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PINEAPPLE CULTIVATION FOR SMALL HILLSIDE FARMERS IN ST. CATHERINE PARISH: AN INTERVENTION CASE STUDY

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PINEAPPLE CULTIVATION FOR SMALL HILLSIDE FARMERS IN ST. CATHERINE PARISH: AN INTERVENTION CASE STUDY

The purpose of this bulletin is to describe a pineapple cultivation intervention strategy designed by the Hillside Agriculture Sub-Project (HASP) field personnel with cooperation from a farmer in St. Catherine parish. The intervention had as its goal to enhance small-farmer well-being through improved pineapple productivity, intercropping, and soil conservation measures.

INTRODUCTION

The pineapple, *Ananas comosus* (L.) Merr., probably originated in tropical South America. However, Columbus returned to Spain with specimens of the fruit and reported that the Carib Indians cultivated pineapple in the West Indies (Purseglove, 1985). In Jamaica today, many small farmers cultivate pineapple as a component of their traditional, mixed-cropping systems. In the northern sector of St. Elizabeth and in areas of Portland, pineapples are grown commercially. Pineapples are sold in the local markets and to companies for processing into juice or canned fruit.

PINEAPPLE VARIETIES

The main varieties of pineapple grown in Jamaica are Sugar Loaf, Red Spanish, Ripley and Smooth Cayenne (Ministry of Agriculture, 1979). Because of its conical shape, the Sugar Loaf is not used for canning but is popular in the local, fresh fruit market for its rich, sweet flavor. The Red Spanish variety is accepted by both pineapple processors and the local market. However, the Smooth Cayenne is the variety preferred by commercial growers as well as by processors because of the combination of good flavor, lack of spines and the square shape of the fruit. A relatively new cultivar developed in Puerto Rico is a hybrid between Red Spanish and Smooth Cayenne, PR1-67, which is considered to have good commercial production potential in Jamaica (AGRO 21, 1986).

PINEAPPLE RESEARCH

Very little documentation could be found concerning research on pineapple production for small, resource-limited farmers in Jamaica. However, two pineapple related research projects were underway while the HASP pineapple intervention demonstration reported here was active.

The Rural Agricultural Development Authority (RADA) began research in 1992 on intercropping pineapple with coconut trees. This experiment, which was supervised by Mrs. Edie Gidden, RADA Subject Matter Specialist, used a polyethene mulch as

a means of controlling weeds. Results of this research were unavailable at the time of this publication. Soil erosion trials were established in June, 1992, by Mr. Vincent Campbell, Director, Rural Physical Planning Division, Ministry of Agriculture, at the HASP pineapple intervention demonstration plot. The purpose of this research was to determine the amount of erosion using various pineapple spacings and mulching practices. Results of this research were unavailable at the time of this publication.

Farming systems work using pineapple barriers, continuous mounds, and minimum tillage as soil conservation measures in the Guys Hill and Watermount areas was carried out by the Ministry of Agriculture from 1985-86. A publication summarizing this work is listed in the references.

More recently, Hutton (1992) reports on the influence of rainfall on nematode population fluctuations on pineapples.

TRADITIONAL PINEAPPLE CULTIVATION IN JAMAICA

In general, small farmers grow pineapples in their traditional mixed-cropping system because the crop requires relatively low expenditures of time and materials; can be easily and successfully intercropped with various crops; and the growing period to reach the final product is consistent with the traditional farming strategy of maintaining a constant cash-flow.

The spatial arrangement of pineapple plants in the traditional farming system is generally varied (Figure 1). The general practice is that of individual pineapple plants scattered throughout a mixed cultivation. Farmers' explanation of this practice is that they are not interested in growing more than a few pineapples and that this is the easiest way to manage a small number of plants.

Another practice is to use the pineapple plant as a living-fence. Living-fences are used to delineate farmers' property and/or to act as a barrier to keep people and animals from entering certain areas. Using pineapple as a living-fence takes advantage of the thorny nature of the plant. Finally, another practice observed is that of planting single rows of pineapples, including various spacings, along hillside contours in an effort to control soil erosion. Similarly pineapples can be observed planted in single rows, including a range of spacings, without concern for soil erosion.

Small farmers generally do not apply fertilizers, herbicides or pesticides to the pineapple crop. However, they occasionally hand-weed around the plants. In general, farmers' practices in pineapple cultivation result in variable yields and quality of fruits.

PINEAPPLE CULTIVATION INNOVATION FOR SMALL FARMERS

The objectives of designing and implementing an innovation for the cultivation of pineapple by small farmers were four-fold:

1) *To facilitate intercropping with short-term cash crops. This was achieved using a field design which gave a wide spacing between double rows, thus allowing intercropping;*

2) *To increase pineapple production by introducing high density plantings within the double rows. The high density planting was actually within the recommended spacing for commercial pineapple cultivation, but was considered high density when compared to the spacing used by small farmers;*

3) *To enhance soil conservation, since pineapples were cultivated in rows across the land contour; and*

4) *To show area farmers how to implement the above innovations, and how to apply the Ministry of Agriculture recommended cultural practices of weed control and fertilization as detailed in the pamphlet "Pineapple growing in Jamaica."*

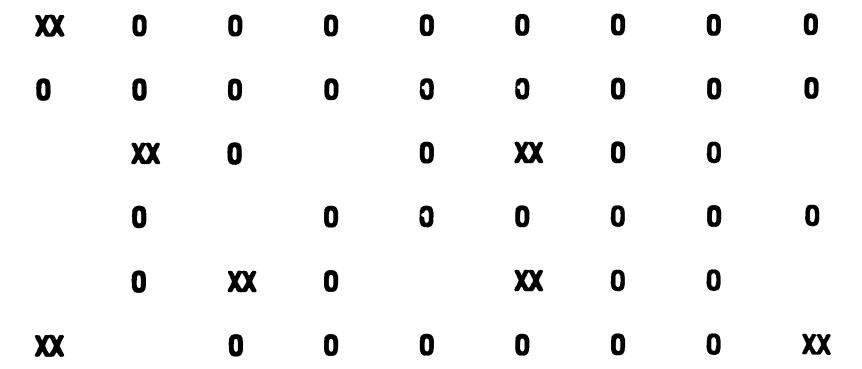

Figure 1. Spatial arrangement of pineapple plants in the traditional farming system.

INNOVATION METHODOLOGY AND CULTURAL PRACTICES

Land preparation: The land was cleared of all debris and lined-out, following the contour. Along the contours, furrows were constructed 0.6 m wide and 1.5 m apart. This was done by using a fork to invert the top 30 cm of soil resulting in a ridge and furrow formation (Figure 2).

Planting material: The basal suckers from mature pineapple plants were recommended for use as planting material (Figure 3). Each basal sucker was stripped of dead leaves and unhealthy tissue. The base of each sucker was then dipped in a fungicide and insecticide mixture (Figure 4). The recommended mixture for 5 gallons of water was 75 cubic cm of the insecticide Basudin and 170 g of the fungicide Mancozeb. After dipping, the suckers were allowed to dry for 15 minutes.

Planting: Each bed contained 2 rows spaced 0.6 m apart. The rows were spaced 1.5 m apart and the suckers planted 30 cm apart and staggered to give a triangular formation (Figure 5). The suckers were planted so as not to cover the central bud. Suckers were planted in double rows in the furrows and not on the ridges as is the traditional crop practice. The two rows were staggered so that the plants alternated. The companion crop (intercrop) was planted on the ridge between the double rows.

Fertilization: One application of fertilizer (N-P-K) was applied to the pineapple plants at the beginning of each rainy season, approximately April-May and October-November. The first application was applied 6 to 8 weeks after planting, the time when feeder roots should be established. The fertilizer was applied at a rate of 113 g of 16-5-19 per 4 plants. In local farming standards, this worked out to approximately 1 condensed milk-can of fertilizer for every 8 pineapple plants. The fertilizer was placed just outside the leaf area of the plants. It must be realized that for every locality the soil analyses will help determine fertilization needs.

Weed control: Weed control was carried out with Hyvar X, a pre-emergence herbicide, used at preplanting and a few weeks after planting. The recommended label requirements for pineapple were followed. Cost of this material may be beyond the means of small farmers and more hand-weeding may need to be substituted. Also, because of possible residual effects on following crops, attention should be given to timing applications of the herbicide so that the active ingredients dissipate simultaneously with the termination of pineapple cultivation.

Farmers may find that hand-weeding, though labor intensive, is preferred after the first herbicide treatment. Equipment recommended for hand-weeding are heavy-duty, long sleeve gloves and some form of eye protection. Weeding is recommended when weeds begin to out-compete for sunlight and root space.

Harvesting: Pineapples should be harvested depending on the market. For local markets, fruits may be picked from 1/4 to 1/2 colored. For export, fruit should be picked mature green or just showing light yellow at the base. The Ministry of

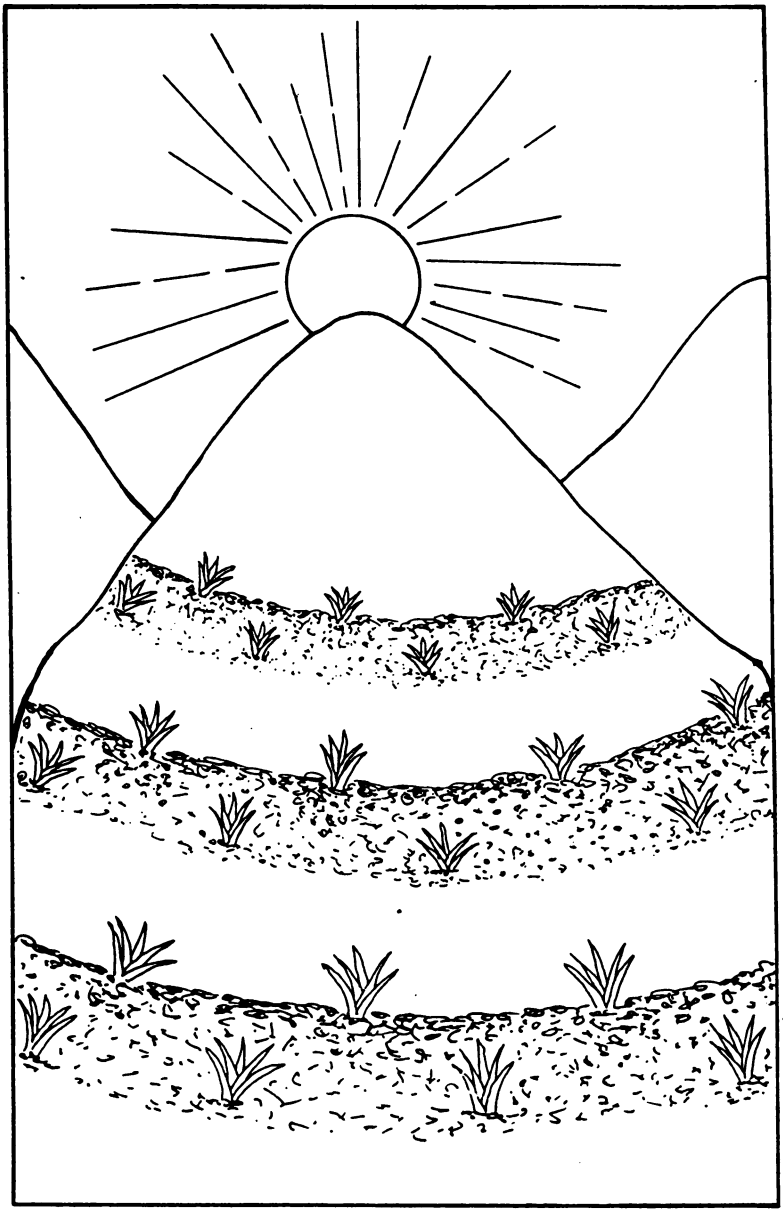

Figure 2. Field layout and plant arrangement along the land contour.

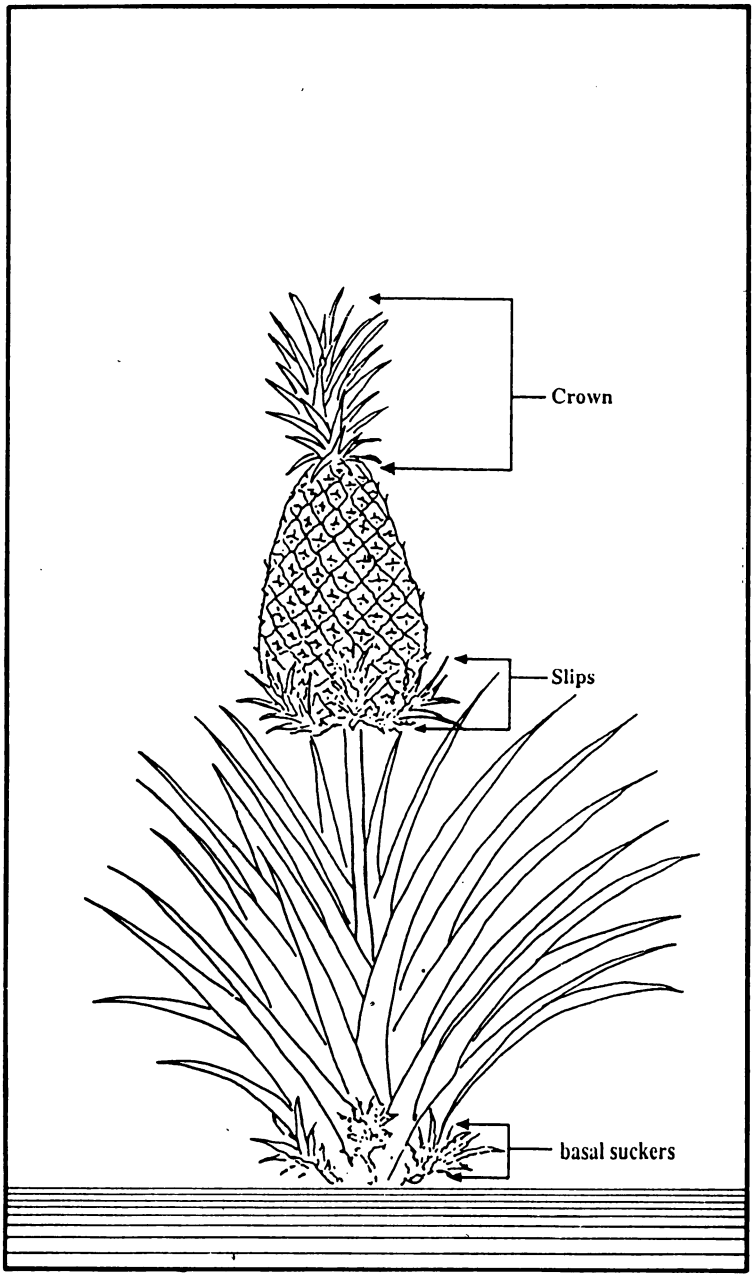

Figure 3. Pineapple plant showing basal suckers and slips.

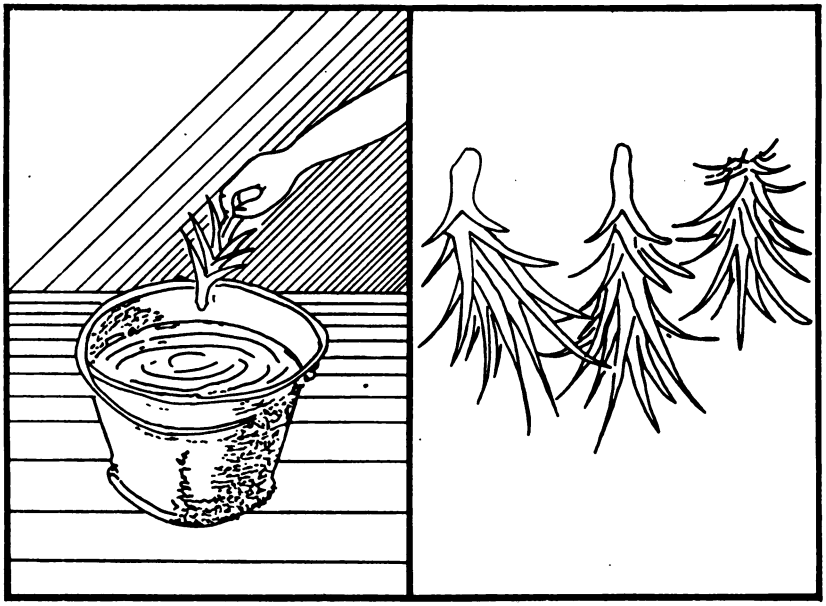

Figure 4. Preparation of planting material.

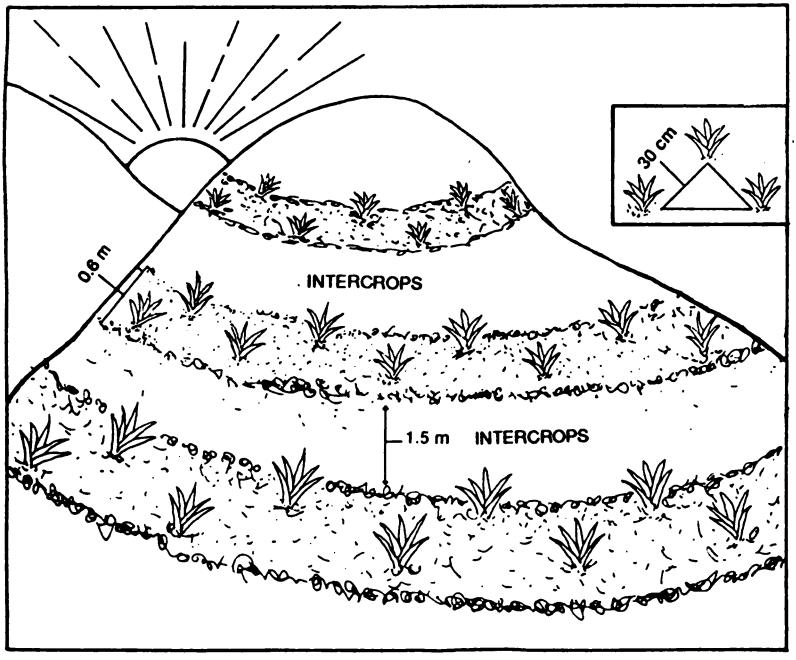

Figure 5. Arrangement of pineapple suckers in the field, showing spacing in beds and between beds.

Agriculture provides standards for grades of pineapples (MINAG, 1986). Since the plants vary in the rate of ripening, farmers have an extended harvesting period. This extended harvest period reduces the demand on labor, allowing the farmer to gradually harvest the crop. Fruits should be harvested carefully to minimize damage.

Potential for intercropping: A major basis for establishing a wide spacing of 1.5 m between pineapple beds was to provide an area for intercropping. The purpose of intercropping was to facilitate the traditional strategy of maintaining a cash-flow. While waiting for the pineapple crop to mature, farmers have the option of intercropping with cash crops. The choice of crops depends on the farmers desire and expertise. Recommended crops include:

Cabbage	*Brassica oleracea* L.
Callaloo	*Amaranthus spp.*
Pak choi	*Brassica chenensis* L.
Peanut	*Arachis hypogaea* L.
Cow peas	*Vigna unguiculata* (L.) Walp
Red peas	*Phaseolus vulgaris* L.
Sorrel	*Hibiscus sabdariffa* L. var. *sabdariffa*
Tomato	*Lycopersicon esculentum* (L.) Karst.

It is recommended that only 1, or possibly 2, short term crops be planted since the pineapple canopy soon covers and shades the intercropped area between the double rows.

CASE STUDY

INTRODUCTION:

In August, 1990, a farmer was selected to demonstrate the pineapple intervention package described above. The following provides detailed information on the farmer's site characteristics, the management practices he adopted (and adapted) as well as the rationale for his actions.

Location: The site was located at approximately 76° 58'N longitude and 18° 11'W latitude, approximately 2.5 miles northeast from the village of Riversdale in the community known as Harewood, in the Parish of St. Catherine. In January, 1993, the field had the following characteristics:

Main cultivation: *Ananas comosus* var. *Sugar Loaf*
Altitude: 200 m
Aspect: 360°N
Slope: 27%
Area: 0.12 ha

Soil Type: The soil type was undetermined but was in association with Flint River sandy loam. The soil color was brown. When dry the soil was friable. At 2 locations on the site the land had slipped and then eroded when the field was being established. On these eroded areas a terraced barrier was constructed of bamboo and later planted with a single row of pineapple in an effort to halt the erosion.

Land History: Before 1988, yams *Dioscorea* spp., and the traditionally associated crops (red peas, *Phaseolus vulgaris* L.; cow peas, *Vigna unguiculata* (L.) Walp; corn, *Zea mays* L.; cocoyam, *Colocasia esculenta*(L.) Schott) were cultivated on the land. It was assumed that the yam/fallow cycle (planting yams on the land for 2 years followed by a fallow period of from 2 to 7 years) had been followed for at least two decades or longer.

From approximately March, 1988 to August, 1990, the land was in a grass fallow. In August, 1990, the land was prepared and planted for the pineapple demonstration trial. The pineapple field had been harvested once and was to be harvested a second time in early 1993.

Crop management: The farmer choose to cultivate this particular field because it was the only field he had available at the time. The pineapple variety, Sugar Loaf, was chosen because the farmer knew it grew well in the area and because it was the only stock material available in large enough quantity to plant the field. The farmer elected not to intercrop short-term crops in this field until he had observed the pineapple innovation. However, another farmer who had adopted the spacing design and established a field in October, 1992, intercropped his pineapple field with sorrel, *Hibiscus sabdariffa* L., and reported a successful sorrel harvest in December, 1992.

TECHNOLOGY DIFFUSION AND ADAPTATION

By 1993, several farmers in the area had adopted and adapted the pineapple intervention technology. Adaptation included 2 farmers using single rows of pineapple but following the increased planting density and allowing for a wider intercropping spacing between the rows. The original collaborating farmer adapted the pineapple intervention to accommodate a mixed intercropping of long-term crops in another field. The long-term intercropped species used were:

yam	*Dioscorea spp.*
banana	*Musa (AAA Group)*
papaya	*Carica papaya* L.
cassava	*Manihot esculenta* Crantz
coco yam	*Colocasia esculenta* (L.) Schott

ECONOMIC ANALYSIS

COSTS OF PRODUCTION

A. PURE STAND:

A production cost model for pineapple is presented in Table 1. This model outlines the various labor and material input costs associated with the establishment and maintenance of the project's 0.12 hectare plot as well as the crop's selling price, sales revenue and gross return on the farmers' total investment.

As shown in the model, total cost for the 3-year period was $12,344.56. From that amount, $5,450.00 was spent on plot establishment and an additional $1,678.66 for operating expenses in the first year. However, variable costs (that is, operating costs plus other charges) remained constant at $2,226.00 for the 2 following years (see part d). It should be noted that the labor costs took into account both the costs of hired labor as well as the current value of the farmer's labor contribution.

Although not indicated in the model, the average yield for each of the 2 years of harvesting was 1,397 kilograms and the average selling price $7.18 per kilogram. Therefore, the plot generated revenue averaging $10,030.46 per year (see part e).

In terms of the investment return, (see part f) the farmer earned a gross margin of $7,803.94 for each of the remaining 2 years. However, after recovering the amount spent for first-year costs, he was left with a total of $7,716.36 at the end of the three-year period, which compensated him for the use of his labor and management.

Based on the project, it was determined that the production costs for pineapple utilizing this technological package was $4.42 per kilogram (or $2.00 per pound). This is higher than the published figure of $1.80 per kilogram (or $0.82 per pound) from the Farm Management unit of the Ministry of Agriculture. However, under the innovation the farmer still earned a gross return of $2.76 per kilogram ($1.25 per pound).

Table 1
Cost of Production and Returns
for Pineapple
per 0.12 ha.

Activity	Year			Total
	1	2	3	
	$	$	$	$
a. Establishment cost	5,450.00	—	—	5,450.00
b. Operating expenses	1,678.66	1,978.66	1,978.66	5,635.98
(i) labor	1,260.00	1,560.00	1,560.00	4,380.00
(ii) materials	418.66	418.66	418.66	1,255.98
c. Other charges	762.86	247.86	247.86	1,258.56
d. Total variable costs	7,891.50	2,226.52	2,226.52	12,344.56
e. Revenue (a+b+c)	—	10,030.46	10,030.46	20,060.92
f. Gross Margin (e-d)	(-7,891.50)	7,803.94	7,803.94	7,716.36

Density : 2,400 plants/0.12 ha.

Assumptions Used in Model

1. 'Other charges' consist of a land charge of $500 per hectare and a contingency charge of 10% of establishment and operating expenses.
2. Gross margin = revenue — total variable costs, where the revenue is the farmgate price times yield (1,397 kg. x $7.18 per kg.)

B. PINEAPPLE INTERCROPPING PACKAGE :

In Table 1, pineapple production costs are presented for a 0.12 hectare, pure stand model, which are based on actual experiences during 1990-1992. As the project is also interested in intercropping packages for small, hillside farmers, a production cost model for a 3-year period has been developed for a 0.4 hectare (1 acre) plot of pineapple intercropped with tomato. The costs and returns of the HASP demonstration plot have been extrapolated to a 1 acre unit of cultivation in order to assess the profitability of the intercropping package. For the sake of consistency, metric measurements will continue to be used.

Costs are higher due to the inclusion of the cash crop. Also, changes in the Jamaican economy create increases in many input prices. For instance, the wage rate in the project area averaged $30.00 for a day in mid-1990, but increased to $70.00 in early 1993.

The cost model for the pineapple/tomato combination, as shown in Table 2, indicates that the total production cost is $32,553.31. Subsections a (i) and (ii) as well as b (i) and (ii) give a breakdown of establishment costs for both pineapple and tomato. Approximately 74% of the total variable costs covers the establishment costs for both pineapple and tomato.

However, the farmer has the potential to earn $68,720.00 from the sale of tomato in the first year, and $51,639.44 from pineapple sales in both the second and third year after planting. Hence, the total income at the end of the period will be $171,998.89.

As shown in part (f) of the table, tomato should provide a positive gross return of $44,766.49 in the first year. At the end of the three-year period, the farmer should earn a total gross return of $139,445.58.

It should be noted that tomato is a high-risk crop especially 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.

Finally, the major factor that affects the profitability of the intercropping package is the choice of intercrop. Tomato adds only $6,015.36 to the overall production cost, but increases total income by over $60,000.00.

Table 2
Estimated Production Costs and Returns
for pineapple/tomato intercropping per 0.4 ha (1 acre)

Activity		Year			Total
		1	2	3	
		$	$	$	$
a.	Establishment cost — pineapple	13,422.54	—	—	13,422.54
	(i) Labor	7,452.00	—		
	(ii) Materials	5,970.54	—	—	
b.	Establishment cost — tomato	5,944.51	—	—	5,944.51
	(i) Labor	4,480.00	—		
	(ii) Material	1,464.51	—		
c.	Operating expenses	2,227.14	3,727.14	3,727.14	9,681.42
d.	Other charges	2,359.42	572.71	572.71	3,504.85
e.	Total variable costs (a+b+c+d)	23,953.61	4,299.85	4,299.85	32,553.31
f.	Revenue	68,720.00	51,639.44	51,639.44	171,998.89
g.	Gross margin (e-f)	44,766.49	47,339.59	47,339.59	139,445.58

Density : 5,000 plants/0.4 ha.

Assumptions used in model

1. Land clearing costs $5,000.00 per hectare and $2,500.00 per hectare on a job work basis.
2. The daily wage rate is $70.00.
3. Maintenance costs and yields as well as the selling prices will remain constant over the remaining two years.
4. The yield for pineapple is 4,346.75 kilograms per hectare and selling price is $11.88 per kilogram, for both the second and third year.
5. There is one crop of tomato in year 1.
6. The yield for tomato is 3,639.84 kilograms per hectare and selling price is $18.88 per kilogram in the first year.

SUMMARY

In this bulletin the practices of small farmers growing pineapple in traditional mixed intercropping systems were described. A farmer in collaboration with HASP personnel helped design and implement a pineapple cultivation intervention which was demonstrated on-farm in the harewood community. Pineapple production was shown to be a profitable enterprise for the small farmer even without the intercropping component.

The pineapple intervention was adapted by a farmer who claims to have successfully planted sorrel as a short-term crop. Several farmers adapted the intervention with an emphasis on intercropping long-term crops.

FURTHER RESEARCH

1. ***The effect of an intercropping component and the resulting planting density and spatial arrangement on size, quality and yield of pineapple.***
2. ***Pineapple response to various levels, types and timing of fertilizer application in mixed cropping systems.***

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