COMMERCIAL

CASSAVA PRODUCTION

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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](image)

Varieties

The choice of varieties depends on the purpose for which they will be used e.g. varieties with relatively high hydrocyanic 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. Sugarcock and Buttersick 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:

<table>
<thead>
<tr>
<th>Variety</th>
<th>Root Surface Colour</th>
<th>Flesh Colour</th>
<th>HCN Content</th>
<th>Potential Fresh Consumption</th>
<th>Potential Use Animal Feed</th>
<th>Resistance to diseases Superelongation</th>
<th>Bacterial Blight</th>
</tr>
</thead>
<tbody>
<tr>
<td>M Mex 59</td>
<td>Light brown</td>
<td>White</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Very Low</td>
</tr>
<tr>
<td>M Col 2215</td>
<td>Dark brown</td>
<td>White</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Very Low</td>
</tr>
<tr>
<td>M Pan 70</td>
<td>Dark brown</td>
<td>White</td>
<td>Low/Med</td>
<td>High</td>
<td>High</td>
<td>Very High</td>
<td>Very Low</td>
</tr>
<tr>
<td>M Ven 77</td>
<td>Dark brown</td>
<td>White</td>
<td>Medium</td>
<td>High</td>
<td>Med</td>
<td>Very High</td>
<td>Very High</td>
</tr>
<tr>
<td>M Col 1468</td>
<td>Dark brown</td>
<td>White</td>
<td>Low/Med</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
<td>Med./High</td>
</tr>
</tbody>
</table>

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 Nutrox at the manufacturers’ recommended rates. Captan 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.

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. 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 an N:P:O\textsubscript{5}:K:O ratio of roughly 1:1:2, e.g. 40 - 80 kg N, 40 - 60 kg P\textsubscript{2}O\textsubscript{5} and 80 - 150 kg K\textsubscript{2}O 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 1.5 kg 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.
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.