

PAPAYA PRODUCTION (Figure 1)

Arceli G. Yebes

DESCRIPTION

Papaya (*Carica papaya* Linn.), originated from tropical America and is considered as one of the most important fruit crops in the Philippines because of its great economic potential. It may be grouped into 3 sex types according to the flowers they produce. The 3 types are female, male and hermaphrodite. The white male and female flowers are normally found in separate plants (Dioeciously). Male papaya trees produces long, pendulous and many flowered inflorescence throughout the year but occasionally bear flowers which are capable of producing fruits if fertilized. Normally female flowers produce rounded fruits that bear 5 distinct scars which are arranged in circular fashion at the base of the fruit. The hermaphrodite flowers, sometimes referred to as bisexual flowers, contain both the essential organs of the female and male flowers. Most of the hermaphrodite flowers are unstable under field conditions, being easily affected by the changes of the environmental conditions. Hermaphrodite flowers are highly seasonal but some produce fruits throughout the year. There are several variants of hermaphrodite flowers. Some of these produce only two stamens while others produce as many as 10 stamens. Fruit produced by hermaphrodite flowers are elongated.

Papaya is a good source of Vitamins A and C, iron, calcium, protein, carbohydrate and phosphorous. It can be grown for different purposes that include food preparation, for industrial and for medicinal uses. Unripe papaya contains enzyme papain which is obtained from the latex and is used as a meat tenderizer, in beer processing, softening of woolens, manufacture of toothpaste and nowadays it is usually the main ingredient in many whitening products like soap and lotion. The leaves when properly flavored can be made into cigarette. The ripe fruit is eaten as a breakfast fruit or as an ingredient in fruit salads.

In calendar year 2011, the Philippines had a total area of 8,647.41 hectares planted to papaya with total volume of production of 157,906.79 MT (BAS, 2011). The top producing region is the SOCCSKSARGEN with 65,842.99 MT wherein South Cotabato has the highest volume of production of 55,568.16

VARIETIES

Solo is an improved, high quality selection with reddish-orange flesh. Its fruit weighs about half a kilogram. (Figure 2)

The most popular strains of Solo papaya commercially propagated in the Philippines are the Kapoho and Sunrise which are high-yielding and pear shaped. They are smoother and sweeter but smaller and lighter compared to other solo strains.

Cavite Special is a popular semi-dwarf type that blooms 6-8 months after planting. The fruit is large, oblong and weighs from 3 to 5 kilograms. It has a star-shaped cavity. The flesh is yellow orange and sweet when ripe. (Figure 3)

Sinta is early maturing and prolific, which bears 17-50 fruits per tree. Its fruit weighs 1.2 – 2.0 kg, is sweet and has firmer flesh. (Figure 4)

Red Lady Papaya (F1 Hybrid) – Early, vigorous productive and tolerant to papaya ring spot virus. Plants begin to bear fruits at 80cm. height and normally have over 30 fruits per plant in each fruit setting season. Fruits are short-oblong on female plants and rather long shaped on bisexual plants, weighing about 1.5 – 2 kg. (Figure 5)

Cultural Management

Soil and Climatic Requirements

Papaya thrives best in light, well-drained soils rich in organic matter. Clay soils which lack good aeration are not good for papaya. The soil must have a good supply of available nutrients. Papaya can tolerate soils with pH ranging from 5.8 to 7.0. For best results, the soil should have a soil pH about 6.0 to 6.5.

Papaya prefers a warm climate with abundant rainfall or irrigation. An average daily temperature can be tolerated provided the soil has adequate moisture and relative humidity. Cool weather reduces growth and yield and has an unfavorable effect on fruit flavor.

A minimum annual rainfall of 1200 mm is sufficient provided soil conditions are favorable and water conservation practices are employed. Rainfall should be well distributed throughout the entire growing season.

Propagation and Preparation of planting materials

Propagation by seeds is the most practical method.

Seeds can be sown in flats of soil, seedbeds or in small containers and allowed to germinate in a partially shade place. Soil should be sterilized to avoid damping –off. Germination takes place in 3 to 4 weeks. When 2 to 3 true leaves have appeared, transfer seedlings into small containers. Polyethylene bags, tin cans or any other suitable containers can be used. The seed may also be sown directly in small containers, 3 to 4 seeds per container. As soon as the seedlings are 15 to 20 cm tall or develop 3 to 4 leaves, transplant them into the field.

Land Preparation

Land preparation for papaya is similar to other upland crops. First clear the fields, then plow and harrow alternately about two to three times to kill weeds and provide

good internal drainage. If papayas are to be planted in places where there are distinct wet and dry seasons, land preparation should be properly timed in such a manner that the land is ready for planting when the rainy season begins.

Lay-out and distance of Planting

Lay-out the land so planting and subsequent operations like weeding, fertilizer application, pest and disease control and harvesting are facilitated. On flat to gently rolling land, the square, triangular or rectangular system of planting are recommended. On rolling land, planting on contour is highly recommended to minimize soil erosion.

Distance of planting depends upon the variety, soil fertility and management practices to be followed. The common practice of the farmers is to plant papaya trees as close as 3 meters apart and as wide as 5 meters apart. Wider spacing of 4 to 5 meters is commonly used in areas where the soil is rich or where intercropping is practiced.

Planting and Transplanting

When papayas are directly seeded (3 to 5 seeds) they are immediately planted in the field after the land is laid out. If seed germination is high, more than 50% of the seeds planted will germinate. If the seedlings are released in the seedbed, transplanting time should be when the seedlings are about 15-20 cm high. Water them regularly until they are established in the field. Carefully remove the seedlings from the nursery beds before transplanting. Avoid serious root injuries.

Thinning the Plants

Thin papaya seedlings in the field 4 to 6 weeks after emergence. Leave only 3 of the strongest seedlings in each hole. Save plants that are spaced far enough from one another to allow minimum competition for sunlight and nutrients.

The second and final thinning in the field should be done as soon as flowers appear. This is usually 4 to 6 months after seed germination. At this stage, leave one tree seedling per planting hole. In plantation where female trees are grown, some pollinating trees of either male or hermaphrodite forms should be preserved during the thinning process. Allow one male plant to grow for 15 to 20 female trees for pollination process.

Fertilization

Farmers should have their soil analyzed to determine the nutrient status and pH of the soil for proper application of fertilizer.

In the absence of soil analysis, apply 50g Di-Ammonium Phosphate at the bottom of hole during transplanting. One month after transplanting apply 55g Ammonium Sulfate and 23g Muriate of Potash around the seedlings. At two months after transplanting apply 83g of Ammonium Sulfate and 34g Muriate of Potash. On the third month apply 138g Ammonium Sulfate and 56g Muriate of Potash. No application will be done on the fifth month but on the sixth month apply 165g of Ammonium

Sulfate and 68g Muriate of Potash. Three months thereafter, apply 165g Ammonium Nitrogen and 213g Potassium at quarterly intervals.

Application of Boron with a rate of 5g per hill at quarterly interval is also necessary since Papaya is very sensitive to boron deficiency, which could be due to acidic soil or leaching. Apply Zinc Sulfate at 15g per hill seven months after planting and repeat application four months thereafter.

Water Management

Water is required for papaya during the early stages of growth and periods of prolonged drought. Lack of moisture over prolonged periods causes growth retardation, flower abortion and dropping of young fruits.

For three-month-old flowering trees, it is necessary to water the plants for at least eight hours each week. When the fruits are already maturing, water should be kept to a minimum to hasten fruit maturity. Mulching by the use of rice straw or hulls, dried banana leaves, sugarcane bagasse or wood chips at 30-50 cm away from the base of the tree would help conserve soil moisture and prevent weed growth. It is also necessary to build canals in between rows to drain excess water during heavy rains.

Weed Control

Control early weed infestation by handweeding or hoeing, slashing, interrow cultivation or intercropping. Control the remaining weeds in the field by any one or a combination of mulching or post-emergence herbicides. Sustain weed control until such time the papaya plants have clear growth advantage over the existing weeds.

Important Insect Pests and Diseases

Insect Pests

Mites , *Tetranychus* spp.(Figure 6)

Damage : Spider mites are observed on the underside of older leaves causing leaf discoloration and leaf drop. When populations are high, the apical leaves show deformity, mottling and virus-like symptoms.

Control : Prune and burn infested leaves. The use of biological control agents like predatory mites, spiders and predatory beetles, and spraying of insecticides may be done only under severe infestation.

Scale insects (Figure 7)

Damage: The nymphs and adults , which remain attached to the leaf surface (except for the adult male), suck the sap of the leaves like the aphids and the whitefly. Heavy infestation may lead to drying of infested leaves; otherwise this is still a minor pest.

Control: Remove and burn heavily infested leaves. Biological control agents such as ladybird beetles and parasitic wasp and recommended insecticides against mites may be used.

Fruit fly (Figure 8)

Damage: Adult females insert their eggs into mature and ripening papaya fruits. Eggs hatch into larvae or maggots, which feed on inner tissues of fruits, causing fruit to prematurely turn yellow, rot and drop.

Control: Harvest mature fruit. Do not wait for the fruit to ripen on the tree. Practice sanitation by disposing fallen fruits because these may contain larvae. Do not plant alternate hosts nearby. In severe infestation, insecticide may be applied using some of the recommended insecticides against fruitflies which include fenitrothion, cypermethrin and carbaryl.

Aphids (Figure 9)

Damage: These aphids do not colonize papaya or inflict direct damage on any part of the papaya plant, but they can transmit dreaded virus, which cause Papaya Ringspot.

Control: Use ladybird beetles and hoverfly as predators against aphids, parasitic wasps as parasitoids and some fungi as microbial control agents. Spray plants with the recommended insecticides against aphids. Do not plant alternate hosts of aphids. Practice regular weeding.

Diseases

Damping –off (Figure 10)

Symptoms: Parts of the seedlings above the soil surface appear water-soaked and rotten seedlings fall over and die

Control: Sterilize soil for sowing and transplanting

Place seedlings in benches for good aeration

Maintain good drainage

Avoid overcrowding of the seedlings

Bacterial Crown Rot (Figure 11)

Symptoms: Rotting, wilting and collapse of growing points; blighting of leaves, petioles and flowers and discoloration of vascular areas throughout stem extending to the roots and fruits .

Control: Use of resistant varieties

Monitor and eradicate infected plants

Provide good drainage system to prevent water logging

Papaya Ringspot (Figure 12)

Symptoms: Initially it appears as faint chlorosis on younger leaves. As plant grows, the top leaves or whole crown appear distinctly chlorotic/yellowed with mild mosaic/mottling. Moreover, young shoots that may arise, including those from some axils, are deformed/distorted and expand unevenly at edges of the lamina. In some, shoestringing with blistering effects is very noticeable.

On petioles, water-soaked spots or somewhat short oily streaks are evident. Fruits show characteristic ringspotting or with small water-soaked or oily spots that are still very evident even when fruits ripen.

Control: Practice crop rotation

Eradicate infected plant

Observe field sanitation/weeding

Use tolerant varieties like Sinta

Phytophthora Rot (Figure 13)

Symptoms: root rot, wilt, canker on trunk, and also fruit rot. Affected areas are initially water-soaked and then develop cottony growth and spores on surface. Affected plant fall over.

Control: Do not replant in same areas where the disease previously occurred

Remove and destroy fallen trunks of plant and fruits

Maintain good drainage in the field

Brown Spot (Figure 14)

Symptoms: Light brown, circular spots, up to 5 mm wide, develop on leaves. Long elliptical spots, with a dark coating of spores, develop on leafstalks. Circular brown spots occasionally occur on fruit.

Control: Remove infected leaf and petioles

Apply recommended fungicides

Harvesting

Harvesting is a simple operation when papaya trees are short and the fruit can be reached by hands. The first harvesting starts on the 7th to 8th month after planting. Pick all fruits showing a tinge of yellow at apical end.

Place harvested fruits in picking bags, galvanized containers or pails. Allow fruits to mature more fully to develop better flavor. However, this may shorten shelf life and make them more susceptible to fruit fly infestation.

When papaya trees grow older, harvesting is done with the use of ladder. It is a tedious, time-consuming and costly method of harvesting.

The papaya plant will keep on fruiting for many years but production declines rapidly as it grows older. Old trees grow slower and produce lesser fruits. The productive life span of papaya plantations end after 3-1/2 years. The yield of well-managed papaya plantation is 35 to 40 tons of fruits per hectare which is roughly 4 times the average yield (national) of 10 tons per hectare per year.

Postharvest Handling

Field sorting

Field sorting is necessary in handling papayas. Misshapen, physically damaged and disease infected fruits should be separated from those brought in the packinghouse or packing shed to reduce or minimize contamination and hauling cost.

Washing

Washing removes chemical residues, debris, and more importantly latex which may bring about latex injury. Alum (10%) as delatexing agent or sodium hypochlorite (1%) as a disinfectant may be added to the wash water.

Curing

Curing involves air-drying for at least 12-16 hours to remove excessive moisture from the fruit. This prevents formation of unsightly latex exudates on the skin of fully ripe fruits. Curing is a must before fruits are packed.

Packing

Papayas have very sensitive skin. They must be packed in appropriate manner and with utmost care. Fruits should be individually wrapped with newspaper in a halfway manner from the stem end towards the apex when destined for domestic markets. The fruits are then placed-pack stem end down in newspaper lined wooden crate or in a carton box.

Cost and Return Analysis

Tables 1-3 show the three-year estimated costs of establishing and managing a one-hectare papaya orchard, estimated volume of production and the cost and return analysis. (in excel format)

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