

Fruits and Vegetables

1. Broccoli
2. Cabbage
3. Cantaloupe
4. Carrot
5. Cauliflower
6. Celery
7. Corn
8. Cucumber
9. Hot Pepper
10. Lettuce
11. Parsley
12. Passion fruit
13. Pineapple
14. Pumpkin
15. Salad Beans
16. Sweet Peppers
17. Tomato
18. Watermelon

TECHNOLOGY PACKS



PINEAPPLE

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exist on the various aspects of production and handling/ marketing of crops and livestock, the majority of which are outdated, not easily understood and lacking the where with all for addressing present day challenges such as good agricultural practices (GAPs) and food safety and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



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Introduction

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

Also included in the Tech Pack are appendices:

- Template for cost of production
- 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.

Botanical Description

The commercial pineapple (Plate 1) is the fleshy fruit produced by some varieties of the plant *Ananas comosus* (L.) Merr., a tropical member of the plant family, *Bromeliaceae*. Pineapples are an important non-traditional crop in the Caribbean where the increased commercialization of local production is often featured in diversification programmes. In the Caribbean pineapples are widely grown in an extremely diverse range of production systems, including collection of wild types for small scale production, integrated systems based on local and highly adapted varieties and intensive production systems utilizing improved selections.



Plate 1 Pineapple fruit. Source: http://www.levins.com/p1_01.jpg

Varieties

Some popular varieties grown in the Caribbean are Smooth Cayenne, Montserrat, Sugar Loaf and Antigua Black. Select the variety according to market requirements and farmer preference.

Site Selection

The best soil for pineapple cultivation is a well drained, sandy loam with high organic matter content. Soils should be friable to a depth of at least 2 feet (60 cm) and have a pH range of 4.5 - 6.5. Soils high in calcium and manganese tend to cause chlorosis in leaves. Pineapple cannot tolerate water-logging, therefore, where the subsoil is impervious, drainage must be improved. Pineapples can be grown within a wide annual rainfall range from 25 - 100 inches (600 - 2500 mm), but the optimum annual precipitation for commercial production is 40 - 60 inches (1000 - 1500 mm).

Irrigation can be used in locations with less than the minimum rainfall requirements. Irrigation water, especially from streams and ponds, should be sent for analysis to ensure that the water is not polluted or saline, and must be of good quality for irrigation.

Land Preparation

Remove weeds and crop residues or any other unwanted material like discarded plastic mulch before commencing either manual or mechanical

land preparation, depending on prevailing farm conditions and/or the availability of equipment. Manual land preparation is required on slopes or small plots, where it is not cost effective to mechanize. Mechanical preparation is done on large, gently sloping or flat areas. In manual land preparation, hand tools such as forks, cutlasses and rakes are used, whereas rotovators and other machinery are used in mechanical land preparation. Where possible, it is more cost effective to mechanize land preparation.

During land preparation, incorporate pre-plant fertilizers, organic manures and previous crop residues.

Mark out the planting beds and walkways. The average width of the bed is usually 3 feet (75 cm). Separate beds by drains of 18 inches (45cm) wide. Align beds and drains along the contours of the land to reduce soil erosion.

Farmers can use minimum tillage methods and prepare the soil only in the area where the plant will be placed. This is not recommended if the soils are not free draining as water logging may become a problem, predisposing plants to soil borne diseases.

Where plastic mulch is used for weed control, install this over beds, drains and walkways as the final step during land preparation (Plate 2). Keep plastic mulch in place with stones, wood stumps or coconut trunks. Plastic mulch can also be pinned down with a forked stake or 8 inch (20 cm) piece of wire bent into a U-shaped staple.



Plate 2 Installation of plastic mulch

Planting Material Types, Selection and Preparation

Types of planting material

Pineapples are propagated by vegetative material. These may be of several types which are classified by origin. The following types of propagating materials are commonly used to establish a crop of pineapples in the Caribbean.

Ratoon suckers: These arise from buds on the stem below ground level (Plate 3). These suckers are the most difficult to plant because of their large size. They take an average of 15 – 18 months from planting to fruit harvest. Their fruits tend to mature unevenly but they give the highest yields.

Side shoots: These are suckers arising from buds in the leaf axils and are therefore produced above the ground (Plate 3). Up to three side shoots may be produced on each plant but they are not produced in some varieties. They are suitable for planting when 12 – 14 inches (30 – 35 cm) long. When left on the plant, side shoots produce a ratoon crop.

Slips: These are borne on the peduncle just below or on the base of the fruit (Plate 3). The size and number (0 – 10) produced vary according to the health of the plant. The best slip material is from plants with no more than three slips. Fruits from slips, take an average of 20 months from planting to harvest and they tend to ripen unevenly.

Crowns: These are located at the top of the fruits (Plate 3). Normally, only one crown is produced. At maturity, the crowns become dormant. Crowns tend to produce a more uniform crop. It takes an average of 22 – 24 months from planting to harvest. Crowns are not commonly used by farmers as planting material because the pineapples are sold with the crowns attached and commercial supplies are usually not available.

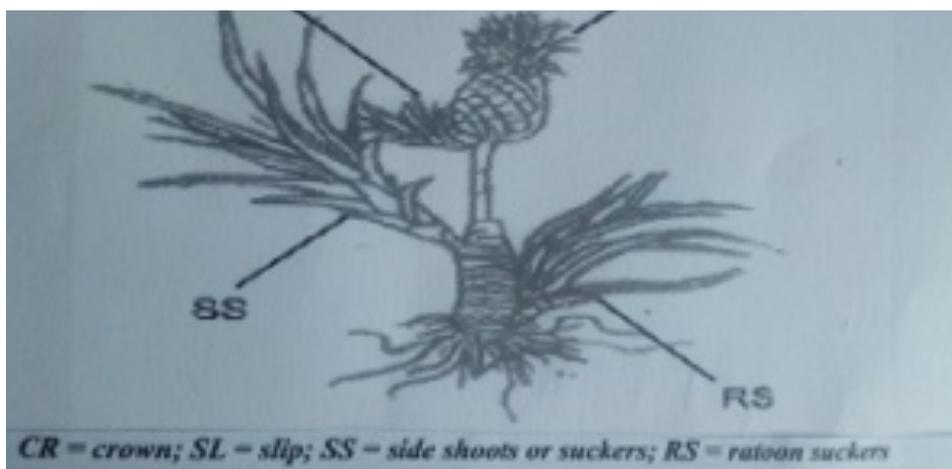


Figure 1: Types of planting material. Source: <http://agriculture.gov.gy/wp-content/uploads/2014/10/Pineapple.pdf>

Source: <http://agriculture.gov.gy/wp-content/uploads/2014/10/Pineapple.pdf>

Plantlets generated from butts: Planting material may be obtained from the stem material of the harvested plant or 'mother plant' by promoting the formation of plantlets from vegetative buds within the leaf axils of the stem. This is done by placing the cleaned stem material called the butt or stump on a specially prepared raised propagating bed. The propagating bed should contain friable soil which has been cleared of weeds and other vegetation and worked into a fine tilth. The butts are then placed horizontally on the surface of the propagating bed and covered with soil or preferably, river sand. After about 3 – 4 weeks, shoots emerge from vegetative buds within the butts and eventually develop into young plantlets which can be used as planting material as soon as they are 1½ inches (3 cm) long.

Tissue culture plantlets: Plantlets generated by tissue culture can also be used in commercial production.

Selection and preparation of planting material:

Select planting material from healthy, disease free plants. Remove dry leaflets from the base of the suckers or slips and trim ends with a sharp knife. Submerge in a solution of an approved insecticide and miticide to control insect and mite pest infestations. Suckers produced from the ground level should also be treated with an approved nematicide. The planting material can be stored under shade in an upright position for about 7 days. Avoid contact with the soil. Prior to planting, grade planting material according to size, type and cultivar.

Crop Establishment

Pineapples can be planted at any time provided sufficient soil moisture is available. For commercial production irrigation must be available to facilitate year round planting. For non-commercial, non-irrigated systems, establish plots preferably at the beginning of the rainy season.

Plant density varies according to the variety grown, farmer preference, market requirements in terms of fruit size and weight, soil fertility and the level of crop husbandry to be implemented, e.g. fertilizer and pesticide applications.

Plant in rows using a triangular formation, at a spacing of 18 – 24 inches (45 – 60 cm) between and within rows. It is best to use double row planting with the two rows spaced 28 – 32 inches (70 – 80 cm) apart. The distance between the double rows or every two rows should be 60 inches (150 cm). Some farmers use single row planting. The rows are spaced 60 inches (150 cm) apart and plants spaced at 24 inches (60 cm) within the row.

Establish plants by size, type and cultivar. Place plants upright and set firmly into prepared soil at a depth of 3 - 4 inches (9 - 10 cm). Ensure that the whorl of the plant is above the soil level; if soil gets into the whorl of the plant and remains moist, rotting of the plant may occur.

Fertilization

Because of the varying soil types, both the quantity and nutrient composition of fertilizer to be used in pineapple production will be specific to the particular sites. Specific kinds and rates of fertilizers should be determined from the results of soil and leaf analyses. Properly composted manure if available should be applied to the soil to help with the uptake of nutrients from inorganic fertilizers; it adds organic matter to the soil, enhances soil structure and growth of micro-organisms. All manure should be well composted to ensure that harmful microorganisms and weed seeds are destroyed.

In the absence of a soil test Table 1 gives general recommendations for application at land preparation.

Table 1 General fertilizer recommendations for pineapple

Nutrient	lb/ac	kg/ha
Nitrogen (N)	530	600
Potassium (K)	350	400
Phosphorous)	130	150

One month before flower induction a second application can be made, in the lower leaf axils of about 0.5 oz (20 g) per plant of a low nitrogen, high potassium fertilizer.

Weed Control

Plastic mulch

Weed control is best achieved using plastic mulch as it is the most economical and convenient. For best results cover beds, drains and walkways.

Manual weed control

Weeds can be controlled manually by cutlassing and hoeing but these activities expose the soil which may result in erosion during heavy rainfall. This method is difficult, expensive and requires protective clothing, gloves and eye protectors.

Mechanical weed control

Brush cutters and weed eaters may be used to control weeds in the drains that are not covered in mulch and in the areas surrounding the crop.

Chemical weed control

Herbicides are usually applied before and during land preparation to remove vegetation that has grown between cropping cycles. Where the area is known to have a problem with weeds, a pre-emergent herbicide can be applied before the mulch is laid down to hinder the germination of weed seeds. The pineapple plant is most vulnerable to herbicide damage when it is 3 - 5 months old as this is the most active period of growth. Therefore great care must be taken during application. Use herbicides listed for use in pineapples and always follow directions on

the label. To avoid damage due to phytotoxicity, during the growing period the application of herbicides should be restricted to the space between the rows. The use of shields is recommended.

Flower Induction

Artificial flower induction can promote uniform flowering and maturity in the fruits and increase fruit size and quality. Thus it is used to attain uniform maturity, control of the time of harvest and to avoid overproduction in the peak periods.

Induce plants when they are on average 8 - 10 months old and at the 30-leaf stage or older. From induction to full maturity takes about 5 months. Hormone treatments for flower induction will only succeed when the nitrogen content of the plant is low. Applications should take place during the cooler periods of the day, e.g. early morning or late afternoon, with preference for the latter. The application is repeated 1 week later to ensure maximum inducement. The main materials used to induce flowering are Naphthalene Acetic Acid (NAA), calcium carbide and etherel.

Pests and Diseases

The major pests and diseases, symptoms and control/management affecting hot pepper are indicated in Table 2.

Table 2 Symptoms and control of pests and diseases of pineapple

Pest & Diseases	Symptoms	Control/ Management
 <p>Plate 4 Ant Mealy Bug complex/ Wilt Disease</p>	<p>Suck plant sap at base of the leaves and around the bottom end of the fruit. Wilting of leaves, eventually leaves turn orange-brown and wither.</p>	<p>Drench ant nests with insecticides e.g. Basudin[®] or apply baits. Apply systemic insecticides to mealy bugs, e.g. Protector[®]. Remove infested material from field.</p>
 <p>Plate 5 Nematodes</p>	<p>Infest plant roots, causing reduced root growth, root death and stunted plants. Yellow and red leaves. Drooping plants with withered tips.</p>	<p>Crop rotation, planting material with nematicides, e.g. Nematicur[®]. Preplant incorporation of organic matter such as cassava residues and neem leaves.</p>
 <p>Plate 6 Rodents</p>	<p>Eat fruits in field and in storage.</p>	<p>Good field sanitation. Baiting stations with rodenticide.</p>

Pest & Diseases	Symptoms	Control/ Management
 <p data-bbox="198 483 247 505">Birds</p>	Eat ripe fruit.	Scarecrows, intermittent noise simulations, cover fruit with bird netting.

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

Best practices in harvesting and in-field handling should include:

- Workers well equipped with protective gear e.g. long sleeves and gloves particularly when picking fruits from spiny varieties
- Fruits are placed in field crates
- All crates and harvesting tools are cleaned and sanitized before use
- Fruits should be harvested in the early morning when temperatures are lower; high temperatures can reduce the shelf life.
- Harvest fruit with a sharp knife leaving more than 1 inch (2.5 cm) of stalk attached to the fruit.

Post Harvest



Store fruits in a shady area in field then transport to the pack-house. During transport, allow for good air circulation and protection from sunlight. It is best to transport during cool periods of the day.

Depending on the market requirements, discard all fruits which are undersized, oversized, over-ripe, under-ripe, damaged, bruised or show fungal or insect damage. Sort fruit according to size, shape, firmness, and colour. For long storage, fruit can be kept at 45 - 55°F (8 - 13°C) and 85 - 90% relative humidity.

APPENDICES



APPENDIX I: TEMPLATE FOR COST OF PRODUCTION ANALYSIS: PINEAPPLE

	Input	Quantity	Units	Unit Cost	Total Cost
1.	Land preparation and planting				
	Planting material				
	Insecticide/miticide				
	Sand				
	Plastic mulch				
	Other land preparation costs (e.g. equipment rental)				
	Total cost for land preparation and planting				
2.	Crop maintenance				
	Water/irrigation				
	Fertilizer (specify types used)				
	Weed control (specify chemicals etc used)				
	Pest and disease control (specify chemicals etc. used)				
	Flower induction (specify material(s) used)				
	Total cost for crop maintenance				
3.	Harvest/storage				
	Crates				
	Estimate any utility costs				
	Transport to market				
	Total cost for harvest/storage				
4.	Labour				
	Land preparation and planting				
	Crop maintenance				
	Harvest/storage				
	Total cost for labour				
5.	Rent/insurance				
6.	Miscellaneous costs				
	Total cost of production				

Notes

1. It is recommended that the above data be completed on a per crop basis.
2. The cost of any fixed structures should be considered. For example if a refrigerator is solely used to store pineapple in the year and is expected to last for 10 years, then one tenth of the cost of purchase should be added at item 6. If, however other crops are also stored then these also need to be considered. If pineapple accounts for half the produce stored in a year, then the annual cost calculated as above needs to be divided by 2. Similar considerations should be given to an irrigation system.
3. The revenue obtained from sale of the crop should be compared with the cost of production to determine the profit/loss on the operation.

APPENDIX II: 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 (Perfethion, 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 (<i>Bacillus thuringiensis</i>)	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-Milttox-Forte	3 teaspoons/gallon of water
Botrilex	5 - 200 lb/acre
Kocide 101	2 - 4 teaspoons/gallon of water
Cupravit	2½ lb/acre

APPENDIX II: LIST OF RECOMMENDED PESTICIDES AND APPLICATION RATES

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

