THE EXPERIENCE AND MAJOR CONSTRAINTS ON THE COMMERCIAL PRODUCTION OF SOYABEANS IN JAMAICA

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Introduction

A recent study [1] by the then Ministry of Industry, Commerce and Tourism has indicated that the establishment of a soyabean processing plant in Jamaica is economically feasible. More recent pronouncements by Ministers of Government confirm that the site has been chosen and the company formed to operate this project. The supply of raw material (soyabeans) for the plant is of immediate import. This paper is concerned with exploring the circumstances concerning the eocnomies of obtaining supplies of raw material domestically. In attempting this exercise the previous Jamaican experience and present potential for the commercial production of soyabeans will be examined and evaluated. Guidelines on possible future developments will be established, and a summation of the policy implications for Caricom will be made.

Soyabeans are the most important source of plant protein in the world and the United States of America produces more than 75 per cent of the world's production. Recent emphasis on the protein content of the human and animal diet has resulted in demand increasing by 8-10 per cent per annum, and thus has placed soyabean in a strategic economic position. Soyabeans are directly consumed by more than 1,000 million people throughout Asia. Processed soya products are used in margarine, other foods and livestock feeds. Thus soyabeans directly contribute to beef, eggs, chicken and margarine production and with increases in income and overall economic development the consumption of these food products has become important.

The end product of soyabean processing is oil, 18 per cent of about 11 pounds per bushel and 32 per cent protein in the form of meal. This meal is the most concentrated source of plant protein that exists. Soy meal is the most important source of protein used in livestock feed due to the fact that the protein of soy meal is the best source of the amino acids needed to balance those found in the proteins for grains such as corn and barley and sorghum - the items that contribute to the bulk of the balanced feed. The most limiting amino acid in common grains is lysine and soyabean is an outstanding source of lysine, therefore it is an ideal protein supplement for grains in human and animal nutrition.

Some Features of the Current Agricultural Situation

The 1973 production of soyabean in the United States of America was approximately 1.6 million bushels. It is estimated that by 1985, soyabeans will require approximately 20 per cent of the total arable acreage in the United States of America. The second major producer, China produced

320 million bushels in 1973 and Brazil, a relative new comer produced 225 million bushels in 1973. The production of soyabeans went up from an average of 21 million metric tons over the 1952-56 period to 39 million tons in 1966. At present, total production (1973) was approximately 50 million tons. The United States of America produces more than 75 per cent of the world's production and is responsible for 90 per cent of world trade which amounts to nearly 50 per cent of its total production.

The 1972 crop in the United States suffered from storms and heavy floods. This situation together with advance sales to the Soviet Union which had a bad crop in the same year, exhausted nearly all national reserve stock. The United States of America then placed an embargo on the export of soyabean meal. This measure was followed by the Canadian imposition of export control on major livestock feed ingredients including soyabeans and soyabean cake. These trade restriction measures were not prolonged, but they underline the vulnerability of countries whose livestock industries are based on imported ingredients. Clearly, the price of feed ingredients will increase, attracting areas of relatively high cost of production. For example, Brazil has plans to triple its present 3 million ton production by 1980.

The Jamaican Experience

Variety Evaluation

A number of varieties from the University of the West Indies collected in Trinidad were screened by the Ministry of Agriculture in Jamaica, in collaboration with the Faculty of Agriculture, U.W.I. and the Jamaica School of Agriculture. Ten of the best varieties (U.W.I. Code Nos. 7,9, 17,20,21,27,30,33,40 and 41 and later 60) were set out in various field trials subsequently. In addition to yield and various favourable agronomic characteristics, the oil and protein content of selected varieties were determined by the Tropical Products Institute, England, and the Scientific Research Council, Jamaica, and in general, the higher the protein content of a variety, the lower was its oil content.

The choice should be based on the use to be made of the crop. As an interim measure, the varieties 27, 30 and 60 are recommended. The recommendation of the committee was that U.W.I. code 30 could be planted all the year round, and U.W.I. code 60 and 27 from June 15th to 21st January All soyabeans are edible, but these particular varieties are not ideal for the table, as they are difficult to cook, and very oily. Although No. 41 produced the highest average yield in monthly planting throughout the year, its extremely small seed size and low oil content render it undesirable. The recommended varieties are relatively high yielding, determinate, and have large seed size with high oil content.

Hybrids also have been made by crossing Nos. 27,30,41 and 60 in all possible combinations and those that show greatest promise are undergoing further testing.

Seed availability, viability and inoculation

At present there is no central organisation for production and distribution of seed although this is desirable. The Ministry of Agriculture plans to keep stocks of good quality seed of recommended varieties for distribution.

Little is known about the length of time that seeds can be stored without serious loss of viability under conditions in Jamaica. Due to photoperiodism, planting would need to be at specific times and this would in some cases necessitate storage for over 6 months. Some varieties, e.g., U.W.I. code 30, are known to have a very short viability period. Viability is also influenced by the moisture content of the seed and storage temperature. It is tentatively recommneded that for storage, seeds should be at 10-12 per cent moisture content.

Although the value of *Rhizobium unoculum* has not yet been proved in all cases investigated, it has improved yields in many instances, even under conditions of good soil fertility. The use of inoculum is highly recommended when plantings are being made for the first time.

Soils and Fertilizers

A loamy soil pf pH 5.8 - 7.0 is considered good for soyabean. Usually a soil on which maize can be grown is suitable for this crop. Land claimed from forest and ruinate preferably should not be used due to the immediately ensuing insect and weed problems.

The literature indicates variable responses to fertilizer placement and rate of application, and crop response varies according to variety, nutrient status of the soil, and environmental factors, e.g., rainfall. An application of 400 pounds per acre of 5:10:10 has given good results using furrow irrigation at Twickenham Park on Syndenham Clay, which has a high fertility rating. Application of 12:24:12 at 450 pounds per acre has been recommended on the Newell Clay Loam at Hounslow (the same recommendation as given for other grain legumes). Placement of fertilizer (i.e. application in a band 3 inches below and to the side of the seed) would be advisable on the Bauxite soil and probably on Newell Clay Loam.

Time of Planting

Many varieties have given reasonably good yields when planted under irrigation on the southern plains at various times of the year. Selected varieties will be tested further in other ecological zones. Yield trends at various planting times and the period for maturation should be both considered in relation to climatic factors in the areas in which plantings are to be made. It is undesirable to have soyabean maturing during a period of high rainfall as this leads to severe seed deterioration in the field.

Land Preparation and Planting

The land should be ploughed to a depth of 9 inches and then harrowed to a fine tilth. Under local conditions it is possible to plough and harrow 12-15 acres per day by crawler tractor.

A small planter can be used if the fertilizer is broadcast, but when applying fertilizer and seed together a large planter is preferable, provided the terrain is suitable. For best results, seeds should be graded prior to planting. Seeds should be planted about one inch deep but could be slightly deeper on light soils.

A plant population of 100 to 130 thousand per acre is desirable for commercial plantings. The spacing between rows should be related to cultivation practices and a minimum of 24 inches between rows is required where post-planting operations are to be carried out with a tractor. It is suggested that for small acreages, rows could be closer (15 - 18 inches) with seeds sown at 3 - 4 inch intervals. This would enable the crop to cover the ground quickly and so suppress weed growth.

Weed Control

A number of preemergence, preplant incorporated and post-emergence herbicides have been evaluated but these have not been sufficiently effective for definite recommendations to be made. Dymid (3 pounds per acre) was used with some success at Hounslow as a pre-emergence treatment and is tentatively recommended. For mechanical weed control, the rolling ciltivator has given good results when used at an early stage of weed growth. A wheel hoe can be quite effective on small areas.

Diseases and Pests in Jamaica

No major diseases have been encountered to data on the experimental plots and small semi-commercial plantings. In the early stages of crop growth damage may be caused by cutworms and crickets, and these may be controlled by treatment with soil chemicals, e.g. Basudin, Chlordane or Dieldrin. The growing plant can be damaged by several species of caterpillars, e.g. leaf webbers, leaf tiers, and the fall army worm, which can be controlled by pesticides such as Basudin or Dipterex. Sucking pests such as the green stink bug and red spider mite may be controlled by pesticides such as Perfekthion, Roger 40 and Malathion.

A mist blower is suitable for pesticide applications on small plantings (2-4 acres) but for larger plantings, a tractor-mounted boom sprayer is essential. Several spray applications may be necessary.

Rotation

Soyabean benefits from residual fertilizers applied to the previous crop and rotation with several crops is possible, e.g. corn, sorghum, Irish potato, miscellaneous vegetables. Residual herbicides may have an adverse effect and particular care should be exercised in the use of Atrazine in corn, in corn-soyabean rotations.

Reaping

Reaping should be done when the leaves have fallen and the pods are dry. Seeds should be about 15 per cent moisture at time of harvest in order to reduce shattering and seed cracking losses. For large acreages use of a combine harvester is preferable but for small areas a portable thresher generally is adequate.

Marketing

At present there are three agencies or firms that utilise whole soyabeans in Jamaica. These are:

1. Food Technology Institute, J.I.D.C.;
2. Fachoy Foods, Falmouth; and
3. West Indies Training College, Mandeville.

The Food Technology Institute uses whole soyabeans for experimenting in the development of new agro-industrial products; Fachoy Foods - soya oil and soya sauce for cooking purposes, while the West Indies Training College have successfully developed and marketed soya bread, canned beans and other consumption goods.

Table 1. Cost of Production of Soyabean at Hounslow, Duration of Crop 110-114 Days.

Category	Estimated Cost[1] A ($)	Estimated Cost[1] B ($)	Rates ($)	No. of Times
Labour Operations:				
Ploughing & harrowing	20			
Harrow	-			
Rotavating	4	4	3	1
Planting	4	4	4	1
Inter-row cultivation	12	12	3	4
Fertilizing	3	3	2.5	1
Applying insecticides				
Applying fungicides	30	30	3	10
Applying weedicides	3	3	3	1
Irrigating	28	28	2	14
Reaping (combine harvester)	15	15	15	1
Sub-Total	119	99		
Materials:				
Fertilizer - 4 cwt. ($100/ton)	33	33		
Seed - 35lb. ($300/ton)	5	5		
Perfekthion	24	24		
Dipterex	17	17		
Sub-Total	79	79		
Other Charges:				
Contingencies 5% of operations	10	9		
Depreciation 10% of materials	8	8		
Land charges $20 per acre	7	7		
Interest @ 6% per annum	5	5		
Sub-Total	30	29		
Production Cost/lb. assuming a yield of 1500 lb./ac. (cents)			15	13.03

[1]Estimated Cost: (A) Assumes that ploughing is required.
(B) Assumes that the crop is rotated with corn and that no ploughing is required.

Notes: (1) The above costs of production assume above average farm management practices.
(2) The optimum use of mechanical equipment is assumed in the cultural practices related to the crop.

Cost of Production

Table 1 shows the cost of producing one acre of soyabeans at Hounslow in St. Elizabeth, Jamaica. It should be pointed out that this exercise was carried out in early 1973 and since then costs of inputs have risen by approximately 100 per cent as a result of the energy crisis. An upward adjustment therefore would have to be made.

The Commercial Production of Soyabeans in Jamaica

Experimental work on soyabeans including testing of varieties has been going on for some time, but since 1965 the effort has been intensified. In 1972 a four-acre plot produced enough seed to go into commercial planting. This plot yielded 1,000 pounds of grain per acre. Most of the work on soyabean development was initiated by Professor Radley and is at present being carried on by Dr. C. Panton of the University of the West Indies. The first major commercial plot was established in 1973 at Hounslow in Jamaica. This ten-acre plot yielded an average of 1,800 pounds per acre which compares favourably with yields obtained in the United States of America. Soyabean does well on flat irrigated land in rotation with corn. At present the best irrigated land is in sugar and the recent high world price for sugar has precluded the possibility of these lands going out of cane. However, predictions are that the boom in sugar prices will only last 2-3 years. It is assumed that at that time some cane lands will go out of cane production and therefore alternative, lucrative enterprises will have to be found. The Government of Jamaica is planning to expand milk and meat production by an intensive build-up of the dairy herd from 30,000 head to 80,000 head by 1980. In order to achieve this objective it is essential that feed production from local sources be increased. To supply the raw material needed to maintain a small soyabean crushing plant costing about $1 million, at least 6,000 acres, producing 1,800 pounds per acre would have to be cultivated. This production would supply 3,500 tons of meal or 11 per cent of the expected demand. To provide the entire requirement, some 55,000 acres would be needed.

Imports of Soyabean Products

Soyabean meal which forms the base of livestock feed manufactured in Jamaica is imported. With the growth of the livestock feed industry it is estimated that imports of this item will increase from 36.4 million pounds in 1972 to 66.4 million pounds in 1975. In the early months of 1973 the price of meal in the United States of America increased to $400 per ton before stabilizing at around $200 per ton. The c.i.f. value of this meal exported to Jamaica was $225 per ton more than twice the average price of meal imports in the 1968-1972 period when the national expenditure on soyabean meal went from J$7,784 in 1967 to J$1,860,951 in 1972. Thus the Jamaica imports of soyabean products including oil and meal as shown in Table 2, reached $6.5 million in 1973 *a significant drain on foreign exchange*.

In mid 1974 the Government of Jamaica established a wholly-owned incorporated company, Jamaica Nutrition Holdings. The reasons for the establishment of the company were:-

Table 2. Imports of Soy Products into Jamaica

	1968	1969	1970	1971	1972	1973
Soya Meal:						
Quantity (m/lb.)	3.2	8.7	16.3	27.8	36.4	46.40
Value c.i.f. ($)	0.15	0.4	0.67	1.4	1.86	5.6
Unit Value ($/S.T.)	92.36	90.90	82.56	100.38	102.20	241.42
Soya Oil:						
Quantity (lb.)	8.7	7	7.7	7.1	9.1	15.2
Value c.i.f. ($)	0.80	0.73	0.57	0.76	1.20	0.93
Unit Value ($/lb.)	0.10	0.10	0.10	0.11	0.13	0.06
Other Soya Oil:						
Quantity (lb.)	3.7	1.8	1.4	2.8	0.7	5.6
Value c.i.f. ($)	0.20	0.02	0.10	0.32	0.07	0.33
Unit Value ($)	0.10	0.10	0.10	0.12	0.10	0.06
Total Soya Oil Quantity (lb.)	12.36	8.76	9.1	9.9	9.8	20.8

(a) Global food supplies have become short and strategic staples like wheat, corn, soya and milk have assumed price demand and supply characteristics, in disproportionate relationship to their intrinsic food value.

(b) International economic behaviour had indicated a preference for holding grains, metal and other raw materials as protection against world inflation, thus distorting the price and supply relationships.

(c) Access to scarce supplies could not now be gained through the inter-play of normal market forces.

(d) The J.N.H. was charged with developing a central prccurement capability which would promote economic stability and preserve the ccuntry's supply of basic nutritional requirements. So far the scope of the company has encompassed:

(i) bulk trading in wheat, corn, soyabean meals and milk solids;
(ii) the importation of baking flour to supplement local supplies;
(iii) operating a price stabilization fund for wheat flour;
(iv) absorbing the Food Control Distribution Department; and
(v) setting up a soya processing plant in association with others.

In another paper to be presented to the Conference the structure and operations of the J.N.H. will be dealt with more carefully. Proposals have been put forward for a project to establish a 5,000 acre block of soyabeans in rotation with corn or sorghum. This project proposal has demonstrated the economic feasibility of growing soyabeans in Jamaica using commercially successful farming techniques. It is hoped that with the increased activities of the J.N.H. such a project will fall under the aegis of the company. At present, however, soyabean production is virtually non-existent.

In conclusion a number of points need to be summarized and policy implications indicated.

1. In the Caribbean Area as a whole there is an urgent and pressing need to improve the nutritional levels of the majority of the population. This need is an indispensable adjunct of increased productivity of the working population on which an improved standard of living depends.

2. In Jamaica, some 70 per cent of the population exist on a diet which is nutritionally inadequate. The production of soyabean products as a basic ingredient in improving the diet of Jamaicans appear feasible for the following reasons:

(a) the production of the bean is less onorous and risk-prone than others with less protein potential;
(b) it can be stored for long periods;
(c) it has many uses and numerous by-product development possibilities; and
(d) it can be mechanically cultivated and harvested, thus making possible large scale production from vast acreages.

3. However, within the foreseeable future it is unlikely that Jamaica will put large acreages into production due to the fact that the suitable acreage is already under sugar cane cultivation, the price of which is at present, very lucrative.

4. The importance of soyabean to Jamaica and indeed the entire region, necessitates immediate action being taken to implement in one instance (Jamaica-Belize) and extend in the other (Guyana-Trinidad) the *regional projects* that have been proposed for some time.

5. In these times, not only is it a tragic waste of scarce foreign exchange and other economic resources but the almost total dependence on outside sources for vital food and nutrition components could also result in economic suicide.

References

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