Virgin Islands
Agricultural Experiment Station
Report No. 6
August 1974

Profitability of HOG PRODUCTION in the U.S. Virgin Islands

VIRGIN ISLANDS AGRICULTURAL EXPERIMENT STATION
Fenton B. Sands, Director
St. Croix, U.S. Virgin Islands

Virgin Islands
Agricultural Experiment Station
Report No. 6
August 1974

Profitability of HOG PRODUCTION

In the U.S. Virgin Islands

College of the Virgin Islands
Virgin Islands Agricultural Experiment Station
Fenton B. Sands, Director
St. Croix, U.S. Virgin Islands

CONTENTS

FOREWORD

This report, "Profitability of Hog Production in the U.S. Virgin Islands," is one of a series of feasibility studies sponsored by the newly created Virgin Islands Agricultural Experiment Station, College of the Virgin Islands. These investigations were financed totally with Federal funds made available to the Station under the provisions of the Hatch Act, Amended.

Preparation of this report was accomplished by contracting for the services of the following team of specialists: Dr. Farrell E. Jensen, Assistant Professor, Department of Agricultural Economics and Marketing, Rutgers University, New Brunswick, N.J. and Dr. Robert L. Park, Professor of Animal Science, Brigham Young University, Provo, Utah. This team conducted the study and wrote the manuscript for this report.

The objective of these studies was to try to determine the agricultural enterprises both plant and animal, that have economic potential on the Virgin Islands. It is my belief that the agricultural industry must be economically sound in order to be viable.

On the Virgin Islands, agriculture has been on the decline since the early part of the 1960's. The average number of farms, farmers, and production of agricultural commodities (with the exception of fluid milk) have all declined at a consistent rate. Among the questions which are uppermost in the minds of many people are: What factors have been responsible for these declines? Can these downward trends be stopped and perhaps reversed? What is the future of the agricultural industry, particularly on St. Croix where 85 percent of the farmland is located? This report on the profitability of hog production, along with the others, sheds some light on these questions.

These feasibility reports have also revealed the areas where lack of training and education on the part of the farmers has adversely affected production. These subjects have now become part of the new program of the V.I. Extension Service. At the same time, the lack of information about the response of crops and livestock in this environment, which also limits production, has been recognized. These gaps in our knowledge have become the basis for the planned research program of the V.I. Agricultural Experiment Station. Thus, these studies have given more direction to the efforts of the Extension and research programs of this land-grant institution. More importantly, the results of these studies are expected to be beneficial to full- and part-time farmers, as well as to potential investors.

This series of reports rests squarely on the belief that a revival of agriculture would contribute substantially to the general welfare through increased output of goods and services and by providing additional employment. Moreover, expanded production and marketing of farm products could provide greater, and in some cases cheaper, sources of nutritious foods for consumers.

A more fully developed agriculture would complement the major industry—tourism—in two ways. First, visitors would be pleased to be served local products, especially tropical fruits and vegetables, by hotels and restaurants where such products are often not now available. Second—and perhaps more important—an expanded agriculture would tend to preserve the environment of exotic tropical islands. Most visitors and some permanent and semi-permanent residents come to the Virgin Islands to seek this environment. If this attraction is destroyed, the basis of the major industry of the Islands will be undermined.

The Virgin Islands Agricultural Experiment Station gratefully acknowledges the cooperative assistance and contributions from many St. Croix farmers; Rudolph Shulterbrandt, Commissioner, V.I. Department of Agriculture, and his staff; and Bennett S. White, Jr., project consultant and former USDA agricultural economist, now retired.

Fenton B. Sands, Director
March 1974

SUMMARY AND CONCLUSIONS

The hog industry on St. Croix is small—both in overall size and scale of individual operation—and has been in a state of decline in recent years. Individual production units are typically herds of 9 to 10 sows operated on a part-time basis. In 1970 there were 61 Virgin Islands farms producing hogs. Between 1964 and 1970 the hog population declined by nearly a third to 898 animals, and numbers sold decreased from 622 to 430—a drop of 30.9 percent.

Much of the demand for pork is for 40 to 60 pound animals for roasting; this demand peaks at Christmas time. An intermediate market also exists for pigs from roasting weight up to approximately 125 pounds. There is a limited demand for heavier hogs (over 125 pounds) and these are usually sold on a cut-and-yield basis. Carcass prices range from $.75 to $1.00 per pound; $.85 per pound is typical. Liveweight prices range from $.50 to $.70 per pound.

Under present conditions, the future for the hog industry on St. Croix is uncertain. The two major problems are high feed costs and substandard management practices.

Feed costs are high largely because of transportation rates; shipping charges exceed $50 per ton for feeds originating in the U.S. mainland.

Farmers have insufficient management skills to operate efficient units. Many hog enterprises are characterized by slow gains and high death losses. Too many pigs are lost between the time of birth and market age. Most hogs do not get enough proper feed for satisfactory growth.

The demand for 220-pound hogs is unstable. Butchers often discount the heavy hogs because the market prefers lean meat. The average size of hogs slaughtered in 1972 was approximately 108 pounds.

As a basis for analysis of factors affecting costs, returns, and profitability, a model was developed featuring an 8-sow part-time operation. This size was selected because it represents the operation of a majority of island producers. The analysis assumes proper management practices which generally do not prevail at present.

To cover all costs except the owner's part-time labor, 66-pound pigs must sell for $.79 per pound; 132-pound pigs at $.56 per pound; and 220-pound animals at $.50 per pound when feed prices are $9.00 per cwt.—which approximates the July 1973 situation when this study was made. A major problem for farmers serving the roasting pig market (40–100 lbs.) is that local prices do not reflect the differences in the costs of production. Production costs per pound are greater for light pigs, but generaly there are no price differentials in the market for this weight range. The model shows that heavier hogs are more profitable under present price conditions. However, buyer preference for lighter weights likely would lead to price discounts for heavier animals if larger numbers were produced. For 132-pound pigs, the costs per pound of gain excluding manager's labor was $.45 per pound at $7.50/cwt. feed price.

The internal rate of return for the model with 132-pound pigs, $7.50/cwt. feed price and $60 per pound liveweight price was equal to 0.9 percent—which is not an attractive investment.

It is doubtful that a full-time operation with the necessary investment in facilities and relying on commercial feed at present prices would be profitable. This type of operation would be more capital intensive than the 8-sow model which did not provide a satisfactory return to a limited amount of invested capital.

If the decline in the hog industry is to be reversed, the importance of lowering feed costs and improving management cannot be overemphasized. The success of research efforts to reduce feed costs through providing the basis for much larger supplies of locally grown sorghum for grain and development of local feed processing are critical to the future of the hog industry.

On every hand, there is evidence that producers could do a better job with the resources they are now utilizing. An educational program is needed to provide more information about feeding programs, equipment and facilities, and proper sanitation and medication practices.

The model used in this analysis assumed complete reliance on commercial feed. More than one-half of the producers at present are feeding garbage to reduce feed costs, and as a result they have been able to stay in business. These growers

would benefit from some information about a balanced garbage feeding program. A balanced diet would improve the rate of grain of their animals. When farmers bargain over prices with buyers, they should be aware of the higher cost of producing roasting pigs.

If costs of purchased feed can be reduced significantly and if vigorous extension efforts succeed in inducing growers to improve management to levels that are clearly attainable, hog production could be a viable part-time enterprise in the Virgin Islands.

PROFITABILITY OF HOG PRODUCTION

in the U.S. Virgin Islands

by

FARRELL E. JENSEN and ROBERT L. PARK

The hog industry on St. Croix is characterized primarily by small herds of 7 to 10 sows operated on a part-time basis. In 1970, 61 Virgin Islands farms were producing hogs. From 1964 to 1970, the hog population declined by 32.2 percent to 898 animals. Over the same period, the total number of hogs sold decreased from 622 to 430—a drop of 30.9 percent (Table 1).

Table 1.—Statistical summary of Virgin Islands hog numbers and production by size of farm, 1964, & 1970.

Description	*Year* 1964	1970	*Percent change*
Number of farms with hogs	*Number*		*Percent*
Under 3 acres	29	19	−34.5
3 to 9 acres	69	18	−73.9
10 to 49 acres	35	13	−62.5
50 to 99 acres	10	5	−50.0
100 to 500 acres	15	5	−66.7
Over 500 acres	—	1	—
TOTAL	159	61	−61.6
Number of hogs on farms			
Under 3 acres	316	151	−52.2
3 to 9 acres	510	166	−67.5
10 to 49 acres	182	344	89.0
50 to 99 acres	137	90	−34.3
100 to 500 acres	175	124	−29.1
Over 500 acres	3	23	666.7
TOTAL	1,323	898	−32.2
Number of hogs sold			
Under 3 acres	134	76	−43.3
3 to 9 acres	208	41	−80.3
10 to 49 acres	67	186	177.6
50 to 99 acres	168	62	−63.1
100 to 500 acres	45	63	40.0
Over 500 acres	—	2	—
TOTAL	622	430	−30.9

Source: 1969 Census of Agriculture, U. S. Department of Commerce, Bureau of Census, 1972.

The objectives of the hog study were to (1) identify and define a typical benchmark production unit appropriate to the Virgin Islands, (2) determine the costs and returns to the production unit, (3) determine the breakeven points under changing conditions, and (4) calculate the internal rate of return as a standard for assessing feasibility.

Interviews were conducted with local farmers to obtain relevant production information. Additional information was obtained from local businessmen and other sources. The analysis assumes higher levels of efficiency than presently exist in the operations. With proper management practices, however, the standards can be achieved under Virgin Islands conditions.

THE PRESENT SITUATION

Demand

The demand for pork appears to be relatively unstable; peak demand occurs at Christmas time when 40–60 pound hogs are sold for roasting and barbecuing. A majority of the producers interviewed for the study sold most of their pigs for roasting. An intermediate market also exists for pigs from roasting weight up to approximately 125 pounds. Local butchers purchase most of the intermediate weight hogs. The local demand for hogs heavier than 125 pounds appears to be limited because lighter weight animals are preferred. The heavy hogs (over 125 pounds) are usually sold on a cut-and-yield basis; that is, total value is determined after the hog is dressed and the fat is trimmed from the carcass.

Animals are sold on both a liveweight and dressed weight basis, but dressed weight prices were most commonly reported. Carcass prices ranged from $.75 to $1.00 per pound; the majority

were around $.85. These correspond with live-weight prices ranging from approximately $.50 to $.70 per pound. The same carcass prices generally apply over all weight ranges.

Feeding Programs

Six of the nine farmers who were interviewed fed waste food products supplemented by a complete commercial ration. The waste food is collected from hotels, restaurants and in some instances from homes. One producer used waste products exclusively, while the others purchased their commercial feed from Puerto Rican firms. High commercial feed prices and insufficient knowledge of good feeding and management practices hamper the industry.

Buildings and Equipment

Most of the structures have been made from used lumber and tin. The facilities are generally inadequate for a successful enterprise. The most serious problem is the lack of suitable facilities for farrowing and handling baby pigs. A large number of baby pigs are lost as a result. Out of 9 farmers interview, 5 sold less than 4 pigs per litter and 2 operators sold less than 2 pigs per litter.

Equipment is limited and consists of a few barrels, buckets, and improvised waterers and feeders. The operations are mostly drylot.

Efficiency

Feed conversion and rates of gain could be improved. In many instances, pigs 4–5 months of age weigh only 40–50 pounds. Under proper feeding and management programs, a hog should weigh 125–150 pounds at 4 months. The slow growth rates are a result of a combination of factors including insufficient amounts of feed and essential nutrients.

Other problems the study team noted were thievery, some instances of hogs being attacked by dogs, and a need for management knowledge.

THE MODELS

The model selected for the analysis was an 8-sow part-time operation, because this size represented that of the majority of island producers. The analysis assumes proper management practices and the following factors:

1. Owner supplies all labor except for two weeks.
2. The operation has 8 sows and 2 gilts for breeding stock.
3. Gilts are bred at 8 months; sows farrow twice each year.
4. Each sow has four litters before culling. Sows weigh 400 pounds at time of sale. Replacement gilts are taken from the litters.
5. Seven pigs are weaned from each litter. This should be a minimum standard.
6. Operator builds his own buildings and installs his equipment.
7. Feed conversion is one standard deviation below the National Research Council Standads average.
8. A death loss of 2 percent is assumed for pigs under 66 pounds, and an additional 1 percent for those over 66 pounds. These estimates are in addition to the usual losses in the U.S. mainland.

Feeding Program

The feeding program is based on a total commercial ration to determine the feasibility of such an operation. Table 2 shows the average pounds of feed required per day, the number of days on feed and the total pounds of feed per sow and hog at various sizes. These conversion rates should be attainable in commercial operations. A sow is assumed to consume 1,127 pounds of feed between litters. Market hogs require 853 pounds of feed to reach a weight of 220 pounds.

Drylot Rquirements

A drylot program was used for the model to keep the investment in facilities to a minimum. The space requirements are shown in Table 3.

Buildings and Equipment

Estimated costs for buildings and equipment are shown in Table 4. Costs for the construction materials were obtained from a local lumber company. Amounts of materials necessary for the fa-

cilities were then estimated to arrive at the cost figures. The cost estimates *do not* include a labor charge, as it is assumed that the owner will do the construction. All buildings have a wood superstructure, concrete floors and galvanized roofs.

The farrowing facility has a concrete floor with 3½-foot block walls to protect the baby pigs from the weather. Four farrowing stalls are included. The equipment includes heat lamps for the baby pigs. Baby pigs are to be left with sows until weaned at 8-weeks of age.

The nursery-growing facility consists of a fenced enclosure with a concrete slab under the shade. Three sides are made of hog wire and the fourth from chain link fencing. The same construction for the fencing and shade was also used for the finishing and gestation facilities with one exception: the gestation facility has two strands of barbed wire around the hog wire perimeter for extra strength.

One-fourth of the cost of a pickup truck was prorated to the hog enterprise. Depreciation is charged over eight years. Miscellaneous costs include the installation of mist sprayers in each of the facilities to cool the animals.

Variable and Fixed Costs

Table 5 contains a list of all variable costs except for feed costs and death losses. The price of feed and the death losses were handled as variables and will be discussed at a later point in

Table 2.—Assumptions for feeding program for hog enterprise, St. Croix, Virgin Islands, 1973.

Stage of production	*Unit*	*Feed requirements*		
		Average pounds of feed per day	*Number of days*	*Total pounds*
Sow		*Pounds*	*Number*	*Pounds*
Breeding	Per litter	7.0	35	245
Gestation	Per litter	4.0	72	288
Prefarrowing	Per litter	6.0	21	126
Lactation	Per litter	10.0	42	420
Other	Per litter	4.0	12	48
TOTAL		—	182	1127
Finishing pigs				
Birth to 22 lbs.	Per pig	1.3	42	55
23–66 lbs.	Per pig	3.3	43	142
67–132 lbs.	Per pig	5.9	40	236
133–220 lbs.	Per pig	8.4	50	420
TOTAL			175	853
Gilt				
Pre-breeding	Per gilt	7	60	420

Table 3.—Assumptions for determining drylot space requirements for hog enterprise, St. Croix, Virgin Islands, 1973

Type of unit	*Function*	*Space requirement per animal (sq. ft.)*
Sow facility	Feeding	150
	Shade	30
Finishing		
Pigs under 100 pounds	Feeding	75
	Shade	7
Pigs over 100 pounds	Feeding	100
	Shade	10
Boars	Feeding	200
	Shade	30

Table 4.—Estimated purchase cost and depreciation schedule for buildings and equipment, hog enterprise, St. Croix, Virgin Islands, 1973

Item	*Estimated cost*	*Estimated life*	*Annual depreciation*
Farrowing facility	*Dollars*	*Years*	*Dollars*
Building	700	10	70
Equipment	400	10	40
Nursery-growing facility			
Fence	270	5	54
Shade	160	10	16
Water cup	50	10	5
Finishing facility			
Fence	250	5	50
Shade	230	10	23
Water cup	50	10	5
Gestation facility			
Fence	210	5	42
Shade	330	10	33
Water cup	50	10	5
Pickup truck	1,125[1]	8	140
Miscellaneous	300	10	30
TOTAL	4,125		513

[1] Share for hog enterprise.

Table 5.—Partial listing of assumptions for variable and fixed costs calculations, hog enterprise, St. Croix, Virgin Islands, 1973

Cost item	*Cost per litter*	*Total annual cost*
Variable	____*Dollars*____	
Breeding charge[1]	—	—
Veterinary		
Medication and sanitation	10.50	168
Hired labor	5.00	90
Building and fence repairs	2.00	32
Equipment repairs	.75	12
Utilities	2.75	44
Truck, fuel, tires and maintenance[2]	6.50	104
Marketing[3]	5.25	84
Miscellaneous	3.50	56
Fixed		
Property taxes[4]		
Insurance	—	10
Truck[5]		70
Building and equipment[6]		50
Depreciation[7]		
Building, fences and equipment	—	513
Interest on investment		
Buildings and equipment @ 7.5%[8]	—	150
Land @ 7.5%	—	150
Livestock @ 7.5%[9]	—	200
TOTAL		1,733

[1] Assume that sows are serviced by breeding stock owned by Virgin Islands Department of Agriculture.

[2] Assume truck is driven 3,000 miles at 3.5 cents per mile. Estimate includes depreciation, and insurance.

[3] Assume that owner pays for processing 8,400 pounds through slaughterhouse at 1 cent per pound.

[4] According to the tax assessor, land and buildings are assessed at 60% of appraised value. The tax rate is 1¼% of assessed value. Agricultural tax liability is 25% of amount determined by applying tax rate to assessed value. The hog operation requires 1 acre of land at $2,000. The value of buildings and equipment is $3,000.

[5] Insurance estimate from local company was $275 per year for liability and collision coverage of which 25% is charged to hog enterprise.

[6] Fire and extended coverage rates for wooden frame farm buildings obtained from local insurance company are $1.75 per $100.

[7] See Table 4.

[8] See Table 4.

[9] Breeding stock value is assumed to be $250 per head. Assume an average investment of $1200 in feeder and finishing hogs.

the analysis. Assumptions underlying the cost factors are specified in the footnotes. Estimates were obtained from local resources whenever possible.

Only a minimal amount of hired labor was charged to the operation, as the operator should be able to handle the workload on a part-time basis. Interest on the investment in land, buildings, equipment and livestock was charged at 7½ percent per year. This represents the opportunity cost of capital investment in the enterprise and does not represent an interest figure paid to a lending institution. The total of the listed fixed and variable costs excluding feed and death losses is $1,733 per year.

Sale Weights

Models for three market weights were developed. The 66-pound hogs are assumed to meet the needs of the roasting pig market and the 132-pound hogs are for the intermediate weight market. A model for 220-pound pigs is also included. The model assumes no price differentials for the alternative market weights.

ANALYSIS OF MODELS

Returns to Labor and Management Equations

The first stage of the analysis was to determine the returns to owner's labor and management after subtracting all costs including interest on investment (opportunity costs). This figure indicates the annual income that the owner could generate from the enterprise.

The following equations were developed for each market weight model: [1]

1. 66-pound market:

$$R_{lm} = +4\,W_f P_m (3.92\,N_f - 1) - 3396.96\,P_f N_f - 22336 P_f + 1600 P_c - 1732.96$$

2.—132-pound market:

$$R_{lm} = 4W_f\,P_m\,(3.92\,N_f - 1) \quad 7105.12\,P_f N_f - 21392 P_f + 1600 P_c - 1732.96$$

3.—220-pound market:

$$R_{lm} - 4W_f\,P_m\,(3.92\,N_f - 1) - 13623\,P_f N_f - 19712 P_f + 1600 P_c - 1732.96$$

[1] See Appendix, section 1 for derivation.

Where:

R_{lm} = Annual dollar returns to owner's labor and management.

W_f = Weight of market hogs in pounds.

P_m = Price of market hogs per pound.

N_f = Number of pigs weaned per litter.

P_f = Price of hog and sow feed *per pound* (not per hundred weight).

The last figure on the right can be rounded off to $1,733 and represents the variable and fixed costs contained in Table 5. An advantage of the equations is that an operator can use his own figures for any of these variables and calculate the returns to labor and management.

Sensitivity Analysis

For the sensitivity analysis, three values for the price of feed, market weight and farm liveweight price were assumed (Table 6). The feed price assumptions range from $6 to $9 per cwt. The present price in effect is approximated by the highest price; the lowest figure approximates what might be the lowest possible price of feed on the island under the present transportation rate structures. The cost of shipping grain from Florida is $2.62 per cwt. or $52.40 per ton. If this is added to the price of feed in the U.S. mainland (prior to the June 1973 high price period) then $6.00/cwt. appears to be the best possible feed price for hog pellets or mash. Liveweight prices vary from $.50 to $.65 per pound—the most common being $.60 per pound.

Table 6.—Value ranges for variables included in sensitivity analysis, hog enterprise, St. Croix, Virgin Islands, 1973.

Variable	*Range*		
	1	*2*	*3*
Price of feed per cwt.[1]			
Hog and sow ration[2]	$6.00	$7.50	$9.00
Market liveweight in pounds	66	132	220
Farm liveweight price/pound[3]			
66 Pounds	$ .50	$ .60	$ .65
132 Pounds	.50	.60	.70
220 Pounds	.50	.60	.70
Sows	.25	.25	.25

[1] Local shipping company quoted a rate of $2.62 per cwt. to ship feed from Florida.

[2] For cost analysis, the cost of pig starter is assumed to be 1.33 times the cost of hog and sow ration. This is the price relationship that existed on price list of a local feed supplier.

[3] Dressing percentages are 73% for 66-pound pigs, 71% for 132-pound pigs and 70% for 220-pound pigs. Prices listed here cover range of prices received by farmers.

The returns to owner's labor and management from all possible combinations of the variables are shown in Table 7. A relationship demonstrated in the table is that the owner's return in dollars increases with the market weight of the hogs. At $6.00 feed costs, all combinations of weight, liveweight prices (except the $.50 liveweight price in 66-pound class) had a positive return although the amounts were less for the smallest market weight hogs. At both $7.50 and $9.00 feed costs, only the intermediate and heaviest weight classes had positive returns. At the highest feed costs, liveweight prices had to be $.60 and $.65 per pound to provide a positive return for the owner's time.

In the bottom section of the table, a charge was calculated for the value of the owner's labor and management and this figure was included in the costs. To cover all costs, the figures in the table should be zero or greater. However, most of them are negative which indicates that the enterprise was not covering all costs. With $6.00 feed prices, there is opportunity for selling 132- and 220-pound hogs. At $7.50 feed costs, the only profits are for 132-pound hogs at $.65 per pound or 220-pounders at $.60 and $.65 per pound. At prices approximating the present situation, only the 220-pound hogs at $.65 per pound covered all costs. However, as previously stated, the market for the heavy hogs is unstable.

Returns to Owner's Labor and Management

Complete breakdowns of the sales and costs for the three footnoted returns in Table 7 are shown in Table 8. These are labeled as alternatives A, B and C. Alternative A is for 132–pound hogs, $7.50 feed prices and $.60 per pound liveweight prices. Alternative B is the same, except that feed prices are $9.00 per cwt. For alternative C, feed prices are $9.00 and liveweight prices are $.50 per

Table 7.—Sensitivity analysis to measure impact of charges in variables on returns to owner's management and labor and net returns after all costs, hog enterprise, St. Croix, U.S. Virgin Islands, 1973

Price of hog and sow feed per cwt.	*66-pound hogs*			*132-pound hogs*			*220-pound hogs*		
	Selling at a liveweight price per pound of:			*Selling at a liveweight price per pound of:*			*Selling at a liveweight price per pound of:*		
	.50	*.60*	*.65*	*.50*	*.60*	*.65*	*.50*	*.60*	*.65*
	Dollar returns to owner's management and labor								
$6.00	−610	88	437	1,380	2,776	3,474	3,396	5,723	6,886
7.50	−1,301	−603	−254	313	1,709[1]	2,407	1,670	3,997	5,160
9.00	−1,993	−1,295	−946	−754[1]	642[1]	1,340	−56	2,271	3,434
	Net dollar returns after all costs[1]								
6.00	−2,456	−1,758	−1,409	−773	623	1,321	935	3,262	4,425
7.50	−3,147	−2,449	−2,100	−1,840	−444	254	−791	1,536	2,699
9.00	−3,839	−3,141	−2,792	−2,907	−1,511	−813	−2,517	−190	973

[1] See Table 8 for total breakdown of sales and cost items.

Table 8.—Returns to labor and management for hog enterprise, St. Croix, Virgin Islands, 1973

Item	*Alternative A*[1]	*Alterantive B*[2]	*Alternative C*[3]
Sales		*Dollars*	
Market hogs (132 pounds)	8,376	8,376	6,980
Cull sows	400	400	400
Gross sales	8,776	8,776	7,389
Variable costs			
Commercial feed	5,334	6,401	6,401
Hired labor	90	90	90
Veterinary, medication and sanitation	168	168	168
Building and fence repairs	32	32	32
Equipment repairs	12	12	12
Truck fuel, maintenance	104	104	104
Utilities	44	44	44
Marketing	84	84	84
Miscellaneous	56	56	56
Total variable costs	5,924	6,991	6,991
Fixed costs			
Depreciation on bldgs., fences, equipment	513	513	513
Property taxes	10	10	10
Insurance	120	120	120
Total fixed costs	643	643	643
Interest on investment	500	500	500
Total costs	7,067	8,134	8,134
Returns to labor and management	1,709	642	−754

[1] Based on assumption of feed price of $7.50 per cwt. and a market price of $.60 per pound liveweight.

[2] Based on assumption of feed price of $9.00 per cwt. and a market price of $.60 per pound liveweight. Most closely approximates present situation on island (June 1973).

[3] Based on assumption of feed price of $9.00 per cwt. and a market price of $.50 per pound liveweight.

pound. The returns are the same as shown in the previous table.

Per Unit Costs and Returns

Table 9 contains a breakdown of the costs and returns on a per-unit basis. The total costs per hog sold including the owner's labor are $64.40, $74.12 and $74.12 for the three alternatives. At a feed price of $7.50 per cwt., feed costs per hog total $48.60; they amount to $58.32 at a $9.00 per cwt. feed price. Costs per pound range from $.454 to $.522. Returns to labor and management per hog sold are $15.58, $5.85 and —$6.87 for the three alternatives.

Breakeven Analysis

Feed costs are the largest cost component in the model. Breakeven equations were determined to find the relationship of feed prices and farm meat prices for the producer to breakeven. At the breakeven points, all costs are covered except the owner's labor.

The equations are: [2]

1.—66–pound market:

$$P_{m,e.66} = \frac{1332.96 + 461.15\ P'_f}{105.76\ W_f}$$

2.—132–pound market:

$$P_{m,e.132} = \frac{1332.96 + 711.28\ P'_f}{105.76\ W_f}$$

[2] See Appendix, section 2 for derivation.

Table 9.—Summary of per unit costs and returns for 132-pound hogs for hog enterprise, St. Croix, Virgin Islands, 1973 (Includes manager's labor)

Item	*Alternative*		
	A	*B*	*C*
Number of pigs weaned per year	112	112	112
Number of hogs sold per year			
Market hogs	105.76	105.76	105.76
Sows	4	4	4
TOTAL	109.76	109.76	109.76
Number of pounds sold per year			
Market hogs	13,960	13,960	13,960
Sows	1,600	1,600	1,600
Value per animal sold			
Market hogs	$ 79.20	$ 79.20	$ 66.00
Sows	100.00	100.00	100.00
Costs per hog sold			
Variable (excluding feed & manager's labor)	$ 5.38	$ 5.38	$ 5.38
Fixed	5.86	5.86	5.86
Interest on investment	4.56	4.56	4.56
Feed costs	48.60	58.32	58.32
TOTAL	$ 64.40	$ 74.12	$ 74.12
Costs per pound sold			
Variable	$ .038	$ .038	$ .038
Fixed	.041	.041	.041
Interest on investment	.032	.032	.032
Feed costs	.343	.411	.411
Total cost per pound sold	$ .454	$ .522	$ .522
Returns to labor and management			
Per hog sold	$ 15.58	5.85	—6.87
Per pound sold	.110	.041	—.048

3.—220-pound market:

$$P_{m,e.220} = \frac{1332.96 + 1150.77\ P'_f}{105.76\ W_f}$$

$P_{m,e.}$ = Breakeven liveweight price

W_f = Weight of market hogs in pounds

P'_f = Feed prices per *hundredweight*.

Figure 1 shows the relationship between the two prices for each of the three market weight models. The fact that farmers must receive a higher price per pound for small pigs is evident in the chart. To break even (all costs except owner's labor and management) at $9.00 per cwt. feed prices, the farmer must receive $.50 per pound for 220-pound hogs, $.56 for 132-pound hogs and $.79 for 66-pound hogs. The present market pricing system (1973) does not reflect these cost differences. Any other feed price and meat price relationship can be determined in the same manner. The equivalent carcass price is on the right vertical axis. Table 10 shows the relationship between a series of liveweight and equivalent carcass price relationships.

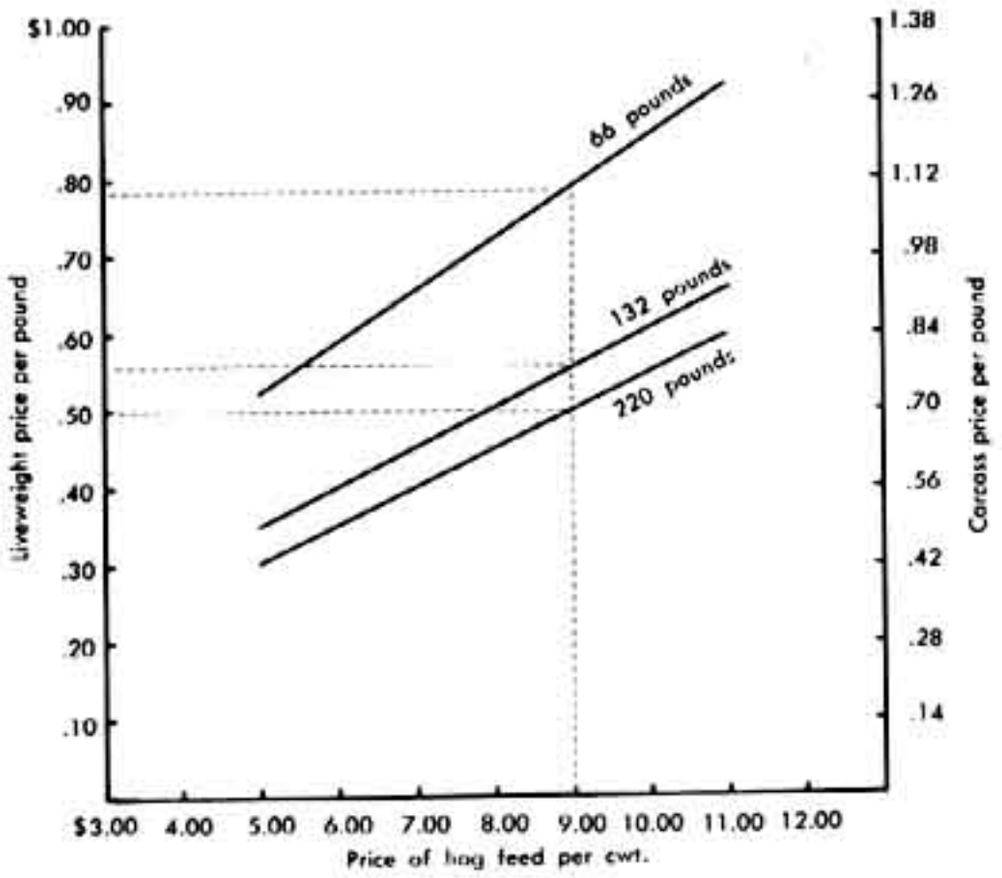

Figure 1.—Breakeven relationship between price of feed per cwt. and liveweight and carcass weight per pound, hog enterprise, St. Croix, U.S. Virgin Islands, 1973. Note that on any point on the lines, the owner would cover all costs except his management and labor.

Internal Rate of Return

The internal rate of return (IRR) is defined as that discount rate which equates the stream of cash benefits and the stream of cash over the planning horizon. If the internal rate of return is above the rate for alternative uses for capital, then the investment should be considered after compensation for risk. If the internal rate of return is below alternative uses, the investment is not feasible.

To determine the internal rate of return, it is necessary to estimate the amount of cash generated each year. Non-cash items like depreciation are not included as costs. Since the IRR represents a return to capital, a charge for the owner's management and labor was included (Table 11). After deducting $2,153 for the owner's salary, the alternative A model generated $569 in cash. The other alternatives were cash deficit each year after the owner's salary withdrawal. Table 12 shows the 20-year budget used to calculate the net benefits

Table 10.—Equivalent carcass and liveweight prices per pound at a 72 percent carcass-to-liveweight ratio

Price per pound		*Price per pound*	
Live	*Carcass*	*Carcass*	*Live*
$ .10	$ .14	$ .20	$ .14
.20	.28	.30	.22
.30	.42	.40	.29
.40	.56	.50	.36
.50	.69	.60	.43
.60	.83	.70	.50
.70	.97	.80	.58
.80	1.11	.90	.65
.90	1.25	1.00	.72
1.00	1.39	1.10	.79
		1.20	.86
		1.30	.94
		1.40	1.01
		1.50	1.08

stream. Periodically, fences, buildings, equipment and the pickup are replaced. These are included in the buildings and equipment column.

The discounted net benefits curve is shown in Figure 2. The point where it is equal to zero gives the internal rate of return. For alternative A, the IRR = 0.9 percent which is less than the rate from alternative uses of capital. This model is not a profitable investment for capital after the withdrawal for the owner. The IRR for the other models would also be negative.

Comment on a 50-Sow Commercial Operation

Based on the study team's analysis of the 8-sow models, the possibility of a 50-sow operation appears marginal. The larger model would require a greater investment per animal in facilities and equipment, more hired labor, and may necessitate expenses for boars. The combination of these factors and the high feed costs are the major impediments to a successful large scale full-time hog operation.

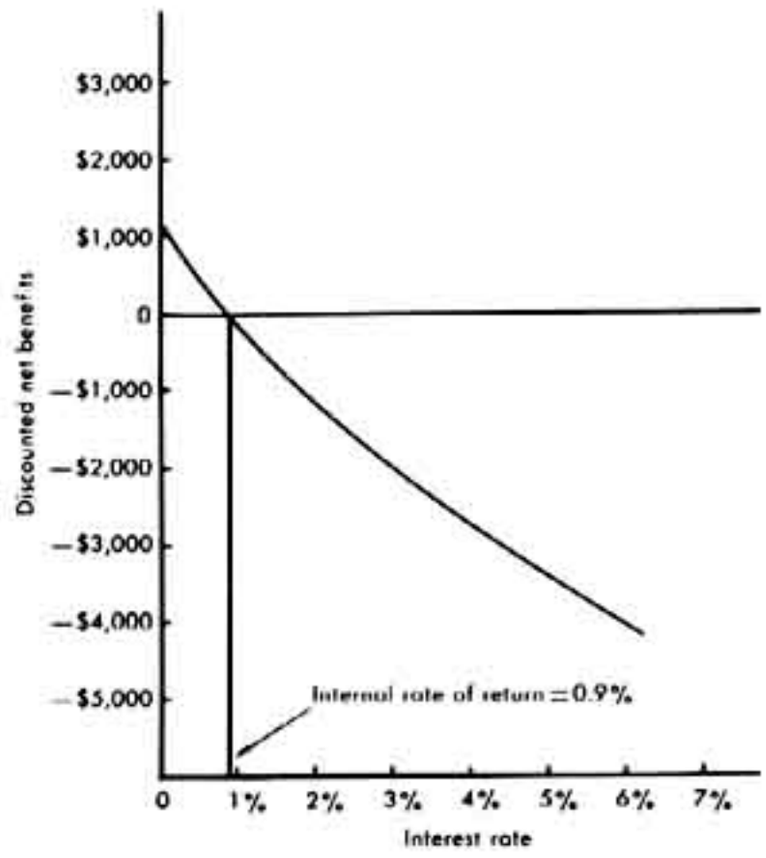

Figure 2.—Determination of internal rate of return from discounted net benefits, Alternative A, hog enterprise, St. Croix, U.S. Virgin Islands, 1973. Note: the internal rate of return is that interest rate at which the sum of the discounted net benefits is equal to zero.

Table 11.—Internal rate of return after a charge for owner's labor and management for hog enterprise, St. Croix, Virgin Islands, 1973

Item	*Alternative*[1]		
	A	*B*	*C*
	Dollars		
Annual operating income			
Market hog sales	8,376	8,376	6,980
Sow sales	400	400	400
TOTAL	8,776	8,776	7,380
Annual cash operating expenses			
Variable costs	5,924	6,991	6,991
Owner's labor and management	2,153	2,153	2,153
Fixed costs (cash items only)	130	130	130
TOTAL	8,207	9,274	9,274
Annual cash generated	569	[498][2]	[1,894][2]
Investment (Year 1)			
Buildings and equipment	4,125	4,125	4,125
Land	2,000	2,000	2,000
Livestock	2,667	2,667	2,667
TOTAL	8,792	8,792	8,792
Internal rate of return[3] (After a charge for owner's labor and management)	0.9%	Negative	Negative

[1] See footnotes on Table 8 for feed costs and price assumptions.
[2] Brackets indicate a loss in cash. [3] See Table 12 for computations.

Table 12.—Cash flow projections for internal rate of return, hog enterprise, St. Croix, Virgin Islands, 1973 (Alternative A)

Year	*Land*	*Buildings and equipment*	*Livestock*	*Operating expenses*	*Total cash outlay*	*Operating income*	*Net benefits*
				Dollars			
1	2,000	4,125	2,667	8,207	16,999	8,776	—8,223
2	—	—	—	8,207	8,207	8,776	569
3	—	—	—	8,207	8,207	8,776	569
4	—	—	—	8,207	8,207	8,776	569
5	—	730[1]	—	8,207	8,937	8,776	—161
6	—	—	—	8,207	8,207	8,776	569
7	—	—	—	8,207	8,207	8,776	569
8	—	1,125[2]	—	8,207	9,332	8,776	—556
9	—	—	—	8,207	8,207	8,776	569
10	—	3,000[3]	—	8,207	11,207	8,776	—2,431
11	—	—	—	8,207	8,207	8,776	569
12	—	—	—	8,207	8,207	8,776	569
13	—	—	—	8,207	8,207	8,776	569
14	—	—	—	8,207	8,207	8,776	569
15	—	730[1]	—	8,207	8,937	8,776	—161
16	—	1,125[2]	—	8,207	9,332	8,776	—556
17	—	—	—	8,207	8,207	8,776	569
18	—	—	—	8,207	8,207	8,776	569
19	—	—	—	8,207	8,207	8,776	569
20	—2,000	—563[4]	—2,667	8,207	2,977	8,776	5,799

[1] Replace fences
[2] Replace pickup truck
[3] Replace buildings, fences and equipment excluding pickup truck
[4] Estimated remaining value of pickup

APPENDIX

Appendix Section 1: Derivation of Gross Income, Total Cost and Returns to Owner's Labor and Management Equations, Hog Enterprise, St. Croix, Virgin Islands, 1973

DEFINITION OF FACTORS

Income Equation

G_L = Gross income per litter
N_f = Number of pigs weaned per litter
N_s = Number of sows sold per litter
W_f = Weight of market pigs in pounds
W_s = Weight of sows in pounds
P_m = Price of market pigs per pound
P_c = Price of sows per pound
N = Number of pigs weaned per litter
G_y = Gross income

Cost Equations

E_L = Total costs per litter
V = All variable costs excluding feed and owner's labor per litter
F = Fixed costs per litter
R_b = Number of pounds of baby pig starter consumed per pig
R_f = Number of pounds of hog ration consumed per pig
R_s = Number of pounds of sow ration consumed per litter
R_g = Number of additional pounds of feed consumed by gilts to breeding age
P_b = Price of baby pig starter per pound
P_f = Price of hog ration per pound
P_s = Price of sow ration per pound
E_y = Total costs for year

INCOME EQUATIONS

Income Equations—Per Litter

$$G_L = (N_f - .25)\ W_f P_m + N_s W_s P_c - .02\ [N_f W_f P_m]$$

(N_f—.25) pigs are sold because 4 gilts are retained from a yearly total of 16 litters for breeding stock. Therefore $N_s = .25$ or 4 sows are sold per year.

The last term accounts for a 2% death loss after weaning.

$$G_L = N_f W_f P_m - .25 W_f P_m + N_s W_s P_c - .02\, N_f W_f P_m$$

But $N_s = .25$ and $W_s = 400$

$$G_L = N_f W_f P_m - .25 W_f P_m + 100 P_c - .02\, N_f W_f P_m$$

$$G_L = .98 N_f W_f P_m - .25 W_f P_m + 100 P_c$$

Income Equation—Per Year

$$G_y = (2)(8)[.98\, N_f W_f P_m - .25 W_f P_m + 100\, P_c]$$

$$G_y = 15.68\, N_f W_f P_m - 4 W_f P_m + 1600\, P_c$$

EXPENSE EQUATIONS

Expense Equation—Per Litter, 66-Pounds Sale Weight

$$E_L = (V + F) + R_b P_b N_f + R_f P_f N_f + R_s P_s + .25\, R_g P_s - .02\, [R_f P_f N_f]$$

Last term assumes that 2% mortality rate occurs at 25 pounds.

But $R_b = 55$, $R_s = 1127$, $R_g = 420$ and $R_f = 12$ for 66-pound pigs

$$E_L = (V + F) + 55 P_b N_f + 142\, P_f N_f + 1127 P_s + (.25)(1076)\ P_s - 2.84\, P_f N_f$$

$$E_L = V + F + 55\, P_b N_f + 139.16\, P_f N_f + 1396\, P_s$$

But $P_b = 1.33\, P_f$. Approximate relationship existed on June 1973 price list of local feed company.

$$E_L = V + F + 73.15\, P_f N_f + 139.16\, P_f N_f + 1396\, P_s$$

Expense Equation—Per Litter, 66-Pounds Sale Weight (continued)

$$E_L = V + F + 212.31\ P_f N_f + 1396 P_s$$

$$\text{But from Table 5 } V + F = \frac{\$1733}{16} = \$108.31$$

$$E_L = 108.31 + 212.31\ P_f N_f + 1396\ P_s$$

Expense Equation—Per Year, 66-Pounds Sale Weight

$$E_y = (2)\,(8)\,(108.31 + 212.31\ P_f N_f + 1396\ P_s)$$

$$E_y = 1732.96 + 3396.96\ P_f N_f + 22336\ P_s$$

Expense Equation—Per Litter, 132-Pounds Sale Weight

$$E_L = (V + F) + 55\ P_b N_f + 378\ P_f N_f + 1127\ P_s + (.25)\,(840)\ P_s - .03\,[236\ P_f N_f]$$

Last term assumes that 3% mortality rate occurs at 66 pounds.

$$E_L = (V + F) + 55\ P_b N_f + 370.92\ N_f P_f + 1337\ P_s$$

But $P_b = 1.33\ P_f$ (See previous example)

$$E_L = V + F + 73.15\ P_b N_f + 370.92\ N_f P_f + 1337\ P_s$$

$$E_L = V + F + 444.07\ P_f N_f + 1337\ P_s$$

$$E_L = 108.31 + 444.07\ P_f N_f + 1337\ P_s$$

Expense Equation—Per Year, 132-Pounds Sale Weight

$$E_y = (2)\,(8)\,(108.31 + 444.07\ P_f N_f + 1337\ P_s)$$

$$E_y = 1732.96 + 7105.12\ P_f N_f + 21392\ P_s$$

Expense Equation Per Litter—220-Pounds Sale Weight

$$E_L = (V + F) + 55\ P_b N_f + 798\ P_f N_f + 1127\ P_s + (.25)\,(420)\ P_s - .03\,[656\ P_f N_f]$$

Same death loss assumption as 132-pound example.

Expense Equation Per Litter—220 Pounds Sale Weight (continued)

$E_L = 108.31 + 851.47\ P_f N_f + 1232\ P_s$ See previous examples for computation procedure.

Expense Equation—Per year, 220-Pounds Sale Weight

$$E_y = (2)\,(8)\,(108.31 + 851.47\ P_f N_f + 1232\ P_s)$$

$$E_y = 1732.96 + 13623.52\ P_f N_f + 19712\ P_s$$

RETURN TO OWNER'S LABOR AND MANAGEMENT EQUATIONS

Sale Weight, 66-Pounds

R_{lm} = Return to owner's labor and management

$$R_{lm} = 15.68\ N_f W_f P_m - 4\ W_f P_m + 1600\ P_c - [1732.96 + 3396\ P_f N_f + 22336\ P_s]$$

$$R_{lm} = 15.68\ N_f W_f P_m - 4\ W_f P_m + 1600\ P_c - 1732.96 - 3396.96\ P_f N_f - 22336\ P_s$$

However $P_s = P_m$ (Prices are about equal on local feed price costs)

$$R_{lm} = 4\ W_f P_m\ (3.92\ N_f - 1) - 3396.96\ P_f N_f - 22336\ P_f + 1600\ P_c - 1732.96$$

Sale Weight, 132-Pounds

$$R_{lm} = [15.68\ N_f W_f P_m - 4\ W_f P_m + 1600\ P_c] - [1732.96 + 7105.12\ P_f N_f + 21392\ P_s]$$

$$R_{lm} = 4\ W_f P_m [3.92\ N_f - 1] - 7105.12\ P_f N_f - 21392\ P_f + 1600\ P_c - 1732.96$$

Sale Weight, 220-Pounds

$$R_{lm} = [15.68\ N_f W_f P_m - 4\ W_f P_m + 1600\ P_c] - [1732.96 + 13623\ P_f N_f + 19712\ P_s]$$

$$R_{lm} = 4\ W_f P_m [3.92\ N_f - 1] - 13623\ P_f N_f - 19712\ P_f + 1600\ P_c - 1732.96$$

Appendix Section 2: Breakeven Equations for all costs excluding owner's Labor and Management for 66-,132- and 220-Pound Sales Weights, St. Croix, Virgin Islands, 1973

BREAKEVEN EQUATIONS [1]

Breakeven Liveweight Price—66-Pound Sale Weight

At breakeven point $G_y = E_y$

$$15.68\ N_f W_f P_m - 4\ W_f P_m + 1600\ P_c = 1732.96 + 3396.96\ P_f N_f + 22336\ P_s$$

But assume (as in the analysis) $P_c = .25$, $N_f = 7$ and $P_s = P_f$

$$(15.68)(7)\ W_f P_m - 4\ W_f P_m + 400 = 1732.96 + (3396.96)(7)\ P_f + 22336\ P_f$$

$$109.76\ W_f P_m - 4\ W_f P_m + 400 = 1732.96 + 23778.72\ P_f + 22336\ P_f$$

$$105.76\ W_f P_m = 1332.96 + 46114.72\ P_f$$

$$P_m = \frac{1332.96 + 46114.72\ P_f}{105.76\ W_f}$$

P_f is the price per pound of feed. With feed prices expressed in cwt. the equation becomes:

[1] Calculated to include all costs except owner's labor and management, as this is assumed to be a part-time enterprise.

Breakeven Liveweight Price—66-Pound Sale Weight (continued)

$$P_{m\,e\,66} = \frac{1332.96 + 461.15\ P'_f}{105.76\ W_f}$$

P = Breakeven prices for 66-pound hogs

Breakeven Liveweight Price—132-Pound Sale Weight

By the same procedure as above the 132 pound breakeven equation is:

$$P_{m\,e\,132} = \frac{1332.96 + 711.28\ P'_f}{105.76\ W_f}$$

Breakeven Liveweight Price—220 Pound Sale Weight

$$P_{m\,e\,220} = \frac{1332.96 + 1150.77\ P'_f}{105.76\ W_f}$$

Appendix Section 3: Explanation of the Internal Rate of Return

The internal rate of return, or discounted rate of interest as it is sometimes called, is a means of refining the usual cost and returns analysis by taking into account the income and cost flows over over the life of the project as opposed to an estimate for a point in time under the usual analysis. The internal rate of return is a measure of long term profitability under specified cash flow assumptions. The concept is particularly useful if year-by-year cost and returns relationships are expected to change over time. For example, major capital costs may be incurred during the first two or three years of a project while the revenues may not reach full development levels until the project is several years underway. Since the internal rate of return is based on discounted cash flows, it is useful in analyzing the above effects even when based upon the same data used in the conventional analysis.

In layman's language, the internal rate of return is the highest rate of return on invested capital that an enterprise could afford to pay and cover total costs over the life of the project. If the rate of interest charged by banks is higher than the indicated rate of return on the proposed investment, the project is not considered feasible because anticipated returns are insufficient to

pay for the cost of the capital. If the internal rate of return is higher than the rate of interest charged by the bank, the project is feasible and will contribute some entrepreneurial income to the owner or owners because the returns on capital are greater than its cost.

Technically, the internal rate of return is that rate of interest on invested capital at which the sum of the discounted income flows is equal to the sum of the discounted cost flows. Alternatively, it is the rate of interest at which the sum of the differences in the cost and income flows is equal to zero.