

## LEC. 12

# PAPAYA – SOIL, CLIMATE, WATER AND NUTRIENT MANAGEMENT, PAPAIN EXTRACTION, USES, PESTS AND DISEASES MANAGEMENT

### **Papaya (*Carica papaya* L.), caricaceae , 2n 18**

The papaya is native of Tropical America was introduced to India in the 18th century. It is now grown in almost all tropical and subtropical countries in the world.' In India, it is largely grown in Bihar, Assam, Maharashtra, Madhya Pradesh and Andhra Pradesh with a total area of 34,000 ha, producing about 3,50,000 tonnes.

Papaya is a wholesome fruit and is rich in vit-A (2000 IU/100g). Products such as jam, jelly and nectar can be prepared from the fruits. Papaya yield a valuable proteolytic enzyme, papain, which has several and varied use in medicine and industry. Papain is used to correct certain digestive ailments, for tenderizing meat, in the manufacture of leather and in clarifying beer. The other uses of papain are in the treatment of ulcer, diphtheria, pre-shrinking of wool, manufacture of chewing gum, degumming natural silk and rayon, in cosmetics, dental paste preparation etc. The raw fruits are cooked as vegetables and consumed. Papaya is usually dioecious but hermaphrodite type and gynodioecious types are also recognized. In dioecious type, both male and female plants are separate. The male flowers are found on long pendulous panicle. Female flowers are solitary and are much larger than male. The ovary usually large in female flowers. In the case of hermaphrodite flowers, two kinds are often observed viz. one with long corolla type and 10 stamens and another type with a short corolla and 5 functional stamens. Fruit is a large hollow berry elongated or globular in shape. In gynodioecious type, the female and bisexual flowers are borne one on the same plant. The fruit develops from female flowers are globular in shape while fruits that develop from bisexual flowers are elongated in shape. The edible fruits are found only in *Carica papaya*. *C. candamarcensis* known as 'mountain papaya' thrives well at an elevation between 1500 to 2000m in western ghats. *C. monica* is found growing wild in Amazon basin.

### **Soil and climate**

It does well in varied soil types, the best performance is observed on loams of uniform texture upto 1.8 m in depth. The most important requirement is that the soil should have good drainage. Even two to three cm of water stagnation around the tree for a few hours is likely to damage them due to the collar-rot disease occurrence. Papaya performs well in tropical climates where summer temperature ranges from 35,°C to 38,°C. At higher elevations, the fruit quality is usually lower. It cannot tolerate very hot summer or frost, this limits cultivation in Northern India. It cannot tolerate, very hot summer or frost, a dry warm climate tends to increase the sweetness of the fruits. In strong wind prone areas, wind breaks have to be provided to save the trees from wind damage.

Tamil Nadu is an ideal home for growing papaya because of the mild temperatures and freedom from mosaic and leaf curl virus diseases. These features help all the year round cultivation of papaya.

### **Seed production**

Papaya is a highly cross-pollinated crop. Seeds taken from a fruit would rarely breed true to type. If a variety is to be maintained pure, controlled pollination between selected female and male progenies of the same parent i.e., crossing of sister and brother, called sib mating has to be done. This consists of collection of pollen from the male parent and applying it on the previously bagged female flower. Seeds from such sib mated fruit should be used for further multiplication. Failure to observe this precaution leads to the deterioration of the variety resulting in the progeny being a mixture of all kinds of types within a few years.

### **Propagation**

The most common method of propagation of papaya is from seeds. Seeds are collected from well mature, ripe and large fruits borne on female plants to hermaphrodite plants as the case may be. The fruits are cut open and seeds are carefully extracted in trays. They are washed and dried in the sun or shade and are stored in bottles. Fresh seeds may be mixed with fine cold wood-ash which absorbs the slimy coating on them and helps to keep the seeds separate on drying. About 500 g seed is required for raising in one hectare. Seedlings can be raised in the raised nursery beds or in polythene bags, however the seedlings from the latter one are good. Two seeds in gynodioecious type or 5 to 6 seeds in

dioecious type' should be sown per poly bag. The papaya plant can also be propagated from cuttings and grafts. Propagation from seeds is, however, preferred, because the vegetative methods of propagation are not economical.

### **Planting**

Pits of 45cm x 45cm x 45cm size are dug at about 1.8x1.8m apart either way. This would accommodate 3000 plants per hectare. Due to sex variations, about 40 to 60 per cent of the plants may turn to be male in the case of dioecious varieties. Therefore, in such case 2 to 3 seedlings per hole at 30 cm apart in the pit should be planted, so that when they reach the flowering phase, the unproductive male trees can be removed to keep the population ratio of one male tree for every 15 to 20 female trees. In the case of bisexual varieties, such contingency may not arise. One good seedling per pit may be planted. The best time for planting papaya is the beginning of the South- West monsoon in most parts of India. In south India, June to October and January to March are suitable for planting as the other months are either too hot or rainy.

### **Manures and fertilizers**

The nutrition of papaya is different from other crops because of its quick growing, continuous and heavy fruiting nature. Nutrient uptake studies conducted at TNAU showed that the uptake of N,P,K is more between flowering and harvesting stage, its peak requirement being between fruit development and harvesting. As three stages ie flowering. fruit development and harvesting concurrently occur in papaya plant, regular fertilizer application ie., 10 kg of FYM/plant as basal .besides 50g each of N, P and K per plant at bimonthly interval is recommended by TNAU. At Indian Institute of Horticulture Research. Bangalore. a dose of 250 g each of N, P<sub>2</sub>O<sub>5</sub> and 500 g K<sub>2</sub>O per plant per year in six split application recommended to get higher yield. .

### **Irrigation**

Papaya responds well to copious irrigation in well drained soils. Regular irrigation helps fruit development and induces the tree to bear larger sized fruits. Water stagnation should be avoided. In most parts of India; papaya are irrigated once in 8 or 10 days.

### **After cultivation**

It is not possible to identify the sex at the early stage until they put forth flowers which may take 4-5 months from planting. At this stage, male trees should be removed maintaining one male tree for every 20 female trees for proper pollination and fruit set. In each pit only vigorously

growing female/hermaphrodite tree should be retained and other plants removed. During the pre-bearing age, short duration vegetables like cabbage, cauliflower, onion, chillies, radish, etc. can be grown as intercrops. Weeding should be done regularly to keep the field weed free in the young plantation as in the grown up

field, the interspace remain well covered with the top growth which helps in checking weeds.

### **Sex expression**

Many sex forms such as dioecious, hermaphrodite, gynodioecious etc., have been reported in papaya. There, are no distinct or definite methods to ascertain the sex of the plants at the early stage itself. Besides, many factors have been reported to influence the sex expression.

1) **Environment:** Low temperature tends to produce perfect flowers on the male tree and female flower production is increased in cool weather and short days. Season of planting also affects the sex expression. Planting during February shows more male plants while planting in March/April produces an equal number of staminate and pistillate plants.

2) **Growth regulators:** such as GA (50 ppm), ethrel (200ppm) SADH (250ppm) and phosphon - D (2500ppm) increase the femaleness in dioecious types.

### **Harvesting and yield**

The first crop of fruits becomes available in 12-14 months from the time of planting. The cropping is practically continuous during the life of the tree. In the plains of North India fruits continue to mature through the spring and summer, but in the cooler places in the hills only 3 to 4 months from February to May. Fruits should be harvested when the colour changes from green to yellowish green. It should be harvested individually with hand, taking care to avoid injuries on the fruits. The yield varies considerably and the yield per tree may vary from 50 to 100 fruits. The yield may also vary according to the number of female and hermaphrodite trees in the orchard. TNAU bred varieties yield 100-160 t/ha. Papaya gives economic crop upto 2 years and thereafter it declines drastically. Fruits to be consumed locally should be stored in a single layer of straw until they become yellow. For distant market, it should be packed in bamboo baskets lined

with straw to avoid bruising.

### **Extraction of papain**

The latex or 'milky juice of the unripe green papaya fruit contains a large amount of digestive enzyme called papain which is able to digest the protein in our feeds. Fully developed

green large sized hard papaya fruits which are about three months old are selected for tapping. The latex is obtained by making scratches or shallow incisions on the skin of the fruit. The incisions are about 0.3 cm deep. Usually not more than four incisions per fruit at equal distance are made every day. To cover the whole surface around the fruit not more than five tappings at intervals of four or five days would be necessary. Non-metallic instruments should preferably be used in tapping and collecting, as the juice acts upon metals and gets discoloured. An ivory blade or a sharp edge or piece of bamboo splinter may be used. The latex should be collected in porcelain glass or earthen containers. After about 2 to 4 hours, the latex is scraped out from the tray and dried in the sun. Tapping should be undertaken early in the morning so that drying in the sun can be done before mid-day. This makes the material sufficiently dry by the evening. When thoroughly dried, the latex becomes crisp and flaky. It may be then ground into a powder, preferably still warm. The dried papain is powdered and sieved in 10 mesh sieves. The cream coloured powder should be placed in air-tight bottles or poly bags. Papain can be also dried artificially at temperature of 50 to 55°C which will attain better colour and quality. Potassium metabisulphite (KMS) at 0.5% may be added to it for better colour and keeping quality. The papain production is influenced by certain factors such as fruit size, fruit maturity, varietal factor etc.