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Projected Costs and Returns for Sugarcane Production on Mineral Soils of South Florida, 2007-2008[1]

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Introduction

The Florida sugar industry is a major component of the state's agricultural economy. The 2007–2008 season produced 1.54 million short tons of raw sugar from approximately 14 million tons of sugarcane (*Sugar Journal* 2008: 6), harvested on 381,657 acres (Glaz 2008: 6).

Sugar is a basic Florida industry because it channels outside dollars into the area and generates direct, indirect, and induced impacts on 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 south Florida and the state's economy. The industry generates more than $2.2 billion of annual output. When the multiplier effect is taken into account, 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 sugarcane primarily on mineral (or "sand") soils. Total Florida sugarcane acreage remained fairly steady at 425,000 acres until 2004. By the 2007–2008 growing season, acreage had declined by more than 9 percent, to 381,657 total acres devoted to seed and sugar. Acreage in 2007–2008 was divided into 304,902 (80%) acres on organic soils and 75,923 (20%) acres on mineral soils (Glaz 2008: 9).

The purpose of this report is to develop an enterprise budget that reflects annual costs and returns for a 5,000-acre farm that grows sugarcane on mineral soils. Sugarcane grown on mineral soils is commonly referred to as "sand land cane." The nearly 76,000 acres of sand land cane are located primarily in eastern Hendry and Glades Counties.

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Cost and return information is 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 such as the following:

- Complete mechanization of harvesting operations
- Increasing implementation of Best Management Practices (BMPs)
- Declining acreage of sugarcane grown by independent growers
- Declining acreage due to the conversion of land from sugarcane production to public water storage as part of the Comprehensive Everglades Restoration Plan
- Changes in factor and output prices

Advantages and Disadvantages of Sugarcane Production on Mineral (Sand) Versus Muck Soils in Florida

Advantages

- More area available for industry expansion, as sugarcane grown on muck soils faces increasing pressures for tighter environmental management and public land acquisition.
- Suitable for planting high-value winter vegetable crops, such as beans and corn, during the fallow period between sugar crops.
- In general, land costs for sand land cane are lower.
- Less use of insecticides at planting (e.g., wireworm control).
- Generally, higher sucrose content.

Disadvantages

- Higher costs of fertilizer programs and water management.
- Many sand land farms require soil amendments such as calcium silicate.
- Generally, sand land produces less sugarcane tonnage.
- Greater need for field drainage ditches reduces arable land by about 10 percent as compared to farms on muck soils.
- Riskier production environment:
    - Lower water-holding capacity and higher susceptability to drought.
    - Tends to be in colder areas.
- Sandy soils are more abrasive and will increase wear and tear on field and factory machinery and equipment.
- With the exception of sugarcane grown near the Clewiston sugar mill, sugarcane grown on sand land is farther away from mills, and thus incurs higher hauling costs.

Assumptions and Data Sources

Many variables influence sugarcane production in south Florida. Farm size, soil type and depth, management, distance to Lake Okeechobee, composition and age of the machinery and equipment, number of ratoon crops, and many other factors 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, opinions of university and United States Department of Agriculture, Agricultural Research Service (USDA/ARS) sugarcane scientists, and interviews with sand land sugarcane growers. This report presents considerable details on crop yields, revenues, and specific costs to allow individual growers to contrast and compare their respective operations.

Management

The numbers presented in this report are not based on area-wide averages. Instead, this study reflects management as reported from individual interviews with seven sand land sugarcane growers. These growers collectively accounted for more than 75 percent of the sand land sugarcane acreage grown during the 2007–2008 growing season. The focus of this study is on the costs and returns from growing a sugarcane crop, and not on the costs and returns associated with sugarcane milling and refining. In that sense, this report treats the farmer as an independent grower, despite the fact that the Florida sugar industry is dominated by growers of administration cane, meaning that the sugarcane belongs to a grower-processor.

Farm Characteristics

Sizes of 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 producers and sugarcane scientists at the University of Florida suggested a substantially larger representative farm size for the following four main reasons: 1) to facilitate the mechanical harvesting operation to ensure the delivery of appropriate tonnage to a mill; 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 there are no land and development costs to defray. 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 cane to a mill.

The land distribution within the representative farm is shown in Table 1. One crop cycle lasts five years. “Plant cane”, or the first crop, grows for 15 months, followed by three 12-month ratoon (or stubble) crops. After the last ratoon crop, the field is left fallow for about nine months before replanting to plant cane. This crop cycle closely follows findings of a variety census for the 2006–2007 growing season, where Glaz (2007: 11) reported 33.4 percent in plant cane, 28.6 percent in first ratoon, and 24.4 percent in second ratoon, for a total of 86.4 percent of all land in sugarcane production. Third and fourth ratoons accounted for the remaining 10.6 and 3.1 percent, respectively, of the total sugarcane acreage in Florida. The inclusion of a fallow period reflects a major difference in the land utilization between organic and mineral soils. According to Glaz (2007: 20), "successive planting is not generally practiced on sand soil in Florida, while it is done on roughly half of the muck lands." Successive planting is a cultural practice where sugarcane is replanted immediately after harvesting the final ratoon crop, thus eliminating the summer fallow period.

For our farm, sugarcane is harvested annually from 3,240 acres, or 64.8 percent of the total farm area (Table 1). Only 3,070 acres are harvested for sugar. The remaining 170 acres are "plant cane" acres harvested for seed. Acreage allocated to first, second, and third ratoons total 2,105 acres and are based on data from commercial growers. Acreage by ratoon age declines, reflecting the fact that growers keep only their better blocks for the second and third ratoons. Poorer yielding blocks that are removed from production after the first or second ratoon become part of the fallow acreage that is replanted to plant cane in the following season. Hence, in this report 1,135 acres (22%) are assumed to be managed as fallow land, which corresponds to the number of acres planted to plant cane each year. The remaining 625 acres (12.5%) are occupied by buildings, roads, drainage ditches, and waste areas.

Yields

Variety CP 78-1628 is the representative variety for sand land sugarcane production in south Florida. According to Glaz (2007: 14), this has been the leading variety on mineral soils for the past eight seasons, occupying 41.6 percent of sugarcane land on mineral soils in 2006–2007. 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 data in terms of gross tonnage and sucrose percentage are developed from published annual sources and grower interviews. One source of yield data is from the USDA/ARS Canal Point, Florida Sugarcane Field Station. These data suggest that average farm production from CP78-1628 is more than 44 gross tons per acre (Glaz 2007). These data, however, may be regarded as more "theoretical" since yields are collected from sample plots and extrapolated to report tonnage per acre. Yield data from commercial operations are collected by the National Agricultural Statistics Service (NASS). NASS data indicate that average farm production in Hendry County ranged between 35 and 40 gross tons per acre between the years 2000 and 2007 (NASS 2009). These data, however, include production from richer, organic soils in the far eastern part of Hendry County. Commercial growers on mineral soils contend that annual production across their entire harvested area should average between 30 and 35 gross tons per acre. If production from mineral soils were 15 percent lower than production averages reported by NASS, then a farm average of 32 gross tons per acre would be reasonable.

Table 2 presents one scenario for production by crop age. Plant cane is assumed to yield 40 gross tons per acre. Production rates from first, second, and third ratoons decline and are 30, 27.5, and 26 gross tons per acre, respectively. Given the stated yields and land distribution by ratoon age, the overall production average across all crop stages is 32.1 gross tons per acre. Many growers report that their sucrose percentage in normal juice is between 15.5 and 16.0 percent. For this report, normal juice sucrose is assumed to 15.75 percent. A typical value for trash percentage is 5.28 percent (Glaz 2007).

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). Calculation of gross revenue for the representative farm is presented in Table 3. Details on the data and respective calculations in Table 3 are as follows:

- GTA – Gross Tons per Acre as reported in Table 2.
- NTA – Net Tons per Acre calculated by deducting the trash percentage (5.28%) from GTA.
- QF – Quality Factor converts net tons of cane (NTA) to net standard tons (NST) by accounting for sucrose levels different from the reference point of 12.5 percent sucrose in normal juice. Alvarez and Rohrmann (1984) estimate an equation that converts any value for normal juice sucrose to its relevant QF. The QF for 15.75 percent normal juice sucrose is 1.325.
- NST – Net Standard Tons equals net tons (NTA) multiplied by the quality factor (QF).
- PU – Price per net standard ton of sugarcane is assumed to be $25.46/NST. Calculated by multiplying the average price of raw sugar during the 2006 calendar year ($22.14/ton) with the fair price determination factor (1.15). ("Fair price determination factor" is a mechanism that allows sugar cane growers to share in some of the profits generated at the mill.) Data on the raw price of sugar can be found at http://www.ers.usda.gov/Briefing/Sugar/data/Table04.xls.
- TRA – Total Revenues per Acre equals the number of net standard tons (NST) multiplied by the price (PU).
- 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.
- The molasses revenue assumes the average historical yield of seven gallons of blackstrap molasses per net ton of sugarcane at a price of $0.2013/gallon paid to the grower after the required adjustments and settlement amounts are taken into account. This information was provided by the producers since the National Market News Molasses Report was terminated April 15, 2005 due to lack of industry cooperation in providing trade information (

http://www.ams.usda.gov/mnreports/gx_gr851.txt). Total revenues from molasses are the product of total net tons (NTA), seven gallons/NT, and the molasses price per gallon.

Cultural Practices

Data for field operations, production inputs, and general overhead costs were obtained through personal interviews with producers, industry consultants, and sugarcane scientists with the University of Florida and the USDA/ARS. For this report a detailed cost analysis of equipment ownership and operation 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 along with 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, 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 (equipment owner and farm operator are assumed to be two different people). Alternatively, custom rate charges fully account for all costs, including administrative overhead charges, which owners/operators may neglect to include in their cost accountings.

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 information found in the EDIS documents, "Sugarcane Production in Southwest Florida: Mineral Soils and Amendments" (Muchovej et al. 2005) (http://edis.ifas.ufl.edu/SC073) and "Nutrient Requirements for Sugarcane Production on Florida Muck Soils" (Gilbert and Rice 2006) (http://edis.ifas.ufl.edu/SC026) for mineral and muck soils, respectively; and "Nutritional Requirements for Florida Sugarcane" (Rice et al. 2006) (http://edis.ifas.ufl.edu/SC028) for micronutrients, and personal communications with Dr. James M. McCray, sugarcane soil scientist at the UF/IFAS Everglades Research and Education Center.

Herbicide treatments are based on growers' input; the EDIS document, "Weed Management in Sugarcane–2007" (Rainbolt and Dusky 2006) (http://edis.ifas.ufl.edu/WG004); and personal communications with Dr. Curtis R. Rainbolt, former weed science specialist at the Everglades Research and Education Center.

Information for other cultural practices was provided by growers and the EDIS documents, "Insect Management in Sugarcane" (Cherry et al. 2001) (http://edis.ifas.ufl.edu/IG065), "Sugarcane Ripeners in Florida" (Rainbolt et al. 2005) (http://edis.ifas.ufl.edu/SC015), and "Water Management for Florida Sugarcane Production" (Lang et al. 2008) (http://edis.ifas.ufl.edu/SC031).

Costs and Prices

Information on costs of materials and custom rates was provided by growers' records or during 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 was also taken from growers' records. Grower prices for sugar and molasses were explained above.

Fertilizer prices increased dramatically during the 2007–2008 growing season. A significant increase in crude petroleum prices drove much of the inflation in fertilizer prices. 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 because they are many times overlooked or under-estimated by agricultural producers. Overhead costs are expenses 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 if the grower is 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 Returns

Revenues

More than 123,500 net standard tons are produced annually from the representative farm, generating nearly $3.28 million in total annual revenues (Table 3). Average revenue is $1,067 per harvested acre (3,070 acres), or $655 per farm acre (5,000 acres). Per acre revenues include $1,278 from plant cane fields and $959 from first ratoon fields. Second and third ratoon crops generate revenues of $879 and $831 per acre, respectively. The sale of molasses, a by-product of milling raw sugarcane, contributes an extra $131,000 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 is estimated to cost $38 per acre and involves controlling weeds with two herbicide (generic glyphosate) spray applications (Tables 4 and 5). Land preparation immediately precedes establishment of plant cane and is estimated to cost $226 per acre. Costs associated with plant cane are estimated to be $486 per acre while the costs of growing ratoon crops are estimated to be $319 per acre. Cane harvesting is assumed to be a custom operation and the flat rate of $6.50 per gross ton includes field burning (if necessary), cutting, loading, and hauling cane stalks up to 25 miles. If a mill is located farther than 25 miles from a field, the grower would have to pay additional hauling costs. Given the yield and land distribution assumptions for our representative farm, the weighted average harvesting cost is $208 per harvested acre. Total farm costs are calculated by multiplying the per acre cost of each crop stage by the appropriate number of acres in that stage (Table 7).

Total annual costs to manage a 5,000-acre sugarcane farm with 3,070 harvestable acres are more than $3.1 million (Table 7). Overhead expenses account for nearly 30 percent of the total costs, or $875,000 per year. Harvesting is the next most important cost category, accounting for 23 percent of total costs. Growing costs of ratoon and plant cane make up 16 percent and 15 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 $106,000 per year, or 7 percent of the combined costs of fallow land management, land preparation, and growing costs of plant and ratoon crops. If the liquid assets of the sugarcane farm are sufficient to cover the annual operating expenditures, the interest expense could be voided and added to the farm's overall net return.

The substantial increase in fertilizer cost had a dramatic effect on overall production costs. Based on 2006 fertilizer prices, unit prices for N, P_2O_5, and K_2O would have been close to 40, 25, and 22 cents per pound, respectively. Per acre costs to fertilize increased by nearly $65 per acre, from $133 in 2006 to $198 in 2008.

Net Returns

The net return to land, management, and risk (LMR) is the difference between total revenues and total cost. For the representative farm described in this report, net returns to LMR are projected to be $131,208 (Table 7). On the basis of 3,070 harvested acres, net returns to LMR are $42.74 per harvested acre (Table 8). Across the entire farm, or 5,000 acres,

net returns to LMR are $26.24 per farm acre. The representative farm earns $1.06 per net-standard ton of sugarcane. Net returns to LMR of $131,000 represent a 4.2 percent return on annual production costs expenditures of $3.1 million.

A positive net return to land, management, and risk (LMR) is a necessary condition to continue in sugarcane production. Long-term economic sustainability, however, requires that sugarcane production yield a positive net return to all "economic" costs. Opportunity costs are non-cash costs that can be charged to an enterprise to determine whether continued sugarcane production is the best economic option for an owner/operator. Two opportunity costs are considered in Table 8: 1) interest income earned from a "risk-free" asset and 2) income earned from leasing land to other growers or for purposes other than sugarcane production. One estimate of foregone interest income from a "risk-free" asset is the interest rate earned from a U.S. Treasury bond. Assuming that the farm has $3.1 million of liquid assets, a 2 percent Treasury bond would return an annual income of $63,000, or $12.58 per farm acre. Net income less the opportunity cost of investing in a "risk-free" asset ($26.24 – $12.58) remains positive at $13.66 per farm acre.

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 $131,208 and remaining annual overhead costs were $380,000, a land rental rate of at least $102 per farm acre would return as much income to the farm owner as would growing sugarcane. (Even if the entire farm were leased to another grower or used 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].) If the owner of our representative farm received an offer to lease the entire farm for $105 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 $100 per acre, total income would decrease and the farm owner should continue producing sugarcane.

Conclusions

Costs and returns were estimated for a sugarcane operation on mineral (sand) soils in south Florida. The modeled farm was assumed to be 5,000 acres and followed a five-year production cycle of four years of sugarcane harvests (plant cane plus three ratoon crops) and one fallow period. This crop cycle, along with land set aside for roads, drainage ditches, and service buildings, allows only 64.8 percent of the arable land to be planted (and harvested) in any given year.

Annual production from the representative farm harvested an average of 32.1 gross tons per acre from 3,070 planted acres. Given 15.75 percent normal juice sucrose, the farm sold 123,527 net standard tons and earned more than $3.2 million of annual revenues, or an average of $1,067 per harvested acre. Given prices and cultural practices prevalent during the 2007–2008 growing season, a sugarcane grower on mineral soils spent $1,024 per harvested acre annually. The sugarcane operation earned more than $131,000 of net returns to land, management, and risk, or $42.74 per harvested acre and $26.24 per farm acre.

Our cost estimate includes costs associated with management of fallow land and production of seed cane. 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 or the development costs required to set up the original growing operation.

A net return of $26.24 per farm acre is positive but relatively small, suggesting that long-term economic sustainability of independent sugarcane growers may not be feasible. If growers can lease their land for at least $100 per farm acre, the economic profitability of sugarcane production would be close to zero. The phrase "if growers can lease" is an important caveat because the lease

market, like the general land market, is very site specific. Property appraisers in south Florida report land leases ranging from $70 to $200 per acre for sugarcane production. A grower in the $200 per acre market has more economic options than a grower in the $70 per acre market.

Another factor to consider is that the Florida sugar industry is dominated by growers of administration cane. This means that the growers have a financial stake in sugarcane milling and processing. Consequently, lower financial returns from the farming operations may be more than offset by gains from milling and processing.

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Table 1. Assumed land distribution[a] for a 5,000-acre sugarcane farm on mineral (sand) soils in south Florida.

Item	Acreage	Percent Net Acreage
Seed cane[b]	170	4
Plant cane	965	22
Stubble cane	2,105	48
First ratoon	970	22
Second ratoon	810	19
Third ratoon	325	7
Total cane area	3,240	74
Fallow	1,135	26
	Acreage	Percent Gross Acreage
Total net acreage	4,375	87.5
Infrastructure (roads, ditches, etc.)	625	12.5
Total	5,000	100.0

[a] Source: Overall farm size and allocation of acreage by land use category based on conversations with growers and property appraisers.
[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: [(1,135 acres of newly planted area times the planting rate of six gross tons per acre) divided by 40 tons per acre equals 170 acres (1,135 x 6 ÷ 40 = 170)], where 40 tons per acre is the assumed yield for plant cane (see Table 2).

Table 2. Assumed yield (gross tons), normal juice sucrose percentage, and trash content by plant age (the weighted average production across planted acreage derived from land use percentages reported in Table 1).

Age	Yield[a]	Normal Juice Sucrose[a]	Trash[b]	Net Acres[c]	Plant Acre[d]	Weighted Average Yield by Crop Age[e]
	(gross tons/acre)	(%)	(%)	(%)	(%)	(gross tons/acre)
Plant cane	40.0	15.75	5.28	26.00	35.00	14.0
First ratoon	30.0	15.75	5.28	22.00	30.00	9.0
Second ratoon	27.5	15.75	5.28	19.00	25.00	6.5
Third ratoon	26.0	15.75	5.28	7.00	10.00	2.6
				74.00	100.00	32.1
						Weighted average yield across all planted acreage

[a] Representative yields and sucrose estimates based on seven grower interviews.
[b] Source: Glaz (2007).
[c] Acreage percentages reported in Table 1.
[d] Percentage of planted area calculated from reported net acreage land allocation.
[e] Weighted average yield by crop age calculated by multiplying yield by the percentage of planted area. Growers reported annual average farm production that ranged between 31 and 35 gross tons per acre across all crop ages.

Table 3. Projected total net returns based on gross tonnage, trash percentage (5.28%), and normal juice sucrose (15.75%) from a 5,000-acre sugarcane farm on mineral (sand) soils in south Florida, 2007–2009.

Item	Area	GTA	Tr	NTA	QF	NST	PU	TRA	TGR
	(acres)	(tons/ acre)	(%)	(tons/ acre)		(tons/ acre)	($/ton)	($/acre)	($)
Seed cane	170							0	0
Plant cane	965	40.0	5.28	37.89	1.325	50.20	25.46	1,278	1,233,447
First ratoon	970	30.0	5.28	28.42	1.325	37.65	25.46	959	929,878
Second ratoon	810	27.5	5.28	26.05	1.325	34.51	35.46	879	711,788
Third ratoon	325	26.0	5.28	24.63	1.325	32.63	25.46	831	270,016
Seed	170								
Fallow	1,135							0	0
Harvest acres	3,070								
Farm acres	5,000								
Molasses	(Molasses revenue: seven gallons per net ton (NT) & price $0.2013 per gallon)								131,368

	Gross Tons	Net Tons	Net Standard Tons	Revenue
Totals	98,425	93,228	123,527	3,276,497
Revenue per harvest-acre				1,067/acre
Revenue per farm-acre				655/acre

GTA = Gross tons per acre.
Tr = Trash percentage of gross tons harvested.
NTA = Net tons per acre equals GTA times (1 minus Tr).
QF = Quality factor for normal juice sucrose of 15.75%. Source: Alvarez and Rohrmann (1984).
NST = Net standard tons per acre equals NTA times QF.
PU = Price per unit; $22.14 per ton of raw sugar times 1.15, fair price determination factor.
TRA = Total returns per acre.
TGR = Total gross revenues to the representative farm.

Table 4. Field operations and custom rates for pre-harvest and fallow periods on a sugarcane farm on mineral (sand) soils of south Florida, 2007–2008.

Activity		Times Over	Custom Rate	Cost/Acre
		(pounds)	($/pounds)	($/acre)
Fallow				
	Chemical spray	2.0	4.00	8.00
	Total fallow			8.00
Land Preparation				
	Heavy disc	3.0	15.00	45.00
	Light disc	3.0	12.00	36.00
	Laser level	0.5	60.00	30.00
	Slag application	1.0	5.00	5.00
	Lime (dolomite) application	1.0	5.00	5.00
	Total land preparation			121.00
Plant Cane				
	Planting operations	1.0	130.00	130.00
	Seed cane harvest[a]	1.0	40.00	40.00
	Fertilizer application — dry	2.0	6.50	13.00
	Fertilizer application — aerial	2.0	6.00	12.00
	Chemical applications	2.0	4.00	8.00
	Mechanical cultivation	2.0	6.50	13.00
	Total plant cane			216.00
Ratoon (stubble) crops[b]				
	Mowing & chopping fodder	1.0	11.50	11.50
	Fertilizer application — dry	2.0	6.50	13.00
	Fertilizer application — aerial	2.0	6.00	12.00
	Chemical applications	2.0	4.00	8.00
	Mechanical cultivation	3.0	6.50	19.50
	Ripener application (aerial)[c]	0.5	5.00	2.50
	Total ratoon			66.50

[a] Fee to mechanically cut seed cane ($25/acre) plus fuel for tractors and harvester (6 gallons per acre times $2.50 per gallon equals $15.00 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] One-half of the ratoon acreage will be fallowed the following season.

Table 5. Projected per acre costs of cultural practices performed on a 5,000-acre sugarcane farm on mineral (sand) soils of south Florida, 2007–2008.

Activity	Unit	Rate	Times	Price/Unit	Cost/Acre
Fallow land total cost per acre					
Custom rate charges (Table 4)					8.00
Round-Up + surfactant	Quarts	2.0	2.00	7.50	30.00
Total fallow costs					38.00
Land preparation total cost per acre					
Custom rate charges (Table 4)					121.00
Soil testing[a]	Dollars	1.0	1.00	8.00	8.00
Slag	Tons	1.5	1.00	56.00	84.00
Dolomite	Tons	1.0	1.00	28.00	28.00
Total land preparation costs					226.00
Plant cane total cost per acre					
Custom rate charges (Table 4)					216.00
Fertilizer — N	Pounds	50.0	4.00	0.60	120.00
Fertilizer — P_2O_5	Pounds	60.0	1.00	0.50	30.00
Fertilizer — K_2O	Pounds	80.0	2.00	0.30	48.00
Micronutrients	Pounds	20.0	1.00	0.12	2.40
Thimet (insecticide)	Pounds	15.0	0.75	2.05	23.06
Atrazine 4L (pre-emergence herbicide)	Pounds	4.0	1.00	3.00	12.00
Prowl 3.3 EC (pre-emergence herbicide)	Gallons	1.0	1.00	16.50	16.50
2,4-D Amine 4 (post-emergence herbicide)	Quarts	2.0	1.00	3.00	6.00
Asulox LA (post-emergence herbicide)	Gallons	1.0	0.25	25.00	6.25
Oil (surfactant)	Quarts	2.0	2.00	1.65	6.60
Total plant cane costs					486.81
Ratoon (stubble) crops total cost per acre					
Custom rate charges (Table 4)					66.50
Fertilizer — N	Pounds	50.0	4.00	0.60	120.00
Fertilizer — P_2O_5	Pounds	60.0	1.00	0.50	30.00
Fertilizer — K_2O	Pounds	80.0	2.00	0.30	48.00
Atrazine 4L (pre-emergence herbicide)	Pounds	4.0	1.00	3.00	12.00
Prowl 3.3 EC (pre-emergence herbicide)	Gallons	1.0	1.00	16.50	16.50
2,4-D Amine 4 (post-emergence herbicide)	Quarts	2.0	1.00	3.00	6.00
Asulox LA (post-ermergence herbicide)	Gallons	1.0	0.50	25.00	12.50
Oil (surfactant)	Quarts	2.0	2.00	1.65	6.60
Chemical ripener (only on last ratoon)	Ounces	6.0	0.50	0.33	1.00
Total ratoon costs					319.09
Harvesting (weighted) cost per acre					
Cane cutting, plant cane	Gross tons	40.0	965.00	6.50	260.00
Cane cutting, first ratoon	Gross tons	30.0	970.00	6.50	195.00
Cane cutting, second ratoon	Gross tons	26.0	810.00	6.50	178.75
Cane cutting, third ratoon	Gross tons	26.0	325.00	6.50	169.00
Cane hauling	Miles	0.0	0.00	0.25	0.00
Average harvesting costs					208.39

Table 6. Estimated annual overhead expenses for a 5,000-acre sugarcane farm on mineral (sand) soils in south Florida, 2007–2008.

Activity	Annual Budget	Cost/Farm-Acre
	($/year)	($/acre)
Supervison & vehicles	125,000	25.00
Fuel (general adminstration, 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

[a] Fuel 33 gallons per day times 300 days per year times $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 volorem, water management, drainge districts, and special assessment such as 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 sugarcane operation on mineral (sand) soils in south Florida, 2008—2009. Gross acreage of farm is 5,000 acres and harvest acreage is 3,070 acres.

Production Summary	Total Tons	Tons/Harvested Acre	Tons/Gross-Acre
Gross tons	98,425	32.1	19.7
Net tons	93,228	30.4	18.6
Standard tons	123,527	40.2	24.7
Income Summary			
Revenues	Dollars/Acre	Acres	Total
Plant cane	1,278.18	965	1,233,447
First ratoon	958.64	970	929,878
Second ratoon	878.75	810	711,788
Third ratoon	830.82	325	270,016
Molasses payment	42.79	3,070	131,368
Total revenues			3,276,497
Costs	Dollars/Acre	Acres	Total
Fallow	38.00	1,135	43,130
Land preparation	226.00	1,135	256,510
Plant cane[a]	486.81	1,135	552,532
Stubble cane	319.09	2,105	671,684
Interest[b]			106,670
Harvest	208.42	3,070	639,763
Overhead	175.00	5,000	875,000
Total costs			3,145,289
Net returns to land, management, and risk			131,208

[a] 1,135 acres are prepared and planted as "plant cane" each year. Only 965 acres of plant cane are harvested for sugar. The remaining 170 acres are harvested for seed.
[b] Interest payments to cover growing season costs are estimated to be 7% of fallow, land preparation, plant cane, and ratoon crop costs.

Table 8. Net returns to land management, and risk from sugarcane production on mineral soils by acreage and production.

	Gross Acres	Harvested Acres	Gross Tons	Net Tons	Standard Tons
	($/acre)	($/acre)	($/ton)	($/ton)	($/ton)
Revenue	655.30	1,067.26	33.29	35.14	26.52
Cost	629.06	1,024.52	31.96	33.74	25.46
Net returns to land, management & risk	26.24	42.74	1.33	1.41	1.06
Opportunity cost of "risk-free" asset (2%)[a]	12.00	20.00			
Land rental rate[b]	102.00	158.00[c]			

[a] 2% annual interest rate for a U.S. Treasury bond, which is considered to be a "risk-free" asset.
[b] Minimum land rental rate to create a break-even point between continuing sugarcane production and leasing the entire farm to another grower or for another purpose.
[c] 64.8% of gross, or farm, acreage planted.