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2010 Cost Estimates of Establishing and Producing Pitaya (Dragon Fruit) in South Florida[1]

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Introduction

As a consequence of increasing foreign competition and declining returns to traditional agricultural commodities, many growers in South Florida have embarked on an aggressive search for viable alternative agricultural commodities. One commodity that has gained attention is pitaya (genus *Hylocereus*, also known as dragon fruit), a climbing-vine cactus species native to the tropical forest regions of Mexico and Central and South America (Mizrahi, Nerd, and Nobel 1997). From less than 50 acres planted in Florida as recently as 2006 (Steele and Crane 2006), production has grown six-fold and is now estimated to be around 320 acres (personal communication, Jonathan Crane).

Several factors are responsible for the attention being given to this crop, such as the promise of high net returns based on an increasing US-Asian population; the reported health benefits associated with the fruit's high antioxidant properties; and the fruit's popularity at high-end restaurants due to its unique taste, beauty, and versatility (it can be eaten fresh or processed into juice, desserts, jam, ice cream, cocktails, and wine). As a consequence, pitaya fruit has steadily become popular with growers and consumers alike (Lobo and Bender 2008).

Pitaya also exhibits certain desirable and distinctive agronomic features/characteristics that enhance its prospects as a suitable and viable replacement commercial crop. These features include the relative ease with which it can be propagated (by cuttings), thereby reducing the expense normally associated with purchasing additional planting materials; its relatively low crop maintenance; the short turnaround time between planting and harvesting (12–18 months) compared to other traditional fruit trees; and its high yield rate, ranging from about 20 to 60 pounds per plant (Gunasena, Pushpakumara, and Kariyawasam 2006). In addition, pitaya is a perennial crop, with a life span of 20 to 30 years, ensuring that, with proper care, it can provide a

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steady stream of income (Crane and Balerdi 2009; Gunasena, Pushpakumara, and Kariyawasam 2006).

On the negative side, there needs to be more information on the cost of establishing and maintaining a pitaya orchard and the profitability of the operation (Crane and Balerdi 2009; Gunasena, Pushpakumara, and Kariyawasam 2006). Consequently, the objective of this article is to provide needed information on the costs and returns associated with establishing and operating a five-acre pitaya orchard in South Florida, and to assess the prices and yields that must be obtained to make the establishment and production of a pitaya orchard a profitable venture. As such, our focus is less on agronomic practices and more on production economics. Readers interested in more information on the agronomic aspect of pitaya production might wish to see EDIS document HS1068, *Pitaya Growing in the Florida Home Landscape* (Crane and Balerdi 2009).

Approach and Main Assumption of Analysis

Information used in the analysis was obtained from a combination of interviews with growers, nursery operators, packinghouses, chemical suppliers, and other agricultural input retailers in South Florida. A questionnaire was prepared by the researchers to guide the interview process, and included questions pertaining to the establishment and operation of a pitaya orchard. Participant information was gathered over the summer of 2010 via first-person and telephone interviews. In addition to the interviews, information was also gathered from University of Florida Extension agents and the existing literature. The following is a list of the major assumptions used in the model, including:

- *Land*—Because most of the South Florida growers already owned their land, a rental cost of $500 per acre was used in this analysis to reflect the opportunity cost of land. The budget and production cost items were based on a five-acre orchard (the minimum size farm allowed).
- *Orchard Layout*—Trellises were placed using a 5-foot long by 15-foot wide spacing pattern (5 feet between trellises and 15 feet between rows) for a total of 581 trellises per acre. Three cacti were planted at each trellis, totaling 1,743 cacti per acre.
- *Trellis System*—For this analysis, each trellis was made up of one 8-foot long by 5-inch wide square fence post planted 2 feet deep through the center of a 65-gallon container filled with 6.7 feet of potting soil. For each trellis, two holes were drilled at the top of the post. Two 2-foot pieces of #3 rebar were inserted into the holes and a 4-foot long piece of hog-wire fencing secured to each rebar. The cost was estimated at $32 per trellis.
- *Varieties*—A generic Vietnamese white-flesh species (*Hylocereus undatus*) was chosen because it produces high volumes of fruit.
- *Fertilization*—Fertilizer treatments included four treatments per year of 8-3-9 fertilizer at a rate of 1,188 pounds per acre, per application, and one treatment per year of a foliar fertilizer (16-16-8) at a rate of 1.5 gallons per acre, per application.
- *Weed Management*—Weed control methods included spraying several times a year. For weed control within the rows, Four applications of a generic glyphosphate-based herbicide were used at a rate of 0.5 gallon per acre, per application, per year within the rows, and four applications of pre-emergent Ronstar® were used at 45 pounds per acre, per application, per year within the containers. Rows were also mowed four to six times per year at a total cost of $120 per acre.
- *Pest Management*—Pesticide treatments included four applications of "slug and snail bait" at a rate of 50 pounds per acre, per application, and one application of Malathion® at rate of 1 pound per acre, per application. Several of the growers also treated with a fungicide.
- *Irrigation*—Most of the growers installed sprinkler irrigation systems due to the crop's high water requirement even though it is a member of the cactus family. Irrigation costs, which included the costs for pumping water and maintenance labor, were estimated at $50 per acre, per year.

- *Wage Rates*—The hourly wage rate was assumed to be $15.00 for skilled workers and $11.00 for field workers. These rates included employer contributions to benefits such as worker's compensation, social security and medicare taxes, and fringe benefits such as health insurance. Piece-rate wage rates were used for harvesting.

- *Harvesting and Marketing Costs*—The cost for harvesting and transporting pitaya fruit was assumed to be $0.05 per pound.

- *Yields*—Significant yields of pitaya can occur starting with the second year of production. On the basis of information provided by the growers, average marketable yields were estimated as follows: first year, zero pounds per acre; second year, 10,000 pounds per acre; third year, 15,000 pounds per acre; and full production years (fourth year and forward), 19,000 pounds per acre.

- *Pitaya Prices*—The average price per pound for pitaya was estimated at $1.35. This estimate was calculated from the prices paid by the local South Florida packinghouses over the period July to September of 2009. Prices ranged from $0.85 per pound to $2.50 per pound.

- *Interest on Pre-Harvest Costs*—This reflected the costs of borrowing money or an opportunity cost for using equity. A nominal rate of five percent was used in the calculations.

- *Machinery and Equipment Charges*—Machinery and equipment charges (capital recovery costs) were computed based on the expected life of the asset, salvage value, purchase price, and a five-percent interest rate. These charges represented the amount of money to charge the enterprise for the use of an asset so that the value of the asset will be recovered within a specified period of time at a designated rate of interest.

- *Amortized Establishment Cost*—Because the first three years are considered the establishment phase, we made the assumption that an orchard is considered mature after the third year. The accumulated cost over the first three years was amortized over the life of the orchard (assumed to be 20 years) and was charged to the enterprise as part of the fixed cost.

- *Accrued Interest on Establishment Costs*—This represented the accruing charges on loans or returns forgone on equity during establishment phase. The nominal interest rate of five percent was applied.

Summary of Results

Based on the assumptions provided in this study, the estimated cost of establishing a pitaya orchard (Table 1) is about $15,136 per acre. The highest costs are incurred in the first year and are estimated at about $29,679 per acre, based on the costs for onsite preparation, planting the cacti, constructing a trellis system, and cultural practices. Because the fruit can be harvested from the second year onwards, thereby providing revenues to offset operation costs, the accumulated costs decline from $29,679 per acre in the first year, to $25,687 per acre in the second year, and to $15,136 per acre in the third year. The cacti require three years to reach maturity, so the third-year accumulated cost of $15,136 is amortized over the life of the orchard (assumed to be 20 years) at an interest rate of five percent for an annual fixed charge of about $1,215, which is charged to the enterprise during each of the full years of production (fourth year and forward). Hence, the cost of establishing a five-acre orchard is estimated at $75,680 ($15,136 times 5). This amount does not include the costs of any capital items purchased by the owner.

Annual growing costs and returns for a mature orchard are also summarized in Table 1 under the heading "Full Production Years." Full production years occur from the fourth year onwards based on the assumption that the crop requires three years to reach maturity. Total growing costs for a typical year in the mature orchard are estimated at $10,127 per acre. There is a pre-harvest variable cost of $6,780 (66.9%) that covers costs such as irrigation, chemical application, labor, and interest. Harvest and marketing costs are estimated at $950, representing 9.4 percent of the total cost of production. Hence ***total variable costs*** (pre-harvest variable costs plus harvest and marketing costs) are $7,730, or 76.3 percent of

the total cost of production. ***Fixed costs***, comprising both cash-overhead charges of $555 (5.5%) and non-cash overhead charges of $1,843 (18.2%), make up the balance of the total costs, accounting for 23.7 percent of the total cost. Assuming yields of 19,000 pounds per acre (90% pack-out) during the full production years implies a production cost of about $0.53 per pound.

Based on an estimated yield of 19,000 pounds per acre and an average market price of $1.35 per pound, total receipts are estimated at $25,650 per acre. This results in net returns to the growers (net profit) of $15,523 per acre ($25,650 minus $10,127). The breakeven price and yield are calculated at $0.53 per pound and 7,502 pounds per acre, respectively (Table 2). This implies that on the basis of current assumptions, prices or yields would have to decline by more than 61 percent from the average before net returns would be negative. Given the wide fluctuations in yields and prices, Table 3 shows the net returns per acre for various combinations of prices and yields. It is worth noting that even when prices fall to about $0.85 per pound (about 37% below average) and yields fall to 17,000 pounds per acre (about 11% below the average), growers can still expect positive net returns.

Table 4 summarizes the total investment (capital) costs and the annual amount charged to enterprise (capital recovery) based on the requirements to establish a five-acre pitaya orchard. ***Total investment costs*** are estimated at $109,830. This represents the upfront costs of all capital items used in the operation of the enterprise that are owned by the grower ($34,150), such as the costs of a utility vehicle, mower, irrigation systems, mainline and digging well, and other tools. It (total investment costs) also includes the orchard establishment costs calculated earlier at $15,136 per acre, or $75,680 for the five acres. The investment costs also assume that all capital items would be purchased new and would be used exclusively in the orchard. Purchasing used equipment would lower the investment costs but could increase the costs of repairs and maintenance. It should be noted that the cost of land is not included in the investment costs, based on the assumptions that most of the growers already own the land. Including the cost of land in the analysis would increase the investment costs substantially.

The annual capital recovery costs (cost of depreciation and interest) are estimated at $1,842 per acre. As discussed earlier, this represents the annual amount that is charged to the enterprise for the portion of the fixed assets utilized in the operation during that year.

Conclusions

Tropical fruit growers in South Florida are in search of profitable alternatives to increase revenue and ensure that their operations remain profitable. One fruit that holds promise is the pitaya. There is a high demand for this product, especially among Asian consumers, that bodes well for producers. Fruits viewed as "super fruits" that have high levels of antioxidants or nutrients are becoming increasingly more popular with consumers. Demand for pitaya (dragon fruit) is expected to rise because it has been labeled as a "super fruit" due to its high content of antioxidants, such as lycopene. Moreover, the fruit is fast becoming a favorite for high-end restaurant chefs due to its beauty and versatility.

This study sought to provide growers with information on the cost of establishing and operating a five-acre pitaya orchard in South Florida. Under the assumptions of the analysis, the cost of establishing such an orchard would be $15,136 per acre, or $75,680 for the five-acre orchard. Total investment costs (the purchase costs of all capital items and the establishment and development costs for the first three years of a five-acre orchard) are estimated at $109,830. This amount does not include the cost/value of land. The total costs of operating a mature pitaya orchard (from the fourth year onward) are estimated at about $10,127 per acre. With an average price of $1.35 per pound and a marketable yield of 19,000 pounds per acre, total revenue is estimated at $25,650 per acre, resulting in net returns (net profit) of about $15,523 per acre. This represents a very favorable return, compared with other tropical fruit crops, such as mangoes and avocados, with an average return of about $1,500 per acre.

Despite the favorable outcome of the analysis, growers are advised to proceed with caution, as the market for the crop could easily be oversupplied. There are opportunities for streamlining and improving the production process for pitaya using advanced technologies (e.g., flowering could be induced with artificial lights). However, a careful analysis of costs versus returns would need to be conducted to see if the increase in production efficiency would justify the additional costs.

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Table 1. Cost per acre of establishing and producing pitaya on a five-acre orchard in South Florida

	Unit	Establishment Years			Full Production Years
		Year 1	Year 2	Year 3	
Estimated Yield	lbs/acre	0	10,000	15,000	19,000
Estimated Price	$/lb	0	1.35	1.35	1.35
Total Receipts		0	13,500	20,250	25,650
COSTS					
Site Preparation Cost					
Land preparation		500			
Trellis materials & construction		18,590			
Vines and planting costs		3,360			
Pre-Harvest Variable Costs					
Irrigation		50	50	50	50
Fertilize		1,410	1,560	1,560	1,705
Herbicide		388	400	412	424
Insecticide		415	427	440	453
Fungicide		28	29	30	31
Mowing		120	124	127	131
Labor costs (pruning, fertilizing, etc.)		3,102	3,195	3,291	3,390
Repairs		250	258	265	273
Interest on pre-harvest costs (5%)		288	302	309	323
Harvesting and Transportation Costs					
Picking, packing, and transporting		0	500	750	950
Total Variable Costs		28,501	6,844	7,234	7,730
Annual Cash Fixed Costs					
Property tax		50	52	53	55
Land (rental price)		500	500	500	500
Annual Non-Cash Fixed Costs					
Irrigation equipment		203	203	203	203
Other machinery and equipment		425	425	425	425
Amortized establishment costs					1,215
Total Fixed Costs		1,178	1,180	1,181	2,397
Accrued Interest on Establishment		0	1,484	1,284	0
TOTAL COSTS		–29,679	9,508	9,699	10,127
NET RETURNS		29,679	3,992	10,551	15,523
Accumulated Establishment Costs		29,679	25,687	15,136	

Table 2. Breakeven price and yield

Item	Unit	Total
Breakeven price	dollar per pound	0.53
Breakeven yield	pounds	7,502

Table 3. Estimated net returns per acre at various price and yield levels

	Yield (lbs/acre)				
Price ($/lb)	17,000	18,000	19,000	20,000	21,000
0.85	4,491	5,291	6,091	6,891	7,691
1.00	7,041	7,991	8,941	9,891	10,841
1.35	12,991	14,291	15,523	16,891	18,191
1.50	15,541	16,991	18,441	19,891	21,341
2.00	24,041	25,991	27,941	29,891	31,841
2.50	32,541	34,991	37,441	39,891	42,341

Table 4. Investment costs for five-acre orchard and annual per acre capital recovery

Investment Inputs	Purchase Price* ($)	Useful Life (years)	Interest Rate (%)	Capital Recovery ($/acre)
Utility vehicle	9,500	15	0.05	183
Mower (50 inches)	7,000	15	0.05	135
200-gallon sprayer and accessories	3,500	15	0.05	67
Irrigation system, mainline, pump & well	12,650	20	0.05	203
Other tools and equipment	1,500	10	0.05	39
Orchard establishment and development costs	74,870	20	0.05	1,215
Total investment for five-acre orchard	74,870			1.842

* Excludes the cost of land