	93.37	98.58
W/Park	1,322	1,199	1,500	79.93	160.99	133.89
Hamp	783	717	1,200	59.75	76.04	56.44
Trop	746	844	1,350	62.52	61.70	70.24
Tot./avg.	**13,767**	**13,466**	**19,950**	**67.48**	**923.48**	**909.48**

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

	1997/98 (final)			1996/97 (final)			1998/99 (final)		
	Downtime			Downtime			Downtime		
Factory	**Non-fact**	**Factory**	**Oper Time**	**Non-fact**	**Factory**	**Oper Time**	**Non-fact**	**Factory**	**Oper Time**
Frome #1	28.31	15.31	59.01	22.47	15.51	64.68	16.68	13.85	67.94
Frome#2	31.25	17.16	54.14	24.70	13.72	64.32	15.42	19.05	63.71
M/Musk	23.50	12.40	67.57	17.21	17.45	69.40	21.27	8.76	68.40
B/Lodge	25.89	16.98	61.39	24.32	14.52	65.85	25.39	10.58	62.61
L/Pond	26.28	18.16	58.69	20.89	16.87	66.25	26.16	14.23	63.46
Trop	20.50	18.82	64.97	10.18	31.67	61.87	21.57	26.32	55.67
Appleton	9.08	38.96	54.74	10.92	21.14	71.26	31.40	11.39	59.69
W/Park	24.70	3.31	79.42	13.24	5.47	87.20	24.50	3.10	77.38
Hampden	16.71	38.97	47.05	27.78	15.97	60.17	21.52	28.79	52.54
Avg.	**23.75**	**18.63**	**61.02**	**16.65**	**19.37**	**67.79**	**22.66**	**15.10**	**63.48**

Table 10.8: Comparison of cane quality - JRCS (1996 - 1999)

	JRCS			
Factories	**1996**	**1997**	**1998**	**1999**
Frome	9.17	9.81	9.23	9.27
M/Musk	10.26	10.48	8.84	9.39
B/Lodge	10.32	10.63	9.02	9.49
L/Pond	9.35	11.36	10.12	9.77
Trop	9.25	10.61	8.76	10.27
Appleton	9.42	10.05	8.35	8.55
W/Park	11.74	12.09	10.85	11.17
Hampden	9.40	11.29	9.48	9.71
Average	**9.82**	**10.49**	**9.29**	**9.52**

Growers Share

It is important for growers to understand that increases in the sugar price by itself will not increase the price of cane as the latter is also dependent upon the quality of cane produced.

The standard cane quality (the 5-yr moving average) must be maintained or exceeded for growers to maximise their earnings. This is demonstrated quite clearly in *Table 10.10* where, for 1994/95 and 1996/97 the grower's actual share was greater than the standard share for 1998/99, the situation was reversed.

Factory Recovery Index

In 1996/97, six factories reported levels above the 91 standard. Only three factories were above the 91% standard in 1997/98, with **Appleton** at the lowest (78.73). On average, the FRI was 90.98 due mainly to the higher levels reported at **Bernard Lodge, Monymusk**

Table 10.9: Comparison on the Price of Cane (1996/97 vs 1997/98 and 1998/99)

	Price/tonne cane					
				Diff/t	**Diff/t**	**%age diff**
Factories	**1996/97**	**1997/98**	**1998/99**	**1997 - 98**	**1997 - 99**	**1997 - 99**
Sugar price	$17,000.00	$16,670.00	$19,098.00	($330.00)	$2428.00	14.28
Frome	945.77	826.98	957.02	(-118.79)	11.25	1.18
M/Musk	1,051.06	767.47	977.54	(-283.59)	(73.52)	(6.99)
B/Lodge	1,074.53	794.15	994.24	(-280.38)	(80.29)	(7.47)
L/Pond	1,189.40	961.58	1,044.34	(-227.82)	(145.06)	(12.20)
Tropicana	1,071.06	754.98	1,130.66	(-316.08)	59.60	5.56
Appleton	983.80	693.91	831.55	(-289.89)	(152.25)	(15.48)
W/Park	1,302.93	1,072.46	1,237.38	(-230.47)	(65.55)	(5.03)
Hampden	1,177.77	864.30	1,033.01	(-313.47)	(144.76)	(12.29)
Average	**1,052.84**	**835.68**	**999.64**	**(-217.16)**	**(53.20)**	**(5.05)**

Table 10.10: Effect of std. cane/F.F. on payment

	1993/94	**1994/95**	**1995/96**	**1996/97**	**1997/98**	**1998/99**	**1999/2000**
Std. cane	10.04	9.99	9.97	9.90	9.95	9.92	9.84
Growers' share (std)	6.22	6.19	6.18	6.14	6.17	6.15	6.10
F.F. (38%)	3.82	3.80	3.79	3.76	3.78	3.77	3.74
Act. JRCS	9.87	10.04	9.82	10.49	9.29	9.52	?
Growers' share (actual)	6.05	6.24	6.03	6.73	5.51	5.75	?
% to growers	61.30	62.15	61.40	64.16	59.31	60.40	?

*What will it be?

and **Worthy Park**. For the 1998/99 crop, five factories reported levels which surpassed the standard with an average of 94.54 (*Table 10.11*).

Table 10.11a: Comparison of FRI (1996 - 1999) reported

	FRI REPORTED			
Factories	**1996**	**1997**	**1998**	**1999**
Frome	93.06	98.25	90.25	95.33
M/Musk	96.72	97.31	93.87	96.70
B/Lodge	100.20	93.86	92.58	96.83
L/Pond	93.22	92.62	86.54	90.33
Trop	82.66	81.57	83.56	82.39
Appleton	91.07	93.12	78.73	93.23
W/Park	99.14	101.05	101.47	99.94
Hampden	90.54	86.20	79.01	82.89
Average	**94.37**	**95.38**	**90.98**	**94.54**

Factories continue to report FRI values without including the sub-standard cane processed. From information received for the 1998/99 crop, a total of 45,862.17 tonnes sub-standard cane was processed, ranging from zero at **Worthy Park** to 24,281.24 tonnes at Frome. When this is included in the FRI calculation, the actual value is 92.90 with the average difference at 1.64 (*Table 10.11b*).

Oil Consumption

Oil consumption increased by 15.33% or 1.764 million litres above 1997/98. The rate of consumption was at 73.24 litres per tonne 96 sugar compared to 71.06 in 1997/98 (*Table 10.12*).

SUMMARY

Over the past several years, the focus has been on cane production and cane quality, in particular to move the industry forward. All is certainly not well in this sector. Meanwhile, factories have been reporting significant improvement in efficiency which is misleading since the sub-standard cane processed is not reported.

Table 10.11b: Comparison of the impact of sub-std. cane on the FRI and cane yard loss

Tonnes cane	**B/L**	**Appl**	**Hamp**	**W/P**	**Trop**	**M/M**	**L/P**	**Fro**	**Total**
Normal cane	340,055.56	257,244.28	97,489.79	207,452.71	110,401.14	449,147.17	139,829.81	672,291.46	2,273,911.92
Sub-Std. Cane	2,553.47	8,020.28	2,118.81	-	901.16	5,674.01	2,313.20	24,281.24	45,862.17
Total cane	**342,609.03**	**265,264.56**	**99,608.60**	**207,452.71**	**111,302.30**	**454,821.18**	**142,143.01**	**696,572.70**	**2,319,774.09**
FRI									
Normal cane	96.83	93.23	82.89	99.94	82.39	96.70	90.33	95.33	94.54
Total cane	**96.17**	**91.57**	**81.04**	**99.94**	**81.85**	**95.64**	**89.12**	**92.16**	**92.90**
Diff	0.66	1.66	1.85	-	0.54	1.06	1.21	3.17	1.64

Table 10.12: Comparison of oil consumption (1996/97 - 1998/99)

	M. litres	**Litres/96° Sugar**
1996/97	11.489	53.81
1997/98	11.527	71.06
1998/99	13.291	73.24

Management must be cognizant of this. The entire industry is not well.

Factories must be made accountable for all the sugar received in cane by using the methods available and where possible make personnel responsible for all excessive losses.

Factory operating time is unacceptable. This has been so for many years due to the lack of replacement/upgrading of equipment. This, coupled with improved cane quality and the training of personnel, cannot be delayed any longer.

11 SUGAR TECHNOLOGY

11.1 CLARIFICATION SURVEY

This survey was done to assess the control of the process parameters impacting on good clarification. The factories studied were **Bernard Lodge, Appleton, Hampden** and **Tropicana**.

Bernard Lodge

The phosphate level in mixed juice averaged 255 ppm with the residual phosphate in clarified juice averaging 17 ppm during the period of the survey. The low level of phosphate in clarified juice is an indication of the reaction with lime which kept the level within the threshold of the pH of mixed juice was in the range 7.3 to 8.3 and clarified juice 6.2 to 7.4. Flocculant dosage was 3 ppm on juice. The clarity of the juice was excellent, with turbidity levels in the range of 29 to 60 NTU. Preparation of lime was at 15 Baumé.

The percent suspended solids in mixed juice ranged from 0.65 to 3.0%. Juice heater temperature was satisfactory and ranged between 230 to 232 F. During the period of the survey, rain interrupted the cane supply to the factory on several occasions. The mud level in the clarifier was relatively high but the clarifier was properly operated, hence the good quality sugar.

Appleton

The phosphate level in mixed juice averaged 185 ppm with the residual phosphate in clarified juice averaging 50 ppm. The pH of clarified juice was in the range of 6.3 to 7.0. Lime was prepared at 10 Baumé and the flocculant dosage was 2 ppm on juice.

The percent suspended solids ranged from 0.74 to 1.83% with two clarifiers in operation. For Clarifier No. 1, juice turbidity ranged from 56 to 103 NTU and that of No. 2 ranged from 51 to 157 NTU. The combined pH of juice from both clarifiers ranged from 6.1 to 7.5.

The No. 1 vacuum filter operated with a high vacuum of 10" Hg and a low vacuum of 8" Hg. The No. 2 vacuum filter had only one gauge working, which indicated a vacuum of between 6 to 9" Hg. The water applied to the filter cake was inadequate and the cake was thin.

The quality of the sugar was unsatisfactory with respect to polarisation, colour, dextran and inverts.

Hampden

The clarification survey was conducted over five days during the period April 07 to 14, 1999.

Suspended solids in mixed juice ranged between 0.24 to 0.74%, clarified juice pH was slightly low and the temperature of the heated mixed juice was well below the boiling temperature being in the range 194 to 198 F. The phosphate levels in mixed and clarified juices were not determined.

The vacuum filter was observed to be operating unsatisfactory with low levels of vacuum, insufficient water and bagacillo.

Observations

The canes came in with high levels of extraneous matter. The mills were kept relatively clean. There was a routine wash down and steam out. Cane Milling Aid (CMA) was available but was not applied continuously at the mills.

Press Juices

The average daily dextran concentration in the incoming canes ranged from the lowest (30) to the highest (100) ppm on juice. The daily averages were all below the threshold level of 250 ppm on juice.

Crusher Juice

The daily average dextran concentration in the canes crushed ranged from the lowest (30) to the highest (90) ppm on juice. All values were below the threshold level of 250 ppm on juice.

Mixed Juices

The daily average dextran levels ranged from 30 to 70 ppm on juice. When the values were converted to ppm on brix, there were two days that the dextran levels increased from crusher to mixed juice.

During the period of the survey, the phosphate level in mixed juice averaged 400 ppm, with the residual phosphate in clarified juice averaging 10 ppm. The phosphate level in clarified juice is acceptable and indicates that the retention time allowed for the reaction with lime was sufficient.

Clarified Juice

The daily average dextran levels ranged from 50 to 260 ppm on juice. All but one was below the threshold level of 250 ppm on juice. It was surprising that the daily average dextran levels in clarified juice were higher than crusher and mixed juices on four days on which the study was done.

One major limiting factor observed during this survey was the application of flocculant. The vessel was always found to be empty when examined. One reason

for this happening is that the existing vessel is small (approximately 17 imp. gals).

Sugar Sample

The dextran values were all above the 250 mau level. This is higher than expected from the values in the juices. The sugar quality was disappointing, in particular colour, dextran and inverts.

Conclusion

The results showed that the dextran levels in incoming canes tested were low. Therefore, the canes received were relatively fresh. The sugar values show that there was a build-up of dextran in the factory which is reflected in the high levels in the sugars.

Tropicana

This clarification study was conducted over the period April 26 to May 07, 1999. Analyses for dextran were done on April 28 to 29 and May 05 to 06, 1999.

Observations

The canes came in with a large volume of extraneous matter. The mills were kept relatively clean and there was a routine wash down and steam out. No bactericide was added to the mills.

Pressed Juices

The average daily dextran concentration in the incoming canes ranged from the lowest (21) to the highest (203) ppm on juice. The daily averages were all below the threshold level of 250 ppm on juice.

Crusher Juice

The daily average dextran concentration in the canes crushed ranged from the lowest (30) to the highest (122) ppm on juice. All values were below the threshold level of 250 ppm on juice.

Table 11.1: **Results of core laboratory collaborative testing**

	Juice			Cane		
Factory	**Brix**	**Pol %**	**Purity**	**Pol %**	**Fibre %**	**JRCS**
Frome	19.13	17.56	91.78	14.60	13.47	13.66
B/Lodge	19.65	17.50	89.09	14.50	13.70	13.34
W/Park	19.41	17.43	89.78	13.90	16.03	12.65
Appleton	19.14	17.78	92.86	14.73	13.67	13.85
Average	19.33	17.57	92.86	14.73	13.67	13.85
Std. Dev.	0.21	0.13	1.51	0.32	1.05	0.46
CV	1.11	0.75	1.66	2.20	7.39	3.41

Mixed Juices

The daily average dextran levels ranged from 34 to 126 ppm on juice. When the values were converted to ppm on brix there were three days that the dextran levels increased from crusher juice to mixed. From the raw data, this occurred in the afternoon period when the mills were not washed down.

Clarified Juice

The daily average dextran levels ranged from 43 to 147 ppm on juice, all below the threshold level of 250 ppm on juice.

Sugar Quality

The daily dextran concentrations in sugar ranged from 180 to 225 mau. These values are below 250 mau specification and are expected from the low levels of dextran in juices.

Discussion

The results showed that the dextran levels in the canes tested that are coming into the factory were low. The levels in sugar were all below 250 mau during the trial. The display of low dextran could be due to two reasons:

- The canes coming in at the factory are fresh;
- Dextran needs hot, wet conditions in which to grow. The weather condition at this factory during the study was hot and dry, therefore, the growth of dextran was slow.

The suspended solids in mixed juice ranged between 0.51 - 1.72%. The clarity of the clarified juice was satisfactory, except for one day when the turbidity was in excess of 100 NTU. The pH was satisfactory and so too was the temperature of the juice heater which was observed to be at the boiling temperature of the juice.

The filter operation has room for improvement, with respect to bagacillo supply, application of water and vacuum. It was felt that the high pol in bagacillo might be a contributor to the high pol in filter cake. No phosphate results were made available.

The sugar quality was disappointing, in particular dextran and inverts.

Collaborative Testing - Core Laboratory

Only one comparative trial was done between core laboratories islandwide. The factories involved in this trial were **Frome, Appleton, Worthy Park** and **Bernard Lodge**. Given the natural variability within cane samples, the tests showed the core laboratories maintaining acceptable levels of accuracy and precision in cane testing (*Table 11.1*).

FACTORY AUDIT

Monymusk

An evaluation was done at the core laboratory in order to verify the cane quality reported. The audit revealed that the results reported by this laboratory were accurate and reflected the quality of the raw material entering the factory. These findings would suggest that the reaping practices should be closely examined.

Hampden

This factory reported low FRI values and high losses in the cane yard. An investigation was carried out which examined the core laboratory, cane scales and factory operations.

The established core laboratory procedures and methods with respect to analyses were adhered to. However, there were concerns about the accountability of core sample tickets and weighbills as discrepancies were found. There were also concerns about the number of handwritten weighbills.

The operation of the factory in many areas was not satisfactory. The boiling house and chemical control need proper procedures to be put in place and these procedures monitored in order to improve efficiencies and maintain standards. Assistance was required with respect to high cane yard losses, boiling house operation and chemical control.

Tropicana

This factory reported low levels of FRI and high losses in the cane yard. The factory had concerns about the accuracy of the JRCS being reported.

Cane samples were exchanged between **Tropicana's** core laboratory and another factory labora tory and the JRCS values compared favourably. A comparison was also made between the JRCS generated from Tropicana's core data with the computer at that factory and that of the other factory and the values also compared favourably. Other checks at the laboratory suggested that the laboratory was accurately predicting the cane quality entering the factory.

The high cane yard loss could be influenced by incorrect mixed juice and imbibition water weights, inaccurate analyses of mixed juice and bagasse. There were concerns about the accuracy of these weights and analyses. The low FRI seems to be a consequence of poor operation of the factory.

Sugarex Trial

Two trials were done at **Frome** and **Appleton**. Experimental analysis of the sugarex trial was planned and co-ordinated and the results of the juices treated and the sugar produced evaluated. Indications were that this product had a positive impact on factory performance and sugar quality.

Preliminary study of Octapol with NIR

The Octapol worked effectively in clarifying cane juice at the core. The filter rate was just as fast as lead and the readings were not significantly different from that with lead. However, this product was not found to be suitable for the use with juices from all varieties.

ENVIRONMENTAL ACTIVITIES

For the period January to June 1999, a number of scheduled environmental meetings, wastewater sampling and analyses were conducted at each of the eight sugar factories. The main areas of focus at the first set of environmental meetings were as follows:

- Re-activation of the factory level environmental committees;
- Re-composition of the committees to include representatives from other departments such as health and safety, fields, personnel and distillery, where applicable;
- Identification of all sources of waste generated at the factory;
- Development of flow diagrams and maps of drainage system;
- Investigation of water supply and usage with emphasis on recycling and reuse;
- Development of emergency response plans.
- Proper disposal of waste oils and use of filter cake as a soil conditioner;
- Formation of a pollution control budget;
- Interaction of committee with top management and the holding of regular meetings of the factory environmental committee;
- Providing the NRCA with information on pollution control monitoring (sampling of waste streams at least three times for the year).

Of each of the above-mentioned list of activities, items 1, 2, 3 and 10 have been achieved at all the factories. Only **Frome, Appleton** and **Tropicana** have completed item 4, while with the exception of **Worthy Park**, not much is being done at the factories in terms of item 5. In terms of item 6, **Frome** and **Bernard Lodge** have more or less formulated an Emergency Response Plan. These plans have been combined and a general plan has been formulated which will be adopted and used by all the sugar factories. This plan would however have to be passed by the ODPEM before the factories adopt it. **Tropicana** has submitted a Disaster Preparedness Plan,

while **Appleton** and **Long Pond** are currently working on one of their own.

With respect to item 7, all the factories are properly disposing of their filter cake, except **Bernard Lodge** and **Monymusk**, who are still washing a substantial quantity down the drain. **Bernard** Lodge, however, has indicated at their last meeting held Wednesday, May 19, 1999, that plans have been approved to install another conveyor belt during this out-of-crop period, to take the filter mud to the fields. None of the factories to date has developed a pollution control budget.

Scheduled Wastewater Sampling and Analyses

Wastewater sampling and analyses, as required by the NRCA were done for all the eight sugar factories.

12 ENGINEERING

12.1 INSTRUMENTATION

Assistance was given to:

Long Pond

The drum level transmitter had to be taken out of service and replaced with one from the steam flow transmitter. A few weeks before the end of crop, it started to malfunction again, but was quickly corrected.

The boiler controls were commissioned, but the No. 3 level and steam flow transmitters were out of service. A set of new combustion controls of all three boilers and actuators was installed on all ID and FD dampers. A new pH meter was calibrated, commissioned and the entire system worked perfectly for the rest of the crop.

Hampden

The installation of the evaporator level controls continued and the need for clean, dry air was addressed. All four transmitter control valves and controllers were installed. One I/P current to pressure transmitter was totally damaged and one of the control valves malfunctioned due to the poor air quality supply.

The imbibition water meter was taken out of service for repairs and the No. 2 evaporator level control commissioned.

Monymusk

The No. 8 boiler control was checked and operated satisfactorily. The Donnelly chute level control on the No. 1 mill was commissioned and operated satisfactorily.

CORE SAMPLER MAINTENANCE

The core samplers performed well in most factories except at **Bernard Lodge**, where a number of problems, causing higher than normal downtime. Major problems were experienced at:

Frome

The ejector cylinder seals had to be changed several times, as the piston rods were in need of replacement due to age and damage.

Appleton

There were some electrical problems that damaged another starter at the press.

Bernard Lodge

This unit experienced downtime as a result of:

- worn thread on the plunger and piston rods
- a press cylinder leak
- a number of burst hoses
- a damaged press pump.

All the problems were effectively dealt with.

Worthy Park

There were a few problems with the press at this factory. There was a cylinder leak, an inconsistent gap due to play between the plunger and the piston rod, an internal leak in the cylinder which caused overheating and slippage of the plunger from the "at-rest" position.

Long Pond

A press cylinder was changed and some electrical switches replaced.

Tropicana

The ejector cylinder was changed.

PREVENTATIVE MAINTENANCE

Vibration Measurement

A number of vibration measurement surveys were done during the quarter at **Worthy Park, Appleton** and **Frome**. The trends were studied and used as a guide for the out-of-crop maintenance of units measured at the factories.

Infrared Thermometry

The infrared thermometer was used at **Appleton** and **Worthy Park** factory to determine the condition of various pieces of equipment. This is a simple way to monitor factory equipment as temperature changes are directly related to condition of the machines.

Ultrasonic Thickness Measurement

The ultrasonic thickness tester was used at **Hampden**, **Worthy Park** and **Frome**. This maintenance procedure has become more popular in the industry as a routine check of thickness of pipes, centrifugal baskets, etc.

Out-of-crop Preventative Maintenance

The out-of-crop preventative maintenance programme involved use of the laser alignment procedure for a number of especially high speed machines. Dynamic balancing was a very important procedure, as it has been in the past few years.

12.2 SCALES

All truck scales were checked, calibrated and certified. Serious problems developed on the juice scale at **Monymusk**, and on investigation a bad loadcell was found to be the cause. This was replaced and the scale recalibrated and put back into service. A mechanical Servo Balans scale was completely converted to electronic control using the Servo Balans weighing computer. This scale will be used to weigh the sugar sent to the packaging department.

There was a growing concern about the increasing differences between Ocho Rios and **Monymusk** for sugar shipped to the port. As a result, a calibration check was carried out on the scale at **Monymusk**, which was found to be malfunctioning. During this calibration, it was discovered that the indications at different points on the scale were not the same and this was the cause of the erroneous weights. Further investigations showed that the foundation at the ends of the scale was sinking, and as a result, shims or spacers had to be built to get the scale back to a level plane which is critical to its operation. Two loadcells were also found to be bad at the ends of the scale. These were replaced and the scale calibrated.

Servo Balans - Ocho Rios

The usual servicing and calibration of the Servo Balans was done before each shipment and preventative maintenance checks done during the loading period. This has resulted in no loss time due to scale failures.

Hampden

The Servo Balans was serviced, calibrated and put into service and has been in operation since. This is an achievement as the scale has been put into operation and training of operators and supervisory personnel done many times without success, mainly due to various reasons such as poor air supply and lack of interest being paid to it by maintenance personnel. Presently, personnel are assigned to the scale with responsibility for its maintenance thereby ensuring that it stays in operation.

Long Pond

Repairs to the Servo Balans at **Long Pond** are still continuing. This unit was badly damaged by power surges.

Appleton

The Servo Balans is still out of service due to poor air supply. Other work done during the period consist of the repairing of the ticket printers.

12.3 ENERGY

The energy department was involved in the energy management programmes of some of the factories with the objective to improve efficiency in energy management.

The generation, distribution and usage of steam have always been an integral part of the operation of the factories. There has been a renewed drive to cut back on energy cost, thus no effort was spared to get the boiler running efficiently.

In this light, requests were made by **Frome** and Appleton for assistance after the first series of combustion analyses revealed that their respective boilers were not producing as efficiently as they are required to perform.

Frome

Combustion analyses done in December 1998 revealed that the boilers were operating with CO_2 percent volume in flue gases of between 4.3 to 12.7%, excess air 348 to 58% and efficiency of 64 to 69%. Subsequent to these initial analyses, a request was made to carry out an exercise to improve boiler efficiency.

This exercise was undertaken over a five-day period and arising out of this exercise, the efficiency was increased, ranging from 62.7 to 73.8%, flue gas CO_2 readings increased from 8.2 to 13.2% and excess air reduced from 140 to 52%. Given the circumstances under which this exercise was carried out, the results represent a marked improvement.

There were also a number of useful recommendations coming out of this exercise. These are as follows:

- In order to further enhance good boiler operations, steady state operations must be maintained;
- There is a need for more stringent supervision of boiler operators;
- There is the need for more instrumentation and their proximity to one another must be rationalized;

- There is need for a thorough steam balance to be done to make better analyses of the steam- related problems;
- Dedicating one of the more inefficient boilers to producing the make-up steam required.

Appleton

Combustion analyses were done during January 1999 and a report with the results was discussed with the relevant authorities at the factory. These results revealed efficiency of 67 to 73.6% and CO_2 readings of 9 to 13.5%, with excess air of 112 to 49%. These are fairly good results. Subsequent combustion analyses were done and a report on these results submitted.

Worthy Park

Analyses were also carried out during January 1999, but owing to the malfunction of the combustion analyzer, this exercise will be repeated in the near future.

Tropicana

Analyses were carried out during February 1999, but owing to frequent factory stoppages, the results were inconclusive. This exercise will be repeated. Requests for assistance in energy- related problems were overwhelming, but could not be accommodated.

Hampden

A meeting was held with the General Manager in March 1999, at which time the terms of reference of the involvement of the energy department was discussed. Boiler blow-back and fan settings, steam flow verification and the problems surrounding the inability of the factory to maintain adequate supply of bagasse were the main areas of concern to be addressed.

Investigations started on March 15, 1999 and it was observed that the boilers, especially No. 2 were operating with high blow back, high bagasse pile height and that the chute door regulating the feed of bagasse to the furnaces were jammed and therefore could not properly regulate the bagasse feed. It was also observed that, even after numerous requests were made for sampling points to be put in place, there were none on boiler No. 1.

These observations were discussed in a meeting with senior management and an undertaking was given to have the necessary things put in place by March 19, 1999, at which time the exercise would continue. The factory was visited as planned on that day, but nothing which had been discussed was put in place. The factory was down. The opportunity was taken to install the pitot tube in the steam line and discussions held with the Factory Manager to have copper tube and 110V supply in place for March 22, 1999. When the factory was visited on this day, nothing was in place.

The steam flow meter was finally commissioned on March 30, 1999 and readings showed between 47,000 to 72,000 PPH of steam to the power house and mills.