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MECHANIZED CASSAVA PRODUCTION IN BARBADOS

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ABSTRACT

Barbados has well developed pig and poultry industries but the main feed ingredients are imported from extra-regional sources. The use of chipped cassava as a substitute for some of the imported corn used by feed manufacturers is being investigated by CARDI. Cassava has been grown locally for many years mainly for human consumption but methods have not been scientific and yields have been low. New varieties, mechanisation of planting and harvesting operations and improved agronomic practices are being introduced in an effort to increase efficiency and to produce the crop at a competitive price. In addition the drought tolerance of cassava makes it a useful altenative crop for the dry marginal areas of the island.

RESUMEN

Las industrias porcina y, avícola de Barbados están bien desarrolladas pero los ingredientes más importantes de la la alimentación son importados de fuentes extra-regionales. El uso de pedacitos de yuca como sustituto de una parte del maíz importado por los fabricantes del pienso, está siendo investigodo por CARDI. La yuca ha sido cultivada localmente por muchos años, principalmente para el consumo humano, pero los métodos no han sido científicos y el rendimiento ha sido bajo. En un esfuerzo por aumentar la eficiencia y producir el cultivo a un precio competitivo, se están introduciendo: newvas variedades, mecanización de la siembra y recolección, y mejores prácticas agronómicas. Además, la tolerancia a la sequía de la yuca la convierte en una alternativa útil en las áreas secas marginales de la isla.

Keywords: Cassava; Mechanised production; Animal feed; Barbados

This paper will discuss the progress made in a Cassava for Livestock Feed Project currently being carried out by CARDI. The project is part of a larger Farming Systems Research and Development (FSR/D) Project funded by USAID. An earlier cassava project set up by the Barbados Ministry of Agriculture during the 1970's sought to reduce imports of wheat by producing a composite flour containing 10 per cent cassava flour. The present project is building on the research results of that project and has established pilot commercial plantings on sugar estates to test the feasibility of producing cassava as an ingredient for livestock feed.

Background

Barbados has a reasonably well-developed livestock sector, particularly in the areas of dairying, poultry and pork production. In fact, self sufficiency has been attained in whole chicken, table eggs, and fresh pork with importation of only specific cuts of pork for the growing processing industry. The island's demand for fresh milk is fully supplied by its 31 dairy farmers.

In spite of this, virtually none of the ingredients used in the manufacture of livestock feeds is produced locally. In fact, not only in Barbados, but in all the CARICOM States, the main ingredients of animal feeds are imported from extra-regional sources. During 1984, Barbados imported 25,000 tonnes of corn for use in animal feed manufacture.

Substitution of some of these corn imports by locally grown cassava would save considerable foreign exchange. Production of calories ha^{-1}. day^{-1} is higher for cassava than for any other staple food crop (Toro and Atlee, 1980). Furthermore, because of its drought tolerance, cassava could contribute to the diversification of Barbados' agriculture by providing a useful alternative to sugar-cane, particularly in the drier, marginal areas of the island. In addition, under local conditions, pests and diseases are not normally major problems on cassava if the crop is well managed, and therefore specialised high clearance crop protection equipment is not likely to be necessary as would be the case with corn.

Of course, cassava is not a new crop to Barbados. Its importance and production increased during World War II when Government introduced compulsory measures for increasing local food production. The Vegetable Production (Defence) Control Order (1942) made it mandatory for all sugar estates to plant at least 35 per cent of all arable land in food crops. Cassava was one of the crops widely grown to comply with this Order. Government then erected a processing plant in 1943 to produce flour for human consumption, and meal for livestock, from cassava and sweet potatoes. The capacity of the plant was approximately 12 tonnes of flour per day.

After the War, when shipping facilities improved, and the island returned to many of its former sources of food, the plant was closed. Since then, acreages of cassava have been small, widely scattered and often interplanted with other crops. Cassava has been generally neglected, operations have been manual, inputs negligible and yields low.

Cassava production for animal feed

If cassava production for animal feed is to be feasible, the current production system has to be vastly improved. The price of dried cassava chips delivered to the feed mill will have to be competitive with the price of imported corn, bearing in mind that cassava has 80 per cent of the nutritional value of corn.

If this is to be achieved, and the farmer is to make a reasonable profit, yields must be high and production methods must be efficient to keep the cost of production to a minimum. The FSR/D Project is attempting to achieve these objectives by introducing a number of improved practices based on the recommendations of authorities, such as CIAT, and by establishing the crop on a pilot commercial scale on estates to facilitate the study of its feasibility under commercial conditions.

Toro and Atlee (1980) state, that although experimental yields greater than 70 t ha^{-1} have been obtained, the average yield of cassava roots worldwide is only 9.4 t. ha^{1} . Cock (1985) has suggested that the lack of suitable disease and pest resistant varieties, poor quality planting material and suboptimal agronomic practices are important reasons for the low yields in farmers' fields. The results of 5 years of regional trials at eight locations in Colombia conducted by CIAT, have shown threefold increases in the yields of local varieties by the use of selected and treated planting material, adequate soil preparation, optimum planting density and timely weed control (CIAT, 1979). Yields can be increased even further by the introduction of new disease and pest-free cultivars.

In this paper attention will be restricted to:

- establishment of pilot commercial acreages
- soil preparation
- mechanised harvesting
- chipping and drying

Establishment of pilot commercial acreages

Two out of a targeted 2.4 ha of cassava were established in July and August 1985, in the low rainfall areas of St. Lucy, St. Philip and Christ Church. These plantings will be used to test the improved mechanised production system (see below) and to record costs and returns for the crop with improved practices.

The system of cultivation includes the following:

- variety and spacing
- planting materials
- fertilizer application
- weed control

If results are encouraging, recommendations will be passed on to interested growers.

Towards a mechanized system.

Soil preparation

Mechanised planting and harvesting require specialised cultivation. Fields are disc harrowed, ploughed and furrowed. Ridges must be straight so that the planter does not run off course. If mechanised harvesting is to be carried out without damage to tubers accurate planting is important.

After fertilizer is applied with a Vicon Broadcast Fertilizer Spreader with a Carib Agro Industries Banding Attachment, a moulding operation is done to produce steep sided ridges of a uniform height of about 30cm and width of 168cm.

Mechanised planting

At present, a locally built planter originally designed by Chandler (1973) to plant yams is being tested. It consists of a subsoil tine, moulding discs, planting boxes, an operator's seat and a large tube through which the material is dropped, all attached to a double tool bar. Carib Agro Industries Ltd., a subsidiary of Barbados Sugar Industry Limited modified the implement to plant cassava stakes. The modification involved the addition of two metal wings and a cross bar at the end of the tube to guide the stakes into a horizontal position.

The 168cm ridge coincides with the normal tractor wheel spacing used by most sugar estates. With an 83cm ridge, it is felt that weathering would be a problem, and ridges would be almost flat by harvest time. Chandler (1973) while experimenting with the mechanisation of yams, noted that this would mean that the harvesting implement would have to travel at a depth below the general level of the ridge and adjacent furrow, the result being that too large a volume of soil would have to be loosened and possibly inverted, and exposure of tubers would most likely be poor. Further, there would be the increased risk of meeting large boulders at that depth which could severely damage harvesting implements. Steep sided ridges facilitate correct positioning of stakes in the ridge.

An intra-row spacing of 60cm is used to achieve the CIAT-recommended plant population of 10,000 plants ha^{-1}. Planting depth is approximately 10cm. The planter currently being used has no mechanism for accurately spacing plants. This is regulated by the speed of the tractor and the speed at which the operator places the stakes in the tube. However, with a little practice, operators have been able to achieve quite accurate spacings. A Kubota 7500 tractor in low range and third gear at 1400 rpm is used at one estate, and works satisfactorily. Planting rate is 1.2 to 1.6 ha day^{-1}, with one tractor driver and one planter operator.

The planter places stakes in a horizontal position. The literature on planting position records conflicting views. Toro and Atlee (1980) reported that Fernando and Jayesundera found that vertical planting gave superior yields while Brandao found that in heavy soils, vertically planted stakes bore roots nearly 5cm deeper, and yielded 30 per cent more than those planted horizontally, but the horizontally planted crop was easier to harvest. Chan is quoted as finding no differences in yield from horizontal, vertical or inclined planting of 15cm stakes. It would appear that, in general, horizontal planting 5–10cm deep can be recommended for dry climates and when mechanical planting is used. The system also facilitates mechanised harvesting since roots are nearer to the surface.

Carib Agro Industries plan to make a number of improvements to the planter as long as cassava production appears feasible. These will include a more accurate spacing mechanism and a depth adjustment. Normanha as quoted by Toro and Atlee (1980) states that the highest degree of cassava crop mechanisation in Brazil has been attained by using a two row planter, made in Brazil, which simultaneously accomplished furrowing, fertilising, horizontal planting, covering of stakes and compaction of the soil after planting.

Mechanized harvesting

Preliminary mechanised harvesting trials have been done, using a locally built yam digger. The design of the machine is based on a method pioneered by a UK-firm and developed locally by Carib Agro Industries along with Barbadian farmers.

It consists of a U-shaped digging share made from a 1.6cm plate edged with a 1.6cm meridian steel cutting tip. The tractor PTO drives a gearbox linked by a crank to a set of separating fingers which gently bounce the roots out of the ridge. The digger mounts on a range of tool bars.

A test was carried out on two local varieties in a farmer's field which had not been prepared for mechanical operations and where the ridges were reasonably flat. Cassava stems were first slashed with a cutlass to a height of 10–15cm before the machine passed over them. Labour required for this operation was in the vicinity of 4.4 man hours ha^{-1}.

A Ford 7600 tractor driven in 2nd gear, low range, at approximately 1200 rpm did a satisfactory job. However, it is also possible to use a tractor of 65–75 hp. with the digger.

Tubers up to 51cm in length were harvested with minimal damage to the tips of the tubers. Harvesting rate was 1.2-1.6 ha day^{-1}. By comparison, one man harvested approximately 0.25 ha day^{-1} manually under moist soil conditions when the plant was held by the stem and pulled out of the soil. Under dry soil conditions, a fork would probably have to be used. This would not only further reduce the rate of harvest but possibly do more damage to tubers.

A second harvester – from Agri Projects International Ltd. – was tested on a very small area. Again the cultivation had not been done to suit mechanical operations. The machine is a single conveyor lifter which places the separated roots on top of the dug row behind the machine. The working depth is down to 40cm below soil level. This machine will have to be tested further before a full evaluation could be made.

Chipping of cassava tubers

Cassava tubers are extremely perishable, deteriorating with 24 hours of harvesting. The crop must therefore be chipped and dried promptly after harvest. Chipping and drying also reduce HCN content to a safe level in those varieties with a high initial HCN content.

A chipper built by CARDI – Jamaica is at present being tested. The blade is a Malaysian type with some modification. The machine produces a "French-fry" type of chip in most cases, but requires some adjustments and modifications to reduce the amount of "fines" as well as the number of large unchipped pieces. Preliminary tests indicate that the chipping rate is in the vicinity of 680-1000 kg hr^{-1}.

Drying of chips

Chips must be dried from over 60 per cent to 14 per cent moisture if they are to be safely stored. At present fresh chips are spread at a density of about 10 kg m^{-2} in a high roofed building with a smooth concrete floor. In the absence of direct sun, turning of the chips with a rake every hour is very important to facilitate uniform drying, which is completed in about 5 days.

This method is only a temporary measure since a dryer which will utilise flue gases from sugar factories is currently being manufactured and is expected to be in operation during the next sugar-cane harvest season.

Conclusion

If this pilot project demonstrates that cassava production for animal feed is a profitable commercial enterprise, it is hoped that growers will take advantage of the opportunity to diversify their agriculture as well as to contribute to foreign exchange savings and to the further development of the livestock sector.

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