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

AgriBusiness
Dec. 1998
AB-12
Rev. 6/99

Economics of Ginger Root Production in Hawaii

AGRIBUSINESS

This publication examines the economics of producing ginger root (*Zingiber officinale* Roscoe) in Hawaii's major ginger growing area, the eastern half of the Big Island. The economic analysis is based on a computer spreadsheet budget for managing a ginger root enterprise and uses information gathered from knowledgeable growers and packers and from research and extension faculty and publications of the College of Tropical Agriculture and Human Resources (CTAHR), University of Hawaii at Manoa. The production data used in the model are *typical* for a small ginger root farm in the late 1990s. However, the economic model is flexible, including over 100 variables, any of which can be changed by the user to accommodate individual ginger root farming situations.

This budget has a wide range of uses, but it is primarily intended as a management tool for growers of edible ginger. Growers who enter their own farm data will find the model useful for

- developing an end-of-the-year economic business analysis of their ginger root enterprise,
- projecting next year's income under various cost-structure, 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, and
- planning new or expanded operations.

Assumptions

The first step in determining profitability is to establish some overall production and economic assumptions. The farm in this example is five acres. For horticultural reasons, ginger is usually grown in a rotation system in which one year of ginger production is followed by three years in which the land is not used for ginger. Therefore, the annual ginger root crop comes from only 25% of the land. Some growers simply move to new rented land each year. The model accommodates either system. The average cost of hand labor is assumed to be $6 per hour, with machine labor at $8 plus 33% in "benefits" (e.g., FICA, etc.). Payment for the crop is received two months after delivery. The desired rate of return on equity capital is 6%, and the bank interest rate is 9% for debt capital and 10% for working capital.

Gross income

It is assumed that the example ginger farm sells 90% of its marketable production as mature ginger root, with about 80% selling as Grade A. Packers report that the proportion of Grade A has been slightly but steadily increasing over the years. "Young ginger," a specialty product of limited demand, accounts for 5% of the marketed production sold. The season price averages about 50% higher than the Grade A price, but the yield is significantly lower (Nishina et al., p. 3). (The production costs might be slightly lower, although in this study they are assumed to be the same regardless of grade.) Nishina et al. reported that growers normally keep back about 5% (assuming a 1:20 "seed": crop ratio) of their production for the next season's planting, although one grower interviewed reported retaining 10% of one season's production for the next season's "seed." This grower plants more densely and obtains a higher yield. In this study we follow the 5% described by Nishina et al.

Mature ginger root yields vary substantially from year to year, primarily because of plant disease incidence.

Kent Fleming[1] and Dwight Sato[2]
[1]Department of Horticulture
[2]Cooperative Extension Service, Hilo

Since 1980 the yields have ranged from a high of 50,000 pounds per acre of marketable ginger root (1997/98 season) to a low of 27,500 (1993). The Hawaii Agricultural Statistics Service (HASS) bases its 1998 Outlook Report on "the most recent 3-year average of 47,300 pounds per [harvested] acre" (HASS, p. 3). Our example uses a most-recent-5-year weighted average yield of 46,200 pounds per harvested acre. All growers interviewed believed that their marketable yields, and those of other growers they knew, were greater than those reported by HASS. The marketable yield figure used in this study should be viewed as a conservative estimate. Growers should enter the yield that they believe reflects their situation.

The price per pound received by growers and used in this study is the *weighted average price* received for all grades of ginger root marketed throughout the season. The HASS reported price is the Grade A price, the major but not the sole component of the weighted average price. The weighted average price will be close to but usually lower than the Grade A price. This fact perhaps accounts for the growers' common observation that they never receive a price quite as high as that reported by HASS. As with the annual yields, the Grade A prices have fluctuated considerably since 1980, ranging from a low of 40¢ per pound (1997) to a high of 92.3¢. The most recent 5-year weighted average Grade A price is 68.1¢ per pound. (HASS does not project Grade A prices, although using its method for estimating yield, its price estimate would be about 67.3¢ per pound.) In light of both the 1997/98 year's exceptionally low Grade A price and the feelings of packers that the industry will not again experience the recent high prices, the estimated Grade A price used in our model is adjusted downward by 20% to a more conservative 54.5¢ per pound. Given the marketing pattern of the example farm, the weighted average price comes out to be 53.4¢ per pound. The resulting gross income is $24,674 per harvested acre or $30,843 for the whole ginger enterprise.

Operating costs

Operating costs are all the costs directly associated with growing and harvesting the ginger crop. All costs are expressed as costs per *harvested* acre and per farm and as a percentage of gross income. The various percentages of gross income can be viewed as the number of cents from each dollar generated by ginger sales that are spent on a particular operating expense. For example, 9.3¢ of every dollar of revenue is spent on methyl bromide and plastic sheeting. This item is a major component of the land preparation cost. In this example farm, the land preparation activity is the single largest growing cost, constituting 13.5% of the total growing expenditure. Land preparation costs are likely to increase further as the proposed deadline for the elimination of methyl bromide approaches.

Total growing costs take one-third of the gross revenue; harvesting activities absorb another quarter. Hired labor is the single most significant operating input, consuming over one-quarter of the gross income. Labor is about evenly divided between growing and harvesting activities. The example farm uses a custom operator to provide the machinery operations associated with land preparation and planting. If he did not, the itemized labor cost would be higher (as would his machinery ownership costs). Overall, $23,026, three-quarters of the gross income from this example ginger farm, is expended on total operating costs.

This budget includes two overhead costs that are often overlooked. The first is the cost of working capital (often an operating loan). The second is the cost of retaining ownership of an already delivered crop, as opposed to being paid for it upon delivery to the buyer. Ginger growers typically wait one to three months for payment. In the example farm, payment is deferred two months, reducing the net price 1.7% (0.9¢ per pound). This deferred payment is a hidden cost of marketing, but in effect it functions like a commission. If one's cost of operating capital was 12% and payment was not received for three months, the financial impact would be doubled.

Gross margin

The *gross margin* is the gross income minus the total operating (or "variable") costs. Therefore the gross margin for the whole enterprise is $7,475. It represents the total amount available to pay the ownership (or "fixed") costs of production. Gross margin resembles another frequently used term, "return over cash costs." It is what farmers popularly refer to as their "profit," because it is close to the return to their management and investment (if there is no debt associated with the farming opera-

tion). If one were to deduct depreciation and rent, farm gross margin would approximate "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 in order 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 gross margin is *not* a good measure of a farm's true profitability or long-term economic viability.

Ownership costs

These costs are the *annualized* costs for those productive resources that last longer than the annual production cycle. For example, because capital items last more than one production cycle, they have to be amortized over their "useful lives." 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 assets for one year.* The example farm's total annualized capital cost is $6,554, just over one-fifth of the farm's gross income. It would be higher if custom machinery services were not utilized, because additional machinery would need to be owned.

"The bottom line"

Total cost includes all *cash* costs and all *opportunity* costs. Any return above total cost is *economic profit*. Because economic profit considers *all* costs, a manager would understandably be satisfied with his or her business' performance if economic profit were zero or greater. Economic profit is the single best measure of true profitability. Economic profit serves as a "market signal" to indicate how attractive the enterprise is for potential investors and for potential new entrants into the industry.

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," or it may be intuitively difficult to grasp the meaning of a "negative economic profit." Perhaps a more easily understood "bottom line" term is "return to management." In a typical year, this example ginger farm manager receives a return (before income taxes) of $1,742 for his or her managerial efforts,** that is, 5.6% of the gross income. Because this *return* to the management resource is slightly greater than the resource's *value* (using the "rule of thumb" for the value of management, 5% of the gross income, which in the example farm would be $1,542), we can say the business is in fact profitable. (Of course, this farm manager also would receive additional compensation for any of the manual farm labor which he or she provided.).

Risk

Our model's particular production scenario appears marginally adequate. However, the ginger market includes considerable foreign competition. Prices have generally been good for ginger root, but the 1997/98 average price of ginger dropped to 40¢ per pound, an all-time low. Despite excellent yields, the price was below the break-even point, and generally ginger farming was not economically profitable. In addition to abruptly fluctuating prices, ginger root is relatively susceptible to serious disease problems (Nishina et al.), providing an ever-present possibility for a cultural problem to sharply reduce yields. In 1993, for example, the average yield dropped to 27,500 pounds per acre.

Risk is inherent in all of agriculture, but the ginger root industry appears to be more exposed to risk than many other Hawaii agricultural endeavors. A review of the HASS summary of prices and yields reveals considerable ginger root price and yield volatility with relatively little correlation between the two variables. The

*The "capital recovery charge" method consists of calculating an annual loan payment, using the historic cost minus the salvage value as the principle, the "life" as the term, and the average cost of capital as the interest rate. To this amount is added the cost of holding the asset's salvage value, using the owner's opportunity cost or desired return on capital. If the asset is already fully depreciated (i.e., the capital has already been recovered), enter zero for historic cost.

**If one were to set the "desired return on owner equity" (in the assumptions section above) to zero, the indicated "return to management" would in fact be the frequently used "management and investment income" (M.I.I.), the return to the owner/manager for his or her management and capital investment.

Economics of ginger root production in Hawaii—cost-and-returns spreadsheet

BASIC ASSUMPTIONS			
Ginger root crops per year	0.25	Working capital interest rate	10.0%
Acres of ginger root	5.0	Debt capital (longer-term) interest rate	9.0%
Pounds of ginger root per box	30	Owner's desired rate of return on equity (%)	6.0%
Pounds of marketable ginger root per acre	46,200	Hand labor wage rate ($/hr)	$6.00
Payment terms for crop (months)	2	Machine labor wage rate ($/hr)	$8.00
		FICA and labor benefits (%)	33%

I. GROSS INCOME				PER HARVESTED ACRE		PER FARM PER YEAR		% of
GRADE	*% of Crop*	*PRICE*	*unit*	*units*	*$*	*units*	*$*	*Gross*
Mature A	80%	**54.5**	¢ / lb	36,960	20,143.20	46,200	25,179	81.6%
Mature B	10%	28.0	¢ / lb	4,620	1,293.60	5,775	1,617	5.2%
Off Grade	0%	10.0	¢ / lb	0	-	0	-	0.0%
"Young ginger"	5%	75.0	¢ / lb	2,310	1,732.50	2,888	2,166	7.0%
"Seed"	5%	65.0	¢ / lb	2,310	1,501.50	2,888	1,877	6.1%
TOTAL =	100%	**53.40**	**¢ / lb**	**46,200**	**$24,671**	**57,750**	**$30,839**	**100%**

II. OPERATING COSTS			PER HARVESTED ACRE		PER FARM PER YEAR		% of
Growing operations	*COST*	*/unit:*	*units*	*$*	*units*	*$*	*Gross*
A. Land preparation	*Mow, rake, plow (2), harrow (2), fumigate, furrow, fertilize, and till.*						9.3
1 Methyl bromide	$3.00	/pound	375	1,125.00	469	1,406	4.6%
2 Plastic *(2 uses)*	$86.00	/sheet	27	1,161.00	34	1,451	4.7%
3 Treble Super-P (0-47-0)	$0.20	/pound	1,000	200.00	1,250	250	0.8%
4 10-30-10	$0.22	/pound	400	88.00	500	110	0.4%
5 Fertilizing labor	$7.98	/hour	12.0	95.76	15	120	0.4%
6 Lime	$49.50	/ton	1.0	49.50	1	62	0.2%
7 Composted manure	$0.10	/pound	2,000	200.00	2,500	250	0.8%
8 Machinery labor	$10.64	/hour	0.0	0.00	0	0	0.0%
9 Machinery costs	$40.00	/hour	10.0	400.00	13	500	1.6%
		Land preparation subtotal =		**$3,319.26**		**$4,149**	13.5%
B. Planting	*Select, cut, prepare, and hot-water treat seed; plant seed.*						
1 "Seed"	$0.65	/pound	2,310	1,501.50	2,888	1,877	6.1%
2 Seed handling labor	$7.98	/hour	24.0	191.52	30	239	0.8%
3 Planting labor	$7.98	/hour	16.0	127.68	20	160	0.5%
4 Machinery labor	$10.64	/hour	0.0	0.00	0	0	0.0%
5 Machinery costs	$40.00	/hour	3.0	120.00	4	150	0.5%
		Planting subtotal =		**$1,940.70**		**$2,426**	7.9%
C. Fertilizing	*Side-dressing 10–12" from plant row every 2–3 weeks 8 times; then K twice.*						
1 Composted manure	$0.10	/pound	300	30.00	375	38	0.1%
2 Low-N fert. (10-20-20)	$0.20	/pound	5,600	1,120.00	7,000	1,400	4.5%
3 K-mag (0-0-26)	$0.29	/pound	1,600	464.00	2,000	580	1.9%
4 Hand fertilizing labor	$7.98	/hour	48.0	383.04	60	479	1.6%
		Fertilizing subtotal =		**$1,997.04**		**$2,496**	8.1%
D. Weed control	*By hand once per month (for 6 months).*						
1 Hand labor	$7.98	/hour	96.0	766.08	120	958	3.1%
		Weed control subtotal =		**$766.08**		**$958**	3.1%
E. Insect, nematode control	*Applied monthly (for 8 months).*						
1 Vydate	$20.66	/quart	16.0	330.56	20	413	1.3%
2 Labor	$10.64	/hour	16.0	170.24	20	213	0.7%
		Insect and nematode control subtotal =		**$500.80**		**$626**	2.0%
F. Hilling	*Use tiller to hill 3–5 times per year.*						
1 Machinery labor	$10.64	/hour	24.0	255.36	30	319	1.0%
2 Machinery costs	$10.00	/hour	24.0	240.00	30	300	1.0%
		Hilling subtotal =		**$495.36**		**$619**	2.0%
		Growing operation costs subtotal =		***$9,019***		***$11,274***	*36.6%*

This research was funded by the County of Hawaii, Department of Research and Development, and the Univrsity of Hawaii at Manoa, College of Tropical Agriculture and Human Resources. Mention of specific products or practices does not imply an endorsement by these agencies or a recommendation in preference to other other products or practices.

Harvesting operations

A. Harvesting	*Hand harvested (w/ or w/o mach. digger), crated, and hauled to warehouse.*							
1 Hand harvest labor	$7.98	/hour		200.0	1,596.00	250	1,995	6.5%
2 Machinery labor	$10.64	/hour		20.0	212.80	25	266	0.9%
3 Machinery costs	$14.00	/hour		20.0	280.00	25	350	1.1%
			Harvesting subtotal =		**$2,088.80**		**$2,611**	8.5%
B. Packing	*Washing, curing, trimming, grading, and boxing.*							
1 Wash and cure labor	$7.98	/hour		77.0	614.46	96	768	2.5%
2 Trim and grade labor	$7.98	/hour		75.0	598.50	94	748	2.4%
3 Boxes	$1.25	/box		1,463	1,828.75	1,829	2,286	7.4%
4 Boxing labor	$7.98	/hour		180.0	1,436.40	225	1,796	5.8%
			Packing subtotal =		**$4,478.11**		**$5,598**	18.2%
C. Marketing	*Hauling to mkt/shipper @*			200	*boxes per trip =*	*7*	*trips.*	
1 Excise tax	0.5%	of gross		$24,671	123.35	$30,839	154	0.5%
2 Marketing commission	0.0%	of gross		$24,671	-	$30,839	-	0.0%
3 Marketing payment terms	1.7%	of gross		$24,671	411.18	$30,839	514	1.7%
4 Machinery labor	$10.64	/hour		14.0	148.96	17.5	186	0.6%
5 Machinery costs	$10.00	/hour		14.0	140.00	17.5	175	0.6%
			Marketing subtotal =		**$823.49**		**$1,029**	3.3%
			Harvesting operation costs subtotal =		***$7,390***		***$9,238***	*30.0%*
Operating overhead costs								
1 Management	-	base amt.+	5%	of gross	1,233.54	$30,839	1,542	5.0%
2 Office overhead	-	base amt.+	1.0%	of gross	246.71	$30,839	308	1.0%
3 Interest on operating capital	50%	of growing costs			450.96	$11,274	564	1.8%
4 Other operating costs			*Enter farm total =>*		80.00		100	0.3%
			Operating overhead costs subtotal =		***$2,011***		***$2,514***	*8.2%*
			TOTAL OPERATING COSTS =		**$18,421**		**$23,026**	**74.7%**
GROSS MARGIN:			*(Returns over operating costs)*		**$6,250**		**$7,812**	**25.3%**

III. OWNERSHIP COSTS *(Allocated to the ginger root enterprise)*

A. Capital resource *Investment item*	*Historic cost*	*Salvage value*	*Debt-to-asset %*	*Expected life*	*Avg. cost of capital*	ANNUAL CAPITAL OWNERSHIP COSTS: ***$ / acre***	***$ / farm***	*% gross*
1 Land clearing	0	0	0%	10	6.00%	-	-	0.0%
2 Other land prep.	0	0	0%	10	6.00%	-	-	0.0%
3 Truck	10,000	2,000	40%	5	7.20%	1,684	2,106	6.8%
4 Tractor and tiller	25,000	15,000	20%	7	6.60%	2,256	2,820	9.1%
5 Equipment	6,000	3,500	20%	7	6.60%	551	688	2.2%
6 Buildings	5,000	0	50%	20	7.50%	392	490	1.6%
7 Other capital ownership costs (e.g., prop. insur., rprs., maint.)				*Enter farm total =>*		360	450	1.5%
					Capital resource subtotal =	**$5,243**	**$6,554**	21.3%
Gross margin minus capital costs =					***return to land*** */ harvested acre and for farm =*	*$1,007*	*$1,258*	*4.1%*
B. Land resource								
1 VALUE of land resource					*Enter total land charges (mortgage or rent, tax, etc.) =>*	**$850**	**$1,063**	3.4%
					TOTAL OPERATING AND OWNERSHIP COSTS =	**$24,514**	**$30,643**	**99.4%**
					ECONOMIC PROFIT =	**$157**	**$196**	**0.6%**

Economic profit = the gross income minus total operating and ownership costs, both cash and opportunity.
The goal is to have economic profit = 0 or greater.

VALUE of the labor and management resources =	$7,830	$9,788	31.7%
VALUE of the management resource =	$1,234	$1,542	5.0%
RETURN TO MANAGEMENT =	$1,390	**$1,738**	**5.6%**

BREAK-EVEN ANALYSIS *(In order to cover ALL costs, i.e., for economic profit to = $0.)*		
Given the current weighted average price per pound, the total yield needs to be	**45,907**	**lb / acre**
Given the current yield per harvested acre, the weighted average price needs to be	**53.1**	**¢ / pound**

crop's exceptional vulnerability to diseases increases the yield risk substantially, and growing ginger root demands unusually careful horticultural management. Price is also a special concern, because most of the Hawaii ginger crop is exported to the mainland USA, in direct competition with often lower-cost foreign producers from Central America (Costa Rica, Nicaragua, and Honduras), Brazil, and India (HASS, p. 3). Furthermore, most of these countries, along with Thailand and China, two other highly competitive ginger root exporters, have enormous productivity potential. However, notwithstanding the significant risks associated with ginger production, the Hawaii industry appears to have proven relatively profitable, having increased harvestable acreage nine-fold since 1980 (HASS, p. 2).

While both price and yield are important risk variables, price variability of ginger root is greater than yield variability.* The typical price chosen for this analysis is rather conservative, relative to the average prices received by growers since 1980. A conservative estimate seems justified in light of the greater price variability and the perception of packers, which was noted earlier. While the return to management is adequate in terms of profitability, the extremely small cushion of $200 to absorb a downfall indicates that this operation is close to the break-even level. Given the current cost structure and yield for this example farm, the operation could only generate adequate income to cover all costs (i.e., generate a positive economic profit) as long as the price is at least 53.1¢ per pound. Expressed in another way, given this farm's current cost structure and the average market price of 54.5¢ per pound used in this study, yield could safely drop to 45,900 pounds per harvested acre. However, in 1997/98, while the yield of 50,000 pounds was substantially higher than the figures used here, the 1997/98 Grade A price of 40¢ per pound was dramatically lower. Using roughly the same price spreads and same sales proportions and cost structure, this yield-price combination would result in a negative return to management of about $3,200. In effect, the grower would have received nothing for his or her management or equity, and indeed the manager/owner may have had to dig into his or her net worth in order to pay all of the farm's bills. The break-even weighted average price required to be economically profitable at this yield is 48.7¢.

Ultimately, one's assessment of the ginger enterprise's overall risk potential reflects one's confidence in (a) the expected future market price for ginger root, (b) one's horticultural management abilities (and luck) to minimize disease, and (c) one's economic management ability to control costs. The operation's cost structure is the component over which one usually has the most control. Reducing costs will increase one's ability to face risk more confidently and withstand adverse market prices or yields more successfully. However, reducing costs, which is always difficult, will be particularly challenging with the impending changes, such as the aforementioned decision to phase out methyl bromide, looming on the horizon.

*This is based on the fact that the price coefficient of variation is significantly higher than that for yield (0.238 vs. 0.147).

Literature cited

Hawaii Agricultural Statistics Service (HASS). Hawaii ginger root: annual summary. Hawaii Department of Agriculture and U.S. Department of Agriculture, Honolulu, August 1998.

Nishina, M.S., D.M. Sato, W.T. Nishijima, and R.F.L. Mau. Ginger root production in Hawaii. Commodity Fact Sheet GIN-3(A), College of Tropical Agriculture and Human Resources, University of Hawaii, June 1992.

Acknowledgements

The authors are grateful to the **County of Hawaii Department of Research and Development**, which generously funded the applied economic research for this publication, and to the following individuals who helped to make this publication possible: the cooperative ginger root growers and packers who patiently explained their practices and economic concerns, and Drs. David Hensley and John Halloran of the CTAHR Department of Horticulture, who 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/ginger/ginger.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.

This publication and other recent CTAHR publications can be obtained from the website <http://www.ctahr.hawaii.edu/publications> or by request to the CTAHR Publications and Information Office, 3050 Maile Way, Gilmore 119, Honolulu, HI 96822; 808-956-7046; email <ctahrpub@hawaii.edu>.