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Forestry and Fisheries.
St. Vincent and the
Grenadines

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Fruit Treecrops

A Production Manual for St. Vincent and the Grenadines

Produced by
the Communications Unit
Ministry of Agriculture, Forestry & Fisheries





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ACKNOWLEDGEMENTS

This production guide was compiled by a group of technical Officers of the Ministry of Agriculture, Forestry and Fisheries, namely:

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Mr. Rhol Pierre - Research and Development Division

The contents are a representation of different research work done on the production of the various crops under similar conditions as exist in St.Vincent and the Grenadines.

Graphical presentation as well as photographs were obtained from local situations, provided by the officers involved with assistance from the Communications Unit.

Layout and design were done by Mrs. Jacintha Young of the Communications Unit.



REFERENCES

- EDWARDS, S. 1988 Treecrop Production Manual
- CARDI/CTA. 1996 Julie Mangoe in the Eastern Caribbean.
- PURSEGLOW J.W. 1995 Tropical Crops Dicotyledons
- FUTCH. S.H. and SINGH M. Florida Citrus Pest Management Guide.
- CRANE J.H., BALERDI C.F. & CAMPBELL C.W. Newsletter - the Avocado. (Circular 1034)
- OECS draft fresh produce standards (leaflets)
- MEDICOTT. A Post-Harvest Handling
- BURGESS, K.A 1993 Farmers ' Guide to Citrus Production. Morton Publishing.
- RAJACK, T. A. Establishing Citrus Orchards. CAEP Project, University of the West Indies.
- YANG, Y.L 2006 Guidelines for the Cultivation of Taiwan Jujube.
- LEE. M.L. 2005 Wax Apple - A production Guide.

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INTRODUCTION

The Fruit Treecrop Industry in St.Vincent and the Grenadines is assuming increasing importance. This is demonstrated by the interest of farmers and consumers in the production and consumption of fruits, respectively, and by the Government, in its Agricultural Diversification Policy and its emphases in this area. There is, however, the lack of a complete package of information designed for domestic production for most of the major fruit treecrops emphasized in the Diversification Programme. Consequently, the need for a broad based guide.

The information provided is not exhaustive. It is specifically designed to assist the frontline extension staff and the public with a condensed package on the agronomy of commonly grown fruit treecrops. These include mangoes, avocado, citrus, nutmeg, wax apple and Indian jujube.

USE CHART

	Black rot	Black pod	Black spot	Greasy Spot	phytophthora	Gummosis	Rust	Melanose	Septoria Leaf spot	Southern Blight	Sooty Mould	Scab	Yellow Sigatoka	Fusarium	Botrytis	rhizoctonia
	✓	✓	✓			✓	✓	✓			✓	✓				
		✓		✓			✓		✓	✓		✓				✓
						✓	✓					✓				
									✓							
	✓		✓					✓	✓		✓			✓	✓	✓
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	✓		✓		✓						✓					
							✓					✓				
	✓			✓					✓							
				✓						✓			✓			
				✓						✓				✓	✓	
							✓									



FUNGICIDE

	Contact Fungicide	Systemic Fungicide/Bactericides	Soil Application	Foliar application	Alternaria	Anthraco	Cercospora	Downy Mildew	Powdery Mildew	Damping off
Kocide 101	✓			✓	✓	✓	✓	✓	✓	✓
Bravo (Daconil 2787)	✓			✓		✓	✓	✓	✓	
Bordeaux Mixture	✓			✓						
Captan	✓		✓	✓	✓		✓	✓		✓
Chipco 26018	✓	✓	✓	✓	✓					
Trimitox Forte				✓	✓	✓	✓	✓		✓
Aliette		✓	✓	✓						✓
Subdue 2E		✓	✓							
Banrot	✓		✓							✓
Cupravit				✓	✓	✓				
Dithane M45				✓	✓	✓	✓	✓		
Ridomil				✓				✓		✓
Calixin				✓						
Phyton			✓	✓	✓	✓	✓		✓	
Rizolex			✓							
Amistar					✓		✓	✓	✓	
Bavistin FL						✓	✓		✓	

SITE SELECTION

Site selection is one of the most important considerations in the establishment of a commercial orchard. In site selection, two areas must be considered:-

1. The Soil
2. Micro-climate.

Soil

The best soil for the establishment of fruit trees is loam or sandy loam soils with a pH range of 5.5 - 7.5. It must be deep, rich in organic matter and free-draining, but not prone to rapid and excessive drying. Treecrops may thrive on marginal or less ideal soils, but may give variable and undesirable yields.

Micro-climate

This refers to the local climatic conditions of the area considered for orchard establishment. The following are important:

- I. Rainfall - a minimum of 60 inches of rainfall is required for good growth and production. Excessive rainfall, 100 inches or more, may lead to increased incidences of fungal diseases and problems with drainage and run-off. Citrus (e.g limes, orange, grapefruits) and Mangoes require a dry period of at least 3 - 6 weeks for optimal flowering and fruiting. Mango requires a dry period of 12-16 weeks for optimal fruit set.
- II. Wind - constant, strong winds create rapid water loss from the plants resulting in a general unhealthy appearance of the trees. Excessive winds also cause premature fruit drop, lower yields and plants with a "wind-swept appearance".
- III. Topography - for commercial production, it is best to choose flat or gently sloping lands where mechanical operations can be safely undertaken. Where this is not possible, consideration must be given to soil conservation techniques to reduce soil loss. In addition, pay close attention to the layout of the



Young Orchard at Peter 's Hope

orchard for ease of operation on sloping lands.

IV. Temperature - the range of tree crops grown in the Caribbean is well adapted to the temperatures of the tropics. Temperature is important to some species for fruit colour and development. For instance, the attractive yellow or orange coloration in oranges is influenced by the combination of low soil and air temperatures at night. These conditions may be found at high elevations and in some valleys.

Micro-climate for selected fruit trees

Fruit tree selection is an economic decision based on market potential and the suitability of the available site. The species vary in their production performance owing to their unique environmental requirements.

Mangoes generally do best on exposed hillsides and in areas with a pronounced dry period of 3 - 4 months. They will not fruit well nor produce good clean fruits of the best flavour, in very wet areas.



Mangoes do well in exposed areas

Avocado prefers light, well drained soils in sheltered and moist areas. This plant will not produce well on heavy, wet, badly draining soils or in exposed areas prone to excessive drying.

Citrus (orange, tangerine, grapefruit, lime) are intolerant to high winds and wind breaks should be provided where necessary. They are also sensitive to water logging. Oranges, perform better on heavier soils than the other members of this group. Tangerine will tolerate wetter conditions than other citrus. Lime generally will perform better in poor conditions or marginal soils than would other citrus. Oranges and limes are known to require a pronounced dry period of 3-6 weeks for optimal flowering and fruiting.

Nutmeg cannot tolerate water logged or very dry soils. Shade is beneficial to young trees. Areas with rainfall of 85-150 inches per annum, evenly distributed, and altitudes of up to 1500 ft are best

JSE CHART

Mealybugs	Mites	Leafhoppers	Hoppers	Ants	Midges	Fleas	Cutworm	Grub	Mole Cricke	Leafminer	lacebug
✓	✓	✓	✓								
		✓	✓		✓	✓					
		✓	✓	✓							
✓	✓	✓	✓	✓			✓	✓	✓	✓	
		✓									
		✓	✓								
✓	✓	✓									
✓	✓	✓									✓
✓	✓	✓									✓
		✓	✓							✓	
	✓	✓	✓				✓	✓	✓	✓	✓
	✓									✓	
	✓										
			✓								
		✓									

INSECTICIDES

	Aphids	White fly	Beetle	Weevil	Caterpillars	Thrips	Stinkbugs	Scale Insects
Malathion	✓	✓	✓	✓	✓	✓	✓	✓
Karate	✓	✓	✓	✓	✓			
Sevin	✓				✓			✓
Basudin	✓		✓	✓	✓		✓	✓
Primor	✓							
Decis	✓		✓	✓	✓			
Ambush 50 EC	✓	✓			✓		✓	
M-Pede	✓	✓				✓		✓
Sunspray	✓	✓				✓		✓
Perfekthion	✓	✓				✓	✓	✓
Orthene	✓	✓	✓	✓	✓	✓	✓	
Dursban	✓		✓	✓	✓			
Dipel					✓			
NewMectin (Vertimec)								
Kelthane (Dicofol)								
Actellic			✓	✓				
Admire	✓	✓				✓		

suited.

Cocoa does not perform well in areas with marked or intense dry season; with rainfall of less than 2.5 inches per month. It thrives well under dense shade. Seedlings grow best with 25% shade, which can be gradually removed as long as proper nutrition, drainage and soil aeration are available.

Observation is the best way to determine which fruit will do best under specific climatic conditions. Simply by looking around the farm and neighbouring areas one may be able to determine what fruit trees are thriving and producing well and are thus suited for the area.

TYPES OF PLANTING MATERIAL

The use of good quality planting material for orchard establishment is extremely important since this is a long term investment (20 years or more). Choice of planting material should be based on market requirements and the suitability of the variety to environmental conditions.

Seeds

Generally, for most fruits, it is not desirable to use the seeds as the planting material for the following reasons:

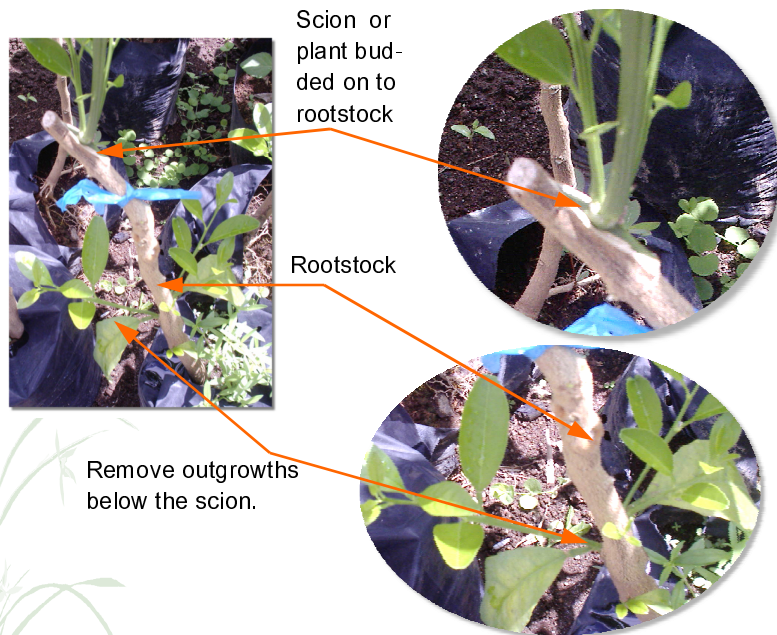
1. Plants from seeds take longer to flower
2. Seeds may not be true to type - there is usually a wide variation in the characteristics of the plants and fruits produced.
3. The plants tend to be susceptible to a wide range of diseases.
4. They tend to grow vigorously upright, which presents difficulties in management; especially so, in pests control and harvesting.
5. Fruits are usually of low quality

Vegetative Propagated Plants

The advantages of propagated plants are:

1. The plants produced are true to type i.e. they will have the same potential as the plants from which the cuttings were taken
2. They begin to produce fruits earlier, usually within two to three years, as opposed to five years for plants grown from seeds
3. When certified scion and stock are used, the plants can be guaranteed disease free with potential for higher yields and therefore, greater profits

It is important to know the variety and the rootstock of budded or grafted plants. The rootstock determines characteristics such as disease resistance of the plant, its vigour, growth and the number, size and quality of fruits, which the plant will be able to produce.



Healthy robust rootstock material is essential for good performance, but it must not be allowed to overtake the growth of the budded scion. Therefore all outgrowths below the scion must be removed.

N ST.VINCENT & THE GRENADINES

* Fruit species affected

Mango) <i>Mangifera indica</i>	Sweet / soursop <i>Annona spp</i>	Plums (Bequia, Jamaican, golden apple) <i>Spondias spp</i>	Wax apple
			*
**			*
	*	*	
			*
*			
*	*	*	*
	*		
*			

SOME COMMON PESTS OF TREE CROPS I

PEST	Avocado <i>Persea americana</i>	Cocoa <i>Theobroma cacao</i>	Citrus <i>Citrus spp</i>
Algal rust <i>Cephaleuros virescens</i>	*		
Anthracnose <i>Colletotrichum gloeosporioides</i>			
Black pod rot <i>Phytophthora palmivora</i>		**	
Black root rot <i>Rosellinia bunodes</i>		*	
Coffee canker <i>Ceratocystis fimbriata</i>		*	
Greasy spot <i>Mycosphaerella horii</i>			*
Gummosis <i>Phytophthora nicotianae var parasitica</i>			*
Root rot <i>Phytophthora cinnamoni</i>	*		
Stem end rot <i>Botryodiplodia theobromae</i>			
Sooty mould <i>Capnodium spp</i>	*	*	*
Nematodes	<i>Meloidogyne incognita</i>		*
	<i>Radopholus similis</i>		*
	<i>Helicotylenchus dihystra</i>		*
	<i>Xiphinema vulgare</i>		*
Sour orange scab <i>Elsinoe fawcetti</i>			*
Stem end rot <i>Botryodiplodia theobromae</i>			
Witches broom <i>Crinipellis perniciosa</i>		*	
Withertip of lime <i>Gloeosporium limetticolum</i>			*

CULTIVARS AND FRUIT VARIETIES

There are several commercial varieties of fruits that are grown locally. These are summarised as follows:

Table 1: Varietal characteristics of Oranges

Variety	Season *	Fruit Size	Seed Content**	Juice content	Flavour	Yield
Parson Brown	Early	Medium	Seedy	Good	Sweet	High
Pineapple	Mid	Medium	Seedy	Good	Sweet	High
Washington Navel	Early-Mid	Medium/large	Seedless	Fair	Sweet	Erratic
Valencia	Late	Medium	seedless	Very Good	Good	High

***Season:** Early = October to December; Mid = January to February; Late = March to April

** **Seedless** = 0-8; **Moderate** = 9-15; **Seedy** = 15 or more

Table 2. Characteristics of Grape Fruits

Variety	Season	Fruit Size	Seed Content*	Juice content	flavour	Yield
White Marsh	Mid	Medium	Seedless	High	Good	High
Duncan	Early	Large	Seedy	High	Good	High
Pink Marsh	Early	Medium	Seedless	High	Good	High

Season: Early = October to December; Mid = January to February; Late = March to April

Table 3: Characteristics of Limes

Variety	Season	Fruit Size	Seed Content	Juice Content	Flavour	Yield
West Indian Lime	Early	Small	Moderate	High	Acidic	High
Tahiti Lime	Early	Medium	Seedless	High	Acidic	Moderate to High

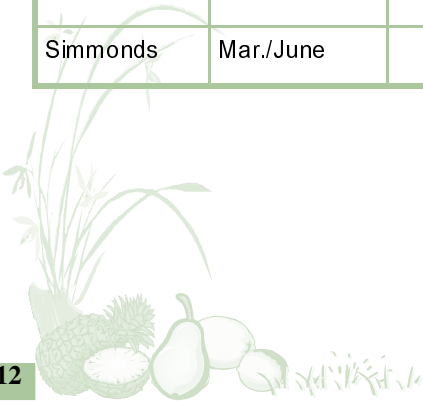
Season: Early = October to December; Mid = January to February; late=March to April

Table 4: Characteristics of Mangoes

Variety	Colour when ripe	Fruit wt (g)	Fibre Level	Sweetness
Julie	Yellow/red blush	284	Low	Very sweet
Imperial	Yellow/red blush	500	Low	Very sweet

Table 5: Characteristics of Some Avocados

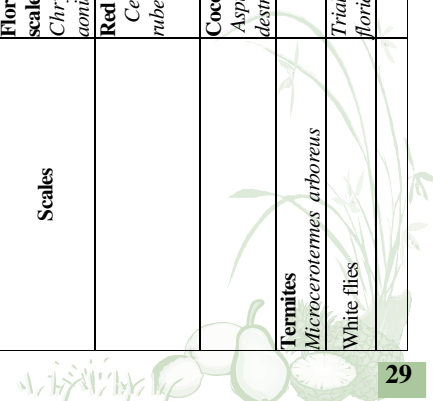
Variety	Flowering time	Fruit wt (g)	Seed cavity	Harvest Time
Lula	Mar./June	450-700	Tight, some loose	Dec-Feb.
Pollock	Dec./Feb.	600-1200	Tight	Jun./Aug
Simmonds	Mar./June			Jun./Aug



Some Common Pest of Treecrops in St.Vincent and the Grenadines

* Fruit species affected

PEST	Avocado <i>Persea americana</i>	Cocoa <i>Theobroma cacao</i>	Citrus <i>Citrus spp</i>	Mango <i>Mangifera indica</i>	Sweet / soursop <i>Annona spp</i>	Plums (Bequia, Jamaican, golden apple) <i>Spondias spp</i>	Wax apple (<i>Syzygium samarangense</i>)
Aphids <i>Aphis spp</i>			*			*	*
Mango Seed weevil <i>Sternochetus mangiferae</i>				**			
Mango midge <i>Erosomyia mangiferae</i>				*		*	*
Mealy bugs	<i>Pseudococcus citri</i>	*				*	*
Red-banded thrips <i>Selenothrips rubrocinctus</i>	<i>Macronelliticoccus hirsutus</i>			*		*	*
Scales	Florida red scale <i>Chrysomphalus aonidium</i>				*		
	Red wax scale <i>Ceroplastes rubens</i>				*		
Termites <i>Microcerotermes arboreus</i>	Coconut scale <i>Aspidiotus destructor</i>	*					
White flies	** <i>Trialeurodes floridensis</i>	*					
					*		*



Crop	Productive Traits	Yields	Grades and Standards for export	Maturity Indices	Recommended Post Harvest Practices
Mango	Begin bearing fruit 3 years after planting - usually from June to August.	400 - 600 fruits per tree per year during 10th - 40th year	<ul style="list-style-type: none"> Firm mature fruits with red tinge on fruit shoulder. 10% sugar minimum when ripe. Uniform shape, free from blemishes (latex stain, diseased, decay, scars, bruises, cuts, sunscalds, insect damage and mechanical injury) Confirm to weight and size specifications eg, Julie Mango, minimum fruit weight 8 ozs (250g) 	<ul style="list-style-type: none"> Well developed fruit shoulders Fruits must develop characteristic shape of a mango. 	Do not pre-cool at lower than 12°C
Avocado pear	Begins bearing fruits 3 years after planting - usually June to October.	100 - 500 fruits per tree per year	<p>Grade 1. Blemish free. Not more than 15% size difference. Clean, mature green, free from pests, stem trimmed to ¼ inch long. Pack 1 variety per carton of weight 11 lbs.</p> <p>Grade 2 16 - 25% size difference, up to 5% surface blemish, carton weight 22 lbs. fruit weight : Minimum 10 oz (280g), Maximum 11lb 7oz (660g) Weight per Fruit per carton: 14 fruits - 280g, each 12 fruits - 330g each 10 fruits - 400g each 8 fruits - 500g each 6 fruits - 660g each</p>	<p>Size, characteristics of variety Colour change, bright glossy, green to pale green, or tinge of red for red-skinned varieties.</p>	<ul style="list-style-type: none"> Grade, pack and store under cool conditions withing 12 hrs of harvesting. Wipe fruits with a damp cloth moistened with bleach solution (1%) Pre-cool at 12°C and 95% RH before shipment Dip fruits in approved fungicide solution.

Taken and adjusted from leaflets prepared by the OECS draft fresh produce standards



ORCHARD ESTABLISHMENT

LAND PREPARATION

The type of land preparation will be dependant on the topography and the existing vegetation. First, clear the area of all trees and shrubs. When clearing the land do not expose soil, as heavy rains will cause erosion.

On low lying areas and areas with drainage problems, raised beds may be constructed in an east to west direction, or, holes and mounds may be used. The width of beds is dependent on the intended spacing of the trees. If the land is steep, beds and mounds will not be practical; use holes with a closer spacing within the rows.

LINING / LAYOUT

Planting distances will depend on the type of fruit tree and the natural fertility of the soil. The more fertile the soil, the larger the tree thus the greater the spacing necessary.

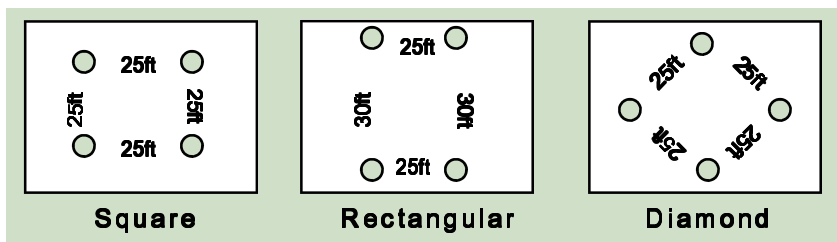
Crop	Recommended spacing (feet)
Grapefruit	25 x 25
Orange	20 x 20
Tangerine	15 x 15
Lime	15 x 15
Avocado	25 x 25
Nutmeg	15 x 15

Crop	Recommended spacing (feet)
Mango (Julie)	25 x 25
Mango (Imperial)	25 x 25
Cocoa (with shade)	12 x 12
Cocoa (without shade)	6 x 6
Wax Apple	23 x 23
Indian Jujube	23 x 23

PLANTING

Planting patterns can be square, diamond or rectangular. Square and rectangular patterns are best suited to flat land and diamond patterns to sloping land. On slopes or steep land, plant more closely to prevent erosion.

Alternative Planting Patterns



Planting holes should be a little bigger than the size of the potting bag and about 5 inches deeper. This is to accommodate fertilizer and pen manure placement at the bottom of the hole.

Place the fertilizer and pen manure into the planting hole. However, it is ideal to delay fertilizer application until the plant shows active growth, about 1 month after planting. If the soil pH is less than 5, add about one pound (1lb) lime to the pen manure in each planting hole. Cover these materials with about 2 inches of soil before planting.



Pen Manure placed in the hole to assist with early growth of seedling

Seedlings are planted out in the field at the beginning of the rainy season. Before planting, carefully remove the potting container (polythene bag or other) from each plant, leaving the roots and soil intact. Each plant is planted at the same depth as it was in the container or polythene bag. The lateral surface roots should not be bent or pressed downwards.



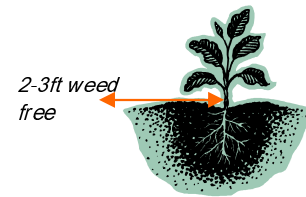
The seedling with soil removed from the bag must fit with adequate space in the hole

Harvesting and Post-Harvest Guidelines for Tree crops

Crop	Productive Traits	Yields	Grades and Standards for export	Maturity Indices	Recommended Post Harvest Practices
Coconut	Plants begin bearing 7 yrs. after planting and gives fruits all year round	3000 - 6000 nuts per tree per year.	<ul style="list-style-type: none"> • Dry and dehusked, Clean • Free from pests, cracks, sunken or damaged eyes and excessive hairs. • Minimum size - 1lb. 9oz. • Not more than 15% size difference 	Usually harvested after falling from the tree.	<ul style="list-style-type: none"> • Pack in sacks or cartons at 20 per sack. • Store at 12°C
Oranges	Plants begin bearing 3 yrs after planting from September to March.	350 - 525 fruits per tree per year (40kg)	Grades : (width of diameter) A - 3.4 inches or more B - 2.8 - 3.3 inches C - less than 2.8 inches Also, grade according to variety, colour, juiciness, freshness, firmness, cleanliness.	Colour change from green to light or bright yellow	<ul style="list-style-type: none"> • Avoid impact and compression injury. • Use picking bag to harvest fruit that cannot be picked by hand • Use field crates with smooth and rigid sides to transport from field.

Taken and adjusted from leaflets prepared by the OECS draft fresh produce standards

After placing the plant in the hole, compact the soil around the plant to improve contact between the plant, root and soil. Make a slight mound around the plant to prevent water collecting at the base of the plant. Water settled at the base will cause rotting and eventually death of the plant. Keep a radius of 2-3 ft around the plant weed free.



Weeds left for long around the base of the young seedling encourages pests and disease problems and deficiencies in the plant nutrition.



- Harvesting and Post-Harvest Guidelines for Tree crops
- Some Common Pests of Treecrops in St.Vincent and the Grenadines
- Insecticides Use Chart
- Fungicides Use Chart

Early and late fruit cultivars as well as different types of fruits should be planted separately, or according to some well defined pattern to facilitate easy harvesting.

WINDBREAK

Strong and constant winds impede pollination, reduce fruit set and cause fruit blemishes due to the rubbing of fruits on the leaves and branches. Therefore, orchards should be located on the leeward side of the hills or woodland. Where this is not possible, windbreaks of suitable quick growing, thick-foliage sturdy trees, should be planted closely on the exposed side of the proposed site. Some examples of local plants used for windbreaks are:

- | | |
|-------------------|--------|
| Dracaena (Dragon) | Mango |
| Nutmeg | Clove |
| Sapodilla | Cashew |
| Galba | |



Trees in the background form natural windbreak, or windbreaks can be planted.



FERTILIZATION

The availability of nutrients to the plants depends on timely application of the fertilizer and the capacity of the soil particles to retain and release the nutrients.

Sandy soils are relatively infertile and lack the capacity to retain nutrients. Frequent applications of fertilizer are necessary to ensure that essential elements are available to the plants.

Two to three (2 - 3) applications of granular (mixed) fertilizer per year are sufficient for adequate growth during the first 3 - 4 years for most plants.

The frequency of application can be reduced with the maturity of trees, but the quantity applied increased.

Controlled or slow-release, sulphur-coated fertilizers are available in a variety of formulations. Slow release fertilizers can be broadcasted, incorporated after planting or applied as a pre-plant treatment.

Fertilizer application rates for specific fruit trees

Mango

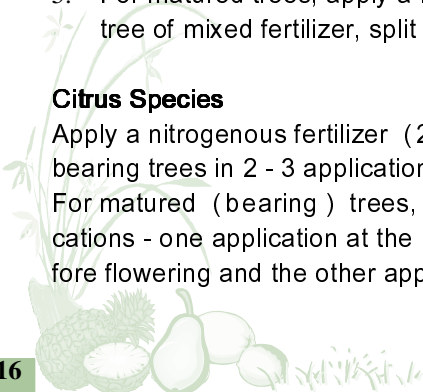
1. Apply $\frac{1}{4}$ - $\frac{1}{2}$ lb (100 - 250g) of NPK 8:2:8:2MgO every 4 months for the first year.
2. Micro nutrient foliar spray can also be used 1 - 2 times per year
3. Apply N:P:K to or beyond the leaf drip area of the plant
4. Gradually increase the amount of fertilizer of each application after about 4 - 5 years to 10 - 12 lbs per year in 3 applications
5. For matured trees, apply a maximum of about 20 - 25 lbs per tree of mixed fertilizer, split in 2 - 3 applications

Citrus Species

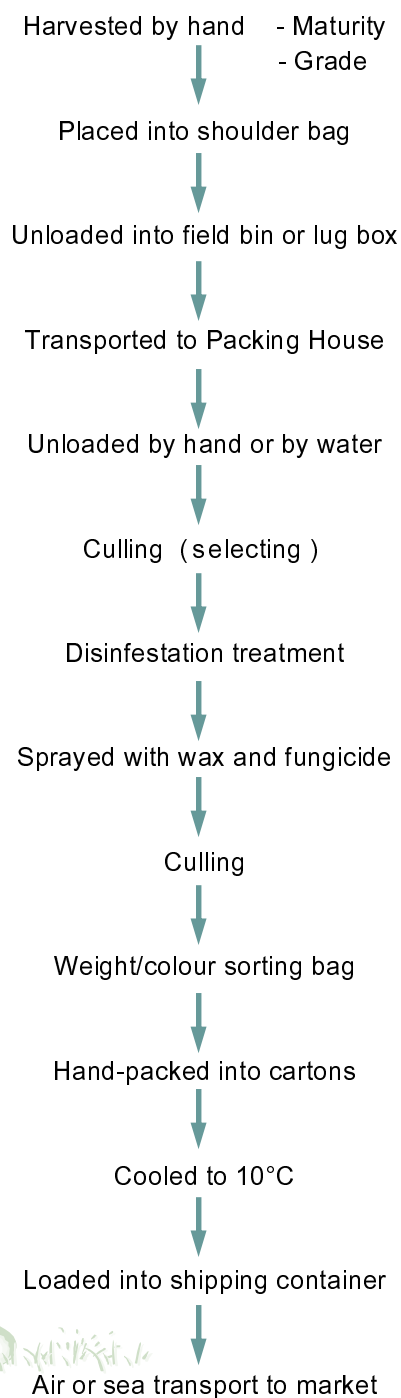
Apply a nitrogenous fertilizer (20%N) at a rate of 1 - 2 lbs to non-bearing trees in 2 - 3 applications.

For matured (bearing) trees, apply 4 - 10 lbs per annum in 2 applications - one application at the beginning of the wet season just before flowering and the other application 4 - 5 months later.

INDEX



A Generalize Handling Scheme for Tropical Fruits



Avocado

Manures and fertilizers similar to that used for citrus can be applied to Avocado.

For a 1 year old tree, apply $\frac{1}{4}$ - 1lb per tree in 4 applications. Increase the rate proportionately in the following years.

Jujube

Young plant require fertilizers formulated with NPK (16:8:24 or 13:8:23) at rate $\frac{1}{2}$ - 1½ lbs in 3 applications

Apply 4.4 lbs (2Kg) NPK to mature plants. Banana fertilizers can be used (3 applications)

Poultry manure can be used at 10 - 20 lbs per plant.

Carambola

For non-bearing trees, apply high-nitrogen manures and fertilizers regularly in small quantities.

Fertilizer with a 16:8:24 formulation can be applied to non-bearing and bearing trees. Use the following as a guide:

Year 1	2.2 lbs
Year 2	4.4 lbs
Year 3	6.6 lbs
Year 4	8.s lbs

Apply in split applications

Apply 50 - 100 lbs of pen manure to 1 tree per year

Wax Apple

Apply NPK as follows:

Year 1 & 2	3 lbs
Year 3 & 4	4 - 6 lbs
Year 5 & 6	7 - 8 lbs
Year 7 & older trees	9 - 10 lbs

PRUNING

Pruning is the removal of a portion of a plant to improve its appearance and health and to control its growth and shape (Ingels 1994)

When pruning, use tools made for the purpose and keep them sharp and clean. To disinfect pruning tools, use either a 70% denatured alcohol solution, or household bleach at one part bleach to nine parts water. Either use a sponge or dip the equipment into these solutions between cuts.

General Recommendations for Pruning

FRUIT TREE	Years 1 - 3	
MANGO	Cut the main stem to determine the height of the first branching.	Choose and remove c branches
CITRUS	Remove watersprouts , dead and diseased branches (twigs) and shoots below the bud union periodically.	Little pruning
AVOCADO PEAR	Formative pruning to encourage the branches to spread and multiple frame work branching.	Cut back
JUJUBE	Cut back young plant 30cm (1ft.) from the graft union (from above) to induce the formation of new shoots. Do this twice per year in commercial orchards. Remove all shoots below the graft union.	Cut back -2ft) of the harvestin union.
CARAMBOLA	Cut the main stem when the tree is 50 - 60 cm (approx. 1½ - 2 ft) tall. Keep 3 - 5 branches.	Prune after year)
WAX APPLE	Cut the main stem when the tree is about 40cm - 60cm (16-24 ins) tall; keep 3 - 4 stems.	Prune before harvest.

POST-HARVEST HANDLING

Post-harvest handling refers to all activities undertaken to maintain good quality, between the time of harvesting and sale to the consumer. It involves such activities as sorting, grading, treatment, pest control, packaging and storage.

After successfully removing the fruit from the plant, void of any injury, preliminary packaging is the first post-harvest operation. Most fruits should be put into crates that are rigid, have smooth sides and allow adequate ventilation. Containers with rough interior, such as baskets must be avoided, or be padded, to prevent mechanical injury. If deep containers are filled with harvested fruits, those at the bottom may suffer from compression injury (squeezing). Avoid piling fruits into heaps on leaves or on the bare soil in the field. Instead take them promptly to a central pack-house or to a designated clean and cool area on the farm, where sorting will be undertaken to remove fruits that do not satisfy the requirements of the buyer.

If specific grades are required ensure that the specifications (standards) are understood and followed. Never attempt to package 'reject ' produce for sale to any buyer, since this will create distrust, leading to the loss of an important buyer or an export market.

Treatment is sometimes necessary to get rid of pests or to maintain quality. Such treatment may include dipping fruits into disinfecting solutions such as diluted Bleach/Clorox or fungicidal dips. Hot water treatment for the control of insect pests, and waxing, to reduce moisture loss, are other treatments that may be applied.

Always remember that if post-harvest losses are high, profits can be eliminated altogether.

HARVESTING



Prune mangoes so that the upper branches do not overgrow and shade the lower portion of the tree. Remove branches growing toward the center of the tree, and the weakest of crossing or closely parallel branches. Maintain an 'open' tree for good management.

The maturity stage at which fruits should be harvested will be determined by market requirements. Immature fruits may be specifically required for pickling or similar forms of processing. Distance from the market also influence the maturity stage that will be required. Full green mature or just-turning (colour change) fruits may be required for the local market, and a similar grade for the export market. Usually, the maturity stage desired by a buyer has a relationship with taste and shelf life.

The ideal time to harvest is early morning, before the heat of the sun begins to accumulate in the fruit. This heat is called field heat and it increases the rate of spoilage after the produce is put into storage. Harvesting on a dry day is preferred to harvesting on a wet day.

Most fresh fruits are easily bruised and should therefore be carefully harvested . Fruits damaged during harvesting, ripen and spoil quicker than undamaged fruits. They also ripen and spoil other fruits close to them. Some impact injuries may not be readily seen during sorting, but will subsequently affect the quality of the consignment with which they are packed.

Harvesting by hand reduces damage significantly. Where this method of harvesting is not possible, a picking stick with a small collecting bag attached, is recommended to ensure that the harvested fruits do not fall to the ground.

Pruning of the Major Fruit Trees	
Years 3 - 7	Years 7 and older
wide angle horizontal branches and lead, diseased and unwanted ;	Remove branches from the center of the tree, open and do maintenance pruning once per year or once every 2 years.
ning until the tree approaches con- size.	Continue the removal of dead wood every 3 - 5 years. NB. Heavy pruning will delay fruit production.
tops of trees to 16 - 20 ft. (5 - 6m)	Continue cutting back the tops of trees to maintain tree height. This helps to reduce spraying for pests and it aids with harvesting.
the tree to within 30 - 60 cm (1 he graft union twice annually after graft. Remove all shoots below the graft	Continue cut back as in previous years and remove all shoots below the graft union.
er each bearing (2 - 3 times per	Maintain pruning by removing dead, diseased, weak crowded growth and suckers from the base of the plant. Keep tree to a manageable height of 2.5 - 3 m. Support weak branches with poles (stakes)
aring trees 2 times per year after	

PEST MANAGEMENT

It is important to know what a healthy plants looks like. This makes it easier to identify when a plant is suffering from a disorder. Therefore, regular checks for signs or symptoms of any abnormalities must be done.

In St.Vincent and the Grenadines, most fruit trees are affected by the same pests problems. The most common insect pests are aphids, scales, mealy bugs, thrips and beetles.



Aphids (seen as spots on leaves) are regular pest of young Citrus plants

Below right: distinct jagged edges of the leaves indicate damage by Beetles.



The coarse rust-like appearance of the Skin of the Avocado Pear indicates mite infestation.

Fungal diseases include Sooty Mould, Greasy Spot, Anthracnose and Rust. To reduce some of the problems caused by these pests, plants must be planted at the correct spacing to avoid the build-up of humid conditions, which is ideal for the development of these organisms.



Sooty Mould affect both leaves and fruits of most fruit trees.

WEED CONTROL

Weeds are considered as pests and should be managed. They compete with the plants for essential nutrients, moisture and light. This competition is undesirable, especially in newly established orchards. Besides, weeds are host for several other pests which may affect the fruit trees.

Generally, pests must be rigorously managed. Where isolated young plants are in the backyard, diseased parts or insects can be removed by hand. However, in the commercial stands or with larger plants, in integrated pest management strategy is recommended with chemical control measures as part of the overall program. (refer to the Pesticide Use Charts), but it is wise to always have an integrated pest management program as the best option.



Weeds must be properly managed to allow the fruit trees to perform at their best. An undergrowth of lawn grass improves the aesthetics, enables good management practices and reduces soil erosion and other pest problems