'ORGANIC FARMING' IN THE COCONUT INDUSTRY OF TRINIDAD AND TOBAGO

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INTRODUCTION

Oil produced from coconuts in Trinidad and Tobago is being advertised as being "*organically grown*". This is part of a promotional campaign currently being waged to stimulate the use of coconut oil in the battle against competition from soyabean oil, also produced in Trinidad and Tobago but from imported soyabean.

A survey of coconut farmers in Trinidad and Tobago was recently completed *[Pemberton, Seejattan and Joseph, 1992]*. This survey permitted a determination of the extent to which this advertisement is factual and the consequences for the productivity of resource use of the adoption of *'organic'* production systems.

This paper is concerned with whether there exists any differences in farm and farmer characteristics, yield and productivity of the major inputs of family labour, hired labour and operational capital between systems of coconut production involving the use and non use of manufactured chemical inputs (MCIs).

APPROACH TO THE PAPER

This paper will next discuss the concept of organic farming which will be useful to determine the extent to which the coconut farmers in Trinidad and Tobago can be typified as organic farmers. Then the paper gives a review of recent developments in the coconut industry of Trinidad and Tobago. This review is based on the Draft National Agricultural Development Plan 1988-1992 and the survey of coconut farmers previously referred to.

This recent survey of 335 coconut farmers in Trinidad and Tobago investigated the farming systems the coconut enterprises are part of, specific aspects of coconut production such as yield, inputs, production technology and costs as well as a profile of the farmers and their attitude to coconut farming.

In the fifth section, data from this survey was used to compare farms that used MCIs and farms that did not. The characteristics of the two groups of farms were investigated by statistical analyses, including the estimation of group means as well as the estimation of production functions, to determine whether there were any differences in productivity of resource use between the two groups.

The regression model used in the production function estimation was as follows:

$$Y = \alpha + \beta_1 D + \beta_2 X_1 + \beta_3 D X_1 + \beta_4 X_2 + \beta_5 D X_2 + \beta_6 X_3 + \beta_7 D X_3 + \beta_8 X_4 + \beta_9 D X_4 + \beta_{10} X_5 + \beta_{11} D X_5 + \beta_{12} X_6 + \beta_{13} D X_6 .$$

Where,

Y = Quantity of nuts sold per acre
D = Dummy variable (User of chemical

inputs = 1, Non-user = 0)
X_1 = Operating expenses other than X_4, X_5 and X_6
X_2 = Mandays of hired labour per acre
X_3 = No. of family workers per acre
X_4 = Fertilizer input per acre
X_5 = Herbicide input per acre
X_6 = Insecticide input per acre

This model allowed the determination of whether there was a significant difference in the intercepts of the production functions between users and non-users (given by the significance of the first coefficient). It also allowed the determination of whether there were differences in the slope coefficients (marginal productivities) for the two groups (given by the significance of the other odd numbered coefficients).

The paper concludes with a discussion of the consequences of the use of MCIs in the coconut industry of Trinidad and Tobago as well as a brief assessment of the extent to which the non-users of MCIs in the coconut industry of Trinidad can be described as *'organic'* farmers.

THE CONCEPT OF ORGANIC FARMING

Organic Systems

According to Oelhaf *[1978]*, organic farming is part of an organic system where the approach is holistic. Land, farmer, food and the consumer compose the whole system. Consumer health is achieved by eating whole (not refined), fresh, and organically raised food. Here, the term organic is used in the traditional sense as pertaining to living organisms or having the character of living creatures.

Oelhaf [p.113] states that:

> *The food system begins with the soil, and that is where organic farming places its focus. Conventional farmers often think of themselves as feeding the plants with certain nutrients. Organic farmers seek to feed the plants indirectly. They feed the soil life with compost and other natural materials, and the microbes in turn feed the plants. The situation is analogous to that in human nutrition. We know that humans need certain vitamins. This does not mean, however, that they must all be eaten. If the bacteria in the intestines are fed properly (for example, with roughage), these bacteria will manufacture vitamins for their human host. Just so does the organic method seek to feed the soil life in order to feed the plant.*
>
> *Balance is a key theme, not only acid-alkaline balance, but a balance of all nutrients in appropriate ratios. Although chemical fertilizer can be applied in a balanced manner, organic farmers believe that only through the intermediary action of the soil microbes can a plant be fed in a truly balanced manner.*
>
> *Organic farmers avoid the use of highly soluble, quick acting, chemically manufactured fertilizers and pesticides that are produced with chemical processes (not derived from natural materials by physical means). Use of other artificial (manufactured) chemicals is also rejected, such as hormones and antibiotics, although antibiotics may be used for medical purposes.*

Why Organic Farming?

It is commonly held that except for some virgin, highly fertile soils, soils in their natural state do not normally provide satisfactory yields without some assistance from man. Since any effort to improve soils has its costs, maximum yields will not be sought, unless a farmer attaches some value to high yields for their own sake. Assuming profit maximization, methods of enhancing soil fertility will be carried out as long as the marginal value of yield exceeds the marginal cost of the improvement. A similar situation will exist for other chemical inputs such as herbicides and pesticides.

However, MCIs are associated with major side effects in terms of soil life, water quality and human health. Thus, some of the gains of modern agriculture have been made at a heavy cost. The manufacture of chemical inputs also generates pollution. Also the use of these chemicals may be causing subtle changes in

human health through changes in food quality that are as yet undetermined.

There is therefore the need for sustaining the health of the soils, plants, animals and humans as far as possible by furthering natural biological processes rather than pushing agricultural systems to extreme limits for the sake of maximum productivity or profit maximization.

Consequently, organic farming has been promoted as an alternative. Since organic farming avoids the use of synthetic fertilizers and other MCIs, nutrient recycling and pest control must be achieved by other means. These include proper management of crop residues and animal manures, crop rotations, and the use of natural fertilizers and pesticides.

Organic farming therefore is not merely the non-use of MCIs. It is a different philosophy to conventional or *'modern'* agricultural systems. This philosophy involves a concern for the sustainability of the soils, plants, animals and man. Sustainability in this context involves farming systems and government policies which are developed in a framework that accounts for their long-term positive impacts on agricultural profitability, environmental quality, food sufficiency and quality, and rural family and community vitality.

THE COCONUT INDUSTRY IN TRINIDAD AND TOBAGO

The Assessment of the Draft National Agricultural Development Plan

According to the Draft National Agricultural Development Plan of Trinidad and Tobago, 1988-1992, the production of copra, the main product of the coconut industry has declined steadily from 11,015 tonnes in 1970 to 4300 tonnes in 1985. The total production of raw oil dropped from 9 m litres in 1970 to 3m litres in 1980, a decrease of 67 per cent. Because of this decline, Trinidad and Tobago has not been able to meet its requirements for self-sufficiency in edible oil, which is estimated 15,000 tonnes at annually, and this had led to the increased importation of raw material substitutes.

The Plan identified the major factors affecting the general decline of the coconut industry as:

(i) Lack of application of proper cultural practices resulting in the loss of nuts due to non-harvesting and increases in pests and diseases;
(ii) Lack of use of fertilizers which results in sub-optimal performance;
(iii) The number of absentee or disinterested landlords;
(iv) The low capital per acre invested in the industry;
(v) The lack of adequate labour;
(vi) The neglect or old age of plantations;
(vii) The effect of red-ring and other diseases; and
(viii) unfavourable weather conditions.

The Plan goes on to state that although the Government has pursued a policy of support for coconut rehabilitation through agricultural incentives (for example, the local guaranteed price was twice that of the world price in 1983), there is little optimism by producers for a turn around in this industry in the short run. The Plan therefore concludes, with respect to a programme for development, that

> "*Because of the constraints being experienced in this sub-sector, especially the market constraints for coconut oil, future development must be centred around diversification and reduction of operating costs.*"

FARMING SYSTEMS

A more recent picture of the industry was obtained from the survey of farmers *(Pemberton et al, 1992)*.

The mean size of farms of all 335 farmers interviewed was 54.22 acres (22 ha). Coconut was considered as the most important farm enterprise by 56.4% of the farmers (Table 1). Table 1 also indicates that coconut is grown in combination with a wide range of other crop and livestock enterprise.

Eighty-eight percent (88%) of the farmers in the survey did not use MCIs in 1990, while 12% of the farmers reported their use on their farms.

TABLE 1

MOST IMPORTANT ENTERPRISE ON SURVEYED FARMS

Most Important Enterprise	No. of Farmers	% of Sample
COCONUT	190	56.4
VEGETABLES	33	9.8
COCOA	31	9.3
LIVESTOCK	26	7.1
BANANA/PLANTAIN	17	5.2
CITRUS	7	2.2
FRUIT TREES	7	2.2
OTHERS	8	2.4
NO RESPONSE	18	5.4

Source: Survey of Coconut Farms of Trinidad and Tobago.

FARMER CHARACTERISTICS

In the survey 75% of the respondents were male and 25% were female. The mean age of the farmers was 58.9 years. The mean family size was four with the average number of male members being two and females also two. It was reported that a total of 312 male family members worked on the 335 farms surveyed, while 180 female family members worked on the farms, a clear bias towards male family farm workers.

Fifty two percent of the farmers stated that they farmed full time while 41 percent of the farmers stated that they farmed part time. The other farmers did not respond to the question.

MARKETING

Seventy nine percent (79%) of the farmers in the survey reported that they sold coconuts that they planted, while 21% did not sell the coconuts. For farmers growing coconuts commercially, the average acreage of coconuts on the farms was 56.3 acres. The mean value of coconut sales was TT$24,019 (TT$1 = US$.235) or approximately $427 per acre.

In the survey, approximately 49% of the coconuts were sold by farmers as copra, 19% were sold as **"water nuts"** for drinking, 14% as dry nuts (for household cooking use) and 18% were sold as wet kernels to be made into copra.

Two thirds of the farmers selling copra do so directly to the Coconut Grower Association (CGA), a producers association, while 24.4% of the farmers sell to buying agents of the CGA. The buying agents also purchase almost all of the wet kernels to be made into copra for sale to CGA.

Coconuts destined for direct consumption by households as water nuts or dry nuts are channelled through vendors and other such small entrepreneurs.

ORIENTATION OF FARMERS

There was no evidence from the survey of any holistic or environmental orientation of the coconut farmers. For example, when asked what were the problems that they faced in farming

coconuts, the responses centred on praedial larceny, pests and diseases, lack of markets for their coconuts at **"good"** prices and problems of cost and availability of inputs, especially labour.

When further asked about the solutions for these problems, the farmers suggested mainly public sector activity in the area of improved security, incentives including price support and provision of other services such as roads, credit and extension.

Only 15% of the farmers stated that they had inadequate information on coconut production. When they were asked about areas in which this further information was required, they stated mainly methods of pests and disease control and production technology.

Even when asked about the best ways to improve agriculture, their responses focused on the receipt of improved services from the state. None of the responses indicated any environmental health concerns. When asked specifically about the coconut industry, 74% of the farmers stated that its future was very poor. Only 19% of the respondents considered its future as promising.

RESULTS

Results of difference between group means

In the analysis of the difference between means one of the most interesting observations is with respect to yield per acre. It is generally expected that yields from farms not using MCIs would be less than yields of farms which utilise MCIs. The results of the analysis, presented in Table 2 below, indicated however, that there was no significant difference between yields from user and non-user farms.

The results of the analysis of the mean age of farmers in the two groups indicated that users of MCIs are younger than non-users (t test showed significant difference).

The survey also showed that the mean number of family workers per acre differed for the two groups with users of MCIs using 3.1 family workers per acre with non-users using 1.7 family workers per acre. A similar pattern was also found with respect to the female family workers per acre which was significantly higher on farms using MCIs.

The survey also indicated that there was no significant differences between the two groups with respect to cost of production per acre, number of years the farmers had been cultivating coconuts, size of the first parcel of land occupied by the farmer and the number of hired workers per acre. This information is also presented in Table 2.

Distribution of farmers with regard to educational level, land tenure and status of farming as an occupation were determined. These tables are given in the Appendix. The data showed that while 12.8% of the farmers who use chemicals had received a tertiary education only 2.4% of *'organic'* farmers had reached this level of education. In the non-user group 80.7% had attained a primary school level education and lower, while in the user group the corresponding percentage was 71.7.

As regards land tenure, there were 46 parcels in the user group and 365 parcels in the non-user group. In the user group, 80% owned their land as compared to 76% in the non-user group. Rented land was the mode of tenure for 5.8% of non-users and 22% for users. In general there was little noticeable difference in the breakdown for the other categories of land tenure. The sample of farmers was also desegregated into full-time and part-time farmers. The distributions were very similar for user and non-user farmers (Appendix, Table 7). Among users 41% were part-time and 51.4% were full-time. (8% were non-respondents) For non-users 41% were part-time and 59% were full-time. For part-time farmers the non-users obtained a mean of 37% of income form their coconut farming while users obtained 33% of their income from farming. This difference was not significantly different.

Results of estimation

Table 3 gives the results of the regression model. Here it is seen that the only significant input affecting the quantity of nuts sold per acre was the number of mandays of hired workers per acre. The results also show that there was no significant difference in the intercept

for the two groups of farmers (users versus non-users of MCIs). Also the results show that there was no difference in the slopes (marginal productivities of inputs) between the two groups of farmers, even for X_2, mandays of hired labour per acre.

The R^2 (coefficient of multiple determination) for the regression in Table 3 was a low value of 0.45. A regression with "*production of nuts per acre*" as the dependent variable gave similar results, but with an R^2 of 0.33. (Table 4).

CONCLUSION

The results of the regression analysis showed that only labour has a significantly positive marginal product, which supports the proposition of the Draft National Agricultural Development Plan of a lack of adequate labour as a major factor affecting the coconut industry. The propositions of the Plan with respect to fertiliser and capital were not supported.

Farmers who utilize MCIs differed significantly from non-users only in two respects. Users are younger and use greater number of family workers per acre. There was no significant difference in the productivity of resource use of the two groups of farmers. What is also interesting is that there was no significant difference in the cost per acre or yield per acre of coconuts for the two groups. Thus the use of MCIs in the coconut industry of Trinidad and Tobago did not provide the farmers with a greater level of productivity.

The evidence available suggested that while the majority of the farmers did not use MCIs, they did not appear to be organic farmers, in the sense that, their non-use of chemicals did not reflect a different philosophy towards convential or modern agriculture systems. The non-use of chemicals seemed merely to reflect the high cost of inputs and the poor markets currently available for their coconut products, especially copra.

Organic farming is being promoted as a more sustainable system for agricultural production. What this paper has shown is that a least in the coconut industry in Trinidad and Tobago no major benefits have been derived from the use of MCIs. This result supports a more sustainable approach to agricultural production and it is hoped that further studies can be done to further examine these issues.

REFERENCE

Government of Trinidad and Tobago (1987) Draft National Agricultural Development Plan 1988-1992, Ministry of Food Production Marine Exploitation and the Environment.

OELHAF, Robert C (1978), Organic Agriculture - Economic and Ecological Comparsions with Conventional Methods, John Wiley and Sons, New York

PEMBERTON, Carlisle, SEEJATTAN, Vidya and JOSEPH, Patrick (1992), Coconut Farmers in Trinidad and Tobago. A Farming Systems Information System Project, Department of Agricultural Economic and Farm Management, UWI, St. Augustine, Trinidad and Tobago

TABLE 2

STATISTICAL ANALYSIS OF DIFFERENCE BETWEEN MEANS

Characteristic	User Mean	Non-user Mean	T Statistic
Yield/acre	713.3	1192	1.18
Cost/acre	296.9	255.1	0.22
Age of Farmer	52.8	59.7	*2.72
Years in farming	22.8	27.7	1.90
Size of Parcel	6.5	39.8	0.99
Hired Workers/acre	5.7	6.9	0.43
Family Workers/acre	3.1	1.7	*-3.50
Family Workers(F)	2.5	1.6	*-2.96
Family Workers(M)	2.4	1.9	-1.56

* Significant at the 5% level of significance

TABLE 3
LINEAR REGRESSION RESULTS

DEPENDENT VARIABLE: QUANTITY OF NUTS SOLD PER ACRE
R^2 = .45

Variable	Mean	Coefficient	Std. Error	T Statistic
D	1.94	3.40	40.51	0.08
X_1	129.33	-0.44	0.36	-1.22
X_2	3.15	193.19	14.79	*13.06
X_3	0.32	327.07	176.46	1.85
X_4	0.31	77.02	385.84	0.20
X_5	0.03	-1628.53	4031.15	-0.40
X_6	0.02	2294.13	4765.55	0.48
D X_1	4.34	-8.16	28.02	-0.29
D X_2	0.44	98.19	261.62	0.38
D X_3	0.32	-152.78	328.78	-0.46
D X_4	168.69	0.02	0.14	0.14
D X_5	1.64	-27.47	20.96	-1.31
D X_6	4.54	-8.11	6.58	-1.23

* Significant at the 5% level of significance

TABLE 4

LINEAR REGRESSION RESULTS
INDEPENDENT VARIABLE: PRODUCTION OF NUTS PER ACRE

R^2 = .33

Variable	Mean	Coefficient	Std. Error	T Statistic
D	1.83	1.05	45.48	0.02
X_1	117.49	0.01	0.41	0.02
X_2	3.26	141.05	13.83	*10.20
X_3	0.32	365.65	187.10	1.95
X_4	0.29	78.20	434.14	0.18
X_5	0.03	-1451.58	4536.01	-0.32
X_6	0.02	2252.79	3362.44	0.67
D X_1	4.10	-8.18	31.53	-0.26
D X_2	0.42	86.49	294.38	0.29
D X_3	0.31	-150.16	369.95	-0.41
D X_4	159.20	0.00	0.16	0.00
D X_5	1.55	-30.39	23.09	-1.32
D X_6	4.28	-4.55	7.38	-0.62

* Significant at the 5% level of significance

APPENDIX

TABLE 1
AGE DISTRIBUTION OF COCONUT FARMERS
BY AGRO CHEM USAGE

	GROUP		
AGE (YEARS)	USERS %	NON-USERS %	TOTAL %
<21	0.0	0.34	0.3
21-30	5.1	6.00	6.0
31-40	7.7	8.1	8.1
41-50	33.3	10.5	13.1
51-60	28.2	20.6	21.5
61-70	15.4	26.7	25.4
71-80	7.7	23.0	21.2
81 -90	2.6	4.4	4.2
>90	0.0	0.34	0.0
TOTAL	100.0	100.0	100.0
MEAN AGE	52.8	59.7	58.9
SD	12.4	15.2	15.1

TABLE 2
DISTRIBUTION OF COCONUT FARMERS
BY GENDER AND AGRO CHEM USAGE

	GROUP		
GENDER	USERS %	NON-USERS %	TOTAL %
MALE	86	73	74.6
FEMALE	14	27	25.4
TOTAL	100	100	100.0

TABLE 3
DISTRIBUTION OF COCONUT FARMERS
BY PERIOD OF CULTIVATION AND AGRO CHEM USAGE

	GROUP		
NO OF YEARS	USERS %	NON-USERS %	TOTAL %
<11	23.7	16.5	17.3
11-20	28.9	20.6	21.6
21-30	21.1	27.5	26.7
31-40	18.4	19.9	19.8
41-50	5.3	9.6	9.1
>50	2.6	5.8	5.5
TOTAL	100.0	100.0	100.0
MEAN	22.8	27.7	27.15
SD	14.0	15.1	15.1

TABLE 4
DISTRIBUTION OF FARMERS BY SIZE OF
PARCEL #1 AND AGRO CHEM USAGE

	GROUP		
SIZE (ACRES)	USERS %	NON-USERS %	TOTAL %
<6	60.5	40.7	43.0
6-10	18.4	27.3	26.3
11-15	13.2	9.4	9.9
16-20	2.6	5.4	5.1
>20	5.3	17.2	15.8
TOTAL	100.0	100.0	100.0
MEAN	16.5	39.8	50.6
SD	63.3	143.6	257.0

TABLE 5
DISTRIBUTION OF COCONUT FARMERS BY EDUCATION LEVEL AND AGRO CHEM USAGE

	GROUP		
EDUCATION LEVEL	USERS %	NON-USERS %	TOTAL %
NR	0.0	2.4	2.1
NONE	7.7	3.4	3.9
PRIMARY	64.0	74.9	73.6
SECONDARY	15.4	16.1	16.1
TERTIARY	12.8	2.4	3.6
OTHER	0.0	1.0	0.9
TOTAL	100.0	100.0	100.0

TABLE 6
DISTRIBUTION OF COCONUT FARMERS BY LAND TENURE AND AGRO CHEM USAGE
% OF PARCELS

	GROUP		
	USERS %	NON-USERS %	TOTAL %
OWNED	80.5	76.8	77.1
RENTED	2.2	5.8	5.3
LEASED	6.6	8.0	7.8
FAMILY	6.6	6.1	6.1
SQUATTER	4.4	1.1	1.5
OTHER	0.0	2.5	2.2
TOTAL	100.0	100.0	100.0
# PARCELS	46.0	365.0	411.0

TABLE 7
FARMING STATUS BY AGRO CHEM USAGE

	GROUP		
STATUS	USERS %	NON-USERS %	TOTAL %
NR	0.0	7.8	6.9
PART-TIME	41.0	41.0	41.0
FULL-TIME	59.0	51.4	52.3
TOTAL	100.0	100.0	100.0

TABLE 8

Distribution of Family Workers by Gender

CATEGORY	USERS		NON-USERS	
	MEAN	SD	MEAN	SD
Male Members Working on Farm	2.4	1.2	1.9	1.4
Female Members Working on Farm	2.5	1.4	1.6	1.0
If P/Time, % of inc. from Farming	37.0	15.0	33.0	19.0