Pruning for avocado & mango production

John Yoshimi Yonemoto (Japan Tropical Fruit Association)
Pruning for a large scale operation
New growth after pruning
Different sections with different stages of development
Large scale operation in Peru
Florida way pinching tips technique
They try to keep tree low
Hillside planting in Spain
They use more hand technique
Heavy cut back pruning after blooming in Spain for intentional alternate bearing method. Keitt & Kent.
Heavy cut back pruning on an older tree
New flash after the pruning
Every other years production of Keitt 4 tons for $\frac{1}{4}$ acre
Shading culture
Inside of the shading net
Espalier training
From now, my way of pruning
Let us start pruning practice

My pruning tools

Fungicide paste for protecting cut surface
I tried low tree height training

• On Durian and mangosteen in Thailand and Vietnam from 2006~2010
Development of low tree height cultivation techniques and year-round production of tropical fruits

Expected Result:
- Low tree height cultivation will save labor for cultivation management and harvesting
- Stable production of high quality fruits and shipment of off-crop season will increase growers' income

Overall goal: 30% increase in growers’ income by saving labor for cultivation and producing higher quality fruits
How to make a tall mango tree short.

Mr. Kinjo, one of the oldest mango grower in Okinawa, Ishigaki Island.
Tall tree has deep taproot. Limiting the taproot growth is required for making short tree height.

We do not need a strong taproot. We need only healthy feeder roots.
What kind of planting do you use?

- Direct planting into a ground
- Pot culture

$10 for 100 litter non woven fabric bag
Direct planting with root limiting sheet

Marking of digging area

Digging of planting ditch

Adjustment of depth and width

Placing of root limiter sheet
Ready for planting

Filling of soil mixture on the sheet

Making a ridge for planting
Planting distance of mango

At planting

6m

2.5m

5.0m

At mature stage

Perman
tent tree

Filler
tree

Root limiter sheet in the ground
Another way of placing root limiter sheet
What kind of training do you use?

- **Wire rope**
- **Training methods**
- **Wire rope**

**Vase form training** for avocado

**Wire rope**

**Vase form training** for mango

**Straight line training** for cherimoya

**Trellis training** for star fruits or jujube

Supporting limbs increase fruit production. We are not producing lumber, producing fruits.
Planting and training for mango

At planting:
- Cut back

Select 2~3 main branches

If you pinch the tip during a new shoot growing:
- Secondary branches grow

Secondary branches grow

Main branch grows upward

Leaning of the main branches

Train main and secondary branches horizontally

Pinching
Keep the tip of main branch higher for preventing water sprout comes out.

Three years old Irwin mango in Okinawa

Once you have developed main trunk structure, it is not so difficult to maintain the low tree height by pruning.

Pipe for tying ropes for pulling down branches.
Root limiter is required for keeping compact tree

Making a frame

Root limiter sheet
(Nonwoven fabric) SH150
(150g/m², 0.4mm thickness, 2.1m width × 100m long/$1300
Root limiter is required for keeping compact tree

Soil for good drainage at the bottom

Soil mix (soil: peat moss:perlite; 2:1:1)
Train tree as short as possible. Produce lateral branches as many as possible by pinching. Produce fruits within 2 years.
Let us start hand pruning practice on mango

My pruning tools

Fungicide paste for protecting cut surface
We prune mango tree soon after harvest

Soon after harvest; there are many peduncles remaining

Soon after pruning; there are many branches on the ground
Another example; before and after pruning

First: cut upright branches,
Second: thin out crowded branches
Third: cut back every branches
Fourth: pull down upward branches horizontally
First: Cut the upright branches at the base (thinning)
2\textsuperscript{nd}: Thinning out crowded branches
The lightest cut back is cutting back the fruit peduncle before new shoots come out around the base of the peduncle.

New shoot comes out at here and produce fruit in the next season on this shoot. Suited for warm region.
Cutting back at below the base of fruit peduncle

This cutting produce many new shoots. Therefore, thinning shoots is required later. Leave only two shoots for the fruit production in the next season.
Cut ½ of a shoot node

A cut-back practice produces strong new shoots. Suited for cool regions where winter temperature gets down below 15°C.
Cut back one shoot node

This is popular cut back for mango growers to keep the tree compact.

Cut back one shoot node

New shoot node produced

Fruit production on this shoot
Cutting back above or below the node

This produce many new shoots.

This produce 2 or 3 Strong new shoots.
Do not cut back brown colored branch

Cut back only green stems.

Cutting back a brown branch produce very strong new shoots which will not produce flower in the next season.

when you need to cut brown branch, you had better to thin off the brown branch.
Thinning of new shoots is important to produce good fruiting shoot for the next season.

Leave only 2 good shoots for fruiting in the next season.
Two or three flashes (nodes) produce high quality fruit.

After the cut back pruning, many shoots come out.

Thin the shoots and leave only 2 shoots.

This shoot must be matured enough to produce flower.

5 litter pot
Horizontal training of shoots is important to prevent fall shoot, and promote floral initiation in a warm area (October in Okinawa)
Making a upright limb down to horizontal position

Sawing a limb to the half of its diameter

bending the limb down until the cut area closed

Cover with a tape to protect from disease and mechanical damage
Make cuts into the bark with a knife

Hold the cut area by your palm

Twist the limb and bend down

Cover the twisting area with a tape

Twist until the xylem is broken
Low temperature for one or two month initiate flowers

These are mango flowering in August after low night temperature treatment in May and June
Roofing for preventing rain during flower season in Okinawa

This tree height is too high for the roofing. He must make his tree short. Also he must thin off the branches. He needs my advice, isn’t he?
Limiting root culture requires frequent irrigations.
Avocado in greenhouse

Japan Tropical Fruit Assn. Dr. John Y. Yonemoto
Japanese way of low tree height culture
Place a Water-permeable root limiting sheet inside the box.
Upright growth habit cultivar Bacon

Planted October, 2012

September, 2013

June, 2014. 20 fruits on the tree
2014, August, one years and 11 months after planting. 50 fruits on the tree. Cultivar is Pinkerton.
May, 2009, Planted in 300ℓ pot (2trees/3.8 × 7.0 = 26.6m² = 37 trees/1000m² = 148trees/1 acre)

May 24, 2009, Soon after planting

June 30, 2009
New shoot is pushing out on Bacon tree
Horizontal training of Bacon

December 3, 2009

June 8, 2010
New shoots flashing on Bacon
June 21, 2014  Produced 300 fruits per tree
Yield increased by a greenhouse culture

Pinkerton  Hass
300litter and 60litter pot culture
Yield per tree increased up to 250 in the 5 years after planting

**Number of fruit per tree after planting**

<table>
<thead>
<tr>
<th>Years (planted in April, 2009)</th>
<th>Number of fruit /tree</th>
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<tbody>
<tr>
<td>2010</td>
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</tr>
<tr>
<td>2011</td>
<td>50</td>
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<tr>
<td>2012</td>
<td>100</td>
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<tr>
<td>2013</td>
<td>250</td>
</tr>
<tr>
<td>2014</td>
<td>300</td>
</tr>
</tbody>
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- **Hass-W**
- **Hass-E**
- **Hass-P**
May, 2009, Planted in 300ℓpot ($3.8 \times 3.5 = 13.3\text{m}^2$ =75trees/1000m$^2$=300trees/1 acre)

May 24, 2009, Soon after planting

June 30, 2009
New shoot is pushing out on Bacon tree
Harvesting 250 Fruits/tree from 3.8 × 3.5m spacing means:

• 250fruits/tree × 70 trees = 17,500 fruits/1,000m²
• If average fruit weight is 380g,
  • 380g/fruit × 17500 fruits = 66450kg(3019Lbs)/1000m².
  • 3019lbs × 4 = 12,076Lbs/acre
• You can harvest 70,000 fruits, 12,076Lbs / acre
• We sell $5/fruit, Then $5/fruit × 70,000fruits = $350,000/acre
• Even if the price was $3/fruit, × 70,000fruits = $210,000/acre
• Isn’t it amazing?
Top-working for changing cultivar and germination
Fruit set in the third year after top working

Grafted in May, 2012
Canopy has been clouded 3 years after planting in 60 litter pot.
Straight line training of atemoya
Straight line training of avocado on 60 litter pot

60 ℓ pot
Let’s enjoy hundred tastes of the hundred fruits

Irwin mango
100 litter pot

Passion fruit
60 litter pot

avocado
500 litter pot

cherimoya
90 litter pot
Let’s try Bonsai fruit tree culture

20 litter pot
acerola

60 litter pot passion fruit.
Training in the form of a quadratic column

300 litter pot
avocado

120cm
Big tree of mango and avocado
Against the gravity

• Why fruit trees have a strong big limbs and taproot?
• Because of supporting the fruits and the tree weight.
• If there is no gravity, tree can produce more fruits on a slender limbs and no taproot.
We want **more fruits, not fat limbs and taproot**

- What you keep in your mind to do so,
- Try to **minimize the gravity** on your tree.
- Think about a cheaper way for hanging branches and fruits
What I would like to do in Hawaii is

- Use tall wild mango trees as a stake for wire
- Hang branches and fruits to the wire
Thank you very much for your attention