MINAG

HILLSIDE AGRICULTURE SUB-PROJECT : (HASP)

Economics of Pineapple Intercropping

A. Shaun-Marie Grant
Jamaica, W.I.

December 1994

USAID

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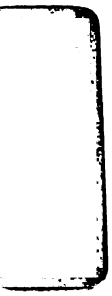

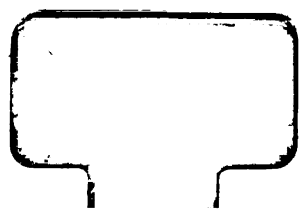

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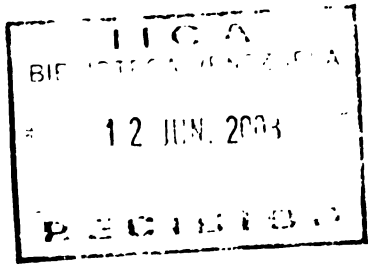

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Foreword

The Hillside Agriculture Sub-Project (HASP) is funded by the U.S. Agency for International development (USAID) through the Hillside Agriculture Project (HAP) and is implemented by the Ministry of Agriculture (MINAG) and the Inter-American Institute for Cooperation on Agriculture (IICA). Its broad objective is to develop crop production systems which can contribute to increased incomes for small farmers in the northern Rio Cobre region while protecting watershed resources.

The HASP, working through a multi-disciplinary team, conducts on-farm adaptive research on tree crops and companion/intercrops (e.g., vegetables). Ms. Shaun-Marie Grant is the HASP team Economist.

Hillside farmers produce mainly for the domestic food market on small plots characterized by a mixture of permanent tree crops and short-cycle cash crops. Production is targeted to meet household food requirements and the surplus to meet cash needs. Thus, the economic objective is not necessarily profit maximization but rather short-term income security.

The information in this publication is intended to help farmers meet their short-term cash needs by intercropping vegetables and other crops with pineapple. In addition to improved pineapple productivity and income intercropping, the technology incorporates soil conservation measures.

It is with great pleasure that HASP provides this valuable information which can contribute to the economic well-being of small, hillside farmers.

L. Van Crowder Jr.
Technology Generation
& Transfer Specialist
IICA/Jamaica

Acknowledgements

The Hillside Agriculture Sub-Project is a unique in that it is a project that is staffed and executed by a multi-disciplinary team of specialists. It is in this vein, that this document is the outcome of the work of team effort and collaboration throughout all stages of its preparation. Therefore, I first wish to thank Messrs. E. Pinnock, E. Stone, Z. Annakie, HASP Agronomists, as well as Ms. J. Mayne and Messrs. H. Demetrius and G. Wallace for their contribution in terms of supplying technical information.

I would also like to thank Doctors L. Van Crowder and J. T. Mulleady as well Mr. C. Reid, for their contribution in terms of reviewing the document and providing technical guidance.

I would also wish to thank Mrs.L. Miller, Mrs. C. Shaw and Ms. J. Khanhi for their assistance in terms of the layout and design of the document.

CONTENTS

THE ECONOMICS OF PINEAPPLE INTERCROPPING

1. Introduction

1.1 Purpose

The purpose of this report is to present information on the profitability of various intercropping packages, promoted by the Hillside Agriculture Sub Project(HASP). It is intended for extension officers,farmers, researchers and other agriculturalists.

1.2 Justification

The adoption of these packages offers benefits to diverse groups in the following ways:

(a) provide benefits to small farmers in terms of increasing their farm income;

(b) ensure a cash flow for small farmers,particularly those with recently established tree crops that have not begun to yield;

(c) develops a low-cost, easily maintainable soil conservation strategy for those wishing to preserve hillsides and watersheds;

(d) promotes agronomically compatible crop combinations ;

(e) ensures greater risk diversification for small farmers, who are basically risk minimizers.

1.3 Crop Combinations

These intercropping packages consist of a mixture of a cash crop and pineapple. The cash crop is either a vegetable, legume or specialty crops. These combinations are, namely:

- Pineapple/Cabbage
- Pineapple/Callaloo
- Pineapple/Pak choy
- Pineapple/Tomato
- Pineapple/Cow Peas
- Pineapple/Red Peas
- Pineapple/Sorrel

2. The Model

The economic results of pineapple intercropping have been derived from numerous production models. Each model has been constructed for a specific crop combination over a three-year period. The model provides information on total variable costs, total income as well as gross return. An explanation of these economic terms can be found in Appendix II.

Each model covers costs and returns for a one acre (0.4 hectare plot). These costs and returns serve as points of comparison between the packages. Therefore, various crop mixes can be modeled high/low risk, high/low input or high/low return.

2.1 Assumptions

The following assumptions have been applied to the models:

1. Fixed yields and production for pineapple.
2. Constant maintenance costs.
3. Fixed selling prices.
4. All labour is hired.
5. Daily wage rate is $70.00.
6. Land clearing is done on a job basis and costs $5000 per hectare.
7. Weeding is done on a job work basis and costs $2500 per hectare.
8. Yield for pineapple is 4346.75 kilograms each of the last two years.
9. Farmgate price for the pineapple is $11.88 per kilogram for each year.

3. Results

3.1 Data Sources

The results are based on data from HASP's demonstration plot near Riversdale in St. Catherine. The study has also been supplemented with price information from the Databank of the Ministry of Agriculture.

3.2 Technology

The results are based on a medium-level technological package with a medium-resource content of fertilizers and farm chemicals. This technology is labour intensive, with only a capital limited investment of small tools and equipment.

The technology is geared for small farmers and in particular, those farming on the hillsides under rainfed conditions.

The techniques of double-row planting of the pineapple suckers and planting the cash crop in individual holes ensures that soil erosion is minimized. Traditional ways of land preparation, such as forking and ploughing is not recommended to farmers.

3.3 Vegetable Intercrops

3.3.1 Pineapple/Cabbage

As indicated in Table 1, the total production cost for the crop combination for the period is $32,029.69, with approximately 73% being spent in the first year. This combination gives the second highest income of the grouping ($142,482.89).

As shown in Appendix I, the sale of cabbage allows the farmer to recover his start- up costs and earn a gross return in the first year. In fact, he will earn a total return of $110,453.20.

3.3.2 Pineapple/Callaloo

Table 1 shows that the total cost for cultivating this crop combination, is the third lowest of the whole grouping, that is, $29,171.36. Approximately, 73% has been spent on establishing the two crops in the first year.

In terms of revenue, the farmer will receive a total of $119,514.88, the fourth lowest in the grouping. The revenue from the callaloo sales is relatively low and the farmer will end up with a negative gross return in the first year (see Appendix I for more details).

3.3.3 Pineapple/Pak Choy

As shown in Table 1, the total cost is the highest in the whole grouping ($34,370.74). Approximately, 77% has been spent on establishment and operating expenses in the first year.

The total income is the third highest in the grouping ($124,662.88), and as shown in Appendix I, $21,384 of that amount comes from pak choy sales.

TABLE 1

TOTAL COSTS AND INCOME
PINEAPPLE INTERCROPPING PACKAGES

Crop Combination	Establishment Costs $	Total Cost $	Total Income $
Pineapple/Cabbage	23,430.56	32,029.69	142,482.89
Pineapple/Callaloo	21,335.46	30,071.36	119,514.88
Pineapple/Pak Choy	26,671.04	34,370.74	124,662.88
Pineapple/Tomato	23,935.61	32,553.31	171,998.89
Pineapple/Cow Peas	21,159.02	29,758.72	109,704.64
Pineapple/Red Peas	21,586.82	30,186.52	111,293.88
Pineapple/Sorrel	21,338.05	29,934.75	106,768.00

Notes

1. Establishment costs covers the expenses for establishment and maintenance of both crops in the first year.

2. Total cost is the summation of all the costs associated with cultivating the cash crop in year 1, as well as operating expenses for pineapple in years 2 and

3. Total income is the combined income from the sales of both crops, the cash crop in year 1, and pineapple in years 2 and 3.

3.3.4 Pineapple/Tomato

As shown in Table 1, the total cost is $32,553.31, the second highest in the grouping. 73% of that figure goes toward the first-year expenses for both crops.

However, the farmer is able to receive the highest income in the grouping ($171,998.89). As a result, the farmer will be able to earn a positive gross return in year 1, as well the highest gross return.

3.4 Legume Intercrops

3.4.1 Pineapple/Cow Peas

The total cost for cultivating this intercropping is $29,758.72 for the three-year period, which is the lowest of the grouping. About 71% is spent on the first year's expenses of establishment and maintenance.

As shown in Table 1, this combination has the second lowest income, ($109,704.64) from which $6,425.76 comes from the sale of the peas in the first year.

The total return for the farmer should be $79,945.88. He will have a negative gross return in the first year , and be unable to recover his whole investment in that short time.

3.4.2 Pineapple/Red Peas

The total cost for this intercropping is $30,186.52, which is among the lowest costs in the grouping. Like cow peas, 71% has been spent in year 1.

As shown in Table 1, the income is the third lowest in the grouping,(of $111,293.88). Similarly, the revenue from the intercrop is too low to enable the farmer to earn a positive gross return in the first year. Figure 1, shows that it also has one of the lowest gross returns in the grouping.

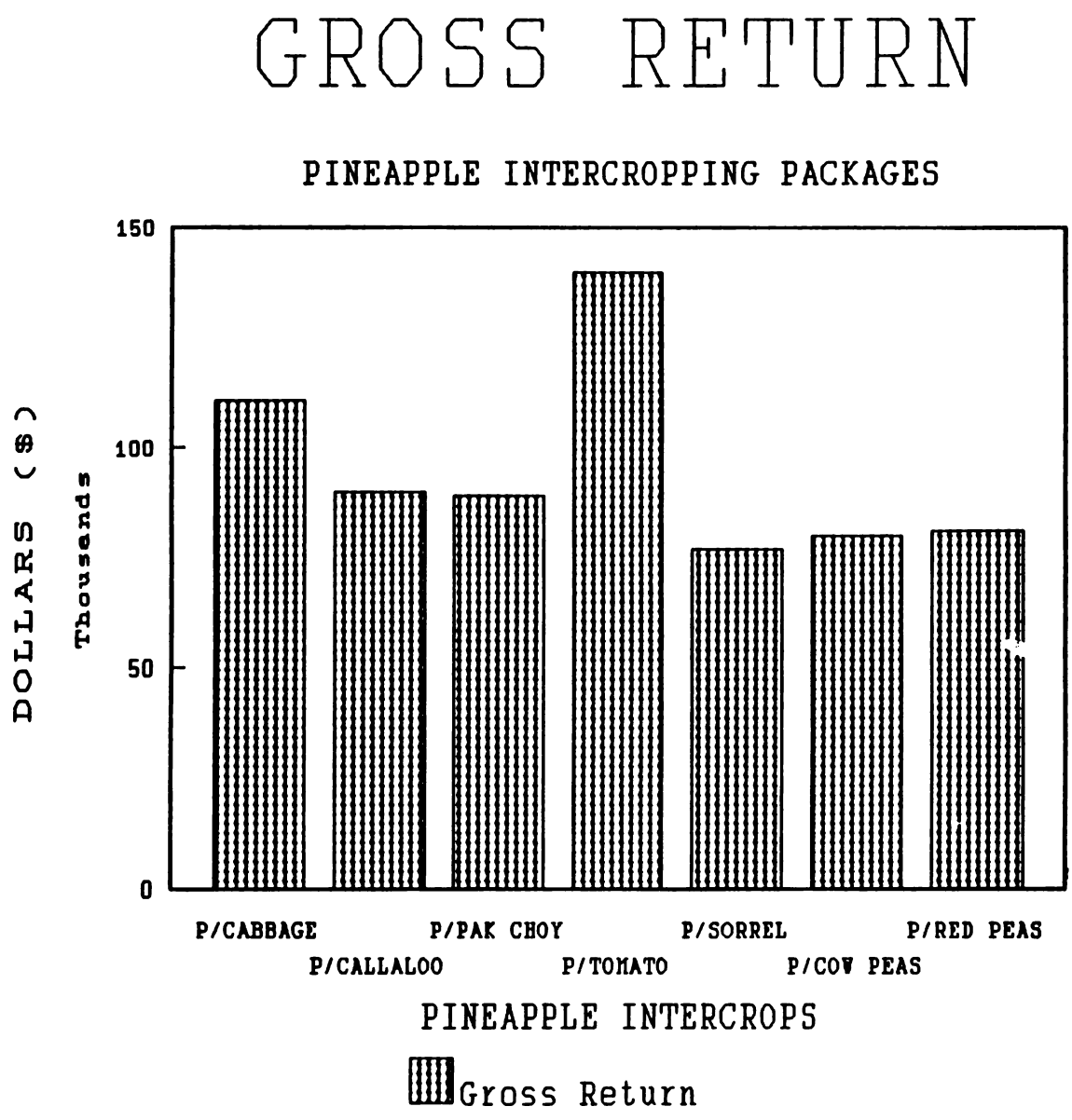
3.5 Other intercrops

3.5.1 Pineapple/Sorrel

The cost, as presented in Table 1, is $29,934.75, which is one of the lowest in the grouping. Approximately 71% has been spent in year 1.

However, this intercropping gives the lowest income in the whole grouping ($106,768.89). The low income of $3,490 that will be received from sorrel sales, results in the farmer earning a negative return in year 1. As shown in Figure 1 ,he will have the lowest total gross return in the grouping.

Figure 1


GROSS RETURN
PINEAPPLE INTERCROPPING PACKAGES
DOLLARS ($)
Thousands
150
100
50
0
P/CABBAGE
P/CALLALOO
P/PAK CHOY
P/TOMATO
P/SORREL
P/COW PEAS
P/RED PEAS
PINEAPPLE INTERCROPS
Gross Return

4. Conclusion

A comparison of the costs and benefits from these various intercropping packages is given in Figure 1. It can be seen that pineapple/tomato package has the highest income and, as shown in the graph, the highest gross return for the three-year period.

By comparison, the pineapple/ cow peas package has the lowest cost and second highest gross return. Pineapple/sorrel has the lowest gross return, even though its costs are relatively low.

There are other intercrops that can offer the farmer higher income and return, namely: cabbage and pak choy.

These results are not surprising as tomato, cabbage and pak choy are high risk crops, particularly subject to the vagaries of weather, pest, disease, and the market. For instance, lower yields should be expected for tomato whenever it is harvested in a hot, wet season while cabbage production is higher when planted in the cooler months.

Therefore, the major factor that affects the overall profitability of the package is the choice of the intercrop.

Although a low -input crop such as sorrel does not contribute heavily to the total cost structure, it still cannot prevent the farmer from getting a negative return in the first year. In the case of cabbage, the situation is reversed; that is, higher costs and income enable him to recover his initial investment within a shorter time.

5. Recommendations

In selecting a suitable crop combination, the farmer should not only take into account the associated costs and returns, but also certain agronomic and marketing factors. The farmer should consider his own particular agro-ecological conditions such as the rainfall pattern, slope, and soil erosion.

As mentioned earlier, certain crops such as cabbage give better yields when planted during specific times of the year. Other crops such as tomato and callaloo can be planted year round. However, the older varieties of tomato, such as Oxheart, are not very heat resistant.

It should be noted that vegetable yields also vary with cultural conditions, growing season, as well as crop management. Furthermore, factors like the days to harvesting vary with the variety, weather conditions and method of propagation.

On the marketing side, there is a seasonal variation in prices over the course of a typical year. Hence, the time that the produce reaches the marketplace is of the utmost importance in determining whether it will experience a glut or a shortage.

There are certain crops that the farmers have little control over planting times, but there are others whose planting times can be adjusted so that the harvest can coincide with periods of higher market prices. These market prices will no doubt influence the prevailing farmgate prices.

In the case of vegetables, the highest prices are obtained in the fourth quarter of the year, also known as the christmas months. For instance , the best prices for cabbage are received between the months, October to December and the lowest are in the March to July period.

The pattern for tomato is the same , with only very slight adjustments attributable to variety. The best prices for Manalucie can be obtained between September to November, while for Roma, they are in August, October and November.

Sorrel prices follow a similiar pattern to that of vegetables, in that the highest prices are in the Christmas months. In fact, it can be considered a Christmas crop as it is one of the main staples of the festive season.

This situation is reversed in the case of legumes, and in particular red peas. With this crop, farmers can get the best prices in February and the lowest in September.

6. SUMMARY

The Hillside Agriculture Sub-Project is developing and promoting various pineapple intercropping packages to fulfill the purposes of soil conservation, improvements in farm income, better short-term cash flows for small farmers, as well as ensuring greater risk diversification.

The intercrops that are proving to be agronomically compatible with pineapple are cabbage, callaloo, pak choy, tomato, cow peas, red peas and sorrel.

It should be noted that the results are based on project experiences related to a medium-resource technology which is not capital intensive. The double-row planting of the pineapple, as well as the planting of cash crop in individual holes, should guarantee maximum production on the hillsides.

In order to evaluate the profitability of these crop combinations , a three-year model has been developed with certain assumptions of constant yields, farmgate prices and operating expenses.

In terms of profitability, the vegetable based intercroppings have the highest cost, but also the highest combined income as well as return to management. Pineapple/ pak choy ranked as the highest cost combination, while tomato and cabbage have higher incomes.

Sorrel and the two legumes have the lowest production costs, but also the lowest income and returns. With these various intercroppings, the farmer will be unable to recover his initial investment in the first year.

However, the farmer should not be guided only by costs and returns when selecting the most appropriate crop combination. Other factors that should be considered in his decision include selling price, best market times, crop husbandry practices and planting times as well as his unique agro-ecological conditions.

7. APPENDIX I

PRODUCTION MODELS
PINEAPPLE INTERCROPPING PACKAGES

The results of the study are given earlier in the report. In this section, the individual production models, upon which the study has been based, are presented. There is a production model for each crop combination outlining certain variables such as variable costs, income, gross return, cost per area as well as cost per kilogram. The models are presented in this order :

TABLE 2 - COST OF PRODUCTION : PINEAPPLE/CABBAGE 0.4 HA(1ACRE)

ITEM	RATE	QUANTITY	YEAR 1 $	YEAR 2 $	YEAR 3 $	TOTAL $
A.ESTABLISHMENT COSTS						
I. Labour						
Land clearing	$5000/ha.	0.4	2000.00			2,000.00
Lining	$70/day	6.0	420.00			420.00
Furrow prep.	$2500/ha.	0.4	1000.00			1,000.00
Sucker prep.	$70/day	6.0	420.00			420.00
Planting	$70/day	36.0	2520.00			2,520.00
Herbicide appl.	$70/day	16.6	1092.00			1,092.00
Seed bed prep.(i)	$70/day	0.5	35.00			35.00
Seed bed irrigation(i)	$70/day	7.0	490.00			490.00
Seed bed spraying (i)	$70/day	4.5	315.00			315.00
Hole-digging (i)	$70/day	20.0	1400.00			1,400.00
Transplanting (i)	$70/day	20.0	1400.00			1,400.00
Fertilizer appl. (i)	$70/day	10.0	700.00			700.00
Weed and mould (i)	$70/day	15.0	1050.00			1,050.00
Pesticide appl. (i)	$70/day	13.0	910.00			910.00
Harvesting (i)	$70/day	7.0	490.00			490.00
II. Materials						
Pineapple suckers	$1/each	5000.0	5000.00			5,000.00
Hyvar-x Herbicide	$1617/1.8kg.	0.6	970.54			970.54
Cabbage Seed (i)	$830/.1kg.	2.0	1660.00			1,660.00
NPK11:22:22 Fertilizer-i	$215.87/50kg	15.0	3238.00			3,238.00
Dithane Fungicide (i)	$77/0.45kg	0.1	7.70			7.70
Malathion Insecticide-i	$121.8/lit.	0.7	85.30			85.30
SUB-TOTAL			18891.55			18,891.55
B. Operating Expenses						
I. Labour						
Weeding	$2500/ha.	0.4	1000.00	1000.00	1000.00	3,000.00
Fertilizer appl.	$70/day	4.0	280.00	280.00	280.00	840.00
Rat Bait appl.	$70/day	6.0	420.00	420.00	420.00	1,260.00
Harvesting	$70/day	15.0		1500.00	1500.00	3,000.00
II. Materials						
Rat Bait	$22.7/0.45kg	3.0	68.10	68.10	68.10	204.30

TABLE 7 - COST OF PRODUCTION : PINEAPPLE/RED PEAS 0.4 HA(1ACRE)

ITEM	RATE	QUANTITY	YEAR 1 $	YEAR 2 $	YEAR 3 $	TOTAL $
SUB-TOTAL			2,227.14	3,727.14	3,727.14	9,681.42
C. Other charges						
Contingency 10%(A+B)			1,956.64	372.71	372.71	2,702.06
Land Charges	$500/ha.	0.4	200.00	200.00	200.00	600.00
SUB-TOTAL			2,156.64	572.71	572.71	3,302.06
D. TOTAL COST			21,723.02	4,299.85	4,299.85	30,322.72
E. Revenue-pineapple				51,639.44	51,639.44	103,278.88
F. Revenue-intercrop			8,015.00			8,015.00
H. GROSS INCOME			8,015.00	51,639.44	51,639.44	111,293.88
I. Gross Return (H - D)		1	(13,708.02)	47,339.59	47,339.59	80,971.16

* (I) = Intercrop

Assumptions used in the model

1. There is only one cycle of planting per year for the intercrop, and this takes place in year 1 .

2. The average yield for pineapple in years 2 and 3 is 4,346.75 kilograms.

3. The average farmgate price for pineapple is $11.88 per kilogram both in years 2 and 3.

4. The average yield for the intercrop, red peas in year 1, is 240 kilograms.

5. The average farmgate price for the intercrop, red peas in year 1, is $33.40 per kilogram.

TABLE 8 - COST OF PRODUCTION : PINEAPPLE/SORREL 0.4 HA(1ACRE)

ITEM	RATE	QUANTITY	YEAR 1 $	YEAR 2 $	YEAR 3 $	TOTAL $
A.ESTABLISHMENT COSTS						
I. Labour						
Land clearing	$5000/ha.	0.4	2000.00			2,000.00
Lining	$70/day	6.0	420.00			420.00
Furrow prep.	$2500/ha.	0.4	1000.00			1,000.00
Sucker prep.	$70/day	6.0	420.00			420.00
Planting	$70/day	36.0	2520.00			2,520.00
Herbicide appl.	$70/day	16.6	1092.00			1,092.00
Seed bed prep.(i)	$70/day	0.5	35.00			35.00
Seed bed irrigation(i)	$70/day	10.0	700.00			700.00
Seed bed spraying (i)	$70/day	4.5	315.00			315.00
Hole-digging (i)	$70/day	7.0	480.00			480.00
Transplanting (i)	$70/day	10.0	700.00			700.00
Fertilizer appl. (i)	$70/day	2.0	140.00			140.00
Weed and mould (i)	$70/day	14.0	980.00			980.00
Pesticide appl. (i)	$70/day	13.0	910.00			910.00
Harvesting (i)	$70/day	3.0	210.00			210.00
II. Materials						
Pineapple suckers	$1/each	5000.0	5000.00			5,000.00
Hyvar-x Herbicide	$1617/1.8kg.	0.6	970.54			970.54
Sorrel Seed(i)	$20/0.11 kg.	0.2	4.00			4.00
NPK11:22:22Fertilizer-i	$215.87/50kg	5.0	1075.00			1,075.00
Dithane Fungicide (i)	$77/0.45kg	0.1	7.70			7.70
Malathion Insecticide-i	$121.8/lit.	0.7	85.30			85.30
SUB-TOTAL			17059.54			17,059.54
B. Operating Expenses						
I. Labour						
Weeding	$2500/ha.	0.4	1000.00	1000.00	1000.00	3,000.00
Fertilizer appl.	$70/day	4.0	280.00	280.00	280.00	840.00
Rat Bait appl	$70/day	6.0	420.00	420.00	420.00	1,260.00
Harvesting	$70/day	15.0		1500.00	1500.00	3,000.00
II. Materials						
Rat Bait	$22.7/0.45kg	3.0	68.10	68.10	68.10	204.30

TABLE 8 - COST OF PRODUCTION : PINEAPPLE/SORREL 0.4 HA(1ACRE)

ITEM	RATE	QUANTITY	YEAR 1	YEAR 2	YEAR 3	TOTAL
			$	$	$	$
NPK 16:5:19 Fertilizer	$117.06/50kg,	2.0	358.12	358.12	358.12	,074.36
Mancozeb Fungicide	$3042.1/25l.	0.01	30.42	30.42	30.42	91.26
Basudin Insecticide	$235/20 lit.	0.3	70.50	70.50	70.50	211.50
SUB-TOTAL			2,227.14	3,727.14	3,727.14	9,681.42
C. Other charges						
Contingency 10%(A+B)			1,928.67	372.71	372.71	2,674.09
Land Charges	$500/ha.	0.4	200.00	200.00	200.00	600.00
SUB-TOTAL			2,128.67	572.71	572.71	3,274.09
D. TOTAL COST			21,415.35	4,299.85	4,299.85	30,015.05
E. Revenue-pineapple				51,639.44	51,639.44	103,278.88
F. Revenue-intercrop			3,490.08			3,490.08
H. GROSS INCOME			3,490.08	51,639.44	51,639.44	106,768.96
I. Gross Return (H - D)			(17,925.27)	47,339.59	47,339.59	76,753.91

* (I) = Intercrop

Assumptions used in the model

1. There is only one cycle of planting per year for the intercrop, and this takes place in year 1 .

2. The average yield for pineapple in years 2 and 3 is 4,346.75 kilograms.

3. The average farmgate price for pineapple is $11.88 per kilogram both in years 2 and 3.

4. The average yield for the intercrop, sorrel in year 1, is 3,490.08 kilograms.

5. The average farmgate price for the intercrop, sorrel in year 1, is $14.55 per kilogram.

APPENDIX A1

A GLOSSARY OF ECONOMIC TERMS AND DEFINITIONS

This section explains the definitions and terms [1] that are found throughout the report, and are listed below :

Gross Return : Also known as return on farmers' capital and management; this is the gross income minus total variable costs.

Variable Costs : Cost of labour inputs used in the production and harvesting of the crop. These costs do not include interest on cash used up in the production process (that is, the return on investment in operating capital).

Total Income : Also known as gross income; the crop yield per acre, or 0.4 hectare, times the farmgate price.

1

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[1] Many of these terms have been derived form the IICA/MINAG Farm Management publication, Cost of Production of Food Crops (1990)

9. REFERENCES

- Hillside Agriculture Sub-Project
  Pineapple pamphlet (draft 1993).

- IICA/Hillside Agriculture Sub Project
  Wholesale Price Variations for Coronation Market
  (Internal document, n. d.))

- IICA/MINAG (Farm Management Section)
  Cost of Production of Food Crops St. Catherine (1990)

- P. Maitland
  The Farmers' Almanac 1990 (1990)

NOTES

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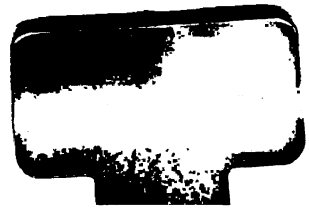

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