COMPONENT 3

FARMER PARTICIPATORY TRAINING IN IMPROVED AGRONOMIC & MANAGEMENT PRACTICES

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Objective: To increase through training the viability and sustainability of cane farming by technology transfer and adoption by farmers of cost efficient appropriate techniques

BACKGROUND

Jamaica's sugar industry has experienced considerable fall off in production, productivity and profitability. This is reflected in both factory and field operations. In the field, production fell from 4.8 million tonnes cane in the 1960's to under 2.0 million tonnes by the turn of the Century while yields fell from approximately 80 to just over 60 tc/ha.

Several factors have contributed to this decline. Among them are the inability to replant at a required rate, poorly maintained ratoon fields and high cost of production. The resultant low earnings forced many cane farmers out of business and threatened the long term viability of the industry.

At the same time, the emergence of bio-energy as a valuable commodity in world trade was opening new prospects for the sugar industry with its capacity to convert sugar cane to ethanol and electricity in addition to the traditional products of sugar and molasses. There was therefore growing need for the industry to get back on course and exploit the potential for diversification. Technology capable of boosting the industry's production was very much available as good quality cane varieties abounded and technical services to guide the process were at the industry's disposal. Yet the industry's future appeared uncertain as production seemed to be grinding to a halt. This CFC funded project was therefore very timely as it could provide a stimulus to halt decline and take the industry forward.

The Jamaican industry introduced a system of cane payment based on quality during the 1990s. Farmers now had a means of influencing the price of cane in a manner largely independent of factory operations. After more than a decade of operating the new system, however, farmers seemed no closer to capitalizing on this opportunity. In fact they seemed powerless to control harvesting as reaping cost increased to account for more and more of cane price received. Farmers were getting increasingly disenchanted with cane production.

It was against this background that a project for farmer training was conceived under the CFC project. Training was clearly needed in the area of agronomy, to increase cane yield, and in harvest management to ensure the best price possible. As the year starts with cane harvesting, that area became the focus of the first training thrust.

Improving Cane Quality at Harvesting

For many farmers harvesting cost has been a depressingly high ranging from some 25% to well over 40% of production cost in some instances. Yet, harvesting remains highly inefficient. A low quality product, measured in terms of Jamaica Recoverable Cane Sugar (JRCS) is often delivered to the core sampler (cane testing station) resulting in a low cane price.

In many instances the quality of cane is so low that first payment (approximately 70% of final price) is less than the cost of harvesting. As cane quality is a product of variety planted, agronomic practices during the growing season, weather leading up to time of harvest and management of the harvest, a successful training programme would have to be comprehensive in dealing with factors under the control of the farmer. The training information provided, targeted cane farmers, reaping contractors, cane cutters, supervisors and factory personnel who managed the process.

IMPLEMENTATION

Training took the form of pre-crop seminars/workshops in each of the respective factory areas and was followed up by

field days when the crop was in progress. The main message was to identify steps that could be taken such as shortening "kill-to-mill" time and reduction of extraneous matter (trash, tops, suckers, dirt, debris) in loads to improve quality.

Following Hurricane Ivan in September 2004 which caused extensive damage to cane cultivation the need for a project of this nature became even more apparent. Canes were broken at the tops, lodged and uprooted and reaping was expected to be difficult under the circumstances resulting in adverse effects on cane quality. To minimize loss of earnings to growers, training took the form of seminars/workshops conducted by technical persons from the Sugar Industry Research Institute (SIRI) led by the Extension Staff in which topics presented were:

- Factors affecting cane quality
- Reducing extraneous matter to tolerable levels (4%)
- Factors affecting sugar quality
- Guidelines for harvesting hurricane affected canes
- Understanding the Cane Payment System

A major emphasis of the seminar was on means of reducing the kill-to-mill time from the allowable 72 to a more acceptable 48 hours. This by itself could reduce sucrose losses from 17% to 8%. Over 500 farmers, contractors and other persons associated with the reaping process across the industry participated in vibrant discussions.

Maturity testing of fields using the Hand Refractometer Brix Method was another measure taught to farmers. This was a device to determine the relative maturity of fields thus facilitating reaping in a logical sequence to maximize earnings.

Prolonged flooding, following the passage of three hurricanes in 2006, posed challenges of a different sort. Consequently training emphasis was shifted to deal with drainage as well as field rehabilitation.

Fig 1: Training Workshop in Trelawny

Impact

Given the impact of extreme weather in the form of hurricanes and floods on field conditions during the course of the project, it was difficult to measure any real impact from training efforts aimed at producing better quality. Jamaica Recoverable Cane Sugar (JRCS) levels above 10 are considered satisfactory for profitability, while levels below 9 are usually uneconomic. Cane quality measured as JRCS in 2005 was of a reasonable good standard averaging 10.46 JRCS for the industry as a whole. This compared with 10.62 JRCS obtained in 2004. This however was aided by the good reaping weather which was a boost to the sugar recovery process. JRCS in 2006 averaged just 9.92, with many farmers achieved JRCS ranging 11 – 13 from employing good reaping practices. There were still however too many unfortunate growers who fell well below this range.

Training in Agronomic & Management Practices

With severe drought following Hurricane Ivan in 2004, cane production by farmers fell to a low of 559,000 tonnes and cane yield a mere 48.3 tc/ha in 2005. Many farmers were unable to service their loans and had no means of maintaining fields in satisfactory condition. This merely marked a worsening of a trend developing over many years. Under these circumstances recommended practices tended to be either totally omitted or applied late or in half measures. The challenge was to convince the grower that despite the difficulties, he would be better off making sacrifices to maintain standards of cultivation in order to stay in business. The approach adopted for this type of training was in the laying down of demonstration plots in which recommended practices were carried out and showing that profitable yields could result.

Foremost among the objectives was to demonstrate that sound agronomic practices, administered on time could halt the

Fig 2: Inter-Row Tillage Practice

Fig 3: BJ8532 variety

decline and restore productivity to levels of profitability. This was being done against the backdrop of the decision by the EU, Jamaica's main sugar market, to reduce sugar price by 36% over a four year period. Improving production and profitability was therefore sharply becoming even more critical for the survival of the Jamaican cane grower.

Demonstration Plots

Demonstration plots were directed and managed by the Extension Agronomists with supervisory support from farmers in the major ecological regions: Irrigated Clarendon and St. Catherine, Wet West, Dry North Coast and Central uplands.

Farmers were chosen not only on the basis of their experiencing challenges but also on the basis of a track record of cooperation with Extension Agronomists and a commitment to the project.

Demonstration plots were used for four main purposes:

1. to show that economic yields could be obtained by applying recommended practices

2. to introduce to growers five recently released, high yielding varieties adapted to various areas – BJ8532, BJ78100, BJ7465, BJ7938 and J9501

3. to demonstrate a new high density planting technique to ensure higher field population and thus greater yield

4. to introduce farmers to the use of the Reduced Tillage Machine shown in earlier studies by the Institute to be effective in lowering land preparation cost

Farmers were also exposed to the new dual-row planting method which is capable of increasing yields upwards of 20% in the first two years.

The typical package of practices demonstrated (varying with zone) was as follows:

- Analysis of soil to determine nutrient status
- Conventional tillage practices of 3 – 5 operations
- Selection of recommended sugar cane variety
- Seed cane rate of 10 tc/ha
- Fertilizer - 250kg 14-25-14 applied with seed piece (followed by 500 kg 17-0-17 at 8 weeks)
- Pre-emergent application of herbicides

- Irrigation where necessary
- Filling-out spaces (supplying)
- Moulding
- Post-emergent application of herbicides
- Maturity Testing
- Harvesting (timely delivery of properly cut, extraneous matter free cane)
- Record keeping

Ten such demonstration plots were established and maintained. At the same time, four ratoon fields were adopted for rehabilitation. The aim of ratoon rehabilitation was to prolong the life of the field by providing basic field maintenance practices - controlling weeds, fertilizing, inter-row cultivation and applying irrigation water where possible or implementing drainage.

RESULTS

Mixed results were obtained in the first year as the project got off to a late start and was affected by severe drought. Plots established were also affected by hurricane Ivan. Nonetheless, by the second year these demonstration plots were able to provide seed cane of new varieties to several farmers in the respective areas. For the most part, profitable yields exceeding 75 tc/ha were obtained with one plot achieving a yield as high as 110 tc/ha. Fire damage resulted in only 44 tc/ha being salvaged from one plot.

Plots that were rehabilitated also gave outstanding results and recorded yields up to 91tc/ha. This indicated that as a cost saving exercise ratoon fields, depending on the state of deterioration, may be resuscitated to last another 2 – 3 years. This activity was only carried for one year as unfortunately two of the participants died. Details of results of demonstration plots and current status are in Table 1.

Table 1: Demonstration Plots established under the CFC project

Names	Location	ha	Yields in 2007/Status
Oliver Green	Biddiford, Trelawny	2.4	yields ranged 78 – 97tc/ha in varieties - satisfactory
Garvey Maceo	Vernamfield, Clarendon - Irrigated	3.6	
Weston Lamey	Hyde, Trelawny	1.6	44tc/ha fire damaged plot
Renford Nairne	Springvale, Bogwalk - Central	0.4	Seed cane of new varieties were distributed to farmers - satisfactory
Sharon Fairclough	Crawle, Bogwalk – Central	0.4	Seed cane of new varieties were distributed to farmers - satisfactory
Aston Henry	Four Path, Clarendon	2.8	76tc/ha – replanted due to smut
William Smith	Spring Garden, Wet West Westmoreland	2.0	75tc/ha in 2007 - satisfactory
Leroy Bucknor	Bull Head, Westmoreland	2.4	76tc/ha - satisfactory
Audley Cabellero	B/L, St. Catherine – Irrigated	2.02	110tc/ha - satisfactory
Vincent Tulloch	Windsor Park, St. Catherine	2.02	80tc/ha - satisfactory
Ratoon Rehabilitation			
Randal Robinson	B/L, St. Catherine	1.00	Yields estimated at 75tc/ha - satisfactory
Ransford Dale	B/L, St. Catherine	2.02	Used as seed cane, yielded 91tc/ha
Vincent Tulloch	B/L, St. Catherine	2.02	67tc/ha - satisfactory
Daudet Stanford	B/L, St. Catherine	2.02	Farmer died, being managed by Estate

Training in Sugar Cane Agronomy

Extension Agronomists conducted training for farmers whose holdings were equipped with the Drip Irrigation Systems funded by the CFC. Training was conducted in the appropriate cultivation practices to maximize the benefits of this improved irrigation technology. While efficient delivery of water is essential, high yields are dependent on complementary practices. Training highlighted good field plant population, use of recommended fertilizer blends, effective pre and post emergent control of weeds and water management. Training also emphasized the careful use of machinery for inter-row tillage (to avoid damage to drip tubes) and provided guidelines for cost effective irrigation.

From plots established in Clarendon yields were obtained as follows.

Farmer	Plot Size (ha)	tc/ha 2007
N. Nugent	3.2	140
S. Less	3.6	125
K. Evans	2.8	93
B. Earle	2.02	120
M. Morrison	2.02	169
P. Morgan	2.4	97

In St. Catherine demonstration plots were established under drip irrigation as well as conventional furrow irrigation. Some 50 farmers participated in training in maintaining field population, managing dual-row spacing, fertigation, effective weed control and water management under the conventional long-line irrigation method. Cane yields realised in 2007 were as follows:

C. Fearon	4.04 ha	yielded 100tc/ha
M. Anderson	4.04 ha	yielded 93tc/ha
R. Dale	2.02 ha	yielded 91tc/ha
J. Lambert	2.02 ha	- farmer died
D. Stanford	4.04 ha	yielded 35tc/ha – Farmer died

Training - Centre Pivot Use

Farmers benefiting from the CFC funded Centre Pivot scheme received special training in agronomic as well as management practices to enable their use of this technology. Training initially focused on farmers working together and dealt with communication, group dynamics, irrigation scheduling, pivot security and operation of the pivot as a long term investment. An important concept stressed was the need to coordinate field activities so as to facilitate the 16 farms in the pivot zone operating as a unit. This involved coordinating operations such as harvesting, replanting of new fields and weed control so that such activities did not unduly disrupt use of the pivot which is best operated when the entire area covered by its sweep may be wet without hindrance to other operations. Specialist training was given, with the aid of suppliers of the pivot, to the designated operators of the system.

Training – Rain-Fed Areas

Demonstration plots in Westmoreland were the site of training in plant nutrition and weed control practices. Some 40 farmers participated in these training activities.

In Trelawny the focus of training was on choosing the right chemicals for the job. Some 20 farmers participated.

In the Bog Walk area of St. Catherine farmers were taught proper field maintenance and establishment of desirable plant populations for improved yields.

Reduced Tillage Technology

High cost has curtailed the ability of many farmers to replant fields at acceptable intervals - in Jamaica once every six years. Instead, the norm is probably no better than once every 12 years. Meanwhile, experiments and practical experience have shown that traditional land preparation approaches may be excessively complicated and costly. Standard operations in land preparation may involve ploughing followed by ripping, cross ripping, harrowing cross harrowing, before eventually

opening a planting furrow. This is often time consuming and results in total disturbance of the soil surface exposing it to erosion during heavy rains.

In recent times a number of industries have been adopting a less time consuming, less costly and more environmentally friendly method of land preparation variously referred to as reduced tillage, strip tillage or minimum tillage which comes under the label of conservation agriculture. This usually involved use of specialized machinery to prepare a seedbed in one or two passes as against the four to six passes typical of traditional land preparation. This seedbed may be formed by working just the furrow or by splitting the bank of the old cane field. The previous stubble is usually allowed to germinate and is then killed by herbicidal treatment. The old stubble is often dying as the new plants germinate. This operation however requires a special piece of equipment to achieve the desired seedbed preparation with the corresponding limited expenditure in energy.

In Jamaica, SIRI had designed and built such a Reduced Tillage Machine (RTM) and the prototype was demonstrated in several locations with good effect. However, the technology of planting by reduced tillage was yet to be fully brought to the farming community. Although not originally part of the CFC

project, the desire to build such machines for demonstration to farmers was put to the Fund at the project Mid-Term Review. This received favourable consideration and SIRI was authorized to build five RTMs for introducing the technology to farmers in each of the major ecological zones.

Technical Details

- Old cane stools approximately 6 weeks old are killed with the chemical glyphosate
- Tillage with RTM
- Canes are planted using the standard guidelines
- After establishment at 6-8 weeks, old banks are broken down with moulding discs while banks are formed for the new plants
- At 3 months the field should look similar to those established by conventional tillage

Fig 4: RTM attached to tractor

Implementation

The process of obtaining competitive bids for construction of the machines and the actual fabrication delayed the availability of the RTMs until the final year of the project. Unfavourable weather then restricted actual field use so that very limited demonstration had occurred by the time the project was scheduled to be completed. The PEA then received an extension of project duration in order to facilitate proper demonstration of the technology to farmers.

Plots Established:

Clarendon	two plots - 1.5 ha and 1.4 ha established
Westmoreland	two plots - 2.4 ha and 1.7 ha established
Trelawny	1.0 ha being established

In the Westmoreland area the RTM encountered some challenges as a rocky sub-soil resulted in damage which necessitated periodic repairs and strengthening of the implement.

Growers and equipment contractors are favourably impressed by the RTM and early cane growth from established plots suggests that in some instances the tilth obtained may be even better than in some fields prepared by old worn-out conventional tillage equipment commonly used in the industry. It is anticipated that the RTM will have a positive impact in reducing the cost of cane production, increasing the speed of land preparation while providing better environmental practice in terms of reducing soil erosion.

Walk Behind Tractors (W/B)

At the same time of the Mid-Term Review, approval was also sought and obtained to import Walk Behind Tractors

Fig 5: Fields established with the RTM in Westmoreland

suitable for use on small plots on relatively hilly terrain farmed by large numbers of smallholders but largely inaccessible to conventional tractors. As with the RTM, the walk-behind tractors were only delivered by the suppliers in the third year of the project and arrived without critical attachments through a misunderstanding between the importing agent and the supplier. The machine was therefore hardly demonstrated within a year characterized by frequent periods of wet weather. Demonstrations have so far only taken place in Clarendon and upper St. Catherine.

The W/B Tractor is capable of doing various applications i.e., ploughing, furrowing, rationing and pumping water. The W/B tractor and cart attachment could modernize the removal of canes on slopes now being done with donkeys. It has limitations however and will not be suitable for use on extremely steep slopes planted by many growers. Its application and demonstration is continuing.

Use of GPS/GIS Equipment

The availability of GPS/GIS technology to Jamaica's sugar industry provides useful information to

Fig 6: Walk Behind Tractor

aid management decision and assists the Extension Officer in obtaining information related to field boundaries, land area estimation, road network, irrigation canal and drainage routes that is valuable in farmer training.. Accurate field measurements enable a more correct determination of inputs required and yields obtained e.g. tc/ha.

GPS equipment was used alongside the replanting programme to determine correct field sizes in Westmoreland, Clarendon, St. Elizabeth, Trelawny and St. Catherine. GPS was used to confirm field measurements and to make adjustments to previous records.

The exercise so far has measured some 800 ha of replanted fields in Clarendon, St. Elizabeth, Westmoreland, Trelawny, St. Catherine and Central Areas. This was done simply by traversing field boundaries or area to be measured. Measurements varied between 5 and 10% of previous records and may have been due to whether or not roadways were included.

The project targets, in the first instance, fields which are to be replanted. This will continue over several years until the entire industry is mapped and measured.

Fig 7: Field Mapping with GPS

Lessons Learnt

In an atmosphere of uncertainty as prevailed in the industry during this exercise it was always possible to get farmer attendance at training seminars, field days etc. However, they often seemed less interested in the topics being discussed than in having an opportunity to air grouses.

Growers gave vent to a sense of being powerless in their relationship with harvesting gangs. They appreciated points made about techniques to improve cane quality but feared they were at the mercy of contractors providing harvesting service.

So long as the system remains in which farmers are paid on the quality of canes supplied while the harvesting gangs are paid only on quantity only, farmers will find great difficulty in effecting meaningful improvements in price of cane obtained.

Hurricanes which affected the industry during the period also added to a feeling of hopelessness on the part of some farmers.

The industry was faced with critical shortages of tractors and field equipment in some areas which handicapped field operations, especially in land preparation, and added to harvesting inefficiencies.

Impact of Projects

- Cane yields obtained from various plots were outstanding, compared with a national average of some 60 tc/ha, and have demonstrated the importance of timely application of adequate resources for viability.
- In general plots performed satisfactorily and in many instances yields were above projected targets. By straight comparison yields have been transferred from the region of 50 tc/ha to well over 80tc/ha in most of these plots.
- New varieties expanded under the project performed satisfactorily and found favour with the farmers.
- The use of the RTM gained acceptance in Clarendon, St. Elizabeth and St. Thomas where farmers actually requested its use following demonstrations. It is expected that similar responses will be obtained wherever the machine is demonstrated in other in other areas.
- Farmers in the Clarendon hills were excited about the Walk Behind Tractor and were eager to gain possession of similar units
- In St. Catherine two farmers who benefited under the drip irrigation project have bought into the technology and have invested in expanded systems for their farms.

Some comments expressed by farmers who participated in the projects were as follows:-

- The projects were very good
- Projects were of tremendous assistance to farmers
- Drip Irrigation makes irrigation easier to manage
- SIRI's task and contribution in the execution of the project were very commendable
- The Industry should facilitate more projects of this nature.

Dissemination of Results

Dissemination has so far taken the form mainly of field days and seminars surrounding various aspects of the project. Farmers will continue to be informed of results obtained from demonstration plots through periodic field days to promote agronomic practices. Meanwhile results will also be published in newsletters and the Institute's magazine 'Sugar Cane'.

CONCLUSIONS AND RECOMMENDATIONS

- Training conducted under the CFC project sought to focus on the major area of deficiencies in farm operations which result in low productivity and low earnings. Growers were receptive to concepts but struggled to realize improvements against prevailing adverse weather and the existing atmosphere of uncertainty surrounding the industry.
- Unless systems are put in place to ensure orderly cutting and delivery of cane in the industry as a whole, farmers without their own harvesting capability will remain at a distinct disadvantage.
- Meanwhile, harvesting remains a high cost operation and improved efficiency is necessary for profitability.
- Against the background of a 36% cut in the price of sugar sold to the European Union (EU) extending ratoon life of fields at maximum productivity is essential to attaining and maintaining viability.
- The combined impact of training, demonstration plots, introduction of new technology in the forms of reduced tillage machines and walk behind tractors has been a motivation to the many farmers who benefited. They and others have seen the performance of fields when appropriate practices are applied and should have renewed hope for the viability and sustainability of a sugar cane industry. ✯