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Ministry of Agriculture, Land & Fisheries



Extension Training and Information Services Division

Technical Bulletin

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Breadfruit Production

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Extension Training and Information Services Division
Breadfruit Production

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Table of Contents

Introduction	1
Varieties	1
Propagation	3
Selection of Planting Materials	5
Site Selection and Preparation	6
Field Layout and Spacing	6
Preparing the Planting Hole.....	8
Planting	8
Fertilising	9
Weed Management	9
Irrigation	9
Pest and Disease Management.....	10
Harvesting	11
Cost of Production.....	12

Breadfruit Production

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INTRODUCTION

The breadfruit *Artocarpus altilis* (Parkinson) Fosberg is a good source of carbohydrate (84.2 g/100 g), fibre and vitamins. In Trinidad and Tobago it is mainly prepared in a famous one-pot dish known as 'Oil-Down'. Other preparation methods include roasting, boiling, frying and baking. Breadfruit has the potential to be used as a substitute for rice, wheat and white potatoes.

Did you know?

Breadfruit has a low to intermediate glycaemic index, that is, it does not release glucose into the blood stream quickly. Therefore, consuming it can assist in controlling blood glucose.

VARIETIES

There are two types of breadfruit: those that contain seeds (seeded) and those that do not (seedless). The seeded type is not very common and mainly found in the Pacific region. Locally, there are two seedless cultivars that we cultivate, namely, the 'Local Yellow' and 'Local White'. There is also a seeded type known as 'Ma' afala' that is becoming popular. **Figures 1 a - c** present general information on fruit and tree descriptions of these varieties.

'Local Yellow'

Fruit Description

Type:	Seedless
Flesh colour:	Pale yellow
Latex production:	High
Fruit weight:	1.6 - 2 kg (3.5 - 4.4 lbs.)
Skin colour:	Green when immature and yellowish-green at maturity.

Tree Description

Yield:	200 - 300 kg (440 - 660 lbs.) per tree
Harvest season:	February - September
Time to bearing:	2 - 3 years
Harvest period:	6 - 7 months
Canopy width:	6 - 9 m (20 - 30 ft.)



Figure 1a: Characteristics of 'Local Yellow' breadfruit cultivar

'Local White'

Fruit Description

Type:	Seedless
Flesh colour:	Creamy white
Latex production:	Low
Fruit weight:	1.5 - 1.6 kg (3.5 - 4.4 lbs.)
Skin colour:	Green when immature and light green at maturity.

Tree Description

Yield:	200 - 300 kg (440 - 660 lbs.) per tree
Harvest season:	February - September
Time to bearing:	2½ - 3 years
Harvest period:	6 - 7 months
Canopy width:	6 - 9 m (20 - 30 ft.)
Mature height:	12 - 18 m (40 - 60 ft.)



Figure 1b: Characteristics of 'Local White' breadfruit cultivar

'Ma' afala'

Fruit Description

Type:	Seeded
Flesh colour:	Pale yellow
Latex production:	Meduim
Fruit weight:	0.9 - 1 kg (2.0 - 2.2 lbs.)
Skin colour:	Green when immature and light yellowish-green at maturity.

Tree Description

Yield:	80 - 100 kg (176 - 221 lbs.) per tree
Harvest season:	August - December
Time to bearing:	2 - 2½ years
Harvest period:	4 - 5 months
Canopy width:	5 - 6 m (16 - 20 ft.)
Mature height:	10 - 14 m (33 - 46 ft.)



Figure 1c: Characteristics of 'Ma' afala' breadfruit cultivar

PROPAGATION

Propagation of breadfruit is primarily done using vegetative methods, while seeds can be used to propagate the seeded types. The following three main methods can be used to propagate breadfruit plants:

- ◆ Root Suckers
- ◆ Root Cuttings
- ◆ Stem Cuttings from Nursery Plants

Root Suckers



Figure 2: Root suckers on parent root

This method has been traditionally used and provides small amounts of planting materials. Short sections of subsurface parent tree roots that grow 3 - 6 cm (1.2 - 2.4 in.) above the ground and remain exposed can either produce adventitious root suckers naturally or in response to injury, for example, cutting it accidentally (figure 2). Remove sucker when it is between 30 - 46 cm (12 - 18 in.) in height along with 15 - 20 cm (6 - 8 in.) of parent root and plant into a potting bag containing a mixture of soil, manure and sharp-sand in a ratio 3:2:1. Keep in a shaded environment for 4 - 6 weeks. Water as necessary and **DO NOT ALLOW** soil mixture to dry out.

Root Cuttings



Figure 3: Newly adventitious shoot that develops on parent root cutting

Harvest a length of subsurface root, that is, 4 - 5 cm (1.5 - 2 in.) in diameter and between 0.9 - 1.5 m (3 - 5 ft.) in length (figure 2). Cut this root into 0.3 m (1 ft.) sections. Make six evenly spaced notches on one side of each root section. Place root section in sharp-sand at 1 cm (0.4 in.) in depth. Water as needed but **DO NOT ALLOW** the sharp-sand to dry out. Generally, a new shoot (adventitious) would develop at each notch with an independent root system within 3 - 4 weeks (figure 3). Remove each newly developed shoot and its independent root system along with a piece of the parent root. Place each plantlet into a potting bag containing a mixture of soil, manure and sharp-sand in a ratio 3:2:1.

Stem Cuttings from Nursery Plants



Figure 4: Developing young adventitious shoot/plantlet

This is one of the main methods that is used commercially to produce plants. Allow several of the young adventitious shoots/plantlets (figures 3 and 4) that were produced from the root cutting method to grow and develop.



Figure 5: Stem cutting harvested from donor nursery plants

Once shoots develop to pencil thickness in diameter and 15 - 20 cm (6 - 8 in.) in length from the shoot tip, harvest them and use as stem cuttings. Remove stem cuttings at a 45° angle above a node that is within the green to brown region. Leave approximately five leaves on the stem cutting, from the shoot tip (figure 5). Cut leaves in half to reduce water loss from cutting.



Figure 6: Adventitious shoot plants used as donor plants for stem cutting materials

The node that is left behind on the adventitious shoot will grow and develop into another shoot that will be harvested and used as a stem cutting within 4 - 6 weeks (figure 5). Once stem cuttings are removed above a node, the plant will continue to produce new shoots and develop into donor nursery plants from which stem cuttings would be continually harvested (figure 6).



Figure 7: Stem cuttings in rooting medium

Dip 2.5 cm (1 in.) of the cut end of the harvested stem cutting (figure 5) into a semi-hardwood rooting hormone. Place cutting at a 45° angle and 6 - 8 cm (2½ - 3 in.) in depth into a rooting medium, for example, sharp-sand or coco peat fibre (figure 7). Ensure that the moisture level surrounding the cutting is high (85% - 90% humidity) and do not allow the medium to dry out.



Figure 8: Rooted stem cuttings

The cuttings would develop roots within 3 - 4 weeks (figure 8). At this stage, transplant to a potting bag containing a soil, manure and sharp-sand mixture in a ratio 3:2:1. Place in a cool and shaded environment for 4 - 6 weeks before the hardening process begins.

SELECTION OF PLANTING MATERIAL

Obtain plants from a reputable supplier to ensure that you get the desired cultivar.

The selected plant should:

- Be between 4 - 6 months old, from propagation date. This would ensure that there are no overgrown and protruding roots, which may lead to poor root growth and anchorage support of the mature plant.
- Have an intact growing tip showing signs of new growth. Plants with a decaying tip may be an early indication of a disease and should not be selected.
- Be pest and disease free.

NB: The plant should have an overall healthy appearance as seen in **figure 9**.



Figure 9: Young healthy breadfruit plant

SITE SELECTION AND PREPARATION

Breadfruit plants start to bear fruit 2 - 3 years after planting and can continue production for more than twenty years. Therefore, careful consideration of site selection, placement and access are important. It is recommended that the site be flat to gently sloping land in order to facilitate easy management and harvesting.

A soil test is strongly recommended, since it confirms extreme cases of under-fertility or over-nourishment. The growth of breadfruit is more vigorous in deep, fertile and high humus soil. However, it can be grown on light to medium soils with good drainage and a pH range of 6 - 6.5. Ensure that the soil does not hold water for extended periods, since poor growth, development and fruit drop may occur with soils that have a high water holding capacity. Make drains, if needed, to remove excess water.

Ensure that planting is done at the beginning of the rainy season to prevent heat and water stress.

FIELD LAYOUT AND SPACING

Careful consideration must be given to access roads, buildings, water source, irrigation, availability of planting materials, capital cost, land topography, wind direction and sun direction when planning field layout and spacing. Establish length of field in a north to south direction. This would allow maximum sun coverage and adequate wind movement through entire field. There are various field layout patterns that you can use to establish a breadfruit orchard, as shown in **figures 10 a - d**.

SQUARE

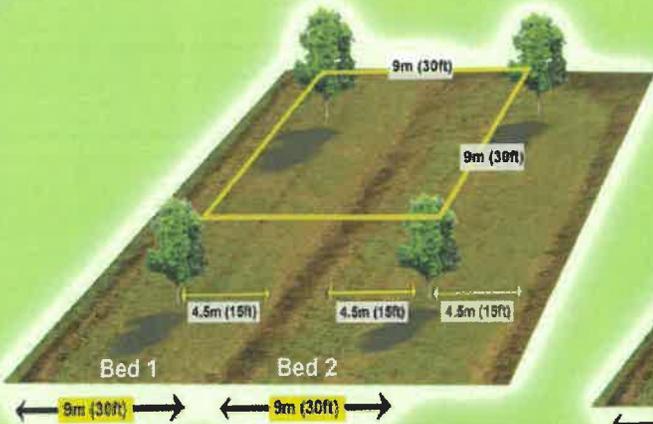


Figure 10a: Square field layout pattern

NB: 1 hectare can potentially accommodate 11 cambered beds, with 14 plants per bed.
Plant density: 121 plants /ha

RECTANGULAR

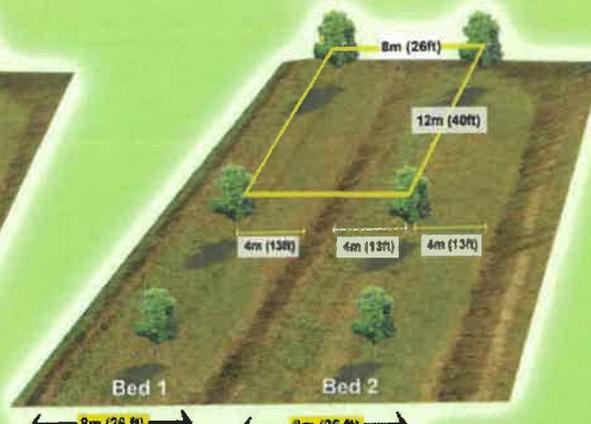


Figure 10b: Rectangular field layout pattern

NB: 1 hectare can potentially accommodate 13 cambered beds, with 8 plants per bed.
Plant density: 107 plants /ha

TRIANGULAR

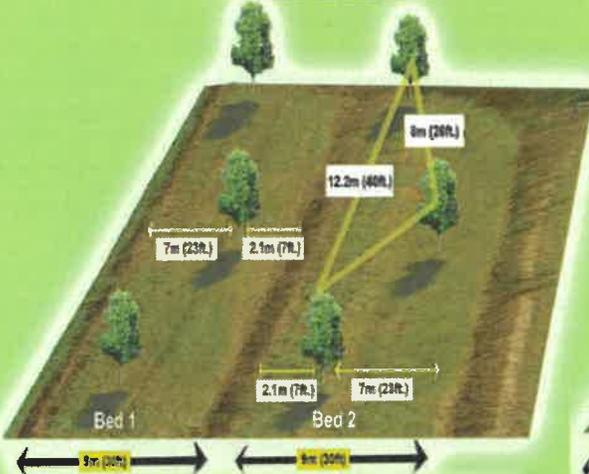


Figure 10c: Triangular field layout pattern

NB: 1 hectare can potentially accommodate 11 cambered beds, with 15 plants per bed (double row planting).
Plant density: 165 plants /ha

QUINCUNX

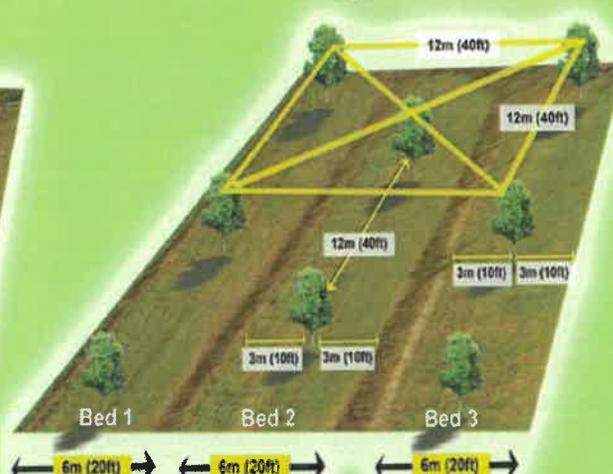


Figure 10d: Quincunx field layout pattern

NB: 1 hectare can potentially accommodate 17 cambered beds, with 8 plants per bed.
Plant density: 140 plants /ha

The rectangular layout facilitates the least number of plants per hectare and requires the least amount of management, while the Triangular and Quincunx facilitate the greatest number of plants and require very high management.

PREPARING THE PLANTING HOLE

Prepare the planting hole for breadfruit by making a hole at least 1½ times the depth and width of the plant's root ball. Prepare a mixture, using the soil that was removed and manure in a ratio 2:1 (**figure 11a inset**). Use this mixture to refill the planting hole. In the absence of a soil test, mix 100 g - 200 g (4 - 8 oz.) of limestone and 30 - 40 g (1 - 1 oz.) of 12:24:12 (a fertiliser) in the soil and manure mixture.

PLANTING

Remove potting bag (**figure 11a**). Place soil mixture to fill at least one-third the depth of the hole and place the plant's root ball in the hole (**figure 11b**). Hold plant upright and fill the hole with soil mixture (**figure 11c**). Lightly pack soil around the plant and water immediately (**figure 11d**). Plant breadfruit at least 5 - 6 m (16 - 20 ft.) away from any structure, for example, house, fence, other fruit trees, overhead power lines and under-ground pipelines.

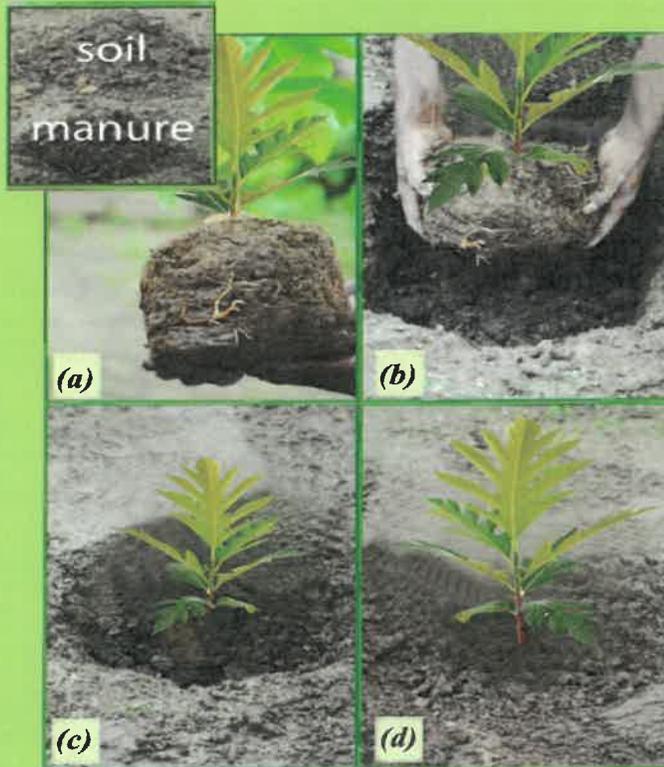


Figure 11a - d: Planting breadfruit

FERTILISING

The breadfruit plant requires nutrients for healthy growth and production. These are usually provided by the growing medium. Apply complete fertiliser around the drip circle to provide additional nutrients if needed.

(Table 1)

Table 1: Suggested Application of Major Nutrients at Different Growth Stages for Breadfruit.

Growth Stage of Plant	Recommended NPK Fertilisers and Application Rates
First year	Apply 100 - 150 g (4 - 5 oz.) of 12:24:12 per tree, once every 4 months.
Second year until flowering starts	Apply 300 g (11 oz.) of 20:10:10 per tree, once every 4 months.
Bearing trees and onward	Apply a total of 1000 g (35 oz.)/tree/yr. of 12:12:17:2 [750 g (27 oz.) at flowering and 250 g (9 oz.) after harvesting is completed].
Throughout the plant's life	Apply a micro-nutrient foliar fertiliser at least three times per year. The first application should be made four months after planting. Follow manufacturer's recommendations.

WEED MANAGEMENT

Weeds compete with the breadfruit plant for sunlight, nutrients and water. Remove weeds manually or mechanically without damaging the main stem of the plant.

IRRIGATION

Water breadfruit plants during dry periods, since they cannot withstand prolonged dry conditions. Lack of water may cause the plant to become stressed, resulting in fruit fall, leaf fall and a general unhealthy appearance.

MANAGEMENT OF PESTS AND DISEASES

Pests: Currently, there are no major pests that affect the breadfruit plant or fruit. There are minor pests, which include, mealy bugs, beetles, bachacs, nematodes, soft scales, ants and termites. Apply a Class IV insecticide using manufacturer's guidelines to control pests.

Diseases: The major disease affecting breadfruit in Trinidad and Tobago is one referred to as Tree Decline or "dieback". The disease is caused by a combination of both environmental and biological factors, for example, drought, waterlogging conditions and pathogens such as *Rosellinia* sp., *Phytophthora* sp., and nematodes. Symptoms of dieback in breadfruit include heavy leaf fall, fruit fall, dieback of branches, which begin from the tip of the plant and moves downwards. Other symptoms include a sparse, scanty and overall unhealthy appearance, and premature death, which can occur within one year of initial symptom (**Figure 12 a - b**).



Figure 12a: Early dieback symptoms in breadfruit



Figure 12b: Late dieback symptoms in breadfruit

Once symptoms are detected early, a cutback/pruning of the tree should be done to promote new growth and delay symptoms. Limestone can also be applied at a rate of 1 kg (2.2. lbs.) per plant. Spread limestone evenly on top of the soil within the root zone to delay symptoms.

There is also a fruit rot caused by *Phytophthora* sp., *Colletotrichum* sp. (anthracnose), and *Rhizopus* sp. It is identified by small, round, dark-brown spots that develop on the skin and gradually expand to form larger lesions that are hard to the touch.

Remove affected fruits from the tree. Do not allow fruits to ripen on the tree or rot on the ground. Apply a copper based fungicide when fruits are immature to prevent fruit rot.

HARVESTING

Select fruits that are generally between 12 - 18 weeks from flowering. Fruits harvested between 12 - 16 weeks are considered green/immature and have a longer shelf life (1 - 2 weeks), but are not preferred because of rubbery texture and low flavour. A mature fruit is usually 16 - 18 weeks old and has latex emerging from it. The cooked fruit has a smooth texture and full breadfruit flavour. Avoid physical damage to fruit.

Fruits should be harvested using a picking tool that would cut or break the fruit stem and then catch the fruits as seen in **figure 13**.

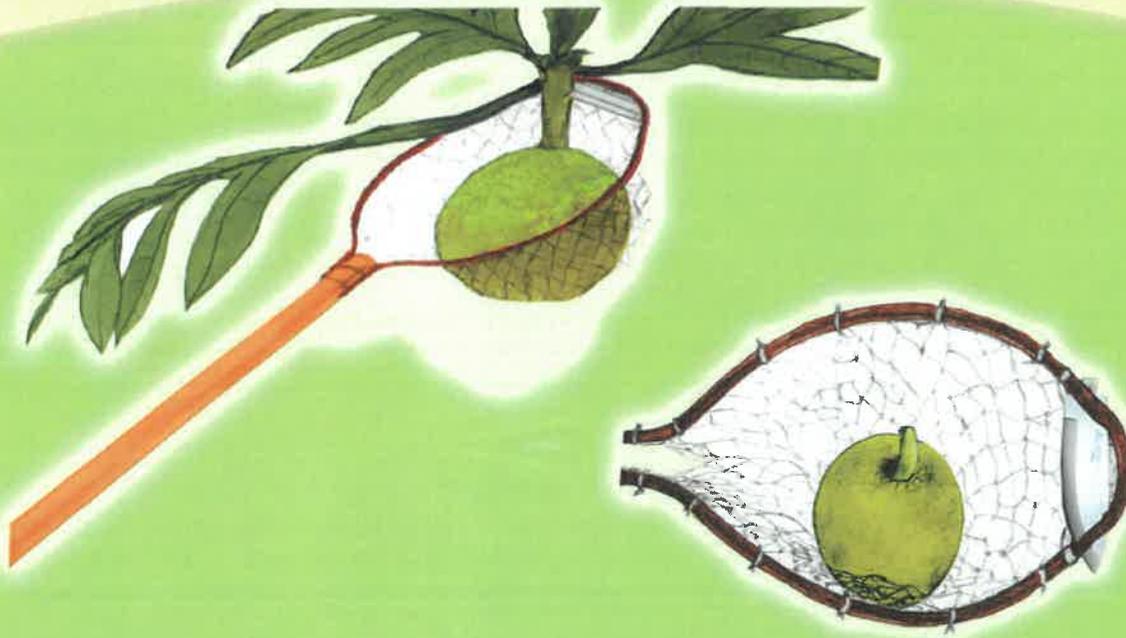


Figure 13: Recommended fruit picker

Table 2b: Cost for an Irrigation System for 1 hectare of Breadfruit

ITEM	UNIT	COST/ UNIT	NO. OF UNITS	COST
Poly-tubing drip line	1000 ft roll	\$1748	4	\$6992
Poly-tubing drip line connectors and accessories				\$500
Electrical Pump	³ / ₄ hp	\$3000	1	\$3000
Sand Filter (2")	1	\$3795	1	\$3795
Screen Filter (2")	1	\$1300	1	\$1300
Irrigation Timer (6 station)	1	\$750	1	\$750
Solenoid Valve	1	\$170	3	\$510
24 Volts Wire	roll	\$300	1	\$300
TOTAL				\$17,147
Assumptions: Electricity is available on the farm holding				

Table 2c: A 10 year Cost of Production Model for 1ha Breadfruit

VARIABLE COST	UNIT	COST/UNIT	NO. of UNITS	YR 1	YR 2	YR 3	YR 4	YR 5	YR 6 - 10
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	ha	\$1342	1	\$1342	\$0	\$0	\$0	\$0	\$0
Planting									
Seedling Purchase	each	\$25	150	\$3750	\$0	\$0	\$0	\$0	\$0
Labour	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+2	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	1 ha	\$17,147	1	\$17,147	\$0	\$0	\$0	\$0	\$0
Weed Control									
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	\$1200	\$1600	\$1600	\$1600	\$1600
Harvesting									
Harvesting Crates	1	\$80	80	\$0	\$0	\$6400	\$0	\$0	\$0
Labour	man days	\$200	20 - 40	\$0	\$0	\$4000	\$8000	\$8000	\$8000
Transportation									
Fertilisers & Farm Inputs	Trip	\$200	5	\$1000	\$1000	\$1000	\$1000	\$1000	\$1000
Miscellaneous									
Spray Can	1 (5 gallon)	\$825	2	\$1650					
Mist Blower	1	\$6000	1	\$0	\$0	\$6000	\$0	\$0	\$0
Brush Cutter	1	\$5000	1	\$5000	\$0	\$0	\$0	\$0	\$0
Fruit Picker	1	\$500	4	\$0	\$0	\$2000	\$0	\$0	\$0
TOTAL VARIABLE COST				\$55,153	\$17,022	\$39,272	\$30,920	\$30,920	\$30,920
RETURNS	per/kg	\$9		\$0	\$0	\$196,020	\$294,030	\$294,030	\$294,030
GROSS MARGIN				[\$55,153]	[\$17,022]	\$156,748	\$263,110	\$263,110	\$263,110

Note: - Returns would be expected after the 3rd year of operation. There is an expected 10% post-harvest loss, which is deducted from the 'Return' values.

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