JAMAICA
SUGAR INDUSTRY
RESEARCH INSTITUTE

Annual Report 1997

Kendal Road, Mandeville
Tel : (876) 962-2241, 962-1287, 961-4408
Fax : (876) 962-1288
e-mail: sirijam@CWJamaica.com

Table Of Contents

STAFF LIST iii

1 PERSONNEL AND TRAINING 1
- 1.1 Staff ... 1
- 1.2 Training ... 1

2 WEATHER 3

3 CANE AGRONOMY 5
- 3.1 Sugarcane Nutrition ... 5
- 3.2 Analytical Laboratory ... 8

4 CROP PROTECTION 12
- 4.1 Entomology ... 12
- 4.2 Weed Control ... 12

5 AGRICULTURAL ENGINEERING 15
- 5.1 Irrigation and Drainage ... 15
- 5.2 Land Development ... 18
- 5.3 Agricultural Mechanization ... 19

6 VARIETY IMPROVEMENT 25
- 6.1 Fuzz and Seedling Production ... 25
- 6.2 Commercial Varieties ... 25
- 6.4 Yield Trials ... 27
- 6.3 Performance of Commercial Varieties ... 27
- 6.5 Planting of Nurseries ... 29
- 6.6 Experiments Planted ... 30
- 6.7 Biotechnology ... 33

7 ECONOMICS & STATISTICS UNIT 36
- 7.1 Irrigated Areas ... 36
- 7.2 Rainfed Areas ... 37
- 7.3 Cost of Cane Production, 1995 - 1996 ... 37

8	AGRICULTURAL PRODUCTION & EXTENSION SERVICES	40
8.1	Weather Impact	40
8.2	Cane Production	40
8.3	St. Catherine	42
8.4	St. Thomas Ye-Vale	44
8.5	Clarendon Area	44
8.6	Dry North Coast	46
8.7	Wet West	48
8.8	Wet East	50
9	ELECTRONIC DATA PROCESSING	53
9.1	Factory Division	54
10	REVIEW OF FACTORY OPERATIONS	55
10.1	Sugar Production (1992 - 1997)	55
10.2	Factory Performance	56
11	SUGAR TECHNOLOGY	60
11.1	Environment	61
12	ENGINEERING RESEARCH	63
12.1	Instrumentation	64
12.2	Scale	64
12.3	Computerization	65
	END TABLES	66
	CANE YIELD SURVEY	71

SUGAR INDUSTRY RESEARCH INSTITUTE

Mr. Michael Hylton* - Director

CENTRAL SERVICES

ADMINISTRATIVE SERVICES

K.M. O'Gilvie	Office Manager
B. Spencer*	Secretary
J. Seaton	Executive Secretary
R. Uter*	Accountant
A. Fearon	Clerk
D. Hepburn	Typist/Receptionist
C. Johnson	Driver
V. Blake	Custodian
D. Baker	Office Helper
J. Vassell	Secretary
M. Bonnick	Jnr. Secretary
D. Brown	Driver
M. Francis	Driver
P. Campbell*	Office Assistant
E. Spencer	General Assistant
Y. Lurch	Office Assistant
D. Gowans	Temporary

CHEMISTRY LABORATORY

H. Thompson	Agricultural Chemist
M. Wilson Ph.D.	Chemist/Lab Manager
A. Lawson	Snr. Lab. Analyst
P. Meikle	Laboratory Analyst
D. Ritchie*	" "
F. Steer	Laboratory Analyst
M. McDonald	" "
G. Schloss-Allen	" "
M. Campbell	" "
A. Williams	" "
J. Saunches	General Assistant
O. Lurch	" "
J. Dennis	Laboratory Assistant

ELECTRONIC DATA PROCESSING

O. Brown	Head - Computer
M. Williams	Programmer/Analyst
V. Morris	" "
D. Montgomery*	Asst. Programmer
W. Edwards	Computer Analyst
L. Lewis	Data Processing Analyst
B. Williams	" " "

ECONOMICS & STATISTICS

C. Woolery	Agri. Economist
V. Smith	Statistical Clerk
Y. Beezer	" "
L. Hall	Consultant
D. Stanford	"

AGRICULTURAL SERVICES DEPARTMENT

Mr. Trevor Falloon - Agricultural Services Manager

EXTENSION

D. Little	Head - Extension Services
M. Curtis	Snr. Area Agronomist
P. Wright	Area Agronomist
M. Lewis	" "
E. Henry	" "
P. White	" "
D. Golding	" "
M. Prince	Extension Agronomist
J. Fearon	Snr. Area Extn. Officer
W. Senior	Extension Officer
L. Robinson	" "
C. Reid*	" "
K. Chandon**	" "
W. Fray	Extension Agronomist

ENGINEERING

L. White	Snr. Agri. Engineer
L. Pinnock	Field Officer
K. Grant	Asst. Field Officer
C. Brown	" " "
C. Lawson	Draughtsman/Asst. Surv.
L. Agra	Consultant

AGRONOMY

M. Bennett-EasyHead,	Variety Dept.
A. Lyle**	Field Assistant
K. McPherson	Snr. Field Officer
C. Coleman	Field Assistant
R. Dixon	Asst. Field Officer
S. Mitchell	Bio Technologist
O. Brown	Field Asst. (Temp)
D. Wright	Field Officer
C. Fearon	Nutrition Agronomist
L. Collins	General Asst. (Temp)

FACTORY SERVICES DEPARTMENT

J. Jaddoo - Factory Services Manager

ENGINEERING

M. Christopher	Sup - Instrument Technician
B. Wilson	Instrument Technician
J. Williams	" "
H. Cole	Foreman
A. Hinds	Welder/Mechanic
P. Ellis	Machinist
S. Roman	Technician
W. Morgan	Workshop Asst.
B. Smith	Consultant

SUGAR TECHNOLOGY

L. Brown	Snr. Sugar Techn.
A. Welsh	Assistant Chemist
M. Donaldson	Sugar Technologist
D. Lewis	Research Techn.
G. Bent	Energy Technologist
A. Wright*	Research Techn.
D. Shady	Technical Assistant
A. James	" "
R. Lee	Mechanic
S. Watson	"

* - left during the year
** - on study leave

1 PERSONNEL AND TRAINING

1.1 STAFF

Overseas Visits

Messrs. Michael Hylton, Director of Research and Trevor Falloon. Agricultural Services Manager attended the annual meeting of the Technical Committee of the Sugar Association of the Caribbean (SAC) in Guyana. The main focus of the meeting was the planning of the upcoming Conference of the West Indies Sugar Cane Technologists (WIST).

Messrs. Trevor Falloon and Edmond Lewis attended a Seminar on Weed Control and Sugar Cane Ripeners in the Dominican Republic, June 8-11, 1997.

Edmond Lewis attended a course entitled, "Research Methods for Agricultural Experimenters", at the University of Reading, England from July 9 to September 16, 1997.

Messrs. Trevor Falloon, Easy, and McPherson attended the Annual Cane Breeding Workshop at the West Indies Central Cane Breeding Station in Barbados from September 17 to 19, 1997.

SIRI was represented by Messrs. Trevor Falloon, Malcolm Easy, Clarence Fearon, Michael Christopher, Varden Morris and Mrs. Sylvia Mitchell at the WIST Conference in Georgetown, Guyana from September 22-26, 1997.

Donna Lewis attended a Sida International Training Programme on "Total Quality Management" in Sweden, from September 2 to October 10.

Arrivals

Ms. Janice Seaton joined the Institute as Executive Secretary to the Director on January 13, 1997. On December 19, 1997, Ms. Nesta Kerr joined as Receptionist.

Departures

The following persons departed the Institute during 1997:

Mrs. B. Spencer, Director's Secretary on May 2; Mr. M. Hylton, Director of Research on June 19; Mr. C. Reid, Extension Officer on September 17; Mr. D. Montgomery, Asst. Programmer, on October 24; Mr. D. Ritchie, Laboratory Technician, on October 24; Ms. P. Campbell, Office Helper on November 24; and Mrs. R. Uter, Accountant on December 31.

1.2 TRAINING

SIRI hosted a Seminar entitled "Operating Strategies for Improved Productivity in the Jamaica Sugar Industry" on February 5, 1997. Ninety-four persons Industry-wide attended.

Mr. Mark Williams attended a Microsoft Windows NT 4.0 Training Course at TrainX, April 7-11, 1997.

Mr. Michael Hylton attended a Seminar entitled "Feasibility Studies & Project Analysis", at the Mona Institute of Business on April 10 and 11, 1997.

A Seminar entitled "The Operation and Maintenance of Tractor and Transport Equipment" was held at SIRI on April 9, 1997. This was attended by Transport Managers from factories islandwide.

Mrs. Dornette Hepburn attended a training course in Microsoft Excel 5.0 at Computer Creations in May, 1997.

Mr. Cuthbert Lawson attended a training course in Supervisory Management at JAMPRO from August 18-29, 1997.

Mrs. Dornette Hepburn and Ms. Janice Seaton attended the Jamaica Professional Secretaries Association Annual Convention at the Wyndham Rose Hall Hotel from October 3-4, 1997.

Mr. Warren Edwards attended the Annual Jamaica Computer Society Conference at the Jamaica Grande Hotel from October 30 to November 2, 1997.

The Sugar Cane Processing course at the UWI, Mona consisting of lectures and a field trip was attended by 20 final-year students during the year. A member of staff of **Tropicana** was trained in sugar technology.

The annual summer training programme commenced on July 28, 1997 and was completed on September 5, 1997. Only four of nine courses planned were held. Five were canceled due to financial constraints. The courses were conducted with the assistance of the University of Technology (UTech), HEART/NTA and persons from within the Sugar Industry.

Thirty-three persons participated in the summer course, this was an 87% reduction from the previous year. **Hampden** again did not participate. The Mechanical Technician Certificate course over two summers was completed. Successful participants should be eligible to sit the National Certificate Examination.

The following is a breakdown of the courses held and the number of participants:

Mechanical Technician Certificate	-	10
Industrial Hydraulics	-	7
Laboratory Techniques	-	8
Industrial Instrumentation	-	8
Total	-	33

Technical Papers

Papers presented by members of staff at the 59th Annual Conference of the JAST, held on November 3-5, 1997 were:

- ✍ "Review of the 1996/97 Sugar Crop" *by✍D. Little/ J. Jaddoo.*
- ✍ "Comparative Costs of Cane Harvesting in the Caribbean" *by T. Falloon.*
- ✍ "Sugar Industry Environmental Action Plan" *by Dr. M Barrett/J. Jaddoo/H. Lung Kit/M. Brooks.*
- ✍ "Prospects for Increased Sugar Cane Production" *by P. Wright/W. Fray/W. Senior/J. Fearon/D. Golding/M. Curtis.*
- ✍ "Cost Trends of the 90's and Implications for the Sugar Cane Growing Sector" *by C. Woolery.*
- ✍ "Trends in Sugar Cane Productivity in Jamaica 1986-1996" *by M. Bennett-Easy/K. McPherson/D. Wright.*
- ✍ "Outlook on Chemical Ripening in Jamaica" *by E. Lewis.*
- ✍ "Response of Varieties to Nitrogen in the Irrigated Plains" *by C. Fearon/O. Brown.*
- ✍ "Reduced Tillage, A Path to Improve the Establishment Cost" *by L. Oliva./T. Falloon.*
- ✍ "Development of a Viable Sugar Cane Microprogation System for use in the Jamaican Sugar Industry" *by S. Mitchell.*
- ✍ "Review of Irrigation Water Quality 1994-1997" *by M. Wilson.*
- ✍ "Experiences with Drip Irrigation at Monymusk" *by L.White/T. Beaumont.*

Visitors

Visitors to the Institute during the year included Mr. Bill MacMillan from Steel Test (Pty) Ltd, South Africa; Mr. Robert Duin from Yosoy Chemicals; Dr. David Lee from CaribEcosystem; Mr. Thomas Salvador from Monsanto Chemical Company; Dr. Kennedy from the West Indies Central Cane Breeding Station; Martha Pajori & Antolin Hilez - Cuban Students; Mr. Armando Hechavarria from Tecnoazucar.; Ms. Egene Latchman & Mr. Lionel James from the Caribbean Development Bank and Eduardo Bastilda & Anitol Cenfriegas from the University of Cunfurgas, Cuba.

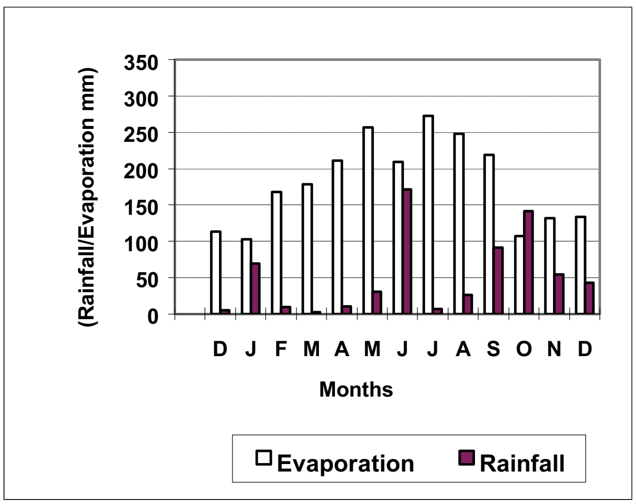
2 WEATHER

In the first half of 1997 Jamaica, under the influence of the el niño phenomenon, was said by meteorologists to have recorded the worst drought in nearly 70 years. This was reflected by the substantial moisture deficits recorded throughout most of the Industry, with the notable **exception of Frome** which actually recorded surpluses **for every month except March and April and,** *Fig. 2.1.* Irrigated areas such as **Monymusk**, **Innswood** and **Bernard Lodge** were particularly hard hit failing to receive 25 mm (an inch) of rainfall for consecutive months from February to May, *End Table 3.* May, the traditional rainy month, saw the Irrigated area receiving less than a fifth of the 30-year mean rainfall.

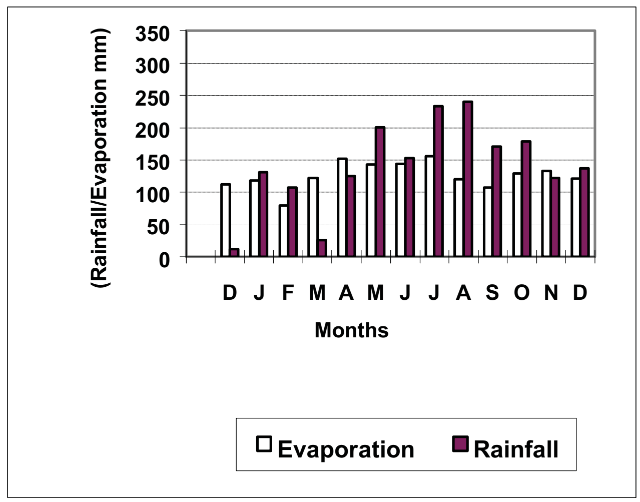
Rainfall pattern changed dramatically in the second half of the year to create moisture surpluses in several months for most factory areas. So radical was the shift that the Central Uplands (along with the Wet West) ended with annual rainfall in excess of the respective 30-year means.

The concentration of rainfall in the second half of the year stimulated late growth and was expected to adversely affect juice quality at the start of the 1997/98 crop. Failure of the spring rains was also expected to have negative impact on cane yield in most areas.

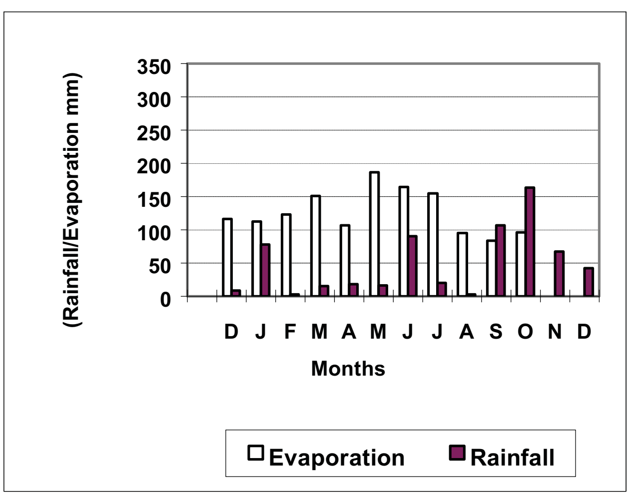
Fig. 2.1 Water Balance Data - December 1996 to December 1997



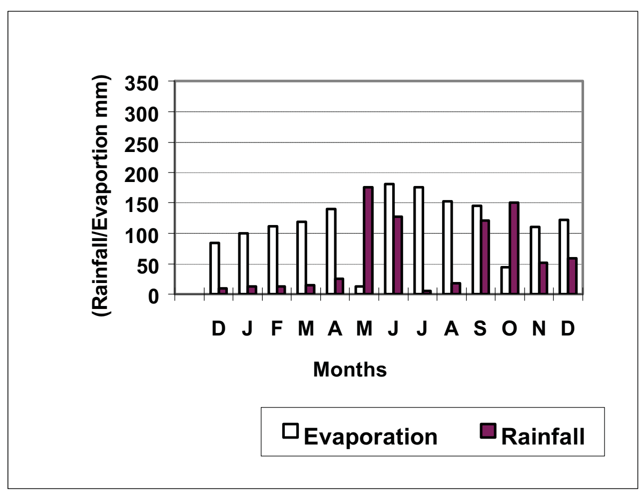
Bernard Lodge



Frome

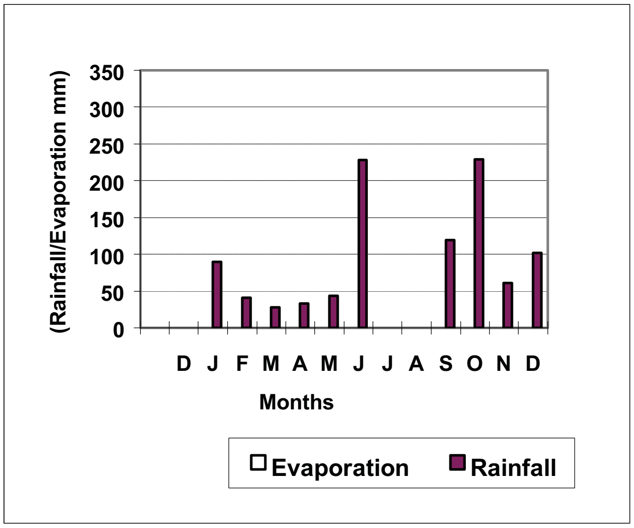


Innswood

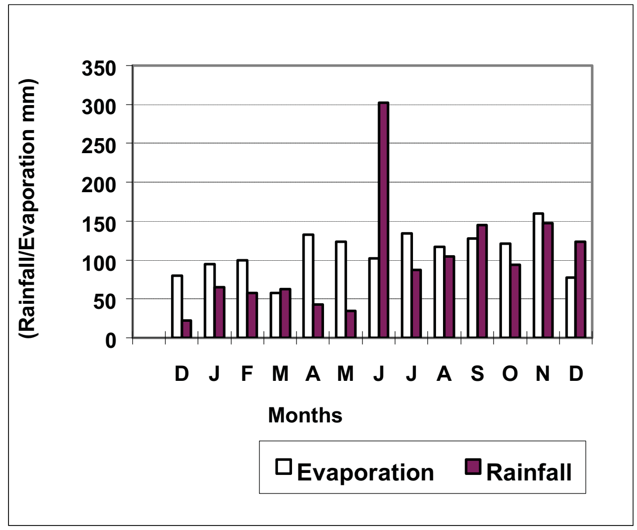


Monymusk

Fig. 2.1 Water Balance Data, cont'd



Tropicana



Worthy Park

3 CANE AGRONOMY

3.1 SUGARCANE NUTRITION

Varieties x Nitrogen

Evaluation was made of the nitrogen requirements of four commercial varieties on the SIRI experiment farm, **Monymusk**, harvested as first ratoons. The nitrogen recommendation for this area is 90-100 kg N/ha supplied by 550-600 kg/ha of 17-0-17 fertilizer.

An increase in fertilizer dosage from 90 to 120 kg N/ha did not bring about sugar yield increases in BJ7015, BJ8226 and BJ82119, *Table 3.1*. In the case of BJ7314 however, there was an increase from 13.84 to 15.08 ts/ha as a statistically significant increase in cane yield, was not at the expense of cane quality, *Table 3.2.*

Split applications of N made at 3 and 10 weeks after harvest did not result in greater sugar recovery except with BJ7015 which showed a marginal increase brought about mainly by increase in cane tonnage. Current practice of early, single application is therefore justified.

The depressed %pol and %JRCS with split applications, except with BJ7314 (*Table 3.2*), further support the view that this practice can be disadvantageous. Single dressings of nitrogen above 90 kg/ha also tended to result in depressed %pol and to some extent, JRCS.

Higher leaf nitrogen in the third visible dewlap (TVD) at 5 months for BJ7015 and BJ82119, from single dosage of 120 kg N/ha, tended to result in lower sugar recovery at harvest. Highest sugar recoveries coincided with leaf nitrogen levels of 1.55 for BJ7015 to 1.58% for BJ82119.

Dry North Coast

Similar evaluations of the nitrogen requirement were made at **Long Pond** on plant canes, reaped at 12 months. No statistically significant yield increase was obtained at N dosages above 80 kg N/ha for BJ7015, BJ8226, BJ82119 and BJ7548, *Table 3.3*.

With each variety there was a tendency towards reduced JRCS at the higher N dosages, *Table 3.4*. The favourable yields obtained in this trial were attributable mainly to very good crop establishment and fair rains during early growth stages, although rainfall received for the 12-month period was only 861 mm, or less than the average annual rainfall of 1162 mm for **Long Pond**.

Soil Nutrient Status

A soil nutrient evaluation, utilizing data from the computerized database, was conducted by way of careful examination of the **New Yarmouth** records covering the period 1987-1996 to determine the appropriateness of the fertilizer grades used. The study comprised 206 fields or approximately 830 ha on Farms 1, 2 and 3.

Phosphorus

On Farm 1, of 102 fields sampled, 65% were rated moderate to very high in phosphorus, *Table 3.1*. Some 23% of Farm 2 and 49% of Farm 3 fields fell in this category.

Table 3.1: Cane and sugar yields in response to varying nitrogen rates, Springfield, Monymusk

	BJ7015		BJ8226		BJ82119		BJ7314	
kg/ha	tc/ha	ts/ha	tc/ha	ts/ha	tc/ha	ts/ha	tc/ha	ts/ha
50	76.30	10.00	85.42	11.10	75.82	10.39	88.28	12.97
90	82.04	11.01	100.75	12.86	86.66	12.07	96.60	13.84
90 *	91.84	11.88	87.15	10.89	91.05	11.57	93.83	13.58
120	89.87	10.75	81.95	10.26	87.55	11.15	104.28 **	15.08 **

SED(tc) 1.75 LSD .05 (tc) 3.55
SED(ts) 0.25 LSD .05 (ts) 0.51
* Split applied on a 50:50 basis at 3 and 10 weeks after reaping.

Table 3.2: Percent pol and JRCS of varieties (first ratoons) in response to nitrogen rates Springfield

	BJ7015		BJ8226		BJ82119		BJ7314	
kg/ha	Pol %	JRCS	Pol %	JRCS	Pol %	JRCS	Pol %	JRCS
50	18.16	13.17	18.46	13.02	18.42	13.72	20.35	14.75
90	18.59	13.46	18.25	12.80	19.14	13.92	19.88	14.35
90 *	18.45	12.96	17.81	12.52	17.59	12.75	20.31	14.50
120	17.28	12.02	17.85	12.56	18.24	12.82	19.88	14.53

SED (pol %) 0.191 SED (JRCS) 0.162
LSD.05 (pol %) 0.39 LSD.05 (JRCS) 0.33
* Split application on 50:50 basis at 4 and 10 weeks after reaping.

Table 3.3: Plant cane yields of 4 newer varieties in response to varying N rates, at 12 months, Hyde Hall, Long Pond

	BJ7015		BJ8226		BJ82119		BJ7548	
kg N/ha	tc/ha	ts/ha	tc/ha	ts/ha	tc/ha	ts/ha	tc/ha	ts/ha
50	107.76	14.90	100.27	11.85	95.47	14.84	112.97	14.86
80	118.51	16.10	113.42	13.96	104.27	15.8	121.15	16.07
100	112.38	14.40	115.08	14.81	103.73	15.47	109.83	15.1
120	102.72	11.60	108.27	13.64	100.5	13.82	101.58	12.99

SED (tc) 2.02 (ts) 0.34 LSD.05 (tc) 4.17, (ts) 0.70

Table 3.4: JRCS of 4 newer varieties in response to varying N rates, Hyde Hall, Long Pond

	BJ7015	BJ8226	BJ82119	BJ7548
kgN/ha	JRCS	%JRCS	%JRCS	%JRCS
50	13.84	11.85	15.54	13.22
80	13.49	12.34	15.17	13.28
100	12.87	12.86	14.91	13.79
120	11.4	12.58	13.77	12.81

SED 0.21 LSD .05 0.43

Potash

Approximately 75% of Farm 1 fields were moderate to very high in potash as against only 19% of Farm 2 and 56% of Farm 3 fields.

The study reflected high levels of adequacy of phosphorus and potash on Farm 1, which justifies the use of mainly zero phosphate and potash grades, i.e. sulphate of ammonia only. This favourable nutrient status is due, to some extent, to occurrence of loams having high reserves of phosphorus and potash. It should also be noted that the practice of discharging dunder, and at one time filter cake, into irrigation water would have contributed to maintaining potash reserves.

Farm 1 ratoon fields should therefore be treated with 500-525 kg/ha sulphate of ammonia as main dressing and specific ratoons showing phosphorus and/or potash shortage, 600 - 625 kg/ha 17-0-17 or 16-9-18.

In contrast, the majority of fields at Farm 2 and 3 were low in potash. Hence the frequent recommendation of 600 - 625 kg/ha 17-0-17 on these clays.

Similar evaluation at **Monymusk**, *Table 3.6*, showed generally high to very high potash reserves for most of the areas. Fields could therefore be treated with sulphate of ammonia alone for a period without reflecting potash shortages. However the areas of Dry River, Raymonds, Springfield, Milk Spring and St. Jago showed low potash levels that would require maintenance dressings. The area for which withdrawal could not be recommended was potash deficient acidic clays and calcareous loam of St. Jago. A dressing of 65 kg/ha seemed appropriate for Dry River, Raymonds, Springfield and Milk Spring and 85-100 kg/ha at St. Jago.

Tropicana

At **Tropicana**, the focus was on leaf analyses over the period 1990-1996. The most frequent recommendation for ratoons in the area is for 550-625 kg/ha 16-9-18 or 17-0-17. Nitrogen deficiencies were recorded in only 3% of a total of 33 fields sampled at Cheswick (*Table 3.1*) but relatively high incidences of N deficiency were found at Duckenfield, 36%, and Spanish Wood 28% of fields.

The phosphate levels appeared satisfactory at Duckenfield, 4% of fields deficient, and Cheswick where all were adequately supplied. However, Spanish Wood reflected 15% of fields to be phosphate deficient. Apparent high phosphate reserves at Duckenfield and Cheswick support the application of phosphate to plant cane only.

Potash deficiencies appeared relatively high at Duckenfield, 35%, and Spanish Wood, 48%.

Further evaluations, involving laying down of formal experiments and routine leaf sampling, were in progress at Tropicana.

Table 3.5: Phosphorus and Potash status of fields sampled at New Yarmouth, 1987-1996.

Farm	No. of Flds	ppm P_2O_5	Mod - V high	V low-medium
1	102	211	65	35
2	57	49	23	67
3	26	91	49	51
		ppm K_2O		
1	102	301	75	25
2	57	172	19	81
3	26	232	56	44

NB Moderate - very higl >220 ppm $K_2O > 80$ppm P_2O_5
Very low - medium: <220 ppm $K_2O > 80$ppm P_2O_5

Composting

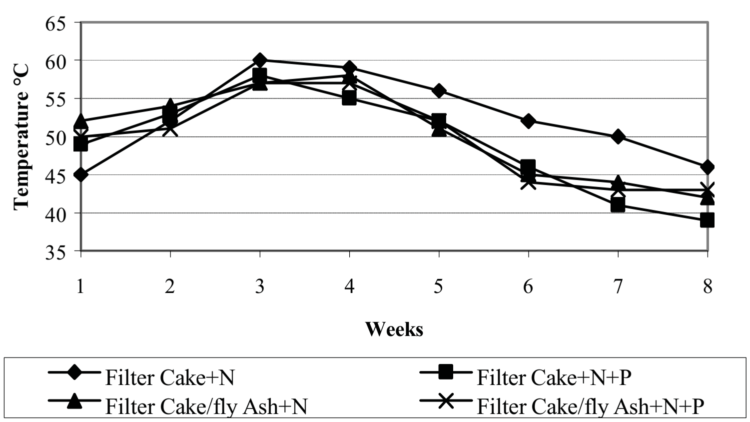
The composting programme using filter cake and fly ash which began at **Bernard Lodge** continued with efforts to determine whether additions of phosphorus would accelerate the composting. It is known that phosphorus is essential for the decomposing microbes.

Table 3.6: Soil potash status of areas of Monymusk, 1986- 1996

Area	No. flds	ppm K_2O	% Mod-V high	% Low-medium
Morelands Hillside	63	263	97	3
Bog Dry River	56	250	92	8
Raymonds Ashley Hall	25	257	32	68
Caswell Hill Heathfield	73	256	79	21
Vizzard Run	31	227	87	13
Greenwich	39	252	82	18
Mumby Exeter	33	248	91	9
Paradise Springfield	184	272	85	15
Milk Spring	156	229	45	55
Comfort Hall	10	221	60	40
St. Jago	24	173	12	88

NB Low - medium: <220 ppm K_2O
Moderate - very high: >220 ppm K_2O

Fig. 3.1: Mean weekly temperature of compost piles during composting stages at Bernard Lodge



Four compost piles of filter cake with or without fly ash, each of approximately 5 tonnes, were laid out on May 21, 1997.

Nitrogen, in the form of urea, was added at 5 kg/t of compost (0.25% N) was added to Pile 1(filter cake) and Pile 3 (filter cake +fly ash). Pile 2 (filter cake) and Pile 4 (filter cake + fly ash) received 3.30 kg urea + 2.5 kg diammonium phosphate/t of compost (0.25% N + 0.12% P_2O_5). The piles were manually turned every 3 days.

Up to the end of week 2, the surface of compost piles exhibited a grey appearance and mushroom growth was more numerous in Piles 1 and 2, probably as a result of the higher water contents of the piles which contained filter cake without fly ash.

Moisture content by week 2 varied from 66% for filter cake with nitrogen and phosphorus added (Pile 2) to 74% for filter cake with nitrogen (Pile 1). By week 3 patches of grey were less evident and piles were becoming light to dark brown in appearance. At week 4 moisture content of the piles remained just above 50% although water was not added and no rains had fallen since the beginning of the composting period. Droplets of water could be extracted by squeezing the compost between the thumb and index finger. Water was added twice weekly during weeks 5, 6, 7 and 8 as moisture content at the beginning of week 5 had fallen below the acceptable level of 50%.

Maximum temperature within piles developed at weeks 3 to 4 and fell gradually thereafter up to week 8. Filter cake with nitrogen added showed an initial 45°C which rose to 60°C by week 3. Pile 2 with phosphorus added reached a maximum of 58 °C by week 3 falling to 39°C by week 8. The peak temperatures were indications of high microbial activity and the lowered temperatures towards week 8 marked the end of the decomposing process.

Phosphorus content of the finished product, *Table 3.6a*, was higher for Piles 2 and 4 to which inorganic phosphorus was added. However phosphorus was generally lower in piles containing fly ash.

There was a dramatic rise in carbon/ nitrogen (C/N) ratio by week 4, presumably the result of microbial activity and nitrogen depletion. All piles were within the acceptable C/N ratio of 20 or less and where phosphorus was added lowest C/N ratios of 14-15 was recorded by week 6.

Compost Trial

Compost produced was tested as a source of nutrients, or soil ameliorant for sugar cane.

Comparisons were made among composts, standard inorganic fertilizer (350 kg/ha 14-28-14+ 300 kg/ha 17-0-17) and 40 t/ha fresh filter cake + standard.

Cane tonnage for BJ7504 was 113.10 t/ha with the application of fresh filter cake in addition to standard inorganic dressing compared with 126.34 tc/ha for plots treated with 7 t/ha compost B in combination with inorganic fertilizer, *Table 3.8*. There seemed to be little merit in reducing usual fertilizer rate when 7 t/ha of compost was applied, as cane tonnage for BJ7504 was appreciably lowered where standard dressing was reduced by 50%.

Although JRCS for BJ78100 was over 1 unit higher when inorganic fertilizer was reduced by 50% and applied with compost A, sugar recovery was merely 0.74 t/ha higher with the increased cane tonnage obtained with 100% standard in combination with compost A.

The more vigorously growing BJ7504 responded more favourably to compost added to standard inorganic dressing in this preliminary trial.

Table 3.6a: Percent P_2O_5 (dry matter) of compost piles during composting stages at Bernard Lodge.

Compost Piles	Wk2	Wk4	Wk6	Wk8
Filter Cake+N	6.6	6.3	6.3	5.9
Filter Cake+N+P	7.2	6.4	6.5	6.1
Filter Cake/fly Ash+N	6.2	5.0	5.9	5.0
Filter Cake/fly Ash+N+P	6.2	5.8	6.3	5.6

Table 3.7: Nutrient status of ratoon leaf submitted from Tropicana during 1990-1996.

Farm	No. Flds	Nutrient	% Adequate	% Deficient
Duckenfield	80	Nitrogen	64	36
		Phosphate	96	4
		Potash	65	35
Cheswick	33	Nitrogen	97	3
		Phosphate	100	0
		Potash	94	6
Spanish Wood	61	Nitrogen	62	28
		Phosphate	85	15
		Potash	52	48

Adequacy Levels

Nitrogen	- 1.55% and above
Phosphate	- 0.40% and above
Potash	- 1.30 and above

Table 3.8: Carbon/nitrogen ratios of compost piles during composting stages at Bernard Lodge

Compost Piles	Wk 2	Wk 4	Wk 6	Wk 8
Filter Cake+ N	21	85	18	11
Filter Cake +N+P	15	58	15	10
Filter Cake/Fly Ash+N	22	67	16	14
Filter Cake/Fly Ash+N+P	19	73	14	13

Table 3.9: Yields of 12 month-old BJ7504 and BJ78100 in response to varying rates of compost, Field 05, Innswood.

Treatments	tc/ha	JRCS	ts/ha
BJ7504			
350 kg/ha 14-28-14			
+300 kg/ha 17-0-17	113.80	9.56	10.85
Standard + fresh filter cake	113.10	9.91	11.17
50% Standard+Compost A	105.49	9.89	10.38
50%Standard+Compost B	96.11	9.72	9.28
100% Standard+Compost A	126.34	9.63	12.14
100% Standard+Compost B	120.11	9.66	11.52
BJ78100			
350 kg/ha 14-28-14			
+300kg/ha 17-0-17	86.99	11.52	9.94
Standard +fresh filter cake	90.55	11.84	10.64
50% Standard +Compost A	81.23	11.57	9.37
50% Standard +Compost B	86.12	11.10	9.56
100% Standard +Compost A	97.50	10.43	10.11
100% Standard +Compost B	91.36	10.92	9.90
S.E.D.	3.10	0.39	0.56
L.S.D.05	6.47	0.81	1.17

3.2 ANALYTICAL LABORATORY

Production

The Laboratory completed 37 471 determinations for the year 1997 as shown in *Table 3.10*. This was an increase of 9.8% over the 1996 production figure. There was a significant increase in water analyses, by 31.4%, and this could be due to the severe drought experienced by the industry.

Evaluation of Laboratory Method

The SIRI's Laboratory continued to participate in the leaf tissue and soil material exchange programmes conducted by Wageningen University of the Netherlands. This is an on-going effort by the Central Laboratory to maintain precision and accuracy in laboratory analytical techniques. In this year, the University of Wageningen collected and statistically processed results from 218 laboratories in 62 countries that participated in the Plant Tissue Exchange Programme and from 300 laboratories in 73 countries that participated in the Soil Material Exchange Programme. The results were published along with the mean and median values, as well as the average and standard deviations for each element determined, after discarding 10 to 15% of the values submitted as being statistically unacceptable.

Leaf tissue material was analysed for Kjeldahl nitrogen, total nitrogen, phosphate, potash, calcium, magnesium, boron, copper, manganese, iron and zinc while soil material was analysed for pH (water), pH ($CaCl_2$), calcium, magnesium, potash and sodium ions by ammonium acetate extraction and potassium, magnesium, sodium and phosphate by calcium chloride extraction. Additional determinations were for cation exchange capacity (CEC), electrical conductivity(EC) and percentage calcium carbonate.

Plant Tissue Exchange

For 1997, 77.2% of SIRI's values for the analyses conducted on the samples received fell within the accepted limits of average ± two standard deviations. This was a small increase on the 76% achieved for 1996. For the micronutrients, nitrogen, phosphate and potash 86.1% of results were acceptable with total nitrogen at 83.3,

Table 3.10: Analyses conducted in the Laboratory for 1997

Analysis	**Leaf**	**Soil**	**Cane juice**	**Water**	**Sugar**	**Molasses**	**Comp.**	**Fert**	**Lime stone**	**Corn**	**Total**
Organic Matter	237	188					63				488
Nitrogen	2 208	624	196	10			62	6			3 106
Phosphate	1 476	1 272	196	1			124				3 069
Potash	1 220	1 358	196	1 005			121	3			3 903
pH		1 474		1 008			61				2 543
Sodium		946		1 005			16				1 967
Calcium	683	953		1 005			120		7		2 768
Magnesium	445	956		1 005			121		7		2 534
Chloride		56		1 003							1 059
Brix			839			396					1 235
Pol			839		2 390	202					3 431
Sucrose						52					52
Reducing Sugar				11	2	52					65
Electrical Conductivity		131		1 004							1 135
Moisture	1 709	65			2 390		45			7	4 216
Ash	205				356	200					761
C.E.C.		46									46
Mechanical Analysis		107									107
Carbonates		42		1 003							1 045
Bicarbonates		38		1 003							1 041
Lime Requirement		14									14
Sulphates				1							1
Micro-nutrients	1 127	332					6				1 465
Grain Size					233						233
Insoluble Solids					368						368
Colour					562						562
Dextran					242						242
$CaCO_3$		8							7		15
Total	**9 310**	**8 610**	**2 266**	**9 064**	**6 543**	**902**	**739**	**9**	**21**	**7**	**39 472**

phosphate 79.1 and potash at 100%. For calcium and magnesium together, 68.7% were acceptable, with magnesium only at 87.5%. Boron values were 75% acceptable as also were copper, iron and manganese at a low overall of 62.5%. Zinc had a 91.7% acceptability. The atomic absorption spectrophotometer used in the determination of most of the elements was overhauled in 1997 and so much improved results are expected in 1998. The laboratory also acquired a lamp for the determination of iron. This should facilitate greater accuracy in iron determinations.

Soil Sample Exchange Programme

For 1997, in the Soil Material Exchange, scores of 100% were obtained for potassium and sodium by ammonium acetate extraction and 83.3% for pH (water), and calcium by ammonium acetate extraction. Acceptable values for $CaCl_2$ extraction of potassium, magnesium and sodium were disappointingly low at 44.4%. This could have been due to the fact that $CaCl_2$ is a weak extracting solution and could have resulted in only a partial extraction of the ions being achieved.

Collaborative Testing of Raw Sugar and Final Molasses

The collaborative testing of raw sugar and final molasses organised by the Laboratory was continued. Samples were sent to all eight Sugar Factory Laboratories. The Jamaica Bureau of Standards(JBS) was asked to do the analyses as a check. The latter was used because the results for pol obtained by SIRI's Laboratory in the past were consistently higher than those obtained by the Factory Laboratories. Determinations of pol in sugar and molasses, moisture in sugar and brix of molasses were carried out. The results for the two tests completed are shown in *Tables 3.11 and 3.12*. Letters are used to represent the Factory Laboratories.

Table 3.11: Results of the first collaborative test 1997

Lab	Sugar Pol			Avg.	% Moist	Molasses Pol			Avg.	Brix	Purity
SIRI	97.22	97.26	97.36	97.28	0.68	29.22	29.04	29.30	29.19	89.90	32.47
JBS*	-	-	-	97.33	0.81	-	-	-	-	-	
Lab. C	96.39	96.00	96.54	96.31	0.75	29.04	28.78	29.04	28.95	89.40	32.38
Lab. D	96.88	96.84	96.86	96.86	0.85	29.04	28.86	28.95	28.95	87.28	33.17
Lab. E	96.82	96.82	96.84	96.82	0.92	29.04	29.04	29.04	29.04	89.40	32.48
Lab. F	Did not participate in this test.										
Lab. G	95.88	95.92	95.92	95.91	0.42	29.66	30.01	29.92	29.86	89.00	33.55
Lab. H	96.68	96.60	96.63	96.64	0.50	29.76	30.40	30.09	30.08	89.40	33.65
Lab. I	96.66	96.66	96.80	96.71	0.61	30.36	29.48	29.04	29.63	89.60	33.07
Lab. J	96.64	96.61	96.62	96.62	1.60	35.53	35.64	35.73	35.63	87.40	40.77

*The Jamaica Bureau of Standards(JBS) was asked to analyse the samples as a check, they did not participate in the collaborative testing.

Table 3.12: Results of the second collaborative test 1997

Lab	Sugar Pol			Avg.	% Moist	Molasses Pol			Avg.	Brix	Purity
SIRI	97.50	97.60	97.62	97.57	0.59	28.25	28.16	28.25	28.22	83.26	33.89
Lab. C	97.50	97.44	97.45	97.46	0.59	26.97	27.28	27.20	27.15	84.40	32.17
Lab. D	97.18	97.14	97.14	97.15	0.76	29.36	29.04	28.80	29.07	84.40	34.44
Lab. E	97.70	97.70	97.68	97.69	0.60	27.20	27.20	27.20	27.20	84.80	32.08
Lab. F				97.80	0.74				25.96	85.60	30.33
Lab. G	95.74	95.82	95.88	95.81	0.35	28.34	28.16	28.16	28.22	82.64	34.15
Lab. H	96.60	96.70	96.60	96.63	0.70	29.16	29.04	29.20	29.13	85.00	34.27
Lab. I	97.60	97.60	97.70	97.63	0.32	33.81	33.81	34.85	34.15	84.60	40.37
Lab. J	Did not participate in this test.										

Table 3.13: Results for collaborative test organised by the Sugar Association of London

Month	January		April		July		October	
Parameter	**Pol**	**% Moist.**	**Pol**	**% Moist.**	**Pol**	**% Moist.**	**Pol**	**% Moist.**
SIRI	97.62	0.41	97.33	0.49	97.37	0.62	99.02	0.21
Avg. results	97.50	0.52	97.18	0.58	97.38	0.57	98.67	0.31

Generally, the results in terms of reproducibility were good. The variations from one laboratory to the next could be due to poor analytical skills because the methods used by the different laboratories were similar. This programme will be continued in the coming year with special attention being paid to the laboratories which appeared to be having problems with their analyses.

The Laboratory also participated in the collaborative testing of raw sugar organised by the Sugar Association of London. Acceptable values for pol and moisture were obtained every quarter as shown in *Table 3.13.*

Wastewater Analyses

Effluent from all eight factories were analysed at the laboratory, both in and out of crop. The values for the parameters checked varied depending on the activities in the factories, for example, higher values were usually obtained for all parameters during rather than out of crop. Generally the biochemical oxygen demand (BOD) and chemical oxygen demand (COD) from **Long Pond**, **Monymusk**, **Tropicana** and **Hampden** were extremely high and far above the maximum limit set by the National Resources and Conservation Authority (NRCA). Results for coliform analyses conducted at the Biotechnology Centre, UWI on samples taken from all the factories greatly exceeded the limit, however, the results for pH, sulphates, nitrates and oil and grease were within the specifications.

Development of Databases

The Laboratory developed several database management systems during 1997. These included chemical inventory, results of soil analyses, water analyses and sugar analyses. These allow for easy comparison of several parameters as well as for complex analyses and for the generation of several reports. The input of information into the system is continuing.

ISO 9000

Writing of the quality manual and work procedures required for ISO 9000 certification continued. A gap analysis conducted in April gave an indication of the progress made by the Laboratory towards full implementation of the standard. The findings were encouraging and led to several improvements in laboratory practicesincluding record keeping especially those of equipment usage and calibration status.

Training

A student from the College of Agriculture, Science and Education (CASE) was trained in the Laboratory for 10 weeks, beginning March 4, in areas of sugar and molasses analyses, plant tissue and soil analyses and also water analyses. A recruit to the Factory Laboratory at **Monymusk** attended a one day workshop at the Laboratory on June 26, 1997. Emphasis was placed on colour determinations of refined sugars. An observatory visit was made to the **Monymusk** Laboratory on June 27, 1997.

4 CROP PROTECTION

4.1 ENTOMOLOGY

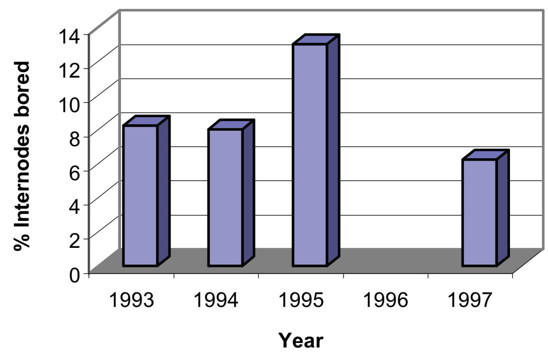
Stalk Borer (*Diatraea saccharalis*) Damage Survey

The 1997 stalk borer damage survey was conducted at **Monymusk**, **Innswood**, **Bernard Lodge** and **Caymanas**, all areas prone to heavy attack, and **Long Pond** which has a tendency for wild swings in levels of borer activity. Mature cane stalk samples were extracted, split open and damage recorded from a total of 104 fields, in relative proportion to the size of the estates involved and from a representative sample of the varieties.

Damage ranged from a high of 20.8% of internodes in a field of BJ7465 at **Innswood** to a low of 1.2% in BJ78100 at Swanswick, **Long Pond**. Despite the high level of damage associated with BJ7465, it may not be appropriate to conclude that this variety is particularly damage prone as on the very same farm at **Innswood** damage of only 5.1% was recorded in Field #092. **Innswood** was indeed the 'hot spot' for borer damage with some 11% internode damage while the **Long Pond** area fell below the 3% level.

The survey showed overall a return to normal levels of damage for the areas sampled, 7.33% of internodes bored, following the aberration of 1995 when damage surged to 13.35%, *Fig 4.1*. That high was attributed in part to severe drought which preceded the survey. Although 1997 saw an even worse drought the survey was conducted early in the year before the full effect was felt. A complete survey was not carried out in 1996 but indications were that normal damage levels were by then already restored.

Fig. 4.1: Summary of borer damage survey results, 1993-97



West Indian Canefly (*Saccharosydne saccharivora*)

Populations of the canefly remained at relatively low levels during the first half of the year. The one area of concern was the Quaminos area of **Monymusk**, site of the commercial drip irrigation project. This area was unfortunately omitted in the aerial spraying that took place at **Monymusk** and **New Yarmouth** towards the end of 1996. The site is separated from **New Yarmouth** only by the Rio Minho river and the infestation seemed to be a spillover of problems on that estate. Infestation was quite heavy but confined to a few fields. Towards the end of the year populations grew to outbreak levels as the high nutritional status maintained through fertigation for as long as 4 months after harvest at Quaminos sustained conditions favourable to proliferation of the insect.

While there was a more gradual buildup of populations at **New Yarmouth** its proximity to Quaminos and number of relatively young fields affected made it prudent to include that estate in the aerial application carried out in early December.

Aphids (*Sipha flava*)

A severe outbreak of yellow aphis, with the occasional presence of the grey aphid, occurred at **Holland** during the first Quarter. A number of varieties were affected over an area of some 100 ha, but heaviest infestations were found in BJ8226. Canes affected ranged from six weeks to approximately six months in age. The toxic effect of feeding coupled with dry weather caused considerable stress particularly in the younger canes. The farm was advised against spraying as there was evidence of adequate buildup of natural enemies. By the end of March the outbreak was completely controlled. The most visible of the natural enemies were ladybird beetles, green lacewings, Zelus longipes and a range of spiders. Full recovery of the cane came with the onset of the spring rains.

Chinch Bug (*Blissus insularis*)

There was not the same high level of activity of the chinch bug at **New Yarmouth** in the Fall of 1997 compared with that of recent years. Although there were a few symptoms of attack the affected area was much smaller and the intensity much reduced. Symptoms were again spotted in BJ7015 primarily.

4.2 WEED CONTROL

Evaluation was done in the herbicide screening trial against broadleaf weeds at **Monymusk**. The main weeds with high density at the site were flatgrass (*Panicum reptans*), sprangle top (*Leptochloa filiformis*), and corngrass (*Rottboellia cochinchinensis*), in roughly equal proportions. Isolated patches of bermudagrass, ricegrass, and wild pangola were found within some plots. Others included purple and yellow nutsedge (*Cyperus rotundus* and *C. ferax*) plus an array of broadleaves.

Results

Planned evaluation at 15dpa (days post application) was aborted as the field was being irrigated. The first evaluation, done at 20 dpa, showed no difference between treatments, as all plots were clean. Subsequent evaluations at 35 and 50 dpa showed decreased levels of weed suppression for all treatments. As was found at **Long Pond**, the better treatments were Velpar with either Actril, 2,4-D or Martril, and Karmex with either Actril or Martril. Karmex tended to give more persistent control than Velpar in comparable treatments (as seen with Banvel and SNS 2000). Ally did not show much promise, and SNS 2000 showed satisfactory response with Velpar only. Although these treatments were effective, none was equal to or superior to the standard Gesapax Combi plus Actril.

Strip Trials

Two sets of strip trials were set out at Williams' farm, Four Paths, to do preliminary efficacy tests with new pre-emergent and post-emergent herbicides. The chemicals and rates used were as outlined.

Pre-emergent:

1. SL160, 0.3 kg/ha + Actril, 1.0 L/ha
2. Combi, 4.0 L/ha + Actril, 1.0 L/ha
3. Herbadox, 3.0 L/ha + Actril, 1.0 L/ha
4. Relay, 1.5 L/ha + Racer, 1.5 L/ha

Post-emergent:

1. Gesapax 80WDG, 3.0 kg/ha + Actril, 1.25 L/ha
2. Amigan, 3.0 kg/ha + Actril, 1.25 L/ha
3. Marlox, 6.0 L/ha + Martril, 1.25 L/ha
4. SL1160, 0.5 kg/ha
5. Amigan, 3.0 kg/ha + Martril, 1.25 L/ha

Table 4.2: Percent control of pre- emergent broadleaves, Monymusk at 35 & 50 days post application (dpa), 1997

Treatments	35 dpa	50 dpa
1. Velpar 1.5 L/ha + Ally 10 g/ha	87	78
2. Velpar 1.5 L/ha + Actril 1.0 L/ha	95	91
3. Velpar 1.5 L/ha + Banvel 1.2 L/ha	85	83
4. Velpar 1.5 L/ha + SNS 2000, 1.2 L/ha	90	83
5. Velpar 1.5 L/ha + 2,4-D at 3 L/ha	96	91
6. Velpar 1.5 L/ha + Martril 700, 1.0 L/ha	94	91
7. Karmex 80 WDG 3 kg/ha + Ally 10 g/ha	86	80
8. Karmex 80 WDG 3 kg/ha + Actril 1.0 L/ha	94	93
9. Karmex 80 WDG 3 kg/ha + Banvel 1.2 L/ha	89	89
10. Karmex 80 WDG 3 kg/ha + SNS 2000, 1.2 L/ha	89	89
11. (Std) Combi 80 WDG 3.5 kg/ha + Actril 1.0 L/ha	98	96
12. Karmex 80 WDG 3 kg/ha + Martril 700, 1.0 L/ha	91	90

The area used for the pre-emergent test was expanded to accommodate the post emergent sprays applied some 60 days after.

Weed Spectrum

Grass: flatgrass, sprangletop, millet (*Panicum fasciculatum*), wild pangola (*Dichanthium annulatum*), jungle rice (*Echinochloa colonum*), and bermudagrass (*Cynodon dactylon*).

Sedge: yellow, and purple nutsedges

Broadleaf: consumption bush (*Cleome sp.*) mallow (*Malva mulata*), golden button (*Melampodium divaricatum*), hog slip (*Ipomea triloba*), worm bush (*Spigelia anthelimia.*)

Evaluation at Pre-emergence

At 15 dpa there was hardly any sign of germinating weeds; but at 45 dpa, only plots treated with Gesapax Combi and Relay/Racer showed adequate levels of control. The SL160 was ineffective particularly when used with hormone herbicides. Weed densities of golden button and worm bush were excessively high in such plots (relative to the control strip and other treatments), as if fertilized. This was in contrast with results obtained at **Long Pond** and **Bernard Lodge** in the previous year.

Plots treated with Gesapax Combi were fairly clean, with only the occasional wild pangola, bermudagrass and nutsedge emerging. Herbadox gave reasonable grass control, but broadleaf control was unsatisfactory even with the inclusion of a hormone-type killer.

Relay and Racer also gave good grass control but poor suppression of sedges. Germinating broadleaf weeds were yellow and stunted, with necrosis at leaf tips and around margins. Probably higher rates were required. In one section of the field, flatgrass germinated and flourished irrespective of herbicide used.

Evaluation at Post-emergence

Gesapax did the best job of controlling flatgrass, but gave only partial burn down of jungle rice and wild pangola. A higher rate and earlier application would probably give adequate kill. Broadleaf control was satisfactory.

The treatment containing Amigan gave good kill of broadleaves, but again only partial kill of wild pangola, sprangle top, and purple nutsedge. Similarly, a higher rate of the chemical needs to be considered.

Marlox gave good overall control of all categories of weeds but there was evidence to suggest early regrowth of wild pangola, flatgrass, and millet.

SL160 gave the best kill of yellow nutsedge, partial kill of Cleome, but had no effect on flatgrass, sprangletop, jungle rice and bermudagrass. It was the only herbicide to which BJ7504 showed some evidence of phytotoxicity.

Amigan with Martril also gave good overall control. A problem with Amigan is its low solubility, hence takes too much time to prepare the spray mixture.

Conclusions

1. SL160 is a poor herbicide at pre-emergence, with limited spectrum of kill at post-emergence, hence will not find favour within the Sugar Industry;

2. Amigan, because of solubility, may not find favour with users but is potentially a good herbicide. The rate of 3 kg/ha needs to be increased to improve its efficacy;

3. Marlox also shows potential, but will require rates above 6 L/ha. The cost of the material could be a determining factor;

4. At current sugar price, weed control cost needs to be contained below $3 000/ha. Herbicides which show efficacies at rates higher than 4 L/ha pre-emergent, (3.0 kg/ha post) must be substantially cheaper than Gesapax Combi, or give a wider spectrum of kill to find favour with users;

5. If the prices of Relay and Racer are competitive, the addition of a broadleaf killer could provide useful weed control;

6. Efficacy of Herbadox becomes high when used with a triazine herbicide at **Innswood**, **Bernard Lodge**, Springfield (**Monymusk**), and Frome.

Chemical Ripening

Some 706 ha were chemically ripened during late crop: 314 ha at **Bernard Lodge**; 16 ha at FMJ; 48 ha at **Tropicana**; 12 ha at **Worthy Park**; 292 ha at JWN Ltd.; 24 ha at **Monymusk**. This brought the total area treated for the crop to 2 120 ha, or 5% of the approximately 43

Adjuvant

A new adjuvant, Mas Azucar, was applied with Roundup and Fusilade to some 5 ha at **Worthy Park**, and with Roundup to 10 ha at **Bernard Lodge**, and 41 ha at **Tropicana**. At each location, the adjuvant did not significantly enhance the activity of the ripener. It was expected that more tests would be done for the next early crop season. Analysis of overall performance was incomplete.

Table 4.3: Hectares chemically ripened during the 96/97 crop, Jamaica

Farm/chemical	Roundup	Fusilade	T/down	Totals
Frome Estate	683.50	0.00	0.00	683.50
Frome Farms	51.50	0.00	0.00	51.50
Bernard Lodge	463.61	121.20	0.00	584.81
Worthy Park	6.48	5.67	0.00	12.15
Holland	113.26	172.60	38.69	324.55
Appleton	224.68	127.60	22.97	375.25
Tropicana	47.31	0.00	0.00	47.31
Tropicana Farms	16.15	0.00	0.00	16.15
Monymusk	24.30	0.00	0.00	24.30
Total	**1 630.79**	**427.07**	**61.66**	**2 119.52**

5 AGRICULTURAL ENGINEERING

5.1 IRRIGATION AND DRAINAGE

Drip Irrigation

During the first quarter the drip irrigation system at the SIRI farm, Springfield, was expanded to field # 1270. This is a 3.7 ha field of clay adjacent to the variety museum, which is similarly drip irrigated. Three tube types are being compared in a Randomized Block design, *Fig. 5.1.*

The three treatments are replicated five times. Each treatment plot consists of 6-rows with tubes inserted by tractor mounted pipe layer at average 20 cm depth below the invert of each planting furrow to minimize damage from machete cuts and fire during harvesting. Row were approximately 240 m long and 1.67 m apart.

Fig. 5.1: Schematic diagram of drip irrigation trial, Randomized Block Design Trial, Field 1270, Springfield

UNDERGROUND 75 Media PVC Pipe															
INTERVAL															
c	c	b	a	a	c	b	c	a	b	b	a	c	b	c	a

Plot	Treatment (Source and Brand)
a	Israel, Netafim Brand
b	United States, Ro- Drip Brand
c	Australia, T- Tape Brand

Drip System Water Supply

The water supply, estimated at 80 m^3/hr flow rate, is pumped from rivers and wells and normally flows into a night storage reservoir. This is then gravity fed to a sump from which the drip system is pressurized by a second pump. An additional 40 m^3/hr is abstracted via a 75 mm diameter underground pipe by tapping into a pumped main supply that bypasses the Springfield site. Chemical precipitate clogging, a phenomenon often encountered with most drip systems supplied by ground water, was not evident. This may be attributed to the dilution of 0.1% phosphoric acid that is regularly used for flushing the drip tubes. The nutrient program also offers some degree of protection from clogging as phosphoric acid is sometimes delivered through the system as a phosphate source, during fertigation.

Water analyses indicated a salinity range between 0.791 and 1.492 dS/m which should not be a threat to sugarcane crop development. There were no inordinately high levels of calcium, magnesium, bicarbonate or sulphate that should result in unmanageable precipitation.

Irrigation Schedule

An irrigation schedule based on effective rainfall utilizing the principles of supplementary irrigation and water budgeting was developed. Crop and evaporation factors are estimated, based on the various stages of crop growth and climatic conditions.

Monthly soil moisture balances varied between -8.1 mm and 226 mm for fields 1241B and 1270 respectively, *Table 5.1.* The high balance of 226 mm occurring during October would have been in excess of useful rain to the crop.

Soil Type

Chemical analysis showed the soil to be in the mildly alkaline range with pH varying between 8.04 and 8.06 and P_2O_5 levels falling between 128 and 141 ppm, *Table 5.2.* The entire trial site consists mainly of clay which compacts upon drying and has a high soil moisture holding capacity.

A mechanical analysis indicated in excess of 57% clay, approximately 25% sand and 15% silt.

Soil Moisture

Soil moisture testing devices consisting of 24 gypsum blocks and electrical leads were installed mainly in field 1241A, the variety museum site to determine the moisture content of the soil at various locations and to observe any variations along the lengths of the rows. A calibration exercise was conducted for moisture meter readings taken at the test sites. For purposes of calibration, several soil samples from these sites were analyzed at the SIRI laboratory for moisture levels.

The moisture readings did not indicate any appreciable variation as the distances from the head mains increased, *Table 5.3A & 5.3B*. There were two aberrant cases of low moisture contents of 17.9% and 15.8% at sites C and H respectively in Field 1241A. These may have been due to faulty moisture meter readings or localized cracks in the soil at the gypsum block sites. However the frequency of occurrence of the high moisture levels exceeding 30% (by weight) implies that the fields were adequately irrigated in most cases.

Irrigation Project, Raymonds Hillside

Designs for the expansion of irrigation facilities for an additional 100 ha of cane lands as well as the documentation for procurement of a Grant from the Canadian Fund For Local Initiatives (CFLI) were pursued on behalf of the Raymond Hillside Cane Farmers. Approximately 2153 m of 150 mm diameter PVC pipes will be acquired through the Joint efforts of SIRI, the farmers and **Monymusk** personnel. The CFLI also proposed to assist with the funding for the infrastructural work comprising mainly of backhoe excavation.

The ADB, and JCPS were considered possible sources of loans for crop production.

Irrigation Supply and Costs

Continued efforts of the cane farmers' lobby group, including SIRI's representative, resulted in a significant reduction in proposed increases in water charges by the National Irrigation Commission (NIC). Costs are currently based on Service and Demand charges.

The settlement arrived at resulted in a 25% increase over the 1995/96 average demand charges of $ 5000/ha and no increase in the service charges of between $300 and $750/ha/mo. This was down from the over 500% increase proposed by the NIC. The 1996/97 average total charges varied between $6 000 and $8 000/ha/an assuming a supply of 16 000 m^3/ha/an at 30% irrigation efficiency. This still represented Government subsidies of between 60% and 70% of the NIC's unit production cost.

The Lobby Group's efforts were later diverted to the training of farmers within sections of Mid- Clarendon in the areas of billing interpretations and Water Measurement. Further work was being undertaken jointly with farmers and the NIC to have the lining of canals completed in order to increase conveyance and water application efficiencies.

Table 5.1: Monthly Soil Moisture Balances

	July			August			September		
Field	**1241A**	**1241B**	**1270**	**1241A**	**1241B**	**1270**	**1241A**	**1241B**	**1270**
Size (ha)	2.02	1.82	3.44	2.02	1.82	3.44	2.02	1.82	3.40
Irrigation (m3)	1 141.00	1 317.00	Nil	1 150.00	1 025.00	924.00	610.00	1 388.00	1 150.00
Irrigation (m3) per ha	564.80	723.60	Nil	569.30	563.20	269.00	301.90	762.60	338.20
Irrigation (mm)	56.00	72.00	Nil	57.00	56.00	27.00	30.00	76.00	33.00
Rainfall (mm)	6.70	6.70	6.70	11.60	11.60	11.60	31.00	31.00	31.00
Crop factor kc	0.25	0.50	N/A	0.25	0.50	0.25	0.25	0.50	0.25
Ave. Daily Evap	5.60	5.60	5.60	4.90	4.90	4.90	5.20	5.20	5.20
Monthly Eto	173.60	173.60	174.00	151.90	151.90	152.00	156.00	156.00	156.00
Monthly Et =kcEto (mm)	43.40	86.80	N/A	37.90	75.95	37.90	39.00	78.00	39.00
Balance (mm) Soil Moisture	19.30	- 8.10	N/A	30.70	- 7.35	0.70	21.50	28.50	24.50

	October			November			December		
Field	**1241A**	**1241B**	**1270**	**1241A**	**1241B**	**1270**	**1241A**	**1241B**	**1270**
Size (ha)	2.02	1.82	3.40	2.02	1.82	3.40	2.02	1.82	3.40
Irrigation (m3)	418.00	282.00	702.00	912.00	980.00	2 291.00	1 019.00	1 042.00	1 812.00
Irrigation (m3) per ha	206.90	154.90	206.50	451.40	538.40	673.80	504.40	572.50	532.90
Irrigation (mm)	20.00	15.00	20.00	45.00	53.00	67.00	50.00	57.00	53.00
Rainfall (mm)	218.00	218.00	218.00	47.00	47.00	47.00	72.00	72.00	37.00
Crop factor kc	0.50	0.75	0.25	0.50	0.75	0.50	0.50	0.75	0.50
Ave. Daily Evap	1.56	1.56	1.56	3.93	3.93	3.93	4.13	4.13	4.13
Monthly Eto	48.00	48.00	48.00	118.00	118.00	118.00	128.00	128.00	128.00
Monthly Et =kcEto (mm)	24.00	36.00	12.00	59.00	88.00	59.00	64.00	96.00	64.00
Balance (mm) Soil Moisture	214.00	197.00	226.00	33.00	12.00	55.00	58.00	33.00	61.00

Table 5.2: Soil chemical analysis results - Field 1270

Depth cm	pH 1:10	Truog's P_2O_5 ppm	K_2O	Na	Ca	Mg	Nutrient Ratings			
			ppm Exchangeable Cation							
0-25	8.00	128	18	357	8100	1150	pH	Mildly alkaline	Ca	Very high
25-50	8.10	141	18	334	8700	1500	P	Very high	Mg	high
Avg.	8.05	135	18	346	8400	1325	K	V low	Na	Medium

Table 5.3A: Gypsum block moisture readings field 1241 A

	12/9/97		29/10/97		21/11/97		
Site	Meter Reading %	Lab Moist %	Meter Reading %	Lab Moist %	Meter Reading %	Lab Moist %	Distance from Head Main (m)
A	99.70	37.00	99.90	37.10	99.80	37.10	12.00
B	81.60	30.10	99.20	36.80	99.80	37.10	12.00
C	35.80	17.90	99.70	37.10	99.70	37.00	43.00
D	100.00	37.20	99.90	37.10	99.20	36.80	71.00
E	99.20	36.84	99.80	37.10	97.40	36.10	99.00
F	83.60	30.80	100.00	37.20	98.70	36.60	99.00
G	97.10	35.90	48.50	20.70	99.70	37.00	124.00
H	87.70	32.30	98.60	36.60	25.00	15.80	140.00
I	92.10	33.98	99.40	36.90	98.00	36.30	171.00
J	98.90	36.70	99.20	36.80	93.60	34.50	171.00

Table 5.3A: Gypsum block moisture readings field 1241 A

	12/9/97		29/10/97		21/11/97		
Site	Meter Reading %	Lab Moist %	Meter Reading %	Lab Moist %	Meter Reading %	Lab Moist %	Distance from Head Main (m)
A	99.70	37.00	99.90	37.10	99.80	37.10	12.00
B	81.60	30.10	99.20	36.80	99.80	37.10	12.00
C	35.80	17.90	99.70	37.10	99.70	37.00	43.00
D	100.00	37.20	99.90	37.10	99.20	36.80	71.00
E	99.20	36.84	99.80	37.10	97.40	36.10	99.00
F	83.60	30.80	100.00	37.20	98.70	36.60	99.00
G	97.10	35.90	48.50	20.70	99.70	37.00	124.00
H	87.70	32.30	98.60	36.60	25.00	15.80	140.00
I	92.10	33.98	99.40	36.90	98.00	36.30	171.00
J	98.90	36.70	99.20	36.80	93.60	34.50	171.00

5.2 LAND DEVELOPMENT

The surveying and grading of sections of fields # 1242 and 1273 totaling 8.39 ha were undertaken at Springfield. Surveying, grading and reblocking were undertaken on 25 ha at Handal's farm in St. Catherine where a profile of 1563 m of proposed canal route was also developed. Spot heights and compass mapping of 20 ha primarily for drainage purposes were also done at the request of Mr. P. Newman, cane farmer within the Bog Walk area.

A boundary survey and the development of field layout maps for 101.5 ha were carried out at L. Baugh's farm in Clarendon. On Johnson's farm, Rhymesbury, 813 m were surveyed for a proposed irrigation canal route.

Approximately 14.35 ha at "Farm" and 2 ha at Ebony Grove, both in Clarendon, were surveyed, reblocked and graded. Boundary and topographic surveys were also undertaken for farmers on 5.45 ha at Gravel Hill and 1.0 ha at Osbourne Store respectively.

Table 5.4: Turnaround times as percentages of operating times

Date	Location	T.A.T. as a % of operating time	Comments
26/03/97	McCooks Pen	38.50	
02/04/97	Salt Pond	34.30	
09/04/97	March Pen	51.50	
12/03/97	Hartlands	58.60	19.65 % of time spent awaiting new carts
02/04/97	Salt Pond	34.30	
09/04/97	March Pen	51.50	
5-6/4/97	Salt Pond	60.70	31.2% of time spent unloading and 15% awaiting empty carts
08/05/97	Salt Pond	73.60	45.7%of T.A.T. spent unloading
29/05/97	Blair Pen	11.50	
Average		**46.06**	

Turnaround Times of Chopper Harvesters

Observed turn around times were as high as 51.5% of operating times at March Pen, **Bernard Lodge**, *Table 5.4*. Of the 58.6% turnaround time at Hartlands, 19.6 % was due to time spent on the interval awaiting empty carts.

The main reason for the high turn around times at Salt Pond was awaiting return of carts which were slow. Turnaround time at Blair Pen showed a more tolerable level of 11.5%.

5.3 AGRICULTURAL MECHANIZATION

Bonnel B-80 Whole Stalk Seed Cane Cutter

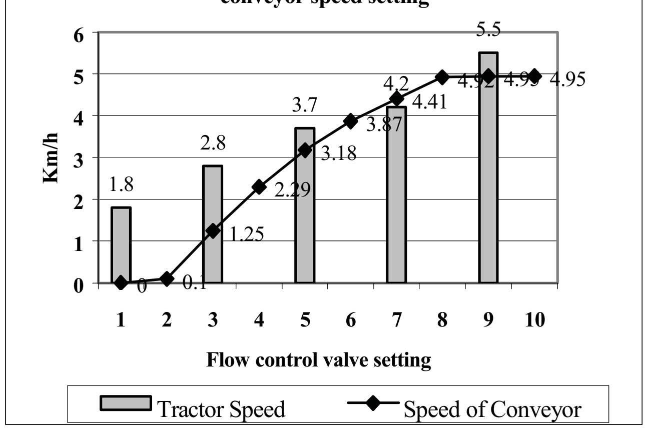
Investigations related to the use of the Bonnel B-80 whole stalk seed cane cutter were carried out to improve the work quality of the machine. This involved correlating machine travel speed with the conveyer speed. A table was drawn up (*Fig. 5.2*)with the correlation between the tractor travel speed, the flow control valve of the hydraulics motor that controls the speed of the conveyer and the tractor transmission to be selected in the Fiat 80-66 tractor gear box.

The relationships between the spin speed of the base cutter, the number of blades and the travel speed of the machine were also adjusted to improve the stool cut quality. After the adjustments the machine was field tested.When the number of blades was reduced from eight to four, this resulted in a good clean cut of the stalks. The cleanness of cut and the top cutting were satisfactory and little damage to the cane buds was observed. However, the machine was occasionally clogged by trash (tops and green leaves) during operation, producing interruption of operation due to design of the base cutter support frame. This deficiency would have to be corrected for efficient operations.

Mechanical Harvester

A CAMECO chopper harvester at **New Yarmouth**, was evaluated following the recommendations of the "Test procedure preferred by the ISSCT for mechanical sugar cane harvesters" & other ASAE standards. The pre-harvest sample showed that 34% of the cane was recumbent and lodged, 35.2% sprawled and 30.5% erect. About 74% of

Fig. 5.2: Bonnel B-80 wholestalk seed cane cutter conveyor speed setting



Flow control valve setting	1	2	3	4	5	6	7	8	9	10
Fiat Gear Low	1st		2nd		3rd				4th	
8066 Medium							1st			

stalks were longer than 700 mm. The net yield was estimated 52.8 t/ha with a 16.4% extraneous matter content.

Observations were that tops comprised approximately 6.9% of the loads sent to the factory. The harvester's cleaning efficiency was estimated at 40%. Uncollected cane in field was 20.5%, comprised of 12.5% uncut (lodged & recumbent) cane, 4.9% billets lost during trans-loading to the trailer, 2.3% of tall stumps (mean height 3.3") and 0.8% of cane on tops. Approximately 76.4% of billets had 2-4 nodes, and the 81.6% were between 200-300 mm in length with a mean billet diameter of 24.9 mm, *Fig. 5.3*.

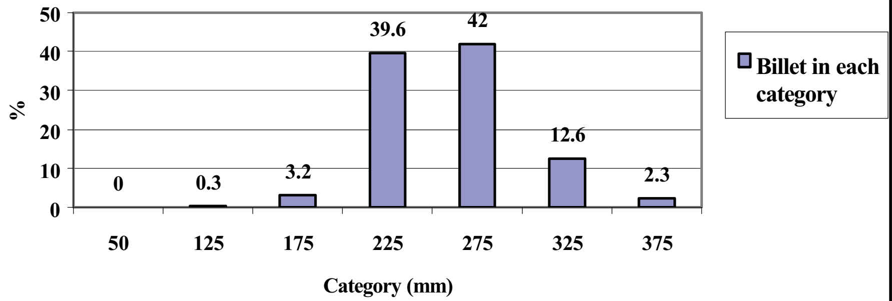
The machine while working had a mean travel speed of 6.2 km/h, with a material capacity of 43.2 t/h and an area capacity of 0.81 ha/h. Most of the stumps were frayed by the blades and the 31.3% of billets presented different types of damage due to the chopper system.

Mechanical Fertilizer Applicator

Modifications to a Bonnel mechanical fertilizer applicator at **Monymusk**, were made in such a way as to improve the machine's efficiency by 50% (instead of two rows at each pass, three rows were fertilized). In terms of field capacity, (*Table 5.5*) output increased from 0.75 to 1.13 ha/h at a working speed of 4.2 km/h. The working speed and the field capacity will be influenced by field size, outline and surface quality. This machine can also be modified to put fertilizer into rather than on the soil, both sides of the stool or within a split stool with the attachment of a coulter. The fertilizer applicator can be calibrated to deliver 13 different doses by changing the position of the sprocket.

At **Long Pond**, a Jumbo fertilizer applicator with hydraulic action was checked and calibrated. *Table 5.6* shows with the relationship between the position of the hydraulic valve, the travel speed of the tractor, the selection of the sprocket and the doses to be applied.

Fig. 5.3: Cameco combine, New Yarmouth Estate billet size distribution



Billet Size Distribution						**Mean Length: 249.9 mm**
Range	100-150	150-200	200-250	250-300	300-350	350-400
Wght (kg)	1.4	3.3	36.6	38.7	12.9	1.3
%	0.3	3.2	39.6	42.0	12.6	2.3
% of Sound, Damaged and Mutilated Billets & % Sound Billets of Good Length.						
Range	Damage	Mutilated	100-250	>250		Good Length
%	19.1	12.2	17.0	48.4		Total 65.4
Billet Diameter Distribution						
Range	15-20	20-25	25-30	30-35		Mean diameter: 24.9mm
%	7	46	45	2		91
Billet Node Distribution						**Mean: 2.4**
Range	1-2	2-3	3-4	5-6	5-6	6-7
%	11.3	56.4	20.0	10.5	1.9	-
Mean Combine Harvester Travel Speed (km/h):				**6.2 (0.3)**		
	Field Capacity					
Field Efficiency	Area Capacity (ha/h)	Material Capacity (t/h)			Time for loading a Trailer:	Turning Time on Heads:
0.8	0.81	43.2			6.1 min	12.0 sec.

Table 5.5: Field capacity of the Bonnel Fertilizer Applicator.

	Fertilizing During Planting					
Field Efficiency	**Area Capacity (ha/h) Normal**	**Area Capacity (ha/h) Modified**	**Material Capacity (t/h) Normal**	**Material Capacity (t/h) Modified**	**Dose: 374 kg/ha; Field Speed: 4.2 km/h; Working Width (m) Normal**	**Working Width (m) Modified**
Theoretical: 1	1.26	1.89	0.47	0.71		
0.8	1.01	1.51	0.38	0.57	Normal	Modified
0.6	0.75	1.13	0.29	0.42	3	4.5

	Ratoon Application		
Field Efficiency	**Area Capacity (ha/h) Normal**	**Material Capacity (t/h) Normal**	**Doses: 374 kg/ha; Field Speed: 4.2 km/h; Working Width (m)**
Theoretical: 1	1.26	0.47	
0.8	1.01	0.38	Normal
0.6	0.75	0.29	3

Table 5.6: Long Pond Estate. Disc Ratooner Fertilizer Applicator.

Calibration application rate. S.I.R.I. Agriculture Engineering Department, June 1997.
Modificated for 4.5 m working width.

Speed (km/h)	6.0	8.0	10.0	12.0	6.0	8.0	10.0	12.0	6.0	8.0	10.0	12.0
W (ha/h)	1.6	2.2	2.7	3.2	1.6	2.2	2.7	3.2	1.6	2.2	2.7	3.2
Valve Turns	**Doses per ha at different travel speeds, with 19 teeth sprocket**				**Doses per ha at different travel speeds, with 17 teeth sprocket**				**Doses per ha at different travel speeds, with 13 teeth sprocket**			
Open (max)		290						305				
1	348						323					
2	280					335						290
3						293					280	
4					330					325		
5					313					305		
6					278							

Loaders, Push Piler and Grabs.

Kits of the different parts to modify the push-piler and grabs of cane loaders were designed and installed on different estates. The modifications did not gain general acceptance. Only at **Cambria Farms** did the push piler modification seem fully appreciated and used. At other locations, the modification was deactivated by the tractor drivers - often without the knowledge of supervisors. The suggested reason was that the push piler is sometimes used for other jobs such as moving soil, etc. Nevertheless, this modification is designed to increase the efficiency of the push piler, to reduce the failure of the hydraulic jack, and minimize contamination of the cane pile with soil and stones.

During the study it was observed that row spacing tended to be very uneven with the result that the right side of the push piler tended to dig into the side of the bank thus introducing soil and stones into the cane pile.

It was also found that during furrowing tractor drivers were often required to estimate the spacing between rows by sight. (If he draws one furrow at a time then by placing a wheel in the last cut furrow, row spacing would be constant). A device was designed that would allow the driver to make two furrows at a time with accuracy. This comprises an attachment to the tractor frame of a rod with a chain at the end that is pulled along the last made furrow. By this means the furrower is able to increase field capacity to 1.01 ha/h (from an estimated 0.50 ha/h when a single furrow is drawn at each pass) at a travel speed of 4.2 km/h, with an estimated field efficiency of 80% *(Table 5.7A)*. The working width of the furrower increases with the modification from 1.5m to 3m.

Seedling Planters

SIRI has been working with two basic types of planting machines for handling seedlings set in jiffy cups (or possibly bare roots) in the field transfer of 50-60 000 seedlings annually germinated from fuzz in the Variety Development program. The machine for handling seedlings set in jiffy cups developed in collaboration with Richmond Farms using different parts of a seed planter (for corn, beans, etc) was tested with satisfactory results, but the presence of large clods, part of old stools, stumps and trash impeded performance and reduced quality of the operations.

An old **Holland** planter, designed for handling plants with bare roots, was modified for insertion of cane seedlings, and seemed better adapted to typical seed bed preparation for sugar cane. Tests nonetheless highlighted the importance of good seed bed preparation for efficient operation. This machine was used for planting all the seedlings in the 1997 Stage I variety trials.

A time & motion study of this planter, showed the main limitation was the need to stop and start in order to keep track of the different clones being laid out in various family plots (*Table 5.7B*). Field Efficiency was measured at 38% with a Capacity of 10 200 ± 500 seedlings per 8-hour man day. Field Capacity was estimated at 1.6 ha/8 h, or a 75% increase over the manual process. Labour saving was approximately 71%. Because of the age of the machine, the level of the technical stoppages (38.6%) was high. Similarly, technological stoppages (20.2%) were also high, as a result of inadequate seed bed preparation.

Table 5.7A: Improvement of the Two-Row Furrower. A device was designed to improve the Field Capacity of the Two-Row Furrower

Efficiency	**Furrower Field Capacity (ha/h) at 4.2 km/h Field Speed**		**Working width (m)**	
%	**Normal**	**Modified**	**Normal**	**Modified**
0.8	0.5	1.01		
0.6	0.38	0.75	1.5	3.0

Table 5.7B: Seedling planter performance. (Holland)
Time & Motion Study. Springfield SIRI Farm July, 1997

	Units	Mean	s	%
Plants Stalk Diameter	mm	9.3	± 1	8
Travel Speed	Km/h	1.4	± 0.1	7
Head Turns Time	min	1.2	± 0.1	8
Row Length	m	204.0	± 2	1
Plants Intervals	cm	58.0	± 5	8
Plants per Row	Plants	352.0	± 2	1
Labour Capacity	Plants/hour	2 571.0	± 170	7
Field Capacity	Ha/h	0.2		
Field Efficiency	%	38.0		
Technical Stoppages	38.6 % of Working Time			
Technological Stoppages	20.2 % of Working Time			

Labour Incorporated to the Technological Process.

Technological Variant	**TP01**	**TP02**	**TP03**
Tractor Driver	1	1	0
Labour at the Planting Machine	2	2	0
Carrying Plants from Field Heads	1	2	0
Checking and Correcting Planting	2	0	0
Preparing Plants in the Boxes	1	1	0
Labour for Manually Planting	0	4	24
Total Labour	7	10	24
Field Capacity (Ha / 8 hours)	1.6	0.8	0.4
Labour Saving (%)	71	58	
Field Capacity Improvement (%)	75	50	

TP01.- Planting the seedling plants with the holland planter.
TP02.-Distributing the seedling plants with the holland planter in the row and planting manually.
TP03.- Manually planting.

Reduced Tillage Trial

Cane production cost is of major concern in the Industry. Land preparation constitutes the biggest segment of cane establishment cost. Reductions in cost of this operation would therefore have a meaningful impact on overall cost of production. Accordingly, investigations were started on reduced tillage technology which may improve the efficiency of land preparation and reduce establishment cost.

The trial site selected was at **Caymanas**, with significant tracts of clay loam soils (21% sand and 26% clay), *Fig. 5.4*. Reduced tillage is generally considered unsuitable for clays.

Glyphosate (Roundup) at a rate of 5 L in 460 L of water/ ha, was used to eradicate old stools and other vegetation present after which soil preparation was restricted to the inter-row space where the new crop would be planted. Approximately seven weeks after harvest, glyphosate application, by tractor-drawn boom sprayer, was made in 5-row swaths to the regrowth of BJ7627. At that time sprouts were on average 75 cm tall. It was hoped that by then all shoots had emerged and sprouts would have been actively growing. Unfortunately, this was in a period of drought which caused some buds to remain dormant only to emerge after planting was carried out and the field irrigated.

Two weeks after glyphosate treatment, some 88% and by the 4th week 94% of old stools were killed, *Fig. 5.5.* Sprouting took place in approximately 6% of the old stools.

Fig. 5.6 shows graphically the technology. A John Deere 4650 tractor + John Deere 90 two-shank chisel plow was used with the objective of shattering compacted subsurface layers in the inter-row space. This operation was performed at a rate of about 1.8 ha/h. Inter-row space was 150 cm, and bank height 28 cm. Tractor wheels were run on top of the banks thus further destroying old stools.

A Ford 6610 tractor + ratooner comprised of four sets of discs, was then used for shattering the top soil in the inter-row space at a rate of about 1.5 ha/h.

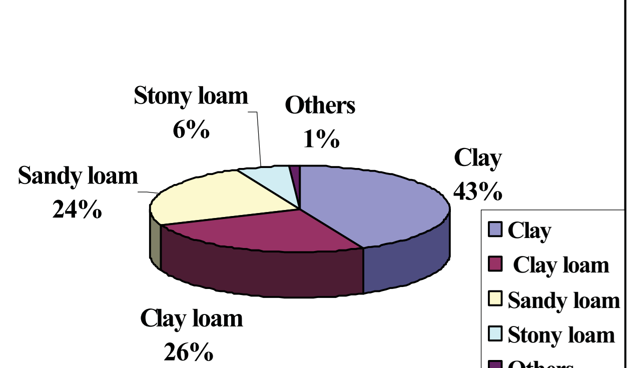
Finally, the John Deere 4650 tractor + three-shank furrow opener was used to open the furrows at a rate of about 2.2 ha/h.

BJ8226 seed cane was then manually dropped and slashed in the planting furrows. Rate of carrying out this operation (from loading seed cane, transporting, distributing in the field, cutting in the furrow and fertilizing) was approximately 0.30 ha/h.

Covering was by means of the Ford 6610 tractor + one disc covering tool with a field capacity of about 1 ha/h.

The operations were not carried out with specialised equipment, yet seed bed preparation appeared adequate, *Fig. 5.6.* Cane growth, except in a poorly drained depression, seemed at least as vigorous as in the adjacent field prepared in conventional manner. Conventional

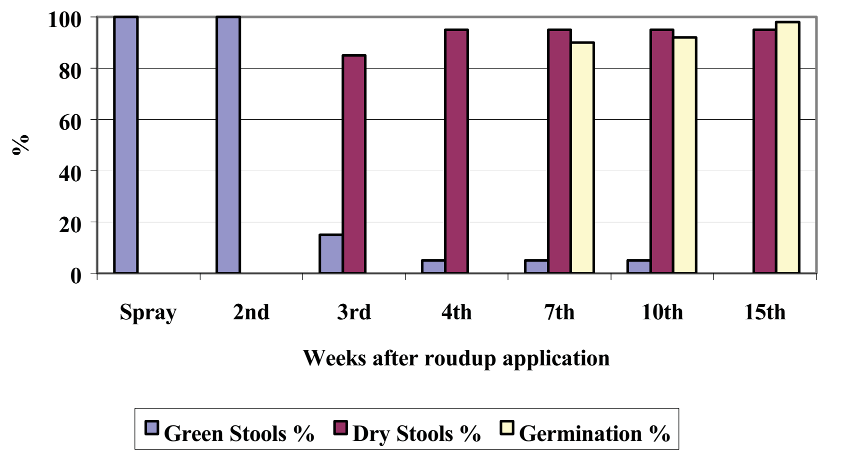
Fig. 5.4: Major soil type distribution at Bernard Lodge Estate



tillage comprising ploughing, ripping, harrowing, furrowing and covering was conducted at a rate of roughly 0.2 ha/h in this "control" field. By the 15th week in the reduced tillage plot, it became very difficult to identify the old banks which had disappeared with degradation of the old stools and inter-row cultivation (*Fig. 5.7 &5.8*).

Field populations studied periodically showed that by the 25th week, only marginal differences were conventional tillage, 88% and reduced tillage, 85%.

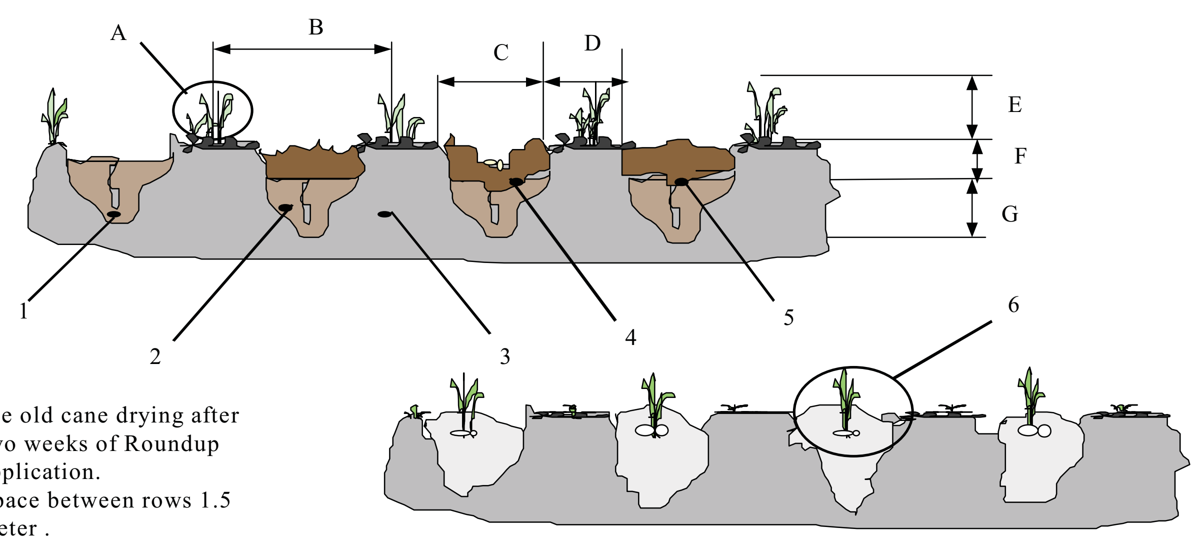
Fig. 5.5: Roundup application effects & germination of the new plants in the reduced tillage trial



Reduced Tillage Equipment

The **Caymanas** trial was conducted using available makeshift equipment attempting to adapt these to working within the inter-row space. Some pieces were not even properly adapted to the tractors to which they were attached. It is however envisaged that effective reduced tillage requires specialised tool(s), preferably combining the three operations of chiseling-shattering-furrowing so that with one pass, the field is ready for planting. Field capacity using such technology would be in the region of 0.4 ha/h.

Fig. 5.6A: Transverse soil cut diagram of the strip tillage trial, Caymanas Clay Loam soil.



A.-The old cane drying after two weeks of Roundup application.
B.- Space between rows 1.5 meter .
C.- Inter-row space width 0.80 meters.
D.- Bank width 0.70 meters.
E.- Old cane height 0.75 meters.
F.- Bank height 0.30 meters.
G.-Chiselling depth 0.35 meters.

1.- Soil loosened by chisel ploughing .
2.- Destroying clods, preparing seed bed with inter-row harrowing.
3.-Part of the soil not tilled.
4.& 5. -Furrow opened in the inter-row, planting and covering.
6.- Eight weeks after planting 88% germination.
7.- 95% of the old stools are completely dry after the 7th week.

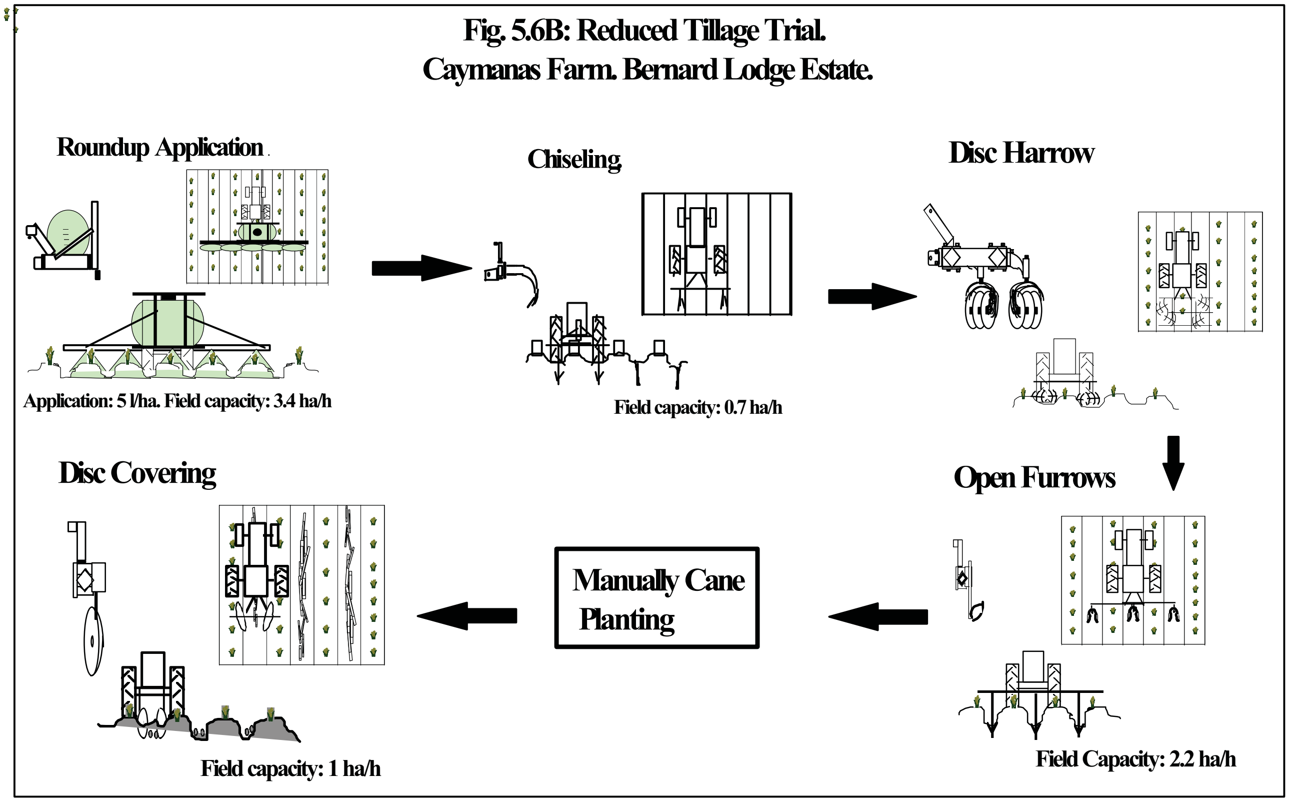


Fig. 5.7: Reduced tillage trial after 25 weeks. No old stool can be identified

6 VARIETY IMPROVEMENT

6.1 FUZZ AND SEEDLING PRODUCTION

In 1997 a total of 1 786 grams of fuzz were sown. Seedlings emerging totaled 62 000, representing 238 families, *Table 6.1.* This population, considerably greater than the 41 000 produced in 1996, was a result of improvement in the quality of the medium, control of glasshouse temperature and relatively fertile fuzz supplied by the Cane Breeding Station. About 95% of seedlings survived potting. The highest mortality, due mainly to overcrowding, was in those families with higher than average germination. Polycross families yielded more seedlings overall than bi-parental families. However, there were some fertile bi-parental families that produced large numbers of seedlings.

Table 6.1: Number of seedlings planted (x 000) for period 1990-1997

Year	1990	1991	1992	1993	1994	1995	1996	1997
# of seedlings	44	39	44	46	36	54	41	62

6.2 COMMERCIAL VARIETIES

BJ7504 (28%) was the most widely grown variety, *Fig. 6.1.* The next most popular BJ7015, occupied 22% of the cane area, a decrease of 5% from the previous year. BJ7015 was the principal variety planted for several years but the introduction of the quality based cane payment system has resulted in this moderate quality variety losing its preeminent position. Although of no better quality, selective removal of the older BJ7015 has left BJ7504 as the leading variety in cultivation.

BJ7465 (19%) showed a moderate increase of 1% to remain in third position for the sixth consecutive year. BJ7452 (8%) showed further reduction in area covered but remained in fourth position jointly with BJ7627, which increased from 7 to 8%. The area under UCW5465 was brought down to 4%, or 1% below the 1996 level. Recently released varieties BJ8226 and BJ82119 were undergoing rapid expansion in most areas of the industry. BJ8226 occupied 4% while BJ82119 was planted to 3% of cane area. Other new varieties gaining steady ground were BJ82102 and BJ8252.

TRENDS

Wet West

In the Wet West BJ7504 (*Table 6.2*) was the main variety in cultivation occupying 41% of the cane area. BJ7015 (16%) was in second place. At Frome estate BJ7504 showed a marginal decrease in cane area from 52% in 1986 to 51%. BJ7015 (22%) showed no change over the previous year. BJ8226, undergoing rapid expansion, occupied 8% of total area. BJ7465 (6%) decreased by 2% from 1996. Area in BJ82119 (4%) increased during the year while the area planted to BJ7627 continued to decline from 3 to 1%. BJ8252, BJ82102 and BJ7938 were the other varieties extended during the year.

Table 6.2: Distribution of varieties in the Wet West

Variety	%
BJ7504	41
BJ7015	16
BJ7465	12
BJ7452	11
BJ7627	5
BJ8226	10
Mixed	5

In the Appleton area BJ7015 (25%) and BJ7465 (16%) were the leading varieties. The largest percentage of area, decreasing from 49 in 1996 to 40%, consisted of mixed varieties. Undergoing expansion were BJ8226, BJ82119, BJ8252 and BJ82102.

At **Holland** BJ7504 remained the leading variety occupying 60% of the area planted. This represents a decrease from the 70% of cane area occupied in 1996, and was in recognition of its unsuitability for chopper harvesting, the main method employed by the farm. Other leading varieties were BJ7465 and BJ7452. Varieties under rapid extension were BJ8226, BJ82102, BJ82119 and BJ8252 while the area under BJ7465 was being reduced.

Irrigated Area

The leading varieties in the irrigated area were BJ7504 (27%), BJ7465 (26%) and BJ7015 (15%) . The area planted to UCW5465 (11%) and BJ7627(10%) remained stable. BJ7504, BJ7015 and BJ7465 each increased by 2% over 1996. At **Monymusk** the area planted to BJ7504 (33%) and BJ7465 (25%) increased over the previous year while UCW5465 (20%) declined in importance. Newer varieties being extended were BJ8226 and BJ82119. The distribution at Bernard Lodge showed UCW5465 (37%) remaining the most important, followed by BJ7504 (31%) and BJ7015 (21%) while area under BJ7627 declined to 13%. There was sharp increase in area planted to BJ78100 (4%), BJ8226 and BJ82119 during the year.

Dry North Coast

The principal varieties in the **Hampden** area were BJ7504 (25%), BJ7465(15%), BJ7452 (17%) and BJ7015 (16%). Largest cane area was in mixed varieties for the sixth consecutive year. Of the newer varieties, BJ8226 and BJ82119 were being rapidly extended. At **Long Pond** the planting programme was particularly severely hampered by the drought, but accelerated towards year-end with improvement in rainfall. BJ7504 remained the principal variety followed by BJ7015 and BJ7465. The varieties being extended during the year were BJ7548, BJ8226 and BJ82119.

St. Thomas Ye Vale

BJ7504, though showing a marginal 1% decrease, remained the main variety in cultivation occupying 30% of the cane area in the St Thomas Ye Vale area. The distribution of varieties at Worthy Park was BJ7504 (31%), BJ7627 (13%), BJ7230 (11%), BJ8226 (11%) and BJ82156 (6%). Other leading varieties on the farm were BJ7465 and BJ7262. Expansion of the area planted to BJ7555 and BJ82119 continued during the year. At Cambria, BJ7627 (31%) was the leading variety followed by BJ7465 (23%) and BJ8226 (14.5%) .

Wet East

There was no major shift in variety distribution in the Wet East. At **Tropicana** BJ7465 (24%) showed marginal decrease from 1996 while area planted to BJ7015 (20%) remained stable. Area under BJ7314 increased by 2%. Varieties extended during the year were BJ82119, D14146 and B51129.

6.3 PERFORMANCE OF COMMERCIAL VARIETIES

Overall the high yielding, but relatively poor juice quality, BJ7504 gave the highest average tonnes sugar per hectare per month (ts/ha/mo) of 0.58 with BJ7015 (0.57) ranking next in a year characterized by severe drought. Studies conducted to determine the profitability of varieties indicated that moderate yielding varieties with excellent juice quality are more profitable than the high yielding with moderate to low quality. BJ7465 and BJ7452 averaged 0.56 and 0.55 ts/ha/mo respectively. At **Frome**, BJ8226 exceeded BJ7504 in overall productivity yielding more cane and sugar per hectare.

In the irrigated area, particularly at **Monymusk** and **Bernard Lodge**, BJ7504 gave the best performances followed by BJ7465 and BJ7015. UCW5465, grown on the worse quality lands in the area, continued to show relatively poor performance.

In the central region the most productive varieties were BJ7230, BJ7015, BJ7504, BJ82156 and BJ8226 while at **Cambria** BJ7627 gave its best performance since 1994 when it was determined to be one of the most profitable. BJ8226 also performed outstandingly.

In the Wet East BJ7465 and BJ7314 were leaders in cane and sugar per hectare. BJ82119 performed satisfactorily but was grown on a relatively small area thus reducing the significance of its performance.

At **Hampden** and **Long Pond** in the Dry North Coast BJ7504, BJ7015 and BJ7465 were the outstanding varieties in overall productivity. Older varieties, B51129 and B51415 gave good performances but they were grown on only a small scale.

6.4 YIELD TRIALS

Final Trials

There were five trials scheduled for reaping, but complete results were obtained for only three as two were reaped before adequate provision could be made for obtaining weights.

BJ84124 (*Table 6.3*) was the most promising variety of the BJ83, BJ84 and J83 series reaped at **Innswood**. It out-yielded the standard BJ7015 in all parameters examined namely: tc/ha, %sucrose, ts/ha to be first in Economic Sugar Index (ESI). BJ83143 and BJ83149 merit special mention as they both showed fairly good juice quality. BJ8388 and BJ83126 showed adaptation to a wide range of agro-climatic conditions and exhibited fairly good juice quality. BJ83126 gave very good ratoon performances. These varieties are now being multiplied on an industrial scale to further assess their commercial potential.

BJ8388, the best of the BJ82 and BJ83 series at **Bernard Lodge**, though exceeding BJ7465, the standard, in quality, still fell short in ESI. BJ83143 and BJ8252 gave good cane tonnage comparable with BJ8226 while BJ8388 and BJ83149 displayed good juice quality, *Table 6.4*. The attributes of these varieties are high cane yield, fairly good sucrose content combined with acceptable morphological features.

In the BJ88 and J88 series at **Holland**, *Table 6.5*, the best performers were BJ8859, BJ8897 and J8808. BJ8897 combined moderate cane yield with good juice quality to emerge with the highest ESI. BJ8859 had moderate juice

Table 6.3: Best performers in (4 x 9) final trial, Innswood. Yield expressed relative to BJ7015 (=100)*

Variety	tc/ha	%Sucrose	ts/ha	ESI
BJ7015	78.94	14.62	11.39	100*
BJ8388	75.00	15.56	11.71	107
BJ83149	74.03	16.23	11.92	110
BJ83143	89.74	16.10	14.59	135
BJ83126	101.54	14.36	14.46	126
BJ84124	102.84	15.31	15.96	145

Table 6.4: Promising varieties in 4 x 9 trial, Bernard Lodge. Yield expressed relative to BJ7465 (=100)*

Variety	tc/ha	%Sucrose	ts/ha	ESI
BJ7465	97.98	15.33	14.96	100*
BJ8226	89.44	13.67	12.37	79
BJ8252	92.50	13.98	12.68	80
BJ83143	88.89	14.18	12.62	81
BJ8388	71.34	16.13	11.65	80
BJ83149	85.33	15.21	12.89	86

quality but gave high tc/ha to be ranked second while J8808 was ranked third.

Imported Varieties

In order to provide information on outstanding varieties from other sugar cane producing countries, imported commercial varieties are grown in trials along with locally adapted varieties to determine their suitability for local conditions. Trials were established at **Frome** and **Hampden** during the year with imports from Guyana, designated DB, Dominican Republic (CR), Trinidad (BT), Barbados (B), Reunion (R) and Hawaii (H).

B8088 (*Table 6.6*) was the most promising at Frome combining good quality with moderate cane yield and acceptable morphological features to be ranked first in the trial. The juice quality of the others was not significantly better than the standard BJ7015.

None of the imports measured up to BJ82119 at **Hampden**, *Table 6.7*.The best of the imports were DB73419, B8088 and H73310 which all surpassed. On the basis of the performance in this trial (and observations on commercial farms in the area) the Estate was advised to proceed with extension of BJ82119.

In the trial of the BJ87 series at **Monymusk** the most promising varieties were BJ8770, BJ8708 and BJ8532, ranked first, second and third respectively, *Table 6.8*. These varieties will undergo further evaluation.

In the BJ88 and J88 series at Frome only smut susceptibility CR67400 measured up to the standard, BJ7015, *Table 6.9*.

Meanwhile in the BJ84 series at Frome BJ8435 was the most promising out-performing the standard BJ7015 in tc/ha and ts/ha, *Table 6.10*. Other good performers were BJ8402, BJ84107 and BJ8457.

At **Long Pond** the BJ88 series, severely drought affected, there were encouraging performances from BJ8811, BJ8859 and BJ8874, *Table 6.11*.

The best performers in the BJ82 trial at Tropicana were BJ8207, BJ82149 and BJ82156 *Table 6.12*. BJ8207 shows adaptation to high rainfall areas and because of its good juice quality could be of value for early harvest in those areas. BJ82149 yielded more sugar per hectare than the standard BJ7465 but its recumbence makes it unsuitable for commercial considerations. BJ82156 is a high yielding, very erect variety, particularly attractive for machine harvesting, that performs well on clay loam soils and is gaining acceptance in several areas of the Industry.

Results of the BJ88 trial at **Worthy Park**, showed BJ8874, BJ8859 and BJ8897 to be among the better performers, outperforming the standard, BJ7627, *Table 6.13*.

The most promising of the BJ90 series, planted on clay loam soil at **Worthy Park**, were BJ9029, BJ9056, BJ9095 and BJ9062, *Table 6.14*. In this trial, BJ9029 outclassed the standard, BJ7627, to be first in ESI. This promising variety appears to be a good ratooner, is self trashing and has good juice quality. BJ9095 and BJ9062 were ranked second and third respectively.

The second trial of the BJ90 series reaped at **Worthy Park** on clay soils showed BJ9017, BJ9035 and BJ9056, *Table 6.15,* being the most productive. Performances should be viewed against the background of relatively poor cane yield of 58.86 tc/ha by the standard, BJ7627.

Table 6.5: Promising varieties in 4 x 9 trial at Holland Yield expressed relative to BJ7504 (=100)*

Variety	tc/ha	%Sucrose	ts/ha	ESI
BJ7504	74.97	12.40	9.26	100*
BJ8859	102.27	13.20	13.23	147
BJ8897	70.76	15.40	12.14	155
J8808	72.88	14.40	10.82	130

Table 6.6: Best performers in 3x24 lattice trial at Frome. Yield expressed relative to BJ7015 (=100)*

Variety	tc/ha	%Sucrose	ts/ha	esi
BJ7015	95.59	14.71	13.79	100*
BT79116	99.62	14.09	14.10	101
B83131	96.64	15.24	14.64	109
B84746	92.95	14.37	13.69	100
BR7548	86.56	15.68	13.74	104
R570	90.52	15.59	14.21	107
B8088	86.75	16.21	14.01	107

Table 6.7: Promising varieties in 3x25 lattice trial at Hampden. Yield expressed relative to BJ7015 (=100)

Variety	tc/ha	% Sucrose	ts/ha	ESI
BJ7015	69.19	12.65	8.67	100
H657052	68.68	13.79	9.41	115
H631153	65.14	14.79	9.55	120
DB7869	64.65	15.36	9.89	127
DB84305	63.61	14.83	9.54	122
DB73419	76.20	13.65	10.56	129
B8088	58.75	15.21	9.04	117
H73110	76.94	13.98	10.57	129
B83131	74.98	13.85	10.44	128
BJ82119	81.12	14.28	11.89	150

BJ9056 appeared to be adapted to both clay and clay loam soils. The main attributes of this variety are high cane and sugar yields, resistance to the major diseases and desirable morphological characteristics.

Stage 1- BJ99 Nurseries

Selection was conducted in the Stage I nursery (BJ99 series) located at **New Yarmouth**. Severely affected by drought and inadequate irrigation water, mortality was high and growth of survivors unthrifty including the family plots. Objective evaluation could therefore not be undertaken. Adverse growing conditions were compounded by poor weed control.

The rejection rate for genotypes infected with smut was approximately 3% which was 2% below the 1996 level. The major cause of rejection, approximately 30%, was lack of vigour. A total of 1 300 clones were selected and promoted to Stage II.

Stage II - BJ98 series

Selection in two nurseries, one each at **Frome** and **New Yarmouth**, resulted in 377 and 130 clones respectively being promoted to Stage III.

Stage 111: BJ97 and BJ96

The plant cane assessment of regional nurseries at **Frome**, **New Yarmouth** and **Hampden** was completed in March. First ratoon assessment will be done in 1998. The BJ96 nurseries at **Frome** and **Innswood** were brixed and assessed during the same period. The exercise resulted in 100 clones being selected for screening in the smut trial.

6.5 PLANTING OF NURSERIES

Stage I- BJ99

Two nurseries were planted; one at **Monymusk**, comprising approximately 40 000 seedlings and the other at **Frome** with 22 000. A modified seedling planter was used to circumvent the increasing problem of obtaining workers for planting on the estates. This resulted in an increase in the planting rate per day and reduction in the number of persons required.

The nursery at **Monymusk** was affected by frequent disruption in irrigation water supplies which resulted in high mortality and unsatisfactory growth. Establishment in the nursery at Frome was good.

Stage II-BJ97

The Stage II nursery, planted at **Innswood**, contained 1 300 clones selected from Stage I at **New Yarmouth**. Growth and establishment were good.

Stage 111- BJ96

The 500 clones selected from the Stage II at **Frome** and **New Yarmouth** were planted at **Innswood** and **Frome**. Establishment in both was satisfactory.

Table 6.8: Best performers in lattice trial at Monymusk of the BJ87 series. Yield expressed relative to BJ7015 (=100)

Variety	tc/ha	% Sucrose	ts/ha	ESI
BJ7015	77.60	11.85	15.18	100*
BJ8532	79.96	15.82	12.62	108
BJ8770	80.52	17.21	13.92	124
BJ8773	71.53	16.22	11.67	101
BJ8708	78..27	16.53	12.96	113
BJ8776	70.63	16.60	11.70	102

Table 6.9: Best performers in 3 x 18 lattice at Monymusk. Yield expressed relative to BJ7015 (=100)

Variety	tc/ha	% Sucrose	ts/ha	ESI
BJ7015	88.31	12.12	14.14	100*
CR67400	74.79	12.10	16.09	107
J8802	79.92	11.20	15.03	95
BJ88104	86.64	11.49	15.34	92
BJ8841	88.79	11.17	12.48	86

Table 6.10: Promising Varieties in 3 x 25 trial at Frome. Yield expressed relative to BJ7015 (=100)

Variety	tc/ha	% Sucrose	ts/ha	ESI
BJ7015	80.01	15.18	12.08	100*
BJ8457	79.56	15.34	12.03	100
BJ8402	74.65	16.39	12.37	107
BJ84107	77.99	16.26	12.61	108
BJ8435	80.35	15.88	12.81	109

Table 6.11: Best performers in 3 x 18 lattice trial at Long Pond. Yield expressed relative to BJ7015 (=100)*

Variety	tc/ha	%Sucrose	ts/ha	ESI
BJ7015	60.63	13.05	7.83	100*
BJ8811	84.02	14.58	12.22	167
BJ8820	70.59	14.19	10.01	135
BJ8874	75.05	13.84	10.48	140
BJ88105	70.63	13.74	9.63	127
BJ8897	64.23	15.01	9.60	133
BJ8872	71.19	13.88	9.67	131
BJ8859	77.15	14.36	11.12	151
J8808	63.88	14.16	9.05	122

Table 6.12: Best Performers in 3 x 12 lattice trial at Yield expressed relative to BJ7465 (=100)

Variety	tc/ha	% Sucrose	ts/ha	ESI
BJ7465	127.35	13.38	17.26	100*
BJ82156	114.50	15.85	18.36	116
BJ8207	121.59	15.71	19.17	120
BJ82149	134.07	14.46	19.64	119
BJ82118	112.37	15.36	17.47	109
BJ82103	100.11	15.81	17.77	117

6.6 EXPERIMENTS PLANTED

A lattice trial was planted at **Monymusk** and a final trial at **Worthy Park**. The varieties tested were of BJ88 and BJ90 series. Trials scheduled for planting in the Dry North Coast area were abandoned because of drought.

Propagation Nurseries

Nurseries at **New Yarmouth**, **Holland**, **Worthy Park** and **Tropicana** were cut back and expanded. These will be the main sources of seed cane for trials in 1998.

Planting Recommendations

Difficulties in obtaining seed cane of the newer varieties in 1996 eased towards year end as the SIRI nursery at Springfield made available BJ82102, BJ8226 and BJ82119. A limited supply of BJ7555 was distributed to growers in the Wet East and Irrigated areas.

Sugar cane variety recommendations for period 1998 are presented in *Table 6.16.*

Release of New Varieties

During the year BJ7555 was released for use in rain-fed areas and on well drained soils of the irrigated areas. BJ7555 is recognized by its erect reddish purple stalks that bear close resemblance to BJ7548. Germination is usually slow and unreliable in old seed cane. The variety tillers moderately at first, later forming larger stools of erect uniform canes which make it well suited for mechanical reaping. Trash is easily removed and the juice quality is excellent sometimes exceeding that of BJ7230. It appears to be a very good ratooner on clay soils in rain-fed areas and well drained soils in the irrigated belt.

Disease Screening Trial

The screening of 47 varieties (BJ92 series) to determine their reaction to smut was done towards year-end at **New Yarmouth.** Those varieties rated as resistant and moderately resistant on a scale of 0-9, will be promoted to the replicated trial stages for more precise assessment and evaluation.

BJ7230 continued to show heavy smut infection in the Lucky Valley area of Clarendon resulting in accelerated replanting of infected fields with resistant varieties.

There were no other major incidences of sugar cane diseases except for a light outbreak of eye spot observed in isolated locations in the Industry.

Export

Sixty varieties of the BJ91 and BJ92 series were exported to the Cane Breeding Station to be used as parents in the cross breeding programme.

Table 6.13: Best performers in 3 x 12 lattice trial at Worthy Park. Yield expressed relative to BJ7627 (=100)*

Variety	tc/ha	%Sucrose	ts/ha	ESI
BJ7627	68.58	14.44	9.89	100*
BJ8859	87.47	14.44	12.62	128
BJ8874	91.01	14.58	13.27	135
BJ8855	80.10	14.46	11.57	117
BJ8897	85.37	14.51	12.35	125
BJ8841	84.13	14.06	11.84	118
J8803	80.35	14.64	11.76	120

Table 6.14: Promising varieties in 3 x 25 lattice trial at Worthy Park. Yield expressed relative to BJ7627 (=100)*

Variety	tc/ha	% Sucrose	ts/ha	ESI
BJ7627	81.37	14.78	11.91	100*
BJ9056	107.46	14.41	15.50	129
BJ9062	97.14	14.29	14.56	124
BJ9095	102.15	14.89	15.27	130
BJ9029	91.23	16.41	14.43	132
BJ9086	107.06	13.96	14.92	122
BJ9081	93.00	15.07	14.05	120
BJ9035	96.25	15.23	14.42	122

Table 6.15: Best Performers in 3 x 25 trial at Worthy Park. Yield expressed relative to BJ7627 (=100)

Variety	tc/ha	% Sucrose	ts/ha	ESI
BJ7627	58.86	14.95	8.78	100*
BJ9035	82.95	15.04	12.46	142
BJ9017	102.45	15.84	16.42	193
BJ9070	79.40	15.17	11.96	137
BJ9067	73.08	15.20	11.23	130
BJ9056	76.16	15.93	12.07	141
BJ9086	74.23	16.08	11.93	141
BJ9037	69.87	15.43	10.79	125

Table 6.16: Variety recommendations for different harvesting periods and soil types - 1998

		SOIL TEXTURAL CLASS				
Area	**Harvesting Period**	**Sandy Loam/peat**	**Clay Loam**	**Light Clay (Saline)**	**Heavy Clay**	**Heavy Clay (non-saline)**
Westmoreland	Early	BJ7555	BJ7452	BJ7465	BJ7015	BJ7015
& Hanover		BJ7465	BJ7015	BJ7452		BJ8252
		BJ7452	BJ7555	BJ7015		
		BJ7314		BJ8552		
		BJ7015		BJ7555		
	Middle	BJ7504	BJ7555	BJ8226	BJ7627	BJ8226
		BJ7015	BJ8226	BJ7504	BJ7015	BJ7504
		BJ7555	BJ7627	BJ7015		
			BJ7015	BJ7938		
			BJ7938	BJ82119		
			BJ82119			
	Late	BJ7627	BJ7627	BJ82119	BJ7627	BJ7627
			BJ82119	BJ7627		
Irrigated	Early	BJ7452	BJ7452	BJ7452	UCW5465	UCW5465
Clarendon &		BJ7465	BJ7015	BJ7465		
St. Catherine		BJ7314	BJ7555	BJ8252		
		BJ7015		BJ7555		
		BJ7555				
		BJ7452	BJ7627	BJ8226	BJ7015	BJ7015
		BJ7938	BJ7015	BJ82119	BJ7627	BJ7627
	Middle	BJ82119	BJ82119	BJ7504		BJ7548
		BJ7548	BJ7548	BJ7627		BJ82102
		BJ82102	BJ82102	BJ82156		
		BJ7555	BJ7555	BJ7548		
				BJ82102		
				BJ7555		
	Late	BJ7627	BJ7627	BJ7627	BJ7627	BJ7627
Upper	Early	BJ7555	BJ7555	BJ7555	N/A	BJ7015
St. Catherine		BJ7015	BJ7452	BJ7465		BJ82156
&		BJ7452	BJ7015	BJ7015		
Upper Clarendon		BJ7465	BJ82156	BJ7452		
		BJ7314		BJ82156		
		BJ82156				
	Middle	BJ7555	BJ7555	BJ7555	N/A	BJ7504
		BJ7465	BJ7015	BJ7262		BJ8226
		BJ82119	BJ82119	BJ82119		BJ82156
		BJ7262	BJ7262	BJ8226		BJ7504
		BJ82156	BJ8226	BJ82156		
		BJ7504	BJ82156	BJ7504		
			BJ7504			
	Late	BJ7627	BJ7627	BJ7627	N/A	BJ7627
				BJ7504		

Cont'd

Table 6.16: Variety recommendations for different harvesting periods and soil types - 1998 *(Cont'd)*

		SOIL TEXTURAL CLASS				
Area	**Harvesting Period**	**Sandy Loam/peat**	**Clay Loam**	**Light Clay (Saline)**	**Heavy Clay**	**Heavy Clay (non-saline)**
Trelawny	Early	BJ7015	BJ7452	BJ7465	N/A	N/A
		BJ7465	BJ7015	BJ7452		
		BJ7452	BJ82156	BJ82156		
		BJ82119				
		BJ82156				
	Middle	BJ7504	BJ7452	BJ7452	N/A	BJ7015
		BJ82119	BJ7627	BJ7627		BJ7504
		BJ8226	BJ8226	BJ7504		BJ8226
		BJ82156	BJ82156	BJ8226		BJ82156
			BJ82119	BJ82156		
	Late	BJ7627	BJ7627	BJ7627	N/A	BJ7627
St. James	Early	BJ7452	BJ7452	BJ7452	N/A	BJ7015
		BJ7015	BJ7015	BJ7015		
		BJ7465				
	Middle	BJ7504	BJ7627	BJ7504	BJ7627	BJ7015
		BJ8226	BJ8226	BJ7627		BJ8226
			BJ7015	BJ7015		BJ7504
				BJ8226		BJ8226
	Late	BJ7627	BJ7627	BJ7627	N/A	BJ7627
St. Thomas	Early	BJ7555	BJ7555	BJ7555		BJ7015
		BJ7452	BJ7452	BJ7465		
		BJ7015	BJ7314	BJ7015		
		BJ7465	BJ7015	BJ7452		
		BJ7314		BJ7314		
		BJ8207		BJ8207		
	Middle	BJ7555	BJ7555	BJ7555	BJ7627	BJ7504
		BJ7504	BJ7627	BJ7627		BJ82119
		BJ7015	BJ7015	BJ7015		
		BJ82119	BJ82119	BJ7504		
		BJ8226	BJ8226	BJ8226		
		BJ8207	BJ8207	BJ8207		
	Late	BJ7627	BJ7627	BJ7627	BJ7627	BJ82119
		BJ82119		BJ82119		
St. Elizabeth	Early	BJ7452	BJ7452	BJ7452	BJ7015	BJ7015
		BJ7015	BJ7015	BJ7465		
		BJ7465				
		BJ7314				
	Middle	BJ8226	BJ7627	BJ7627	BJ7627	BJ8226
		BJ7262	BJ78226	BJ7265		BJ7504
		BJ82119		BJ7938		
		BJ82102		BJ7504		
		BJ7504				
	Late	BJ7452	BJ7627	BJ7452	N/A	BJ7465
		BJ7465	BJ7465	BJ7465		BJ7627
		BJ7627	BJ7627	BJ7627		

6.7 BIOTECHNOLOGY

Tissue Culture

During 1997 clones of the BJ91 and BJ92 series were initiated into culture, established and multiplied. Sugar cane plantlets of these clones were sent to the West Indies Central Sugar Cane Breeding Station in Barbados. Several experiments were conducted to improve the micropropagation system. The laboratory also mounted exhibits at Denbigh, the Heads of Government Commonwealth meeting at Montego Bay and at several conferences hosted by the Scientific Research Council.

BJ91 and BJ92 series

A total of 618 buds from 88 stalks were initiated from the BJ91 clonal series and 970 buds from 123 stalks from the BJ92 series. The BJ91 series began with 41 535 seedlings sown at SIRI in 1989 from fuzz obtained from Barbados. From Stage III, 60 clones had been tested for their resistance to smut. The best 35 smut-resistant varieties were chosen to be micropropagated and exported to Barbados. The BJ92 clones were initiated from the Stage III selection before testing for their resistance to smut. The best 41 clones were micropropagated and exported to Barbados. The apical tips that were subject to a double sterilization process outperformed the other types of explants in terms of the percentage of 'clean' explants obtained after four weeks (*Table 6.17*). Explants from the BJ91 clonal series that were subjected to a second sterilization of 10% bleach for 3 minutes had more 'clean' explants after four weeks than the BJ92 clonal series which were subjected to a second sterilization of 5% bleach for 3 minutes (*Table 6.17 & 6.18*). In vitro growth however was better for the BJ92 series (*Table 6.18*). Overall Apical Tip explants responded better to Media B than to Media A while Lower Buds responded better to Media A (*Table 6.19*).

Table 6.17: Effect of explant type and re-sterilization on the percentage of 'clean' explants

Variety	Explant type	% of 'clean' explants after four weeks: Placed in test-tube after sterilization	Dissected	Dissected & resterilized
BJ91 series	ApT	0	51	96
	UB	36 (large)	23	78
	LB	0	5	68
BJ92 series	ApT	-	-	43
	UB	61 (small) 47 (large)	-	57
	LB	19	-	44

Explant type:
ApT = Apical Tip; UB = Upper Buds, buds above wrapping of the leaf sheath; LB =Lower Buds, buds below wrapping of the leaf sheath, (-) did not initiate.

Table 6.18: Initiation of the BJ91 and BJ 92 clonal series in terms of the % of 'clean' explants and the growth of these explants after eight weeks

Variety	#Stalks initiated	# Bud explants initiated			% 'clean' explants at 4 wks			# Shoots or buds/ explant at 8 wks		
		ApT	UB	LB	ApT	UB	LB	ApT	UB	LB
BJ91 clonal series (35 clones)										
Total #	88	85	275	158	-	-	-	-	-	-
per clone	2.5	2.4	7.9	4.5	72	66	55	7.5	1.6	1.6
BJ92 clonal series (41 clones)										
Total #	123	123	579	268	-	-	-	-	-	-
per clone	3	3	14.1	6.5	46	55	42	8.7	2.2	1.7

Explant type: ApT = apical tip; UB = buds above wrapping of the leaf sheath; LB = buds below wrapping of the leaf sheath.

Training

A student from the College of Agriculture and Science Education did her internship at the Biotechnology Laboratory of SIRI. She was taught techniques such as media preparation, sterile technique, data gathering and processing needed for the micropropagation of sugar cane. Experiments conducted included multiplication, rooting and hardening experiments. The results of these experiments have helped to improve the efficiency of the micropropagation system for sugar cane at SIRI. Also an experiment was conducted to identify possible causes of contamination within the tissue culture laboratory.

Progress in Biotechnology

In vitro multiplication

Two cytokinins, benzyl amino purine (BAP) and kinetin (K) were tested for their efficiency in the multiplication of the sugar cane plantlets. The medium BM with 0.2 mg/l BAP and 0.1 mg/l kinetin produced the highest multiplication rate for BJ7314 . High multiplication rates were also obtained on BM supplemented with 1.0-5.0 mg/l kinetin.

Rooting

Two auxins, napthalene acetic acid (NAA) and indole butyric acid (IBA) were tested for their efficiency in causing rooting of the sugar cane plantlets. More roots were produced on BJ82119 plantlets on BM with 6% sucrose than when NAA or IAA were added. On BJ8207 plantlets more roots were produced when the BM and 6% sucrose were supplemented with 2 mg/l NAA or 8 mg/l IAA. Survival of BJ82119 plantlets after hardening was highest (89%) for plantlets rooted on BM with 6% sucrose and 8 mg/l IAA.

Hardening

The effect of 5 mg/l NAA and sucrose on root growth *in vitro*, and the survival and shoot height after three weeks of hardening was studied. Plants were placed in soil mixed with peat, sand and farm yard manure. Addition of sucrose increased the number of roots per plantlet of BJ82119 and BJ8226 more than did the addition of NAA to the medium. Survival of the plantlets was also better from media with increased sucrose concentration than by the addition of NAA. The survival rate of the plantlets from BM+6% sucrose was 83% for BJ82119 and 87% for BJ8226.

Contamination

The aim of this experiment was to indicate the level of contamination within the media preparation room and the growth room. Observation of petri dishes containing multiplication medium which had been opened at various locations indicated that the following areas were without contamination: laminar flow, the shelves beside the laminar flow and the first and second shelf of the growth room. The petri dishes placed in the media preparation room had more fungal colonies than those in the growth room. It was suspected that the presence of fungi colonies in petri dishes placed on the third shelf in the growth room could be caused by the air conditioner which on further inspection was discovered to have colonies of fungi growing on the blades. The inside of the air conditioner was covered with fungi and it was subsequently cleaned.

Mineral analysis of micropropagated plants

Plantlets formerly in initiation or multiplication media for four weeks and hardened plantlets four weeks after transfer from culture were analysed for their mineral content. It was found that the plantlets in culture for different lengths of time only varied in their potassium content. The plantlets in tissue culture had higher nitrogen and potassium contents and lower iron, copper and manganese contents than plantlets that had been hardened (*Table 6.20*). This may be due to the amount of minerals in the tissue culture medium or to the uptake of available minerals by the plantlets. Studies in this area will continue to see if by manipulating the mineral levels the multiplication rate could be further enhanced.

Status of SIRI's Biotechnology Laboratory

None of the problems reported on in 1996 still remained. The percentage of 'clean' explants where as high as could be expected from field grown plants. Plantlet establishment and growth were much faster. The plantlets showed no sign of vitrification while chlorotic and deformed leaves and browning at the base of the plantlets was not excessive. The rate of survival of hardened plants has also been improved and was more than 96%. More work needed to be done to further improve the rate of multiplication or production of new tillers after subculturing.

Two series were established in culture, clones of the BJ91 series and the BJ92 series. The other varieties in culture included BJ7314, BJ7555, BJ8226, BJ8252, BJ82156, BJ82102, BJ82119, BJ7465 and BJ8207. Two sugarcane varieties, BJ82156 and BJ755, high sucrose varieties in short supply in the industry were being multiplied in the lab to facilitate their rapid expansion.

Future work includes initiation of the BJ93 and BJ94 series and other sugar cane varieties. Also field experiments are being planned. The facilities in the growth room were limited to one rack with three shelves. Plans were therefore being made to expand the capacity of the growth room.

Table 6.19: Effect of explant type, re-sterilization and media on the growth rate of explants from the BJ91 series

Explant type	Growth rate: One sterilization, Medium A		One sterilization, Medium B		Dissected and re-sterilized, Medium A		Dissected and re-sterilized, Medium B	
ApT	ns		ns		7.6±0.28	(96)b	9.9±0.46	(100)
UB	1.3±0.06	(44)	2.1±0.14	(32)	1.4±0.05	(50)	1.4±0.06	(45)
LB	ns		ns		2.7±0.35	(50)	1.2±0.03	(29)

(a) Growth rate = number of buds or shoots at eight weeks per explant, ns = no explant or shoot grownfrom an explant survived by eight weeks,
(b) mean±SEM, no. in brackets is % of explants producing at least one shoot by 8 wks. Explant type: ApT = Apical Tip; UB = Upper Bud, buds above wrapping of the leaf sheath; LB = Lower Bud, buds below wrapping of the leaf sheath.
Medium A = BM (Mitchell et al 1995) with 0.2 mg L-1 BAP and 0.1 mg L-1 kinetin,
Medium B = BM with 0.5 mg L-1 BAP and 0.1 mg L-1 kinetin

Table 6.20: Mineral analysis of micropropagated plants

Mineral		Plantlets after 4 wks on initiation medium: BM+0.2BAP+0.1kinetin	Plantlets after 4 wks on multiplication medium: BM+0.2BAP+0.1kinetin	Plantlets 4 wks after transfer from culture
Nitrogen	% dry	5.3	5.4	2.6
Phosphorus	matter	1.1	0.7	1.1
Potassium		6.2	5.9	3.4
Iron	ppm	not enough to analyse	23.4	283.0
Copper		not enough to analyse	0.8	9.3
Manganese		not enough to analyse	9.9	48.3

n=4-6

7 ECONOMICS & STATISTICS UNIT

Economics and Management Information Profitability Studies - 1997

Cane production cost in 1997 was above that incurred in 1996 despite a revaluation of the Jamaican currency by roughly 12% in 1996. In fact, this reversal in currency value took place when most crop inputs were already used up in the production of the 1997 crop. Additionally, growers had to face an irreversible 20% increase in labour cost for the 1997 crop, based on previous wage agreement. Conversely, growers' earnings were significantly slashed as sugar price was rolled back from just over $20 000 to roughly $17 000/tonne.

With expected reduced earnings, however, growers were faced with increased cane production and harvesting cost in 1997. For the Rain-fed areas, total establishment cost/ha increased from $82 723 in 1996 to $84 882 in 1997. With respect to the Irrigated areas these costs moved from a high of $98 754 to $101 785, *Table 7.1*.

In terms of individual operations, land preparation and planting costs were maintained at the 1996 levels.The reduction in cultivation cost in rainfed areas resulted from reduced cost of supplying and weed control. The modest level of increase in the irrigated areas stemmed mainly from an increase in irrigation water. The increase in harvesting cost, due to negotiated wage increases.

Table 7.1: Cane establishment costs, 1996 vs 1997, Rainfed and Irrigated areas

	Rainfed		Irrigated	
	1996	**1997**	**1996**	**1997**
Land Prep.	13 750	13 750	15 000	15 000
Ploughing	20 020	20 020	20 020	20 020
Cultivation	17 373	15 752	22 215	22 920
Harvesting	21 000	24 750	29 175	31 125
Sup. & Contingencies	10 340	10 610	12 167	12 623
Total	**82 723**	**84 882**	**98 754**	**101 785**

Table 7.2 : Prices of selected inputs, 1996 vs 1997

Input	**1996**	**1997**
Fertilizer ($/tonne)	10 252	10 252
Herbicide ($/L)	310	310
Irrigation ($/ha)	5 313	6 500
Seed Cane ($/tonne)	1 300	1 300

Prices of Selective Inputs

The price of certain inputs remained at the 1996 levels, *Table 7.2*. For instance, a selected grade of fertilizer, 16-9-18, remained at roughly $10 252/tonne. Similarly, a widely used herbicide, Gesapax, was maintained at $310/liter. The price of seed cane remained at rough $1 300/tonne. Providing Irrigation water by contrast, moved from roughly $5 337/ha to $6 500 - which led to increased cultivation cost in the irrigated areas. This seemingly high increase was reported to be the product of high energy costs and reduced government subsidy.

Harvesting Costs

Harvesting cost showed some level of increase over 1996, *Table 7.3*. This was in general related to the labour component of this operation. Based on previously agreed wage agreement, basic cutting cost moved from roughly $65/tonne in 1996 to $78.25 in 1997, a 20% increase. It is instructive to note that such rates were obtained mainly on the estates; while rates ranging from $130 to upward of $200/tonne were charged on other category of farms.

Harvesting rates in Mid-Clarendon moved from $389.44 to $416.25/tonne. In the **Bernard Lodge** area, upward of $430.00/tonne were reported. At **Frome**, while the higher rate of $350/tonne was not surpassed, the lower rate moved from roughly $305 to $330/tonne. In the **Tropicana** area, the adjustment reflected more or less the 20% increase in labour cost.

Harvesting cost continued to account for a major position (over 25%) of production cost. On some farms, it accounted for over 40% of price received/tonne cane.

Return on Investment (ROI)

Despite reduced earnings and increased establishment costs, sensitivity analyses showed that positive ROI were realized by growers who achieved good cost control, high cane yield and cane/sugar ratio.

7.1 IRRIGATED AREAS

For growers in the Irrigated areas, a positive ROI required a cane yield of not less than 70 tc/ha and a JRCS of 10.20 - 10.50. In general, the analyses conducted indicated that at yields of less than 70 tc/ha, some growers were losing money when full economic costs were considered.

It was also shown that at average yields of 70 tc/ha it required a JRCS of roughly 10.80 to maintain the opportunity cost of capital, example interest rates on fixed deposits; at 75 tc/ha, a JRCS of roughly 10.50 and at 80, a JRCS of 10.20.

These analyses were structured around an interest rate of 19% for ACB Loans, and 15% for JCPS funds. The 25 to 30% interest rate obtained at commercial windows proved quite prohibitive for cane growing.

7.2 RAINFED AREAS

Consistent with lower cane production cost in the Rainfed areas, growers could realize a positive ROI at yields of roughly 65 tc/ha and a JRCS of 10. However this could be marginal in some areas owing to relatively high land preparation and harvesting costs. An average yield of 70-75 tc/ha and a JRCS of 10.20 should be considered an attainable goal for growers in the Wet West and Wet East regions.

Outlook

It is expected that the cost/price curve will remain fairly flat for some time as producers battle to bring cost in line with expected price. However, with a narrowing profit margin and by extension less equity capital, the availability of low cost capital will be the prime determinant governing viability as interest rates seemed to be trending upwards. In the meantime, for arrival small farms will in general probably continue in the trend of low input/low output and longer ratooning.

Cane Yield Survey - 1992-1996, Economic Implications

An examination of CYS data for the period 1992-1996 showed considerable yield decline in ratoon fields relative to plant cane, resulting in loss of potential farm income. Most dramatic however, was the apparent decline in yield of first and second ratoons, *Tables 7.4 & 7.5*. For instance, in 1996, plant cane yielded on an average 84 tc/ha compared with first ratoons at 77 tc/ha, and second ratoons - 68 tc/ha, resulting in yield decline of seven and 16 tc/ha, respectively, and a combined loss of 23 tc/ha. In general, such fall off in yield have contributed to the overall low cane productivity over the years.

Estimates of costs and returns, showed that with the expected yield curve, gross farm income should be highest in the second and third year of investment; namely first and second ratoons.

Replanting data pertaining to the period (1992-1996) showed that in any one year no less than 21% of total cane area or an estimated 8 400 hectares are occupied by first and second ratoons.

Since the CYS usually represents approximately 50% of cane area or 42 000 ha, a combined first and second ratoons loss of 23 tonnes indicate that in 1996 an estimated 96 600 tonnes of potential yield were unrealized; and represented much needed revenue at this time.

Cane Yield Survey - 1997

Information pertaining to the 1997 crop is detailed in the Cane Yield Summary towards the back of the Annual Report.

The Cane Yield Survey is an annual project and in any one year captures vital production data on over 50% of the island's cane production. It therefore provides vital statistics on production and various measures of productivity within the Sugar Industry, inclusive of hectares of cane reaped, tonnes cane and sugar produced and fertiliser and water used.

The data obtained is used to monitor variety performance, determine sugarcane productivity per ha per month and to derive other indices of productivity.

Table 7.3: Harvesting rates/tonne 1996 vs 1997, selected areas

Selective Areas	1996 ($)	1997 ($)
Mid Clarendon	389.44	416.25
Bernard Lodge	359 to 407	420 to 450
Upper Clarendon	362 to 392	450 to 550
Frome	305 to 350	330 to 350
Tropicana	376 to 426	393 to 450
Long Pond	293 to 383	350 to 370

Table 7.4: Tonnes cane per hectare by class performance, cane yield survey, 1992 - 1996

	Year				
Class	1992	1993	1994	1995	1996
SP	74	86	80	76	84
1R	70	75	71	69	77
2R	63	65	65	63	68
3R	60	62	64	59	68
OR	62	62	67	62	68

Table 7.5: Yield loss from ratoon fields, 1992 - 1996

Year	First & Second Ratoons	Total Ratoons
1992	-14	-40
1993	-33	-81
1994	-25	-54
1995	-21	-53
1996	-23	-55

7.3 COST OF CANE PRODUCTION, 1995 - 1996

The annual survey on cost of cane production and harvesting was undertaken during the year. Although the detailed results will be published in the annual cost bulletin, some aspects of these results are highlighted in this report.

National Cost

The survey showed that the national average cost of cane production and harvesting for the 1996 crop was $79 835.79/ha and $1 105.48/tonne when classified by inputs used and $80 107.24/ha and $11 04.27/tonne by operations performed. These differences in cost between the two classifications arose because it was not possible to include the entire data set when analysing cost by operations performed. Since cost by inputs include the entire data set, it may be considered to be more representative.

When examined by operations performed, overheads accounted for roughly 41%, and as in previous years, the greater portion of total cost. Cultivation cost, (excluding land preparation and planting) was 29.3% of total cost, followed by harvesting with 25.9% of total cost.

When these costs were examined by inputs used, administrative expense was the most costly input, accounting for 31.42% of total cost. Equipment was next in magnitude at 23.65% while labour accounted for roughly 20% and material 18.03%.

Cost Comparison

A comparison of overall production cost for 1996 (by operations performed) with that of 1995 showed an increase of roughly 33.70%, or from $ 60 170.93 to $80 107.24/ha. *Tables 7.6*. Other cultivation costs increased quite significantly by 46.3%, mainly because of hike in irrigation rates. Overheads registered a 21% increase.

On a per tonne basis however, the increase was 17.1% *(Table 7.7)*. This resulted from increased cane yields over 1995. In terms of individual operations harvesting increased by 24.50%, from $229.35/tonne to $285.52/tonne; and overheads a significantly lower increase of 6.8%.

On an input basis overall production cost per hectare increased by 31.70% from $60 605.94/ha to $79 835.79/ha. Labour cost increased by 46.8% and equipment by some 43%. Administrative cost showed increase of roughly 18%.

Other Activities

Sugar Cane Investment Profile

Sugar cane investment profiles for the Irrigated and Rainfed area were compiled and updated during the year. The objective was to provide reliable cost estimate of cane production and harvesting in light of any changes in financial & economic indicators which were likely to influence inputs and operational costs and consequently the viability of cane growing.

Training Programme(s)/Seminar(s)

The Economics & Statistics Unit participated in the following seminars/training programmes.

- Out-of-Crop Training at Ebony Park for trainee supervisors in the Sugar Industry;
- Sugar Cane Agriculture Course for students at Ebony park - Cost Management & Record Keeping.

Economic Analyses

The Economics & Statistics Unit also carried out various economic analyses on request and/or in conjunction with other departments and the wider industry in general.

Cane Valuation

Frome, Monymusk, and Bernard Lodge

A further valuation of roots on divested farms was carried out at **Monymusk**. This was to facilitate: (a) first ranked applicants who did not meet all the requirements; and (b) to enter into negotiations with second ranked applicants

Table 7.6: Comparison of cost/ha by operation in 1995 and 1996

Operation	Cost/ha 1995	Cost/ha 1996	Change in cost from 1995
Land Prep & Planting.	24 494.97	29 541.59	20.6
Cultivation	16 067.25	23 508.48	46.3
Harvesting	14 684.97	20 712.45	41.0
Overheads	27 015.05	32 676.81	21.0
Total	**60 170.93**	**80 107.24**	**33.7**

Table 7.7: Comparison of cost/tonne by operation in 1995 and 1996

Operation	Cost/tonne 1995	Cost/tonne 1996	Change in cost from 1995
Land Prep & Planting.	331.27	363.56	9.7
Cultivation	250.94	324.06	29.1
Harvesting	229.35	285.52	24.5
Overheads	421.93	450.45	6.8
Total	**939.76**	**1 104.27**	**17.5**

for the additional farms to be divested. The farms considered were:

- Springhead;
- Spring Field - Cherry Tree;
- Hillside;
- Carrion Crow;
- Paradise;
- Ashley Hall;
- Hayes Common.

Valuation was also carried out at Riley Farm, Hanover on behalf of SCJ - Frome Division; and Abingdon Farm Hanover.

Meteorological Report

On a monthly basis, meteorological data from the various ecological zones were compiled and circulated to the respective estates/farms and selected agencies. The information included monthly and annual rainfall data, relative humidity, minimum and maximum temperatures and sunshine readings from the various estates.

Table 7.8: Comparison of cost/ha by Input category in 1995 and 1996

Operation	Cost/ha 1995	Cost/ha 1996	Change in cost from 1995
Labour Cost	10 655.54	15 643.78	46.80
Material Cost	10 213.04	14 393.06	40.09
Equipment Cost	13 205.08	18 881.65	43.00
Real Est. Cost	5 296.23	5 837.37	10.20
Admin. Cost	21 236.06	25 079.93	18.10
Total	**60 605.94**	**79 835.79**	**31.70**

8 AGRICULTURAL PRODUCTION & EXTENSION SERVICES

8.1 WEATHER IMPACT

Weather was the major factor impacting on productivity during the 1996/97 sugar crop. Severe drought from December 1996 to April 1997 adversely affected cane yield of the late season canes. The frequency with which rainfall exceeded 10 mm on any day was extremely low during that critical period (*Table 8.1*). All areas except the Wet West received less than average rainfall.

Usually 2-3 days per month with rainfall in excess of 10 mm are required for sustaining growth. In early 1997 that quantity of rain was received on less than one day/ month and in some areas there were even consecutive months with no day of 10 mm rain.

Table 8.1: Number of days rainfall exceeded 10 mm, Dec-Apr. 1996/1997

Region	Dec	Jan	Feb	Mar	Apr	Total	% Mean
Irrigated	0	1	0	0	1	96	49
Wet West	0	5	4	3	2	458	115
N/West Coast	0	0	0	1	2	129	38
Eastern	0	2	0	0	2	192	44
Central	1	2	2	0	2	170	85

8.2 CANE PRODUCTION

A total of 2 487 783 tonnes cane was harvested from 39 582 ha or from 83% of the cane area. Cane yields averaged 62.9 tc/ha, a decline of 5.4 tc/ha or 8% from the previous year, *Table 8.2.*

Standover cane was estimated at 78 000 t with over 60 000 t in the Tropicana area alone, as that factory ended crop prematurely.

Cane production over the last 7 years show year to year fluctuations with no consistent trend towards achieving the production target of 3.1 million, *Table 8.3*.

Table 8.2: Cane productivity 1997 vs. 1996

	Area reaped (ha)	Tonnes reaped	tc/ha 1997	tc/ha 1996
Estates	20 555	1 346 503	65.5	72.7
Farmers	19 027	1 141 280	60.0	64.0
Total	**39 582**	**2 487 783**	**62.9**	**68.3**

Table 8.3: Cane production, 1991 - 1997

Crop years	Area reaped (ha)	Tonnes reaped	tc/ha
1990/91	42 091	2 765 705	65.1
1991/92	39 920	2 558 694	64.1
1992/93	40 071	2 688 338	67.1
1993/94	39 158	2 526 766	64.5
1994/95	39 580	2 325 592	58.8
1995/96	38 672	2 643 212	68.3
1996/97	39 582	2 487 783	62.9

Harvested Area

Despite a gradual increase in the total cane area, the anticipated increase in harvested area has not occurred. This partly indicates, that as new area is put into cultivation there has been a decline in maintenance of previously existing areas. Between 1991 and 1997 the percentage of area harvested has fluctuated between 82 and 93%, *Table 8.4*.

Cane Quality

Despite a shortfall in cane production by some 229 000 tonnes, improvement in cane quality, as marked by a higher JRCS of 10.49, brought sugar production to only 1 800 t below the 1996 production. This improvement however, cushioned only marginally the effects of reduced earnings from cane and sugar as the Industry experienced reduced revenues from lower sugar prices.

The **Frome** and Appleton areas experienced reduced revenues from low cane quality and low payment due to harvesting inefficiencies, factory problems, and extended harvesting period in addition to the drop in sugar price.

Table 8.4: Percentage of area harvested, 1991 - 1997

Year	% Harvested
1990/91	93
1991/92	88
1992/93	89
1993/94	86
1994/95	85
1995/96	82
1996/97	83

Replanting Programme

A total of 5 323 ha was planted for the crop year November 1996 to October 1997. The estates achieved 88%, while farmers achieved only 45% of target, *Table 8.5*. This failure by farmers to achieve a satisfactory replanting rate, for year after year, is a major factor causing low productivity in the Industry.

The annual requirement is 16% of total area but over the last six seasons the area replanted by farmers averaged only 9%, *Table 8.6.*

The Industry needs to address in a substantial way the funds required for the replanting programme. The assistance that is available by JCPS is being spread thinly and most farmers are not supplementing this amount with other funds to achieve good field establishment. The loan provided, amounts to 42% of establishment costs per hectare.

Table 8.5: Hectares planted 1997

Area	Estates	Farmers	Total
Frome	504	573	1 077
St. Elizabeth	497	81	578
Long Pond	164	165	329
Hampden	243	176	419
Clarendon	1 173	437	1 610
St. Catherine	817	287	1 104
Tropicana	8	69	77
Worthy Park	165	110	275
Total	**3 601**	**1 898**	**5 469**
% of Target	87%	49%	70%

Table 8.6: Hectares replanted by cane farmers

Years	Area in cane	Area replanted (ha)	% replanted
1992	21 101	1 816	9
1993	21 148	2 324	11
1994	21 310	1 494	7
1995	22 554	2 364	11
1996	22 582	2 275	10
1997	22 912	1898	8
Total/Avg	**21 935**	**12171**	**9**

Table 8.7: Hectares fertilized 1997

Area	Estate	Farmers	Total
Frome	5 586	5 920	11 506
St. Elizabeth	2 301	1 057	3 358
Long Pond	1 354	873	2 227
Hampden	834	514	1 348
Clarendon	5 989	3 470	9 439
St. Catherine	3 803	2 525	6 328
Tropicana	50	595	645
Worthy Park	848	2 169	3 017
Total	**20 765**	**17 123**	**37 868**

Fertilizer Programme

A total of 37 868 ha was fertilized up to the end of October 1997, *Table 8.7*. This represents 96% of the area harvested in 1997 and 80% of the total cane area. The figure suggests a decline in fertilizer usage during 1997.

Extension Services

High costs of agricultural inputs and low earnings brought about a relaxation in the timeliness and often quantum of agronomic practices. In response, Extension officers put major effort on increasing earnings from improvement in cane quality. The challenge of achieving a JRCS of 11.0 across the Industry as a compensatory factor for lower prices was frustrated by conditions in the Wet West where the JRCS was well below the standard.

Other areas of activity to improve cane husbandry and productivity were: Advisory on fertilizer usage backed up by soil and leaf sampling and field demonstrations; advisory on weed control practices supported by herbicide demonstrations; cane quality assessments with maturity testing and investigations of low JRCS, management of nursery plots to provide new sugar cane varieties to farmers; assessment of the quality of cultivation to legitimize replanting and maintenance loans under the JCPS as well as the PCB loan programmes; provision of crop estimates, cane yield data and facilitating cost of production surveys necessary for forecasting and management.

Agricultural Training

The Institute continued its Agricultural Training Programme in August 1997. Training included Sugar Cane Agriculture, Mechanics' Training Module I and II and Tractor Care Workshop.

A course in Sugar Cane Agriculture (For Supervisors, Farm Managers and Farmers) attracted 19 participants to Ebony Park HEART Academy August 11-29, 1997. Participants included two from Belize Cane Farmers Association and two from Spooner and Estridge Estates in St. Kitts. All achieved passing grades and were presented with certificates.

Course Content - Supervision and Management, Industrial Relations, Sugar Cane Agronomy, S.C. Soils, Sugar Cane Varieties, Nutrition and Fertilizers, Weed Control Practices, Cost Management, Irrigation and Drainage, Tillage Practices, Harvest Management, Cane Payment, Equipment Management, Safety in Use of Chemicals, Pest and Disease Control.

Specialized Training of Mechanics was conducted at **New Yarmouth**, **Monymusk** and **Tropicana**.

The course delivered was Part 1 of Basic Diesel Engine Repairs.

Part 2 - Power Shift Transmission conducted at:
- Appleton
- Bernard Lodge
- Monymusk
- Long Pond
- Tropicana
- Hampden

A total of 68 Mechanics participated in these hands-on Workshops over a period of four days at each location. Of the total, 45 achieved passing grades above 70% and received certificates.

Tractor Care Workshop

A total of 17 tractor operators participated in a Tractor Care Workshop held at **Long Pond** on December 9 and 10, 1997.

8.3 ST. CATHERINE

Severe drought was a main factor in further decreasing cane productivity/production in irrigated St. Catherine. Irrigation water only partially stemmed the decline. Extension efforts were geared mainly towards sensitizing growers to the need for improving cane quality, while attempting to increase output for subsequent crops.

The thrust towards increased quality was backed by a programme of maturity testing targeting approximately 30% of the canes grown in the area. Farmers at Amity Hall, Hartland, Bushy Park, Windsor Park and Half Way Tree, were trained in 5 group sessions and 16 individual field sessions in maturity testing using the hand refractometer.

Another mechanism used was cane quality monitoring towards which approximately 8 hours per week were devoted. In addition, 4 seminars, several field and farm visits, coupled with the harvesting committee meetings, were used to communicate the importance of good quality cane and its impact on cane payments. The reduction of tops, trash, soil, in-transit spills, as well as the need for good stumping were all featured.

Daily core lab reports were used to assist growers in identifying and correcting poor cane quality. Growers were encouraged to aim at JRCS values above 10.0 and those receiving readings below 9.0 were targeted for special assistance.

Replanting

Projections were for producing 0.35 million tc from the 5 992 ha in 1997, with a target of 0.45 million tonnes by year 2000. Actual output was 338 788 tc from 5 310 ha at 63.8 tc/ha. To get the programme back on track, special attention was paid to land preparation, nursery cane production and distribution, irrigation, weed control and fertilizing. Farmers at Windsor Park and Half Way Tree (divested lands), Amity Hall and Thetford farm were encouraged to restore approximately 300 ha to cane production. Under the ACB/PCB programme, applications were made for loans totaling $9.5 million. Approximately $8.95 million were approved and $7.5 million disbursed. The main varieties planted were BJ8226, BJ82119, BJ7465, BJ7627 and BJ7504.

Extension assisted in setting up five commercial seed cane farms on the holdings of Stanford and Shaw, Sunshine, Robinson and Fearon's farms.

Tillage Investigations

An experiment to investigate the feasibility of reduced tillage was started at Half Way Tree. The (standard) six operations were reduced in stages to five, by the elimination of one ploughing, and then to four, by the exclusion of one ploughing and one ripping. The 2.35 ha field was divided into three to facilitate the three treatments. Observations indicated quicker emergence of shoots and better weed control from the conventional 6 operations. Covering of seed pieces was more difficult in reduced tillage plots.

Weed Control

The newer herbicides pendimethalin (Herbadox) and oxadiazon (Ronstar), tested in cocktail with atrazine (Gesaprim), ametryne (Gesapax) and 2,4-D/Oxynil (Actril), provided good pre-emergent and early post-emergent control of grasses in trials at Half Way Tree, and Windsor Park, consistent with those done at Bernard Lodge and Innswood.

Herbadox applied at 2.5 L/ha with Gesapax Combi, 1.5 L/ha, gave approximately 80-90% pre-emergence weed control up to approximately 6 weeks. Herbadox at 1.5 L/ha with 2.5 L/ha ametryne/atrazine on the sandy soils at Half Way Tree gave over 80% control for upwards of 4 weeks.

At Windsor Park isoxaflutole (Merlin) was tested at a rate of 0.2 kg/ha combined with diuron at 1.75 kg/ha and Actril at 1.0 L/ha. The results were variable when farmers conducted spraying on their own.

Ripeners

Commercial ripener application, using Round-up and Fusilade, was carried out in fields at **Tropicana**, F.M. Jones and Bernard Lodge. On treated fields brix averaged 17.5 compared with 15.7 in untreated fields after four weeks. Plans to include Windsor farms were aborted because of low productivity and intermixing of suitable and unsuitable fields.

Nutrition

Approximately 186 soil and 130 leaf samples were taken, analysed and results and recommendations discussed with growers. The protracted drought and high cost hampered fertilizer application. Presentations were made at

Hampton Court, Thetford, Amity Hall, Windsor Park and Half way Tree on the benefits of proper selection and timing of application. A demonstration at Sunshine Farm showed cane yield of 89 tc/ha, at 7 months, on fields treated with 11 bags/ha (recommended) as against 74 tc/ha on fields treated with 3 bags/ha and 69 tc/ha where no fertilizer was applied.

Ratoon Management

A total 4 035 ha (76% of target) received adequate and timely maintenance. Interrow cultivation was done to 3 010 ha. However, 480 ha received no fertilizer.

Other Activities

Other activities undertaken included participating in the cost of production surveys on 16 farms, conducting cane yields surveys, attending 128 harvesting committee meetings, and 20 group meetings. Extension also participated in the out of crop training at Ebony Park and Tractor Care workshop at **Bernard Lodge**.

For purposes of directing Extension effort, farms were reclassified according to productivity, based on 1997 output, *Table 8.8.*

Except for the 5.5% of farms on 935 ha, much work needed to be done to increase productivity to over 72 tc/ha. Targets to year 2000 for increased productivity in the respective categories are given in *Table 8.9.*

Nursery Cane Production

During 1997 the Extension nursery at Great Salt Pond # 47D yielded 200 tonnes cane seed at 65.86 tc/ha at first harvest. The severe drought took toll on the regrowth but in August the field was partially harvested and cane seed sold to the SIRI farm at Springfield and Noel Lowe's farm, Clarendon. The field should again be ready for harvest in January - February 1998. Varieties produced were BJ8226 and BJ82119.

Growth Measurements

In March 1997 growth stations were harvested and re-established at H. Ricketts, and M. Sturridge in Old Harbour, Lindo's Farm in Fellowship Hall and Caymanas Development Company. Each field had 20 sub-stations of one meter in length. Sub-stations were selected along rows chosen at random. There were two sub-stations per row and 25 meters between sub-stations.

Observations of field husbandry and measurements of growth parameters were made on regular field visits. Initially, tillers within sub-stations were counted; later a single primary shoot within a sub-station was tagged and monitored. Accessibility of stations varied from farm to farm becoming more difficult with cane vigour.

Table 8.8: Farms grouped into productivity categories, St Catherine - 1997

Categories	Area (ha)	%	Tonnes Reaped	%	Tc/ha Reaped
50 tc/ha	461.14	-8.70	21 913	5.40	47.50
50-65 tc/ha	1 007.11	-19.00	61 969	18.29	61.50
66-80 tc/ha	217.00	-4.00	16 761	4.90	7.24
80 tc/ha	718.00	-1.50	6 543	1.90	83.80
Estate	3 546.91	-66.28	231 602	68.48	65.30
Total	**5 310.16**	**-100.00**	**338 788**	**100.00**	**63.80**

Table 8.9: Projections for productivity increases to year 2000, St. Catherine

Year	Area Reaped	Tonnes Reaped	Tc/ha	Area in Cane
1996/97	5310	338 788	63.80	5992
1997/98	5310	330 000	62.21	5992
1998/99	5507	380 000	69.00	6300
1999/2000	6300	407 300	71.00	6300
2000	6300	466 200	74.00	6300

Table 8.10: Growth station data at 12 months, St. Catherine

Variety	Station 1 BJ7452	Station 2 BJ7465	Station 3 UCW5465	Station 4 UCW5465
Cycle	5R	4R	3R	4R
Row space (m)	1.5 m	1.5 m	1.5 m	1.5 m
No. of stalk/m	13.0 m	16 m	13 m	12 m
Millable stalks	11	12	10	9
Non-millable	2	4	3	3
Stalk length at 12 mo	216	223	216	154
Internode length (cm)	14.82	14.74	14.40	12.13
Stalk weight (kg)	1.21	1.44	1.10	1.25
Open leaves	8.00	8.00	9.00	9.00
Actual tc/ha	108.56	123.52	68.30	76.70
Cal. Length/mth m	18.00	18.58	80.00	12.83

Key: Station 1 - Ricketts; Station 2 - Sturridge; Station 3 - Lindo; Station 4 - Caymanas Dev. Co.

When the above data is compared with the past 3 years indications are that there has been steady decline in yields, perhaps due to the increase in ratoon cycle. Generally the number of tillers, length of stalk and weight of stalks have declined below levels previously obtained. The yield obtained varied between a 1.3% increase at station 4 to a 22% decrease at stations #1 Indications are that productivity for 1997 should be lower than in 1996.

Table 8.11: Production/productivity in St. Thomas-Ye-Vale, 1996/1997

Growers	Area (ha)	1996	Tonnes Cane	1997	% Change	Productivity (tc/ha) 1996	1997
Worthy Park	798	72 344	67 384	- 7	97	84	
Hill Farmers	1 631	107 246	97 202	- 10	67	60	
Bog Walk	410	39 141	31 266	- 20	79	76	
Groups	282	8 700		9 218	-16	35	32
Total		**3 121**	**227 431**	**205 070**	**-11**	**75**	**67**

8.4 ST. THOMAS YE-VALE

Cane area in St. Thomas Ye-Vale increased by 103 ha (3%) but production fell as a result of persistent drought which intensified in the latter half of the growing period. Overall production declined by 22 361 tonnes cane, or about 11%, when compared with 1996 levels, *Table 8.11.*

Planting

Area planted in 1997 was 9% less than in 1996. A total of 239 ha (*Table 8.12*) was established during the year. Replanting would have been higher had there not been a shortage of tillage equipment at critical periods and if loans were made available on a more timely basis.

Crop Nutrition

A total of 198 soil and 71 leaf samples were collected and submitted to SIRI's Analytical Laboratory for nutrient analyses and recommendations. Farmers on small holdings were sensitized, through training programmes, to plant nutrient requirements. The effect was quite noticeable as, aided by a reduction in price, there was a marked increase in area fertilised to 3 017 ha.

Over the years, farmers on small holdings in the uplands of Clarendon, St. Ann and St. Catherine have traditionally used 16-9-18 or 18-9-18 grade fertilizers. Experiments were laid down on loam to medium clay soils, on four holdings, to assess the effect of withholding phosphate, an expensive ingredient. Results should be obtained at the next reaping.

Projects

Sugar cane museums were established at the Kellits Secondary and Stacyville All Age Schools to assist students and farmers in identifying and observing the different characteristics of commercial varieties. Ten varieties were planted at Kellits Secondary and eight at Stacyville All Age from among BJ7452, BJ7465, BJ7627, B51129, BJ7262, BJ7504, BJ8226, BJ82156, B41227 and BJ82119. These museums were being monitored to ensure maintenance of proper practices.

At Kellits Secondary, a lecture was given to the 11th Grade students on agronomic practices with an aim to foster early appreciation of sugar cane culture and stimulate interest in cane farming.

Other efforts at grower education took the took the form of group meetings, individual discussions and field demonstrations. There were 18 farmers' meetings in the Bog Walk area dealing mainly with loan application and disbursement, machinery and equipment usage, varieties and field fertilization.

Six group meetings were held with **Worthy Park** farmers. These, backed up by three field demonstrations, were convened to discuss fertilizer grades and quantity, weed control, cane quality and payment.

McNie Nursery

The McNie Nursery was fertilised with ammonium sulphate and 16-9-18. Weed control was by treatment with Gesapax 80 WG and 2,4-D amine along with grass stumping.

An additional 0.32 ha was planted with BJ8226 to give a total nursery area of 0.93 ha. Eighteen tonnes of cane seed were sold to farmers to establish secondary nurseries. The area was fenced to keep out animals which had been plaguing the nursery for several years.

8.5 CLARENDON AREA

Sugar cane production of 506 633 tonnes in Clarendon was 7% less than in 1995-96. This decline in production

Table 8.12: Cane planting, St. Thomas-Ye-Vale, 1996-97

Growers	New Land	Replanted	Total
Worthy Park	63	116	179
W/Park Groups	10	25	35
Others	25	-	25
Total	**98**	**141**	**239**

was attributed mainly to prolonged drought during the growing season, coupled with inefficiencies in the Mid-Clarendon Irrigation Scheme. Juice quality was however, very satisfactory as good weather for harvesting prevailed throughout most of the cropping period. Overall tc/ts achieved was 10.07 with an average JRCS of 10.43 for **Monymusk** estate and an even better 10.69 for independent farmers. The bulk of the canes were delivered within 48 hours of kill, *Table 8.13*.

Table 8.13: Independent farmers' cane delivery profile to Monymusk factory

Time Range (hours)	Percentage of Delivery
12-24	31.50
24-48	30.00
48-72	37.60
>72	0.90

An intense maturity testing programme along with cane quality monitoring was pursued in an effort to promote the best possible returns to growers. While quality was of satisfactory standard, cane productivity remained at unsatisfactory levels of 60 tc/ha and below, *Table 8.14*.

Special Projects

After a number of stops and starts, farming was abandoned on T. G. Mignott's farm, one of the Extension Special Project farms in the area. A similar situation also developed at J.V.C. farm, another Special Project.

At the other Special Project, M & K Young, several discussions and demonstrations were held highlighting weed control and fertilizer application to which other growers in and around the area were invited.

Table 8.14: Production data for 1996/97 crop

Grower	Cane Area (ha)	Area Reaped	Tonnes Delivered	tc/ha	Tonnes Seed Cane	Tonnes S/O
Monymusk	4 949	4 225	229 664	54	13 000	25 065
New Yarmouth	1 912	1 643	95 123	58	4 000	1 300
Mid/Upper Clarendon	1 600	1 433	86 498	60	1 500	-
Vere	610	448	26 063	58	600	-
Mid/Upper Clar.Group	912	891	50 766	57	500	-
Vere Group	350	337	18 520	55	100	-
Total	10 361	8 997	506 634	56	19 700	26 365

Harvesting was closely supervised to ensure delivery of high quality material to the factory. A comparative study of the production data for special projects over a three year period shows the trend towards decreasing cane productivity, *Table 8.15*.

Replanting Programme

The slow pace of disbursement of the JCPS. loans resulted in much lower than desired replanting rate which was further aggravated by the long drought. Performance of some tillage contractors was also below acceptable standard. In support of replanting, Extension Officers:

- collected soil samples prior to land preparation to determine fertilizer requirements
- assisted in accessing $2 345 638.12 in planting/ replanting loans (and $505 269.88 for ratoon maintenance)
- coordinated surveying and land development for 35 ha
- conducted a seminar and six field days to highlight problems relating to land preparation and inter-row cultivation
- assisted land preparation contractors to adjust, regulate and maintain machines used in their operations
- assessed work done by contractors;
- identified sources for 5 000 tonnes of cane seed of mainly new varieties, 150 tonnes of which came from SIRI, Springfield nursery
- maintained 7.6 ha of nursery

A very special effort was made to encourage growers to ensure maintenance of well populated fields. Correct methods of supplying were emphasized.

The bulk of replanting was conducted at **Monymusk**, *Table 8.16*, while the most popular varieties planted were BJ7504 (409 ha) and BJ7015 (377 ha), *Table 8.17*. Substantial areas were planted to the newer varieties, BJ82119 (134 ha) and BJ8226 (101 ha).

Crop Nutrition

The fertilizer programme was hampered by lack of irrigation water in some areas. Soil and leaf analyses indicated that for a major part of the area, most appropriate treatment for plant cane was 350 kg/ha of 14-28-14 in the planting furrow followed by 250 kg/ha of 17-0-17 at one month. In the case of ratoons, 500 - 600 kg/ ha of 17-0-17, applied as early as possible after reaping, was sufficient to provide the nutrients required.

Table 8.15: Production data for special projects

Years	Area Reaped	Tonnes Delivered	tc/ha	tc/ha	ts/ha	JRCS
T.G. Mignott & Sons Limited						
1994-95	130	5 600	43	10.48	4.10	9.54
1995-96	125	5 015	40	9.50	4.20	10.53
1996-97	44	1 547	35	9.42	3.71	10.62
J.V.C.						
1994-95	16	974	60	11.51	5.20	8.96
1995-96	17	1 065	60	9.67	6.20	10.34
1996-97	24	597	24	11.16	2.15	8.96
M.K.Young						
1994-95	24	1 703	70	10.13	6.90	9.87
1995-96	25	1 515	61	9.35	6.52	10.67
1996-97	24	1 543	64	9.17	7.30	10.90

Table 8.16: Area planted during 1996/97 planting season, Clarendon

Grower	New Planting (ha)	Replanted (ha)	Total
Monymusk	-	923	923
New Yarmouth	-	250	250
Farmers	117	320	437
Total	**117**	**1 493**	**1 610**

Table 8.17: Area planted to different varieties, Clarendon, 1996/97

Varieties	Estate	Farmers	Total
UCW5465	90	-	90
BJ7015	208	169	377
BJ7465	125	41	166
BJ7504	270	133	409
BJ7627	92	128	220
BJ82119	51	83	134
BJ8226	40	61	101
Others	20	36	56
Mixed	21	36	57
Total	**923**	**687**	**1 610**

Table 8.18. Hectares fertilised during the year

Grower	Ratoons	Plant Cane	Total
Monymusk	3 271	923	4 194
New Yarmouth	1 525	250	1 775
Farmers	3 033	437	3 470
Total	**7 849**	**1 610**	**9 439**

Weed Control

Weed control continued to be a major challenge to growers as weed competition tended to be high especially with furrow irrigation and this was often aggravated by a lack of funds. Growers were encouraged to apply an integrated approach to control noxious weeds, such as wild pangola. Several field days and demonstrations were conducted throughout the area to promote better control. Gesapax Combi, 4.5 - 5 L/ha, plus Actril, 1 L/ha proved to be the most effective treatment.

8.6 DRY NORTH COAST

Growers in the Dry North Coast experienced a reduction in production and productivity, *Table 8.19*, due mainly to severe drought during much of the growing season. A mere 840 mm of rainfall was recorded for the crop year June 1996 - May 1997 as against 1 536 mm for the previous corresponding period.

Special Projects

Despite efforts by Extension and good cooperation from farmers on holdings targeted as special projects, lower cane yields were registered, largely as a consequence of the drought, *Table 8.20.*

Other Project Farms

At the beginning of the year, four farms, Advanced Farm Technology, Richmond Farms Ltd, New Forest 4H Club and Dannie Ricketts Holdings were given special attention in an effort to foster development and improve productivity.

Advanced Farm Technology

Advanced Farm Technology, located at Martha Brae, established a 10.11 ha nursery plot in 1996 for the development of a 121 ha sugar cane farm. Technical assistance was provided in developing a farm plan, while recommendations were made for appropriate varieties, nutrition and weed control. The nursery which yielded 62.80 tc/ha, was used to plant an additional 32.39 ha in 1997, bringing area under cultivation to 42.50 ha, Table 3. In efforts to limit expansion in one variety beyond 30% of area, recommendations were made for acquisition of other adapted varieties. Further, assistance was provided

Table 8.19: Cane production '96 and 97, North Coast area

Year	Area Harvested (ha)	Tonnes Delivered	tc/ha
1996	4 953.12	306 928.93	61.96
1997	4 990.92	283 460.74	56.79

in accessing a JCPS replanting loan and advice given in weed control.

Richmond Farms Ltd.

The 121 ha Richmond Farms harvested 97.12 ha at 39.93 tc/ha. Conscious of the need to increase yield, the farm installed an overhead sprinkler irrigation system with the capacity to irrigate 3.64 ha/24 h. Recommendations were made in respect of Johnson grass control. Assistance was given in accessing a ratoon maintenance loan for 23.67 ha through the JCPS loan scheme. Nurseries of BJ82156 (0.4 ha) and BJ8226 (0.80 ha) were established while an additional area of 15.30 ha was planted to BJ7452.

New Forest 4H Club

The New Forest 4H Club farm consists of 6.07 ha in cane, a total of 4.86 ha of which was harvested, yielding 26.9 tc/ha. Drought stress resulted in 1.21 ha being too unthrifty to warrant harvesting.

Dannie Ricketts

Dannie Ricketts' farm, at Jack's Lodge, consists of 56.66 ha, 14.16 ha of which is in sugar cane. Output in 1997 totaled 149.98 tc at 10.59 tc/ha. This poor yield was due mainly to low plant population, made even worse by the severe drought. Replanting was therefore recommended.

The farmer accessed a loan of $500 000 through the Clark's Town P.C. Bank for the replanting of 14.16 ha plus the development of an additional 6.00 ha. Recommendations were made with respect to field layout, nutrition, varieties to be planted and weed control.

Replanting/Loan Scheme

Drought severely curtailed replanting to just under 750 ha, *Table 8.22.* Notwithstanding this, the extension team spearheaded and facilitated the replanting on a number of farmers' holdings by assisting with the accessing of loans through the various lending institutions. Advisories pertaining to variety identification, and nutrition were distributed. Growers encouraged and assisted in establishing variety nurseries included Richmond Farms (BJ8226 and BJ82156) and Linden Peart's farm (BJ78100 and BJ82156). A total of 311 ha were developed by loan proceeds from the various lending institutions, *Table 8.23.*

Other Projects

Other projects embarked on by the Extension Team in order to address the needs of the farmers included:

- Cane quality promotion
- Etherel Trial
- Tillage Investigations

Cane Quality Promotion

Three studies of the effect of suckers and tops on JRCS were conducted on Harold Grier, Hyacinth Barley and Bryan Chin's holdings. The exercise compared adjacent cane rows: one in which special effort was made to remove suckers and tops while the other was harvested in the normal fashion. The cane trucks leaving the field were tagged accordingly and JRCS compared. All three cleaning exercises resulted in considerable improvements in JRCS with the sharpest increase, 1.59 units, recorded at Harold Grier's farm, *Table 8.24.*

Etherel Test

A trial to test the effect of Etherel on germination at Lottery had to be abandoned because of severe drought which rendered results inconclusive. The chemical was tested at rates of 0.25%, 0.05%, 0.75% and 1% concentration on BJ7504.

Table 8.20: Productivity on Special Project farms

Farm	Cane Area (ha)	Area Reaped	Tonnes Delivered	tc/ha 1997	tc/ha 1996	Percent Change
Russell	9.71	9.71	383	39.46	58.37	-32.39
Biddiford	35.61	33.59	1 980	58.95	51.37	14.75
James	35.20	32.37	1 233	38.09	61.54	-38.12
Dalrymple	16.20	16.20	856	52.85	74.25	-28.82
Octan	19.42	10.11	436	43.09	47.56	-9.39

Table 8.21: Variety distribution on advanced Farm Technology

Cane Area (ha)	BJ7504	BJ7465	BJ8226	BJ7627	BJ7015
42.50	16.20	16.20	2.02	4.85	3.23

Tillage Investigations

A trial was laid down at Hampshire in which the number of tillage operations was varied in efforts to determine the most cost effective land preparation. Details will be provided after the first harvest. Growth parameters will be measured over four consecutive years through the use of growth stations.

Farm Development

At the invitation of the Hampden Management, a farm plan was prepared for establishment of cane on 162 ha at Phoenix, an area formerly in pasture, and Springvale farms. This expansion of cane growing was being contemplated in efforts to meet a target of 20 000 tonnes of sugar by the year 2000. The extension team rendered further assistance through soil sampling for fertilizer needs, assistance in loan applications as well as in recommendations for appropriate varieties. Planting will commence in 1998.

Table 8.22: 1997 area replanted, North Coast, 1997

Grower	Replanting Target	Area Replanted (ha)
Long Pond Estates	243	164
Farmers	243	165
Hampden Estates	304	243
Farmers	250	176

Table 8.23: Disbursement of Loan Proceeds for 1997

Lending Agency	# of Applications	Approved	Area Replanted	# of Farmers	Disbursed
JCPS	91	4 353 769	189	91	4 003 769
Lower Trelawny P.C.	94	8 533 140	167	94	5 908 590
St. James P.C.	21	249 112	25	14	196 500
Total	**206**	**13 136 021**	**381**	**199**	**10 108 859**

Table 8.24: Effects of suckers and tops on JRCS

Varieties	Nature of Pile	Brix	Pol	Purity	JRCS
Harold Grier	Normal	17.82	14.95	83.88	10.69
BJ7504	Cleaned	18.77	16.32	86.92	12.28
H. Barley	Normal	18.90	15.70	83.07	11.11
BJ7015	Cleaned	19.60	16.78	85.61	12.02
B. Chin	Normal	18.10	14.64	80.87	10.27
BJ7015	Cleaned	17.50	14.61	83.47	10.62

NB. Cleaned = Suckers and tops removed

8.7 WET WEST

Production

An increase in cane production, from 969 450 to 1 053 412 t, was achieved in the Wet West despite a decrease in cane area from 15 427 to 14 327 ha between 1994/95 and 1995/96 but this was not sustained in 1996/97 as a decline of approximately 4% to 1 013 459 t was registered.

Factors contributing to the falloff were:

- Severe drought
- Illicit fires
- Spoilt cane: Frome Estate - approximately 19 015 t; Frome Farmers - 3 150 t, Holland & Casa Marantha - 6000 t, Appleton Estate - 8000 t, Appleton Farmers - 6000 t
- Severe cattle damage especially in the Barton Isle area of Appleton

With growers experiencing low cane payment from poor quality canes, farmers were visited on a regular basis particularly in the Old Hope, New Hope and Broughton areas to emphasize good harvesting practices. On-site discussions were held with Contractors in the Group 15 area of Appleton in efforts to improve quality while frequent visits were made to individual farmers in the area to assist in harvest management. Investigations of soil and leaf nutrient status also led to specific recommendations for fertilizer application.

Replanting Programme

Inadequate financing, untimely disbursement and drought adversely affected the replanting programme. In the Frome and Appleton areas respectively, only 67 and 41% of replanting targets were achieved.

Holland expanded cane cultivation to some 850 ha. Growers in the Group 15 area were advised to reduce the area in BJ7504 in favour of high sucrose varieties such as BJ82119 in order to increase profitability.

Approximately 1655 ha were replanted by the end of October, the bulk occurring on the estates, *Table 8.25*.

The extension team worked very closely with growers, giving advice on land preparation, variety selection, weed control and fertilizer application.

Loan Programme

Some 132 farmers were visited and their operations monitored for maintenance loans covering 673 ha and replanting loans on 425 ha to a value of $19 394 003, *Table 8.26*. Farmers were assisted in identifying and acquiring recommended varieties.

Weed Control

To reduce weed infestations in the **Frome** area several group discussions followed by method & result demonstrations were conducted. A trial was conducted in corn grass control at Farmcot in the New Hope area. Recommendations after assessment were for 5 L Igran + 2.5 L Actril D'S/ha. Approximately 90% effectiveness was observed 6-8 weeks after treatment.

Two method/result demonstrations were conducted in the Roses Valley & Thorton areas to emphasize timely weed control practices, proper calibration, care of equipment and safety precautions in handling and mixing chemicals.

Table 8.25: Replanted area Wet West 1996/97 crop

Area	Replanting Target	Area Replanted (ha)	New ha	Total
Frome Estate	520	504	-	504
Frome Farmers	850	457	116	573
Sub Total	1 370	961	116	1 077
Appleton Estate	242	199	-	199
Appleton Farmers	200	24	57	81
Holland & Casa				
Marantha	306	109	189	298
Sub Total	748	332	246	578
Grand Total	**2 118**	**1 293**	**362**	**1 655**

Table 8.26: Loan disbursement Wet West 1996/97 crop

Source	Loan Type	Area (ha)	Value ($)	Disbursed ($)
PC Bank	Maintenance	195	2 768 680	2 364 372
JCPS	Maintenance	478	7 083 960	6 964 500
Sub Total		673	9 852 640	9 328 872
PC Bank	Replanting	185	7 025 022	4 687 551
JCPS	Replanting	242	6 050 000	5 377 580
Sub Total		427	13 075 022	10 065 131
Grand Total		**1 100**	**22 927 662**	**19 394 003**

Table 8.27: Area fertilized in the Wet West, 1996/97 crop

Area	Area Fertilized (ha) Plant	Ratoon	Total
Frome Estate	846	4 740	5 586
Frome Farmers	520	5 400	5 920
Sub Total	1 366	10 140	1 366
Appleton Estate	194	1 175	1 369
Appleton Farmers	59	998	1 057
Holland & Casa			
Marantha	277	655	932
Sub Total	530	2 828	3 358
Grand Total	**1 896**	**12 968**	**14 864**

Nutrition

The severe drought in the first half of the year also tended to cause farmers to postpone fertilizer application. Farmers were encouraged to persist with early application to foster early and rapid growth. By the end of October most areas had received fertilizer, even if timing was not always satisfactory, *Table 8.27.*

The fertilizer demonstration in the **Appleton** area to show the value of planting with 14-28-14 followed by 17-0-17 after 8 weeks, was reaped in January. Results showed that this regime yielded 145 tc/ha or 32 tc more than plot given a single dosage after the cane had germinated.

Two other demonstrations, one at Thornton and the other at New Hope, set up jointly with ALLCANE, were also designed to show the importance of incorporating fertilizer with the seed piece followed later by a top dressing, both with recommended dosages. Results will be obtained during the 1997/98 crop.

Harvest Management

In order to facilitate efficient harvesting, a maturity testing programme was organised, as approximately 1 200 ha were maturity tested using the hand refractometer. Findings were made available to the Cane Farming Departments at both **Frome** and **Appleton** to guide the process of cane ordering. Monitoring showed that better results were usually obtained when reaping was guided by test results. This programme was often undermined by the spate of illicit fires which plagued the **Frome** area.

A number of group discussions were held with harvesting teams to encourage proper topping, stumping, piling, removal of suckers and avoiding the loading of stones and mud to reduce extraneous matter content and maximise cane price.

Divested Lands

Monthly visits showed that of the 12 farms divested, 11 were progressing fairly well as productivity had increased over the last 3 years.

8.8 WET EAST

Programmes to increase productivity being adversely affected by persistent drought, the focus was shifted to strategies to obtain the best results from harvesting. Essentially the harvest management programme was designed to achieve maximum sugar from relatively low cane yield. Main programmes pursued during the year could be summarised as:

- Production management to develop and maintain scheduled activities in all aspects of cane cultivation;
- Farmer education aimed at manipulating and using information beneficial to cane farming;
- Developing efficient production systems based on the most cost effective procedures.

SPECIAL PROJECT FARMS

Hamilton Farms

Activities during the year on Hamilton Farms included maintenance of ratoons, promoting early and effective weed control by proper use of herbicides and early fertilizer application to all fields using the recommended grades and rates.

Despite the protracted drought experienced, the farm realised only 3% decline in productivity and a decrease in production due to premature closure of the **Tropicana** mills. The farm reaped only some 3.2 ha of the existing 30 ha, delivering 218 tonnes (*Table 28*). Efforts to implement proper harvesting techniques resulted in a satisfactory 12.26 average JRCS.

Morant Farms

At Morant Farms extension effort guided the development of a ratoon management programme to include effective and precise interrow cultivation practices, the replanting of 3 ha of BJ7465, BJ7627 and BJ8226, the resurrection of 15 chains of head drains to assist with the removal of excessive moisture in some low lying fields.

By the end of crop the farm had delivered some 93 tonnes from 1.4 ha with a slight decline in productivity and a significant decrease in production compared with the previous year's 979 tonnes from 14.2 ha *(Table 8.28)*. The farm ceased harvesting as a consequence of the premature closure of the factory. Expectations were for productivity and production increases in 1998.

Roselle Farms

Roselle Farms continued to show improvements in all aspects of crop husbandry. Harvesting nearly the same area as in the previous year, the farm managed to maintain productivity, delivering 2 666 tonnes cane from 46.0 ha compared with the previous year's 2 668 tonnes from 47.6 ha (*Table 8.28*). JRCS values averaged 10.50 compared with 10.45 in the previous year.

The harvest management programme, aimed at obtaining best possible cane quality, focused on Harvesting Techniques/Methods, Contractors' Supervision, Infield Harvesting Activities, Ripening Management, Meetings with Cane Cutters to discuss removal of tops, suckers, and debris.

The cultivation management programme included:

- proper use of equipment in land preparation
- replanting (variety selection)
- fertilizer application (emphasizing grade/rate on all fields)
- early/effective herbicide usage (introduction of Asulox and Merlin used on some 20 ha for weed control)
- inter-row cultivation (moulding of all harvested fields)

These programmes were focused on all categories of work done on the farm. Every effort was made to ensure that the schedules stated in the programmes were met.

Table 8.28: Production Data for Special Project Farms, Wet East 1995-97

	1995				1996				1997			
Grower	Reaped (ha)	Tonnes deliv.	tc/ha	JRCS	Reaped (ha)	Tonnes deliv.	tc/ha	JRCS	Reaped (ha)	Tonnes deliv.	tc/ha	JRCS
Morant	93.10	501	53.50	8.83	14.20	979	69.00	8.37	1.40	93	67.10	8.40
Roselle	54.63	2 609	49.50	9.61	47.60	2 668	55.70	10.45	46.00	2 666	57.20	10.50
Hamilton	27.12	1 686	62.16	9.60	22.00	1 455	66.20	9.83	3.20	218	68.10	12.26
Flynn	13.76	394	28.60	8.36	-	-	-	-	-	-	-	-
Total/avg	**102.82**	**5 191**	**48.47**	**9.10**	**81.80**	**5 102**	**63.60**	**9.55**	**50.60**	**2 577**	**64.10**	**10.38**

Table 8.29: Area (ha) replanted in Wet East, 1996-97

Growers	1995	1996	1997
Tropicana Estate	71	80	8
Large Farms	63	58	75
Small/Group Farms	13	7	13
Total	**146**	**145**	**96**

Table 8.30: Delivery profile for harvesting period 1996-97

Growers	24-36 h	36-48 h	48-60 h	60-72 h	after 72 h
Tropicana	2 000 t	20 000 t	14 000 t	14 000 t	4 000 t
Farmers	4 000 t	25 000 t	13 000 t	15 000 t	1 500 t
Total	**6 000 t**	**45 000 t**	**27 000 t**	**29 000 t**	**5 500 t**

Significant increases in productivity and production were expected for the next crop.

Ratoon Management

Ratoon management was largely unsatisfactory, particularly as Tropicana ceased cultural activities including inter-row cultivation, weed control, drainage and fertilization. Satisfactory cultural practices were carried out only at F.M. Jones estate and a few medium sized farms such as Pera Development Company, Golden Downs, West Potosi, Rosselle, Morant and Bowden. Small group farms and medium sized farms around Serge Island and Duckenfield carried out limited post harvest and inter-row cultivation activities.

Replanting/ Loan Programme

Replanting was recommended for some 400 ha for the 1996-97 crop year; but only 77 ha or 24% of target was achieved. This was much less than in the previous year and included a mere 8 ha from Tropicana, *Table 8.29*. Main reasons for the shortfall included:

- severe drought;
- shortage of machinery and equipment for land preparation;
- inadequate/unreliable seed cane source.

Approximately 25% of area planted was to the newer varieties, BJ82119, BJ8226, BJ8207 and BJ82156.

The Replanting Programme was supported through loans from J.C.P.S. and the Morant Bay P.C. Bank schemes. Under the JCPS programme, applications were made for over $2.5 million to replant some 155 ha. Some $1.2 million was approved and disbursed. A total of 11 farmers applied for some $600 000 for 20 ha of replanting and maintenance loans. Approximately $450 000 was approved and another $70 000 disbursed during the year.

Cane Quality Management

There were significant improvements above the previous year with regard to cane quality control. Emphasis was placed on removal of tops and suckers and the delivering of mature, fresh cane for processing. There was also considerable improvement in “Kill to Mill”, as more than 65% of the canes were delivered in 48 hours *(Table 8.30)*.

Approximately 10% of deliveries from Serge Island Farms and 15% from Duckenfield, Spanish Wood and F.M. Jones were monitored. By the end of the crop the average JRCS in the region had improved by some 2 units.

Maturity Testing

In anticipation of the start of the crop, a programme of maturity testing of cane was started in the region. Some 500 ha of canes were tested and the results and recommendations on the sequence of reaping reported to growers.

Education

Weekly reports from the core lab were used as reference to impart the importance of quality in the payment system. Two sessions were held at the laboratory, to further familiarize growers with the system. Attendance was good and most farmers showed appreciation for observing the system in operation.

Crop Nutrition and Fertilizer Usage

Most growers completed their fertilizer application programme, using recommended grades 22-0-22 and 16-9-18. Fertilizer was applied to some 600 ha of ratoons and 25 ha of plants. Unfortunately the major estate, Tropicana, reduced severely (to only 50 ha) its fertilizer application, as well as other cultural practices, with potentially adverse consequences on the next crop.

Table 8.31: Hectares fertilized during 1996-97 crop year

	Plant			Ratoon		
Grower	22-0-22	16-9-18	14-28-14	22-0-22	16-9-18	Total
Tropicana	-	-	3	10	40	53
Large Farms	15	25	5	250	130	425
Small Farms	2	3	2	65	100	172
Total	**17**	**28**	**10**	**325**	**270**	**650**

A total of 128 results and recommendations of foliar and soil analyses from the analytical laboratory were distributed among and discussed with respective growers, *(Table 8.32)*.

Training in collection and preparation of leaf/soil samples was given to growers in Dalvey, Bath, York, Dam, Pond Pasture and Bailey's Piece.

Table 8.32: Recommendations based on foliar/soil analyses crop year 1996/97

Grower	Foliar Analyses	Soil Analyses
Tropicana	40	10
Large Farmers	35	5
Group farmers/small farmers	30	5
Total/Average	**105**	**20**

Table 8.33: shows variety distribution in the Wet East 1997

Variety	Percentage
BJ7465	25
BJ7015	25
BJ7314	10
B51129	8
UCW5465	6
D14146	7
BJ7452	5
BJ7013	6
Others	7

CROP PROTECTION

Weed Control

With persistent drought, weed infestation levels were low within the region. Towards the end of the year, a weed control trial was laid down at West Potosi to compare the use of Asulox plus Actril against Gesapax Combi plus Actril. The more effective combination will be promoted in the next year.

Pest/Disease

Routine checks and regular field visits indicated that pests and diseases such as canefly, leaf scald, smut and rust were all contained.

Land Development

Two small group sessions were held on the importance of land utilization, layout and drainage. Discussions on land preparation, furrow direction, interval and roadway location and construction were highlighted. Participants were growers in the Dam, Pond Pasture, York, Rocky Point and Bath areas.

A session was held at Seaforth earlier in the year to assist farmers in the low lying areas of Serge Island on different methods of draining, for improved productivity. Participants expressed appreciation and indicated a desire for such sessions to be held annually.

Varieties

The multiplication of newly released varieties continued with the planting of BJ82119, BJ8207, BJ82156 and BJ8226. Dominant varieties that were planted included BJ7314 (15%), BJ7465 (12%), and BJ7013 (20%). The BJ7452, BJ7015 and the D14146 were planted to a lesser extent.

A detailed variety survey conducted in August showed that the BJ7465, BJ7015, BJ7314 and the B51129 were the major varieties in cultivation *(Table 33)*.

9 ELECTRONIC DATA PROCESSING

During the year several programs/databases were either created or modified to meet the changing needs of the Sugar Industry and the Institute. Copies of some of these software have been made available to sugar estates, large-farmers and the Jamaica Cane Products Sales (JCPS). These databases will help to monitor performance of varieties, track cane and sugar yields, provide cane nutrition details, and quantities of cane supplied for milling. Also, loans to farmers by the various lending agencies can be tracked and monitored.

Software developed or modified include:

- Cane Yield Survey (CYS);
- Library Catalogue;
- Field Inventory;
- Loan Program;
- Soil Nutrition;
- Laboratory Analyses.

Cane Yield Survey (CYS)

Originally developed to assist in the data collection and information reporting by the Economics and Statistical Unit of the Institute, the CYS program has evolved into a full-fledged software package that can be used as a management tool. Written in Clipper 5.1, the software is menu-driven and quite user-friendly. Sugar data captured at the core by the Core Program (another SIRI developed software) can be inputted directly into the CYS program from a diskette.

Inputs to the program include:

- Field data (e.g. field number, farm number, variety, cycle, etc.);
- Fertilizer data (e.g. quantity used, blend(s), etc.);
- Rainfall data;
- Sugar data (e.g. brix, pol, fibre, etc.).

Reports produced include:

- Field sugar figures;
- Variety summary;
- Weekly Harvesting;
- Estates class by variety;
- Estates variety by class;
- Fertilizer statistics;
- Field History

Laboratory Analysis Database Manager

Much information can be harnessed from the large volumes of data produced from the analyses carried out in the laboratory each year. However the extraction of such information proves unwieldy in a manual system, thus a computerised system was put in place to address this problem.

The program was developed to allow full access to the analyses done in the Central Laboratory by both laboratory staff and other SIRI personnel.

Inputs to the program include:

- Soil analysis data;
- Ash, moisture, pol, dextran, etc., for both local and export sugar;
- Water samples composition;
- Waste water results;
- SIRI vessel (sugar) - special shipment samples;
- Return analysis (sugar) - copy of findings from U.K. importers, etc.;
- Soil salinity survey data.

Reports produced include:

- Factory averages;
- Local & export sugar - report generated for each factory;
- SIRI vessel analysis results;
- Soil analysis and fertilizer results;
- Water analysis results;
- Dextran analysis results.

Other Databases

Several other Access databases were created and or maintained. These include:

- Estate Field Inventory - manages field area and cane production for an estate or estate cane farmers;
- Chemical Inventory - manages the receipt and issue of chemicals in the laboratory;
- Debtors Inventory - Manages a debtors ledger;
- Cane Suppliers Database - manages data relating to farms supplying cane to factories;
- Variety Database - manages data captured during

the variety development program;

- Motor Vehicles Management System - manages licensing, insurance, mileage and servicing data for the Institute vehicles;

- Library Program - manages the catalogue of books and journals in the SIRI library;

- Sundry Inventory - program developed to assist in keeping track of sundry domestic items used at SIRI;
- Author Index - program developed to list articles written by authors in the Sugar Industry;

- Crop Lien Loan Program - records loan applications, disbursements, and repayments. It generates management reports such as schedules of loans for approval, loans approved but not disbursed, second or final disbursement, loans currently due and farmers and contractors loans and interests.

Monthly Rainfall Report

This MS Excel program was developed to store rainfall data received from weather stations located at all the major sugar estates in Jamaica. It is being replaced by a new MS Access program for greater efficiency.

Inputs to the program include:

- Weather station name;
- Reading date;
- Rainfall Reading;
- 30 year mean.

Calculations performed include:

- Average Rainfall (mm);
- Mean Number of Rainy Days;
- Days Average Rainfall Exceeded 10 mm;
- Average Maximum One Day Rainfall (mm);
- Number of Stations Reporting.

Reports produced include:

- Monthly Weather Report;
- Monthly Meteorological Report.

Work also commenced on the development of a statistical model to predict cane or sugar yield from rainfall data. The results so far are inconclusive and the project will be continued in the next year.

The drive to develop a central in-house database hit several snags during the year. However, most of the historical data have been inputted and work has begun on the interface needed to extract the various reports and information that will be required from these data.

9.1 FACTORY DIVISION

The factory report program was installed to run parallel to existing systems at Tropicana and Bernard Lodge for the 1996/97 crop. Modifications were made to facilitate the variations in the reporting procedures for each factory.

10 REVIEW OF FACTORY OPERATIONS

Crop Review

The 1996/97 crop lasted 257 days, from the 27/11/96 when Frome started to the 10/08/97 when Appleton finished. This was the shortest cropping time in 11 years, equal to that of the 1985/86 crop.

Although there had been a gradual decline in cane and sugar production since 1991, the 1997 crop recorded the following milestones:

- the highest level of JRCS (10.49) since the inception of cane testing by core sampling (1990/91);
- the highest level of FRI (95.38);
- the highest rate of daily sugar production (923 tonnes) since the 1978/79 crop of 984;
- the lowest t c/ts ratio of 10.17 since 1986/87 (10.44);
- the best time grinding % net available time of 67.79 in five (5) years.

10.1 SUGAR PRODUCTION (1992 - 1997)

In 1992, a target was set that by the year 2000, output by the Jamaican Industry would be approximately 300 000 tonnes sugar per annum. Although there was no stated annual incremental growth in cane and sugar production, no real progress has been made towards this target as the 1997 output of 237 331 was actually slightly below 1991 production of 239 552 ts. The 1997 sugar output was approximately 79% of the year 2000 target, *Table 10.1.*

On the one hand, cane production seemed to be declining rather than increasing and was the main reason for the 1997 shortfall. On the other hand, tc/ts ratio for 1997 was the best in 19 years, moving to within 0.20 of the target, countering to some extent the drop in cane output.

Sugar production as a percent of target (79.11%) for the first time moved slightly ahead of the cane production (76.84%) as a result of improved tc/ts ratio. This in turn was the combined effect of improvements in cane quality (JRCS) and Factory Recovery Index (FRI), *Table 10.2.* In fact, this was the best performance since 1993 when cane quality sunk to its lowest level, while the FRI continued to improve, with both values peaking in the 1996/97 crop.

Frome, **Long Pond**, **Appleton** and **Hampden** recorded increased sugar production over the previous year. Meanwhile, the other four factories showed declines as a result of reductions in the cane processed, *Table 10.3.*

Table 10.1: Cane and sugar production vs target

		Tonnes cane	% of Cane Target	Tonnes Sugar	% of Sugar Target	tc/ts	Diff tc/ts
Target		3 069 000	100.00	300 000	100.00	10.00	
1991/92	*	2 571 886	83.80	224 664	74.89	11.31	1.31
1992/93	*	2 696 793	87.87	225 776	75.26	11.94	1.94
1993/94	*	2 508 560	81.74	222 758	75.86	11.27	1.27
1994/95	*	2 337 032	76.15	212 476	70.82	11.00	1.00
1995/96	*	2 642 253	86.09	239 192	79.73	11.05	1.05
1996/97	*	2 413 380	76.84	237 331	79.11	10.17	0.17

*Including sub-standard cane and that processed for distillery

Table 10.2: Annual average JRCS and FRI, 1991-97

	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
JRCS	10.16	10.22	9.65	9.87	10.04	9.82	10.49
FRI	85.13	86.29	87.18	90.75	91.77	94.37	95.38

Sugar Yield (JRCS)

It is envisaged that at 300 000 ts cane should have an average quality of some 10.68 JRCS. The 1997 crop average of 10.49 was therefore just under that target but the best since the start of core sampling.

Factory Efficiency

The corresponding target for FRI, 91.5, has been consistently exceeded since 1995. Reported figures have been somewhat inflated by cane accepted and processed but for which no proper accounting has been made, designated as "sub-standard cane."

The progress made by factories is measured by expressing the sugar recovered as a percentage of the sugar estimated to be in cane, *Table 10.4*. Although several factories are yet to achieve or maintain the 91% standard FRI, the factories have made significant improvement.

Factories produced 10 969 tonnes more than they would have if they had operated just at standard FRI in 1997. In contrast, they made losses estimated at over 15 000 tonnes in 1991.

Table 10.3: Factory production (1995/96 vs 1996/97)

	1995/96			1996/97			
	Tonnes cane	*Tonnes sugar	tc/ts	Tonnes cane	*Tonnes sugar	tc/ts	Diff. in t sugar
Frome	807 242	66 995	12.05	761 189	70 896	10.74	3 901
Monymusk	523 498	51 325	10.20	486 489	48 409	10.05	-2 916
Bernard Lodge	375 494	38 369	9.79	355 122	35 339	10.05	-3 030
Long Pond	165 634	14 062	11.78	154 272	15 802	9.76	1 740
Tropicana	166 033	12 015	13.82	110 036	9 318	12.09	-2 697
Appleton	250 025	20 676	12.09	226 948	21 195	10.87	519
Worthy Park	213 024	24 691	8.63	195 586	23 826	8.21	- 865
Hampden	141 303	11 058	12.78	123 738	12 546	10.24	1 488
Total/avg	**2 642 253**	**239 192**	**11.05**	**2 413 380**	**237 331**	**10.17**	**-1 861**

*Including Sugar to Distillery

- high factory downtime (averaging 18.55% in the last five years), with stoppages caused by mechanical and electrical failures as well as low steam; and

- high non-factory downtime (averaging 24.08% for the past five years) with stoppages for weather, shortage of cane and premeditated shut downs being the major contributors, *Table 10.7.*

Factories were approximately 21% away from the targeted output of 300 000 tonnes/crop to be achieved by year 2000, *Table 10.8.* Worthy Park (8% away) was closest to that target.

The industry should have been following a plan, moving progressively to 300 000 tonnes of sugar. Unfortunately, cane supply seems to be receding rather than increasing. Meanwhile, there is no doubt that in spite of the excessive downtime, factories have made considerable improvements in:

- cropping time, which could have been greater had there not been a shortage of cane;
- efficiency - from a deficit of 15 476 tonnes sugar in 1991 (to meet 91 FRI) to a surplus of 10 969 tonnes in 1997, an increase of 26 445 ts, with FRI moving from 85.13 to 95.38.

With just two crops before the year 2000, achieving the target now seems unlikely.

Table 10.4a: Sugar recovered as a percentage of sugar in cane at 91.5% FRI, 1991-97

Year	Est. sugar in cane	Ts at target FRI (91.5)	Ts prod.	Prod. % target	FRI rept.
1991/92	260 270	238 147	224 656	94.34	86.29
1992/93	260 240	238 120	225 776	94.81	87.18
1993/94	244 774	223 968	222 758	99.46	90.75
1994/95	231 745	212 047	212 476	100.20	91.77
1995/96	254 002	232 412	239 192	102.92	94.37
1996/97	248 749	227 605	237 331	104.27	95.38

Cropping time

Although the staggered starting time tends to mask the overall picture, the industry again operated out of cycle. Given factory capacity and cane supply, cropping period should not extend over 225 days and not beyond June 30, though this has not been achieved in the last seven crops, *Table 10.5*.

Compared with the previous crop, the 1996/97 crop was shorter by 26 days at Frome, 38 at Long Pond, 20 at Worthy Park, 46 at Hampden 10 at Monymusk and 64 at Tropicana, *Table 10.6.* Only Bernard Lodge had a longer crop, by 15 days. Overall cropping time was reduced by 29 days.

Although factory operating time was at its highest level (67.79%) within the past five years it was still approximately 18% below the target of 85%. This was due to:

10.2 FACTORY PERFORMANCE (1996/97)

At Frome:

- cane processed decreased by 46 053 t but sugar production increased by 3901 t. This was due to an increase in cane quality (JRCS) by 0.64 unit above the previous year's 9.17;
- FRI reached 98.25, a new peak for this factory, compared with 93.06 in the previous year;
- factory operating time increased by 3.54%, while oil consumption decreased by 56.90%, or 19.89 L/t 96°S.

At Monymusk:

- the JRCS increased by 0.22 unit to 10.48 with the tc/ts ratio improving by 0.15;
- FRI was 97.31, a new peak for this factory;
- factory operating time increased from 68.99% in the previous crop, to 69.40%;

Table 10.4b: Estimates of sugar lost or gained, allowing for standard losses given the FRI reported to that attainable 1991-97

	1991	1992	1993	1994	1995	1996	1997
FRI reported	85.13	86.29	87.18	90.75	91.77	94.37	95.97
FRI	94.88	96.14	95.11	95.96	94.99	94.06	94.45
Tonnes sugar diff.	-15 476	-11 770	-9 422	- 8	1 783	8 541	10 969

- canes processed decreased by 37 009 t, or 7.06%, and as a result, the sugar production fell by 2 916 tonnes or 5.68%. Oil consumption increase from 48.49 to 55.26 L/t 96°S.

At Bernard Lodge:

- the canes processed decreased by over 20 000 t or 5.42%, with sugar production decreasing by 3 030 tonnes or 7.9%;
- the cane quality increased by 0.31 unit JRCS to 10.63 and the FRI reported was 93.86 - a decrease of 6.34 units below 1995/96;
- factory operating time decreased from 75.06% in 1995/96 to 68.85. However, oil consumption was reduced from 29.05 to 26.62 L/t 96°S.

At Long Pond:

- cane production fell by 11 362 t, while sugar production increased by 1 740 t or 12.37% over 1995/96 crop;
- cane quality reached its highest level at 11.36 JRCS while FRI fell away from 93.22 achieved in 1995/96 to 92.62;
- there was sharp increase in factory operating time, moving from 55.89 to 66.25%, while oil consumption decreased from 160.29 to 117.69 L/t 96°S - an improvement of 26.58%.

At Tropicana:

- cane processed went down by 55 997 t to 110 036 t and sugar production fell by 2 697 tonnes;
- the marked improvement in cane quality to 10.61 JRCS did not impact positively on sugar production, as the FRI fell to its lowest level of 81.57 compared with 82.66 in 1995/96 and the crop was brought to a premature end;
- factory operating time, 61.87%, was close to 1995/96 levels (60.75%);
- fuel oil consumption fell by 26.41 L/t 96 s, averaging 25.88.

At Appleton:

- cane processed decreased by 23 077 t, while sugar production increased by 519 t as cane quality increased from 9.42 to 10.05 JRCS;
- FRI achieved was 93.13 compared with 91.07 in the previous crop;
- factory operating time improved by 7.09% to 71.26% while oil consumption increased to 120.69 L/t 96°S from 114.28.

At Worthy Park:

- cane production fell by 17 438 t and sugar production by 865 t to 23 826 t;
- cane quality (JRCS 12.09), tc/ts ratio (8.21) and FRI (101.05) were the best in the island;
- oil consumption was nil;
- operating time was at 87.20% as against 83.47 in the previous crop.

At Hampden:

- cane production decreased by 17 565 t even as sugar production increased by 1 488 t with improved tc/ts ratio by 2.54 due to the highest JRCS, 11.29, in seven years;
- factory operating time was 59.67% (10.24% above the previous crop);
- FRI was 86.20, down from 90.54;
- oil consumption decreased significantly to 112.56 L/t 96°S, compared with 212.91 in the previous crop.

Table 10.5: Cropping time and sugar output/day, 1991-97

Year	Begin	End	# of days	ts/day
1990/91	27/11/90	23/08/91	289	829
1991/92	20/11/91	20/08/92	293	767
1992/93	23/11/92	21/09/93	301	750
1993/94	22/11/93	09/09/94	286	779
1994/95	24/11/94	25/08/95	275	773
1995/96	09/11/95	20/08/96	286	836
1996/97	27/11/96	10/08/97	257	923

Table 10.6: Cropping periods (1995/96 vs 1996/97)

	1995/96		1996/97		# of Cropping Days		Diff. In
	Start	Finish	Start	Finish	1995/96	1996/97	# of Days
Frome	12/11/95	08/06/96	27/11/96	28/05/97	209	183	-26
Monymusk	15/01/96	20/07/96	25/01/97	20/07/97	187	177	-10
Bernard Lodge	25/01/96	05/07/96	07/01/97	01/07/97	162	177	15
Long Pond	25/01/96	07/08/96	17/01/97	22/06/97	195	157	-38
Tropicana	18/01/96	20/08/96	20/02/97	20/07/97	215	151	-64
Appleton	09/11/95	01/08/96	27/12/96	10/08/97	266	227	-39
W/Park	10/01/96	26/06/96	08/01/97	04/06/97	168	148	-20
Hampden	08/01/96	06/08/96	28/12/96	10/06/97	211	165	-46
Total					**286**	**257**	**-29**

Table 10.7: Factory time accounting, 1992-97

Years	1992/93	1993/94	1994/95	1995/96	1996/97	Avg.
Time Grinding % N.A.T.	56.33	53.00	63.16	63.64	67.79	60.36
Fact. Downtime %	17.04	20.70	18.94	16.83	19.37	18.55
Mechanical %	8.39	7.97	7.62	8.37	10.15	8.47
Electrical %	1.21	1.51	2.33	1.14	1.83	1.57
Low Steam %	2.61	2.61	2.96	2.25	1.74	2.45
Non-Factory Downtime %	29.46	28.82	21.38	22.97	15.68	24.08
Weather %	14.49	5.17	4.02	5.89	1.47	6.50
Shortage of Cane %	4.98	7.99	7.26	5.28	4.48	6.02
Premeditated %	2.37	3.76	1.95	3.68	2.65	2.91
Total Downtime %	**46.50**	**49.52**	**40.32**	**39.80**	**35.05**	**42.63**

Table 10.8: Output in 1997 compared with target of 300 000 ts/crop by year 2000

	Target (yr 2000)	1997 Crop	Tonnes Diff.	% Age Diff.
Frome	87 000	70 896	- 16 104	-18.51
Monymusk	60 000	48 409	- 11 591	-19.31
New Yarmouth	- 104 000	- 83 748	- 20 252	-19.47
Bernard Lodge	44 000	35 339	- 8 661	-19.68
Appleton	25 000	21 195	- 3 805	-15.22
Long Pond	20 000	15 802	- 4 198	-20.99
Hampden	15 000	12 546	- 2 454	-16.36
Tropicana	23 000	9 318	- 13 682	-59.49
Worthy Park	26 000	23 826	- 2 174	-8.36
Total	**300 000**	***237 331**	**- 62 669**	**-20.89**

*Including sugar to distillery

Table 10.9: Cane quality and relevant factory processing data (1995/96 vs. 1996/97)

Factory	1995/96 JRCS	FRI	Operating Time	L oil/t 96s	1996/97 JRCS	FRI	Operating Time	L oil/t 96s
Frome #1}	9.17	93.06	60.88	46.15	9.81	98.25	64.68	26.26
Frome #2}	-	-	60.47	-	-	-	64.32	-
Monymusk	10.26	96.72	68.99	35.09	10.48	97.31	69.40	55.26
Bernard Lodg	10.32	100.20	75.06	29.05	10.63	93.86	65.85	26.62
Long Pond	9.35	93.22	55.89	160.29	11.36	92.62	66.25	117.69
Tropicana	9.25	82.66	60.75	52.29	10.61	81.57	61.87	25.88
Appleton	9.42	91.07	64.17	114.28	10.05	93.12	71.26	120.69
Worthy Park	11.74	99.14	83.47	NIL	12.09	101.05	87.20	NIL
Hampden	9.40	90.54	49.93	212.91	11.29	86.20	60.17	112.56
Avg	**9.82**	**94.37**	**63.64**	**56.18**	**10.49**	**95.38**	**67.79**	**48.41**

11 SUGAR TECHNOLOGY

Core Lab Monitoring

Core labs across the Industry were monitored to observe the level of accuracy and precision in conducting various cane analyses. The parameters measured were pol % juice, pol % cane, fibre % cane and JRCS.

Eleven trials were done during the crop showing high repeatability of results within laboratories, *Table 11.1*. Analyses on each sample were repeated six times within each lab to test precision.

Although differences in JRCS of more than one unit were observed both within and between laboratories the variations were within statistically acceptable limits. Such differences were deemed to be due to the inherent variability within cane samples.

Of all the parameters measured, *Table 11.2*, the fibre % cane showed the highest standard deviation. Fibre determinations, nonetheless showed a high degree of reproducibility of 0.42-1.83 standard deviation within various labs. Between labs, the standard deviation was an acceptable 0.64, *Table 11.2*.

Near Infrared (NIR)

A comparison between the Near Infrared (NIR) technique, which uses higher wavelengths (in the region of 880 nm) and polarization by conventional polarimeter (589 nm wavelength) was carried out on juices, raw sugar and molasses. NIR, if feasible, would allow for elimination of the dangerous lead reagent, thus reducing health and environmental hazards. This study confirmed that lead sub-acetate clarification can be replaced by simple filtration with kieselguhr - a filter aid. NIR pol readings were easily obtained for dark solutions, provided the filtered solution was free of turbidity. The technique proved to be simple and there was no need for chemical disposal.

There were however, differences in results for the same samples using the two methods. For cane juice, out of 51 readings, 40 showed higher pol readings and pol % using the NIR as against the conventional method. Pol readings ranged from 0.73 to 1.07 with an average of 0.176. The differences for the % pol ranged from -0.17 to 0.26 with an average of 0.048.

Analyses of 23 sugar samples found 16 showing higher pol values using the NIR technique than with the ICUMSA method. The differences for pol ranged from -0.44 to 0.65 with the average at 0.199.

From 13 molasses analyses, 12 showed higher pol using the NIR as against the conventional method. Pol differences ranged from -0.17 to 26.16 with the average at 14.06.

However, differences in mean polarization values between the two methods used to determine pol in juice and sugar were not statistically significant. Precision of both methods was basically equal. Therefore, the NIR technique could be used instead of the conventional method without affecting payment for cane and sugar.

With molasses analyses however, values differed significantly and precision of determination was lost. This could be due to the impact of other components such as dextran and reducing sugars within the molasses.

Application of the NIR technique would result in:

- elimination of lead use in pol determinations;
- the ability to read darker solutions without additional clarification agents; and
- polarization values expressed in sugar degrees.

Table 11.1: Results of tests, repeated six times, on single sample of cane within core laboratories

	Juice			Cane		
	Brix	Pol %	Purity	Pol %	Fibre %	JRCS
Frome						
Avg.	17.87	14.60	81.70	11.83	15.04	10.27
Std. Dev.	0.28	0.03	1.36	0.10	0.60	0.04
Monymusk						
Avg.	18.89	16.11	85.32	12.92	15.69	11.46
Std. Dev.	0.16	0.10	0.79	0.37	0.83	0.31
Appleton						
Avg.	18.55	15.01	80.90	12.13	15.19	10.46
Std. Dev.	0.17	0.27	1.30	0.27	0.42	0.13
Worthy Park						
Avg.	19.83	16.60	83.74	13.42	15.23	11.81
Std. Dev.	0.19	0.07	0.89	0.23	1.23	0.33
Long Pond						
Avg.	18.70	15.45	82.93	12.79	14.54	11.24
Std. Dev.	0.06	0.08	0.59	0.19	1.14	0.23
Hampden						
Avg.	19.37	16.13	83.25	13.45	13.29	11.94
Std. Dev.	0.11	0.08	0.56	0.44	1.83	0.45

Disadvantages associated with use of the NIR method would be:

- slow filtration rate for cane juice compared with the conventional method resulting in decreased throughput in the core laboratory;
- NIR pol values would be affected by other compounds found in the solutions, especially for molasses.

Effect of Dextrans on Pol

It is known that juice and sugar with high dextran levels will inflate pol readings due to dextrans' high dextrorotatory effect. However, the effect is not as great when juice and sugar are clarified using lead as it removes dextran by forming an insoluble complex. The dextran influence should therefore exist in the samples prepared to be read by NIR.

Table 11.2: Results of tests done on sub-samples of a carefully selected main sample, at the same date and time in the various core labs

	Juice			Cane			
Factory	Brix	Pol %	Purity	Pol %	Fibre	JRCS	JRCS Diff.
Frome	17.87	14.60	81.70	11.83	15.04	10.27	-0.97
Monymusk	18.89	16.11	85.32	12.92	15.69	11.46	0.22
Appleton	18.55	15.01	80.90	12.13	15.19	10.46	-0.78
Worthy Park	19.83	16.60	83.74	13.42	15.23	11.81	0.57
Long Pond	18.70	15.45	82.64	12.98	12.84	11.50	0.31
Hampden	19.37	16.13	83.25	13.45	13.29	11.94	0.70
Avg.	18.87	15.65	82.93	12.79	14.54	11.24	
Std. Dev.	0.61	0.69	1.42	0.61	1.07	0.64	

There were indications of a positive correlation between dextran levels and polarization values using the NIR method. For juice there was no clear trend. Nonetheless, in some cases where the dextran concentration was high there were large pol differences between the NIR and conventional methods.

Dextran level ranged from 125 to 1433 mau (Haze Method) in 10 sugar samples tested. Pol differences ranged from 0.19 to 1.39%.

Cane Staling

The rate of staling of BJ4675, BJ7504 and BJ8226 was investigated at Bernard Lodge. Thirty cane stalks of each were burnt, cut and stacked outside the core lab in open space exposed to the elements to simulate field or factory yard conditions. Daily tests were carried out to determine the effects of staling on juice pol, brix, purity, pol %, JRCS, dextran.

Data suggested that BJ8226 variety had the highest resistant to dextran formation and the lowest rate of change in purity and JRCS. The least resistant was BJ7465.

11.1 ENVIRONMENT

NRCA Reporting

Wastewater samples from all factories were analyzed at the beginning and end of crop. This was a collaborative effort between the SIRI Laboratory in Mandeville and the Biotechnology Centre, University of the West Indies (for coliform analyses). Out-of-crop sampling was done in November and December.

Verification monitoring by the National Resources Conservation Authority (NRCA) was done for all factories except Bernard Lodge and Worthy Park.

Environmental Audit

The first of the training seminars of the **Frome** audit took place in February 1997. This served to explain the importance of environmental issues in a business environment. This session looked at environmental issues in the global marketplace and comparative advantages to "green" firms. The presentation was well attended and received.

Interviews were conducted to gather information on industrial hygiene and safety, contingency plans, walkaway plans, environmental management capacity and policy. The out-of-crop field survey was completed and the results presented in an interim report. This survey involved investigation and mapping of the main vegetation types surrounding the factory, land use, meteorological conditions, aquatic fauna and flora. It also involved analysis of water at several sample points which allowed for an impact analysis to be done. A laboratory was set up at Frome to analyze samples for nitrates, phosphates, suspended solids and chemical oxygen demand (COD) from 11 sample points.

Demonstration Anaerobic Digester

After some delays the anaerobic digester was finally put in operation at Frome. It was not run continuously over a period adequate for conclusions to be drawn. Monthly meetings were held with personnel from the Scientific Research Council (SRC) and Sugar Company of Jamaica (SCJ) at Frome. During the out-of-crop period the plant was operated using diluted molasses as feed. The emphasis was on developing the sludge bed in preparation for a continuous operation in the 1997/98 crop.

Environmental Committees

A general environmental committee meeting was held at SIRI, Mandeville on June 11, 1997. Representatives from

SIRI's Factory and Field divisions, **Tropicana**, **Long Pond**, **Appleton** and Sugar Company of Jamaica were present. The Industry's Action Plan and changes necessary to get NRCA's approval and the formulation of an Emergency Response Plan (ERP) were discussed. A revised Action Plan was submitted to the NRCA for approval. All factory environmental committees were re-activated by December to function with respect to the Terms of Reference.

Other Environmental Aspects

Various meetings were held with representatives of Big Bridge (the community affected by odours emanating from the effluent stream from **Frome**) and other concerned groups in order to address the issue. The media, the Office of the Prime Minister and the NRCA followed the situation closely. Short, medium and long term solutions were proposed. Short term solutions such as dredging to increase rate of flushing of the stream started immediately.

Two graduate students from Cuba, a chemical and a mechanical engineer, were with the Institute for two months. They visited some factories and SRC gathering information primarily on environmental management.

Workshop/Seminars

A workshop entitled Wastewater Characterization & Analysis was conducted by the Scientific Research Council (SRC). Lasting three weeks, it covered theoretical as well as practical aspects of wastewater management. A workshop on Environmental Performance Evaluation (EPE) was also conducted at the Bureau of Standards.

Assessment & Labeling Committee

Monthly meetings of the Environmental Assessment & Labeling Committee were attended at the Bureau of Standards. The Terms of Reference include:

- Participating in the development of the ISO 14000 series of standards;
- Examining the feasibility of adopting or adapting these standards for national use;
- Drafting appropriate standards and recommending same for approval for national use;
- Participating in activities to bring about implementation of the standards.

12 ENGINEERING RESEARCH

Preventative Maintenance

The preventative maintenance programme which began during 1994/95 was further upgraded during the year with the addition of a machine balancing and a turnable filter vibration meter used in obtaining information on machines and in diagnostics. Not much work was done with the thermograph and ultrasound, as emphasis was on vibration measurements and analyses.

Machine Balancing

Before and during the 1996/97 crop, the balancing of a number of machines was done. The range of equipment tested included boiler fans, bagacillo fans and centrifugal baskets. Equipment used had the capability to do both single and multiple plane balancing. This procedure resulted in the bearings on some equipment lasting for the entire crop; whereas in previous crops, they often failed two to three times.

Machine balancing commenced at **Frome** in October. All boiler I.D. and F.D. fans as well as knives and centrifugal baskets were checked and balanced where necessary.

Vibration Trending

Early in the crop, the turnable filter vibration meter was used to scan the frequencies of the machines at factories in order to determine the frequency range of vibration signals. This instrument was also used to monitor vibration levels at some factories. The equipment facilitated diagnosis of problems with steam turbines at **Frome** and **Appleton** factories.

The "Trendsmaster" which automates data collection and reduction was used also on pumps, motors, knives, fans and other machines in all factories. Six such studies were done at **Monymusk** using the Trendsmaster. Results were computerized. Three were done at **Worthy Park**, four at **Appleton**, two at **Long Pond**, three at **Tropicana**, two at **Bernard Lodge**, one at **Frome** and two at **Hampden**.

Up to 400 locations were measured in a single study. Data was manually analyzed and findings reported to the factory for preventative maintenance or corrective action. The software was loaded on computers at four factories.

Core Sampler Maintenance

The core samplers continued the high level of availability and performance during the 1996/97 crop. A third core sampler along with the automatic press commissioned into service at **Frome** early in the year performed well throughout the crop.

This level of performance resulted from a much improved out-of-crop maintenance programme during the 1995/96 year and some preventative maintenance work done during the crop. Some of the major problems encountered were ejector and press cylinder failures at **Bernard Lodge**, a bent core tube at **Hampden** and ejector and valve problems at **Tropicana**.

Maintenance for the 1997/98 crop was progressing well. Most factories started core maintenance early. The SIRI mechanical workshop offered the usual services including the overhauling or changing of seals on cylinders, valves, pumps and motors, and the fabrication and repair of parts.

ENERGY

A bagasse house survey was done for all factories to determine the procedures as they relate to bagasse stacking and reclamation. The survey showed that three factories, namely **Long Pond**, **Monymusk** and **Frome**, had the necessary facilities installed for mechanically stacking and reclaiming of bagasse, but only Frome's was fully functional.

Other factories continued to rely on front-end loaders to stack and reclaim bagasse. Use of the front-end loader could be eliminated if the bagasse carrier is arranged along the length of the bagasse house with off-loading chutes at various locations, as at **Hampden** and **Appleton**. However, the loader would be needed to load the carriers during stoppages of the mills. It was also noted that not all factories had adequate storage space; as a result bagasse was being stored in the open.

Boiler combustion analyses showed **Worthy Park** operating at efficiencies of between 68-75%. The boilers at **Tropicana** and **Hampden** had low CO_2 (7-12%) and low combustion efficiencies of about 60-70%.

The **Long Pond** boiler station showed fairly good results with CO_2 readings of 8-16% and efficiencies of 75-85%. **Appleton** achieved fairly good efficiencies of about 83-85% but Frome managed only between 70-75%.

Boiler stations at all factories showed a need for closer supervision and attention. Some factors contributing to low combustion efficiency were:

- Overloading of furnaces with bagasse - Operators need to be sensitized that overloading does not mean more flames, but merely causes compression of bagasse in furnaces which inhibits proper mixing with air. Overloading also causes cooling of the furnace, since bagasse with high moisture has to be dried out before burning;
- High excess air;
- High flue gas temperature;
- High moisture and ash content in bagasse.

Power Factor

A thorough power factor measurement exercise was done at **Appleton** in collaboration with the Electrical Department. Power factor and power demand measurements were done for most of the large motors. The results showed that some values tended to be low while others were satisfactory. It was expected that the planned increase in factory capacity should cancel some of the low power factor values.

This exercise was also initiated at **Worthy Park**, but had to be put on hold because of instrument malfunction.

Evaporator Monitoring

A study of the evaporation station at **Bernard Lodge** got off to a slow start but picked up momentum as problems were solved. Data collection period was not sufficiently long to establish a definite trend as the software had configuration problems. This project falls within the plan to fully automate the evaporation station.

12.1 INSTRUMENTATION

Core Interface System

The installation and commissioning of the core interface system was carried out at **Frome** with two new software systems, "Easylink" and "Links" set up to accommodate two refractometers and two polarimeters. Previously the system used one refractometer and one polarimeter but the expansion was necessary to accommodate the increase in sampling to 600/day. The "Easylink" software was programmed to collect sample numbers, date, time, brix and pol values from the keyboards connected to the instruments. "Links" was written to display data instantly on the monitor and download on a diskette at the end of the day. Reports can also be printed of all the data. After a few weeks of debugging, the system was put on test-runs until the end of crop.

Monymusk, **Bernard Lodge** and **Appleton** core laboratories were equipped with polarimeters, refractometers, keyboards and computers to obtain similar results without the use of the "Easylink" and "Links" software. At **Monymusk** and **Bernard Lodge** the systems experienced technical problems with the RP-10 interfaces, and so pol values were not recorded. However, at **Appleton**, operations ran smoothly and data could be collected and displayed on the monitor.

At **Worthy Park**, **Tropicana**, **Hampden** and **Long Pond** the "Purity System" was installed in these core laboratories. This system does not use the keyboard and both polarimeter and refractometer were inter-connected to either a computer or a printer with capacity for daily printouts. Computers were obtained for **Long Pond** and **Tropicana**, while the remaining two factories were connected to printers. Due to their relatively low sampling rate, 150/day, this system was adequate for the operations.

Solar Still

A solar still, similar to those at the SIRI Central Laboratory in Mandeville, was designed, constructed, installed and commissioned on the roof of the core laboratory at **Bernard Lodge**. After a two-week test-run, it became the source of distilled water for the laboratory.

Maintenance and Repairs

The general out-of-crop repairs were done to all eight core laboratories for the start of the 1996/97 crop.

An imbibition water-flow meter was installed at **Hampden** to monitor the total consumption of water at the mill while a factory pH system, with the splitter-box and valve, was installed at **Long Pond** where an electronic pH recorder was also put into operation.

The control valves were modified and re-fitted with new positioners for better operation of the drum-level controls on all three boilers.

At **Worthy Park,** the powerhouse steam-flow meter was reconfigured and reprogrammed. The imbibition water meter at **Appleton** was checked against SIRI's clamp-on flow meter. Also the steam flow meter to the powerhouse was cross-checked against a pitot tube flow meter and differences noted.

12.2 SCALES

Repairs and preparation of scales were completed in time for the start of the 1996/97 crop at each factory and the sugar warehouses. This consisted of servicing, testing, calibration and certification by the Jamaica Bureau of Standards. Servicing and repairing of ticket printers were done where necessary. Modifications to allow entering of tare weights for estate cane carts into the scale computer were done at **Worthy Park**, **Bernard Lodge** and **Hampden**.

Frome

A weighing system was installed on the No.1 cane carrier at Frome in an attempt to control the supply of cane to the knife. Although calibrated, and tested, the level of control achieved std not acceptable.

Monymusk

A new juice weighing system was installed and commissioned using the Servo Balans weighing controller during the early part of the crop, at **Monymusk**. Subsequent operation of the scale was considered reliable and accurate.

Monymusk/Frome

Two new pan boiling controllers were installed and commissioned at **Monymusk** and **Frome** in early March.

Performance was satisfactory, resulting in marked improvement in the graining and boiling operation.

Hampden

The Servo Balans scale used to weigh raw sugar at **Hampden**, was reinstalled near the end of the crop after modifications to the chute which takes the sugar from the scale to the conveyor. The scale was calibrated and tested but not put into operation due to the lack of an annunciator, which should be in place to warn the operator(s) if a failure should develop. This should be installed for the 1997/98 crop.

12.3 COMPUTERIZATION

The ScalePro program was installed at **Frome**, **Bernard Lodge**, **Worthy Park** and **Tropicana**. The program worked satisfactorily after appropriate modifications, testing and analysis at **Tropicana** and **Worthy Park**. Significant testing and modifications were also done at **Frome**. However, the number and frequency of errors were unacceptable within the crop period. Most errors occurred where more than one user were required to access the same file simultaneously on the network, and in the transfer of data from ScalePro to Agris. Another network-related problem was its slow speed. From these and other observations, the programme was significantly condensed. Meanwhile, testing of the program at **Bernard Lodge** over a two-month period gave satisfactory results.

ScalePro at Ocho Rios

A module to display truck numbers, operator name, inbound and outbound weights and time on a video monitor for security purposes was added to the ScalePro program at Ocho Rios. From this modification, Jamaica Cane Products Sales Ltd was able to dial up via telephone line and modem, into the sugar warehouse to monitor the scale operators. Other modifications were made to generate reports by this programme.

Payment and Deductions Program

Arrangements were made to test a Payment and Deductions Program at **Worthy Park's** core laboratory. This program should be ready for a parallel run during the 1997/98 crop.