Tree Crops

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

TECHNOLOGY PACKS

CITRUS

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exist on the various aspects of production and handling/ marketing of crops and livestock, the majority of which are outdated, not easily understood and lacking the where with all for addressing present day challenges such as good agricultural practices (GAPs) and food safety and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

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

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

Citrus, belongs to the Rutaceae family and may have originated in either or Australasia. Citrus production now takes place throughout the tropical and sub-tropical world. The genus Citrus contains many species, those of major present commercial value in St. Lucia are orange, grapefruit, lime, ortanique, tangerine and tangelo (Plate 1). In recent years there has been a decline in citrus production due to the presence of Citrus Tristeza Virus (CTV). However, a national drive is on to revitalize the industry through replanting with CTV tolerant root stock.

Plate 1 Citrus fruit sample Source: http://punjabtribune.com/wp-content/uploads/2015/07/citrus.jpg

Site Selection

Selecting the best site depends on the citrus species or variety selected. For example, limes, grapefruits and pommelos are suited for the drier areas, while navel oranges are best suited for high rainfall areas. Soils must be deep, fertile and well-drained as water logged conditions will soon result in the death of plants. Most citrus species require a minimum of 60 inches (1500 mm) of rainfall per year. A dry period of 4 - 6 weeks is important for good flower initiation. The site chosen should be well sheltered since continuous winds negatively affect the moisture balance of the trees making them susceptible to infestation by scale insects. To get best production of fruits the plants must be exposed to full sunlight for maximum photosynthesis.

Soils with high calcium content should be avoided and the locations chosen must also be easily accessible so that inputs can be easily brought into the field and the harvest easily removed.

In St. Lucia, there have been popular varieties used, however there are newer varieties of excellent characteristics which should be considered for planting to expand the market possibilities (Table 1).

Table 1 Citrus varieties for St. Lucia

Type of citrus	Popular varieties	New Varieties
Orange	Valencia, Parson Brown, Washington Navel, Pineapple	Caracara Navel
Grapefruit	Marsh White, Ruby Red	Chironja, Flame, Chandler Pomello
Lime	West Indian, Tahiti, Rampur	Java, Villafranka Lemon
Mandarin		Encore, Okitsu-wase, Satsuma, Ponkan
Others (easy peelers)	Tangerine, Ortanique, Tangelo	

Propagation

The preferred propagation method is that of grafting on to seedlings. In the past, sour orange was the popular rootstock but its susceptibility to Citrus Tristeza Virus (CTV) has contributed significantly to the decline in citrus production. Therefore, new propagation of citrus should be done on rootstock tolerant to CTV, e.g., Volkamer.

Spacing

The recommended spacings for some types of citrus are shown in Table 2.

Table 2 Recommended spacings types of citrus

	Spacing		Number of plants	
Type of citrus	inches	metres	acre	hectare
Grapefruit	25 x 25	7.5 x 7.5	70	177
Orange	20 x 20	6.0 x 6.0	109	277
Lime and mandarin	15 x 15	4.5 x 4.5	197	493
Easy peelers	15 x 15	4.5 x 4.5	197	493

Land Preparation and Planting

It is best to prepare holes in the dry season so that as soon as the rain begins the trees can be planted.

Dig holes 12 x 12 in (30 cm x 30 cm). Mix pen manure with an equal quantity of soil and incorporate in the hole along with one ounce (30g) Triple Super Phosphate fertilizer.

Remove the plastic bag and ensure that the plant goes into the planting hole at the same depth as in the bag. Press the soil firmly around the plant and mound slightly to ensure water does not settle around the plant.

Pruning

In the first few years after planting, pruning is important to remove all shoots growing from the rootstock. In later years, suckers growing from the trunk and the main branches must also be pruned. It is also important to prune to train the tree to achieve a uniform manageable size, to allow good penetration of light into the canopy, facilitate the application of sprays and to enable easy harvesting. Remove diseased and dead branches. The best time to prune is at the beginning of the rainy season.

Weed Control

Weeds compete with the crop for nutrients, water and sunlight and therefore they must be controlled to obtain maximum crop yield. Weed control can be as follows:

Manual/Mechanical: Cutlass, weed eater, brush cutter.
Chemical: Herbicides that are contact and systemic. When applying herbicides close to young citrus plants, care needs to be taken to avoid spray drifting on to the plants. Therefore a spray shield should be used. For an organic approach, herbicides must not be used.

Cultural: Intercropping with low-growing plants that will not compete for sunlight, such as vegetables and sweet potato. Intercropping can be practised in the first 3- 4 years when the citrus plants cannot shade out the intercrop.

Fertilization

Plants require sufficient nutrients to grow and bear properly. Fertilizer application rates are best determined from a soil test. However, in the absence of such a test, the rates of NPK fertilizer 16.8.24+2 shown in Table 3 are recommended.

Table 3 Recommended rates of application of NPK fertilizer 16.8.24+2 to citrus

Year	Amount of fertilizer	
	oz	g
1	4	115
2	8	230
3	10	280
4	16	450
5	32	1000

The recommended quantities can be split into three applications as follows:

1. Just before the rainy season (April - May)
2. Mid wet season (August - September)
3. End of wet season (December - January)

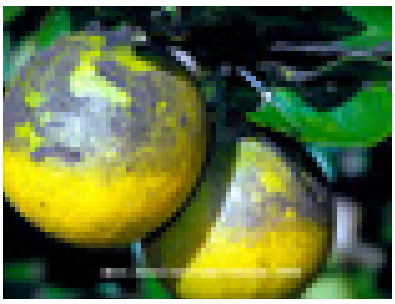
However, the decision to split applications may increase the labour cost so this should be weighed against the better yields expected.

Pests and Diseases

The major pests and diseases affecting citrus are shown in Table 4.

Table 4 Symptoms and control of pests and diseases of citrus

Pest & Diseases	Symptoms	Control/ Management
Plate 2 Citrus Tristeza Virus  Source: http://www.agricoltura.regione.lazio.it/binary/prtl_sfr/tbl_misure/CTV.JPG	Tree decline - leaf chlorosis and general dieback of tree. Stem pitting.	Use tolerant rootstock, e.g. Volkamer. Use shoot tip grafts of virus free scion. Biological control with the Black Citrus Aphid; follow quarantine guidelines.
Plate 3 Citrus Greening Disease  https://upload.wikimedia.org/wikipedia/commons/1/1e/Huanglongbing.jpg	Mottling and yellowing of leaf, defoliation, dieback, death, fruits green at bottom.	Increase the acidity level of soil to match the optimum pH for the rootstock.
Plate 4 Phytophthora Root Rot *Phytophthora spp*  **http://idtools.org/id/citrus/diseases/images/fs_images/06Phytophthora.jpg**	Gum exudation, bark death, eventual plant death.	Avoid waterlogged locations Drench soil around plant with Acrobat, Ridomil or Alliette.

Pest & Diseases	Symptoms	Control/ Management
Plate 5 Anthracnose *Colletotrichum gloeosporioides* (Penz.) Sacc.  **http://www.ipm.ucdavis.edu/PMG/IMAGES/C/h.D-CI-CGLO-FR.005.jpg**	Twig dieback, premature leaf drop, dark staining on fruit and post-harvest fruit decay.	Well aerated fields. If chemicals required, spray foliage and immature fruits with fungicides such as Bellis Carbendazim, manzeb, benomyl, benomyl + propineb, zineb and mancozeb.
Plate 6 Black Citrus Aphid *Toxoptera auranti (Fonscolombe)i*  **http://www.aphotofauna.com/images/bugs_homoptera/aphid_toxoptera_aurantii_07-05-13_1.jpg**	Sucks shoots and twigs.	Neem, insecticidal soaps e.g. safer soaps. Also control from natural enemies.
Plate 7 Sooty Mold  **http://www.annettemcfarlane.com/image/Sooty_Mould_Lg.jpg**	Fungi that grow on honeydew secretions by insects. Reduces photosynthesis resulting in reduced plant growth and lower yields.	Keep plants healthy with adequate fertility. Control honey dew causing insects with systemics like Protector. Apply oil sprays or insecticidal soaps. Apply sticky glue around trunk to keep ants away.

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

Harvest mature fruit by hand or with a kali (picking pole with bag). Do not allow fruit to drop to the ground. Discard the ones that fall to the ground as they deteriorate rapidly. Harvest according to market requirements. Place harvested fruit in crates and not bags. Use the flavour of the citrus fruit as the indicator of ripeness.

Post Harvest

1. Store harvested fruit in the shade and cover during transport to the markets
4. It is best to transport fruit to market during the cooler parts of the day such as early morning, late afternoon or night
2. Stack crates to allow ventilation.

APPENDICES

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 I: LIST OF RECOMMENDED PESTICIDES AND APPLICATION RATES

APPENDIX II: GOOD AGRICULTURAL PRACTICES DATA RECORD SHEET

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/finis time

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