COMPONENT 6

DETERMINING VIABLE FARM MODULES

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BACKGROUND

The Jamaican sugar industry comprises some 7 000 cane growers, the vast majority operating farms less than 10 ha in size and a few operating holdings exceeding the 1000 ha mark. Together they produce roughly 50% of Jamaica's cane supply of approximately 2 million tonnes per annum, the remainder being produced on factory owned lands. Area under farmer ownership is ill-defined but is thought to be slightly more than half of the approximately 35 000 ha estimated total under cane cultivation. Productivity on a whole has fallen in the industry from the heights of 80 tc/ha commonly achieved in the 1960's to just over 60 tc/ha at the start of the 21st Century. Farmers' productivity typically lag 5-8 tc/ha behind that of the factory-owned farms. Some 30% of cane is grown under irrigation; the rest is rain-fed. Within the irrigated area the method of irrigation available varied from the traditional furrow irrigation to the more efficient drip and centre pivot irrigation systems. Farmers for the most part are still using the relatively inefficient furrow irrigation system.

There were several other ways in which farming systems varied across the industry. Field operations such as tillage practices were mechanically carried out. For the most part this service was contracted, while in other cases, it was carried out by on-farm or owned machinery. Other practices such as planting, fertilizing and weed control were usually manually done among farmers. The option for mechanical operations sometimes existed, though for farmers operating on extremely steep terrain, these operations must be manually carried out. Terrain is of particular importance in cane harvesting. The popular system of harvesting was that of manual cutting, manual piling and mechanized loading. In some hilly terrain however, manual cutting is followed by infield bundling and transportation by donkeys to a point accessible for loading on to road haulage units for transporting to the factory.

Given all the variability, and especially in light of the prevailing economic climate of static prices and rising production cost, the viability of many farms has become questionable. A study was therefore undertaken to accomplish the following:

- To conduct technical and economic evaluation of different farm modules
- To establish requirements for viability in the Jamaican sugar industry in the context of the existing economic environment.

The study was of economic importance considering that the number of registered growers in cane production was significantly lower than that which existed a decade earlier. The results should also provide a basis for policy decisions on the industry insofar as they affect farmers in particular.

PROJECT IMPLEMENTATION AND RESULTS ACHIEVED

Data Collection Procedure

Stratification

In order to collect information for this study, growers within the industry were first stratified along the following criteria:

- Farm Size
- Farming Systems
- Rain-fed Conditions
- Irrigated Conditions

- Traditional furrow irrigation
- Technologically more efficient irrigation systems

- Machinery – owned or rented services

Farm Size

Farms were grouped into the following size categories:

- Less than 2 ha
- 2 – <4 ha
- 4 – <10 ha
- 10 – <20 ha
- 20 – <100 ha
- 100 ha and over

Equipment Ownership

A further subdivision was made based on whether farmers:

- owned and operated machinery and equipment or
- rented such services

Ecological Areas

Information was also gathered from the 5 major ecological zones – the Wet West, West East, Irrigated Areas, Dry North and Central Uplands.

Initial Approach

The initial approach to data collection had to be modified when it was found that growers failed to respond in a desired manner. A total of 75 growers were so drafted to keep satisfactory records so that proper assessment of viability could be conducted. That approach involved:

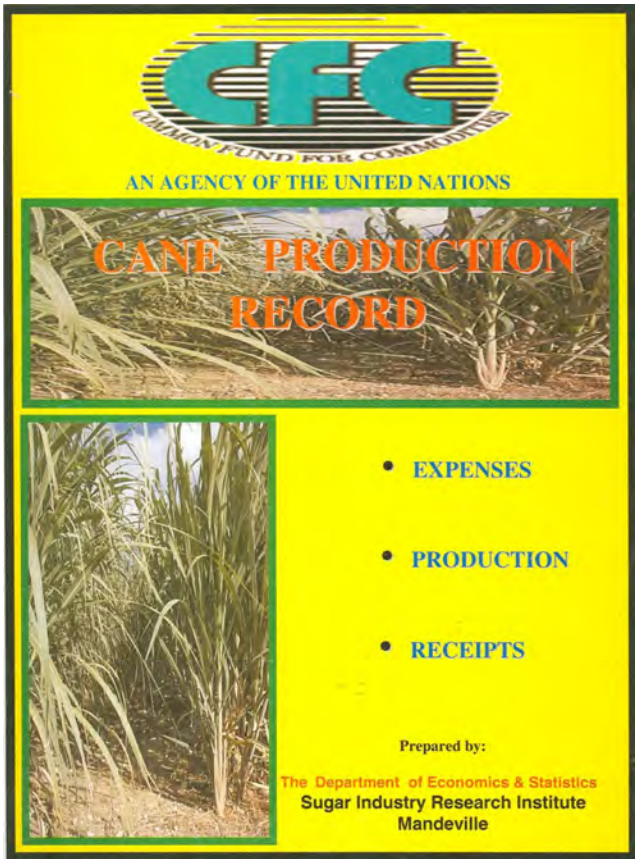
1. Developing a Record Keeping Handbook (to ensure good quality primary data)
2. Conducting a series of training seminars in use of this handbook, followed by handbook distribution
3. Production of a Cost Management Brochure entitled "Three Easy Steps to Determine if Your Farm is Viable' - followed by distribution and training

Despite follow up, it was found that growers tended to merely keep the Handbooks as "souvenirs" and it became clear that this approach would not provide data needed for the study. Not much attempt was being made to undertake record keeping and growers clearly needed ongoing and individual attention to undertake this exercise. It was then decided to modify the approach.

Modified Approach

The new approach taken in 2005 was to develop a Survey Questionnaire and conduct farm visits to gather, directly, information needed. This would cover three crop years, the 2004, 2005, and 2006 crops. A total of 200 farms were selected for the survey. These were not randomly selected; rather the approach was more purposive to ensure that the various farm sizes and ecological areas were adequately represented. The first step was to conduct surveys on both the 2004 and 2005 crops. With limited staff, data collection was slow at first. To expedite the process, a data collection officer was hired on a temporary basis to assist with the task of surveying the 200 growers. The Survey sought to ascertain:

- Cost data associated with the growing and harvesting of the 2004 and 2005 cane crops
- Cane Production & Productivity
- Off Farm Income/Employment etc.



Pic. 6.1: Record Keeping Handbook

Pic. 6.2: Cost Management Brochure

Training Seminar introducing growers to Record Keeping Handbook

The survey was completed in December 2005. This was followed by data entry and preliminary analysis which extended into 2006. Data collection sometimes required multiple visits to some farms to complete the questionnaire.

A cost survey on the 2006 crop was initiated during the third quarter of 2006, which marked the end of the cropping season for most factories. Again, with limited staff personnel, a new data collection officer had to be hired on a temporary basis to assist with data collection as the previous one had migrated. A data entry clerk was also hired over a two-month period.

Major differences in conditions within various ecological zones necessitated that most data be examined on a zonal basis in addition to a national assessment. Return on investment (ROI) along with other measures of viability was used to determine the level of viability. Cost comparisons relative to irrigated areas and the other ecological zones, collectively referred to as the rain-fed areas were made. A cost comparison was also made between farms with owned machinery and those hiring the services. Non-cane income was also examined.

RESULTS AND DISCUSSION

In order to ascertain farm viability, data was analysed at three levels. First the data was looked at purely in terms of inputs used versus income earned in order to determine Returns on Investment (ROI). Then those earnings were examined against an index determined by Government to see whether earnings would be enough to satisfy basic living conditions. Thirdly, vviability was also measured in terms of the farm's ability to finance cultivation expenses from its earnings, and without reliance on loans. Results must always be interpreted against the background of hurricane Ivan which struck during the 2004 cane growing season and hurricanes Dennis, Emily and Wilma which passed off the coast affecting the island by varying degrees in 2005.

Wet West Ecological Zone

The Wet West ecological zone is characterized by rainfall in the range of 1900-2300 mm/annum and is served by the Appleton and Frome factories.

Appleton Area: Thirty-three farms were sampled in the Appleton area. The farm size distribution in this area only allowed for five of the six predetermined farm size categories to be represented. Except for one instance in 2005 when farms in the 2-< 4 ha category showed a negative ROI of 0.45%, relatively high returns were realized by all categories of farms for all three crop years, 2004, 2005 and 2006, Table 1.

Table 1. Return on Investment per hectare by Farm Size Categories, Appleton Areas - 2004, 2005 and 2006 crops

Size of farm (ha)	# of Growers	2004 ROI	2005 ROI	2006 ROI
Under 2 ha	7	33.12%	17.32%	44.74%
2 to < 4	11	32.44%	-0.45%	63.66%
4 to <10	4	15.30%	74.34%	81.58%
10 to < 20	8	55.30%	39.82%	49.89%
20 to <100	3	33.54%	67.59%	58.59%
100 & over	-	-	-	-
Average	33	37.71%	58.30%	56.85%

For the 2004 crop, ROI ranged from 15% for farms in the 4 to < 10 ha category to 55% for farms in the 10 to < 20 ha category. As earlier indicated, except for those farms in the 2-< 4 ha category which showed a negative return, results were even more positive for the 2005 crop with ROI ranging from 17% to a high of roughly 74%. In the 2006 crop, all farm size categories in this zone registered high levels of returns, ranging from 44.7 to upward of 81.6%.

The analysis however showed that the high ROI were not due to high cane yield, but resulted mainly from relatively low production cost coupled with good cane price, as the average sample yield never exceeded 52 tc/ha for the three years under consideration

The negative returns realized by farms in the less than 2 ha category occurred when yields fell (at least in part because of

hurricane damage) to 41.69 tc/ha in 2005. This was also accompanied by relatively high production cost. However, with improved yields in 2006, the ROI improved substantially to 44.74%.

Frome Area: An average of 39 farms was sampled in the Frome area. Only five of the six predetermined farm sizes categories were represented in this sample.

All categories had reasonably high ROI for at least two of the three crop years. Highest returns were realized in 2004 (15.07% to 77.45%). The relatively high ROI resulted mainly from high cane yields, as three categories of farms had productivity levels of 80 tc/ha and above, Table 2.

Table 2. Return on Investment per hectare by Farm Size Categories, Frome Area - 2004, 2005 and 2006 crops

Size of farm (ha)	# of Growers	2004 ROI	2005 ROI	2006 ROI
Under 2 ha	5	36.28%	19.56%	5.21%
2 to < 4	9	57.40%	37.05%	22.33%
4 to <10	7	15.07%	9.69%	17.02%
10 to < 20	11	64.97%	2.74%	37.99%
20 to <100	7	77.45%	48.36%	61.03%
100 & over	-			
Average	39	63.22%	30.06%	50.54%

Levels of viability declined in 2005 (following the hurricane in 2004) with two farm categories earning below 10% ROI, and the other three at 19 to 48%, Table 2. Average sample yield went from 75.02 to 46.79 tc/ha between 2004 and 2005.

The 2006 crop saw some yield recovery but was offset somewhat by a reduction in cane price of roughly $220/tonne relative to the previous crop.

Central Uplands

The Central Uplands are characterized by numerous small farms and relatively few large ones. These small farms are mainly located on very steep hillsides making mechanical operations impossible. The high elevation however, lends itself to higher sucrose and hence higher cane prices. Annual rainfall frequently ranges between 1 700 and 2 400 mm.

Thirty three farms and four farm size categories are represented for this region. The three large farms in the region were exempted, as their relative size would skew the results in their favour.

Except for the lowest size category (less than 2 ha), which showed negative returns of 2.18% in 2004, reasonably high returns were achieved for all three crop years, Table 3. The negative ROI in 2004 was due to relatively high production cost coupled with low cane yields of 52 tc/ha.

Table 3. Return on Investment per hectare by Farm Size Categories, Central Areas - 2004, 2005 and 2006 crops

Size of farm (ha)	# of Growers	2004 ROI	2005 ROI	2006 ROI
Under 2 ha	16	-2.18%	73.26%	25.81%
2 to < 4	4	40.92%	32.59%	90.08%
4 to <10	10	63.62%	43.29%	89.31%
10 to < 20	3	-	-	88.63%
20 to <100	-	-	-	-
100 & over	-	-	-	-
Average	33	29.80%	48.96%	76.86%

Dry North Coast

Inadequate rainfall and poor distribution are the major limiting factors to cane growing in the Dry North Coast region. Cane is grown in two major areas one serving the former Hampden factory, the other surrounding the functioning Long Pond factory. Annual rainfall ranges from some 1300 to 1600 mm in the Hampden and Long Pond areas, respectively.

The sample comprised an average of 28 farms and represented five farm size categories. With the exception of farms in the 20 to <100 ha category, all categories of farms showed negative ROI at least once and some for all three years of the survey, Table 4.

Table 4. Return on Investment per hectare by Farm Size Categories, Dry North Coast Areas - 2004, 2005 and 2006 crops

Size of farm (ha)	# of Growers	2004 ROI	2005 ROI	2006 ROI
Under 2 ha	8	-2.55%	-21.57%	-13.40%
2 to < 4	8	29.96%	-45.37%	14.95%
4 to <10	3	-	-17.36%	-4.58%
10 to < 20	3	-7.28%	-3.45%	27.43%
20 to <100	6	34.06%	26.57%	35.27%
100 & over				
Average	28	11.26%	8.18%	33.35%

The results from the area demonstrate that maintaining reasonable cane yields and or low production costs are necessary conditions for viability. For instance, when yield for farms in the category 2 to < 4 ha fell from 66.71 tc/ha in 2004 to 44.44 tc/ha in 2005, ROI moved from of 29.96% to negative 45.37%. With improved yields of 57.52 tc/ha in 2006 the ROI went to a positive 14.95%.

Wet East

The Wet East receives in the region of 2 100 mm of rainfall annually. Like other rainfall-dependent cane growing areas, it is also predisposed to periods of drought. The area is characterized by a number of small farms and a few large ones served by the St Thomas Sugar Co. factory.

An average of 20 farms was surveyed with five of the selected farm size categories in the sample. Except for a marginal loss of 0.70% in 2005 for farms in the less than 2 ha category, most farms below 10 ha realized net positive returns annually, Table 5. However, margins varied widely from 3.20% to 69%, highly influenced by the level of farm productivity.

Table 5. Return on Investment per hectare by Farm Size Categories, Wet East Areas - 2004, 2005 and 2006 crops

Size of farm (ha)	# of Growers	2004 ROI	2005 ROI	2006 ROI
Under 2 ha	11	15.63%	0.70%	22%
2 to < 4	5	3.20%	13.27%	31.63%
4 to <10	1	57.2%	69.39%	46.63%
10 to < 20	2	-3.75%	54.10%	25.04%
20 to <100	1	-57%	-10.49%	-21.11%
100 & over	0	-	-	-
Average	20	-21.19%	16.18%	13.87%

Farms in the 10 to <20 ha showed inconsistency in performance with ROI moving from negative 3.7% in 2004 to 54.1% in 2005 then down to 25.0% in 2006. The data showed that this was largely yield related, roughly 45 tc/ha in 2004, 54 tc/ha in 2005 and 48 tc/ha in 2006.

Irrigated Plains

The Irrigated Plains comprise cane grown in both southern Clarendon and southern St Catherine. This zone typically receives less than 900 mm/an, which falls short of moisture requirements for an economic sugar cane crop. Irrigation is therefore necessary. The area is served by the Monymusk factory in Clarendon and Bernard Lodge factory in St Catherine.

Irrigated Clarendon

Forty three farms were surveyed in the Clarendon area. Five farm size categories were represented in the sample. The analyses showed that these farms, hard hit by hurricane in late 2004, fared particularly badly in the 2005 and 2006 crops,

ROI for the 2004 crop ranged from a breakeven position of 0.10% for farms in the less than 2 ha category to 10.11% for those in the 2 to < 4 ha category. The larger farms had relatively high returns ranging from 46.25 to over 75%, Table 6.

Table 6. Return on Investment per hectare by Farm Size Categories, Irrigated Clarendon Areas - 2004, 2005 and 2006 crops

Size of farm (ha)	# of Growers	2004 ROI	2005 ROI	2006 ROI
Under 2 ha	7	10.11%	1.44%	10.34%
2 to < 4	7	0.10%	-27.96%	16.72%
4 to <10	16	57.97%	18.91%	9.49%
10 to < 20	8	75.75%	-2.82%	38.31%
20 to <100	5	46.25%	-0.73%	-1.94%
100 & over	-	-	-	-
Average	43	53.98%	2.64%	13.97%

ROI declined considerably for all farm sizes in 2005. Three had negative returns, one was marginally positive, while the other realized an ROI of 18.91%. Negative positions were brought about by a decline in farm productivity, caused largely by the hurricane in 2004. Sample yield in 2005 averaged 43.16 tc/ha compared with roughly 61 tc/ha registered the previous year.

The 2006 survey showed improvements in earnings with ROI ranging from 9 to 38% for most farm sizes.

Irrigated St Catherine:

Interviews were conducted on an average of 14 farms representing five farm size categories. For the most part, ROI was either marginally positive or negative, among the smaller farm sizes, Table 7. Larger farms tended to be profitable.

While the ROI may be a good indicator of the farm's viability it is merely a measure of relationship between the values of inputs used and output realized. Thus a farm denied of inputs would realise very low yields and therefore very low earnings but could still show a positive ROI. In this study, the relatively low sample yield suggests low or inefficient use of inputs and consequently below optimum earnings. Such farms could be facing various degrees of financial crisis.

Net Returns

The study shows that 42 or roughly 20% of the growers sampled registered negative returns on their cane growing operations. A profile of these farms showed that they comprised mainly the smaller farms in the 0.4 to 4 ha category, with relatively low cane yields, sometimes coupled with high production costs, and occurring mainly in the Irrigated and Dry North Coast regions.

Table 7. Return on Investment per hectare by Farm Size Categories, Irrigated St Catherine Areas - 2004, 2005 and 2006 crops				
Size of farm (ha)	# of Growers	2004 ROI	2005 ROI	2006 ROI
Under 2 ha	2	-17.66%	1.03%	-
2 to < 4	3	-	-	-7.31%
4 to <10	5	2.00%	11.11%	49.05%
10 to < 20	-	-	-	-
20 to <100	5	55.33%	18.07%	59.33%
100 & over	1	13.41%	-7.80%	-
Average	16	31.90%	2.51%	24.34%

Net Returns vs Living Expenses

Even where a positive ROI was obtained the question arose as to whether this was sufficient to support an individual or a family or would the grower be required to supplement income by engaging in other income earning activities. Government's Survey of Living Conditions showed an estimate of US$1 054 per annum required for an individual and US$3 862 to supply basic needs for a household of two adults and three children in 2005.

This study indicated that of the 158 farms showing positive net income, 43 or roughly 30% earned below the US$1 054 basic minimum for an individual. The majority of those that fell short comprised small farms in the 0.4 to 2 ha category, although farms of larger size also occasionally fell short. The Dry North Coast had 18 or more than 50% of the 28 farms sampled in this position. Similar conditions were found in the Central Uplands and Irrigated Clarendon, with roughly 50% of farms falling short of the basic minimum. While low cane yields were partly responsible, by reason of their smallness, these farms were just not able to generate sufficient income to meet this minimum requirement. Another reason was sometimes the location of these farms on slopes which necessitated carrying out a number of operations manually, most times at above normal rates, and resulting in inordinately high production costs. In the arid zone, such farms often attempted to counter high irrigation costs by restricting wettings to no more than three, on average, and thus ended up with sub-optimal and uneconomic yields.

Net Returns after Cultivation Expenses

Viability when measured in terms of a farm's ability to finance cultivation expenses from its earnings (and without reliance on loans) showed that only 34 of the roughly 200 growers sampled could successfully meet expenses associated with basic cultivation costs. Only two were from irrigated areas, the others were from rain-fed regions. The two from irrigated areas each had lower than normal irrigation costs, and one had exceptional high yields of 95 tc/ha (the other achieved 65 tc/ha). These were both farms over 8 ha in size.

PRODUCTION COST BY FARMING SYSTEMS

Irrigated versus Rain-fed areas

The survey surprisingly showed that in some instances, no major differences in cost were observed between canes grown under irrigated versus rain-fed, although irrigation is normally a relatively high cost input. This suggests inadequate irrigation, as the study shows an average of only 3 wettings per crop, when a minimum of 8 is usually considered essential.

For both the 2004 and 2005 crops, the survey showed that on average, the highest production cost was observed in the Central Uplands, which fall in the rain-fed area, Table 8. The data for this region was however distorted by a single large farm with atypically high overhead and administrative costs.

As a general trend however, the irrigated areas tended to register higher production costs relative to rain-fed areas.

Hired Services vs On-farm machinery

Twenty-one of the survey participants owned machinery ranging from crawler tractor, rubber wheeled tractor, cane loader

Table 8: Cost per hectare and average yield/ha, ecological regions							
Years	Wet West	Irrigated Clarendon	Dry North Coast	Wet East	Central	Irrigated St Catherine	Overall National
	US$/ha	US$/ha	US$/ha	US$/ha	US$/ha	US$/ha	US$/ha
2004	1299.21	1357.27	1290.45	1407.35	1600.65	1460.12	1642.84
2005	1250.85	1413.81	1364.88	1409.15	1132.86	1435.05	1492.03
2006	1218.75	1539.78	1269.41	1087.52	1491.20	1506.26	1359.02
Average yield							
2004	65.28	60.59	47.70	48.69	65.78	58.98	72.19
2005	49.22	42.94	50.84	48.65	59.99	50.48	51.18
2006	58.77	48.65	48.72	50.02	65.46	58.60	56.16
Average	57.75	50.59	49.08	40.79	63.74	56.02	59.84
Exchange Rate	2004 - J$61.43 ≈ US$1						
	2005 - $62.35 ≈ "						
	2006 - $66.01 ≈ "						

and trailer to trailer truck. Over 90% of these pieces of equipment were being used in a dual role of on-farm use and for hireage. Records on expenses associated with operations of these machines were almost non-existent. The survey showed no marked differences in production costs between those farms with machines and those which contracted such services. The presence of on-farm machinery did not seem to reduce production cost, as the machines were for the most part underutilized, with accompanying high overheads.

Non-Cane income

Non-cane income was seen as any income earned outside of cane farming. Nearly all growers in the sample earn additional income from other sources, including cash crops and semi-permanent crops as well as fixed and salaried income. Some farmers were also service providers to the industry, mainly in the areas of tillage and harvesting operations.

There was no apparent correlation between farm size and the level of off-farm or non-cane income earned. However, lower levels of this income type were associated with smaller-sized farms and tended to increase, as farm size increased. For example, farms up to 10 ha showed total income range of $303- 6 878 per annum, while larger farms earned at $606-58 324 and above, Table 9.

Table 9: Distribution of farm sizes and range of off-farm income - 2006 participants		
Size Category	# of farms	Total Off-Farm income range (US$)
Less than 2 ha	51	303 – 4 727
> 2 to 4 ha	43	227 - 1,8179
> 4 to 10 ha	37	591 –6,878
> 10 to 50 ha	49	606 – 34,389
> 50 to 200 ha	12	757 – 58,324
200 & over ha	1	22,724
Total	193	

CONCLUSION & RECOMMENDATIONS

This study to determine what may be considered a viable farm module in the Jamaican sugar industry established the following:

- Some farms showed reasonable returns on investment. Those failing to cover production costs were among the smaller sized of less than 2 ha, and occurred mainly in the Irrigated and Dry North Coast areas
- Some farms generated sufficient income to cover recurring expenses and meet basic standard of living for an individual as determined by Government
- Relatively low sample yields were being observed in most zones
- Production cost in the irrigated areas were generally higher, though marginal at times, than those in rain-fed areas
- Farms with owned machinery sometimes showed higher production costs than those contracting the services
- Most growers in the sample had non-cane income

The study concludes that farms, irrespective of their size, may realize positive net returns on income, though such returns are marginal in some instances. However, only farms 8 ha and above in rain-fed areas can be considered viable where viability is viewed as the ability to generate sufficient income to cover recurrent farm expenses while meeting basic living expenses. Minimum productivity levels for viability were estimated at 65 tc/ha, but this must be achieved at normal production cost. In irrigated areas higher yields (than 65 tc/ha) must be achieved.

Preferably, farm machinery services should be hired rather than owned as the study indicated underutilization of owned machinery in most cases.

Although farms less than 2 ha tended to show negative returns, numerically they comprised a significant group. These farms tended to not account for the farmers' own time spent in either working in or managing the business, while this was considered in the analysis. Also, in the absence of proper or even rudimentary accounting, some growers were unknowingly subsidizing their farm operations from their non-cane or off-farm income. Nonetheless, supplemental income thus earned may enhance and sustain the farms overall viability.

The study showed sample yields to be generally low thus indicating the potential for increased cane productivity and hence improved viability. Low productivity prevails despite an economic environment of three consecutive years of relative good sugar price countered to some extent by the impact of hurricanes. While it is posited that the low levels of productivity can be improved through a well-managed credit arrangement packaged with technical support and appropriate technology, further insights into the factors responsible for such low yields need to be explored. This is especially significant for a number of reasons. Firstly, a number of farms are showing negative to marginal returns despite reasonable sugar prices. Secondly, the number of growers now in cane production is likely to decline if the farm business is unprofitable. Thirdly, the impending cuts in the EU sugar price, to which most of the sugar produced is sold, will result in a lower income for growers.

LIMITATIONS

1. Record keeping among small holders proved rudimentary to none.
2. Larger holdings tended to have more reliable data but growers tended to be less co-operative
3. There tended to be only minimal accounting for machine operations
4. The drip and centre pivot systems were not featured in the analysis as the samples were inadequate for any meaningful comparison

A more proper assessment of viability could be conducted, given an improvement in the quality of data. This could be greatly improved if a selected number of growers could be assisted in keeping satisfactory records. ☆