

PINEAPPLE, BANANA AND PASSION FRUIT AS INTERCROPS IN COCONUT LANDS

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Predominant among the fruits grown in Sri Lanka are pineapple, banana and passionfruit. They are also prominent intercrops in coconut lands.

These crops can use the interspaces of coconut plantations very profitably. By doing so, the land could be made to give an extra income while increasing the fruit production in Sri Lanka. On account of this potential, it is opportune to draw attention on the cultivation of crops in coconut lands.

As in the case of other intercrops, factors such as the age of the coconut plantation, environment of the holding, edaphic factors, rainfall etc. are important considerations for these fruit crops.

Pineapple as an intercrop

The most popular fruit crop cultivated under coconut is pineapple. Since pineapple is used as a desert, in cordial preparations and in the canning industry for export, this crop is of considerable economic importance.

Mostly, neglected unproductive coconut lands are selected for growing pineapple because more space is available for this crop as coconut palms are weak and have a small crown. However, pineapple can be grown successfully in good coconut lands also.

Pineapples give an extra income, reduce expenditure on weed control and improves soil and moisture conservation of the soil.

Environmental requirements for growing pineapple

Edaphic factors

Well drained lateritic soil and gravels are better suited for pineapple. Clayey soil or sandy soils are not suitable. There should not be excess calcium or magnesium as they tend to increase the soil pH thereby causing the pineapple leaves to turn yellowish brown.

Rainfall

Pineapple grows well in areas with an annual rainfall of 2000–2500 mm. (80–100 inches) Even in areas with rainfall up to 1000 mm (40 inches) pineapple could be grown provided its distribution is satisfactory.

Sunlight

The crop prefers intense sunlight. Under low intensity of sunlight, leaf production is low with consequent delay in bearing fruits. When the crop is grown under coconut, this fact should be considered carefully. Pineapple can be grown in young plantations up to 4–5 years old and in old plantations when it is more than 30–35 years old.

Varieties

In Sri Lanka, there are two varieties namely Kew and Mauritius. The fruits of Kew variety are regular in size. Because of the shape and size of the fruit, Kew variety is ideal for canning. Popularly, Mauritius variety with moderate size of fruits is cultivated. On account of the moderate size of fruits, marketing is easy. Kew variety prefers more sunlight than Mauritius variety.

Propagation

Pineapple is propagated vegetatively. There are four varieties of suckers used as planting material.

1. **Discs** These are planting material obtained by cutting of the main stem or axis into pieces. They take 10–14 months for bearing fruits.
2. **Suckers** These are planting material produced from the leaf axils near the root. They take 12–14 months for bearing fruits.
3. **Slips** These are planting material which grow on the stem just below the fruit or "apple". They take 15–18 months for bearing fruits.

4. **Crowns** These are the tufts of leaves found on the top of the fruits. They take 24 months for bearing fruits.

When the crop is grown on a commercial scale, suckers are used. When suckers are insufficient, other planting materials are used.

in a slopy land, they are tilted towards the upper side of the slope but when the crowns are planted, they are planted erect. For the control of fungal diseases and pests such as mealy bugs, the planting material should be treated before planting with an insecticide such as Lebaycide or Tamaron. This is very important for areas with heavy rainfall.



Pineapple under coconut.

Planting

In slopy lands, the contour drains should be established and contour bunds should be constructed as a soil and moisture conservation measure. Soil erosion could be minimised by planting pineapple across the slope.

While planting under coconut, a distance of 2 m. (6 ft.) should be allowed from the coconut palms and the spacing between rows should be 2 m. (6 ft.). In a coconut plantation planted with a spacing of 24 ft. x 25 ft., 3 rows of pineapple could be planted between 2 coconut rows. The spacing between plants in a row is 1-1½ ft. Using this spacing, about 4000 plants could be planted per acre. By increasing the distance between rows by 8-10 inches, it is possible to get large size fruits but these will not mature uniformly. Disposal of larger fruits in the local market is a problem. Hence it is advantageous to produce medium size fruits by increasing the spacing between plants in a row. When suckers are planted

Weed control

Herbicides are used for weed control as manual weeding is expensive. Herbicides such as Gramaxone is popular. When weedicides are used care should be taken to ensure that the herbicide spray will not come in contact with pineapple leaves. Since most of the herbicides are hormones, they will have some adverse effects on bearing of fruits.

Mulching

Fibre dust is used for mulching on a very large scale. This is very profitable. In areas where the incidence of mealy bugs has been reported, use of fibre dust has to be done with utmost care. Dry straw could be used instead.

Mulching promotes conservation of moisture, control of weeds and incorporation of plant nutrients to the soil. Since the root system of pineapple is shallow, moisture in the surface soil should be conserved.

Fertilizer application

Pineapple responds to fertilizer well. Application of specific fertilizer mixture at the correct level to the crop will not only give a good return from the pineapple crop but would also prevent any harmful effects on the yield of coconut.

Fertilizer requirements for 10,000 plants/ha:

Basal dressing

Super phosphate – At the time of planting 220 kg. (480 lb.) this fertilizer mixture

Muriate of potash – should be applied.

110 kg (240 lb.)

Top dressing

4–6 weeks after planting –

Urea 220 kg. (480 lb.)

5–6 months after planting –

Urea 220 kg (480 lb.)

9 months after planting –

Muriate of potash 175 kg (385 lb.)

The fertilizer applied after this will be useful for the next crop.

Second year fertilizer application

15 months after planting the following mixture is applied.

Urea – 175 kg. (385 lb.)

Saphos phosphate – 10 kg (22 lb.)

Muriate of potash – 35 kg (75 lb.)

Same dose should be applied once every 6 months. Basal dressing mixture is applied to the planting drains and mixed with the top soil while the top dressing should be applied on either side of the pineapple rows and incorporated by digging to a depth of 5 cm (2 ins.). Fertilizer application should be stopped one month before flowering, as it will promote vegetative growth, thereby delaying flowering.

Yields

Fruits could be harvested 5 months after flowering. Main harvesting season is from April to July.

Inducing flowering pineapple

Plant hormones are available in the market for inducing flowering in pineapple. Mostly, calcium carbide dissolved in water is poured to the primary bud region. In order to do this treatment, there should be 30 leaves in a pine

apple plant (or 11–12 months old). One month before the anticipated flowering time, the hormone should be applied.

Control of pests and diseases

Pests

Wilting caused by mealy bugs.

Subsequent to the attack by this sucking insect pest occurring in colonies, the leaves turn orange or brown in colour. They manifest symptoms of wilting as if caused by moisture stress. The pest could be controlled by using pest-free planting material, treated with a systemic insecticide prior to planting. At least once every 3 months an insecticide should be sprayed to control the ants that are responsible for the dispersal of the mealy bugs.

Diseases

In areas with heavy rainfall and excess moisture in the soil, there is a fungal disease causing root decay in plants. In such situations, soil has to be treated with a fungicide. In some areas, bacterial wilt could be noticeable. Planting disease free planting material and maintaining plant sanitation are the control measures recommended.

Problems

The main problem is the fluctuation of price in the harvesting season. Fruits rot due to non-availability of adequate storage. In order to avert this situation to some extent, the methods described below should be adopted to spread out the production over the entire period of four months.

1. Planting time should be staggered
2. Use of different types of planting material. (Different planting materials have been described earlier)
3. Inducing flowering through the use of hormones.

Growing Bananas in Coconut Lands

Banana is the most popular fruit crop in Sri Lanka. The main reasons for its popularity are taste, food value and availability throughout the year. Some varieties can be used in curries. There are some advantages in having some varieties of bananas cultivated for culinary purposes.

Environmental requirements for banana cultivation:

Edaphic factors

Banana could be grown in most types of soil. Even soils with one metre depth is sufficient. The soil should be well drained. Bananas planted in soils with poor drainage are subject to fungal and viral diseases. Since the root system is shallow the soils should have a good water holding capacity. Loamy soil with sufficient lime is considered a very suitable soil. The soil pH could be 4.5–7.5 but the ideal is 6.5. If irrigation is contemplated, water should be free of salts. When the pH of water is more than 7.5, uptake of potassium and iron is impeded, causing yellowing of leaves.

Rainfall

Dry areas with a rainfall of 1250 mm. (50 ins.) are suitable for growing bananas on a commercial scale. This rainfall should be evenly distributed with at least 100 mm. (4 ins.) of rainfall per month. Decline of moisture level in the soil retards the growth. Even the number and the size of fruits will be reduced. In areas with a rainfall up to 3750 mm. (150 ins.), banana could be grown satisfactorily provided that the soil is well drained.

Sunlight

Bananas require a lot of sunlight. Therefore, the growth may not be satisfactory in the wet zone with cloudy skies. Bananas can be grown as an intercrop in young coconut plantations up to 3–4 years of age and in older plantations after 45 years of age.

Main varieties suitable as an intercrop in coconut lands

1. *Embul* – This is the commonly grown variety.
2. *Kolikuttu* – This is a variety of superior quality but highly susceptible to diseases.
3. *Anamalu* – Requires uniformly high level of moisture and would be more suitable for the central wet region.
4. *Embun* – This is an exotic variety mostly grown in the Kandy District.
5. *Alukehel* – This is a culinary variety which prefers a dry climate.

Propagation

Propagated vegetatively. Planting materials are:

1. Pieces obtained from the under ground stem.

Segments of the under ground stem should be separated one bud in each. These segments are first grown in the nursery and later transplanted.



Banana as an intercrop.

2. **Sword suckers** – **Ideal planting material with vigorous vegetative growth** (in these first leaves are **elongated**)
3. **Water suckers** – **Since the vigour of growth is less, takes more time for bearing** (in these the first leaves are **broad**).

Four to six month old suckers are removed for planting. In a mother plant, excess suckers should be removed before fruiting, leaving about two suckers.

Planting

Planting is done during the rainy season. The planting hole should be 60 cm×60 cm×60 cm (2 ft.×2 ft.×2 ft.) and should be filled with a mixture of surface soil and cow dung or 2 to 3 baskets of compost. In areas with strong wind the size of the planting hole should be 1 m×1 m×1 m(3 ft.×3 ft.×3 ft.).

When banana is planted as an intercrop in coconut lands, the competition between the two crops should be minimised as far as possible. It is important that the crops do not compete for nutrients. Both banana and coconut require high level of potash, and therefore a distance of at least 8 feet from coconut should be left without any other crop. In a 8 m×8 m coconut plantation two rows of banana could be grown with banana 3 m away from coconut. Within a row, banana should be 4 m apart and planted in a triangular system in two rows.

Fertilizer application

Application of cow dung or compost at the time of planting promotes growth. Application of nitrogenous fertilizer during the first six months gives very satisfactory growth. Since the life span of banana is short, inorganic fertilizer is recommended. The recommended mixture is as follows:

Urea	– 1 part
Super phosphate	– 1 part
Muriate of potash	– 4 parts

At 2 months and 6 months after planting, 900 g (2 lb.) of the above mixture should be applied. After sprinkling round the banana plant, the mixture is incorporated to a depth of 10 cm. (4 ins.) by digging. In the subsequent years, the same dose is applied during the two monsoonal rains.

Weed control

Tractors should not be used for weeding as the roots could be easily damaged. Slashing and establishment of cover crops will help to control the weeds.

Mulching

For the conservation of moisture in the surface soil, mulching is done in a circle of 1–1.5 m (3–4 ft.) radius from the base of the plant. Dry banana leaves and dry coconut fronds could be used for this purpose.

Yield

Flowering can be expected 4–6 months after planting sword suckers. In another 4–5 months time, the fruits will reach maturity. Sometimes on account of the weight of fruit bunches, the trees could break off. Hence they have to be propped up. In areas with intense sunlight, the bunches should be covered to prevent scorching and pest damage.

Diseases and pests

Diseases

The most important disease afflicting bananas is bunchy top. This is a virus disease spread by plant hoppers. The effected trees are stunted and leaves appear like in a crown. If the diseased leaves are held against sunlight, brown coloured streaks could be seen in the midribs. The diseased trees will not bear fruits.

The diseased plants should be removed and burnt. Disease free suckers should be selected for planting. Spray insecticides to destroy the insect vectors.

The other disease of importance is the anthracnose disease of ash plantains. The fruits turn blackish in colour and dry up. This is controlled by spraying a copper fungicide.

Pests

The principal pest is the banana weevil which bores into the stem and roots. In areas where the damage is prevalent, the soil round the banana bushes should be dressed with Furadan. Unwanted suckers should be removed from the mother sucker. Lime is mixed with soil in the ratio 1:3 and applied in places where the bushes had been destroyed by this pest. Plant sanitation should be adopted for the crop.

In addition, Nematode damage has been observed. As a result of the damage caused by nematodes, the under ground stem will get destroyed. Nematicides should be used to control this pest.

PASSION FRUIT AS AN INTERCROP

Passion fruit has a considerable demand in the market as it used in the preparation of fruit drinks and cordials. The fluctuating prices have occasionally caused losses to the growers.

Ecological requirements

Soil factor: Well drained loamy soils and deep alluvial soils are suitable for the cultivation of this crop.

Rainfall: The crop can be easily cultivated in areas with an annual rainfall of 2000–2500 mm (80–100 inches) without irrigation. However the maximum yield could be obtained in areas with an annual rainfall of 1000–1250 mm (40–50 inches) with a warm climate. Under these conditions, it would be necessary to provide irrigation thereby increasing the cost of production. Excessive rainfall causes root rot, dislodging of vines and flower rot. It also reduces pollination. When moisture is limiting, flower and fruit shedding is common.

Temperature: Passion fruit prefers a warm climate. High temperature is harmful for young vines and flowers.

Varieties: There are two varieties *Passiflora edulis* and *Passiflora plericalpa*.

Passiflora edulis

Fruits are violet coloured and small stem is green. Yield per acre is low. Fruit juice is rich in sugar and acid. Growth is less vigorous. This is cultivated in the up-country.

Passiflora plaricarpa

Fruits large and yellow. The yield per acre is high. Suitable for the low-country.

Propagation

There is seed propagation as well as vegetative propagation. Seed propagation is more common. Vines with an annual yield of more than 600 fruits of about 5 cm (2 inches) in diameter should be selected as mother vines.

The fruit coat should be thin and the vine should be resistant to pests and diseases. The pulp should be removed and the seeds separated and kept for a day. The seeds are then washed thoroughly to remove the sticky substance adhering to them. The seeds are then sundried.

The seeds should be first planted in a nursery. The rows should be 22.5 cm (9 inches) apart and the seedlings in a row should be 15 cm (6 inches) apart. Once the seeds are dibbled in the nursery, they will germinate in 2 weeks. Once the seedlings have reached a height of 25 cm (10 inches) the seedlings should be transferred to poly bags. Later they should be transplanted in the field. Transplanting directly in the field from the nursery is not recommended.

Vegetative propagation is also possible. Cuttings with three nodes from semi mature vines should be used. These cuttings should be treated before planting in the nursery with a hormone to induce rooting. Once the roots are well developed, the cuttings should be transferred to poly bags to be planted later in the field.

Planting in the field: The economic life of a vine is 4–5 years. Passion fruit could therefore be grown in new plantations up to five years and in mature plantations over 35 years of age.

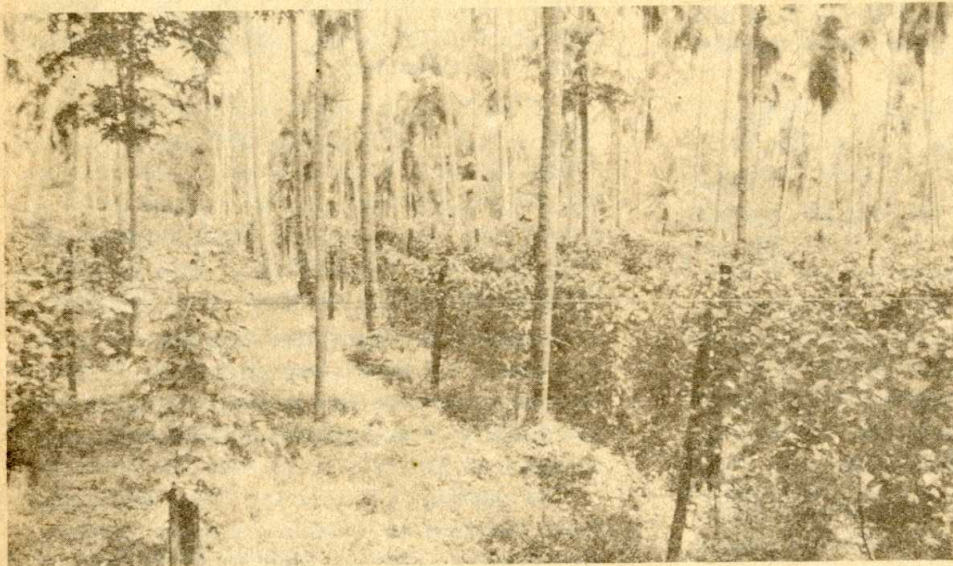
The planting should be laid down in the east west direction to ensure maximum sunlight, two rows of passion fruit could be planted between two rows of coconut palms. Passion fruit should be at least 3m (8–10 ft) away from the palm. The spacing between two passion fruit seedlings should be 4m (12 ft) with 2 rows of passion fruit vines between 2 coconut rows. The planting hole should be 45×45×45 cm (1½×1½×1½ ft). Each planting hole should be filled with a basket of cow-dung mixed with surface soil.

Training vines: It is necessary to have supports for passion fruit vines. In passion fruit rows, wooden or concrete posts 2m (7 ft) tall, should be planted every 5–6m (12–15 ft). The tops of these posts should be connected with a strand of wire. In order to facilitate the vines to reach the wire strand a stake or coir rope is fixed. Once the vine has reached the

wire strand the terminal bud is removed to induce branching which are then trained on to the wire strand in either direction. When vines from either side meet the terminal buds are removed to induce tertiary branches. These vines will then grow and hang downwards. The tendrils of these vines should be removed to prevent them from entangling in the wire strand. These hanging vines will be the fruiting branches. Once fruits are harvested about 50% of the branches are removed. The balance 50% should be pruned in the subsequent year, after fruiting. By adopting this system of annual pruning a vine can be kept for 4–5 years.

the third year 350g of the fertilizer mixture should be applied once every six months. In the fourth year, 450g of the fertilizer mixture is applied once every six months. If it is required to keep the vines for the fifth year the same dosage applied in the fourth year should be applied. Fertilizer should be applied at the beginning or towards the end of the monsoon.

Fruit production: Vines raised from seeds will start bearing from 7–12 months after planting while vines raised from cuttings will start bearing from 6–7 months after planting. Flowers are cross pollinated. However, when they are ready for pollination (normally between



Passion fruit grown in a coconut plantation.

When passion fruit is grown as a home garden crop, a trellis could be erected within the planting square to train the vines.

Manuring: At the time of planting 250g of 1:1:1: a mixture of urea concentrated super phosphate and muriate of potash should be added to each planting hole. If the soil is deficient in magnesium, 50g of Kieserite should also be added.

The same mixture should be applied as a top dressing at the rate of 250g per plant after two months. Fertilizer should be broadcast about 30cm from the plant and incorporated into the soil. This application should be repeated six months after planting. In the second year after planting, 250g of the fertilizer mixture should be applied once every six months. In

11.00 a.m. to 3.00 p.m.), the insects are relatively inactive. On account of this, artificial pollination has to be carried out for increased yield. Pollination is done using a camel hair brush with soft hairs (A trained pollinator can pollinate 2000 to 3000 flowers within an hour). Fruit mature after 70 to 80 days of artificial pollination.

The yield during the first year is low. Maximum yields are obtained during the third year after planting. In Sri Lanka there are two bearing seasons. In February–March the yield is low, in August–September about 80% of the total yield is obtained. During maximum production 3000–4000 kg of fruits per hectare could be obtained.

Pests and Diseases: The incidence of pests and diseases is low in passion fruit.

Diseases: Mosaic virus – This affects vines on a large scale. Yellowing and crinkling of leaves are the symptoms of this disease. At the end the vines get stunted and finally wilting will set in.

The diseased vines should be uprooted and burnt. The field should be free of weeds since insect vectors, which transmit the virus are harboured by the weeds.

Pests: Fruit fly damage. Ripe fruits are damaged by fruit flies. Weekly harvesting will reduce the incidence of this pest.

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