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HILLSIDE AGRICULTURE

SUB-PROJECT

(HASP)

On-Farm Coffee (*Coffea arabica* var. *typica*)
Fertilizer Trials
For Small Hillside farmers
In The Parish of St. Catherine

C. Reid, E. Pinnock, H. Demetrius
Jamaica, W.I.

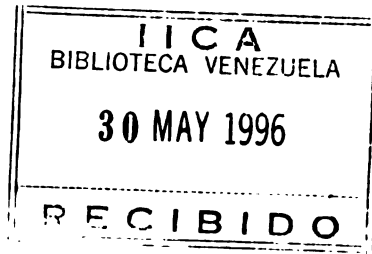
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Abstract of Research Presented to the Hillside Agriculture Project (HAP) in Partial Fulfillment of Requirements for the Hillside Agriculture Sub-Project (HASP)

**ON-FARM COFFEE (*Coffea arabica* var. *typica*) FERTILIZER TRIAL
FOR SMALL HILLSIDE FARMERS
IN THE PARISH OF ST. CATHERINE, JAMAICA**

By

**Charles Reid, HASP Technical & Administrative Coordinator,
and E. Pinnock and H. Demitrius, Agronomist**

November, 1993

This report provides a description and analysis of investigations of *Coffea arabica* var. *typica* out-planted in May and December, 1992, and grown under local farm conditions in the region of Redwood in the Parish of St. Catherine, Jamaica. A randomized complete block design was used to control variability in field conditions. Data was collected on stem diameter, height, and was intended to include time to flowering and production. Analysis of variance was used to determine the diameter differences. The treatments were:

- T1: Spacing of 3 x 1.5 m with one seedling/hole planted with no fertilizer applications,
- T2: Spacing of 3 x 1.5 m with two seedlings/hole planted with 0.23 kg of 6-18-27 and 3.6 kg of bioganic fertilizer (Coffee Industry Board, 1986),
- T3: Spacing of 1.5 x 1.5 m with one seedling/hole planted with 0.11 kg of 6-18-27 and 2.3 kg of bioganic,
- T4: Spacing of 3.0 x 1.5 m with two seedlings/hole planted with 0.11 kg of 6-18-27 and 2.3 kg of bioganic.

There were no significant differences among the treatments 1.5 and 2 years after planting. However, there was an indication that Treatment 1 (no fertilize application) was growing at a slower rate than the other treatments. While there were no significant differences among the treatments, there were differences in treatment responses between sites. Sites were consistently ranked with the Logan site in Red Wood growing the largest diameter plants followed by McLaggon. The plants at Blackman grew the smallest diameter plants. No explanation could be proposed for this difference by the researcher, either by looking at the differences in the site characteristics or by observations at the site.

Further research data needed to be collected to determine differences in the time to flowering and the amount of production. At this time no conclusions were possible.

INTRODUCTION

The Hillside Agriculture Sub-Project (HASP) managed by the Ministry of Agriculture's Research and Development Division (R&DD) and the Inter-American Institute for Cooperation in Agriculture (IICA) was contracted by the Hillside Agriculture Project (HAP) in partnership with the United States Agency for International Development (USAID) to provide support to the HAP. The objective of the Hillside Agriculture Project was to facilitate small hillside farmers to improve the production capabilities of the traditional hillside farming systems, manage soil erosion and fertility, protect the environment and to improve the living standards in farming communities (Suah, 1992). Through the HASP, selected technologies representing potential interventions were compared to local farming practices. The research methodology utilized was part of a Farming System Research and Extension (FSR/E) approach employed by HASP to identify possible solutions to some local farming constraints.

Reason for Coffee (Coffea L.) Establishment and Early Production Trials

A rapid rural appraisal of the project area by the HASP team revealed that farmers had a strong interest in growing coffee. However, farmers indicated that they had limited knowledge pertaining to the use of fertilizers on coffee and did not particularly agree with the establishment recommendations of the Coffee Industry Board (CIB).

Investigating coffee establishment was attractive to the project personnel because it potentially satisfied several stated objectives of HAP. First, coffee was a relatively fast growing shrub which provided soil protection with a dense leaf canopy and anchored soil with a dense root system. Secondly, coffee cultivation had a tested history of productive intercropping with banana (*Musa* (AAA Group)), papaya (*Carica papaya* L.), annonas (*Annona* sp.), timber, fruit and multipurpose trees, as well as with vegetables and some root crops. Therefore, coffee was considered to be readily adaptable to the local tradition of intercropping. Finally, coffee establishment and maintenance was considered relatively easy, inexpensive and with good potential for increasing economic returns for local farmers.

Objective and Justification

The objective of the study was to determine if there were differences in growth and early production of coffee using three varied methods of establishment. The results were intended to provide extension agents, local farmers and researchers with information to better advise small hillside farmers on the early response of coffee to various establishment practices.

METHODOLOGY

Farmer Participant Selection

Farmers were nominated for participation in the research by the Farmers Action Committee Team (FACT) in cooperation with HASP agronomist. Selection criteria included farmers that 1) were active members of the local FACT organization, 2) had crop land on a slope, 3) had a homogeneous area large enough to accommodate the experiment, 4) were willing to conform to research standards as pertained to spacing, weeding, fertilization, and other cultural practices, and 5) were willing to allow other farmers and researchers access to the research/demonstration plot for training purposes. Seventy-five percent of the cost of preparing the land was borne by the project and 25% by the farmers. All inputs were supplied by the project.

Research Design

The experiment was conducted at three sites in the Parish of St. Catherine. Sites one and two were located in the community of Redwood (referred to as Logan and Blackman, respectively) and the third was located near Berry Hill (McLaggon). A randomized complete block design was used to control variability in field conditions. Blocks were arranged across the slope along contours. Each block was divided into four plots and each plot received one treatment (APPENDIX A). The blocks were replicated eight times on both the Logan and Blackman sites and three times at the McLaggon site. Treatment one (T1) represented the farmers practice. Treatment 2 and 3 (T2 and T3) represented IICA modifications. Treatment 4 (T4) represented the CIB recommended establishment practice. The treatment specifics were:

- T1: Spacing of 3 x 1.5 m with one seedling/hole planted with no fertilizer applications,
- T2: Spacing of 3 x 1.5 m with two seedlings/hole planted with 0.23 kg of 6-18-27 and 3.6 kg of bioganic fertilizer (chemical composition undetermined but consisted of composted chicken manure, sawdust and sometimes coffee berry hulls) (Coffee Industry Board, 1986).,
- T3: Spacing of 1.5 x 1.5 m with one seedling/hole planted with 0.11 kg of 6-18-27 and 2.3 kg of bioganic,
- T4: CIB recommended spacing of 3.0 x 1.5 m with two seedlings/hole planted with 0.11 kg of 6-18-27 and 2.3 kg of bioganic.

Planting Material

Coffee seedlings were purchased from the CIB nursery located in the community of Bog Walk, St. Catherine. The seed stock was *Coffea arabica* var. *typica*. Single seeds were direct seeded into polyethene grow-bags measuring 30 cm diameter x 20 cm in height, grown under 60% shade and irrigated as needed. The potting mixture included one part organic matter and two parts soil (soil type unknown) with the N-P-K fertilizer 6-18-27 incorporated at a rate of 0.5 grams per grow-bag. Fungicide and insecticide was applied as needed but quantity or frequency was unknown.

A control plot was intended to depict the farmers' practice of using "rat-cut" seedlings and no application of fertilizer. Rat-cut seedlings were defined as volunteer seedlings of any variety originating from ripe berries dropped naturally or removed by rats which cut and ate the berry pulp, dropping the seed to germinate in the coffee field. Farmers generally transplant rat-cut seedlings by pulling plants from the ground and replanting at another location. In the initial stages of the trials, the mortality rate for the rat-cut seedlings was in excess of 90%. This high mortality may have been caused by transplanting to fields with insufficient shade. Nevertheless, a decision was made to use the seedlings produced by the CIB to promote consistency for treatment response.

Out-planting

The Logan site was established in May, 1992. The Blackman and Molaggon sites were established in December, 1992. During the early stages of establishment, a mortality

rate of 20% among the seedlings was observed at the Logan site. New seedlings were supplied to replace the dead seedlings.

Data Procurement

Data to be gathered included plant height, diameter, days to flowering and berry yield (APPENDIX B). Initial diameter measurements were accomplished using string. Later diameter measurements used calipers and the string data was discarded. Diameter and height measurements were recorded quarterly. After December, 1992, only diameter measurements were taken.

Analysis

Analysis of variance (ANOVA) was used to determine diameter differences between treatments and sites. Data was subjected to a natural log transformation prior to analysis. Where coffee plants were replaced because of mortality (Logan in Redwood) an analysis of covariance was performed.

RESULTS

Site Characteristics

All sites were located near latitude 18° 11' N and longitude 76° 59' W. The site characteristics were fairly homogenous and exhibited many of the characteristics recommended by the CIB for growing coffee (Table 1).

The mean annual rainfall within the HASP region which occurred 75% of the time between 1950 and 1980 was 1,552 mm per year. Two moist periods occurred between April to June and November to December (Figure 1). January to March was the dry period (Rural Physical Planning Division/MINAG, 1992).

The mean minimum and maximum temperatures for Riversdale between 1950 and 1980 showed August as the warmest month with a mean maximum daily temperature of 30.9° C. February was the coolest month with a mean minimum daily temperature of 18.3° C (Figure 2) (Rural Physical Planning Division/MINAG, 1992).

Table 1. Characteristics of the three coffee trial sites compared with the CIB recommended site conditions (CIB, 1986).

Location	Rain	Temp. Mean (Min/Max)	Aspect	Slope (%)	Elev (m)	Soil Series	Soil pH
Redwood (Logan)	1552	20.1 and 29.5	West and South	15	152	Union Hill stony clay loam	7-8
Redwood (Blackman)	1552	20.1 and 29.5	West	5	152	Linstead clay loam	6.0
Redwood (McLaggon)	1552	20.1 and 29.5	East	15	152	Linstead clay loam	6.0
OPTIMAL CONDITION	1524 to 1778	15 and 25	South, North, West	0-35	10 to 1370	deep, free draining	5.5-6.5

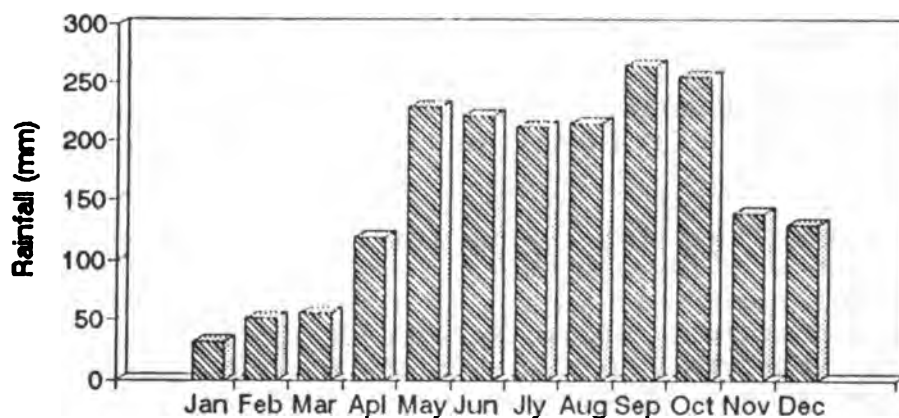


Figure 1. Rainfall records for the Riversdale, St. Catherine between 1950-1980 shown as mm\mo reached or exceeded 75% each year. Rainfall equalled or exceeded 1,552 mm per year 75% of the time. There were two wetter periods, May to June and September to October while January to March was the dry period.

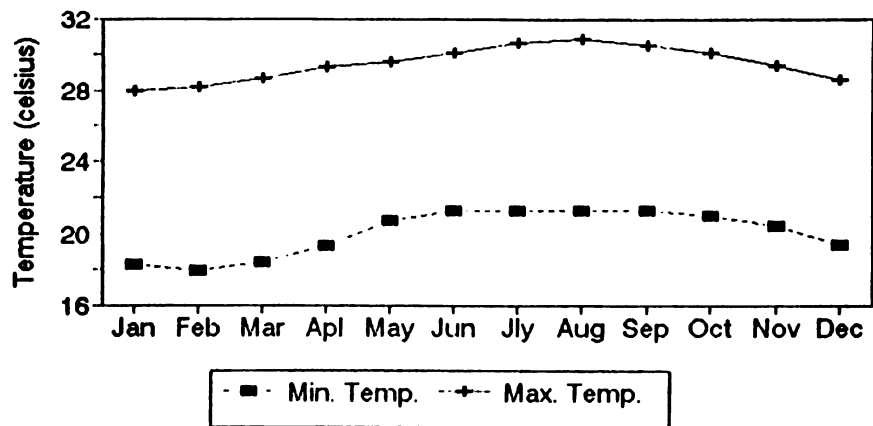


Figure 2. Mean minimum and maximum temperatures for Riversdale, St. Catherine between 1950-1980. For Riversdale, August was the warmest month with a mean maximum daily temperature of 30.9°C and February was the coolest month with a mean minimum daily temperature of 18.3 °C.

In 1989, site one (Logan) was cultivated for one season in red peas (*Phaseolus vulgaris* local cv. red pea) using NPK fertilizer 7-14-14. Thereafter, the land was left ruinant until 1992, when it was cleared for the coffee trial.

Site two (Blackman) was cultivated in red peas without fertilizer in 1986. In 1987, the site was planted with coconut. No other crops were grown on the site until the coffee trial began.

Site three (McLaggan) had not been cultivated in over 20 years and was in a ruinate state when the trials were established.

At all sites fruit trees were left as permanent shade and included cashew (*Anatardium occidentale*), jackfruit (*Artocarpus heterophyllus* Lam.), and breadfruit (*Artocarpus altilis* (S. Parkinson) Fosberg) and other trees. At the McLaggan site coconuts (*Cocos nucifera* var. *Maypan*) were planted as permanent shade following the Coconut Industry Board recommended spacing of 7 x 7 m in a triangular design (Coconut Industry Board, 1989). Plantains (*Musa* (Group AAB)) were planted at a spacing of 3 x 3 m as a temporary shade prior to planting the coffee.

Early Growth: Diameter

Consistently high correlations between diameter and height measurements suggested that both measurements did not need to be recorded. After December, 1992, only the diameter measurements were recorded.

In March, 1993, there was no significant difference between treatments nor was there a site by treatment interaction indicated. Treatments were responding similarly at each site. However, there was a significant difference in the response of treatments between sites ($p = 0.017$). Treatments at the Logan site grew the largest diameters (10.85 mm) followed by McLaggan (8.52 mm) with the site at Blackman recording the least diameter growth (8.12 mm), all with a variant of 0.045 (Figure 3).

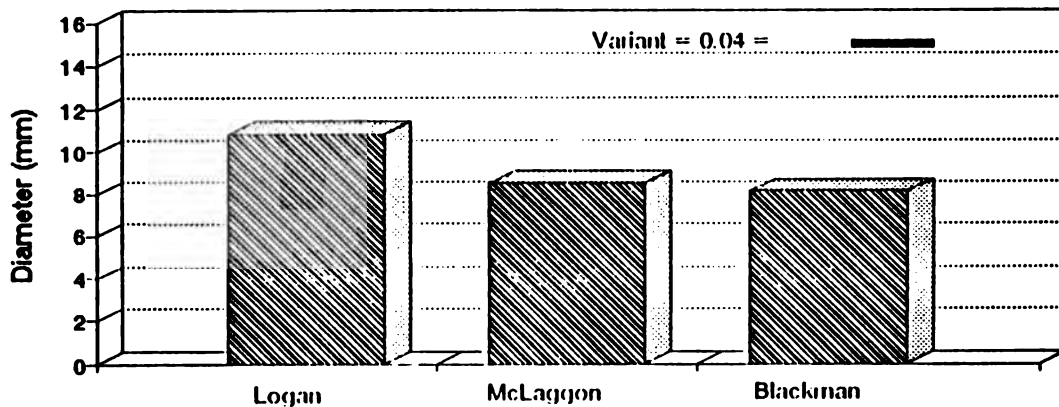


Figure 3. Analysis showing that a significant difference existed in the way treatments responded between sites ($p = 0.017$). Treatments at the Logan site grew the most (10.85 mm) followed by McLaggan (8.52 mm) with the site at Blackman growing the least (8.12 mm), all with a variant of 0.04

In November, 1993, there was again a significant difference in treatments at each site ($p = 0.03$), however, the difference was less than in March, 1993. Treatments at the Logan site had larger diameters (15.59 mm) followed by McLaggan (12.34 mm) and then Blackman (10.81 mm). All had a variant of 0.08 (Figure 4).

While there was no significant difference between the treatments, a proportional change shows that Treatment 1 (spacing of 3 x 1.5 m with one seedling/hole planted with no fertilizer applications) changed at a rate slower than the other treatments ($p = 0.03$) (Figure 5).

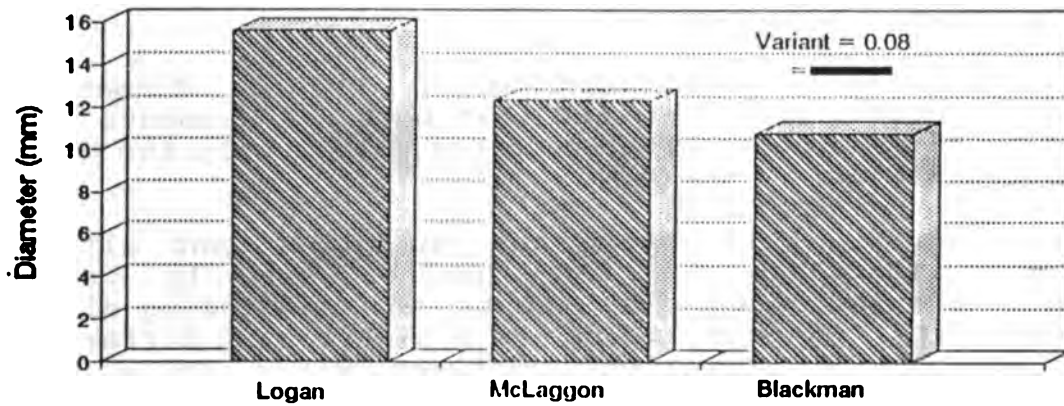


Figure 4. ANOVA showed that in November, 1993, there was a significant difference in the response of treatments at each site ($p = 0.03$). Treatments at the Logan site had the largest diameter (15.59 mm) followed by McLaggon (12.34 mm) with the site at Blackman growing the smallest diameter (10.81 mm), all with a variant of 0.08

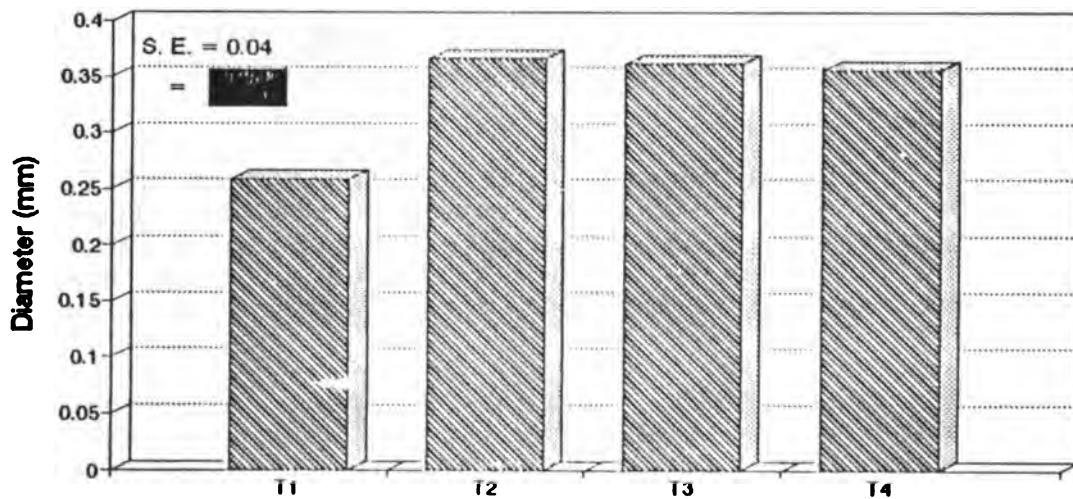


Figure 5. While not significantly different, a proportional change shows that Treatment 1 (spacing of 3 x 1.5 m with one seedling/hole planted with no fertilizer applications) changed at a rate slower than the other treatments ($p = 0.03$)

SUMMARY AND DISCUSSION

While there was no significant difference among the treatments 1.5 and 2 years after planting there was an indication that Treatment 1 (no fertilize application) was changing in diameter at a slower rate than the other treatments. This was not surprising since the positive response of coffee to fertilizer applications (both organic and inorganic) has been well documented.

The coffee treatments consistently responded similarly (no significant difference) at each site but the sites caused differences in treatment responses. Sites were consistently ranked with the Logan site in Red Wood growing the largest diameter plants followed by McLaggon. The plants at Blackman grew the smallest diameters. No explanation could be proposed for this difference by the researcher, either by looking at the differences in the site data or by observations at the site.

Care must be taken not to infer from these results that the Treatments 2, 3 and 4 would continue to produce similar responses over time and what effect the treatments would have when the coffee came into bearing. Continued data gathering and analysis was deemed necessary. Furthermore, the experiment was designed to include the time to flowering and the amount of bearing the different treatments produced. This data would be essential in determining the value of the treatments. It is recommended that data on flowering and production be collected and analyzed for at least two years after bearing begins.

**APPENDIX A
EXPERIMENTAL LAYOUT**

SITE 1: LOGAN, REPLICATE 1

N ←

B1	T3	T2	T4	T1
B2	T2	T4	T1	T3
B3	T1	T4	T2	T3
B4	T3	T2	T4	T1

SITE 1: LOGAN, REPLICATE 2

B1	T4	T2	T3	T1
B2	T3	T2	T1	T4
B3	T1	T4	T2	T3
B4	T4	T2	T3	T1

SITE 2: BLACKMAN

T1	T2	T4	T3	T4	T2	T1	T3	T4	T1	T3	T2
B1				B2				B3			

SITE 3: McLaggon

B1	T1	T4	T2	T3
B2	T4	T1	T3	T2
B3	T4	T1	T2	T3

APPENDIX B

COFFEE DATA

SITE 1 = LOGAN; EXP. 1

SITE 2 = BLACYMAN

SITE 3 = MCLAGGON

CODE:

99 = mortality

98 = reserved

97 = coconut

95 = tree

94 = missing value

1 = new

2 = old

SITE	BLOCK	TREAT.	LOC.	OLD/NEW	15/6/93 DIA.	12/10/93 DIA.
1	1	1	6	2	5.60	7.00
1	1	1	7	1	5.00	*
1	1	1	8	2	17.00	23.00
1	1	1	9	2	25.10	34.20
1	1	1	10	2	16.00	25.20
1	1	1	13	2	10.00	13.70
1	1	1	14	2	17.90	23.90
1	1	2	11	1	11.80	18.60
1	1	2	12	1	10.70	16.80
1	1	2	13	1	10.00	11.70
1	1	2	14	2	7.10	7.90
1	1	2	15	2	12.70	21.00
1	1	2	16	2	8.10	10.60
1	1	2	17	2	17.40	25.30
1	1	2	18	2	14.50	18.60
1	1	2	19	1	11.50	18.60
1	1	2	20	2	14.00	19.70
1	1	3	6	1	8.90	13.10
1	1	3	7	1	*	*
1	1	3	8	2	*	*
1	1	3	9	1	*	*
1	1	3	10	1	4.10	*
1	1	3	11	1	7.00	12.20
1	1	3	12	1	9.60	10.20
1	1	3	13	2	8.60	10.60
1	1	3	14	1	3.90	4.90
1	1	3	15	1	6.10	18.60
1	1	3	16	2	8.30	10.70
1	1	3	17	2	7.90	8.90
1	1	3	18	2	13.00	18.30
1	1	3	19	1	12.10	15.90
1	1	3	20	2	9.90	15.60
1	1	4	11	2	20.70	26.80
1	1	4	12	1	10.60	15.20
1	1	4	13	2	16.50	23.50
1	1	4	14	1	10.10	13.80
1	1	4	17	1	5.80	*
1	1	4	18	1	6.70	8.10
1	1	4	19	1	11.70	17.50
1	1	4	20	1	6.00	6.50

1	2	1	6	2	18.50	28.10
1	2	1	7	2	8.40	12.90
1	2	1	9	2	17.40	23.00
1	2	1	10	2	12.90	16.60
1	2	1	11	2	12.50	14.10
1	2	1	12	2	13.60	19.90
1	2	1	13	2	22.20	27.70
1	2	1	14	2	6.30	8.10
1	2	1	15	1	7.80	10.50
1	2	2	13	2	12.10	16.80
1	2	2	14	1	8.50	11.90
1	2	2	15	1	8.80	*
1	2	2	16	2	13.30	18.00
1	2	2	17	1	12.70	18.90
1	2	2	18	1	11.50	18.00
1	2	3	6	2	*	*
1	2	3	7	2	15.10	23.70
1	2	3	8	2	12.00	16.50
1	2	3	9	2	15.60	24.00
1	2	3	10	2	14.50	23.90
1	2	3	11	1	8.50	12.50
1	2	3	13	2	18.60	27.60
1	2	3	14	2	13.30	17.50
1	2	3	15	2	13.20	17.90
1	2	3	16	1	13.60	19.20
1	2	3	17	1	11.30	*
1	2	3	19	2	10.60	17.30
1	2	3	20	2	6.00	*
1	2	4	11	2	8.70	12.50
1	2	4	12	1	11.40	15.70
1	2	4	13	2	17.80	27.80
1	2	4	14	1	10.50	14.10
1	2	4	15	1	10.50	15.40
1	2	4	16	1	10.20	14.00
1	2	4	19	1	8.00	*
1	2	4	20	2	15.70	22.00
1	3	1	6	1	6.70	7.40
1	3	1	7	2	4.10	5.30
1	3	1	8	2	11.50	14.70
1	3	1	9	2	12.70	15.60
1	3	1	10	2	*	4.90
1	3	1	12	1	5.50	*
1	3	1	13	2	9.60	11.20
1	3	1	14	1	8.10	10.10
1	3	2	11	1	14.10	19.80
1	3	2	12	1	7.80	12.20
1	3	2	13	2	9.00	11.00
1	3	2	14	1	7.50	9.50
1	3	2	15	2	11.00	16.70
1	3	2	16	1	8.50	12.20
1	3	2	17	2	6.00	*
1	3	2	18	2	7.50	12.30
1	3	2	19	2	12.30	17.20
1	3	2	20	1	11.90	14.00
1	3	3	6	2	17.30	24.80
1	3	3	7	2	20.20	27.20
1	3	3	8	2	*	11.80
1	3	3	9	1	6.20	9.80
1	3	3	10	2	7.00	9.30
1	3	3	11	2	16.50	22.70
1	3	3	12	2	12.20	17.70
1	3	3	13	2	15.60	24.20
1	3	3	14	2	14.20	21.60
1	3	3	15	2	13.80	19.40

1	3	3	16	2	15.00	20.90
1	3	3	18	2	16.70	25.80
1	3	3	19	1	7.00	11.40
1	3	3	20	2	12.70	19.50
1	3	4	11	1	10.70	15.40
1	3	4	12	1	6.70	11.20
1	3	4	13	1	9.70	*
1	3	4	14	1	*	*
1	3	4	15	1	7.90	*
1	3	4	16	1	6.50	*
1	3	4	17	1	8.50	12.50
1	3	4	18	1	12.80	19.00
1	3	4	19	2	8.10	13.00
1	3	4	20	1	10.40	13.20
1	4	1	6	2	7.80	10.00
1	4	1	8	2	13.50	18.60
1	4	1	9	2	13.50	16.80
1	4	1	10	2	9.20	12.60
1	4	1	11	2	17.60	14.00
1	4	1	12	2	10.80	25.00
1	4	1	13	2	16.90	12.00
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1	4	2	13	1	8.00	10.80
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1	4	2	16	1	10.00	15.60
1	4	2	19	2	12.30	99.00
1	4	2	20	2	16.60	25.00
1	4	3	6	2	11.40	18.30
1	4	3	7	2	*	*
1	4	3	8	1	*	*
1	4	3	9	1	7.80	*
1	4	3	10	1	9.40	*
1	4	3	12	2	5.20	4.90
1	4	3	13	2	9.00	14.40
1	4	3	14	2	12.30	13.90
1	4	3	16	2	*	*
1	4	3	17	2	6.80	7.50
1	4	3	18	1	9.40	12.10
1	4	3	19	1	11.30	*
1	4	3	20	1	69.00	*
1	4	4	11	2	11.90	17.50
1	4	4	12	1	12.20	18.40
1	4	4	13	1	9.80	12.90
1	4	4	14	1	10.00	13.40
1	4	4	17	1	7.00	9.10
1	4	4	18	2	13.90	21.00
1	4	4	19	2	4.90	*
1	4	4	20	2	5.80	*
					30/6/93	20/10/93
SITE	BLOCK	TREAT.	LOC.		DIA.	DIA.
2	1	1	1	1	9.20	9.90
2	1	1	2	1	7.80	11.50
2	1	1	3	1	6.80	8.10
2	1	1	4	1	10.80	14.30

2	1	1	6	1	7.60	7.70
2	1	1	7	1	6.90	8.10
2	1	1	8	1	5.40	5.70
2	1	1	9	1	6.70	7.10
2	1	1	10	1	8.30	8.90
2	1	1	11	1	9.10	11.90
2	1	2	21	1	7.40	9.20
2	1	2	22	1	7.60	10.90
2	1	2	25	1	5.60	5.60
2	1	2	26	1	7.70	8.40
2	1	2	27	1	10.80	14.20
2	1	2	28	1	8.10	9.70
2	1	2	29	1	7.90	10.60
2	1	2	30	1	9.20	13.30
2	1	3	16	1	7.50	11.20
2	1	3	17	1	9.40	16.50
2	1	3	18	1	9.80	15.20
2	1	3	19	1	8.50	12.20
2	1	3	20	1	6.80	9.60
2	1	3	21	1	11.80	14.40
2	1	3	23	1	6.00	7.70
2	1	3	24	1	11.70	17.80
2	1	4	21	1	9.40	14.50
2	1	4	22	1	7.00	10.10
2	1	4	23	1	4.80	5.70
2	1	4	24	1	5.50	*
2	1	4	25	1	6.20	8.00
2	1	4	26	1	7.50	11.90
2	1	4	29	1	6.20	7.90
2	1	4	30	1	6.00	*
2	2	1	7	1	7.90	11.70
2	2	1	8	1	10.00	11.20
2	2	1	9	1	8.10	12.60
2	2	1	10	94	*	10.00
2	2	1	12	1	14.00	17.90
2	2	1	13	1	9.40	13.00
2	2	1	15	1	7.50	12.60
2	2	2	21	1	6.60	*
2	2	2	22	1	6.60	*
2	2	2	23	1	8.50	*
2	2	2	24	1	7.30	*
2	2	2	25	1	5.90	*
2	2	2	26	1	7.20	*
2	2	2	27	1	4.80	*
2	2	2	28	1	8.80	*
2	2	2	29	1	9.50	*
2	2	2	30	1	5.20	*
2	2	3	16	1	10.20	*
2	2	3	17	1	6.00	*
2	2	3	18	1	10.10	16.00
2	2	3	19	1	14.00	22.30
2	2	3	20	1	10.20	11.90
2	2	3	21	1	7.50	8.00
2	2	3	22	1	9.00	11.60
2	2	3	23	1	9.80	12.10
2	2	3	24	1	11.00	12.70
2	2	3	25	1	8.00	10.80
2	2	4	11	1	9.00	12.00

2	2	4	13	1	9.50	13.00
2	2	4	14	1	10.00	13.70
2	2	4	15	1	7.80	10.30
2	2	4	16	1	7.10	8.90
2	2	4	17	1	7.80	9.10
2	2	4	18	1	8.50	12.60
2	2	4	19	1	8.40	9.60
2	2	4	20	1	10.50	13.80
2	3	1	6	1	*	*
2	3	1	7	1	9.90	9.90
2	3	1	8	1	10.30	10.90
2	3	1	9	1	10.00	11.00
2	3	1	10	1	9.60	8.50
2	3	1	11	1	9.20	10.50
2	3	1	12	1	7.60	*
2	3	1	13	1	8.70	8.90
2	3	1	14	1	5.80	6.40
2	3	1	15	1	6.70	9.70
2	3	1	16	1	*	*
2	3	2	13	1	7.50	9.10
2	3	2	14	1	9.00	10.30
2	3	2	15	1	5.80	6.40
2	3	2	16	1	7.30	8.10
2	3	2	17	1	6.90	9.70
2	3	2	18	1	6.80	8.10
2	3	2	19	1	5.30	6.00
2	3	2	20	1	8.20	12.10
2	3	2	21	1	5.80	7.50
2	3	2	22	1	5.40	5.60
2	3	2	23	1	7.60	*
2	3	2	24	1	*	9.50
2	3	2	25	1	*	*
2	3	2	26	1	7.80	10.80
2	3	3	15	1	10.70	15.70
2	3	3	16	1	9.50	13.60
2	3	3	17	1	6.10	10.20
2	3	3	18	1	6.00	7.20
2	3	3	19	1	*	*
2	3	3	20	1	8.30	9.50
2	3	3	21	1	8.40	*
2	3	3	22	1	9.80	9.50
2	3	3	23	1	7.00	10.60
2	3	3	24	1	5.00	9.20
2	3	3	25	1	7.80	*
2	3	4	23	1	*	*
2	3	4	24	1	8.30	11.00
2	3	4	25	1	11.10	11.40
2	3	4	26	1	10.40	15.10
2	3	4	27	1	6.20	8.10
2	3	4	28	1	5.80	7.40

SITE	BLOCK	TREAT.	LOC.	30/6/93	20/10/93	
				DIA.	DIA.	
3	1	1	6	1	9.30	11.90
3	1	1	7	1	8.20	11.10
3	1	1	8	1	7.40	10.50
3	1	1	9	1	7.50	9.50
3	1	1	10	1	6.70	8.10

3	1	1	12	1	8.80	11.10
3	1	1	13	1	6.00	7.50
3	1	1	14	1	7.20	9.70
3	1	1	15	1	6.00	7.00
3	1	2	11	1	7.00	*
3	1	2	12	1	5.40	*
3	1	2	13	1	6.00	*
3	1	2	14	1	5.50	*
3	1	2	15	1	9.50	14.40
3	1	2	16	1	8.30	*
3	1	2	17	1	7.20	9.60
3	1	2	18	1	7.60	12.80
3	1	2	19	1	7.10	8.60
3	1	2	20	1	6.50	8.10
3	1	3	11	1	6.40	8.10
3	1	3	12	1	7.70	11.30
3	1	3	13	1	6.60	*
3	1	3	14	1	5.20	*
3	1	3	15	1	4.20	8.40
3	1	3	16	1	7.70	*
3	1	3	17	1	4.20	*
3	1	3	18	1	6.10	8.00
3	1	3	19	1	5.60	*
3	1	3	20	1	5.90	*
3	1	3	21	1	5.90	7.10
3	1	3	22	1	6.70	10.50
3	1	3	23	1	7.10	11.50
3	1	3	24	1	6.80	7.00
3	1	3	25	1	4.20	3.80
3	1	4	11	1	7.80	9.90
3	1	4	12	1	7.90	9.40
3	1	4	13	1	6.40	*
3	1	4	14	1	5.10	5.60
3	1	4	15	1	7.30	10.40
3	1	4	16	1	9.00	11.30
3	1	4	17	1	7.60	10.10
3	1	4	18	1	7.70	9.70
3	1	4	19	1	7.50	8.70
3	1	4	20	1	7.30	6.90
3	2	1	5	1	11.00	*
3	2	1	6	1	9.80	12.60
3	2	1	7	1	10.50	12.50
3	2	1	8	1	6.60	7.90
3	2	1	9	1	7.30	12.20
3	2	1	11	1	12.20	16.70
3	2	1	12	1	11.10	14.90
3	2	1	13	1	5.70	7.60
3	2	1	14	1	9.50	13.60
3	2	1	15	1	8.80	13.80
3	2	2	11	1	10.30	14.30
3	2	2	12	1	11.00	16.80
3	2	2	13	1	12.00	18.70
3	2	2	14	1	13.30	17.00
3	2	2	15	1	14.00	19.00
3	2	2	16	1	10.20	14.00
3	2	2	17	1	12.20	17.90
3	2	2	18	1	13.50	21.20
3	2	2	19	1	11.20	16.40

3	2	3	11	1	8.00	10.50
3	2	3	12	1	11.40	14.10
3	2	3	13	1	8.40	11.30
3	2	3	14	1	10.80	15.40
3	2	3	15	1	10.60	10.60
3	2	3	16	1	8.20	13.20
3	2	3	17	1	7.10	10.50
3	2	3	18	1	6.00	8.30
3	2	3	20	1	6.30	7.50
3	2	3	21	1	8.80	11.50
3	2	3	22	1	11.50	13.20
3	2	3	23	1	9.20	11.60
3	2	3	24	1	11.10	14.70
3	2	3	25	1	9.70	15.10
3	2	4	11	1	7.80	11.20
3	2	4	12	1	5.20	7.00
3	2	4	13	1	8.60	9.10
3	2	4	14	1	12.40	17.00
3	2	4	15	1	8.10	12.20
3	2	4	16	1	10.60	16.50
3	2	4	17	1	9.20	19.00
3	2	4	18	1	6.00	19.00
3	2	4	19	1	8.20	12.30
3	2	4	20	1	7.20	10.00
3	3	1	6	1	12.20	14.70
3	3	1	7	1	13.10	16.40
3	3	1	8	1	11.60	15.30
3	3	1	9	1	11.50	16.80
3	3	1	10	1	14.70	21.20
3	3	1	11	1	9.00	15.10
3	3	1	12	1	8.00	10.20
3	3	1	13	1	12.50	19.00
3	3	1	14	1	7.60	11.60
3	3	1	15	1	13.00	18.40
3	3	2	11	1	*	19.00
3	3	2	12	1	*	19.00
3	3	2	13	1	5.80	19.00
3	3	2	14	1	6.80	19.00
3	3	2	15	1	6.50	10.10
3	3	2	16	1	10.00	11.80
3	3	2	17	1	9.30	14.00
3	3	2	18	1	8.50	11.70
3	3	2	19	1	5.40	9.50
3	3	2	20	1	9.00	12.00
3	3	3	11	1	8.90	14.10
3	3	3	12	1	9.20	13.80
3	3	3	13	1	8.50	14.10
3	3	3	14	1	7.40	12.00
3	3	3	15	1	10.90	17.90
3	3	3	16	1	11.20	18.50
3	3	3	17	1	11.10	19.00
3	3	3	18	1	8.90	13.20
3	3	3	19	1	5.60	19.00
3	3	3	20	1	10.10	14.10
3	3	3	21	1	8.00	10.80
3	3	3	22	1	6.90	11.20
3	3	3	23	1	8.10	14.20
3	3	3	24	1	6.60	10.60

3	3	4	11	1	11.30	16.50
3	3	4	12	1	8.50	11.60
3	3	4	13	1	10.20	16.30
3	3	4	14	1	11.10	15.90
3	3	4	15	1	12.60	8.60
3	3	4	16	1	8.20	12.00
3	3	4	17	1	12.20	16.00
3	3	4	18	1	10.20	15.40
3	3	4	19	1	9.20	12.70
3	3	4	20	1	6.90	9.00

REFERENCES

- Coconut Industry Board. 1989. Intercropping coconuts. Coconut Industry Board, Kingston, Jamaica.
- Coffee Industry Board. 1986. Growing coffee in Jamaica. Coffee Industry Board, Kingston, Jamaica.
- Rural Physical Planning Division/Ministry of Agriculture. 1992. MINAG/IICA resource atlas. Ministry of Agriculture, Hope Gardens, Kingston, Jamaica. 35 p.
- Suah, J.R. 1992. St. Mary Parish Agricultural Show. Hillside Agriculture Project, Kingston, Jamaica. 7 p.

NOTES

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On farm coffee...

Título Hillside agriculture sub-
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Devolución

Nombre del solicitante

24/9/00

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