SC088

Costs and Returns for Sugarcane Production on Muck Soils in Southern Florida 2008–2009[1]

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Introduction

The Florida sugarcane industry is a major contributor to the state's agricultural economy. The 2008–2009 season produced 1.54 million short tons of raw sugar from approximately 13.4 million tons of sugarcane (Sugar Journal 2009, 7). Sugarcane was harvested on 388,131 acres, which represented a 1.7 percent increase from the previous year (Rice, Baucum, and Glaz 2009, 6).

Sugar is an important industry in Florida because it channels dollars from outside the state and generates important contributions to the regional and state economies. Cash receipts from the sale of raw sugar and molasses have exceeded $800 million per year over the last decade. The revenue generated by the sugar industry, which includes sugarcane farming and milling, and sugar refining, has a significant impact on the economy of South Florida and the state as a whole. The industry generates more than $2.2 billion of annual output. When the multiplier effect is taken into account, which includes the sales of supporting companies (i.e., fertilizer suppliers and equipment dealers) and the spending of income by employees of the sugar industry on consumer goods, the Florida sugar industry contributes more than $4.5 billion to the state's economy and influences more than 47,000 jobs (Hodges et al. 2004).

Sugarcane production in Florida is concentrated in areas south of and around Lake Okeechobee. Palm Beach, Hendry, and Glades are South Florida counties where sugarcane production is especially important. Growers in Palm Beach County produce sugarcane primarily on "muck" or organic soils. Growers in Hendry and Glades Counties produce cane primarily on "sand" or mineral soils. Acreage in 2008–2009 was divided into 309,521 acres (80%) on organic soils and 78,610 acres (20%) on mineral soils (Rice, Baucum, and Glaz 2009, 9).

The purpose of this report is to develop an enterprise budget that reflects annual costs and returns

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for a 5,000-acre farm that grows sugarcane on organic soil, commonly referred to as "muck." Cost and return estimates are important to sugarcane producers and processors, as well as to researchers, lending institutions, government agencies, public officials, private consultants, and other interested parties. The estimates provided in this report reflect important changes in Florida's sugar industry since its last sugarcane crop budget was published in 1991:

1. Complete mechanization of harvesting operations
2. Increased implementation of best management practices (BMPs)
3. Decreased acreage of sugarcane grown by independent growers
4. Decreased acreage due to the conversion of land from sugarcane production to public water storage as part of the Comprehensive Everglades Restoration Plan
5. Changes in sugar prices and crop input costs, especially fertilizer and fuel costs

Assumptions and Data Sources

Many variables influence sugarcane production in South Florida, such as farm size, muck soil depth, varietal selection, management, freeze protection as associated to the distance from Lake Okeechobee, composition and age of farm machinery, number of ratoon crops, as well as many other factors that result in different systems of production with unequal input and output levels. For these reasons, several assumptions are incorporated in developing this budget. The assumptions are designed to reflect "typical" or representative management, farm characteristics, and crop yields. All assumptions made in this report are based on published data, knowledge, and experience of university and USDA/ARS (United States Department of Agriculture, Agricultural Research Service) sugarcane scientists, and interviews with sugarcane growers. This report provides detailed information that includes material names, application rates, and unit costs.

Farm Characteristics

The focus of this study is on the costs and returns from growing sugarcane crop and *not* on the costs and returns associated with sugarcane milling and sugar refining. In that sense, this report treats the farmer as an independent grower, despite the fact that the Florida sugar industry is largely composed of growers of administration cane, meaning that the cane belongs to a grower-processor.

Sugarcane farms in South Florida range from a few hundred acres to more than 30,000 acres. A 5,000-acre farm is chosen as the size of our representative farm. Previous University of Florida sugarcane budgets based cost and return estimates around a farm size of one section, or 640 acres (Alvarez and Schueneman 1991). Several growers and industry experts suggested a substantially larger representative farm size for the following reasons: (1) to facilitate mechanical harvesting, (2) to achieve economies of scale in production, (3) to portray current land tenure systems that are closer to reality than the previously assumed one section (640-acre) farm, and (4) to make cost and return extrapolations easier and more reliable.

The representative farm is assumed to be already established; hence, land purchases and development costs are not included. At the end of this report is a discussion of land rental rates as one measure of "opportunity costs" associated with land cost to a farming operation. The farm is assumed to be located within the free hauling zone (less than 25 miles from a mill), thus no extra charges are made for transporting the sugarcane to a mill.

The land distribution within the representative farm is shown in Table 1. Each year, the farm plants a new stand of sugarcane on 1,300 acres—156 acres to seed cane production and the remaining 1,144 acres to "plant cane" production. Half of the newly planted acreage (650 acres) follows land that was fallowed the previous season. The other half of the new acreage is successively planted. Sucessive planting means that a block is replanted immediately after the last ratoon of the previous sugarcane crop has been harvested. As much as one-half of the sugarcane acreage on muck soils is successively planted (Rice, Baucum, and Glaz 2009, 11). Plant cane grows for

about fifteen months before harvesting. After the plant cane is harvested, a new crop begins to grow from the stubble. "Stubble" or ratoon crops grow for twelve months before they are harvested. For the representative farm, a first ratoon is harvested from all planted acres (1,300 acres). Whether a second or third ratoon is harvested from the same block depends on the expected productivity of the block's next ratoon. Poorer yielding blocks are removed from production and are replanted to "plant cane" in the following season. On the representative farm, 1,000 acres are carried through a second ratoon, and of those acres, 500 acres continue through a third ratoon. The land distribution of the representative farm closely follows findings from the 2008–09 variety census, where Rice, Baucum, and Glaz (2009, 6–7) reported that of the total harvested acreage 32.9 percent is in plant cane, followed by 31.5 percent in first ratoon, 25.6 percent in second ratoon, 8.4 percent in third ratoon, and 1.6 percent in fourth ratoon or older.

Annually, the model farm harvests sugarcane from 3,944 acres, or 79 percent of the total farm area (Table 1). Seed cane and fallow land occupy 156 and 650 acres, respectively. Only 250 acres, or five percent of the total farm area, is required for infrastructure—buildings, roads, loading areas, field ditches, and canals.

Yields

Variety CP89-2143 has been the leading variety of sugarcane in Florida during the last three seasons. In 2008–09, it occupied 31 percent of the organic soils in south Florida (Rice, Baucum, and Glaz 2009, 7). Yields for the representative farm are estimated in two steps. Average farm production of sugarcane is determined first, and then yield differences by ratoon age are estimated. Yield and sucrose percentage assumptions are developed from published data and grower records. One source of yield data is the USDA/ARS Canal Point Florida Sugarcane Field Station. Canal Point yield evaluations for CP89-2143 in 1993–94 and in 1994–95 report a mean yield of 76.23 gross tons per acre and 50.49 gross tons per acre for plant and first ratoon cane, respectively (Rice, Baucum, and Glaz 2009). These data, however, may not accurately reflect commercial growing conditions since yields are collected from sample plots and extrapolated to report tonnage on a per-acre basis. Another source of yield data is the United States Department of Agriculture, Economic Research Service (USDA/ERS), which collects yield data from commercial operations. These annual yield values represent averages across both muck and sand operations and across entire crop cycles within individual farms (USDA/ERS 2009, Table 15). USDA/ERS average farm yield data, together with grower data, led to a production average of between 40 and 42 gross tons per acre for the representative muck farm.

Table 2 presents the production scenario for the model farm by crop age. Plant cane yields 50 gross tons per acre. Production from first, second, and third ratoons declines to 40, 35, and 30 gross tons per acre, respectively. Given the stated yields and land distribution by ratoon age, the overall production average across all crop stages is 40.8 gross tons per acre. Sucrose percentage in normal juice is assumed to be 14.5 percent and the trash percentage is assumed to be 7.3 percent.

Revenues

The methodology for calculating revenues was set forth in the Sugar Act of 1934. Although the Act expired at the end of 1974, its mechanisms are still applied in the settlement between the mills, cooperative members, and independent producers (USDA 1974). The calculation of gross revenue for the representative farm is presented in Table 3. Details about the data and respective calculations in Table 3 are as follows:

1. GTA – Gross tons per acre as reported in Table 2.

2. NTA – Net tons per acre calculated by deducting the trash percentage (7.3%) from GTA.

3. QF – Quality factor converts net tons of cane (NTA) to net ***standard*** tons (NST) by accounting for sucrose levels different than the reference point of 12.5 percent sucrose in normal juice. Alvarez and Rohrmann (1984) estimated an equation that converts any value for normal

juice sucrose to its relevant QF. The QF for 14.5 percent in normal juice sucrose is 1.200.

4. NST – Net standard tons per acre equal net tons (NTA) multiplied by the quality factor (QF).

5. PU – A grower price per unit of net standard ton is $24.50/NST. Price is calculated by multiplying the average price of raw sugar in 2008 (21.30 cents per pound, $0.2130/lb) with the fair price determination factor (1.15). Data on the raw price of sugar can be found online at http://www.ers.usda.gov/Briefing/Sugar/data/Table04.xls. The fair price determination factor converts the raw price of raw sugar into a grower price per NST. The fair price factor is a mechanism that allows sugarcane growers to share in some of the profits generated at the mill.

6. TRA – Total revenues per acre equals the number of net standard tons (NST) multiplied by the price (PU).

7. TGR – Total gross revenues equal the TRA by crop age multiplied by the number of acres in each age category, and then summed across all acres. A molasses payment is calculated separately and added.

8. The molasses revenue assumes an average historical yield of seven gallons of blackstrap molasses per net ton of sugarcane at a price of 20.13 cents per gallon ($0.2013/gal) paid to the grower after the required adjustments and settlement amounts are taken into account. This information was provided by individual producers (the USDA-AMS Livestock and Grain Market News Branch [LGMN] discontinued the National Market News Molasses Report in April of 2005, citing lack of industry cooperation in providing trade information, this being largely due to industry consolidation and protection of propriety information by larger producers). Total revenues from molasses are the product of total net tons (NTA), seven gallons per net ton (7 gal/NT), and the molasses price per gallon.

Cultural Practices

Data for field operations, production inputs, and general overhead costs were obtained through various University of Florida EDIS publications cited in the references, along with personal interviews with producers and industry consultants. For this report, a detailed cost analysis of equipment ownership and usage was not conducted. Instead, cost data on custom rates for the prescribed field operations were collected from growers, equipment dealers, and custom contractors. The custom rates and the frequency of field operations are presented in Table 4. Costs of field operations are separated into four categories that follow the crop stages—fallow, land preparation, plant cane, and ratoon crops. Typically, harvesting is a custom operation as well. These costs, however, are reported as part of the total cost summary (Table 5).

Custom rate charges incorporate all variable costs such as fuel, machinery repairs, and wages paid to the equipment operator, as well as all fixed costs of equipment ownership costs such as depreciation, insurance, interest, and personal property taxes. Custom rates may, to some extent, overstate costs since they include a profit margin to the equipment owner. Alternatively, custom rate charges fully account for all costs, including administrative overhead charges that the owner-operator may neglect to include in his or her cost accounting.

Table 5 summarizes the production costs of growing sugarcane by crop stage. Costs of field operations are incorporated from Table 4 and added to material costs associated with each crop stage. Details on the material names, application rates, and unit costs are presented to allow individual growers to compare and contrast their production costs with what is presented in this report.

The quantity of applied fertilizer can be derived from Table 5 by multiplying the rate and number of applications of each major nutrient. These rates are based on growers' input, as well as data from EDIS documents SC026 (Gilbert and Rice 2006) for nutrient requirements for production on muck soils and SC028 (Rice, Gilbert, and Lentini 2006) for micronutrients.

Herbicide treatments are based on growers' input and EDIS document WG004 (Rainbolt and Dusky 2006).

Information for other cultural practices was provided by growers and EDIS documents IG065 (Cherry, Schueneman, and Nuessly 2001) on insect management, SC015 (Rainbolt et al. 2005) on ripeners, and SC031 (Lang, Daroub, and Lentini 2008) on water management issues.

Costs and Practices

Information on costs of materials and custom rates were obtained from growers' records and personal interviews. Additional price data were collected from local firms supplying agricultural fertilizers and chemicals to sugarcane growers. Information on land taxes and other overhead costs were also taken from growers' records. Methods for obtaining grower prices for sugar and molasses were explained above.

Fertilizer prices increased dramatically during the 2007–08 season. A significant increase in crude petroleum prices drove much of the inflation in fertilizer prices. While prices decreased to some extent during the 2008–09 season, they remained substantially above pre-2007 levels. Given the volatility of the fertilizer market, prices presented in this report could vary substantially from what an individual grower actually paid.

Overhead costs received special attention, as they are many times overlooked or underestimated by agricultural producers. Overhead costs are those expenses that are distributed across the entire farm, and not to any specific crop stage or field operation. Table 6 lists most of the important overhead costs along with an estimate of an annual budget and per-acre cost. It is likely that these costs vary widely from grower to grower. For instance, taxes could decrease by as much as $25 per farm-acre if the grower is not part of a drainage district or not located in a special assessment area, such as the C-139 Basin or the Everglades Agricultural Area (EAA). Overhead costs are presented in this report mainly to recognize their importance and to provide individual growers with a reference point from which they can compare their own administrative or overhead costs.

Revenues, Costs, and Net Returns

Revenues

More than 180,000 net standard tons of sugarcane are produced annually from the representative farm, generating more than $4.5 million in total annual revenues (Table 3). Average revenue is $1,153 per harvested acre (3,944 acres), or $909 per farm acre (5,000 acres). Tables 3 and 7 indicate per-acre revenues of $1,362 from plant cane fields and $1,090 from first ratoon fields. Second and third ratoon crops generate revenues of $954 and $817 per acre, respectively. The sale of molasses, a by-product of milling raw sugarcane, contributes nearly $208,000 of revenue to the farming operation.

Production Costs

Per-acre costs are estimated by production activity—fallow land management, land preparation, growing costs of plant and ratoon crops, and cane harvesting. Fallow land maintenance is estimated to cost $24 per acre and, based on historical data, assumes weed control with two herbicide (generic glyphosate) spray applications (Tables 4 and 5). Land preparation immediately precedes establishment of plant cane and is estimated to cost $293 per acre. Costs associated with plant cane are estimated to be $329 per acre, while the costs of growing ratoon crops are estimated to be $134 per acre. Sugarcane harvesting is assumed to be a custom operation, and a flat rate of $6.50 per gross ton includes field burning (if necessary), cutting, loading, and hauling cane stalks up to 25 miles. Given the yield and land distribution assumptions for our representative farm, the weighted average harvesting cost is $262 per harvested acre.

Farm overhead costs are listed and estimated in Table 6. These costs can vary widely among different farms. The primary purpose of Table 6 is to list the various costs that farm managers or owners should consider when estimating their annual net returns to their operations. It is important to note that traditional overhead costs associated with farm equipment are not listed in Table 6. For this report, all field equipment is assumed to be custom-hired, and as such, overhead costs such as depreciation, interest payments, and equipment insurance are included in

the custom rate. Total farm costs are presented in Table 7 and are calculated by multiplying the per acre cost of each crop stage by the appropriate number of acres in that crop stage.

Total annual costs to manage a 5,000-acre sugarcane farm with 3,944 harvestable acres are nearly $3.2 million (Table 7). Overhead expenses account for 27 percent of the total costs, or $875,000 per year. Harvesting accounts for 32 percent of total costs. Growing costs of ratoon and plant cane make up 12 percent and 13 percent of total costs, respectively. In addition to the above costs, an interest charge on operating capital is included and estimated to be more than $84,038 per year, or seven percent of the combined costs of fallow land management, land preparation, and growing costs of plant and ratoon crops. Operating capital is assumed to be borrowed from a bank and therefore the interest payments are handled as a direct cost of production. If the liquid assets of the sugarcane farm are sufficient to cover the annual operating expenditures, this interest expense could be voided and added to the farm's overall "cash" returns. A grower with such liquid assets should still consider including an interest expense on operating capital to account for the lost income such funds would have earned if not invested back into the production of sugarcane.

Net Returns

The net returns to land, management, and risk (LMR) are the difference between total revenues and total cost. For the representative farm described in this report, net returns to LMR are projected to be $1,351,492 (Table 7). For 3,944 harvested acres, net returns to LMR are $342.67 per harvested acre (Table 8). Across the entire farm, or 5,000 acres, net returns to LMR are $270.30 per farm acre. The representative farm earns $7.63 per net-standard ton of sugarcane.

Land rental rates can serve as a proxy for an annual land charge. Lease values, however, are location specific and a function of the number of acres available for leasing. Reported lease rates for sugarcane land range from $70 to more than $200 per farm acre. Given that net returns to the representative farm were $1,351,492 and remaining annual overhead costs were $380,000,[3] a land rental rate of at least $346 per farm acre would return as much income to the farm owner as growing sugarcane. If the owner of our representative farm received an offer to lease the entire farm for $346 per acre, the farm owner would earn more income from leasing the land than from growing sugarcane. Conversely, if the best rental offer was for less than $346 per acre, total income would decrease and the farm owner should continue with sugarcane production.

Conclusions

Costs and returns were estimated for a sugarcane operation on organic (muck) soils in south Florida. The modeled farm was assumed to be on 5,000 acres, and followed a production cycle that included plant cane and three ratoon crops. Only 650 acres, or half of the planted acreage, followed a fallow period. The remainder of new acreage was successively planted. Overall, the farm annually harvested sugarcane from 3,944 acres, or 79 percent of the entire farm. The average annual production across all harvested acres was 40.8 gross tons.

Given 14.5 percent normal juice sucrose and 7.3 percent trash, the farm sold 180,784 net standard tons and earned more than $4.5 million of annual revenues, or an average of $1,153 per harvested acre. Given prices and cultural practices prevalent during the 2008–09 season, a sugarcane grower on muck soils spent $810 per harvested acre annually. The sugarcane operation earned more than $1,351,492 of net returns to land, management, and risk, or $343 per harvested acre and $270 per farm acre.

Our cost estimate includes costs associated with the management of fallow land and production of seed cane. Custom rates for equipment usage account for all ownership costs associated with equipment operations on the representative farm. In addition, our cost estimate attempts to account for overhead and administrative costs that would be required to sustain the representative farm. Annual overhead costs, which include maintenance of roads, ditches, and irrigation systems, run nearly 30 percent of total production costs. Our estimate of total cost, however, does not include mortgage costs from land purchases nor the development costs required to set up the original growing operation.

3. Even if the entire farm were leased to another grower or for another purpose, some overhead costs would remain, such as taxes ($350,000), road and ditch maintenance ($25,000), and general liability insurance ($5,000).

A net return of $270 per farm acre suggests relatively high land rental rates for sugarcane land on muck soil. If a grower were able to lease his or her land for at least $346 per farm acre, then the grower would be indifferent to continuing to farm sugarcane or leasing out the land to another grower or for some other activity. Another factor that supports long-term financial stability to the Florida sugar industry is the fact that the industry is largely composed of growers of administration cane. This means that the growers have a financial stake in sugarcane milling and processing. Consequently, in addition to any financial returns from the farming operations, there may be further gains from sugar milling and processing.

References

Alvarez, José and Thomas J. Schueneman. 1991. *Costs and Returns for Sugarcane Production on Muck Soils in Florida, 1990–91*. Economic Information Report EI 91-3. Food and Resource Economics Department, University of Florida, Gainesville, FL (June).

Alvarez, José and Francisco Rohrmann. 1984. *Relationships among Various Measures of Sugar Quality*. Belle Glade EREC Research Report EV-1984-10, Everglades Research and Education Center, University of Florida, Belle Glade, FL (September).

Cherry, Ron H., Thomas J. Schueneman, and Gregg S. Nuessly. 2001. Insect Management in Sugarcane. Electronic Data Information Source (EDIS) IG065. Entomology and Nematology Department, University of Florida, Gainesville, FL. http://edis.ifas.ufl.edu/IG065

Hodges, Alan, R.Mohammad, and D. Mulkey. 2004. Economic Impacts of Agricultural, Food, and Natural Resource Industries in Florida in 2004. Electronic Data Information Source (EDIS) FE680. Food and Resource Economics Department, University of Florida, Gainesville, FL.

Gilbert, R. A. and R. W. Rice. 2006. Nutrient Requirements for Sugarcane Production on Florida Muck Soils. Electronic Data Information Source (EDIS) SC026. Agronomy Department, University of Florida, Gainesville, FL. http://edis.ifas.ufl.edu/SC026

Lang, T.A., S.H. Daroub, and R.S. Lentini. 2008. Water Management for Florida Sugarcane Production. Electronic Data Information Source (EDIS) SC031. Agronomy Department, University of Florida, Gainesville, FL. http://edis.ifas.ufl.edu/SC031

Rainbolt, C.R. and J. A. Dusky. 2006. Weed Management in Sugarcane – 2007. Electronic Data Information Source (EDIS) WG004. Agronomy Department, University of Florida, Gainesville, FL. http://edis.ifas.ufl.edu/WG004

Rainbolt, C. R., R. A. Gilbert, A. C. Bennett, J. A. Dusky and R. S. Lentini. 2005. Sugarcane Ripeners in Florida. Electronic Data Information Source (EDIS) SC015. Agronomy Department, University of Florida, Gainesville, FL. http://edis.ifas.ufl.edu/SC015

Rice, Ron, Les Baucum and Barry Glaz. 2009. Sugarcane variety census Florida 2008. *Sugar Journal 72*(2): 6–12.

Rice, R. W., R. A. Gilbert and R. S. Lentini. 2006. Nutritional Requirements for Florida Sugarcane. Electronic Data Information Source (EDIS) SC028. Agronomy Department, University of Florida, Gainesville, FL. http://edis.ifas.ufl.edu/SC028

Sugar Journal. 2009. American Society of Sugarcane Technologists – 39th Annual Joint Meeting – Florida & Louisiana Divisions. *Sugar Journal 72*(1): 7.

USDA/ASCS. 1974. Sugarcane Prices, Florida 1974 Crop. *Federal Register* of December 3, 1974 (39 F.R. 41826) and December 13, 1974 (39 F.R. 43406). United States Department of Agriculture, Agricultural Stabilization and Conservation Services, Washington D.C.

USDA/ERS. 2009. Production of Sugarcane for Sugar, Table 15. United States Department of Agriculture, Economic Research Service, Washington, D.C. http://www.ers.usda.gov/Briefing/Sugar/data/Table15.xls

Table 1. Land distribution[a] for a 5,000-acre sugarcane operation on muck soil, 2008–09

Item	Acreage	Percent Net Acreage
Seed cane[b]	156	4.0
Plant cane	1,144	28.0
Stubble cane:		
First ratoon	1,300	32.0
Second ratoon	1,000	24.0
Third ratoon	500	12.0
Total cane area	4,100	
Fallow	650	
		Percent Gross Acreage
Total net acreage	4,750	95.0
Infrastructure (roads, ditches, etc.)	250	5.0
Total	5,000	100.0

Notes:
[a] Overall farm size and acreage allocation by crop stage based on Rice, Baucum, and Glaz (2009).
[b] Growers are assumed to supply their own seed cane and plant six gross tons of seed cane per acre. Seed cane is harvested annually from plant cane acreage. Area for seed cane production is calculated as follows: 1,300 acres of new planted area multiplied by planting rate of six gross tons per acre divided by 50 tons per acre equals 156 acres, where 50 tons per acre is the assumed yield for plant cane (see Table 2).

Table 2. Yield by crop age for a sugarcane operation on muck soil, 2008–09

Age	Yield[a]	Normal Juice Sucrose[a]	Trash[a]	Plant Acre[b]	Weighted Average Yield by Crop Age[c]
	(gross tons/acre)	(%)	(%)	(%)	(gross tons/acre)
Plant cane	50.0	14.5	7.3	32.0	15.9
First ratoon	40.0	14.5	7.3	32.0	12.7
Second ratoon	34.0	14.5	7.3	24.0	8.5
Third ratoon	29.0	14.5	7.3	12.0	3.7
Total				100.0	40.8
					Weighted average yield across all planted acreage

Notes:
[a] Representative yields, sucrose estimates, and trash percentage based on grower interviews.
[b] Percentage of planted area calculated from reported net acreage land allocation.
[c] Weighted average yield by crop age calculated by multiplying yield by the percentage of planted area.

Table 3. Production and revenue for a 5,000-acre sugarcane operation on muck soil, 2008–09

Item	Area	GTA	T	NTA	QF	NST	PU	TRA	TGR
	(acres)	(tons/acre)	(%)	(tons/ acre)		(tons/ acre)	($/ton)	($/acre)	($)
Seed cane	156							0	0
Plant cane	1,144	50.0	7.3	46.35	1.20	55.62	24.50	1,362	1,558,599
First ratoon	1,300	40.0	7.3	37.08	1.20	44.50	24.50	1,090	1,446,908
Second ratoon	1,000	34.0	7.3	32.45	1.20	38.93	24.50	954	953,688
Third ratoon	500	29.0	7.3	27.81	1.20	33.37	24.50	817	408,724
Fallow	650							0	0
Harvest acres	3,944								
Farm acres	5,000								
Molasses	(Molasses revenue assumes 7 gallons/net ton (NT) and a price of $0.2013/gallon)								107,953

	Gross Tons	Net Tons	Net Standard Tons	Revenue
Totals	159,200	147,578	180,784	4,545,872
Revenue per harvest acre				1,153
Revenue per farm acre				909

Abbreviations:
GTA – Gross tons per acre
T – Percentage of gross tons of trash harvested
NTA – Net tons per acre equals the GTA less trash
QF – Quality factor for normal juice sucrose of 14.5% is 1.200 (Source: Alvarez and Rohrmann 1984)
NST – Net standard tons per acre equals NTA multiplied by QF
PU – Price per unit: 21.3 cents per pound of raw sugar multiplied by 1.15 (fair price determination factor) to determine the grower price per NST
TRA – Total returns per acre
TGR – Total gross revenues to the representative farm

Table 4. Typical field operations and average cost per acre at custom rates for pre-harvest, fallow, plant cane, and ratoon crops for a sugarcane operation on muck soil, 2008–09

Activity	Trips Over Field	Custom Rate	Cost Per Acre
	(#/acre)	($/#)	($/acre)
Fallow			
Chemical spray	2	4.00	8.00
Total fallow			8.00
Land preparation			
Heavy disc	3	15.00	45.00
Light disc	3	12.00	36.00
Laser level	0.5	60.00	30.00
Slag application	1	5.00	5.00
Lime (dolomite) application	0	5.00	
Total land preparation			117.00
Plant cane			
Planting operations	1	130.00	130.00
Seed cane harvest[a]	1	40.00	40.00
Fertilizer application – dry	1	6.50	6.50
Chemical applications	3	4.00	12.00
Mechanical cultivation	4	6.50	26.00
Total plant cane			234.50
Ratoon (stubble) crops[b]			
Mowing & chopping fodder	1	11.50	11.50
Chisel plow	1	12.00	12.00
Fertilizer application – dry	1	6.50	6.50
Chemical application	3	4.00	12.00
Mechanical cultivation	3	6.50	19.50
Ripener application (aerial)[c]	0.25	5.00	1.25
Total ratoon			62.75

Notes:

[a] Fee to mechanically cut seed cane ($25 per acre) plus fuel for tractors and harvester (6 gallons per acre multiplied by $2.50 per gallon equals $15 per acre).

[b] Rodent control chemical not included but can be applied as needed by plane for an estimated application cost of $3.50 per acre.

[c] Ripener to be applied to only acreage being successively planted. Acreage successively planted one-half of the ratoon acreage.

Table 5. Costs of cultural practices by crop stage for a sugarcane operation on muck soil, 2008–09

Activity	Unit	Rate	Times	Price/Unit	Cost/Acre
				(dollars)	(dollars)
Fallow land total cost per acre:					
Custom rate charges (Table 4)	—	—	—	—	8.00
Round-up + surfactant	quart	2	2	4.00	16.00
Total fallow costs					24.00
Land preparation total cost per acre:					
Custom rate charges (Table 4)	—	—	—	—	121.00
Soil testing[a]	dollar	1	1	8.00	8.00
Slag	ton	3	1	56.00	168.00
Dolomite	ton	0	1	28.00	0.00
Total land preparation costs					293.00
Plant cane total cost per acre:					
Custom rate charges (Table 4)	—	—	—	—	234.50
Fertilizer – N	pound	0	0	0.60	0.00
Fertilizer – P_2O_5 + K_2O mix	pound	50	1	0.50	25.00
Micronutrients	pound	15	1	0.51	7.65
Thimet (insecticide)	pound	15	0.75	2.05	23.06
Atrazine 4L (pre-emerge herbicide)	pound	4	1	3.00	12.00
Evik (pre-emerge herbicide)	pound	1	0.5	3.00	1.50
2,4–D Amine 4 (post-emerge herbicide)	quart	2	1	3.00	6.00
Asulox LA (post-emerge herbicide)	gallon	1	0.5	25.00	12.50
Oil (surfactant)	quart	2	2	1.65	6.60
Total plant cane costs					328.81
Ratoon (stubble) crops total cost per acre:					
Custom rate charges (Table 4)	—	—	—	—	64.00
Fertilizer – N	pound	0	0	0.60	0.00
Fertilizer – P_2O_5 + K_2O mix	pound	50	1	0.50	25.00
Micronutrients	pound	15	2	0.51	7.65
Atrazine 4L (pre-emerge herbicide)	pound	4	1	3.00	12.00
Evik (pre-emerge herbicide)	pound	1	0.5	3.00	1.50
2,4–D Amine 4 (post-emerge herbicide)	quart	2	1	3.00	6.00
Asulox LA (post-emerge herbicide)	gallon	1	0.5	25.00	12.50
Oil (surfactant)	quart	2	2	1.65	6.60
Chemical ripener (only on last ratoon)	ounce	6	0.25	0.33	0.50
Total ratoon costs					134.50
Harvesting (weighted) cost per acre:					
Cane cutting PC (gt = gross tons)	gross ton	50	1,144	6.50	325.00
Cane cutting first ratoon	gross ton	40	1,300	6.50	260.00
Cane cutting second ratoon	gross ton	35	1,000	6.50	227.50
Cane cutting third ratoon	gross ton	30	500	6.50	195.00
Cane hauling	mile	0	0	0.25	0.00
Average harvesting costs					262.37

Table 6. Estimated annual overhead expenses for 5,000-acre sugarcane operation on muck soil, 2008–09

Activity	Annual Budget	Cost/Farm-Acre
	($/year)	($/acre)
Supervision & vehicles	125,000	25.00
Fuel (general administration, not field operations)[a]	25,000	5.00
Office staff & supplies[b]	40,000	8.00
Insurance[c]	150,000	30.00
Professional services[d]	25,000	5.00
Membership & subscriptions	10,000	2.00
Taxes & assessments[e]	350,000	70.00
Utilities	25,000	5.00
Pumping & water control	100,000	20.00
Road & ditch maintenance[f]	25,000	5.00
Total estimated overhead costs	875,000	175.00

Notes:
[a] Fuel = 33 gallons per day multiplied by 300 days per year at $2.50 per gallon
[b] Office staff of one person at $35,000 per year, and supplies of $5,000 per year
[c] Insurance includes crop, vehicle, general liability, and employee health
[d] Professional services include legal, accounting, and crop consultants
[e] Taxes include ad valorem, water management, drainage districts, and special assessment (e.g., C-139 or EAA)
[f] Road and ditch maintenance assumed to cost $10 per acre but done to only one-half the acreage per year

Table 7. Summary of production, revenues, costs, and net returns to land, management, and risk for a 5,000-acre sugarcane operation on muck soil, 2008–09

Production Summary	Tons	Tons/Harvest-Acre	Tons/Gross-Acre
Gross tons	159,200	40.4	31.8
Net tons	147,578	37.4	29.5
Standard tons	180,784	44.9	35.4
Income Summary	**Dollars/Acre**	**Acres**	**Total Cost**
Revenue			
Plant cane	1,362.41	1,144	1,558,599
First ratoon	1,089.93	1,300	1,416,908
Second ratoon	953.69	1,000	953,688
Third ratoon	817.45	500	408,724
Molasses payment			207,953
Total revenue			4,545,872
Costs			
Fallow	24.00	650	15,600
Land preparation	293.00	1,300	380,900
Plant cane[a]	328.81	1,300	427,456
Stubble cane	134.50	2,800	376,586
Interest[b]			84,038
Harvest	262.37	3,944	1,034,800
Overhead	175.00	5,000	875,000
Total costs			3,184,380
Net returns to land, management, and risk			1,351,492

Notes:
[a] 1,300 acres are prepared and planted as plant cane each year. Only 1,144 acres of plant cane are harvested for sugar. The remaining 156 acres are harvested for seed.
[b] Interest payments to cover growing season costs estimated to be seven percent of fallow, land preparation, and ratoon crop costs.

Table 8. Net returns to land, management, and risk from sugarcane production on muck soil, 2008–09

	Gross Acres	Harvest Acres	Gross Tons	Net Tons	Standard Tons
	($/acre)	($/acre)	($/ton)	($/ton)	($/ton)
Revenue	909.17	1,152.60	28.55	30.80	25.65
Cost	638.88	809.93	20.07	21.65	18.04
Net returns to land, management & risk	270.30	342.67	8.49	9.16	7.63
Land rental rate[a]	346.00				

Notes:
[a] Minimum land rental rate to create a break-even point between continuing sugarcane production and leasing the entire operation to another grower or for another purpose. (Land rental rate = net returns [$1,361,492] plus remaining overhead costs [$380,000] divided by farm acres [5,000].)