Cooperative Extension Service
C/T/A/H/R
College of Tropical Agriculture & Human Resources
University of Hawaii at Manoa

AgriBusiness
July 1998
AB-11

The Economics of Producing Coffee in Kona

AGRIBUSINESS

This analysis examines the economics of producing coffee cherry in Kona. It is based on a computer-spreadsheet economic budget for managing a mature orchard using information gathered from many knowledgeable growers, from agribusiness firms, and from the University of Hawaii-Manoa faculty and Kona Experiment Station farm manager. The production information is *typical* for a 4-acre Kona coffee farm in the late 1990s. However, the economic model is quite flexible, including over 100 variables, all of which can be changed by the user to accommodate a specific coffee farming situation.

This budget has a wide range of uses for existing and prospective coffee growers and processors, policymakers, legislators, planners, county, state and federal agriculture department staff, university researchers and extension specialists and agents, students, landholders, developers, land managers, real estate investors, management consultants, and others. But the model is primarily intended as a management tool for growers. Growers who enter their own farm data will find the model useful for

- developing an end-of-the-year economic business analysis of their coffee enterprise
- projecting next year's coffee income under various production and marketing scenarios
- considering the economic impact of business environment changes (e.g., regulatory or wage rate changes)
- determining the economic benefit of adopting new technology
- planning new or expanded coffee operations.

Assumptions

The first step in determining the profitability of a coffee farm is to articulate a few overall production and economic assumptions. On some farms coffee trees are scattered irregularly over the property, intermixed with other fruit or nut trees. The grower will need to count how many coffee trees he/she actually has. On other farms coffee trees are planted in rows, and the number of trees per acre will probably be known. (If one does not know the number of trees per acre, the program will calculate it based on the spacing.) The example farm's spacing is 8 x 8 ft with about 5% of the land used for roadways or other area not directly supporting trees. However, there are a number of alternative spacing plans. Some managers prefer the 5 x 12 ft spacing arrangement because it allows machinery to travel freely between the rows.

The average cost of "growing" labor is assumed to be $7.50 per hour plus 33% in "benefits"(e.g., FICA and withholding). ("Harvest" labor is calculated separately in the program.) Payment for the crop is received within 10 days of delivery. The desired rate of return on equity capital is 6%, and the bank interest rate is 10% for debt capital and 12% for working capital.

Gross income

The example farm sells all of its coffee as cherry, although one could consider any combination of cherry and a processed form, such as parchment. The marketable yield is estimated to average 14.3 lb per mature tree. If young trees (lower yielding or nonbearing) were included in the orchard, this overall average of 14.3 lb per tree would obviously be lower. It is important to emphasize that the yield is the net *marketable yield*, not the potential biological or simply the harvested yield.

The price per pound is the *average price* received for all coffee marketed throughout the season. During the 1997–98 season in Kona, for example, some buyers were paying as high as $1.75 per pound at the end of the season. However, many growers estimate that the price they received, averaged over the whole season, was closer to $1.45. Considering that the 1998 prices were record highs, the price for the example farm is a more conservative $1.25 per pound. The gross income for the farm is therefore about $46,000.

Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Charles W. Laughlin, Director and Dean, Cooperative Extension Service, CTAHR, University of Hawaii at Manoa, Honolulu, Hawaii 96822. An Equal Opportunity / Affirmative Action Institution providing programs and services to the people of Hawaii without regard to race, sex, age, religion, color, national origin, ancestry, disability, marital status, arrest and court record, sexual orientation, or veteran status.

Operating costs

Operating costs are all the costs directly associated with growing and harvesting the coffee crop. All costs are expressed as costs per tree, per acre, and per farm, and as a percentage of gross income. (The percentage of gross income figure can be viewed as how many cents of each dollar from coffee sales are spent on a particular operating expense.)

In this example farm, using the "Kona style" of pruning, the pruning (including mulching) activity is the largest growing cost, constituting almost 9% of the total growing costs. (The "Kona style" refers to the multiple-age vertical system rather the Beaumont-Fukunaga system.) Total growing costs consume one-fifth of the gross income. Hired labor is the single most significant operating input. Harvest labor alone consumes almost two-fifths of the gross income. Recently, growers have been paying pickers about 30–37¢ per pound for harvesting coffee. However, with the dramatically increased price for cherry and the increasing demand for picking labor resulting from expansion of the industry, growers will likely encounter strong pressure for higher picking price rates. The example farm pays 30¢ per pound *or* 30% of the average price received for coffee, whichever is higher, plus 26% in "benefits."

Gross margin

The gross margin is the gross income minus the total operating (or "variable") costs. Almost 60% of the example farm's gross income is spent on operating costs ($27,500); therefore the gross margin is about $18,500. This figure represents the amount available to pay the ownership (or "fixed") costs. It approximates the return over cash costs. It is often what farmers popularly refer to as their "profit," because it approximates the return to management and investment (if there is no debt on the farming operation). If one deducts depreciation, it also approximates "taxable income."

Gross margin is a good measure for comparing the economic and productive efficiency of similar-sized farms. More importantly, it represents the bare minimum that a farm must generate to stay in business. (Even if a farm were to lose money overall, a positive gross margin would enable it to continue to operate, at least in the short run.) But it is *not* a good measure of a farm's true profitability or a farm's long-term viability.

Ownership costs

These costs are the *annualized* costs for the productive resources: land, capital, and management. Since capital items last more than one production cycle, they have to be amortized over their "useful lives." The most significant capital item is the orchard establishment investment. Planting cost is estimated at $6 per tree for a nursery-grown tree, the digging of a hole, the fertilizer, and the labor to plant the tree. Land improvements (clearing and grading, brush disposal, drainage, soil amendments, and the planting of a cover crop) are estimated at $2,350 per acre. Perimeter windbreaks, fences, and roads (if needed) would be another $200 per acre. Installation of an irrigation system is estimated at $3,000 per acre, although there is a fairly wide range of estimates, from $1,000 to $5,000 per acre. In the economic analysis a "capital recovery charge" is calculated for all capital items. This charge is an estimate of what it costs the producer to own the capital investment for one year. The example farm's annualized capital costs amount to approximately $11,000, almost one-quarter of the farm's gross income.

"The bottom line"

Total costs include all cash costs and all opportunity costs. Any return above total costs is *economic profit*. Since economic profit considers *all* costs, a manager would understandably be satisfied with his/her business' performance if economic profit were equal to zero or better. Economic profit is the best measure of true profitability. It is also a measure of how attractive the enterprise is for potential investors and for potential new entrants into the business.

The only problem with the economic profit concept is that it may be confusing to hear that one should be satisfied with an "economic profit of zero," and it may be difficult to grasp intuitively the meaning of a "negative economic profit." *Management and investment income* (M.I.I.), the return to the owner/manager for his or her management and capital investment, is a more easily understood "bottom line." In a typical year, this example coffee farm owner/manager receives a before-tax income of about $6,800 for the managerial effort and investment, or, in other words, almost 15¢ of every dollar generated by the business. (This person also would receive additional compensation for any of the manual farm labor he or she provided.)

Kona Coffee Production Costs and Returns

This program calculates the production costs, the returns to productive resources and the economic profitability of coffee production on a per tree, per acre and per farm basis. All results are dependent upon the initial assumptions and the user's data entered into the outlined cells (colored blue on the computer screen). The various results are only as accurate as the data provided by the grower(s).

This research was funded by the County of Hawaii (Dept. of Research & Development) and the University of Hawaii-Manoa (CTAHR). Mention herein of any specific product or practice should not be misconstrued to imply that the County of Hawaii or the University of Hawaii either endorses such product or practice or does not consider another product or practice to be equally or more effective.

DIRECT QUESTIONS OR SUGGESTIONS to either KENT FLEMING (322-9136 or <fleming@hawaii.edu>) or VIRGINIA EASTON SMITH (322-2718).

ASSUMPTIONS:

NOTE: Enter either tree count for whole farm or trees /acre, but NOT BOTH.

1 Total tree count = [ ] **OR** trees/ac. [647]
2 Acres of coffee trees = [4.0]
3 **Total tree count = 2,588** trees, which is **647 trees/ac.**
4 1 lb. of processed = [4.00] lbs. of cherry
5 Labor wage rate for growing trees ($/hr.) = [$7.50]
6 Labor benefits as % of wage for growing labor = [33%]
7 Receive payment, in months from time crop delivered [0]
(If payment for crop is in form of cash, enter "0")

Trees / acre calculation:
a. Enter spacing (in feet): [8] *by* [8]
b. Enter % of land area required for roads [5%]
c. ***Trees per acre = 647***

8 Desired rate of return on equity capital = [6.0%]
9 Average interest rate on debt capital = [10.0%]
10 Aver. interest rate on working capital = [12.0%]

GROSS INCOME:

	% of Prod.		Number of trees:	Lbs. of cherry:	Average Yield /tree:	units @	$/unit:	=	ANNUAL GROSS INCOME: $/tree:	$/acre:	$/farm:	% gross:
Coffee cherry:	100%	of crop	2,588	37,008	14.3	lbs. cherry	$1.25		17.875	11,565.13	46,261	100.0%
Processed:	0%	of crop	0	0	3.58	lbs processed	$6.00		0.000	0.00	0	0.0%
TOTAL =	100%	of crop	2,588		**Weighted aver. =**		**$1.25**	**/ lb.**	**17.88**	**11,565**	**46,261**	**100%**

OPERATING (or "variable") COSTS:

I. GROWING OPERATIONS:

					Quantity/tree:	units @	$/unit:	=	ANNUAL GROWING COSTS: $/tree:	$/acre:	$/farm:	% gross:
A. Fertilizing:												
1 Super Coffee +					2.9	lbs./tree/yr.	$0.18	/lb.	0.512	331.23	1,325	2.9%
2 Ammonium phosphate					0.0	lbs./tree/yr.	$0.00	/lb.	0.000	0.00	0	0.0%
3 Labor @	4	applications			0.25	min./appli.	$9.98	/hr.	0.166	107.56	430	0.9%
4 Fuel: mach. & equip. operation for fertilizing					*Enter total fuel for fertilizing for farm/year =>*				0.000	0.00	0	0.0%
							Fertilizing sub-total =		**0.678**	**438.79**	**1,755**	**3.8%**
B. Weed control:					*Quantity/acre:*							
1 Round-up @	2.0	oz./gal. &	30.0	gal./acre	60.0	oz./acre	$75.00	/gal.	0.217	140.63	563	1.2%
2 Sticker	0.6	oz./gal. of mixture			18.0	oz./acre	$10.00	/gal.	0.009	5.63	23	0.0%
3 Spraying labo	4	rounds	4.00	hrs/acre	16.00	hrs./ac./yr.	$9.98	/hr.	0.247	159.60	638	1.4%
4 Mowing labor	0	rounds	2.00	hrs/acre	0.00	hrs./ac./yr.	$9.98	/hr.	0.000	0.00	0	0.0%
5 Fuel: mach. & equip. operation (spraying or mowing)					*Enter total fuel for weed control farm/year =>*				0.000	0.00	0	0.0%
							Weed control sub-total =		**0.473**	**305.85**	**1,223**	**2.6%**
C. Rodent control:					*Quantity/acre:*							
1 Rat bait					5.0	lbs/acre	$1.85	/lb.	0.086	55.50	222	0.5%
2 Labor	6	applications	1.00	hrs/acre	6.00	hrs./ac./yr.	$9.98	/hr.	0.093	59.85	239	0.5%
							Rodent control sub-total =		**0.178**	**115.35**	**461**	**1.0%**
D. Other pest control:					*Quantity/acre:*							
1 Sunspray ultra	2.5	oz./gal. &	0.0	gal./acre	0.0	oz./acre	$24.50	/gal.	0.000	0.00	0	0.0%
2 (ant control)					0.0	lbs/acre	$0.00	/lb.	0.000	0.00	0	0.0%
3 Labor	0	applications	0.00	hrs/acre	0.00	hrs/ac./yr.	$9.98	/hr.	0.000	0.00	0	0.0%
							Other pest control sub-total =		**0.000**	**0.00**	**0**	**0.0%**
E. Irrigation:			*weeks:*		*K. = 1,000 gallons*							
1 Water	7.0	gals./tr./wk	35	634 K./yr. =	79	K./irri. mo. =	$178.09	/mo.	0.554	358.22	1,433	3.1%
2 Labor (maintenance)			12.00	hours / acre / year @			$9.98	/hr.	0.185	119.70	479	1.0%
							Irrigation sub-total =		**0.739**	**477.92**	**1,912**	**4.1%**
F. Pruning:					*Quantity/tree:*							
1 Pruning labor	1	major/year	68.0	hrs./ac./pruning	6.31	minutes/tree	$9.98	/hr.	1.048	678.30	2,713	5.9%
2 Pruning labor	1	suckering(s)	22.0	hrs./ac./pruning	2.04	minutes/tree	$9.98	/hr.	0.339	219.45	878	1.9%
3 Mulching labo	1	mulching	2.0	hrs/ac/mulching	0.19	minutes/tree	$9.98	/hr.	0.031	19.95	80	0.2%
4 Fuel: mach. & equip. operation for pruning & mulching					*Enter total fuel for pruning/mulching /yr.=>*				0.155	100.00	400	0.9%
							Pruning sub-total =		**1.573**	**1,017.70**	**4,071**	**8.8%**
							TOTAL GROWING COSTS = $		**3.64**	**2,356**	**9,422**	**20.4%**

Kona Coffee Production Costs and Returns

II. HARVEST-RELATED OPERATIONS:							ANNUAL HARVEST-RELATED COSTS:			
G. Harvesting:							$/tree:	$/acre:	$/farm:	% gross:
1 Picking labor	higher of	$0.30	/ lb. or	30%	of gross income per lb. =	$0.38 /lb.	5.363	3,469.54	13,878	30.0%
2 Labor, overhead		26%	of harvest labor expense =			$0.10 /lb.	1.394	902.08	3,608	7.8%
3 Bags (& twine)		2	uses per bag			$1.25 /bag	0.089	57.83	231	0.5%
4 Labor, sewing		2	minute/bag			$9.98 /hr.	0.024	15.38	62	0.1%
5 Processing (e.g., parchment, green bean, roasting, etc.)						Enter total for farm/year =>	0.000	0.00	0	0.0%
						Harvesting sub-total =	**6.870**	**4,444.82**	**17,779**	**38.4%**
H. Marketing:			Quantity/tree:		Units @	$/unit: =	$/tree:	$/acre:	$/farm:	% gross:
1 Hauling @	15	bags/truck load =		25	truck loads	$5.00 /trip	0.048	30.84	123	0.3%
2 Labor, loading & driving				45	minutes	$9.98 /hr.	0.071	46.14	185	0.4%
3 Opportunity cost of crop pymt. delayed for			0	month(s) on	$17.88	gross inc./tree	0.000	0.00	0	0.0%
4 Excise tax @	0.5%		of	$17.88	gross income/tree		0.089	57.83	231	0.5%
5 Other marketing expense						Enter total for farm/year =>	0.000	0.00	0	0.0%
						Marketing sub-total =	**0.208**	**134.81**	**539**	**1.2%**
TOTAL OPERATING (or "variable") COSTS OF PRODUCTION = $							**10.72**	**6,935**	**27,741**	**60.0%**
GROSS MARGIN = *the gross income minus the operating or variable costs =*							**7.16**	**4,630**	**18,520**	**40.0%**

(The gross margin may be viewed as the return to mgmt. & investmt: land, capital & risk plus any debt service incurred; it is the amount available to pay "fixed costs".)

OWNERSHIP (or "fixed") COSTS:

I. MANAGEMENT RESOURCE ("Overhead") :							ANNUAL OWNERSHIP COSTS:			
							$/tree:	$/acre:	$/farm:	% gross:
1 Management (as %)	5.0%		of	$17.88	gross income/tree		0.894	578.26	2,313	5.0%
2 Office overhead (as %)	1.5%		of	$17.88	gross income/tree		0.268	173.48	694	1.5%
3 Operating interest @ ave rate of	12.0%	/yr. for	9	months @	$3.64	grow. costs/tree	0.328	212.01	848	1.8%
4 Other operations overhead					(Enter total for farm/year) =>		0.000	0.00	0	0.0%
						Overhead sub-total =	**1.490**	**963.74**	**3,855**	**8.3%**

II. CAPITAL RESOURCE: A. Value of investment item:	Historic cost:	Salvage value:		Expect. Years:	Debt/ asset ratio	Op. cost of cap.	Amortization Factor:	$/tree:	$/acre:	$/farm:	% gross:
1 Initial planting	15,528	0		10	0.50	8.00%	0.14903	0.894	578.53	2,314	5.0%
2 Other improvements	9,400	0		20	0.50	8.00%	0.10185	0.370	239.35	957	2.1%
3 Truck(s)	20,000	10,000		5	0.70	8.80%	0.25576	1.328	859.40	3,438	7.4%
4 Other machinery	4,000	500		7	0.10	6.40%	0.18169	0.258	166.98	668	1.4%
5 Irrigation system	12,000	2,000		10	0.50	8.00%	0.14903	0.638	412.57	1,650	3.6%
6 Equipment	2,000	500		5	0.10	6.40%	0.23999	0.151	97.99	392	0.8%
7 Buildings	5,000	2,000		20	0.50	8.00%	0.10185	0.180	116.39	466	1.0%
8 Bldg. prop. tax, ins. & rprs. on		$5,000	@	1.5%				0.029	18.75	75	0.2%
9 Mach. & equip. insurance on		$38,000	@	1.0%				0.147	95.00	380	0.8%
10 Machinery & equip. repairs on		38,000	@	1.0%	plus	0.50%	of gross income	0.236	152.83	611	1.3%
							Annual "Capital Recovery Cost" sub-total =	**4.232**	**2,737.80**	**10,951**	**23.7%**

Note: Equity capital investment = $32,364

III. LAND RESOURCE:	$/tree:	$/acre:	$/farm:	% gross:
Value of the land resource: *(Enter rent, mortgage, or op. cost + prop. tax & ins.)* **Land charge sub-total = $**				
TOTAL OWNERSHIP (or "fixed") COSTS = $	**6.18**	**4,002**	**16,006**	**34.6%**
TOTAL COST OF PRODUCTION = $	**16.90**	**10,937**	**43,747**	**94.6%**
ECONOMIC PROFIT *(Returns after ALL cash & opportunity costs)* **= $**	**0.97**	**628**	**2,513**	**5.4%**
Adding back the value of management & equity investment in term capital, land & working capital:	1.64	1,064	4,255	9.2%
MANAGEMENT & INVESTMENT INCOME = $	**2.62**	**1,692**	**6,768**	**14.6%**

Note: Equity investment in land = $0
Equity in working capital = $0

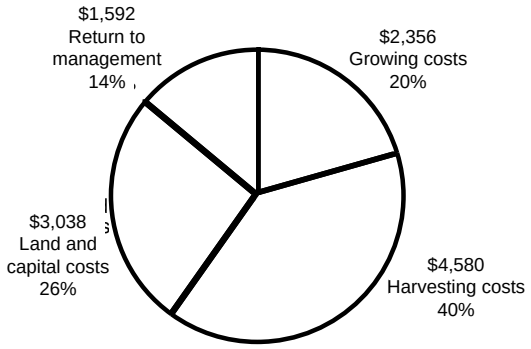
BREAK-EVEN ANALYSIS:

If gross margin is positive, there will be a contribution to fixed costs even if there is an overall loss. However, to cover ALL costs, econ. profit must be positive.

Given the current weighted average price, the marketable yield needs to be **13.5 pounds / tree;**

Given the current marketable yield/ growing acre, the ave. price needs to be **$1.18 / pound.**

Allocation of gross income per acre



Risk

The scenario in our example appears encouraging. However, earlier in this decade coffee cherry was selling for about 40¢/lb, roughly the picking expense. And regardless of fluctuating prices, there is always the possibility that a horticultural problem could reduce yields.

Risk is ever-present, but for this particular operation it appears to be at an acceptable level. First, the fact that the trees are irrigated greatly reduces the *yield risk*. Furthermore, the good M.I.I. indicates a reasonable cushion of $2,500 to absorb any sudden downfall. Finally, a break-even analysis indicates that given the current cost structure, the operation could generate adequate income to cover all costs (i.e., generate a positive economic profit) as long as the price was $1.18 per pound or better, or if yield were at least 13.5 pounds per tree. Expressed in another way, given this farm's current cost structure, and given the current average market price of $1.25 per pound, yield could safely drop to 13.5 pounds (unlikely, insofar as the trees are irrigated). Or, given the current marketable yield of 14.3 pounds per tree, the market price per pound could drop to $1.18. Interpreting risk is in large part a subjective matter. The risk variable of most concern in this study appears to be the *price risk*. Thus in the end one's assessment of the coffee enterprise's overall risk comes down to one's confidence in the expected market price for Kona cherry.

Kent D. Fleming[1], H. C. "Skip" Bittenbender[2], and Virginia Easton Smith[3]

Departments of [1]Agricultural and Resource Economics and [2]Horticulture; [3]Cooperative Extension Service–Kailua-Kona. Production and layout assistance was provided by Shelley Hoose.

Acknowledgements

The authors are grateful to the **County of Hawaii Department of Research and Development**, which generously funded the applied economic research and printing of this publication and to the following individuals who helped to make this publication possible: the cooperative coffee growers who patiently explained their production practices and economic concerns, Drs. Richard Bowen and John Halloran of the CTAHR Department of Agricultural and Resource Economics, Hilary Brown of the UH Farm Management Extension Advisory Committee, and Sotero Agoot of the Kona Pacific Farmers' Cooperative, all of whom reviewed this work in its earlier stages and made constructive comments.

Comments, questions, and requests

The computer model used in the economic analysis was developed using Microsoft Excel 5 printing in Arial Narrow font on a Macintosh computer. The spreadsheet template is available without cost, either in Macintosh or Windows format. To read the template, your computer will need to have Excel 5 or a spreadsheet program that will import an Excel 5 spreadsheet. To read and print the spreadsheet easily, you will also need the Arial Narrow font loaded on your machine or you will need to open the spreadsheet and then reformat the entire template in an alternative narrow or compressed font, such as Helvetica Narrow.

Readers may download a copy of the template from the Farmers' Bookshelf website <http://agrss.sherman.hawaii.edu/bookshelf/coffee/coffee.htm> or receive it as an email attachment from the lead author. Questions and comments may also be directed to this author via email <fleming@hawaii.edu> or telephone: (808) 322-9136.