Farmer strategies for market orientation in ACP agriculture

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Backyard lettuce production using nutrient film techniques: A case study in Trinidad

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The economy of Trinidad and Tobago is heavily dependent on petroleum which, in the 1982–92 period, accounted for an average of 25.6% of the GDP and 73.9% of the value of exports. Agriculture's contribution to the GDP in 1993 was 2.4% *(see* Table 1), but it employed about 11% of the labour force (Ministry of Agriculture 1995). In the late 1970s, when oil prices were high, the country basked in relative affluence. The agricultural sector, however, suffered because it could not keep pace with wages in other sectors. The government, nevertheless, retained various policies aimed at encouraging local production of food, such as import restrictions on certain commodities, including lettuce. As a result, prices of local commodities increased sharply; tomatoes, for example, sold for as much as TT$10.00/lb at certain times (TT$5.7 = US$1.00, February 1995).

Table 1. Trinidad and Tobago: Some economic indicators

	1991	1992	1993	1994
GDP at current prices (US$ million)[a]	3930	3895	4263	4842[b]
Real GDP growth (%)	3.0	-0.1	-1.5	4.1
Consumer price inflation (%)	3.8	6.5	10.8	5.1
Population (million)	1.3	1.3	1.3	1.3
GDP/head (US$)	3023	2996	3279	3725
Total external debt (US$ million)	2329	2262	2306	2001

Origins of GDP 1993	% of total
Agriculture	2.4
Oil	23.0
Manufacturing	8.6
Electricity, gas and water	1.9
Distribution, hotels and restaurants	15.5
Transport and communications	8.7
Financial services	13.1
Government	11.3
Other	15.5

Note: a TT$5.7 = US$1.00 (February 1995)
b Estimated
Source: EIU Country Report, First Quarter 1995

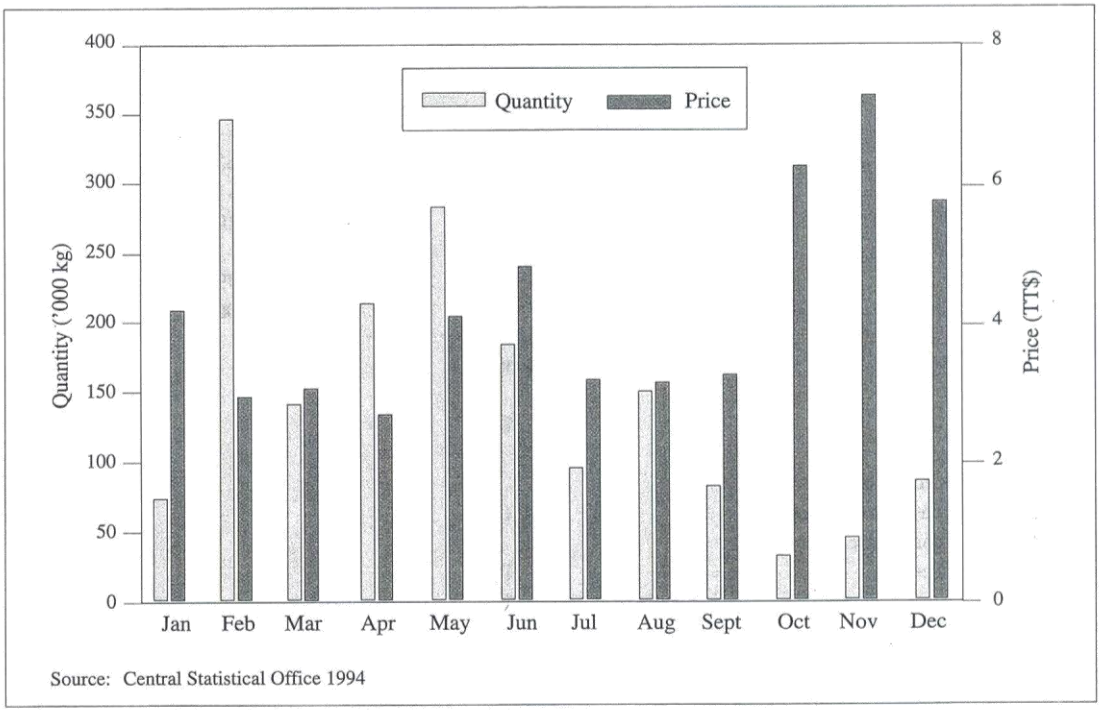
Vegetable production and marketing

Vegetables and short-term root crops are grown mainly on small-scale farms ranging from 0.2 to 2 ha; many farms, however, produce vegetables on less than 1 ha (Williams 1993). Given the small sizes of farms, such crops offer the best potential for farmers to earn a reasonable income because they can use intensive systems for fairly high-value crops and can get more than one crop a year from the plots; the produce is marketed mainly through small wholesalers and retailers who buy directly from the farmers. The vegetables are then sold to consumers at markets in the cities and main towns throughout the country. Although these markets are open during the week, most sales are conducted during the weekend. Some supermarkets, however, are becoming more established as suppliers of fresh local vegetables and fruits, and increasing numbers of farmers are now selling directly to them.

The combination of increasing prices and a policy framework which sought to encourage local production of vegetables offered opportunities for enterprising individuals to make relatively high incomes from agriculture. However, the June–December wet season placed limitations on the traditional systems involving outdoor production, including:

- the physical impact of the raindrops which could damage or dislodge young plants and knock off flowers;
- high soil moisture content which could affect cultural operations and waterlogging;
- high incidence of diseases and pests;
- flooding in low-lying areas.

These limitations applied mainly to outdoor tomato production and, to a less extent, to other vegetables. As a result, the supply was usually lower and prices higher in the last few months of each year than in the earlier months (*see* Figure 1).



Source: Central Statistical Office 1994

Figure 1. Quantity of tomatoes produced and average price/kg received by farmers in 1993

The emergence of soilless culture

The limitations outlined above stimulated growers to consider alternative systems such as undercover or protected cropping and soilless culture as a means of meeting demand. In addition to overcoming many of the problems inherent in the wet season cultivation of vegetables, the use of such systems would obviate the need for irrigation facilities for dry-season cultivation. It was felt that the high costs of establishing such systems could be offset by the high prices which the market would bear for the vegetables.

The main form of soilless culture, promoted mainly by a few commercial dealers, was the nutrient film technique (NFT). The dealers, of course, were also involved in the sale of the necessary equipment. The promotions emphasized the advantages of NFT as a "backyard system" – that is, suitable for farmers who had very limited land space and, in particular, for the production of tomatoes, the most popular locally produced vegetable. The focus was also on people who already had a job, perhaps because they were the ones who could afford the equipment.

The sales pitch promoted the idea that NFT was an "automatic" system, not needing close attention and supervision; this perception is thought to have been partly responsible for many failures with early attempts. Another reason for failures was that NFT was better suited for fast-maturing crops, such as lettuce, rather than tomatoes, the crop with which most farmers started.

The results of a preliminary survey in 1987 showed that there were about 60 growers involved in undercover production on a total covered area of 4.5 ha. Some 75% of them were using NFT. A few farmers eventually went out of business, with the failure rate highest among the tomato growers. In 1991 there were 12 lettuce growers using NFT; their production was, and remains, about 40,000 heads/month (Bedasie 1991).

The farmer selected for the case study started growing tomatoes on a part-time basis in 1994 after being exposed to the technology through a friend who was using NFT. He lost money on the venture, and attributed this to the fact that he had not realised that the system called for close supervision. He later contacted someone trained in soilless culture from the Ministry of Agriculture who advised him to try growing lettuces instead. He started growing lettuces in a small area of his backyard; now, however, the entire backyard, about 15,000 square feet, has been taken up with lettuce production.

The NFT system

Equipment and machinery

NFT has been described by one specialist (Steiner 1984) thus: "In principle, it is made up of gullies with a continuous circulating nutrient solution as a thin layer, a nutrient film. In the gullies are plants grown in blocks. The roots grow out of the blocks into the film in the gully." The plants are grown in very small pots (60 cc in volume) which are placed in the channels of galvanized roofing sheets covered with mulching plastic. The solution is pumped through lines, released through emitters, flows slowly along the grooves and then drains to a collection point for recycling. The sheets stand about 2 feet above the ground. This arrangement is also quite convenient for harvest and post-harvest operations.

In terms of cover, the farmer in the case study started first with clear plastic. This was later removed completely when it deteriorated as a result of wind damage, and the farmer carried on without any cover for a while. He observed, however, that the solution temperatures varied by as much as 3°C from the closest to the furthest point from the emitter. Consequently, plants furthest away were not growing properly and failed to meet the size requirements.

The farmer has since started using saran netting instead of plastic, but this has to be rolled back every afternoon for a short while to allow enough sunlight to reach the plants; without adequate sunlight, the lettuce heads become badly shaped and are therefore less marketable. The rolling back operation takes two workers only about 15-20 minutes.

In addition to the materials required for production, the farmer also has:

- several large plastic tanks for water storage when the pipe-borne supply is shut off;
- a water pump for pumping the solution through the pipes;
- a stand-by generator in case of disruptions in the supply of electricity.

All this equipment is easily available locally.

Variety

The farmer grows a variety which produces the crisp leaves preferred by his customers. It also has a longer shelf life than the more popular varieties sold at the markets. Almost all the lettuce grown for sale in the country is leaf lettuce. Because of high temperatures, the head lettuce varieties do not form proper heads, and thus are also grown as leaf lettuce.

The farmer obtains his seed from one supplier but had to change the variety recently because of the unavailability of the one he was accustomed to growing. The dealer claimed that his overseas supplier no longer provided it because of low demand. The farmer preferred the former variety because it produced a more compact head whereas the new variety has a more "open" head. With the new variety he has had to be more careful with the size of the lettuces because customers are less likely to accept some heads that are smaller than usual if they are less compact.

Production techniques

Seeds are sown in plastic trays containing a shallow layer of potting mixture. They are transplanted 1 week later into re-usable plastic pots (one seed/pot) containing commercial potting mixture, and they remain in the pots until they are harvested. They are "hardened" before being placed 3 weeks later in the NFT system at their final spacing. Here, too, another advantage over the field and even the "grow-box" systems is apparent in that the NFT system allows maximum use of limited space. At first, the plants are kept fairly close together; later, they are shifted to the correct spacing. The nursery operations must ensure that the plants have a good start if they are to be uniform in size.

The nutrient consists of a specially formulated commercial fertilizer for hydroponics and fertilizer-grade calcium nitrate. Small amounts of iron chelate are added to ensure that the leaves have the desired green colour. The solution is recycled and the strength is checked regularly using a conductivity meter. The system is flushed once a month to prevent the build up of toxic materials, and a new mixture sent through. The plants are sprayed once a week with a fungicide to protect them against downy mildew. Insecticides for the control of leaf miners are used if necessary. The cut-off periods for spraying are carefully observed.

Harvesting and post-harvest practices

Harvesting is done three times a week throughout the year when the plants are 7 weeks old. It is carried out in the morning of the same day that the farmer has to make deliveries. Thus, refrigerated facilities are not necessary and the plants reach the customer in a fresh state. The farmer is responsible for delivery. He does not own a vehicle but has a regular arrangement with someone else for transport. His customers are 15–12 km away, and the roads to them are fairly good.

Harvesting under this system is a less tedious operation than when the plants are growing in the ground. The plants are fairly clean and only a little washing is usually necessary. Cleaning also involves the removal of dead or unsightly lower leaves. Heads are placed immediately in plastic bags, usually one in each bag; if under the standard size, however, two are placed in a bag. Usually, no more than 15% of the crop sold will consist of bags with two undersized heads. If larger percentages of small heads are produced, the farmer still maintains the rough limit of 15% rather than give the impression that he is a producer of poor-quality lettuce. All the operations are carried out in the backyard, so there is no need to move the product from one place to another to carry out a particular operation.

Marketing

The operation is geared towards providing a year-round supply of about 3,000 heads of lettuce a week to the customers. These include a supermarket chain, an airline catering service and two "fast food" restaurants. The number of heads produced and sold per square foot per year is 10 if the area required for the whole operation is included.

The assessment as to whether or not a head of lettuce meets acceptable standards is based on a rough visual appraisal. The lettuces are sold on a per bag basis, and the price ranges from TT$1.25/bag to TT$1.50/bag in times of scarcity or high demand. Bagging is estimated to provide about 0.04c value added to the farmer. His customers will not buy the lettuces unless the heads are bagged.

Bagging offers many advantages:

- it results in less damage, higher marketable yield and, therefore, customer satisfaction (crisp leaf lettuces are especially susceptible to brittleness); this could be regarded as value added which benefits the farmer;
- it enhances the shelf life when stored under refrigerated conditions;
- it improves hygiene, which is important in the food business and for supermarket customers;
- it protects the lettuce when placed in a shopping bag to carry home.

The major factor that appears to have influenced the farmer to sell to his particular customers is that he has an assured and fairly stable market. He knows that at times he could get 75% or even 100% more if he retailed the produce himself in the open markets but, apart from the time involved and the inconvenience, there is always the risk that he may have to sell it too cheaply.

The characteristics of the open markets versus the other outlets (supermarkets and restaurants) are as follows:

Open markets:

- Shelf life is shorter, so there is more waste.
- Demand fluctuates, and therefore price fluctuates.
- Customers are mostly in the low- to middle-income groups and, in general, tend to place price above quality and to regard lettuce as a "treat" rather than as a basic food.

Other outlets:

- The demand from the restaurants and airline caterer is regular because lettuces are a standard ingredient in some of the meals they provide.

- While supermarkets are patronized by people from all socio-economic groups, those who buy fresh vegetables and fruits in these outlets constitute a minority. They value the convenience of shopping in a supermarket and are willing to pay the higher prices there than in the open markets. Open markets are generally crowded and parking is difficult. It is likely, therefore, that the price of vegetables for supermarket customers does not seriously influence the amounts purchased, within certain limits, whereas this is not the case in open markets.

The marketing arrangement between the farmer and his customers is in the nature of an informal agreement rather than a legal contract. Mutual trust is a key factor. The arrangement seems to have operated satisfactorily over the years, such that when the farmer sought an increase in price because of currency devaluation and an increase in input costs, his customers agreed to pay the higher price.

The arrangement also allows him flexibility. Thus, in times of high demand, he can sell some produce at a higher price to some customers than to others, but he only takes such chances when supplies are scarce because he does not want his customers to find other suppliers. Indeed, when he has been unable to supply customers he has arranged to have another person supply them rather than risk their going directly to other farmers.

Payments are made shortly after delivery. The farmer notes, however, that there is now a disquieting trend for payments to be held back longer than before, up to 1 month after delivery in some instances. He is watching this situation carefully although it does not seem to be causing him undue concern, probably because he has a regular cash flow and does not have to service bank overdrafts.

Influences on outcome

Tables 2, 3 and 4 summarize the influences of critical factors in production, harvest, post-harvest practices and marketing on outcome. The items are rated on a scale of 1 to 5, with 5 as the highest rating. Table 5 provides an estimate of the financial returns per head of lettuce.

Table 2. Production factors

Production factors	Rating of contribution of factor to Yield	Quality
Variety	4	5
Nursery management	5	5
Nutrition management	5	5
Shade control	5	5
Disease protection	4	4
Pest protection	3	3
Plant population	5	4

Table 3. Harvest factors

Harvest factors	Rating of contribution of factor to Yield	Quality
Days after planting	4	4
Damage avoidance	5	5
Time of day of harvest	4	4
Transport to outlets (assuming same-day delivery)	4	4

Table 4. Post-harvest and marketing factors

Post-harvest and	Rating of contribution of factor to final price
Cleaning/removal of unwanted leaves	4
Bagging	5
Consistency of quality and volume	4

Table 5. Returns per head of lettuce[a]

Minimum price received per head	1.25
Capital costs (TT$80,000 written off over 10 years)	0.06
Variable costs	
Nutrients	0.12
Potting mixture	0.1
Pesticides	0.03
Transport and bagging	0.24
Labour and supervision (inc. farmer/manager)	0.55
Margin	0.15

Note: a All figures are in local dollars (TT$5.7 = US$1.00, February 1995)

Farmer characteristics

The farm family consists of four people (the farmer, his wife and their two sons) who depend entirely on the income from the farm. The farmer and his sons work full-time on the farm and he also employs three other people on a regular basis. The sons, who live with him, assist in monitoring the NFT system when the farmer has to be away. He has used credit from the Agricultural Development Bank mainly to finance capital expenditure rather than operating expenses. He considers that his operation is successful and does not plan any changes in the near future. Outwardly, he appears to be successful, owning a comfortable house with modern amenities. He is clearly an innovative farmer, and there is much evidence of constant experimentation, although he does not take undue risks. He started small and acquired some experience before expanding.

SWOT

Strengths

Good knowledge, understanding and experience of the technology and the market.
Good relationships with customers.
Not dependent on one or two customers, thus minimizing the risks.
Strong relationships with support individuals and institutions (credit agency, input suppliers and, particularly, the Ministry's specialist, in whom the farmer appears to have a great deal of trust and confidence).
Some flexibility in the contractual arrangements with his customers.

Weaknesses

The system is dedicated to the production of lettuce or similar crops; if he has to change his enterprise, costly adjustments will have to be made.
The informal marketing arrangement could be risky; changes in personnel or operating procedure in the buying agencies could result in a breakdown of the arrangement.
It is not clear whether he has sufficient knowledge to deal quickly with any serious problems that might arise in soilless culture.

Opportunities

The number of "fast food" operations is rapidly increasing, presenting new market opportunities.
The health food trend, with its emphasis on fresh fruits and vegetables, may lead to increased demand for lettuce.

Threats

The movement towards organic farming and ecological agriculture might influence people away from crops produced through soilless culture.
Trade reform measures are now being implemented in Trinidad and Tobago. Although some commodities still enjoy a measure of price support through tariffs, these will be removed in a few years time. Lettuce, however, is among those products that cannot be freely imported and this will result in increased competition among local producers.
The system is heavily dependent on inputs, most of which are imported. Currency devaluation might make the price of these inputs prohibitive. Also, the market in Trinidad for the specialized inputs is relatively small, and customers will therefore be unable to influence the decisions of overseas suppliers; the farmer could be adversely affected by such decisions, as happened when the variety he was using was no longer available.

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