# Avocado Growing Systems and Pruning

July 2018

# The Avocado Tree

## Characteristics of Hass trees

- Large vigorous tree reaches heights of over 15m
- Grows 0.5 to 1m+ per year
- Tree shape is typically a dome with dense foliage
- When given room will have a wide spread
- Flowering and fruit set is on the outside of the tree, high determinate flowering rate

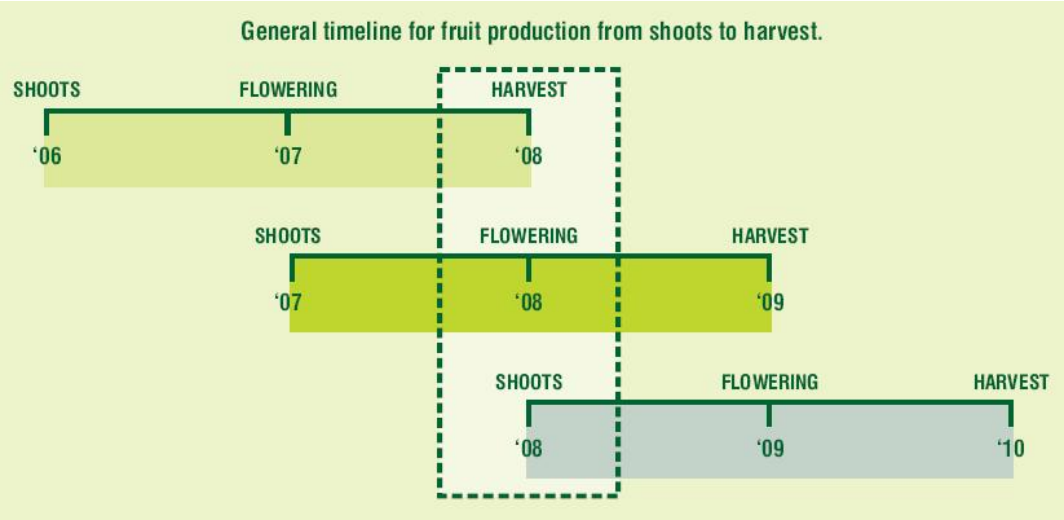
# The Avocado Tree

## Characteristics of GEM trees

- Low vigour tree that reaches heights of over 15m
- Grows about 0.3 to 0.5m per year
- Tree shape is typically a cylinder with dense foliage
- When given room does not spread
- Flowering and fruit set is initially on the outside of the tree, low determinate flowering rate means the fruit ends up inside the tree

# Pruning Challenge

## Overlapping growing cycles




- Type of wood matters – complex flowering biology
- Shoots grow in flushes that vary in vigour, duration and extent

Source: AIC Read Your Trees Booklets

- Two year shoot growth cycle – affects pruning timing
- Challenge of when to prune - crop

# Why Prune?

## If not pruned you get massive trees

# Why Prune?

## Recover sick trees

- Pruning is not always the right thing to do
- Sick tree can decline after pruning
- Poor root systems will be stressed when its support (the canopy) is removed
- The tree responds by growing vigorously then collapses
- Must increase root health first then prune
  - Use foliar fertilisers
  - Inject with phosphorus acid 6-8 weeks before pruning
  - Fresh mulch to encourage new root growth

# Why Prune?

## Individual trees strongly alternate bear

- Due to different amounts of flowering wood each year
- Climate and fertiliser sets the baseline of tree growth
- Pruning gives control of flowering wood

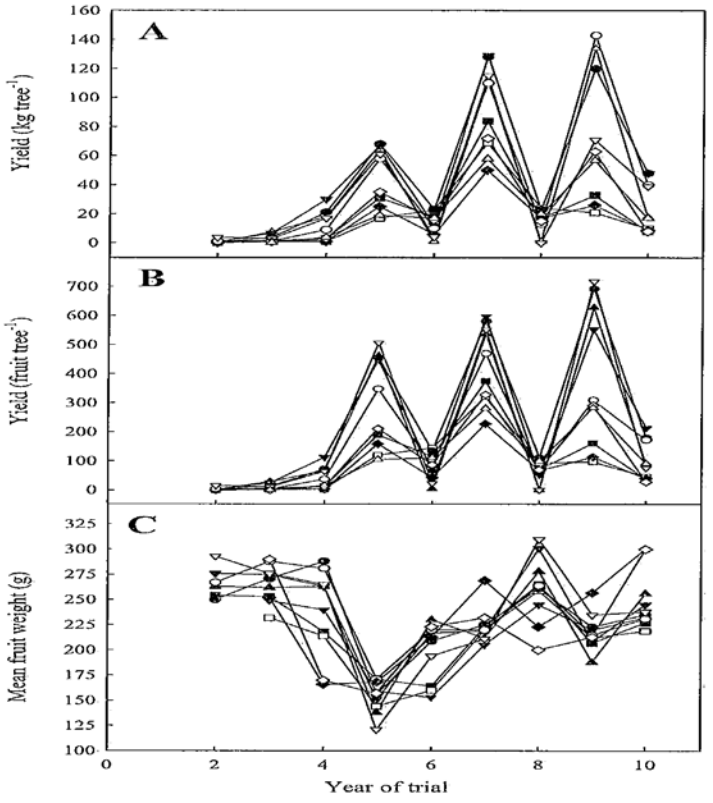



FIG. 1
Yield in fruit weight per tree (Panel A), yield in fruit number per tree (Panel B), and mean fruit weight (Panel C) of 'Hass' avocado trees growing on ten clonal rootstocks ['Borchard' (●), 'D9' (○), 'Duke 7' (▼), G1033 (△), G755A (■), G755B (□), 'G755C' (◆), 'Thomas' (◇), 'Topa Topa' (▲), or 'Toro Canyon' (▽)] 2 – 10 years after planting at the University of California South Coast Research and Education Center.

Arpaia et al.

# Why Prune?

## Consistent high yields

- Your best strategy for managing variability in yield
- Yield is directly proportional to the amount of healthy flowering wood on the tree
- Reduces growing and harvest costs without excessively reducing yields
- Heavy pruning can renew trees restoring productivity

# Growing Systems

## A good avocado growing system manages

- Alternate bearing – manage the amount and quality of shoot flushes
- Excellent pollination – maximum yield potential
- Minimise blemish and insect damage on the fruit – high packouts
- Efficient picking – control costs
- Account for soils and climate – frosts, wet feet and disease

# Growing Systems

## Establishment – tree shape light penetration

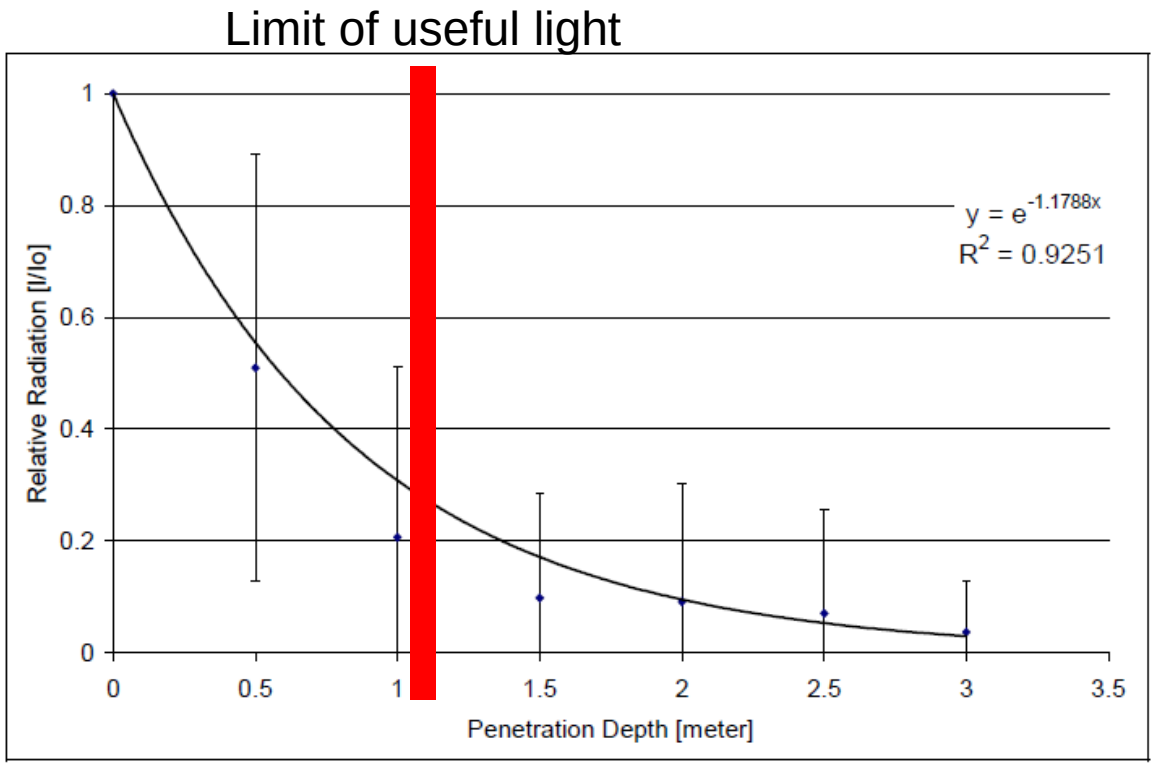



Figure 38 – Relative irradiance in different depth of the canopy as measured on the 3-16/9/2003; 'Shomrat orchard', CV. 'Hass'.

Hadari, Masterate Thesis 2004

# Growing Systems

## Establishment – tree shape light penetration Hedgerow

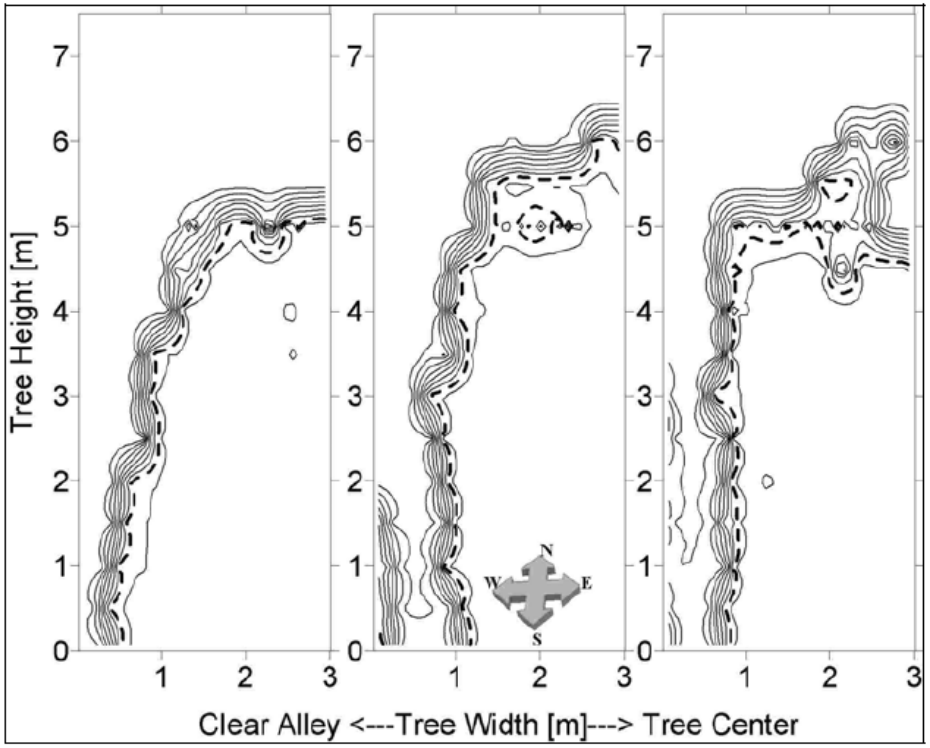



Figure 31 – Iso-luminance contours of half-tree cross sections based on measurements done on the 3/9/2003 in 'Regba' orchard, CV. Hass; pruned hedgerow; three different cross sections from the same row.

Hadari, Masterate Thesis 2004

# Growing Systems

## Establishment – tree shape light penetration Limb removal

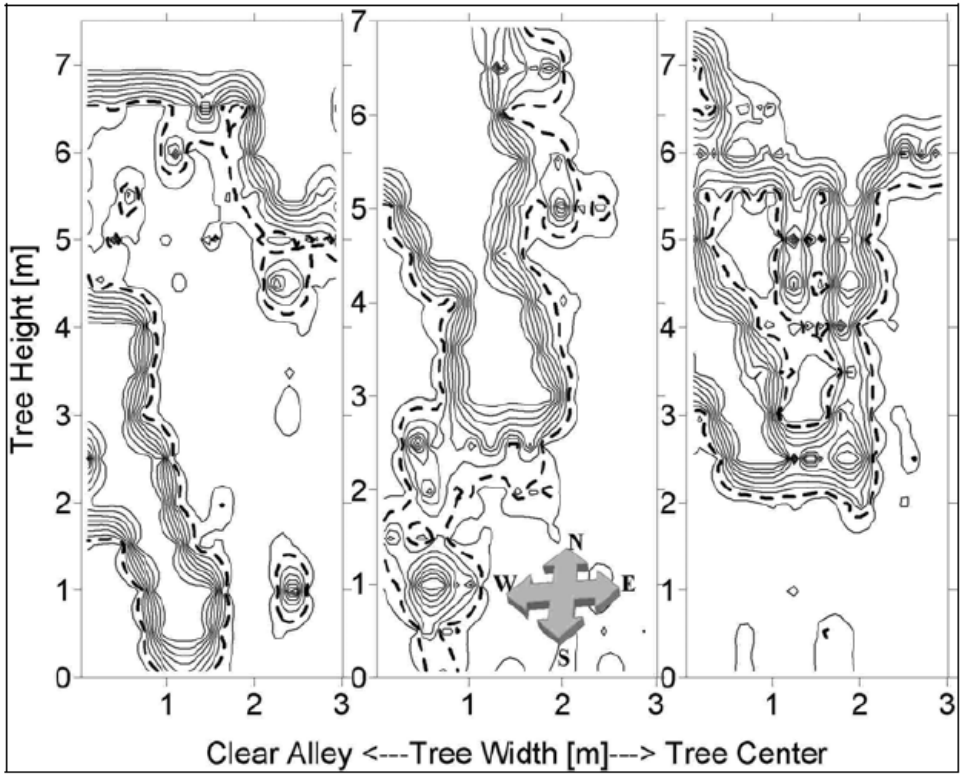



Figure 34 – Iso-luminance contours of half-tree cross section measurements done on the 16/9/2003 in 'Shomrat' orchard, CV. Hass; selective limb removal; three different cross sections from the same row.

Hadari, Masterate Thesis 2004

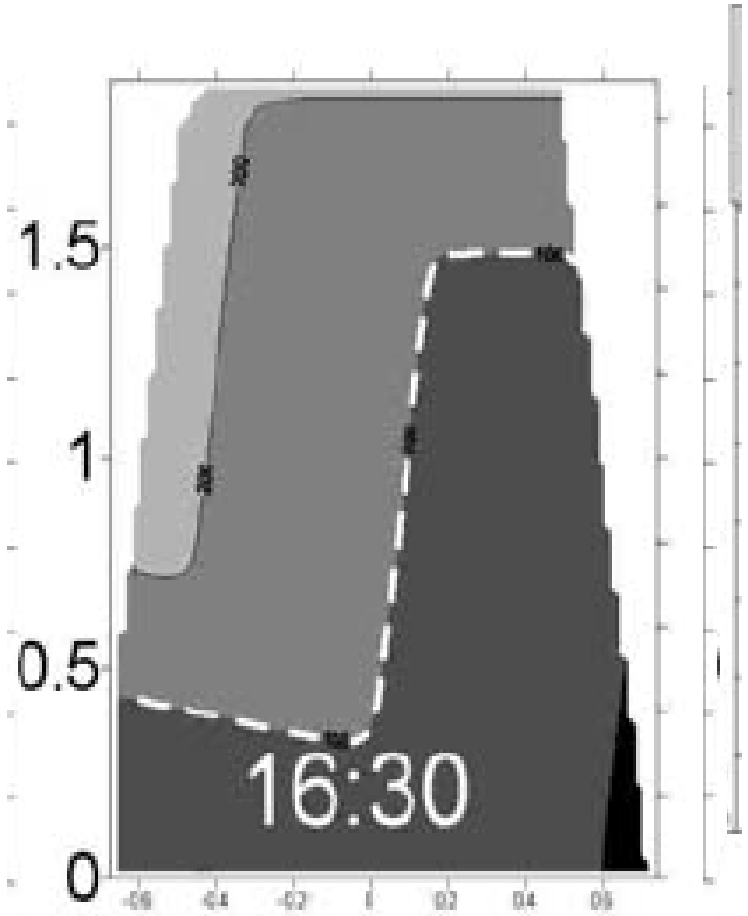
# Growing Systems

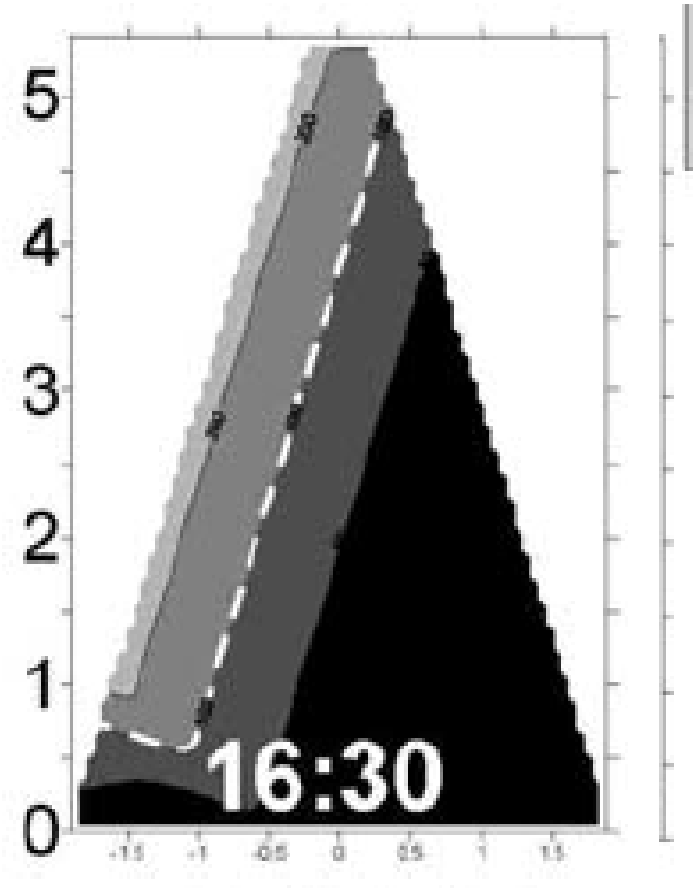
## Establishment – young tree shaping Productive canopy

| Growing system | Tree shape | Percentage productive canopy | Most light at height |
|---|---|---|---|
| Low density | Dome shape | 20% | >4m |
| Medium density | Hedgerow | 56% | 2 – 4m |
| High density | Cylinder | 91% | <2m |

# Growing Systems

## Establishment – tree shape light penetration hedgerow and cone




Hadari, Masterate Thesis 2004

# Growing Systems

## Establishment – tree shape light penetration

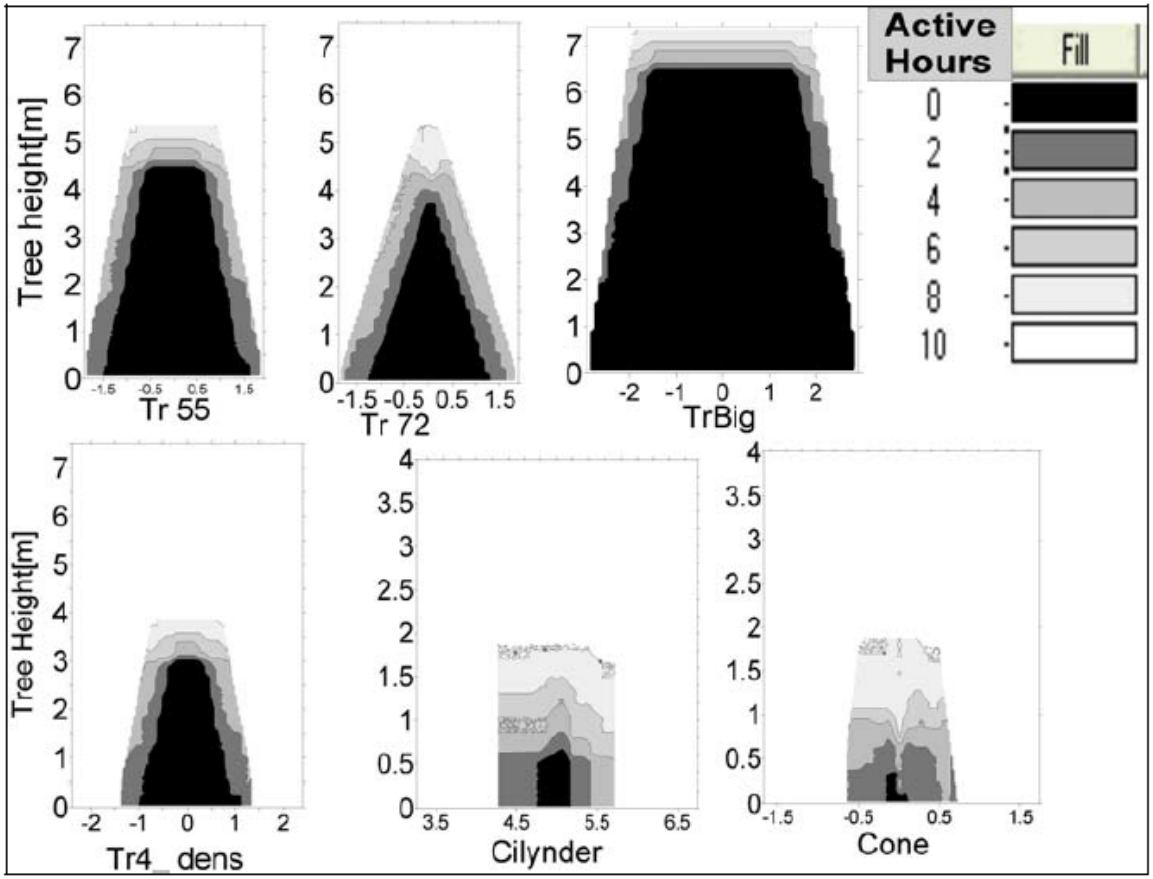



Figure 50 - Seasonally averaged daily exposure for PAR above the threshold level in selected models.

Hadari, Masterate Thesis 2004

# Growing Systems

## Types

- High density – close spacing less than 7m x 7m
- Medium density – traditional 7m x 7m spacing
- Low density – wide spacing 10m x 10m or more spacing
- Over time orchards tend to move from High/Medium density to Low density
- Modern trend is to try and hold trees at the planting density

# Growing Systems

## High density

# Growing Systems

## High density

- Planting at 6m x 4m = 400 trees/ha, 6m x 3m = 550 trees/ha, 3m x 3m = 1100 trees/ha
- Height – tree shape for light, minimise dead space inside the tree
- Between row width – 80% of tree height
- May not suit high vigour soils and varieties
  - May need PGR's (Sunny) to manage tree growth
  - Amount of pruning – 4 times a year minimum
- Fertiliser needs – per tree is less, per hectare more or same

# Growing Systems

## High density

- Advantages – not confirmed in NZ
  - Greater yields – 2 to 3x current standard
  - Lower operating costs
  - Best tree shape for light
- Disadvantages
  - High cost of establishment
  - Hass may be too vigorous
  - Limited life for trees

# Growing Systems

## Medium density

# Growing Systems

## Medium density

- Planting at 7m x 7m spacing
- Thinning trees at year 7 after planting to reduce crowding and shading
  - The trees get very large and still need pruning
  - Yields increase but costs go up faster
  - Growers delay thinning so don’t get the best benefit
  - Wasteful of trees especially in the first thin as the value of fruit produced has not covered establishment costs
- Shelter height needs to match the tree height

# Growing Systems

## New Plantings

There is a right way to plant avocado trees

But.....

What to do after planting?

# Growing Systems

## Planting in shelters

- Cages or shelters for wind and frost protection
- Encourages vegetative growth to get big trees
- Often trees are left too long in cages leads to shape problems

# Growing Systems

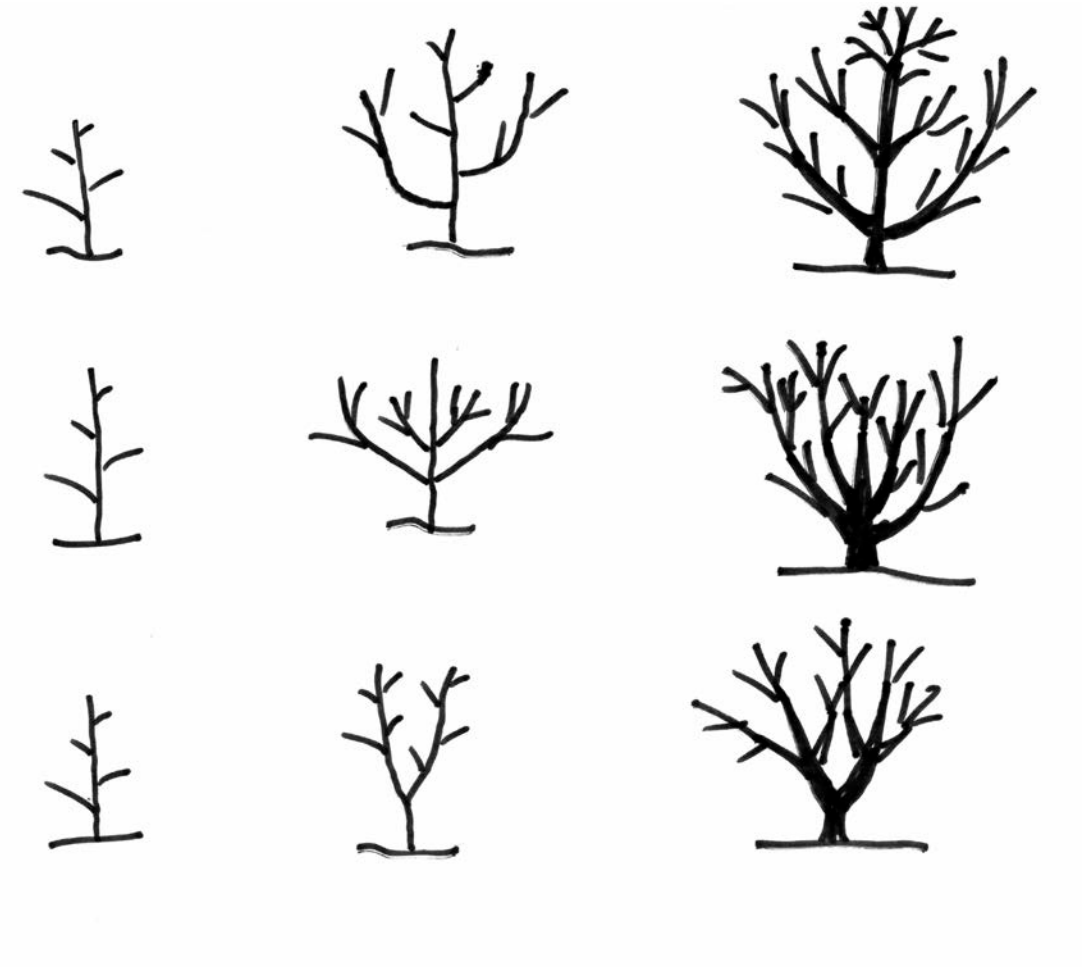
## Establishment – young tree shaping goals

- Achieve the greatest productive canopy volume
- Low tree height where light is good at the bottom of the tree – related to row spacing
- North-South row orientation has the best light exposure profile even on slopes
- High density systems the best shape is a cylinder
- Medium density systems for light best shape is a hedgerow

# Growing Systems

## New plantings what kind of trees do you want?

- Central leader
- Spreading
- Two leaders



# Growing Systems

## Managing old trees

- Old trees can be very large with thick limbs
- Often have long term health problems
- Should these trees be pruned or removed and replanted with new trees?

# Growing Systems

## Making a big tree small

- Gradual or all at once – which is the best way?

# Intermission

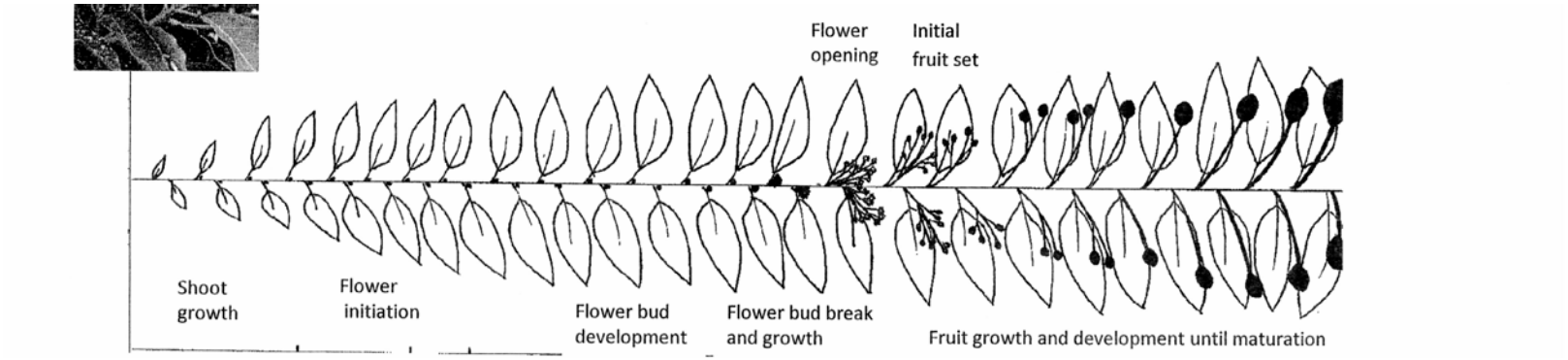
# What to Prune

## Growth pattern

- Branches can flush 2 to 3 times year weather and crop load dependent
- Not all branches flush each time
- Growth is on the outside of the tree increasing trees size over time
- The start of growth flushes are seen as “bud rings”
- These buds survive as the tree grows while other buds can be lost

# When to Prune

## Understanding the life cycle of a shoot




- Pruning before flower initiation (spring/summer) will stimulate more growth in the same growing year
- Pruning after flower initiation (autumn/winter) will remove flowers and stimulate more growth in the next spring

# When to Prune

## Goal: To increase shoot growth for more flowers

- Control numbers of shoots for consistent flowers each year
- If more shoots can be made to grow in the ON-crop year then there will be more flowering in the following year
- How much to cut off is tricky to get right as not pruning enough won't work
- May need to cut off flowers and fruit
- When alternate bearing is severe need to cut off about 30%
- Most failure is because the pruning was too timid on the amount cut off

# When to Prune

## Goal: Grow the right amount of fruiting wood each year

- For pruning need to know when
  - There is lots of shoot growth
  - How many shoots need to be removed
- Do we have a measure of shoots/flowers per square meter?
- In reality growers often have no idea how many shoots need to be pruned as there are no measurements

# When to Prune

## Goal: New growth flowers in the next spring

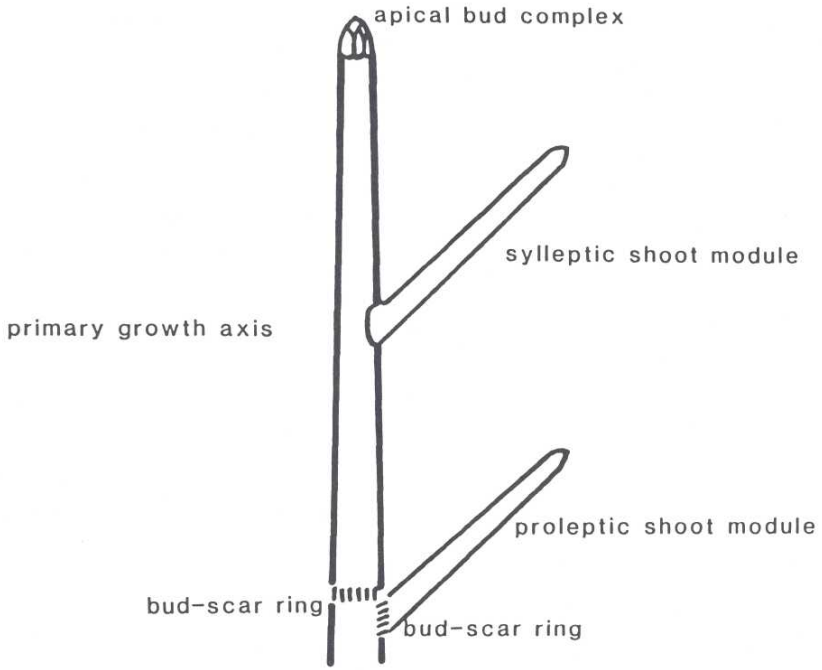
- Want new growth to flower and fruit in the next spring?
- Correct timing of cuts – to match the life cycle of a shoot
- The new growth in full sun
- Apply Sunny in late March to match the timing of vegetative buds to irreversible commitment to flower buds
- Nutrients right to support flowering

# What to Prune

## Avocado trees grow in a rhythmic pattern

- Modular growth habit
- This is the basic structure of the tree from the trunk to the nearest shoot

Thorp and Sedgley, 1992



# What to Prune

## Tree structure made up of the same modules

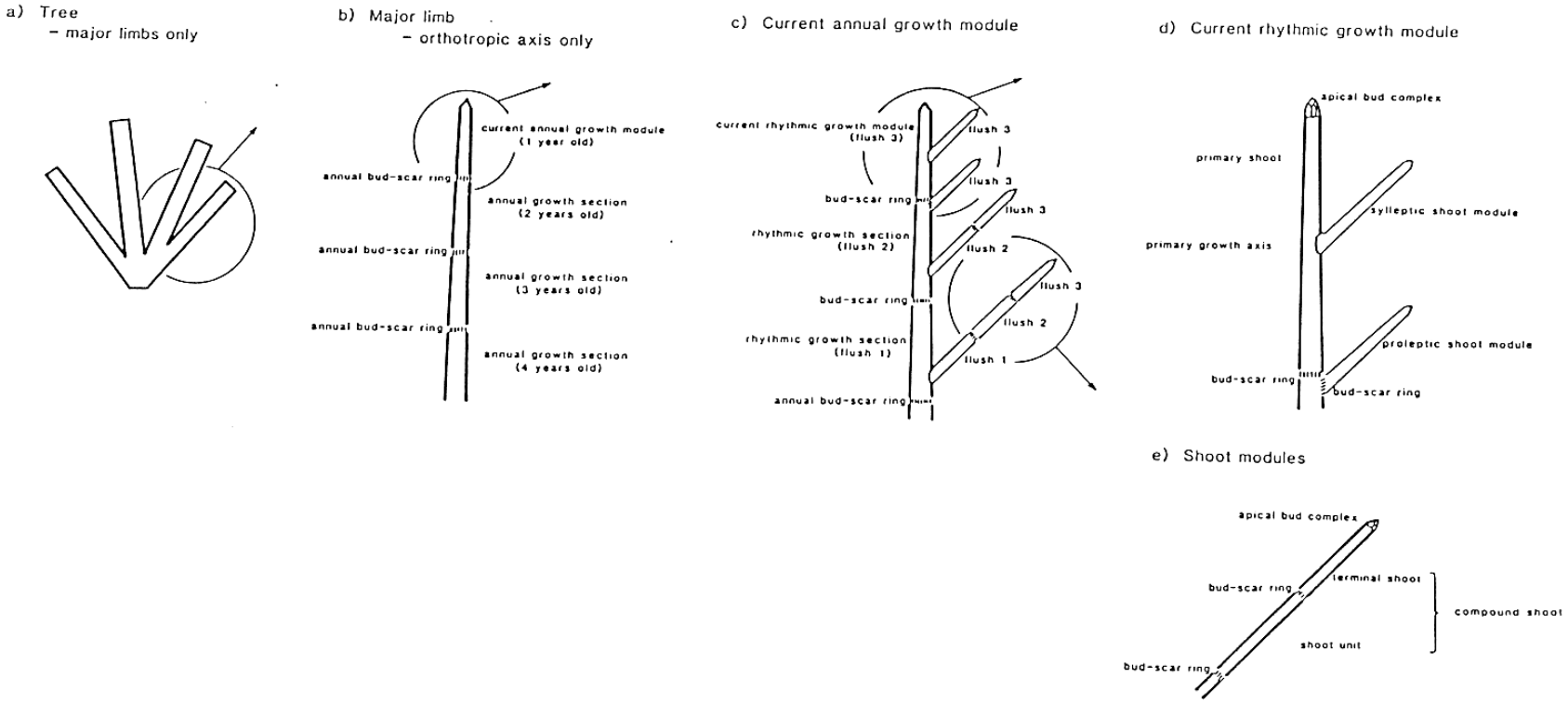



Fig. 7.1 Schematic diagram summarising modular construction in avocado.

# What to Prune

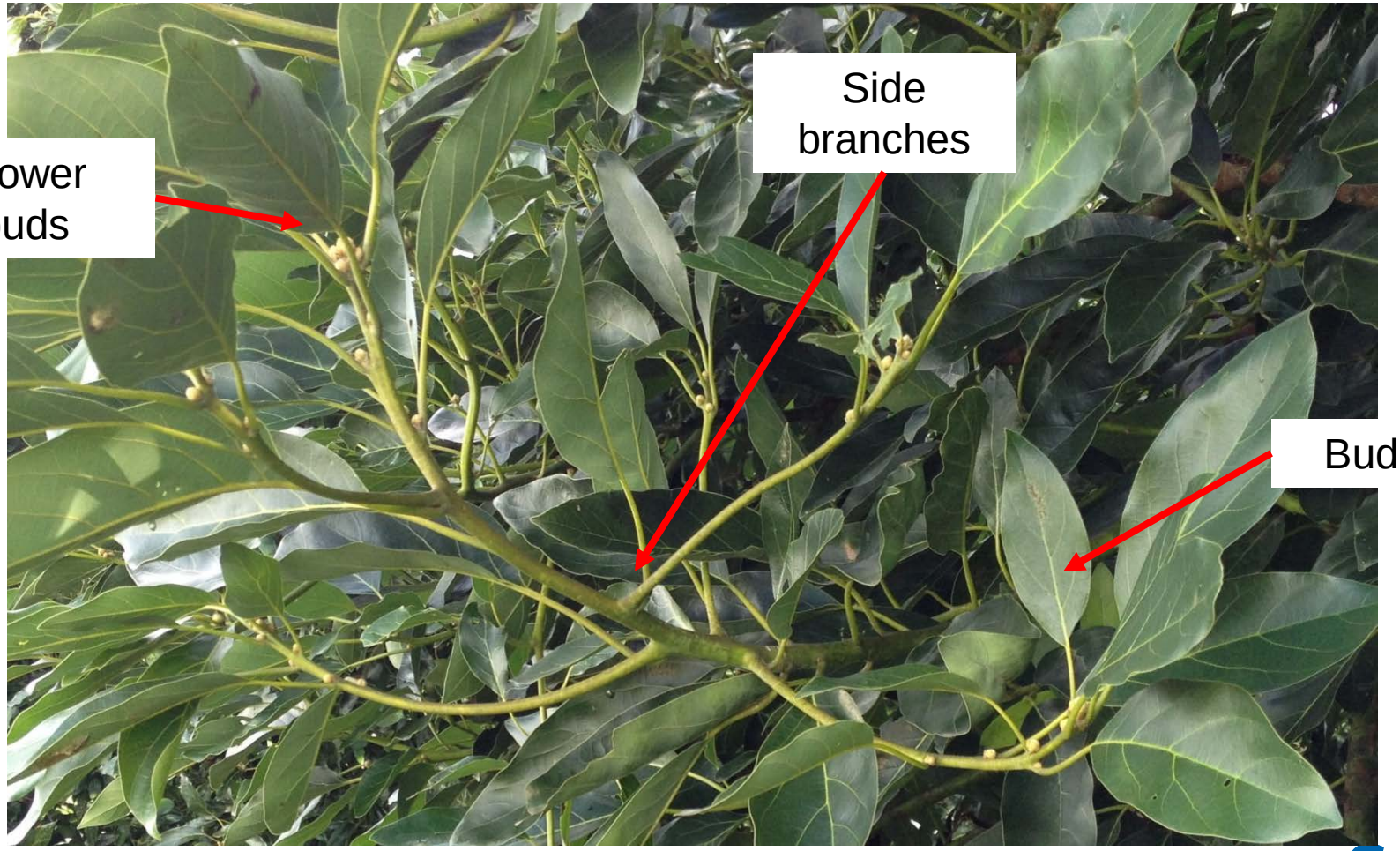
## Bud Ring

# What to Prune

## Proleptic shoot

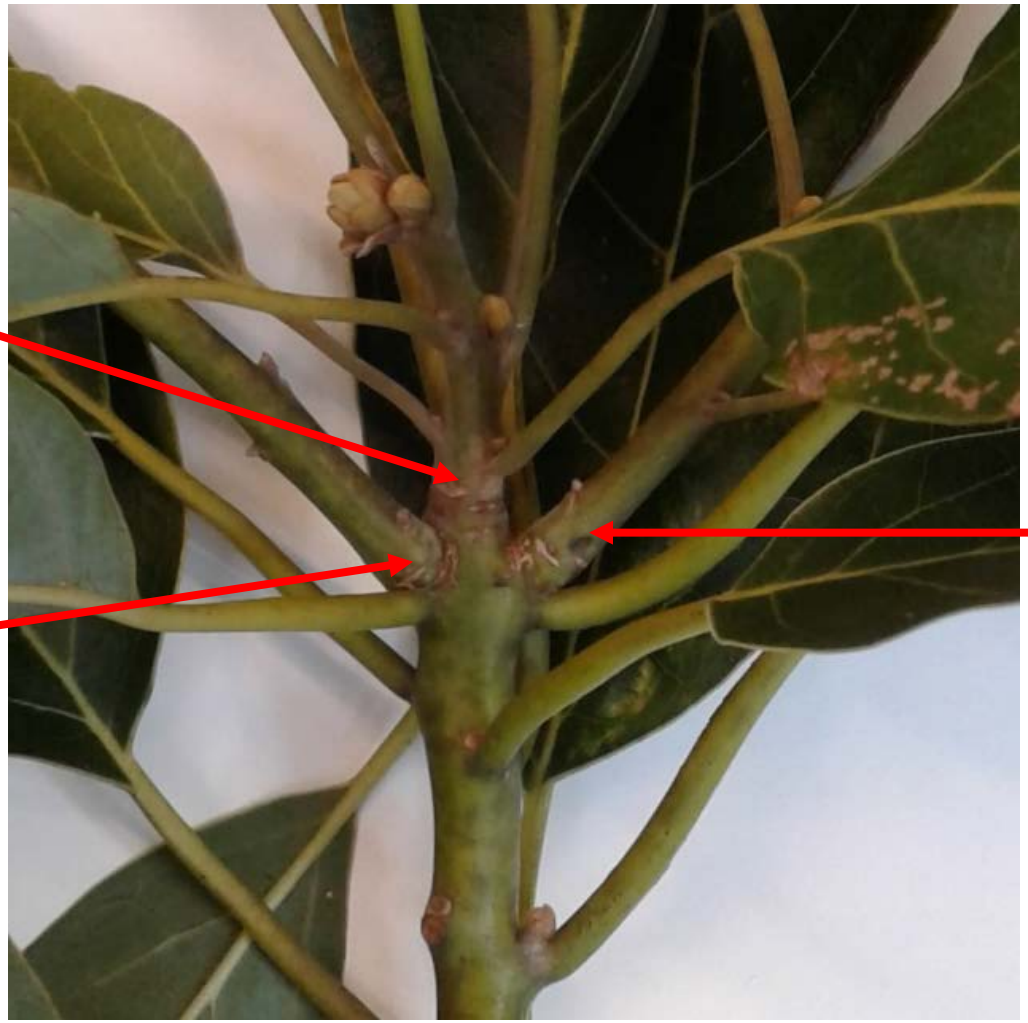
# What to Prune

## Sylleptic shoot



# What to Prune

## Summer flush



# What to Prune

## Important to understand as explains why happens after pruning

# What to Prune

## Follow up is vital or you get this

# What to Prune

## Reading the regrowth, why you need to know about budrings

# What to Prune

## Main types of pruning

- Structural – to fix the problem of trees being too large
- Maintenance – keeping the at the same size and productive
- Establishment – young tree shaping

# What to Prune

## Structural pruning

- Need to remove large limbs
- Target the tallest first and cut out 30% or more
- White wash the cut limbs to prevent sunburn (don’t paint the cuts)
- Regrowth in full sun for best results
- Manage nutrition
- Works best on producing trees to get production quickly

# What to Prune

## Structural pruning

- Stumping and Staghorn

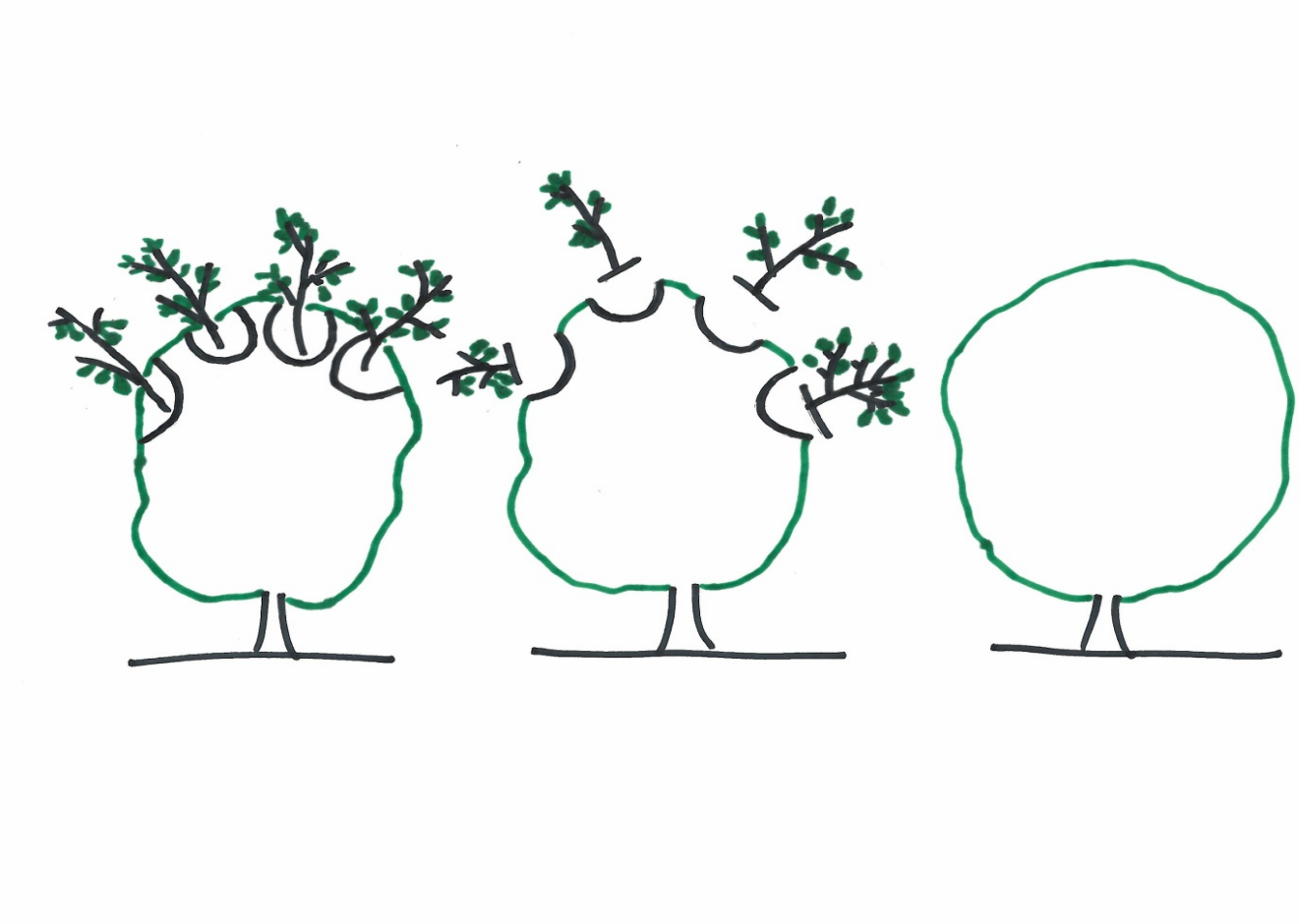
# What to Prune

## Maintenance

- Height control
- Do at least once a year maybe twice a year
- Remove the strong vigorous sylleptic shoots pushing out of the canopy
- These shoots are 1-2m taller than the rest of the tree
- Best cut in April/May below the line of the canopy
- Usually around 3-5 shoots per tree

# What to Prune

## Maintenance



# What to Prune

## Maintenance what and where to cut

- Cut after harvest in autumn
- Below the canopy line so in shade and don't get strong regrowth

# What to Prune

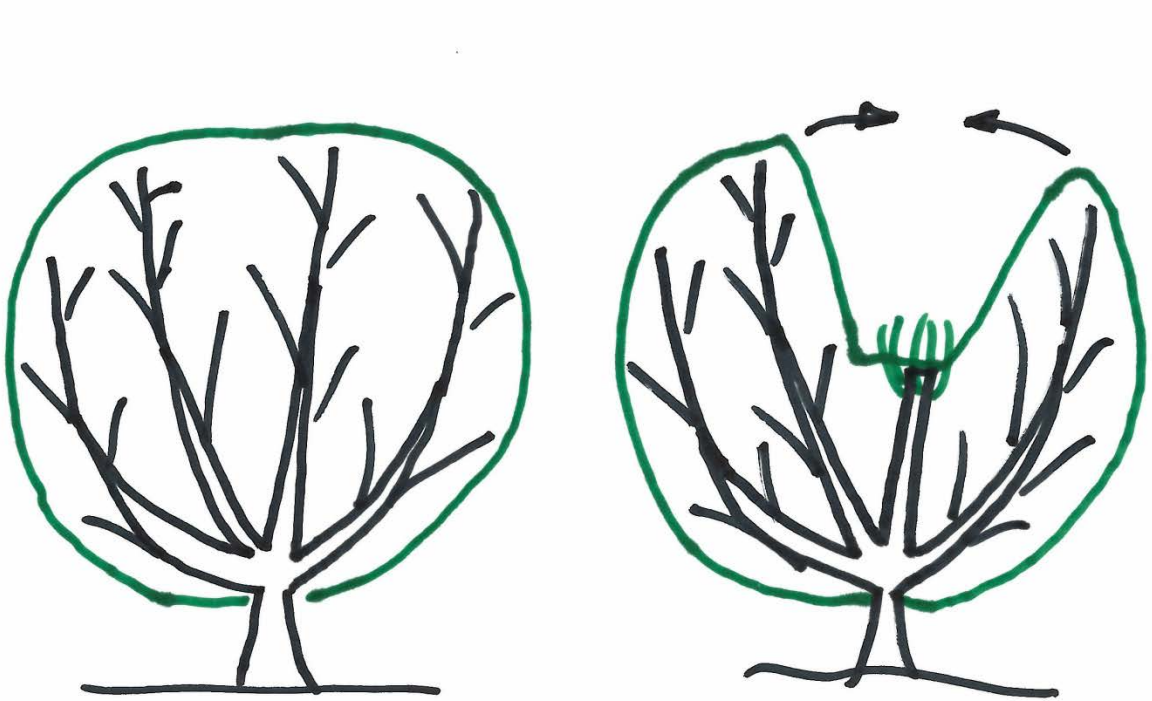
## Maintenance

- Open center
- Lots of variants with the same objective
- Can be for height control but not ideal
- Remove one, two or three large limbs in the middle or sides of the trees plus smaller branches
- Brings light into the tree and between trees and increases the canopy
- Improves spraying and picking efficiency

# What to Prune

## Maintenance

- Downside is canopy can close in quickly and you don’t get the expected benefit
- Don’t be too timid with amount of wood removed



# What to Prune

## Maintenance


# Growing Systems

## The future

- GEM for high density, Hass for medium density
- Plant on berms for easier high density management, good drainage and root location
- Plant at 400-500 trees/ha for GEM, 200 trees/ha for Hass
- Prune often to a plan being mindful of fruiting wood
- Move toward apple growing systems and have structures to support the trees, e.g. post and wire

# Avocado Growing Systems and Pruning

## The End

# Thank You