Commercial dasheen ([*Colocasia esculenta* (L.) Schott var. *esculenta*) production and post-harvest protocol for the OECS

by

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APRIL 2008

This document has been produced in collaboration with the North-South Institute with funding assistance from USAID as part of the Caribbean Trade Expansion Project (C-TEP)
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INTRODUCTION

Dasheen production and exports from the OECS target the increasing demand for dasheen in the drier Caribbean Islands of Antigua, St. Kitts, St. Maarten, British and United States Virgin Islands. The French West Indies, the expanding ethnic market in the United Kingdom, Holland and the United States of America, are the largest importers of dasheen and provide the impetus for acreage expansion. Dasheen exports also provide important foreign exchange for these Countries.

Market requirements and specifications

Commercial dasheen production is guided by specifications from the previously mentioned importing Countries. Market specifications also vary based on the importing Country. Specifications for the UK and US markets are listed below.
Table 2: Organization of Eastern Caribbean States (OECS) includes St. Vincent and Dominica - Export Specification for Dasheen

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Variety:</td>
<td>Any variety meeting the stipulated specifications.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleanliness:</td>
<td>Washed and free of soil.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition:</td>
<td>Corms packed moist for UK and dry for US market.</td>
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<tr>
<td>Appearance:</td>
<td>Rounded and symmetrical. No elongated or deformed corms allowed. Double headed corms allowed, but must weigh more than 1.0 kg. No triple or quadruple headed corms are allowed.</td>
<td></td>
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</tr>
<tr>
<td>Grading:</td>
<td>Mixed - large, medium and small.</td>
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<td></td>
</tr>
<tr>
<td>Maturity:</td>
<td>All corms should be at least 6 months old.</td>
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</tr>
<tr>
<td>Pack:</td>
<td>Pack in white banana type cartons with stapled base plate. Pack 18 kg net, plus 1.0 kg extra to allow for shrinkage. The plastic liner should completely wrap the corms, if wet corms are desired.</td>
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<td></td>
</tr>
</tbody>
</table>
| Sizing:          | Minimum corm weight = 1.0 kg  
Maximum corm weight = 4.5 kg |
| Labels:          | On one short side, print on the carton using a label or ink stamp: Dasheen weight 18 kg (approximately 40lb) and the importers name. The suppliers name should be written / printed on the long side. No hand written labels allowed. |
| Decay:           | No surface mould or corm softening is allowed. |
| Damage:          | Small cormel attachment scars and tail cuts are acceptable, no other cuts or damage are allowed. |
| Trim:            | Maximum leaf base length should be 5 cm |
| Internal:        | Corm flesh should appear moist white with no breakdown or discolouration. |

Source: Caribbean Agricultural Research and Development Institute (CARDI)
**Recommended Varieties**

The cultivar names used are specific to Dominica. Similar cultivars exist in other Islands and are called by different names. The predominant commercial varieties grown are the “Comme” or “Common” dasheen (Plate 1 and 2). The flesh is light blue in colour after cooking and is the predominant variety grown in Dominica. The “White” dasheen (Plate 3) is the predominant cultivar grown in St. Vincent. This variety has numerous roots distributed over the round corms, which can be sometimes forked into two or four parts. Suckers can be as much as 5 to 14 per corm. The other cultivar exported is the "Noir" (Dominica) or “Pink” dasheen (St. Vincent) (Plate 4).

![Plate 1: The “Common” or “Comme” dasheen plant.](image-url)
Plate 2: The “Common” dasheen corm

Plate 3: The “White” dasheen plant
Plate 4: “Pink” dasheen plant
PRODUCTION

Site selection

Optimal dasheen production is best achieved on deep sandy clay loam soils, with good fertility and pH range of 5.5 to 6.5. Rainfall should be between 2500 and 3675 mm annually and evenly distributed. Hot humid conditions, with daily average temperatures in the range of 25 to 27°C, altitudes of approximately 300 to 600 m are best suited for growing the crop. In the Caribbean, dasheen is normally grown under rain fed conditions and therefore in agro-ecological zones where consistently high rainfall (3,800 to 5,000 mm annually) exist. These locations can be very sloppy and thus restricts mechanization.

Land Preparation

After the land is cleared of all brush and trees, Gramoxone (paraquat) a non-selective contact herbicide, at the rate of 2.5 litres per hectare, or Round-up (glyphosate) a systemic broad spectrum herbicide at the rate of 2.0 litres per hectare, is normally used to kill remaining weeds. Since dasheen is usually grown in high rainfall areas and sometimes on slopes, minimum till methods are practiced. These methods include no ploughing and the maintenance of a ground cover by allowing the dead grass/weeds/brush to remain in the field after spraying. Farmers who use irrigation lay and install their pipes at that stage to accommodate sprinkler irrigation systems.
Plate 5: Dasheen plot prepared by the minimum till method and staked at a specific planting distance. Plants are also laid out for planting.

**Selection and preparation of planting material**

Farmers either buy or obtain planting material (suckers) from their own fields after harvest. Suckers (lateral shoots from the main corm) are selected from the most vigorous growing plants. Suckers are cleaned of all roots, dead tissue and soil and are prepared for planting with the following specifications: the upper 2 to 4cm of the corm intact, with a basal diameter of 5 to 7cm, weighing approximately 250g and the petiole cut to a length of 25 to 30cm. To prevent rotting, the prepared planting material is dipped in a solution containing 90ml bleach in 4.5 litres of water for 15 to 20 minutes. A 200 litres drum cut in half, can be used for dipping (Robin, 2000; Robin and Pilgrim, 2004).
Plate 6: Lateral suckers of the “Noir” – pink petiole, “Common” – dark green petiole and the “White” – light green petiole dasheen used as planting material.

Mini setting (Rapid Multiplication technique)

When there is a shortage of planting material, farmers and Agricultural Stations resort to using a rapid multiplication method. This method involves cutting mature (8-10 month old) corms into 100 to 120 g setts (horizontal slabs). These setts are treated with bleach (as previously described), or fungicide - benlate (benomyl) 28.5 gm / insecticide – vydate (oxamyl) 25 ml in 13.6 litres of water and placed in a humid area for sprouting. The humid area consists of raised beds covered with plastic mulch, on top of which is placed a layer
of saw dust or wood shavings 7 to 10 cm thick. The setts are then placed on top of the saw
dust or wood shavings with the cut end facing upwards. The cut ends are then covered
with a thin layer of sawdust, straw material or wood shavings. The covering material is
kept moist until lateral buds begin to emerge. The lateral buds are then excised after they
begin growing and then planted. This process takes approximately 10 to 14 days (Robin
and Pilgrim, 2004).

Plate 7: Dasheen mini-setts laid out for sprouting
Plate 8: Sprouted mini-sett

Unmarketable Whole Corms (Head Setts)

These are prepared using similar methods outlined for the preparation of lateral suckers (Robin and Pilgrim, 2004).

Planting

Time of Planting

In areas where annual rainfall levels are high (between 3500 mm and 4500 mm) and evenly distributed, planting is implemented throughout the year. To ensure dasheen supplies are regular, plantings should be done monthly. Therefore in areas where rainfall levels are less than 2500 mm and unevenly distributed, monthly plantings require the use of irrigation during the drier months. Sprinkler irrigation is recommended. If it is not
possible to irrigate in the drier locations, only one planting on the onset of, or during the rainy season is the only guarantee of having sufficient soil moisture to give good yields.

**Staking, Spacing and Depth of Planting**

Plant spacing and plant depth is dependent on the corm size required for the specific market (de la Pena, 1983; Sivan, 1984; Pardales, 1985; Robin, 1990; Robin, 1993), the soil type and rainfall levels in the area in which the crop is grown also affects corm bulking (Ezumah and Plucknett, 1981; Pardales, 1985). Research experiences in Dominica indicated that when grown in sandy clay loam soils, where annual rainfall levels are high (3500 - 4500 mm), a spacing of 55 x 55 cm and planting depths of 30 cm will give good yields. Where soils are clayey and annual rainfall is less than 2500 mm, a spacing of 65 x 65 cm and planting depths of 20 to 25 cm will also give good yields (Robin, 1993).

Corm shape changes are experienced when dasheen is planted on different soil types and moisture regimes. In clayey soils the higher average bulk densities and lower porosity offer greater resistance to tuber bulking as compared to sandy clay loam soils with lower average bulk densities and higher porosity (Robin, 1993). Irregular rainfall patterns cause irregular growth patterns and may cause tubers to develop “dumb bell” shapes (Robin, 1993). Consistent and higher rainfall levels are more conducive to normal plant growth and uniform corm development. Corms grown at similar spacing and depth in a wide range of agro-ecological zones, tend to be larger and rounder, when grown on sandy clay loam soils in areas with consistently high rainfall (Robin, 1993).
Hole Making

The soil in the area where the hole will be made is loosened using a fork, spade or a hole digger (mechanical or manual) and worked to a fine tilth to enable corm bulking with minimal resistance. The worked area measures approximately 15 to 20 cm² and 20 to 30 cm deep.

Planting

A cutlass, hand fork or shovel is used to move the worked soil while simultaneously placing the prepared plant material at the required depth.

This planting method follows the minimum till requirements. Notice from the photograph that only the soil in the vicinity of the planting hole is worked and that the remaining area is untouched, with a ground cover of dead grass which serves as a mulch.
Plate 9: Planting dasheen
**Weed Control**

Dasheen plots must be kept weed free during the first 3 months of growth (Gurnah, 1985; Hammerton, 1985). During land preparation glyphosate or paraquat may be used to control weeds. Glyphosate is more expensive but its effects are longer lasting. Shielded sprays of paraquat (2.5 litres per hectare) are recommended for the control of weeds before canopy formation. Subsequent weedings should be manual and carried out when necessary. It is not always economical to weed after the crop is 6 months old.

**Fertilizer application**

It is important to determine the nutritional status of the soil before planting. If a ratoon dasheen crop exists in the area designated for planting, fertilizer recommendations should be based on soil and leaf analyses.

The dasheen crop prefers a pH range of 5.5 to 6.5. In situations where the soil pH is less than 5.5, calcium carbonate (CaCo3) should be applied to increase the soil pH to optimal levels.

Formation and bulking of the dasheen corms is of vital importance. Hence, fertilizers that will supply adequate potassium are recommended. At planting, triple super phosphate at the rate 60g per hole is used to induce root formation, growth and to maintain the plant structure. If triple super phosphate is unavailable, NPK fertilizers 7:30:20, 10:30:10 or 12:24:12 can be applied about 2 weeks after planting. Thereafter, at intervals of 4, 10, and 15 weeks after planting NPK 16:8:24 or preferably 15:4:24 + 2Mgo should be applied at the rate of 60g per plant. These recommendations are based on experiments conducted in
Dominica (CARDI, 2001). Fertilizers are applied in a circle approximately 18 cm from the base of the plant and covered with soil to avoid washing by heavy rains.

**Moulding (optional)**

Moulding is normally implemented after the last fertilizer application. Soil may be moulded to a height of 6 to 8 cm around the base of the plant, by moving soil from within a radius of 30 to 35 cm around each plant. Moulding prevents washing of the fertilizer, and allows the corm to remain covered with soil as it pushes to the surface during maturity.

**Pest and disease**

Currently there are no major pests or diseases of economic significance, which affect dasheen production in the OECS (Robin, 1993; Robin and Pilgrim, 2004). Striations (corky fibrous streaks) have been reported in the flesh of the White and Common dasheen during the dry season. This has been attributed to physiological response of the corm to moisture stress.

Damage caused by the dasheen beetle (Ligyrus ebenus), has been reported in Trinidad (NAMDEVCO, 2003) and Dominica (Anselm, 2004). Corms become unmarketable when the beetle bores holes and tunnels through the corm causing secondary infection. The problem occurs mainly in the wet season. Cultural methods of control include the following: use of clean planting material; proper field sanitation; crop rotation, followed by fallowing and ploughing of harvested fields to expose grubs to sunlight. A soil drench
with FASTAC (alphacypermethrin) a systemic soil insecticide destroys the grubs (NAMDEVCO, 2003; Anselm, 2004).

Irrigation

In the Caribbean (Jamaica) only small acreages of dasheen have the recommended sprinkler irrigation system. In these systems, sprinklers are spaced 6.0 m apart, with an application rate of 9.1 - 13.6 litres/hour. Micro sprinklers can also be used where the water pressure is low. When used micro sprinklers are spaced at 3.0 m apart, with an application rate of 9.1 litres/hour (Personal communication).

Harvesting

Maturity (When to Harvest)

Corms are normally ready for harvest when most of the leaves begin to senesce. Other signs of maturity are when the main corms become clearly visible after pushing up to the surface. Since the time to harvest is affected by different agro-ecological zones, corms should be harvested between 7 and 8 months in drier areas (annual rainfall less than 2500 mm) and between 9 and 10 months in the wetter areas (annual rainfall between 3500 - 4500 mm) (Robin, 1993). When corms are harvested at the immature stage yields are reduced. Corms harvested past the maturity stage can sometimes be unpalatable.
How to Harvest

Corms are harvested by pushing a fork about 30 cm away from the base of the plant into the soil and lifting gently at an angle. The fork is moved in a circle until the soil surrounding the base of the plant is completely loose. The main plant and suckers are then held by the petioles and pulled gently from the soil.

Plate 10: Harvesting dasheen
Yield

Average yields of 12 to 14t/ha can be expected where rainfall levels are high (between 3500 mm and 4500 mm) and evenly distributed. In the drier areas (rainfall levels between 1750 and 2400 mm) yields of 8 to 12 t/ha can be expected.

Table 3: Dasheen yields in different locations during the wet and dry season.

<table>
<thead>
<tr>
<th>Location</th>
<th>Season</th>
<th>Yield Grams / plant</th>
<th>Tons / hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry†</td>
<td>Wet</td>
<td>946</td>
<td>12.9</td>
</tr>
<tr>
<td>Wet†</td>
<td>Wet</td>
<td>995</td>
<td>14.1</td>
</tr>
<tr>
<td>Dry</td>
<td>Dry</td>
<td>645</td>
<td>7.9</td>
</tr>
<tr>
<td>Wet</td>
<td>Dry</td>
<td>913</td>
<td>12.3</td>
</tr>
</tbody>
</table>


Wet†: Soil type - Mainly humic allophane latosolic soil and to a lesser extent youthful allophanes. Average annual rainfall is about 5300 mm, with a normally mild or no dry season. Mean annual temperature is approximately 25°C. Altitude is approximately 500 m. The natural vegetation is typically rain forest (Lang, 1972).

Dry†: Soil type - Consist of young soils which are characterized by a plastic, sticky clay without a silica pan. Average annual rainfall is about 2400 mm (94.5 in), with a marked dry season from January to April. Mean annual temperature is approximately 27°C. Altitude is approximately 235 mm. This area has been cultivated for many decades (Lang, 1972).

POST-HARVEST

Post harvest diseases

Post harvest losses in dasheen are mainly due to poor harvesting techniques and inadequate post-harvest handling practices, which cause corm damage thus resulting in secondary infection. In most cases the resulting disease "dasheen corm rot" is caused by soil borne fungi Pithium splendens, Fusarium species, Rhizoctonia species and Botryodiplodia theobromae. These fungi enter the corm through wounds and broken surfaces, causing tissue breakdown and flesh discolouration (browning), which can on occasion extend deep
into the corm. Secondary infection "soft rot" caused by the bacteria *Erwinia chrysanthemi* also causes spoilage.

*Plate 11: Fungal growth on dasheen corm.*

*Plate 12: Dasheen soft rot.*
Preliminary grading on the farmers holding

Grading is first carried out on the farm. This involves cutting the petioles to a length of at least 15 cm, followed by the removal of cormels and loose soil. Undersized, double and triple headed, mechanically damaged, soft, insect damaged and diseased corms are rejected at this stage. Acceptable corms are placed in field crates and transport to pack houses.

Dasheen may be harvested up to 2 days before the day of shipment. However, regardless of the harvest date, the corms should be treated within 4 - 6 hours after harvest. Treatment involves dipping the corms in containers containing Ridomil MZ 72 WP (mancozeb + metalaxyl), 14 g in 23 litres of water, for 5 -10 seconds (Adams et al. 1985). The solution should be changed when the water becomes cloudy and discoloured.
Plate 13: Selecting dasheen corms on the farm
Plate 14: Marketable corms (export grade).
Plate 15: Forked corm not suitable for export.
Plate 16: Treating dasheen corms on the farm.
Pack house Operations

Packhouse operations can be done either at the farm or at a central packhouse. The final selection of corms is carried out at the pack house and this is to ensure that undersized, malformed, damaged, and diseased corms missed during farm selection and corms damaged during the cleaning process on the farm are rejected.

Cleaning

The final cleaning operation is carried out at the pack house. The degree of cleaning is dependent on the requirements of the market.

Treatment

Treatment is similar to that used at the farm level. However when corms are exported to neighboring Islands and used within a short time period, it is recommended that corms be dipped in a solution of bleach (19 ml/10 litres), or in a solution of Ridomil M Z 72 (2.8 g/23 litres of water) (Adams et al., 1985). An alternative approach is double dipping. This involves a first treatment on the farm and a second immediately after cleaning in the packhouse. After dipping, corms are placed on racks to remove excess water before packing (Adams et al., 1985; Robin, 2000; Robin and Pilgrim, 2004).

Grading

The importer decides on the grades. Presently no size grading is carried out, but corms should be within the size specification of 0.9 - 4.5 kg. The average weight of corms exported is between 1.8 to 2.7 kg.
Packing

For the **UK market** corms are packed wet and sometimes enclosed in a polythene wrap to prevent drying out during storage and shipping. For the **US market** corms are packed both wet or allowed to surface dry before packing. In Jamaica coir dust is sometimes used as a medium to cushion the corms.

The net export weight per unit varies between 18 to 20 kg. This is however dependent on importer requirements and package type. An additional 5% (weight) is included to account for the weight loss during storage and shipping.

Packaging

Two types of packaging material are used for exporting dasheen. For the UK market the two piece full telescopic fiber board (banana type) carton is preferred. For the US market both banana type cartons and sacks/bags made out of woven polypropylene are used.

Labelling

Each box and/or sack must be properly labelled. The following particulars should be legibly and indelibly marked on the outside of the package:

- Name and address of packer or dispatcher
- Name of producer
- Origin of produce
- Size (optimal)
- Grade (optimal)
- Weight (net preferably)

**Storage and Shipping**

Dasheen is kept at 12 to 13°C and at a relative humidity of 80 to 90% during storage and shipping. Under these conditions dasheen can remain in good condition for 3 to 4 weeks.
REFERENCES


