TOPWORKING OF MANGO AND AVOCADO TREES

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NOTE TO READERS

This manual on top working of mango and avocado trees has been produced after two years of dedicated work by Mr. Moshe Kimhi, Fruit Specialist employed with the CARDI - TROPRO project in St. Vincent, Grenada and Antigua.

The inputs and guidance of Mr Collin Bully of ADCU, Dominica, and Messrs Barton Clarke and Julius Polius of CARDI have been valuable in execution of the work of the entire project.
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FOREWORD

Much of the mango and avocado production in the West Indies comes from non commercial varieties. The fruit is inferior in quality, doesn't meet export standards, and usually sells locally at low prices.

Trees of commercial cultivars grown under unfavourable climatic condition are susceptible to canopy and fruit diseases. This results in a high proportion of unmarketable poor quality fruit. Changing the variety of unprofitable trees using topworking technique may solve the problems mentioned before and increase farmers income.

This fact sheet summarizes the information based on the experience we have in topworking operation during the last two years in the Windward Islands.

The author hopes that this publication will contribute to a better understanding of the nature of this activity, and a fruitful operation by extension staff and farmers.
TOPWORKING OPERATION

Topworking is usually done because of the following reason:

1. To replace non commercial varieties with an acceptable cultivar.

2. To change an existing cultivar with a better more profitable one.

3. Topworking of a rootstock that hadn't been pruned and became the plant. (Pic 1)

(Pic 1) Mango rootstock topworked with Julie variety, four months after operation.
Several techniques can be used for topworking trees in the field. The method selected depends mostly on the size, and age of the plants to be worked. The existing practice is to graft on the side branches, which grow after the trees were severely pruned. During the last two years, we tested and evaluated the “crown” top-working technique, under local conditions.

The results were successful compared with trees grafted in other ways and the comments received from farmers and extension officers were very encouraging. As a result of it, several top-working workshops have been held by CARDI in Antigua, Dominica, St Lucia, St. Vincent, and Grenada.

In some of the countries extension staff members and farmers are very active in on going topworking operation by increasing number of trees topworked.

In addition, crown topworking technique was successfully operated on carambola and citrus. (Pic 2)

(Pic 2) Avocado tree of a local variety topworked with Simmonds variety. At the time the picture was taken (18 months after operation) the tree started bearing fruit and was 7-8 feet tall.
FIELD OPERATION

TIMING
Mango trees can be worked year around as long as the rootstock is active. Topworking of Julie and Keitt mangoes in Antigua in April, at the peak of the dry season performed very well and produced a canopy of 4-5 feet in a year's time. Avocado trees should be worked only when they don't have fruit and the foliage is in good health. The best time seems to be before flowering.

METHODS
There are two main methods for field operation
1. Side branch grafting
2. Crown Top working

1. Side Branch Grafting

Side branch grafting is done on side branches 1/4" - 3/4" thick, which are formed after the canopy had been trimmed. Side branch grafting can be done using several different techniques. Veneer, chip budding, patch or wedge. (Fig.1)

This method is used when the crown technique didn't work or when the trees are very old, and it is difficult to graft on large stumps.

FIGURE 1: DIFFERENT SIDE BRANCH GRAFTING TECHNIQUES

PATCH
(AVOCADO ONLY)  VENEER  WEDGE
2. Crown topworking

Crown topworking is done by cutting the truck or branches, from 1" to 1 ft thick.

The advantages of using the crown topworking techniques are:

1. The cut site of the branch (stump) heals quickly. (Pic 3)
2. Trees shape is easily controlled by choosing the working site.
3. Grafted trees starts growing immediately after the operation is completed.
4. The canopy recovers fast and in the second year it starts bearing fruit

(Pic 3) Avocado trunk 6" wide, topworked successfully with three pieces of budwood. Note the large cross section which takes a long time to heal.
Topworking of trunk or large stumps is less recommended than working on branches. The cut is larger and it needs longer time to heal. The union is weak since all the new growth radiates from a single point, and becomes important when trees are exposed to severe winds.  (Pic 4)

(Pic 4) Avocado branch 3''-4'' thick with one piece of budwood one year after operation. Note the healing and cover of the cut section.
ROOT STOCK OPERATIONS

Healthy and vigorous rootstocks are vital for a successful operation. It is a must that the bark should separate easily from the wood, this indicates an active cambium tissue. The cambium tissue is located between the bark and the wood. It reacts with the budwood cambium, to form a complete union process between the budwood and rootstock.

Unhealthy, weak or stressed trees, should not be considered for topworking, since this tissue is not active.

Rootstock branches facing different directions, should be cut carefully to avoid splits. Working site depends mainly on the trees structure, but when possible it should be at chest level or lower.

The best way to cut a branch avoiding splits is to make a deep cut, up to 1/3 of the stem diameter thickness, from the lower side which faces the ground, then make a second cut from the opposite direction, 2" above the first cut. (Figure 2).

![Diagram of branch cut preventing splits]

FIGURE 2: BRANCH CUT PREVENTING SPLITS
An active growing tree shows flow of sap from the cut site. Strong sap flows might interfere with the operation. If this happens let the sap flow for 24 hours. Make a fresh cut below the first one before grafting the branch.

Cut branches should be removed from around the tree to facilitate convenience at work. If work is done in sunny weather coat the exposed trunk and stumps with lime to prevent sun damage. (especially important with avocado).
SCION PREPARATION

Scion branches (budwood) should be with swollen buds, 3-4" long and pencil thickness. The budwood should be semi-woody and not too young and soft. Scion buds can be forced to swell by girdling the branches two weeks before collecting them. When removing the scion from the tree, clip the leaves as soon as possible to prevent water loss from budwood. Dip the scion in a 0.5% captan or 0.2% benomyl solution, and enclose in plastic bag. Scion should be used as soon as possible but can be stored in household refrigerator up to five (5) days. In that case, wrap the scion in newspaper first to absorb excess moisture, and enclose in plastic bag. When transferring to the field the scion should be kept in an insulated container in the shade. Remove from the container each time only the budwood needed. (Pic 5).

(Pic 5) Mango budwood ready for operation with rootstock.
GRAFTING OPERATION

The stock branch or trunk should be cut at the exact site of the union. When the tree has been prepared and the cut is a day or two old, a slice of wood two (2) inches thick should be removed to permit working with fresh wood. An active bark should separate from the wood easily. When the trunk or branch is vertical the cut should be inclined 5 degrees to the ground. This prevents any water from accumulating on the cut surface.

Plane the cut bark with a sharp knife. Locate the site for scion insertion, avoiding the lower angle of the branch.

When the bark is too thick, it is very difficult to cut and separate it from the wood. In this case, reduce bark thickness with a sharp knife. Cut into the bark two parallel cuts which fit the budwood size, and by twisting the knife slightly with the blade in the bark lift the bark from the wood.
Cut the scion piece, (Pic 6) lift the bark and insert the scion. The scion's cut should face the center of the branch. (Pic 7) When all the scion pieces are in place, wrap the site with plastic tape tightly. (Pic 8) According to the stump size, two to four budwood pieces are used on a site. Spray the whole operation site including the scions with fungicide to sterilize the surface. (Pic 9) Cover with a plastic bag and place a paper bag or cover with aluminium foil. (Pic 10) Aluminium foil is more expensive but reflects sunshine and reduces heat inside the bag. It also stands up better in rainy conditions. When heavy rain or wind is expected, use a stick nailed to the trunk, and place the paper bags on it for better support.

(Pic 6) Proper holding and cutting of the scion piece.
(Pic 7) Insert the scion piece.

(Pic 8) Topworking site wrapped with plastic tape.
(Pic 9) Spraying the operation site with fungicide.

(Pic 10) Topworking site covered with plastic and paper bag.
After Care

Remove the paper bag for first check after 10-14 days. When the budwood and rootstock start to combine successfully the leaves petioles drop from the budwood. Take off the plastic bag, uncover the budwood, remove the fallen petioles, spray with a fungicide and re-cover with plastic and paper bag. When new growth reaches 2" long, cut the plastic bag corners leaving (one) 1" long holes. When the leaves grow to 4" long remove the plastic bag. Cut the top of the paper bag and replace the open sleeve around the budwood to protect the young leaves from sun and wind damage.

Normally the after care stage takes four (4) to six (6) weeks with mango, and eight (8) to ten (10) weeks with avocado. The plastic tape should be left in place until the budwood establishes a solid connection with the rootstock. (Pic 11)

(Pic 11) Solid connection of the budwood with the rootstock. Remove the plastic tape at this stage.

It is possible to wrap every budwood (Parafilm) instead of covering it with Parafilm and when removing the paper bag drops off. This latest technique in the region in nursery and field.

It is possible to wrap every budwood with Parafilm (laboratory film) instead of covering it with plastic bag. In that case there is no need to remove the Parafilm. The budwood grows through it, and when removing the paper bag, the parafilm dries, breaks and drops off. This latest technique was tested and successfully used in the region in nursery and field operations.

(Pic 12) Budwood wrap with Parafilm. When using that technique cut the budwood pedicles short.
TOPWORKING OPERATION TOOLS

1) Chain saw.

2) Hand saw (bow saw).

3) Topworking Knife - for stump operations.

4) Budding Knife - for side branch operations.

5) Sharpening stone of the finest grains type.

6) Plastic tape 1” thick (stump operation).

8) Plastic tape 1/2” for budding.

9) Plastic bags (different sizes).

10) Paper bags or aluminium foil.

11) Roll of thin wire.

12) Small hand sprayer and fungicide.

13) Parafilm (laboratory film).
   (One roll US$15 for 3000 pieces of budwood.)
   To order - Ripley Scientific Co. Riverside.
   Cal. USA (TEL) 714 894 6633 (FAX) 714 894 8694.
(Pic 13) Topworking Knives: (left to right)
Budding knife used in nursery.
Topworking knife for field operation.
Pruning knife not recommended for topworking operation.

(Pic 14) Some of the tools in use for topworking operation.