Tree Crops

1. Avocado
2. Breadfruit
3. Citrus
4. Cocoa
5. Coconut
6. Mango
7. Plantain

TECHNOLOGY PACKS

MANGO

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exist on the various aspects of production and handling/ marketing of crops and livestock, the majority of which are outdated, not easily understood and lacking the where with all for addressing present day challenges such as good agricultural practices (GAPs) and food safety and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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Published by

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Introduction

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

Also included in the Tech Pack are appendices:

- 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

Mango, *Mangifera indica* L. originated in the Indo-Burma region but is now spread throughout the tropical world. Botanically, it belongs to the family Anacardiaceae, of which the other well-known members are Cashew and Golden Apple. Mango (Plate 1), can be classed as one of the world's most delicious fruits and contains high levels of vitamins A and C, fair levels of thiamine and niacin (B) and 10 - 20% sugar. Fruits are usually consumed in the ripe state but many products are also made from green mango.

Plate 1 Mango fruit
Source: http://www.foodsubs.com/Photos/mango.jpg

Ecology and Environmental Requirements

Mango requires soils that are fertile, well drained and with a pH in the range of 5.5 - 7.5. The site should be exposed to the sun for long periods during the day. Avoid areas with a high water table close to rivers and streams since at such locations the trees tend to have profuse vegetative growth but limited flower and fruit production.

Sites where mango is grown should have annual rainfall of 30 - 100 inches (750 - 2500 mm) and at least 4 months of dry weather between flowering and harvesting.

Mango trees grow well at altitudes below 2000 feet (600 m). Although the trees can withstand strong winds, it is not recommended to plant close to the sea coasts with constant breezes.

Varieties

In St. Lucia, the main varieties cultivated for the fresh market are Julie, Peach, Ceylon and Graham. Long and Rose are usually exported as green fruit for processing.

Propagation

Mango is usually propagated by grafting using Long or Rose as the rootstock. Grafted plants can be obtained from the Ministry of Agriculture.

Land Preparation and Spacing

Remove trees and brush. On sloping land take care to prevent soil erosion when clearing the existing growth and by opening drains on the contour. Try not to disturb the soil when removing the roots of existing stumps. Stumps should be killed over a longer period by continuously removing the re-growth. Recommended spacings per variety are shown in Table 1.

Table 1 Recommendation of spacing for selected varieties of mango

Variety	Spacing	
	feet	m
Julie	25 x 25	7.5 x 7.5
Peach	30 x 30	10 x 10
Ceylon	30 x 30	10 x 10
Graham	30 x 30	10 x 10

Planting

Prepare planting holes 1 – 2 months in advance. Dig holes 18 in x 18 in x 18 in (45 cm x 45 cm x 45 cm). Mix planting soil with an equal volume of well-rotted pen manure.

Remove the plastic bag from around plants before planting and ensure that the plant is placed no deeper in the planting hole than it was in the bag. Press the soil firmly around the base of the plant to remove air pockets. Mound slightly to ensure water does not settle around the plant.

Fertilization

The rate of fertilizer application should be determined from a soil test.However, in the absence of a soil analysis the general recommendations in Table 2 can be followed.

If an organic approach is preferred, then pen manures can be applied to the trees.

Table 2 Rate of fertilizer application for mango

Year	Quantity of fertilizer per plant	
	ounces	g
1	4	115
2	4	115
3	8	225
4	12	340
5	12	340
6 - 7	16	450
8 onwards	32	900

The recommended amounts could be split into two applications with one at the beginning of the rainy season and the other towards the endof the rainy season.

Weed Control

Weeds may be controlled by mechanical tillage, weed eaters, cutlassing or by herbicides. The most economic method of weed control in non-bearing trees is by intercropping with short-term crops

such as vegetables, pumpkin, watermelon, root crops and bananas. At all times, however, it is necessary to avoid competition for sunlight and nutrients from other plants.

Pruning

Prune to control tree height, to admit sunlight into the canopy, to ensure good circulation of air through the canopy thus improving the colour and quality of the fruits and to minimize competition from non-bearing branches. Prune after the crop is harvested and before flowering commences for the next bearing season.

Cut from the underside of the branch going upwards about halfway to the centre. This is to prevent the branch from splitting and damaging the tree. A second cut is then made slanting downwards to finish cutting the branch. The slanted surface helps prevent water from settling on the cut surface and causing rotting.

In young trees, the branches which will touch the ground when fruiting can be propped up, but such branches should be removed in the older trees. Branches should be removed from the centre of the tree to admit sunlight to the lower branches (window). Cut branches to create and maintain a "door" in the canopy in one section, for easy access to the centre of the tree to facilitate spraying and harvesting. Branches which tend to grow straight upwards should be 'topped' to control tree height. Branches should not be allowed to crowd each other, so in areas with high humidity where trees tend to have excessive vegetative growth, thinning of individual branches must be done annually.

Pests and Diseases

The major pests and diseases affecting mango in St. Lucia are shown in Table 3.

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.

Table 2 Symptoms and control of pests and diseases of mango

Pest & Diseases	Symptoms	Control/ Management
Plates 2 and 3 Sucking Insects (Scale insects and Mealy Bugs)  Source: http://www.aos.org/images/img_content/QA/mealybugs.jpg  Source: http://archive.infonet-biovision.org/res/res/files/1838.280x185.clip.jpeg	Sap is sucked from the fruits and leaves causing yellow fruit spots. While sucking the insects excrete honey dew, which causes the development of sooty mold complex (blight) which reduces the productivity of the plant and the quality of the fruit.	For severe infestations begin a spray programme at an early stage using systemic insecticides (e.g. Protector). Prune trees to remove excess branches to encourage air flow throughout the canopy. Apply oil sprays or insecticidal soaps. Use biological control agents such as ladybird beetles.
Plates 4 and 5 Thrips *Selenothrips rubrocintus* (Giard)  Source:http://biocontrol.ucr.edu/images/avothrips_thumb.jpg  Source: http://www.ozthrips.org/wp-content/uploads/2012/05/mango_fruit_thrip_damage_B.jpg	Rasping and sucking sap from leaves, fruits and flowers. Fruits turn brown, rendering them unmarketable.	Apply insecticide containing abamectin as the active ingredient.

Pest & Diseases	Symptoms	Control/ Management
Plate 6 Mango Seed Weevil *Sternochetus mangiferae* (Fabricius)  Source: https://encrypted-tbn3.gstatic.com/images?q=tbn:ANd9GcS8pvhAxyt0OSy8i0ulljUIJfluSeapOkgGLaUn-7QvOKojDWxb8Q	Adults emerging from seed eat holes in flesh making it unsightly.	Burn seeds. Spray trunks and root zone with systemic insecticide (e.g. Actara), during flowering. Do not transport fruit away from areas of infestation.
 Plate 7 Anthracnose caused by the fungus, Colletotrichum gloeosporioides Penz. Source: http://www.hawaiiplantdisease.net/glossary/images/Anthracnose_(fruit)/mango_anthracnose_fruit_sympotms_1.JPG	Black spots on leaves, stems, flowers and fruits making the latter unmarketable. Reduces fruit set. Black spots spread as fruits ripen.	Well drained fields. Prune trees to ensure good air flow in the canopy and removal of dead stems and branches. Use the recommended spacing between plants. Apply the following fungicide sprays (at the recommended rates) to the foliage, flowers and fruit: Carbendazim, Bellis and Anthracol.

Harvesting

Harvest fruit by hand or with a kali (picking pole with bag). Harvest fruit according to market requirements. For example, fruit for fresh consumption are harvested at the physiologically mature, but unripe stage (green mature stage). Some markets require green fruit. Fruit to be consumed shortly after picking should not be allowed to ripen on the tree. Guidelines for harvesting are as follows:

1. Select fruit at the correct stage of maturity for the market and post-harvest handling period to follow
2. Avoid harvesting in the rain, which may increase the likelihood of skin blemishes and post-

harvest disease infections

3. Harvest fruit in the early morning to avoid heat build-up during the hotter part of the day
4. Clip or pick mangoes by snapping the fruit stalk with a sharp twisting action. Snap off any remaining stalk before further handling
5. When harvesting fruit with a kali, ensure that it does not damage the fruit. Three to four fruits should be harvested with the kali before emptying
6. Placemangoes directly into clean harvesting crates and not on soil. Do not overfill crates; exercise care when stacking crates

Post Harvest

1. Keep harvested fruits in the shade and cover during transport to the pack-house
2. It is best to transport fruit to the pack house during the cool part of the day(early morning, late afternoon or at night)
3. Remove latex by washing as soon as possible after harvest
4. Place washed fruits to drain and air dry
5. Stack crates to allow ventilation
6. Pack fruit in boxes according to buyer's specifications, e.g., a buyer may require fruits packed in single layers in 10 lb (4.5kg) boxes.

APPENDICES

APPENDIX I: LIST OF RECOMMENDED PESTICIDES AND APPLICATION RATES

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 II: GOOD AGRICULTURAL PRACTICES DATA RECORD SHEE

Grower name:							
*Name of applicator	Date	Brand and product name	Rate	Size of area/no. of plants treated	Total application (amount of the product used)	Notes/target pest	Start/finish time

*The applicator should be trained or, if not, supervised by a trained or certified person. Proof of training required.