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THE ROLE OF AGRICULTURAL RESEARCH AND DEVELOPMENT IN PROMOTING AGRO-INDUSTRY IN TOBAGO

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Agricultural development in Tobago, as in many other island economies, faces problems which include the small size of the local market - Tobago has a population of only 40,000 - and the physical difficulties associated with the export market. Having to ship everything through Trinidad has been a major deterrent to export from Tobago but it is hoped that current improvements to airport and harbour facilities will benefit agriculture as well as tourism.

Tobago has virtually no manufacturing industry of any kind at present. The development of agro-industries may be most appropriate. These could stimulate agricultural production by providing more secure markets, by giving more flexibility to marketing arrangements through preserving local produce and, at the same time, providing import substitution.

In order to facilitate agro-industrial development several factors need to be in place, the most important of which are:

- improved production system
- appropriate processing technology
- infrastructure
- financing; and
- management skills.

The role of the Caribbean Agricultural Research and Development Institute (CARDI) lies in contributing to the first of these. The Tobago House of Assembly, recognising this, has asked CARDI to focus on the agronomy of selected crops with potential for agro-processing, namely peanut, sesame, seasonings and *Aloe vera*.

The part of CARDI's work in Tobago falls within the Technology Adaptation and Transfer (TAT) Programme. Under this programme, having identified priorities for particular target groups, gaps in the production technology are addressed. Trials are conducted where necessary to examine performance under local conditions and a production

package, or tech-pack, is developed. This tech-pack is then taken for on-farm evaluation.

This paper goes through the research and development steps so far taken for the selected crops.

IDENTIFICATION OF TARGET GROUPS

On the production side, there are estimated to be about 2500 small farmers in Tobago. The majority of these are part-time; many of them have no security of land tenure to allow for long-term investment. These farmers are looking for short-term crops which do not require high labour and other inputs and will not give them marketing headaches due to either physical arrangements or finance.

On the agro-processing side, sesame confectioneries ("*Bene balls*"), liquid seasonings and parched nuts are already being made by many households and small processors. *Aloe vera* is being processed by a local cooperative and is also used for wine making and as a tonic at a domestic level. There is an increasing interest in processing and it is believed that more people would become involved if the cycle of supply and demand could be coordinated.

IDENTIFICATION OF PRIORITIES

Initially, peanut (*Arachis hypogaea*), sesame (*Sesamum indicum*), *Aloe vera* and seasonings (thyme, *Lippia micromera*; garlic, *Allium sativum*; turmeric, *Curcuma domestica* and *Eryngium feotidum* known locally as "shado beni" or fit weed) have been selected for various reasons.

These crops are imported into Trinidad and Tobago, with the exception of shado beni - some examples are given in Table 1. Production of all these crops should provide foreign exchange

savings. There may even be export potential for the processed products directed at selected niche markets.

Peanut, sesame and seasonings may be produced for either the fresh market or for processing - an important consideration until industries are in place. Peanut and sesame also share other qualities which make them attractive crops for Tobago. When properly dried they are relatively easy to store and transport. Both also have potential for oil extraction, as does Spanish thyme.

All these crops can be produced on very small land areas, even backyard gardens, for either home use, or, with suitable marketing arrangements, they could be bulked up into commercial quantities. As mentioned above, these crops are already used, although on a very small scale, for processing in Tobago (peanuts are also processed on a large-scale in Trinidad). These skills could easily be built on to promote commercially viable industries.

TECHNOLOGY ADAPTATION

After reviewing current information, much of it from other CARDI programmes, additional technology testing was seen to be required for these crops under Tobago conditions (Table 2).

Trials and observation plots have provided supplementary information as follows, in summary, for the individual crops. Details are reported in CARDI Annual Technical Reports.

Peanut

Validation of Tech-Pack on Station

The CARDI tech-pack developed under a previous regional programme was validated in Tobago at several sites. However, gypsum was not used since the soils in Tobago are adequate or high in calcium. The variety NC2 proved to be suitable giving yields of up to 2400 kg.ha.⁻¹

Use of Small Machinery

A hand sheller (Fig.1) and pod stripper (Fig.2) have been constructed locally and have reduced labour input. A small solar drier (Fig.3) designed at The University of the West Indies has performed satisfactorily for small quantities.

Sesame

Variety Evaluation

Of seven varieties tested, two gave good

yields in both the wet and dry seasons. Inamar yielded 861 kg ha⁻¹ in the wet season and 972 kg ha⁻¹ in the dry season; Acarigua yielded 1080 kg ha⁻¹ in the wet and 944 kg ha⁻¹ in the dry. Acarigua also had no lodging problems and a greater tolerance to *Alternaria* infection.

TABLE 1. SELECTED IMPORTS INTO TRINIDAD AND TOBAGO

| Crop | Quantity (kg.) | CIF Value (\$T) |
|----------------|----------------|-----------------|
| Peanut | | |
| - Shelled | 323,456 | 12,550,416 |
| - Unshelled | 388,615 | 1,901,072 |
| Sesame | 14,306 | 85,383 |
| Tumeric | 107,010 | 700,677 |
| Garlic - fresh | 1,625,578 | 10,322,467 |

Source: Overseas Trade Report 1989. Central Statistical Office, Trinidad & Tobago.

TABLE 2. TECHNOLOGY TESTING OF SELECTED CROPS REQUIRED UNDER TOBAGO CONDITIONS

| Crop | Variety | Fertilizer | Weed Control | Labour Reduction | Yield Data |
|------------|---------|------------|--------------|------------------|------------|
| Peanut | x | - | - | x | x |
| Sesame | x | x | x | x | x |
| Aloe vera | - | x | x | - | x |
| Seasonings | - | x | x | - | x |

Fertilizer Use

Fertilizer is not usually used on sesame in Tobago. In trials conducted in 1989 high levels did not increase yields significantly. However, moderate use of a mixed fertilizer is recommended to maintain yields and prevent soil depletion.

Defoliant

Use of diquat (Reglone[®]) at 0.75 l ha⁻¹ did not produce the desired results. The treatment desiccated the leaves but did not adequately defoliate the plants. The seed was unattractively stained after treatment.

Non-dehiscent Variety

In theory the use of non-dehiscent variety such as Moradan could allow for in-field drying with

threshing immediately after harvest.

In practice problems were encountered. After the other varieties were harvested, parakeets sought out this variety as a source of food, destroying most of the capsules. The capsules which could be salvaged were extremely hard and would need something in the nature of a hammermill to thresh them.

Aloe Vera

Work on *Aloe vera* was initiated under an Industrial Development Corporation (IDC) funded Caribbean Industrial Research Institute (CARIRI) project which was given agronomic support by CARDI.

Fertilizer Use

No significant responses in yield, weight, number of leaves, gel or sucker production was seen in a trial in which three levels of nitrogen were given, both as urea and in a mixed fertilizer, over a period of one year.

Use of Herbicide

Three easily available herbicides (glyphosate, paraquat and fluzifop) used in six treatments were tested on aloes. Glyphosate gave best results with no phytotoxic symptoms but lack of residue analysis precludes its use of aloes intended for food products.

Seasonings

Thyme

In support of CARIRI's research work on thyme oil production, CARDI looked at the agronomy of Spanish thyme, including a preliminary trial on fertilizer use (Imbert *et al*, 1989). A feasibility study was compiled which will be referred to later.

Garlic

Previous work by CARDI in Barbados has indicated that garlic could be successfully grown by small farmers.

Work in Tobago has been constrained by lack of suitable planting material and efforts are at present directed to collecting germplasm.

Shado beni and Turmeric

Work on these two crops was only recently started with observation plots currently being established.

FEASIBILITY

Sufficient information has been obtained for some of these crops to compile preliminary feasibility studies to give some idea of their potential viability.

A detailed feasibility study for peanut (Robertson, 1989) suggests an initial net income of TT\$10,894 ha⁻¹ crop⁻¹ rising to \$13,961 ha⁻¹ crop⁻¹ after 5 years.

Much less detailed estimates, compiled by the author, indicate that both *Aloe vera* and Spanish thyme may be attractive crops for Tobago farmers. *Aloe vera* is estimated to give a net return of TT\$2105/1000 plants⁻¹ yr⁻¹ (Table 3) and Spanish thyme TT\$11,924 ha⁻¹ yr⁻¹ (Table 4)

For Shado beni, Bridgemohan (1984) calculated a revenue of TT\$7402 ha⁻¹ over the first 15 months of the crop.

In contrast, on the basis of observations so far, in Tobago there should be much more reservation in recommending sesame as a small farmer unmechanized crop. A similar estimate for this crop gives virtually no net returns when high labour inputs into planting, weeding and post-harvest handling are taken into account (Table 5).

ON-FARM EVALUATION

From this year on-farm evaluation will begin for peanut, sesame and Aloe vera.

The main objectives of the evaluations will be:

- To validate, on-farm the production package which has been compiled using information from CARDI trials and other sources
- To arrive at realistic costs of production in order to advise future planning
- To observe on-farm constraints and to be guided by farmers' experiences in addressing these
- To assess market acceptance and market price response to increased production.

Participating farmers will be expected to prepare land, provide labour for planting, crop management and harvesting. Farmers must also provide irrigation as required. CARDI will provide the recommended seed, fertilizer and chemicals.

CARDI and the Extension Officers will make regular visits to ensure that the tech-pack guidelines are being followed, to investigate any problems, and to assist with record-keeping, if necessary.

DEVELOPMENT OF AGRO-INDUSTRIES

There are arguments against the promotion of agro-industries. It is felt that such a focus is wrong in assuming a production response when the farmer cannot respond unless other major changes are made, for example in land resources and marketing services. It is suggested that proper development of fresh markets could be more easily attained.

These arguments have some validity when capital investment into large-scale industries is considered. In Tobago, however, emphasis should be on the role of small processors and cottage industries. It must be remembered that many small processors are women who are restricted to working at home. This kind of activity could give them the opportunity to improve their family's nutrition, to generate income for themselves and to contribute to the national economy. The potential contribution of this type of processor should not be underestimated.

One small new agro-industry has begun in Tobago recently. As a result of a concerted effort by CARIRI, CARDI, the Tobago House of Assembly and funding agencies, a market now exists for Aloe vera gel produced in Tobago where none existed before (Collins and Imbert, 1989). Aloe vera gel is being sent to a large food processor in Trinidad for inclusion into a food product marketed as *Nutravera*.

This involved project funding from IDC, CARIRI's research into processing and product formulation, agronomic research and the formation of a cooperative (the Tobago Agro-Industrial Cooperative) by some graduates of the Kendal Farm School, Tobago to exploit the commercial opportunities. Assistance was also received from the Canadian High Commission directly to the Cooperative for purchase of equipment.

This kind of team effort could and hopefully would be utilized to promote and expand agro-industries based on the other crops discussed in this paper.

As mentioned previously, development of agro-industries and increased production to support this development depends on a cycle of interdependence. Both the production and processing sectors must remain vibrant and viable for such development to be sustained.

CARDI's experiences both in the field and in giving technical assistance to the Cooperative can be drawn upon to show that there may be some problems still to be addressed. Some of these are common throughout the Region, some are unique to Tobago. None of them should be insurmountable

however, if would-be processors and their suppliers are given sufficient support.

Areas of weakness on the production side still include:-

Lack of land with secure tenure -

Other speakers have highlighted this problem. The problems of not being able to obtain land and not having secure title exist in Tobago also.

Lack of co-ordinated rural development -

After a long wait, farmers who finally receive land are jubilant and optimistic. Then they start to struggle with the macro- problems of, for example, poor access roads, lack of water and inadequate communications. They also have all the micro-problems of production from land surveying, land preparation, unavailability of supplies and many others, through to marketing. Any one of these problems can be disturbing - to put all on the farmer's shoulders reduces that initial creative enthusiasm to complete frustration. An integrated approach to rural development by all the agencies involved is necessary.

Inadequate tractor services -

Tobago has a Tractor Pool that has not functioned well for many years. The difficulties are mainly due to inadequate finances to maintain old and deteriorating equipment. Not enough groups of farmer are joining together to buy large equipment. Both of these are expected to happen, in theory, in response to a very real demand but, in fact, they are not happening. Although in this day and age total reliance on government support is not expected, there may be areas where such support is still essential. There is a case for reorganizing and revitalizing the tractor pool, including the acquisition of equipment suitable for hillside farming. Land preparation is a major constraint and it is doubtful if the small farmers can be serviced otherwise.

Inadequate irrigation facilities -

Production in Tobago is still almost all rainfed and seasonal. This is mentioned merely as a fact of life that must be taken into account if continuous supplies for processing are required. Irrigation equipment is expensive but could be put in place if returns were seen to justify expenditure.

Inefficient use of credit -

Emphasis here is put on use of credit.

Sources of credit are available but there may be reservations on the part of the Tobago borrower as well as administrative details to be considered when promoting greater use of credit.

Inadequate business servicing agencies -

On the processing side there are many agencies in this country trying to service small business, including CARIRI, the Management Development Corporation (MDC), the Industrial Development Corporation (IDC) and the Agricultural Development Bank (ADB). Because of the difficulties associated with geographic separation, the local business person can only realistically hope to build up a good rapport with those agencies having a branch in Tobago, like the IDC and the ADB. Many of the problems relate to access - access to information, access to services, access to suppliers. The airline, BWIA, must take some responsibility here. The Tobago business person has no choice but to take on the headaches and hassles of getting to Trinidad frequently. BWIA must be made aware that it is in the national interest for them to give a better service to Tobago.

Inadequate management advice and training -

The other major business problems relate to lack of management advice and training. In considering business development for Tobago it may be thought that managing a small business would be relatively easy. Experience has shown, however, that management skills are acquired more by nurture than by nature and more training opportunities are needed. Many people in Tobago have a lot of faith in the cooperative movement as a means of bringing people with few individual resources together to contribute to the national economy. While this theory is sound, management problems are even worse within cooperatives. At best management by committee is difficult - management by a committee, none of whom have management training, is more so. Even more than the financial assistance all small businesses need, the cooperatives need technical assistance at the management level if they are to succeed.

CONCLUSION

CARDI has a role to play in the development of agro-industries in Tobago and in the rest of the Region. To summarize, this role includes coordination of information, technology testing, and, as has been highlighted in this paper, interaction and cooperation with other organizations in order to effectively meet the stated aims.

Acknowledgements

The field assistance of Selby Quashie of CARDI is gratefully acknowledged.

The work described in this paper was planned and executed in collaboration with the Division of Agriculture, Forestry and Marine Affairs, Tobago House of Assembly.

Dr. M. Imbert of CARIRI was responsible for the research on processing thyme and Aloe vera.

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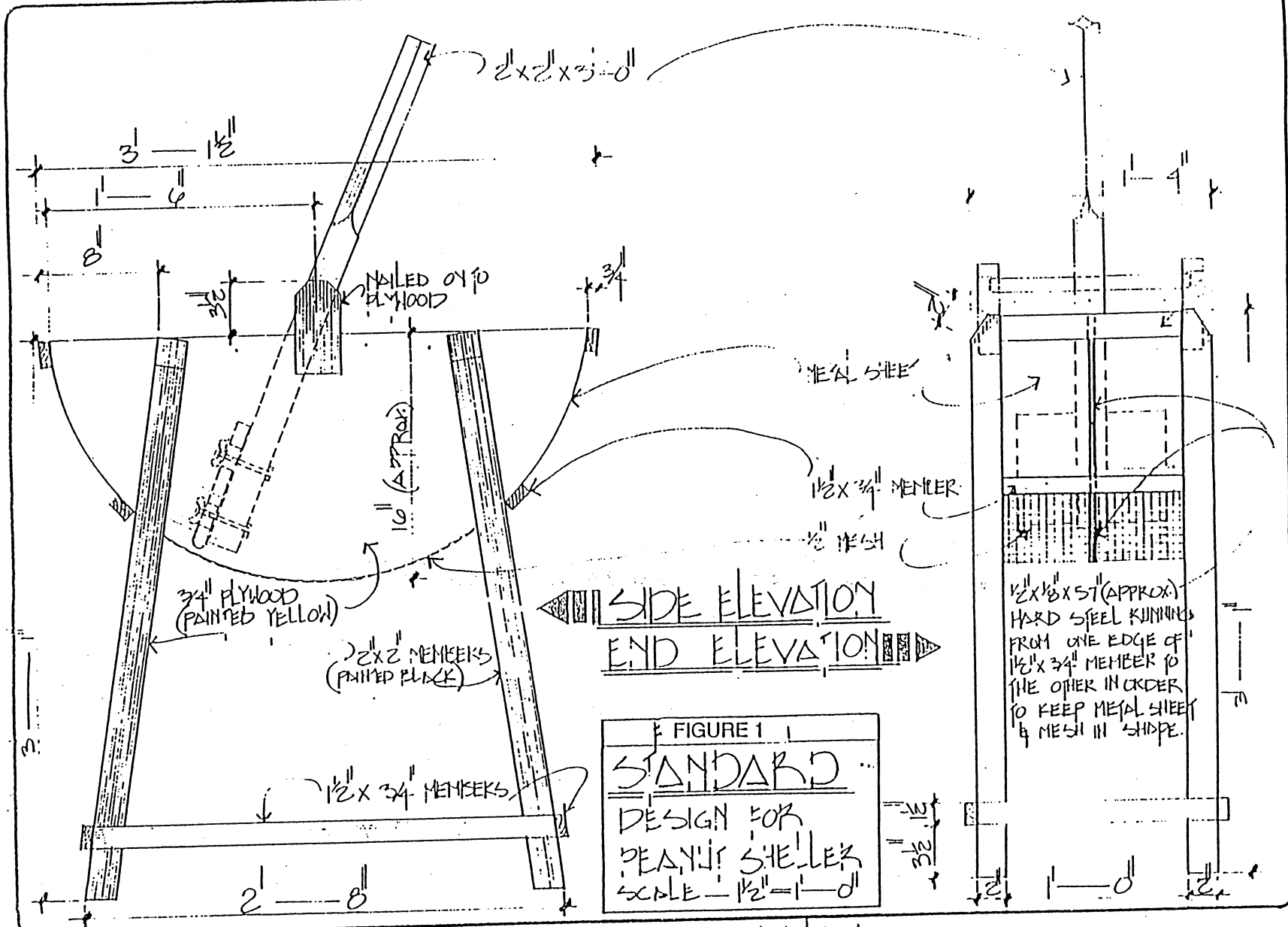
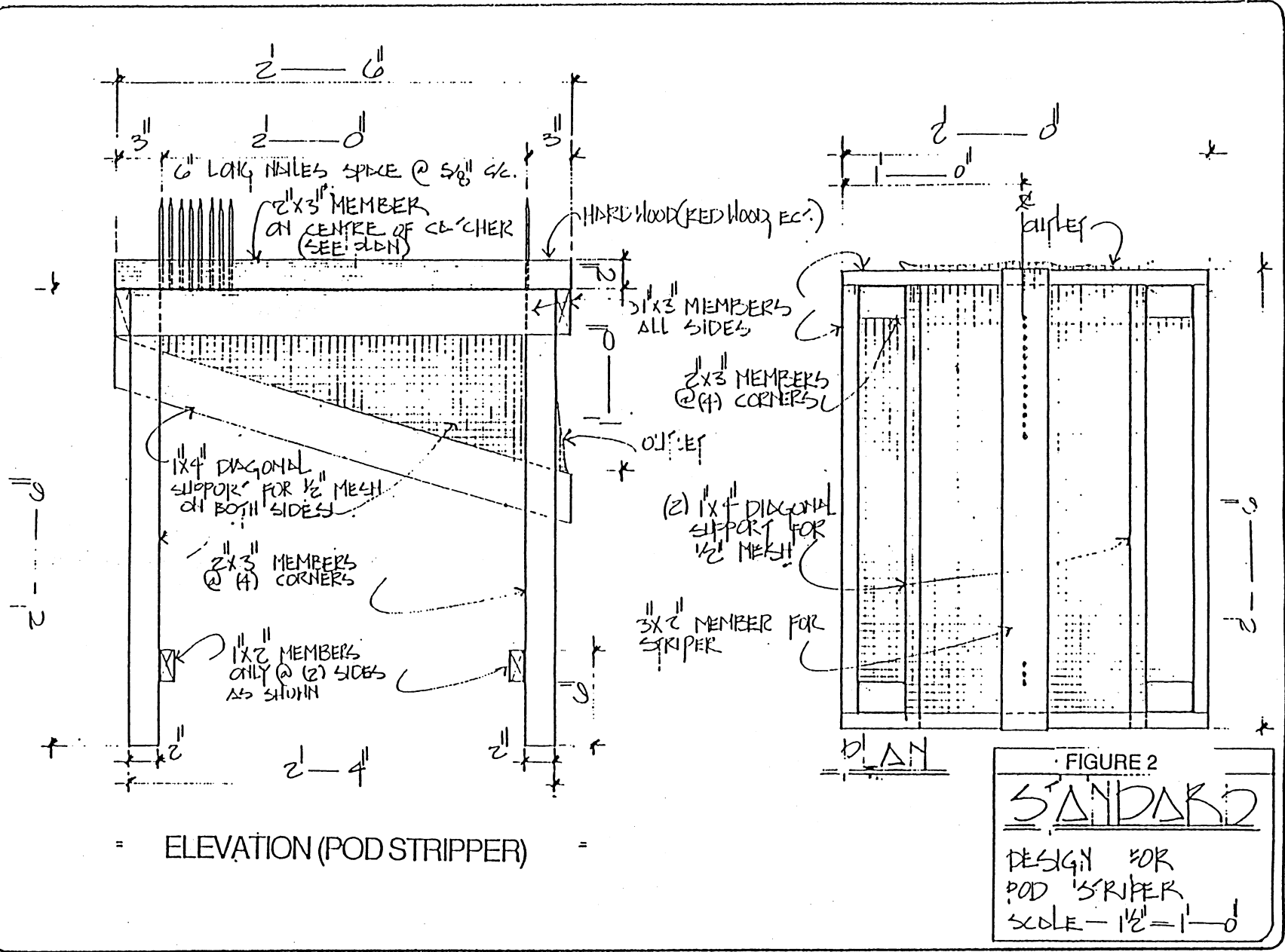


FIGURE 1
STANDARD
 DESIGN FOR
 PEANY SHELTER
 SCALE - 1/2" = 1'-0"

CARDI-BELIZE



ELEVATION (POD STRIPPER)

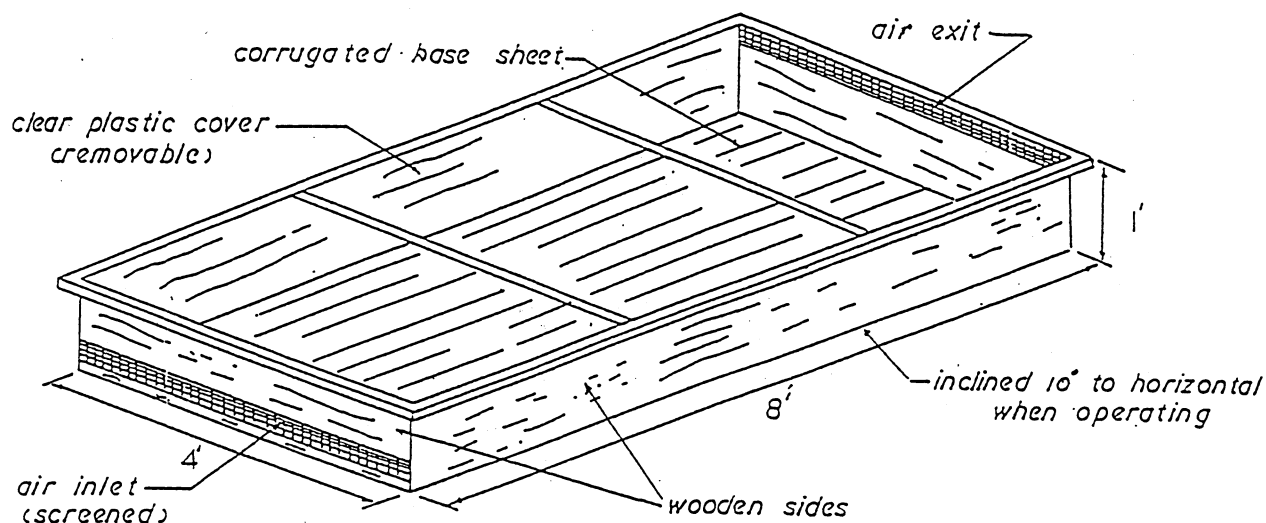
CARDI-BELIZE

Table 3 Annual variable costs and returns of growing *Aloe vera* in Tobago

| Activity | Labour use (man-days) | Cost (\$/1000 plants) |
|------------------------------------|--------------------------|--------------------------|
| COSTS | | |
| Land preparation* | - | 10 |
| Planting* | 0.5 | 30 |
| Bed & drain formation, maintenance | - | 19 |
| Fertilizing | | |
| - materials | - | 42 |
| - labour | 0.5 | 30 |
| Weed control | | |
| - chemicals | - | 14 |
| - labour | 1.5 | 90 |
| Harvesting | 5 | 300 |
| TOTAL VARIABLE COSTS | | 535 |
| RETURNS | | |
| Min. yield: 2 x 0.2 kg x 4/yr | | 1600 kg |
| Gross return @ \$1.65/kg | | \$2640 |
| NET RETURN | | \$2105 |

* Every 5 years

FIGURE 3.



SOLAR CABINET
— DRYER —

