CHAPTER 9

TECHNICAL PERSPECTIVE FOR FUTURE FRUIT TREE PRODUCTION

Tatsushi Ogata, Yin Yin Nwe

Fruit trees have potential in Palau as an economic crop because many fruits have short shelf life that locally produced fruits have an advantage in the fruit quality on imported ones. Fruit trees have another potential in Palau as sustainable agricultural crops which can reduce soil erosion because fruit trees can be cultivated without tillage on sloped land. But fruit trees are currently underutilized in Palau. Commercial fruit production is limited, though many fruit trees have been introduced. There are a lot of factors limiting the utilization. We will discuss some of the solutions for future fruit tree production in Palau.

Selection of fruit trees and varieties

One of the most important factors limiting fruit production in Palau is the climate condition. Palau climate condition is suitable for some fruit trees such as coconuts, breadfruits, papaya but not suitable for some fruit trees such as mango, mangosteen which require dry condition for floral bud initiation essential for fruit production (Table 15). Palau has a dry season from December to April, but the dry condition is not always enough for their floral bud initiation. To enhance tree fruit production, it is necessary to cultivate varieties which can initiate flowers and set fruits under Palau climate conditions. One of the methods is to introduce varieties from abroad and evaluate their characteristics in Palau. This method would work well but takes long years. Another method is to survey varieties currently cultivated in Palau which have higher productivity and good fruit quality. This method could fail to find out varieties suitable for commercial production, so it is better to conduct both methods simultaneously.

Table 15. Suitability of fruit trees in Palau based on the condition of floral bud initiation.

Condition of floral bud initiation	Fruit trees	Suitability for commercial production in Palau
Dry stress is necessary for floral bud initiation.	Mango, Mangosteen, Rambutan, Longan, Avocado	Suitable varieties and cultural techniques are necessary.
Dry stress is not necessary for floral bud initiation but enhances it.	Soursop, Jackfruit, Breadfruit, Starfruit, Java apple, Indian jujube, Guava, (Kinkang),	Suitable.
Dry stress is NOT necessary for floral bud initiation,	Papaya, Pineapple, Banana, Dragon fruit (Pitaya), Cacao	Suitable, easy to grow.

Propagation

Most of the fruit trees in Palau are currently propagated by seed. Seed propagation is easy, but the characteristics of the progenies are not always uniform. In addition, in many cases they need long years from planting to fruit setting, in some cases more than ten years, because of the juvenility. It is better to propagate fruit trees by vegetative propagation methods such as grafting, air-layering (marcotting), or cutting to get uniform and precocious plants (Table 16).

Table 16. Fruit tree propagation methods and their availability.

Fruit tree	Juvenile period	Propagation method			
		Seed	Grafting, Budding	Air layering	Cutting
Mango	Long	G*	E	P	P
Guava			F	F	P
Jackfruit			F	?	?
Star fruit (Carambola)			G	G	G
Avocado	Long		G	P	P
Indian jujube			E	P	P
Java apple			G	G	F
Citrus	Short to Long	G*	E	F	P
Sugar apple	Short	G	G	?	P
Soursop	Short	G	G	?	?

P: Poor, F: Fair, G: Good, E: Excellent
*: Polyembryonic cultivar

Fig.34. Contact of scion and rootstock cambium in grafting

Points to successful grafting and budding.
Use compatible scion and rootstock (graft compatibility).
Use healthy vigorous scion and rootstock.
Use the proper physiological stage of scion and rootstock.
Contact the cambium of scion and rootstock (Fig. 34).

Quick connection of scion and rootstock via callus formed from both cambium is necessary for the successful grafting.
Prevent the scion from drying.
Until connection, water is not supplied to the scion from the rootstock.
Procedure of cleft grafting is summarized in Fig. 35.

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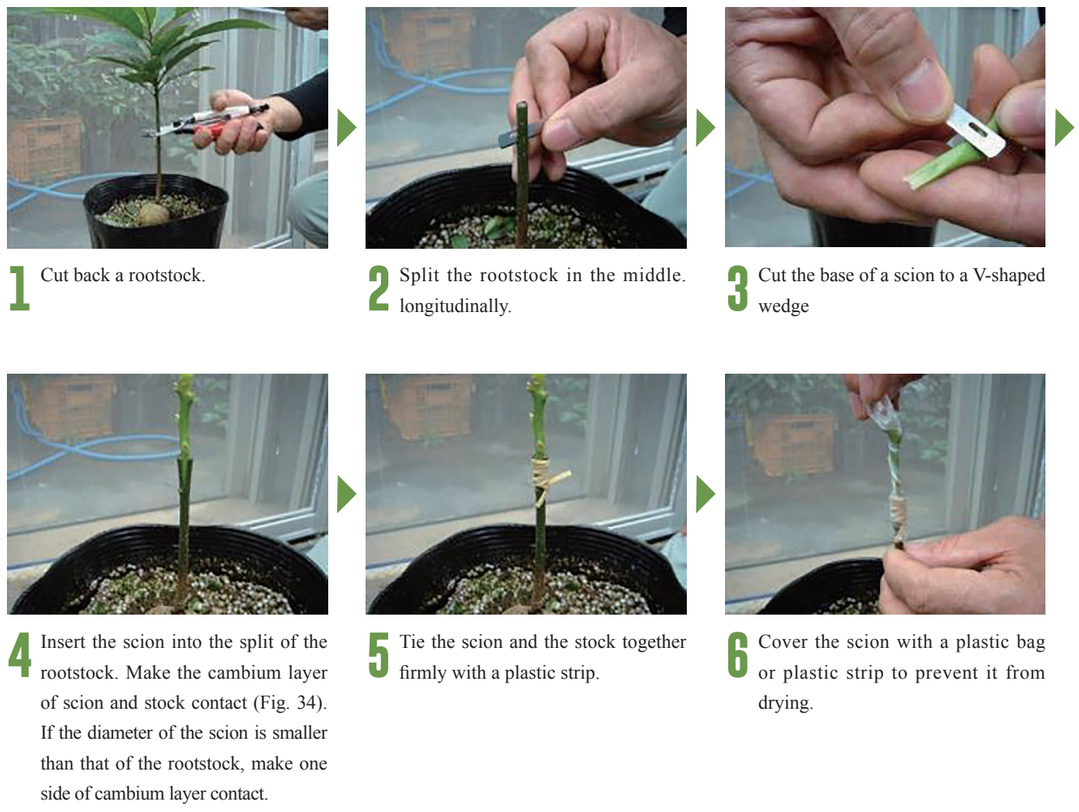

1 Cut back a rootstock.

2 Split the rootstock in the middle. longitudinally.

3 Cut the base of a scion to a V-shaped wedge

4 Insert the scion into the split of the rootstock. Make the cambium layer of scion and stock contact (Fig. 34). If the diameter of the scion is smaller than that of the rootstock, make one side of cambium layer contact.

5 Tie the scion and the stock together firmly with a plastic strip.

6 Cover the scion with a plastic bag or plastic strip to prevent it from drying.

Fig. 35. Procedure of cleft grafting of Avocado.

Pruning of fruit trees

Pruning is removing or shortening the live branches of trees. Fruit trees are pruned according to the following reasons and benefits.
To maintain fruit production in the lower tree canopy by controlling their size and shape.
To maintain a healthy tree by removal of dead, dying, diseased, and crossovers, which all are potential harbor of diseases.

To rejuvenate the old and unproductive tree by the removal of old branches that encourages the formation of new growth.
To maintain a proper vegetative/reproductive balance of the tree to promote earlier flower and fruit production and to be uniformly productive year by year.
To increase fruit production by developing strong wide-angle branches to support fruit load and reduce the likelihood they will fall or break

apart during a tropical storm.

Pruning techniques are complicated and a comprehensive explanation is difficult in this document due to the limited space. Here we will show some points of multileader shape, low-tree height pruning suitable for most fruit trees.

Points of pruning to control tree size and shape

Identify the branches needed to enhance growth for the desired tree shape (Fig. 36-38).

Remove or reduce the length of branches which compete with or dominate the branch identified.

Correct deficits such as dead or broken branches, crossing branches, water sprouts, or branch unions with included bark (narrow branch angle).

Do not remove too many branches (less than 20% at once). Removing too many branches would decrease tree vigor or flowering resulting in decreased fruit production. Try to prune as less as possible (Fig. 39).

Example of low-tree-height pruning of old trees that have already grown too high is shown in Fig. 40.

Fig. 36. Example of young mango tree pruning.

Left (before pruning): There are many vigorous branches growing upright.

Right (after pruning): To enhance the growth of lower branches some of the central branches were removed.

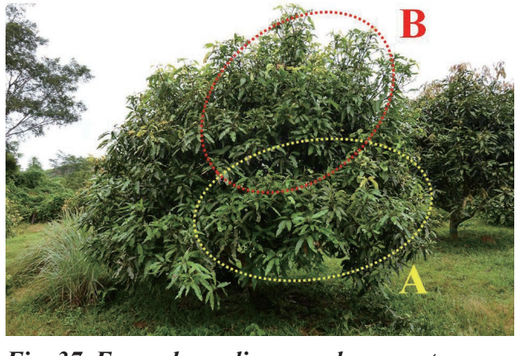

Fig. 37. Example medium-aged mango tree pruning.

Left (before pruning): Branch (A) is useful for low-branched, multileader tree shape. But branch (B) covers over branch (A) that branch (A) cannot receive enough sunlight for growing.

Right (after pruning): To enhance the growth of branch (A), branch (B) was removed.

Fig. 38. Tree shape difference between non-pruned and pruned mango trees 7-year-old.

Left (non-pruned tree): Without pruning the tree will grow higher than growth of lower lateral branches are restricted.

Right (pruned tree): The tree shape is wider and lower compared to non-pruned trees.

Fig. 39. Difference of canopy inside of non-pruned and pruned mango trees.

Left (non-pruned tree): There are many scaffold branches originating from the central trunk.

Right (pruned tree): There are only three scaffold branches originating from the central trunk. They are thick and strong compared to those of non-pruned trees.

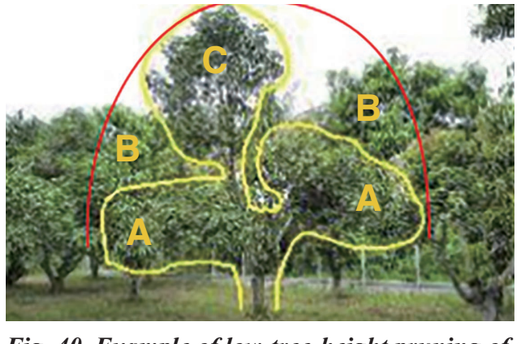

Fig. 40. Example of low-tree-height pruning of old trees already grown too high.

Left (low-tree-height pruning): To enhance the growth of lower lateral branches (A), higher branches (B) covering over (A) were removed. To avoid losing too much vigor, leave the central part of branches (C) if they do not compete with lower lateral branches (A).

Right (two years after low-tree-height pruning): The lower branches have grown well that the central upright branches are removed.