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CARIBBEAN AGRICULTURAL RESEARCH AND DEVELOPMENT INSTITUTE

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Factsheet

COMMERCIAL CASSAVA PRODUCTION

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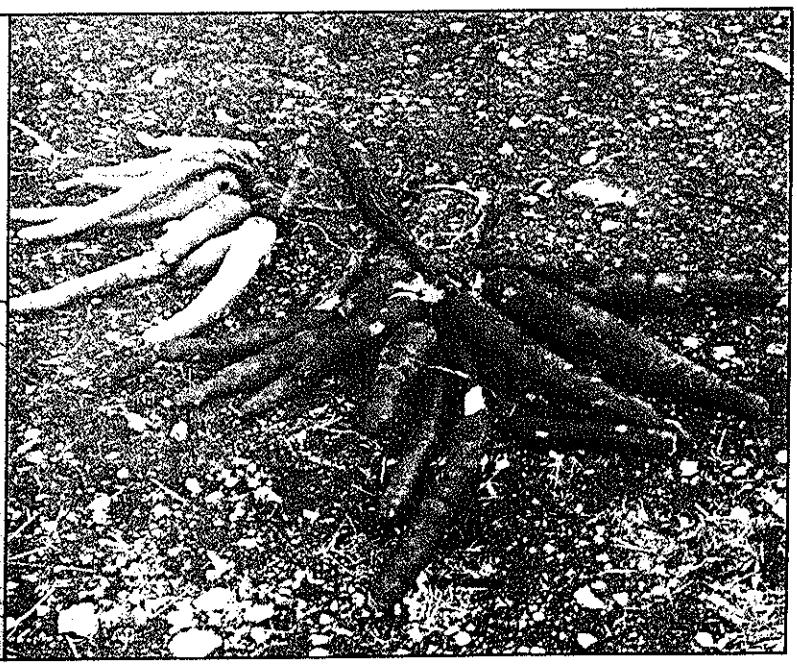

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BARCLAYS

Commercial Cassava Production

Cassava (*Manihot esculenta* Crantz) is a high energy starchy root crop which can be used in both animal and human diets. In the Caribbean, it has traditionally been grown as a subsistence crop with all cultural operations being manual, inputs negligible and yields generally low.

The high yields necessary from commercial enterprises require an efficient production system involving improved varieties and agronomic practices, coupled with mechanized planting and harvesting methods.

This Factsheet describes a commercial production system based on local experience gained over the past 4 years in a USAID-funded Cassava Project but also draws on the experience of such authorities as CIAT in Colombia.

Site Selection

A light fertile loam with pH 6 - 7 is ideal for cassava. A relatively level field which is not prone to flooding should be used. In coastal areas exposure to salt-laden winds can cause severe defoliation of the crop, so sheltered areas should be chosen. The crop is susceptible to damage from the herbicide 2-4, D which may severely reduce yields, so care should be taken to avoid drift of this chemical from neighbouring cultivation operations.

Selection and Treatment of Planting Material

Quality of planting material can seriously affect germination and final yield. Material is best taken from plants between 8 and 18 months old – younger material tends to be soft and susceptible to dehydration and attack by soil borne pathogens, while older material lacks the food reserves necessary for adequate germination of buds. Stakes 20 cm (8 in) in length should be cut using a sharp implement to ensure a clean cut. Cutting may be manual or mechanical. The University of the West Indies has designed a machine for cutting stakes.

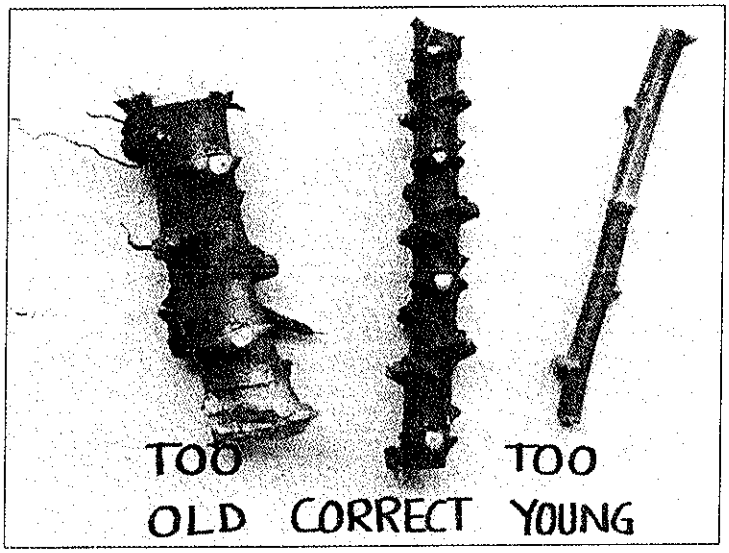
Storage of Planting Material

Storage time should be as short as possible. Long cuttings (preferably 50 -70 cm; 20 -30 in) are recommended to reduce dehydration. These should be dipped in the same fungicide/insecticide solution recommended for pre-plant treatment, (see below) and allowed to dry before being placed in a shaded, well-ventilated area.

Land Preparation

All operations should aim at producing a fine tilth which will allow optimal tuber development.

Mechanized planting and harvesting require specialized cultivation. In fields coming out of sugar-cane, debris must be mixed into the soil by harrowing otherwise it will choke the planter and cause inaccurate spacing and planting depth. Subsoiling should also be done to ensure good drainage since cassava is susceptible to waterlogging. Fields should be ridged to produce 1·7 m (5·5 ft) wide beds.



Key to selecting Planting Material

Varieties

The choice of varieties depends on the purpose for which they will be used e.g. varieties with relatively high hydrocynaic acid (HCN) content which cannot be used for cooking can be used for animal feed since the chipping and drying done during processing reduces the content to an acceptable level. Disease tolerance should also be considered.

Although local varieties may sometimes be preferred for cooking purposes (e.g. Sugarloaf and Butterstick in Barbados) the imported varieties (including hybrids) from CIAT are generally higher yielding. The following CIAT varieties have been grown in Barbados and are among those stored *in vitro* by the CARDI Tissue Culture Laboratory:

Variety	Root Surface Colour	Flesh Colour	HCN Content	Potential Use		Resistance to diseases	
				Fresh consumption	Animal feed	Superelongation	Bacterial Blight
M Mex 59	Light brown	White	Low	High	High	High	Very Low
M Col 2215	Dark brown	White	Low	High	High	Low	Very Low
M Pan 70	Dark brown	White	Low/Med	High	High	Very High	Very Low
M Ven 77	Dark brown	White	Medium	High	Med	Very High	Very High
M Col 1468	Dark brown	White	Low/Med	High	High	Medium	Med./High

It is recommended that varieties should first be tested on a small scale under the specific soil and environmental conditions before large scale commercial production is embarked upon.

M Mex 55, M Mex 23 and M Mex 59 (from CIAT) have been grown on a pilot commercial scale in Barbados with yields ranging from 20 to 45 tonnes per ha. Unfortunately cassava bacterial blight (CBB) has recently been diagnosed on all three varieties and superelongation on M Mex 55 and M Mex 23.

Pre-Plant Treatment of Stakes

All planting stakes should be dipped for 5 min in a fungicide/insecticide/nutrient solution such as copper hydroxide (Kocide 606, Manzate, Tri-Miltox Forte) diazinon (Diazinon, Basudin) and Nutrex at the manufacturers' recommended rates. Captafol at 4000 ppm is recommended as a dip for the eradication of superelongation disease.

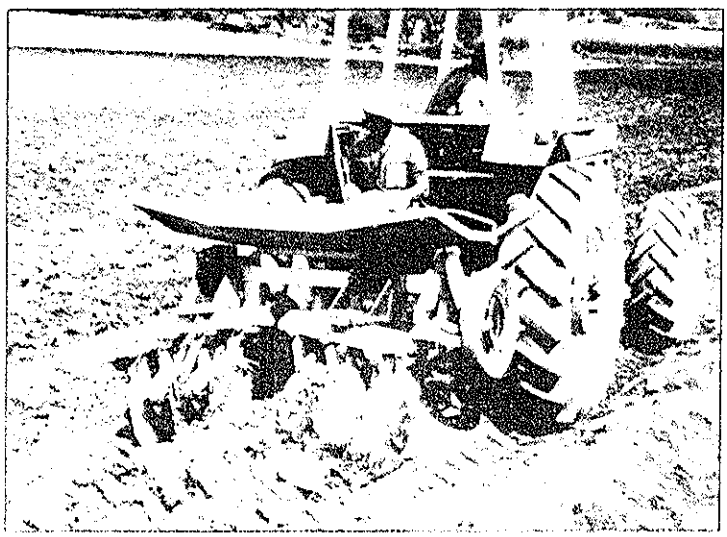
Spacing and Planting

There are conflicting views on what planting position is preferable but, in general, planting the stakes horizontally at a depth of 5 - 10 cm (2 -4 in) can be recommended for dry climates, particularly when operations are mechanized, since tubers will be shallower and easier to harvest. Vertical or inclined planting may be preferable for wet conditions.

One row should be planted on each 1·7 m (5·5 ft) bed with a spacing between plants of 50 cm (20 in) for varieties with a compact habit and 75 cm (30 in) for those plants with a spreading habit. Where superelongation disease is expected to be a problem, the wider spacing is recommended to reduce the humidity under the canopy.

The precision planter built in Barbados by Carib Agro Industries Ltd. (CAIL) plants stakes horizontally one row at a time. Spacing between plants is adjusted by using different sized wheels and sprockets. The planter operator supplies the chambers of a "magazine" from baskets of planting material placed in front of him. The depth of planting is controlled by setting the ridging discs which cover the plants with soil. The planting rate is 0·2 ha (0·5 ac) per hr. The rate is affected by:

1) Availability of uniform pre-cut pieces of planting material which will not choke the planting chute.
2) Skill of the planter operator.
3) Length or rows (since time is lost in turning).
4) Poor soil tilth.
5) High soil moisture.
6) Excessive crop debris.



CAIL Cassava Planter

Fertilizer Application

Cassava can adapt better than most crops to low soil nutrient conditions but nutritional requirements for maximum yields are as high or even higher than several other commonly grown crops.

The crop extracts large quantities of nitrogen (N) and potassium (K) from the soil but smaller quantities of phosphorus (P), calcium (Ca) and Magnesium (Mg), e.g. a yield of 25 tonnes per hectare of the crop removes 122 kg N, 27 kg P, 145 kg K, 45 kg Ca and 20 kg Mg.

Fertilizer requirements should be based on soil analysis if possible. On soils that are moderately deficient in P and K, a general recommendation would be to use fertilizer with a $N:P_2O_5:K_2O$ ratio of roughly 1:1:2, e.g. 40 - 80 kg N, 40 - 60 kg P_2O_5 and 80 - 150 kg K_2O per ha.

Care must be taken not to over-fertilize the crop; this could cause it to become too leafy. Excessive N application may also lead to high HCN content and bitterness of the tubers. Inadequate K will lead to excessive vegetative production at the expense of tuber growth. Added K also decreases the HCN content of the tubers. Cassava appears to be particularly susceptible to zinc deficiency.

Fertilizer should be applied at planting using a mechanical spreader with a banding attachment which will cover three rows in a pass.

Irrigation

Cassava is not generally irrigated and the crop can withstand drought conditions.

Weed Control

This is particularly important during the first few months before the leaf canopy has closed over. The following pre-emergent herbicide treatments have given good control under Barbados conditions.

- Pendimethalin (Herbadox) at 4.5 litres per ha.

- Pendimethalin (Herbadox) at 4 litres per ha, together with diuron (Karmex) at 1.5 kg per ha.

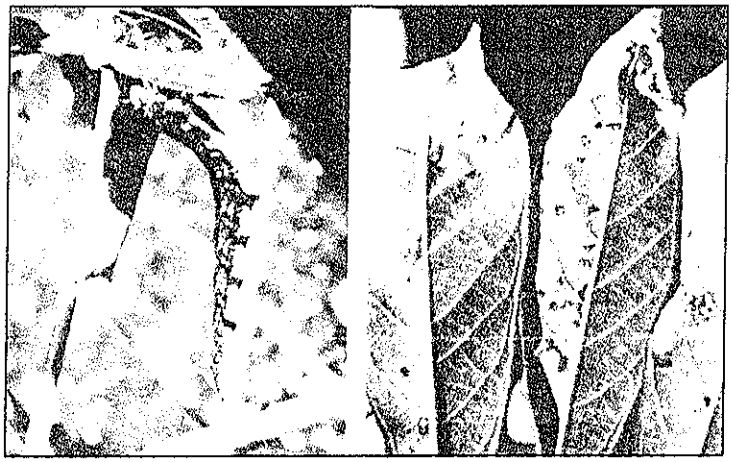
- Diuron (Karmex) at 1.5kg per ha together with alachlor (Lasso) at 3 litres per ha.

Inter-row directed sprays with paraquat (Gramoxone) or glyphosate (Roundup) may also be applied but a shield should be used to avoid damage to the crop.

Insect Control

Although cassava is considered to be a relatively pest-free crop, there are a number of insects which are potential problems. Biological rather than chemical control measures are recommended. Adequate biological control is normally carried out by indigenous parasites. However, in cases of severe pest infestations or where large-scale commercial production is being practised parasites may be bred and released by CARDI.

Pest / Nature of damage	Control Agent
Hornworm (*Errynis ello L.*) More prevalent in poorly managed fields and can cause severe defoliation.	*Trichogramma sp.* parasitize eggs. Ground beetles and Jack Spaniard wasps feed on larvae and pupae.
Cassava mite, cassava thrips and yellow thrips	Rove beetle.
Lace bug - Causes mottling, leaf fall and severe reduction in yield.	Lacewing bug and Ladybird beetle.



Cassava Hornworm *Cassava bacteria blight*

Disease Control

The following lists some of the most important diseases occurring in the Caribbean area and methods for their control:

Disease / Symptoms	Suggested control method
Fusarium solani (Mart) Sacc. Brown dry rot beginning at centre of tuber often accompanies nematode damage.	Control nematodes
Glomerella cingulata (Stonem) Spauld & Schrenk - Most common stem rot on stored cassava cuttings	Fungicidal treatment of cuttings. (see "Pre-plant treatment of stakes" above)
Spaceloma manihoticola (superelongation) spread by infected planting material and wind.	Use a Captafol (80%) dip at 4000ppm a.i. for 3 min. on planting material OR use resistant varieties.
Xanthomonas manihotis (cassava bacterial blight) The most serious cassava disease, particularly in the wet season. Angular leaf spotting followed by blight, defoliation, wilting and die-back. Greenish exudate may occur under some conditions. Root rot occurs in susceptible cultivars. Spread by rain splash and planting material.	Use healthy planting material. Use resistant cultivars. Disinfect tools with Clorox solution. Allow 6 months fallow on infected fields.

Duration of Crop

If the crop is to be used for human consumption, harvesting should begin about 6 months after planting. However periods of at least one year are recommended for good yields for use in animal feed.

Seasonality of Crop

This will depend on local requirements but should be aimed at providing

i) a minimal storage period for planting material
ii) at least 3 months of regular rainfall after planting
iii) harvesting under relatively dry conditions.

If the crop is to be used for feed production, the method used for drying must be considered, e.g. sun-drying, drying by flue gases from sugar factories or drying by diesel-powered driers. If flue gases are to be used, the harvest must coincide with the sugarcane harvest. If sun-drying is to be used it is obviously important that harvest coincides with the dry season.

Harvesting

To facilitate the mechanical lifting of tubers, plant stalks should be cut to a height of approximately 15 cm (6 in) and the plant material either removed from the field or chopped finely enough to prevent fouling of the harvester. A swipe fitted with chains rather than blades has been fairly successfully used for this operation. In countries where chop-stick sugar-cane harvesters are idle at the time of the cassava harvest, these could be considered, depending on operating cost, since they have proved to be most efficient from a practical point of view. The machine cuts all standing material, macerates and delivers it to a transport vehicle. This finely chopped material could possibly be used to produce silage.

The CAIL harvester drawn by a tractor of 65 - 75 hp, in 2nd gear low range at 1200 rpm performs well under weed-free conditions and good soil tilth. Tubers are gently "bounced" out of the soil by a V-shaped digging share and separating fingers. Then they are removed manually from the stems and loaded on to trailers which follow the harvester. Harvesting rate is 1·2 - 1·6 ha (3 -4 ac) per day depending on soil conditions.

Yields

Up to 40 - 45 tonnes per ha (18 - 20 tons per acre) have been harvested from M Mex 59 after a period of 15 months, but 25 tonnes per ha (11 tons per acre) has been more usual on commercial-sized plots.

Mechanical harvesting of the crop.

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