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Extension Training and Information Services Division

Technical Bulletin

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Avocado Production

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Extension Training and Information Services Division

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Introduction

The avocado (*Persea americana Mill*) belongs to the family Lauraceae. Cultivars of economic importance within our region include Pollock, Lula and Simmonds. These cultivars have variable shapes, from tall, upright trees to widely spreading forms with multiple branches and heights ranging between 4 - 15 metres (13 - 60 feet).

The yields tend to be irregular from year to year, with an average between 100 and 200 fruits per tree, each weighing approximately 1.4 kg (3 lbs). A grafted avocado plant starts bearing three years after planting and can continue to bear fruits for more than twenty years.

Recommended Cultivars

The avocado is subdivided into three types (West Indian, Guatemalan and Mexican), which reflect the geographical area of origin. The West Indian and Guatemalan types and crosses between them are most preferred/demanded by consumers and include:

- **Pollock**: A vigorous spreading West Indian type with an oblong to pear shape fruit that weighs up to 2.27 kg (5 lbs) (***Figure 1)***. The seed is loose within the fruit's cavity and the tree has an early July to August or October bearing.

Figure 1: Pollock avocado fruit

- **Lula**: A Guatemalan and Mexican cross hybrid with a tall, vigorous and upright growth habit. The fruit is pear shaped, sometimes with a neck and seed tight within cavity (***Figure 2***). The tree bears mid-November to December.

Figure 2: Lula avocado fruit

- **Simmonds**: A West Indian type with medium vigour. The fruit is oblong-oval to pear shape with seed tight within cavity (***Figure 3***). It bears mid-July to mid-September.

Figure 3: Simmonds avocado fruit

Establishment and Crop Management

Pollination

All avocado varieties are placed into an A or B group based on their flowering pattern.

Group A: Flowers open in the morning (at approximately 6:00 a.m.) as female, close at approximately noon and reopens the following day during the afternoon as male (***Table 1***). Lula and Simmonds belong to this group.

Group B: Flowers open at noon as female, close at approximately 4:00 p.m. in the afternoon and reopens the next morning as male flowers (***Table 1***). Pollock belongs to this group.

Table 1: The Avocado's Flowering Patterns - for type A and B

FLOWER TYPE	DAY 1 (Female)	DAY 2 (Male)
GROUP A		
GROUP B		
TIME (a.m. or p.m.)	06:00 12:00 16:00	06:00 12:00 16:00
	(Time of Day)	

It is important to understand the flowering pattern of Group A and B types, because during the morning Group B pollinates Group A and during the afternoon Group A pollinates Group B.

To increase cross-pollination within a pure stand orchard, the recommendation is to interplant suitable complementary (A and B groups) cultivars at ratio of 10:1, that is, for every 10 desired plants you should include one of its complementary group (pollinator). Pollock and Simmonds are two complementary cultivars.

Site Selection and Preparation

Avocado requires full sunlight and proper drainage in order to grow and produce well. It grows best on a loamy type soil with a soil pH of 5.5 - 6.5. Areas prone to waterlogging should be avoided, because the plant's growth and development will be affected and plant may eventually die. It is highly recommended that a soil test is conducted before any activity is done to the area.

Windbreaks should be established around the border of the field, because the avocado plant can be easily damaged by moderate to high winds. Mango or timber trees are effective permanent windbreaks and can be planted at the same time with the avocado crop.

However, a temporay windbreak, for example double or triple rows of banana plants should be established on the windward side of field at least 2½ - 3 months before the avocado is planted.

Remove all vegetation, tree stumps and/or rocks, then plough. Apply limestone and/or fertiliser as recommended by the soil analysis before rotavating and laying out beds or rows. Cambered beds are recommended for avocado production.

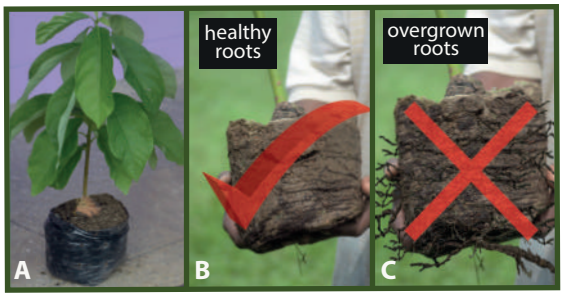

Figure 4: (A) - Healthy avocado plant with intact growing tip
(B) - Good root system for field: ready for planting and
(C) - Overgrown roots not suitable for planting

Planting

Select healthy grafted plants that are between six to nine months old with intact growing tip ***(Figure 4A)*** and no over-grown roots (***Figure 4B and 4C***). Make the planting hole at least 1½ times the depth and width of the avocado plant's root ball (***Figure 5***).

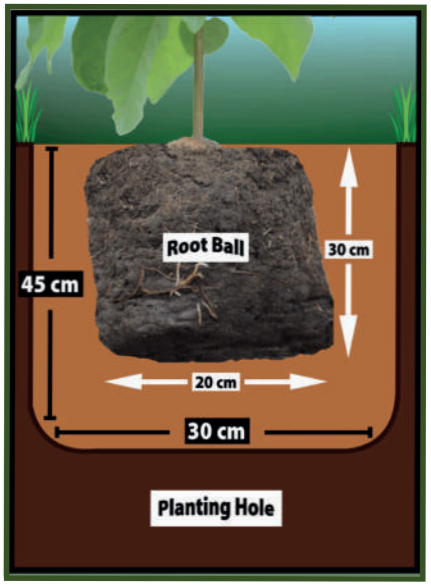

Figure 5: Preparation of the planting hole for avocado plant

Prepare a mixture of 1 part manure to 2 parts of the top soil that was removed. Use this mixture to refill the planting hole. Fill ⅓ the depth of the hole with mixture.

Remove potting bag and place plant in the hole. Ensure that the top of the root ball is at the same level with the top of the planting hole.

Hold the plant upright and fill the hole with remaining soil mix. Lightly pack soil around plant and water immediately (***Figure 6***).

Figure 6: Transplanting the avocado plant

Field Layout and Spacing

Careful consideration should be given to field layout, for example; access roads, buildings, water source, irrigation, wind direction and sun direction. Establish length of field in a North to South direction. This would allow maximum sun coverage and adequate wind movement through the entire field. There are various field layout patterns that you can use to establish an avocado orchard, as shown in (***Figure 7***).

The Rectangular layout facilitates the least number of plants per hectare and requires less management, while the Quincunx and Triangular facilitate the greatest number of plants and require high management. However, some of the factors to consider when selecting the layout include availability of planting material, capital cost and land topography.

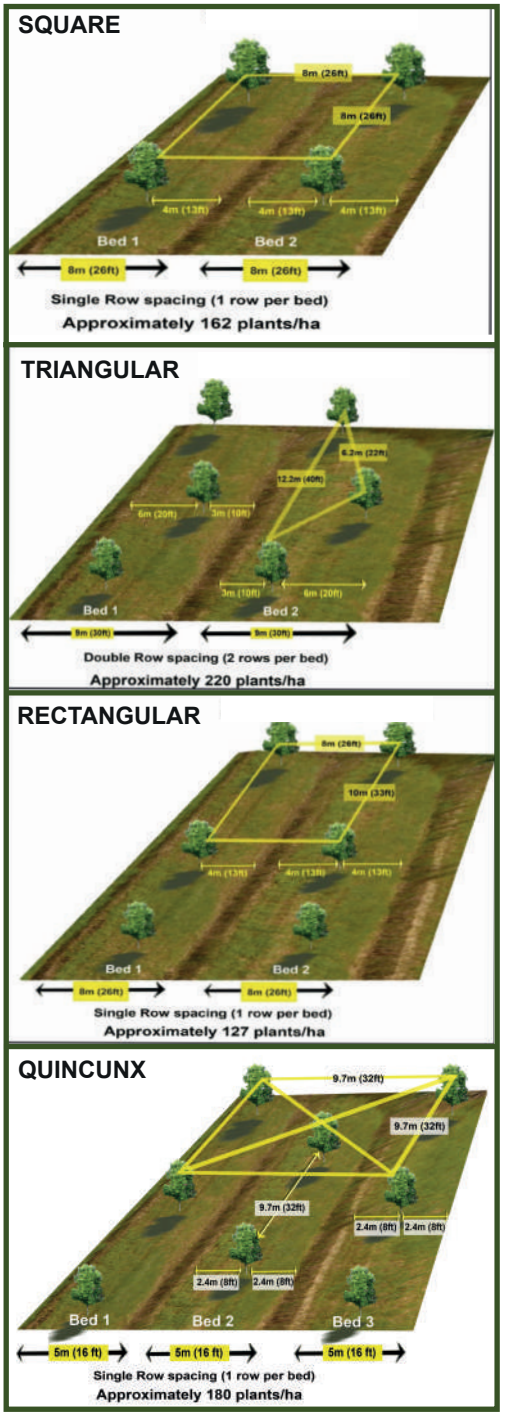

Figure 7: Field layouts for avocado

Fertilising

A soil test is strongly recommended, because it confirms extreme cases of either under-fertility or over-nourishment.

Additionally, periodic leaf analysis can help assist in diagnosing nutritional problems and determining immediate fertiliser needs of the plant. However, in the absence of a soil test and leaf analysis, ***Table 2*** presents a general fertiliser recommendation. Apply fertiliser around the drip circle of the plant.

Table 2: A General NPK Fertiliser Recommendation for Avocado

Growth Stage of Plant	Recommended NPK fertilisers & application rates
First year	50 - 70 grams (2 - 3 ounces) of 12:24:12 per tree, once every 4 months.
Second year until flowering starts	150 grams (5 ounces) of 20:10:10 per tree, once every 4 months.
Bearing trees and onward	Apply a total of 700 grams (25 ounces) tree/year of 12:12:17:2: - 350 grams (12 ounces) at flowering - 350 grams (12 ounces) after harvesting is completed.
Throughout the plant's life	Apply a foliar micro-nutrient fertiliser at 3 - 4 times per year. Follow manufacturer's application recommendations.

Weed Management

Weeds can compete with the crop for nutrients and sunlight and should be controlled. Weeds may be controlled either manually or mechanically. Ensure that the main stem of the avocado plant is not damaged when controlling weeds. Avoid chemical treatments.

Irrigation

Ensure plants are watered during dry periods. Lack of water places the plant under stress which can lead to fruit fall, leaf fall and overall poor growth and development.

Pest Management

Pest

The lace bug (*Pseudacysta perseae*) is the major pest affecting the avocado. It is a tiny black insect found on the underside of leaves (***Figure 8***). The insect feeds on the sap of leaves causing them to appear scorched. In severe cases there is heavy leaf fall. Spray with an insecticide containing *Imidacloprid* at the recommended rates to control this pest.

Figure 8: Lace bug and symptoms on avocado leaves
Source of photos: **Petal Ram** (Entomologist), **MALF**

Disease Management

Root rot disease, caused by a fungus (*Phytophthora spp.*), is the main problem affecting avocado plants (***Figure 9***). The initial symptom of this disease is downward hanging leaves. These leaves further become wilted, turn yellow and fall off prematurely.

If left untreated, branches will begin to 'dieback' leading to the eventual death of the tree. Drench soil or spray tree with a fungicide containing *Dimethomorph* to control this disease.

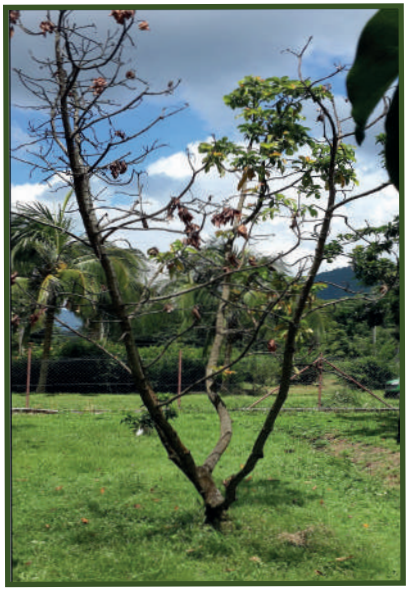

Figure 9: Effect of Phytophthora root rot on avocado tree

Harvesting

Fruits can be harvested using a commercial fruit picker. Avoid any physical damage to the fruit. Do not allow harvested fruit to fall to the ground.

Pollock, Lula and Simmonds avocado are ready to harvest when the stem to which the fruit is attached develops a yellowish tint and the fruit changes colour from dark-green to a somewhat yellowish-green. At this stage, fruits harvested would ripen within 1 - 2 weeks and have a mellow flavour and smooth, creamy texture. Immature fruits will take over 2 weeks to ripen, may taste bitter and have a poor texture.

Cost of Production

A cost of production for any crop includes the cost of all activities and inputs required to produce and maintain the crop. Some of these activities include land preparation, labour for planting, fertilising and harvesting. Inputs would include seedling plants, fertiliser and harvesting crates.

There are also some general assumptions that would be made when putting together a cost of production. These include bearing time, market prices and productive life. (***Table 3a***).

The following cost of production model presented below lists most of the activities and cost involved in cultivating 1 hectare of avocado.

It also incorporates the monetary returns when trees begin bearing from the third year (***Table 3b***).

Table 3a: Assumptions for Cost of Production

Acreage (ha)	1 ha
Time of Planting	Beginning of the rains
Planting Material	Grafted plants
Plant Spacing	7 meters by 9 meters (23 - 30 ft.)
Plant Density/ha	150
Time to Maturity (yrs.)	3 to 4
Productive Life of Tree (yrs.)	20
Topography	Flat to undulating (Ensure that there is good drainage)
Soil Type	Free draining soils
pH	5.5 - 6.5
Fruiting Time:- Pollock	July - August
- Lula	November - December
- Simmonds	July - September
Yield:	
- Year 3	100 fruits/ tree
- Year 4 & Onwards	200 fruits/ tree
Approx. Weight of Fruit (kg)	0.45
Post-Harvest Losses	15%
Market Price (medium)/fruit	~ $8.00
Labour Cost/man day	$200.00

Table 3b: Cost of Production for 1 Hectare of Avocado

VARIABLE COST									
ACTIVITY	UNIT	COST/ UNIT	No. of Unit	YR1	YR2	YR3	YR4	YR5	YR6
Land Preparation									
Brush cut	ha	$2000	1	$2000	$0	$0	$0	$0	$0
Rotavate	ha	$2000	1	$2000	$0	$0	$0	$0	$0
Prepare holes	ha	$2500	1	$2500	$0	$0	$0	$0	$0
Drain Establishment/ maintenance	ha	$1342	1	$1342	$0	$0	$0	$0	$0
Windbreak									
Pine trees	plant	$1. 50	93	$140	$0	$0	$0	$0	$0
Labour	man days	$200	2	$400	$0	$0	$0	$0	$0
Planting									
Seedling purchase	each	$25	158	$3950	$0	$0	$0	$0	$0
Labour - Planting	man days	$200	13	$2500	$0	$0	$0	$0	$0
Mulching and Moulding									
Manure	truck load	$1800	1	$1800	$0	$0	$0	$0	$0
Labour	man days	$200	15	$3000	$3000	$3000	$3000	$3000	$3000
Fertilising									
12:24:12	1 bag (40kg)	$250	5	$1250	$0	$0	$0	$0	$0
20:10:10	1 bag (10kg)	$110	7	$0	$770	$770	$0	$0	$0
12:12:17	1 bag (40kg)	$250	26	$0	$0	$3250	$6500	$6500	$6500
Labour	man days	$200	4 - 7	$800	$1200	$1400	$800	$800	$800
Irrigation System	ha	$17147	1	$17147	$0	$0	$0	$0	$0
Weed Control	litres								
Contact herbicide	gallon	$135		$405	$405	$405	$135	$135	$135
Labour (Manual)	man days	$200	24	$4800	$4800	$4800	$4800	$4800	$4800
Pest/Disease Control									
Contact Insecticide	litres	$876		$876	$1314	$1314	$1752	$1752	$1752
Soil Fungicides	kg	$250	2	$500	$500	$500	$500	$500	$500
Copper Fungicide	kg	$106	1	$106	$106	$106	$106	$106	$106
Adjuvants/stickers	litres	$327	1	$327	$327	$327	$327	$327	$327
Labour	man days	$200	12	$2400	$2400	$2400	$2400	$2400	$2400
Pruning									
Labour	man days	$200	8	$0	$0	$1600	$1600	$1600	$1600
Harvesting									
Harvesting Crates	1	$80	70	$0	$5600	$0	$0	$0	$0
Labour	man days	$200	20-40	$0	$0	$4000	$8000	$8000	$8000
Transportation									
Fertilizers & Farm Inputs	Trip	$200	5	$1000	$1000	$1000	$1000	$1000	$1000
Farm Produce	45.4kg	$10				$1331	$2662	$2662	$2662
Miscellaneous									
Spray Can	1 (5 gallon)	$825	2	$1650					
Mist Blower	1	$6000	1	$0	$0	$6000	$0	$0	$0
Brush Cutter									
Fruit Picker									
TOTAL VARIABLE COST				*$50893*	*$15822*	*$37803*	*$33582*	*$33582*	*$33582*
RETURNS	per/fruit	~ $8		$0	$0	$102000	$204000	$204000	$204000
Year 3									
Year 4 onwards									
GROSS MARGIN				*($50893)*	*($15822)*	*$64197*	*$170418*	*$170418*	*$170418*

Note:

- ***Returns would only be expected within the 3rd year of operation***
- ***It is expected that approximately 100 fruits per 150 established trees, each valued at an average $8 per fruit, which will give you "Returns" values.***
- ***There is an expected 15% post-harvest loss, which is deducted from the "Return" values.***

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