Roots and Tubers

1. Cassava
2. Dasheen
3. Sweet Potato
4. Tannia
5. Yam

TECHNOLOGY PACKS

DASHEEN

November 2015

Background

Production decisions concerning how much effort and resources to invest and which farming practices to follow, have consequences and create opportunities for the farm affecting production levels, input costs, time constraints, and the potentially size of the operation. They also may have implications for resource use and environmental quality.

Numerous information exist on the various aspects of production and handling/ marketing of crops and livestock, the majority of which are outdated, not easily understood and lacking the where with all for addressing present day challenges such as good agricultural practices (GAPs) and food safety and climate change that impact on the environment and rural livelihoods. These issues are also closely related to the importance of the role of primary producers in increasing the earnings of all actors along the value chain in supporting the development of a commercially viable and sustainable agricultural industry.

The production of high quality and easily understood information packages is critical as this forms a basis for farmers to obtain financing from lending institutions and to efficiently increase their production through the availability of modern technology. This will also result in a reduction of rural unemployment and will greatly help in alleviating poverty and other associated social ills.

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DASHEEN

November 2015

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Introduction

This Technological Package (Tech Pack) deals with the production and postharvest aspects of dasheen.

Also included in the Tech Pack are appendices:

- Template for cost of production
- List of recommended pesticides and application rates
- Good Agricultural Practices data record sheet.

Notwithstanding the identification of any specific pesticide for the control of pests and diseases, this decision is for the discretion of the Ministry of Agriculture Area Extension Officer and the farmer.

However, the mention of any pesticides and other products used in the Tech Pack should strictly comply with local regulations and all instructions provided by the manufacturer. Also, the use of trade names in the Tech Pack is for the purpose of citing examples and is not meant to either endorse or discredit any particular product.

Description

Dasheen (known as taro in many parts of the world) is a member of the Araceae family. Its botanical name is Colocasia esculenta (L.) Schott var. esculenta.

Ecology and Environmental Requirements

Optimal dasheen production is best achieved on deep sandy clay loam soils, with good fertility and a pH range of 5.5 – 6.5. Annual rainfall should be between 120 – 150 inches (2,500 – 3,675 mm). Humid conditions with average daily temperatures ranging from 77 - 80oF (25–27oC) and altitudes above 1,000 feet (300 m), are best suited for growing the crop.

The climatic factors of rainfall, temperature, soil nutrition and physical characteristics, should be given priority consideration, when making site selection decisions.

Varietal Selection

Choose varieties which meet the following requirements:

- Consumer acceptance
- High market demand for the fresh and processed products
- High yielding and well adapted to local conditions
- Be readily available and from healthy plant material.

The dasheen cultivar called 'Comme' or 'Common' dasheen (Plate 1), is the variety predominantly grown in St. Lucia and is recommended for the local market and export to the UK market. This cultivar forms a single corm, which tends to be oval to round in shape. Among the known cultivars, it suckers the least and therefore has the least scars (exposed areas on the corm surface resulting from removal of suckers). Corm flesh is white and turns bluish when cooked. The export market requires round, oblong or cylindrical corms about 2 - 4 lb (1 – 2 kg) in weight

.

Plate 1 Dasheen cultivar 'Comme'

Land Preparation

Land clearing

Cut and remove vegetation. Land clearing can either be **light** (shrubs and grasses), **medium** (larger plants) or **heavy** (large trees with deep root systems). **Disturbance of the topsoil should be minimal.**

After the land is cleared of all brush and trees, Gramoxone (paraquat) at the rate of 1.75 pints/acre (2.5 L/ha), or Round-up (glyphosate) at the rate of 1.5 pints/acre (2.0 L/ha), can be used to kill off the remaining weeds. Since dasheen is normally grown in high rainfall areas and sometimes on slopes, **minimum tillage** methods should always be implemented. These methods include no ploughing and the maintenance of a ground cover by spraying and allowing the dead grass to remain in the field until the canopy develops.

PARAQUAT, BECAUSE OF ITS CORROSIVE NATURE ON HUMANS, IS CONSIDERED A RESTRICTED HERBICIDE i.e. persons using this chemical should be trained in its use and application. Recent reports indicate that glyphosate may be a carcinogen.

Drainage and irrigation systems

Use pegs to mark off along the contour. The area where the drainage system is going to be established.

Dig drains and allow the field to drain if necessary. During this activity, conceptualize where the irrigation pipes are going to be laid, and peg these areas also. Install pipes to accommodate a sprinkler irrigation system. Get results of water analyses to determine water quality.

Planting Material Preparation

Suckers approximately 6 months old provide the ideal planting material (Plate 2) and must be selected from the most vigorous and healthy growing plants, cleaned of all roots, dead tissue and soil.

Suckers are prepared for planting with the following specifications: The upper 1 - 1.75 inches (2 - 4 cm) of the corm intact, a basal diameter of 2 - 2.75 inches (5 - 7 cm) weighing approximately 10 ounces (250 g). Petioles should be cut back to a length of 10 - 12 inches (25 - 30 cm), Plate 3.

Dipping suckers in a solution containing 6 tablespoons bleach in 1 gallon (90 ml in 4.5 litres) of water for 15 - 20 minutes prevents planting material from rotting. A 45 gallon (200 L) drum, cut in half, can be used for dipping.

Plate 2 Sucker attached to mother corm

Plate 3 Suckers prepared for planting

Rapid multiplication technique

When there is a shortage of planting material, the farmer may resort to using a rapid multiplication method, i.e. stimulation of buds on the corm. Stimulation methods involve cutting mature (8 - 10 month old) corms into 4 – 5 ounce (100 - 120 g) setts (horizontal slabs). These setts are then put into a bag and dipped in either a bleach solution (as described in the previous paragraph), or in fungicide/insecticide Belate/Vydata, 2½ tablespoons in 3 gallons (25 ml in 15L) 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 - 10 cm thick. The setts are then placed on top of the sawdust or wood shavings with the cut end facing upwards (Plate 4).

Plate 4 Dasheen corm cut into setts

The cut ends are then covered with a further thin layer of sawdust, straw material or wood shavings. The covering material should be kept moist until lateral buds (Plate 5) begin to emerge. After they begin to grow the lateral buds are excised and then planted. This process takes approximately 10 - 14 days

Plate 5 Lateral bud

Time of Planting

In areas where annual rainfall levels are very high — between 140 – 180 inches (3500 - 4500 mm)/ year — and evenly distributed, planting can be done throughout the year. In these conditions regular dasheen supplies can be achieved by monthly planting.

In areas where rainfall levels are lower, approximately 100 inches (2500 mm)/year and unevenly distributed, monthly plantings require the use of irrigation during the drier months. **Sprinkler irrigation** (Plate 6) is recommended, as drip irrigation, if and when used, would not be compatible with the current weed control practices. **Micro sprinklers** should be used where the water pressure is low; these should be spaced approximately 10 feet (3 m) apart, with an application rate of 2 gallons (9 L)/hr. Where water pressure is high, use ordinary sprinklers, spaced approximately 20 feet (6 m) apart, with an application rate of 2 - 3 gallons (9 - 14 L)/hr.

If no irrigation is available in drier locations, then only one planting per year can be done just before the onset of, or coinciding with the beginning of the rainy season.

Plate 6 Sprinkler in dasheen plot in St. Lucia

Spacing and Planting

Plant spacing and plant depth are dependent on the corm size required for the specific market, the soil type and rainfall levels in the area in which the crop is grown. Research in Dominica has shown that when grown in sandy clay loam soils, where annual rainfall levels are high 140 – 180 inches (3500 - 4500 mm)/year, a spacing of 20 x 20 in (55 x 55 cm) and a planting depth of 12 in (30 cm) are appropriate. Where soils are clayey and annual rainfall is less than 100 inches (2500 mm)/year, a spacing of 25 x 25 in (65 x 65 cm) and a planting depth of 8 - 10 in (20 - 25 cm) are recommended.

Ploughing is not advised. First loosen the soil in the area where the hole will be made to as fine a tilth as possible, using a fork or a spade. A hole digger (mechanical or manual) can be used as an alternative. The worked area should measure approximately 6 - 8 square inches (15 – 20 cm^2) and 8 - 10 inches (20 – 25 cm) deep. Use a cutlass, hand fork or shovel to move the worked soil while simultaneously placing the prepared plant material at the required depth.

Fertilization

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. An extension officer will assist in obtaining soil and leaf analyses, which should be the basis for making fertilizer recommendations.

The soil pH for dasheen production should be in the range of 5.5 - 7.8. If the location for planting has a lower pH, it is advisable to spread dolomitic lime at the rate of 1 ton/acre (0.5 t/ha) per year. After the lime is applied, allow the soil to weather for about 3 weeks. The lime should be worked into the soil during the process of land preparation.

Assuming there is no inherent soil nutritional deficiency, the compound fertilizers NPK 16-8-24 or 12-12-17+5 will give good yields. The suggested rate of application is 2 ounces (60 g) per plant at 1 - 2 weeks after planting and at 4 - 6 weeks after the first application.

The fertilizer is best applied in a band around the plant. If the land is sloping, apply the fertilizer on the uphill side about 8 inches (20 cm) away from the plant; then work the fertilizer into the soil.

Weed Control

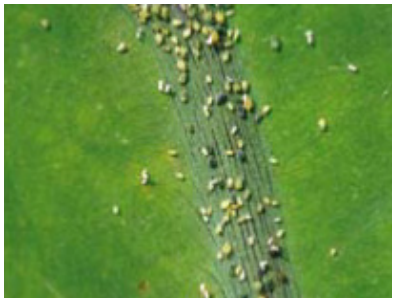
Dasheen plots must be kept weed free during the first 3 months of growth. During land preparation glyphosate (Round-up) or paraquat (Gramoxone) may be used to control weeds. Glyphosate is more expensive but its effects are longer lasting. Before canopy formation shielded sprays of paraquat at a rate of 2 pints/acre (2.5 l/ha) are recommended for the control of weeds. Subsequent weeding should be manual and carried out when necessary. It is not always economical to weed after the crop is 6 months old.

Pests and Diseases

The major pests and diseases affecting dasheen, symptoms and control/management are indicated in Table 1.

Good Agricultural Practice (GAP) related to the use of pesticides, requires farmers to maintain up to date records on the application of pesticides to the crop. These records should include trade names, application rates and dates of application. During the harvesting period use pesticides with a very short harvest interval.

Pest & Diseases	Symptoms	Control/ Management
Plate 7 Ligyrus ebenus, a dasheen beetle The picture shows the adult beetle tunneling through the corm 	Until recently this pest was not affecting dasheen production. However, recently there have been periodic and sporadic outbreaks. Both the lava and the adult beetle cause damage by tunneling through the corm. Adult beetles in particular, often enter the corm at the base of the leaves and feed on the soft tissues of the growing point before moving on to feed on older material. Considerable feeding damage can destroy the entire corm and kill young plants.	**Cultural control:** • Examine planting material carefully for the larva or adult beetle. Do not use infected planting material • Keep dasheen fields clean • Use light traps at the edge of the field to attract adults away from the field • Observe plants regularly for signs of wilting • Do not move planting material from infected fields to clean areas. **Chemical control:** Chemical control is not known to be very effective against this pest, but Fastac (use according to manufacturer recommendations) may provide some control. **Natural enemies:** • The scoliid parasitic wasp Campsoneris dorsata (F) attacks the larvae paralyzing them and depositing an egg on each. The green muscadine fungus, Metarhizium may also attack the larva.

Pest & Diseases	Symptoms	Control/ Management
Plate 8 Aphids Aphis gossypii 	Aphids are small, pear-shaped insects with soft, fragile bodies. Often present in large numbers, they pierce leaves to obtain sap. If aphids are present in high numbers and rainfall is low, leaves senesce faster than normal. In severe cases, the plants wilt and may become stunted. Indirect damage is caused by the accumulation of honeydew produced by the aphids. Honeydew serves as a substrate for sooty moulds, which blacken the leaves, reducing photosynthesis and plant vigour. Aphids are vectors of Dasheen Mosaic Potyvirus.	Control with Pyrethrum or Diazinon 60EC at the rate of 1 tablespoon/gallon (3 mL/L) of water. White flies and aphids are sometimes accompanied by moulds on leaves. If severe, this can be controlled by use of copper based fungicides. Only apply insecticides and fungicides when the damage to the leaf is in a range of 10% to 15%.
Plate 9 Slugs and snails 	Giant African snails damage plants by rasping the leaf tissue.	Control by the use of slug baits and manual control measures.

Pest & Diseases	Symptoms	Control/ Management
Plate 10 Dasheen Mosaic Virus 	The plate shows typical feathery mosaic symptoms on the leaves of dasheen infected with Dasheen Mosaic Virus.	The only control known is the use of virus free planting material.
Plate 11 Striations 	Striation or corky fibrous strings is the hardening of xylem vessels which appear in the dasheen corms as a result of water stress.	Availability of water should also be given serious consideration when planning production.

Good Agricultural Practice (GAP) related to the use of pesticides, requires farmers to maintain up to date records on the application of pesticides to the crop. These records should include trade names, application rates and dates of application. During the harvesting period use pesticides with a very short harvest interval.

Harvesting

Corms are normally ready for harvest when most of the leaves begin to turn yellow. Other signs of maturity are when the main corms become clearly visible after pushing up to the surface.

In wet areas, corms are harvested in 9 - 10 months. In drier areas corms are harvested in 7 - 8 months.

Corms are harvested manually; by placing a fork or cutlass (depending on the softness of the soil) about 6 - 8 inches (15 – 20 cm) away from the corm and leaning the fork backwards while holding the petioles and rocking and pulling the plant upwards simultaneously. Avoid damaging the corm during harvest.

Yield

Yield is dependent on the following:

- Variety
- Soil type
- Rainfall
- Humidity
- Spacing
- Farmer management/ production system

The performance of dasheen at different locations of Dominica, where environmental conditions are more or similar to St. Lucia, is shown in Table 2.

Table 2Performance of dasheen grown under different conditions in Dominica

Location	Annual rainfall (inches)	Season grown	Yield	
			lb/plant	ton/acre
Grand Bay	80	Wet	2.1	5.1
Wet Area	160	Wet	2.2	5.6
Grand Bay	80	Dry	1.4	3.1
Wet Area	160	Dry	2.0	4.9

Post Harvest Handling

Field Handling

The petioles or leaf stalks should be cut away leaving at least 6 inches (15 cm) of the stalks attached to the corm. Cormels should not be removed at this stage. Gently remove loose soil from the corm surface, being careful not to break off cormels. Reject corms that are undersized, double and triple headed, soft, damaged (whether mechanically or by insects) or diseased. Acceptable corms should be placed in field crates and transported to a pack-house. Do not transport corms in bags, as this could result in them getting damaged, and lead to infection and rotting.

Pack-house operations

Pack-house operationsare required for dasheen exports. At the pack-house the degree of cleaning is dependent on market requirements.

For the UK Market the following postharvest operations should be carried out:

- Remove any excess soil by hand, a small film of soil left on corms is desirable
- Remove cormels, dead tissue, and roots with a knife
- Do not wash corms
- Cut "tail" end leaving ½ inch (1 cm) of stalk
- Cut "stem" end leaving 1½ inch (4 cm)of stalk

For the US market

- Remove cormels with a knife
- Scrape with a blunt instrument to remove soil, roots and dead tissue
- Cut "tail" end flush with corm
- Cut "stem" end leaving 1½ - 2 inches (4 - 5 cm)of stalk
- Wash corm

A final selection of the corms is then carried out. This involves the removal of unmarketable corms that were missed during preliminary selection or damaged during the cleaning process. This involves the removal of corms that are undersized, malformed, damaged and diseased.

The corms should then be dipped in a fungicidal solution containing 1 tablespoon (14 g) of Ridomil MZ 72 in 5 gallons (23 L) of water for 5 - 10 seconds. Alternatively treat corms in commercial bleach 1 teaspoon/2 pints (5cc/L) of water, ensuring that the bleach solution is changed regularly. Soon after treatment, the corms are then graded within the size specification before being loosely packed in two-piece full telescopic fibre board (banana type) carton, with each carton having a net weight of 40– 45 lb (20 - 22 kg). Cartons should not be over-packed

For the UK market, corms are packed wet and wrapped in polythene. For the US market, corms should be packed dry without any wrapping.

During the storage and shipping of dasheen, corms should be stored at 45 – 55 0F (7 - 120C) and 80 - 90 % relative humidity. Shelf life under these conditions is about 3 - 4 weeks.

APPENDICES

APPENDIX I: TEMPLATE FOR COST OF PRODUCTION ANALYSIS: DASHEEN

	Input	Quantity	Units	Unit Cost	Total Cost
1.	Planting material				
	Suckers/corms (if purchased)				
	Bleach (for dipping), drum (if purchased)				
	Insecticide, fungicide (specify names used)				
	Plastic mulch				
	Sawdust, straw, wood shavings				
	Total cost for planting material				
2.	Land preparation				
	Gramoxone/Round-up				
	Other land preparation costs (e.g. equipment rental)				
	Total cost for land preparation				
3.	Crop maintenance				
	Water/irrigation				
	Fertilizer (specify types used)				
	Weed control (specify chemicals etc used)				
	Pest and disease control (specify chemicals etc. used)				
	Total cost for crop maintenance				
4.	Harvest/storage				
	Crates				
	Cartons				
	Other materials (e.g. fungicide, bleach, polythene)				
	Estimate any utility costs				
	Transport to market				
	Total cost for harvest/storage				
5.	Labour				
	Planting material				
	Land preparation				
	Crop maintenance				
	Harvest/storage				
	Total cost for labour				

	Input	Quantity	Units	Unit Cost	Total Cost
	Harvest/storage				
	Total cost for labour				
6.	**Rent/insurance**				
7.	**Miscellaneous costs**				
	Total cost of production				

Notes

1. It is recommended that the above data be completed on a per crop basis.
2. The cost of any fixed structures should be considered. For example if anirrigation system is solely used for dasheen in the year and is expected to last for 10 years, then one tenth of the cost of the equipment should be added at item 7. If, however, irrigation for other crops is also provided then this also needs to be considered. If dasheen accounts for half the irrigation in a year, then the annual cost calculated as above needs to be divided by 2. Similar considerations should be given to the cost of any refrigerator if the crop is stored at a low temperature.
3. The revenue obtained from sale of the crop should be compared with the cost of production to determine the profit/loss on the operation.

INSECTICIDES	APPLICATION RATE
Pronto 35 SC	3 - 5 teaspoons/gallon of water
Target	1 - 2 teaspoons/gallon of water
Pirate	½ - 1 teaspoons/gallon of water
Fastac	1 - 2 teaspoons/gallon of water
Caprid	½ - 1 teaspoon/gallon of water
Diazinon (Basudin)	¾ - 1½ pints/acre
Admiral	¼ teaspoon/gallon of water
Dipel	1½ - 2 teaspoons/gallon of water
Aza-direct	1 - 2 teaspoons/gallon of water
Cure	½ - 1 teaspoon/gallon of water
Danitol	1 - 2 teaspoons/gallon of water
Cypro	½ tablespoon/gallon of water
Dimethoate (Perfecthion, Rogor 40)	1 pint/acre
Phosvel	1¼ - 2 pints/acre
Orthene	3.2 ounces/acre
Permethrin (Ambush)	½ teaspoon/gallon of water
Padan 50 WSP	2 - 3 teaspoons/gallon of water
Lannate	1 teaspoon/gallon of water
Decis	½ teaspoon/gallon of water
Kelthane 42%	1¼ lb/acre
Orthene 75S	1 lb/acre
Malathion	½ - 1 pint/acre
Sevin	1½ lb/acre
BT(Bacillus thruingiensis)	Label rates
Rotenone	1 - 2 teaspoons/gallon of water
Neem X.	8 - 10 oz/gallon of water
FUNGICIDES	**APPLICATION RATE**
Bellis	2 teaspoon/gallon of water
Acrobat	2 - 4 teaspoon/gallon of water
Mancozeb (Dithane M45)	1.5 lb/acre
Cabendazim	2 teaspoon/gallon of water
Daconil	1½ - 2 pints/acre
Benomyl (Benlate)	6 oz/acre
Captan	2 - 3 teaspoons/gallon of water
Peltar	3 teaspoons/gallon of water
Manzate DF	2 - 4 teaspoons/gallon of water

Bravo	1½ - 2 pints/acre
Tri-Miltox-Forte	3 teaspoons/gallon of water
Botrilex	5 - 200 lbs/acre
Kocide 101	2 - 4 teaspoons/gallon of water
Cupravit	2½ lb/acre
WEEDICIDES	**APPLICATION RATE**
DCPA (Dacthal W-75)	10 lb/acre¬¬¬
Diphenamide	4 - 10 lb/acre
Paraquat (Gramoxone)	1 - 2 pints/acre
Dymid 80W	5 lb/acre
Atrazine 80 (Gesaprim).	1¼ - 1½ lb/acre
Linuron (Lorox)	1 pint/acre
Prometryn (Caparol)	0.8 - 1.6 lb/acre
Sethoxydim (Poast)	1¼ - 3½ lb/acre
Clethodim (Select)	0.094 - 0.25 lb/acre
Prometryn 50WP (Geagard)	2 - 3 lb/acre
Herbicidal Oil (Stoddard Solvent, Kerosene oil)	40 - 80 gallons/acre

APPENDIX III: GOOD AGRICULTURAL PRACTICES DATA RECORD SHEET

	Input	Quantity	Units	Unit Cost	Total Cost
6.	Rent/insurance				
7.	Miscellaneous costs				
	Total cost of production				