



Avocado Tree Pruning in Chile

The Basics, Part I

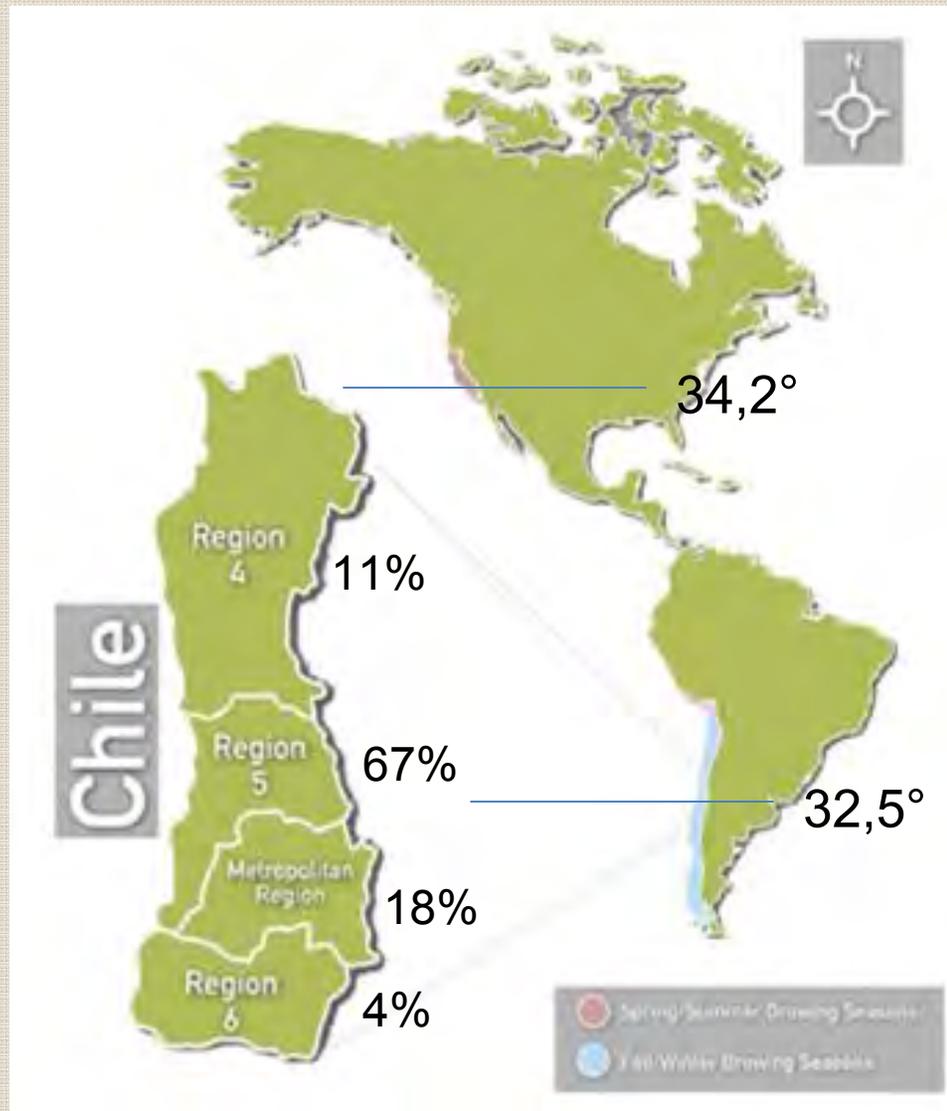
Claudio Hernandez A.
Ing. Agr. Technical Division
chernandez@propal.cl





Population: 17.400.000 (2012 estimated)
Cap: Santiago de Chile
GDP: US\$15.000.- per capita





80.000 Avocado acres
(estimated 2012)



Avocado area planted in Chile (acres)



(ODEPA)



Avocado exporters worldwide (tons)

TEMPORADA	Israel	Mexico	España	Usa	Sudafrica	Perú	Chile	Brasil	Total	Var Temp. Anterior
1994/ 1995	36.000	34.353	26.500	13.380	28.400		12.000		150.633	
1995/ 1996	49.100	44.000	31.500	9.444	27.417		16.700		178.161	15,5%
1996/ 1997	44.000	68.000	31.831	5.002	22.704		15.470		187.007	4,7%
1997/ 1998	35.000	34.117	54.878	4.230	52.000		44.514		224.739	16,8%
1998/ 1999	26.000	38.571	44.900	6.060	33.000		39.993		188.524	-19,2%
1999/ 2000	45.900	22.415	46.300	3.454	54.000		31.454		203.523	7,4%
2000/ 2001	38.545	52.475	42.190	1.697	34.000		54.592		223.499	8,9%
2001/ 2002	46.000	71.621	50.646	1.765	47.741		59.166		276.939	19,3%
2002/ 2003	27.000	94.243	31.000	1.458	39.132		86.425		279.258	0,8%
2003/ 2004	26.000	105.000	53.300	1.478	30.000		90.215		305.993	8,7%
2004/ 2005	53.000	134.000	44.700	1.432	47.400		134.986		415.518	26,4%
2005/ 2006	28.000	228.000	50.500	6.436	35.829	18.670	105.134		472.569	12,1%
2006/ 2007	57.000	271.000	45.400	2.274	37.600	31.738	164.071		609.083	22,4%
2007/ 2008	27.000	303.000	47.700	6.114	51.200	37.606	115.082		587.702	-3,6%
2008/ 2009	32.000	404.000	48.000	2.368	39.080	51.298	74.827	2.164	653.737	10,1%
2009/ 2010	45.000	386.000	28.000	0	40.000	52.663	194.441	1.832	747.936	12,6%
2010/ 2011	51.000	352.000	45.000	1.180	47.740	62.780	88.632	2.970	651.302	-14,8%
2011/ 2012	50.400	409.640	28.125	0	27.300	69.000	105.000	2.970	692.435	5,9%

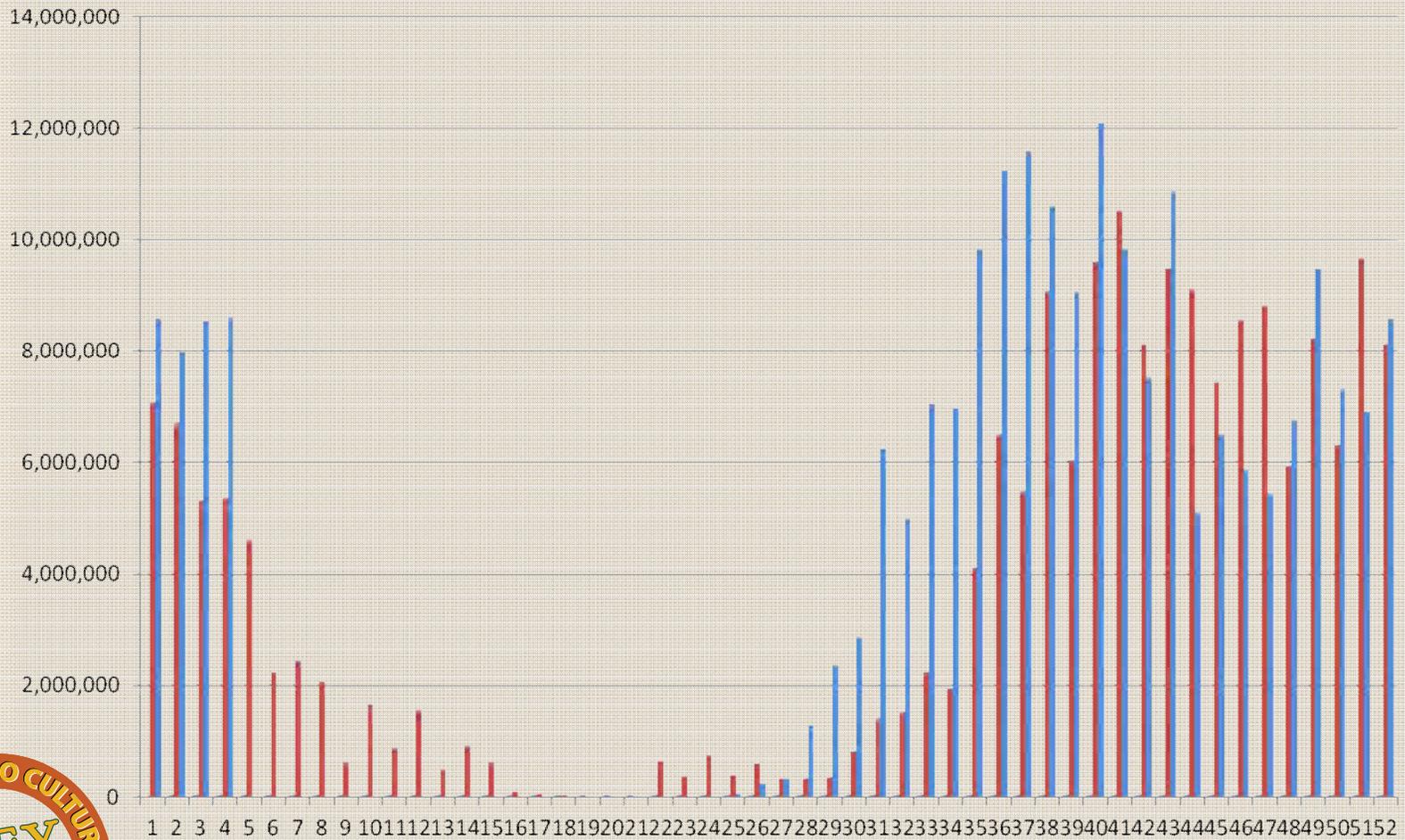
Major avocado importers (tons)

DESTINO	2011 / 2012 acumulado a la fecha		2010 / 2011 Total		Variación 2011/12 v/s 2010/11
	Volumen ()	%	Volumen ()	%	
USA	63.295	63,3%	54.320	61,2%	16,5%
EUROPA	30.075	30,1%	26.530	29,9%	13,4%
JAPÓN	1.014	1,0%	332	0,4%	205,4%
ARGENTINA	5.052	5,0%	6.989	7,9%	-27,7%
OTROS	633	0,6%	539	0,6%	17,4%
TOTAL	100.069	100,0%	88.710	100,0%	12,8%

Comité de Palta Hass

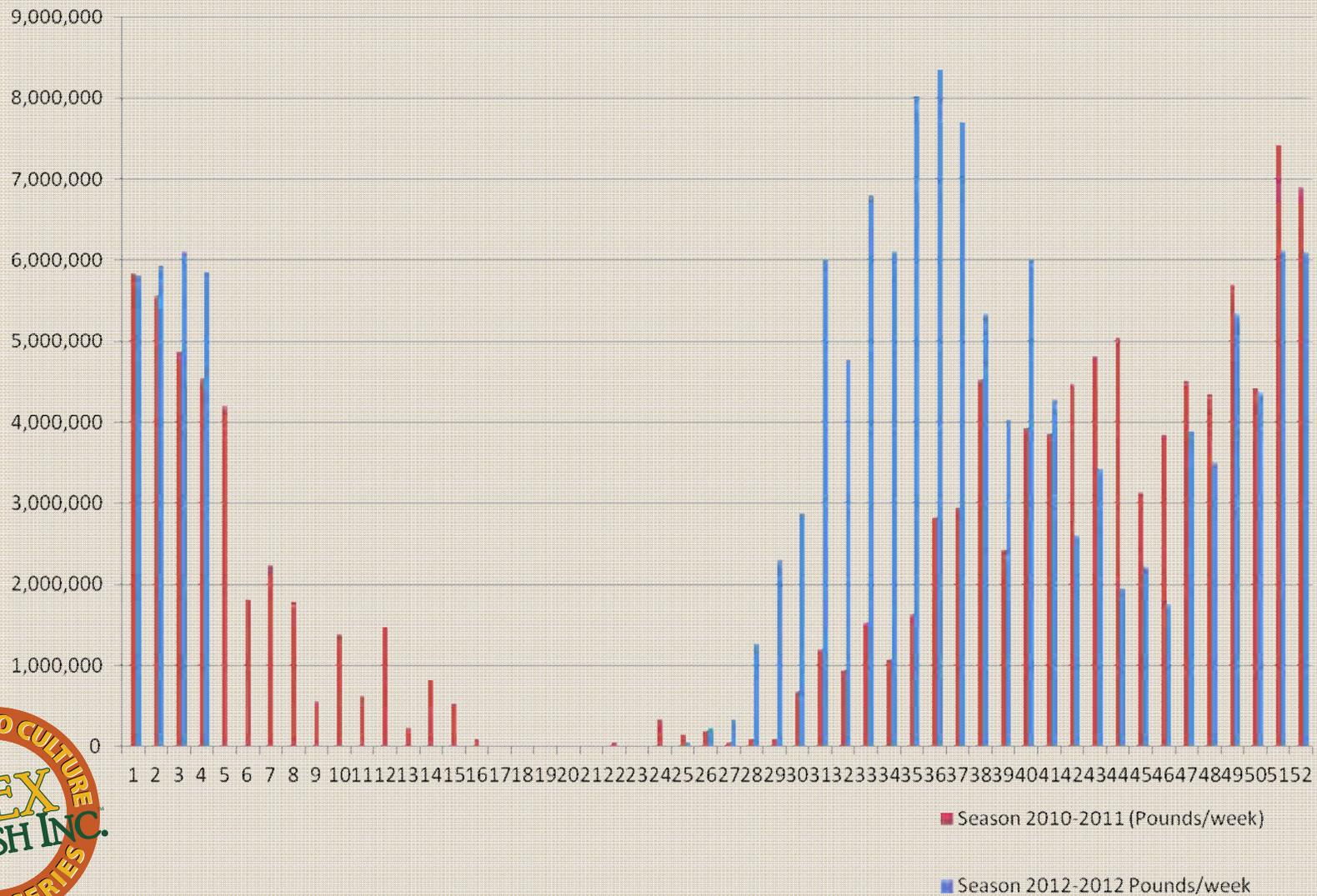


Total Chilean avocado exports 2010-11 / 2011-12

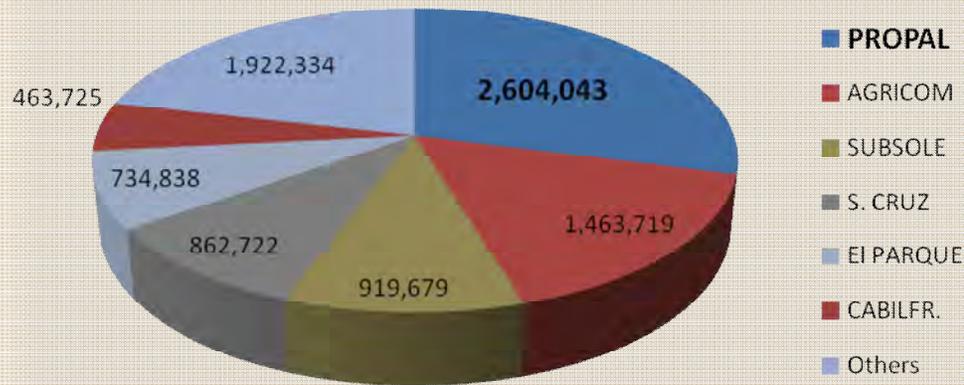


■ Season 2010-2011 (Pounds/week)
■ Season 2011-2012 (Pounds/week)

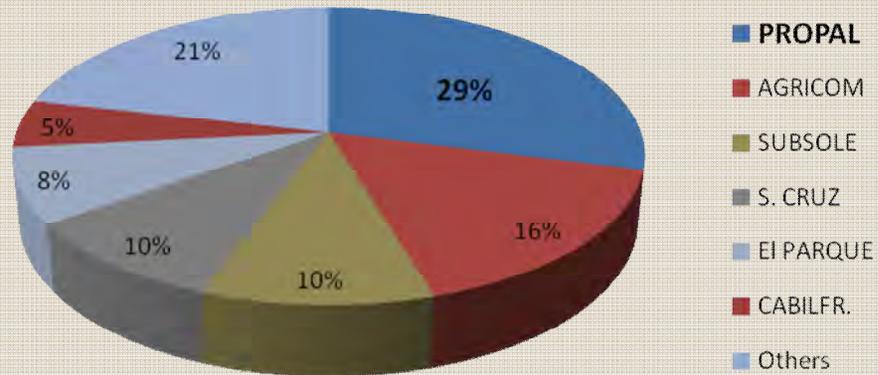
Total avocado exports to USA 2010-11 / 2011-12



Total Chilean Exports



**11,2 Kg boxes
Total: 8.971.061**





Avocado tree pruning in Chile



Introduction

Pruning is key to the productivity of avocado groves and should form part of the maintenance program for **every season**.

Pruning avocado trees reduces alternate bearing and produces more stable harvests. This also results in higher quality fruit (improved fruit size) and lowers production costs.

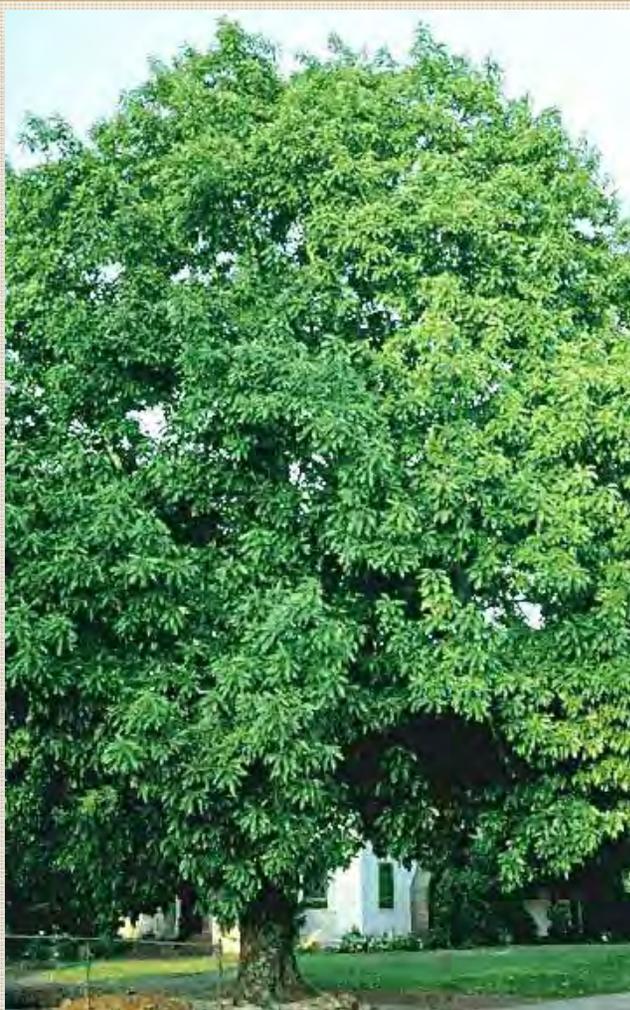


Introduction

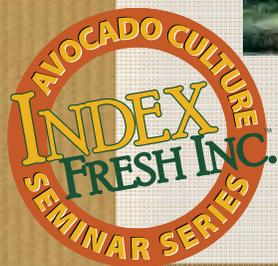
To understand the fundamentals of Avocado pruning, a clear understanding of the phenology (indicating when to prune) and the desired outcome (how to prune) is needed.

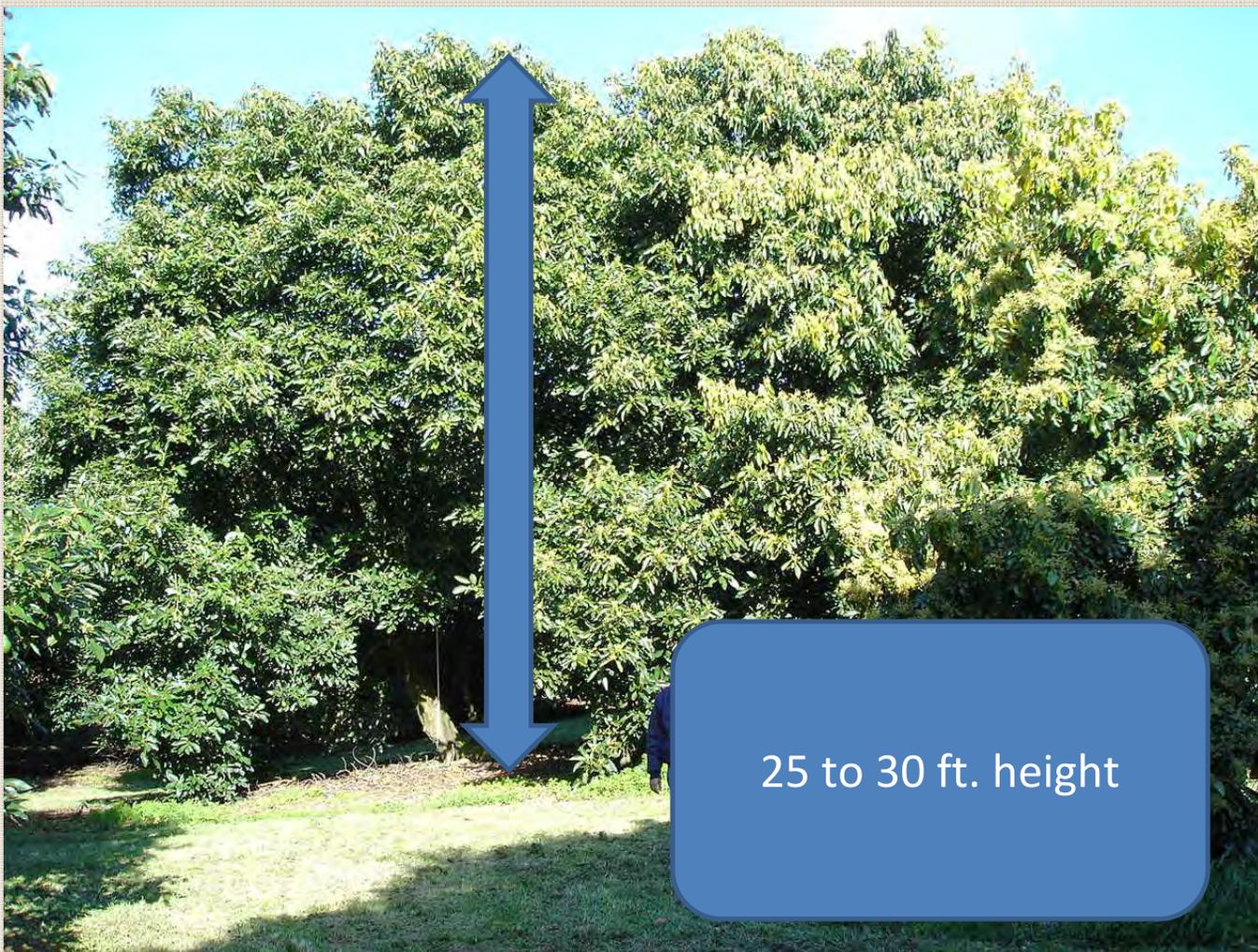
Wolstenholme (2002) indicates that the natural growth pattern of the Avocado is to form lush foliage to capture the most sunlight possible. In its search for light, the tree is capable of generating long, sturdy branches reaching a height of various meters.





The Avocado tree never stops growing; it only slows its development when the soil volume becomes a limiting factor for the growth of its roots.





25 to 30 ft. height



The Avocado originated in the tropical forests of Central America where competing in height with other species was necessary to receive sunlight. The only way to achieve this is to grow long vertical branches.

This natural behavior leads to the Avocado tree forming ample foliage at the top of strong branches. This also occurs when pruning takes place.

This growth pattern leads to the productive canopy being located at a greater height year after year growing further away from the trunk and covering the lower parts in shade which results in a loss of productivity.

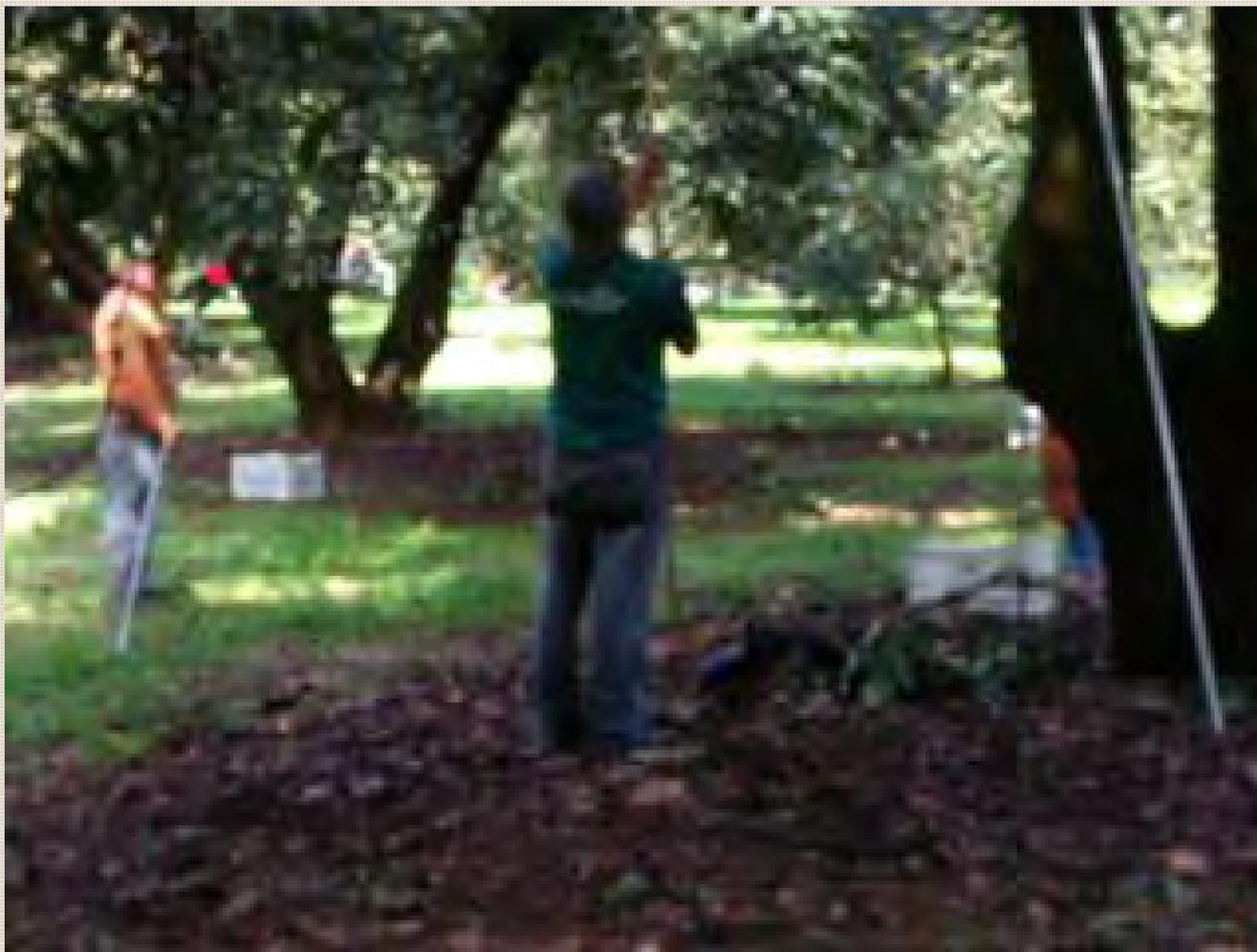
1. Higher harvesting costs
2. Higher accident risk
3. Lower quality of fruit
4. Lower spraying efficiency

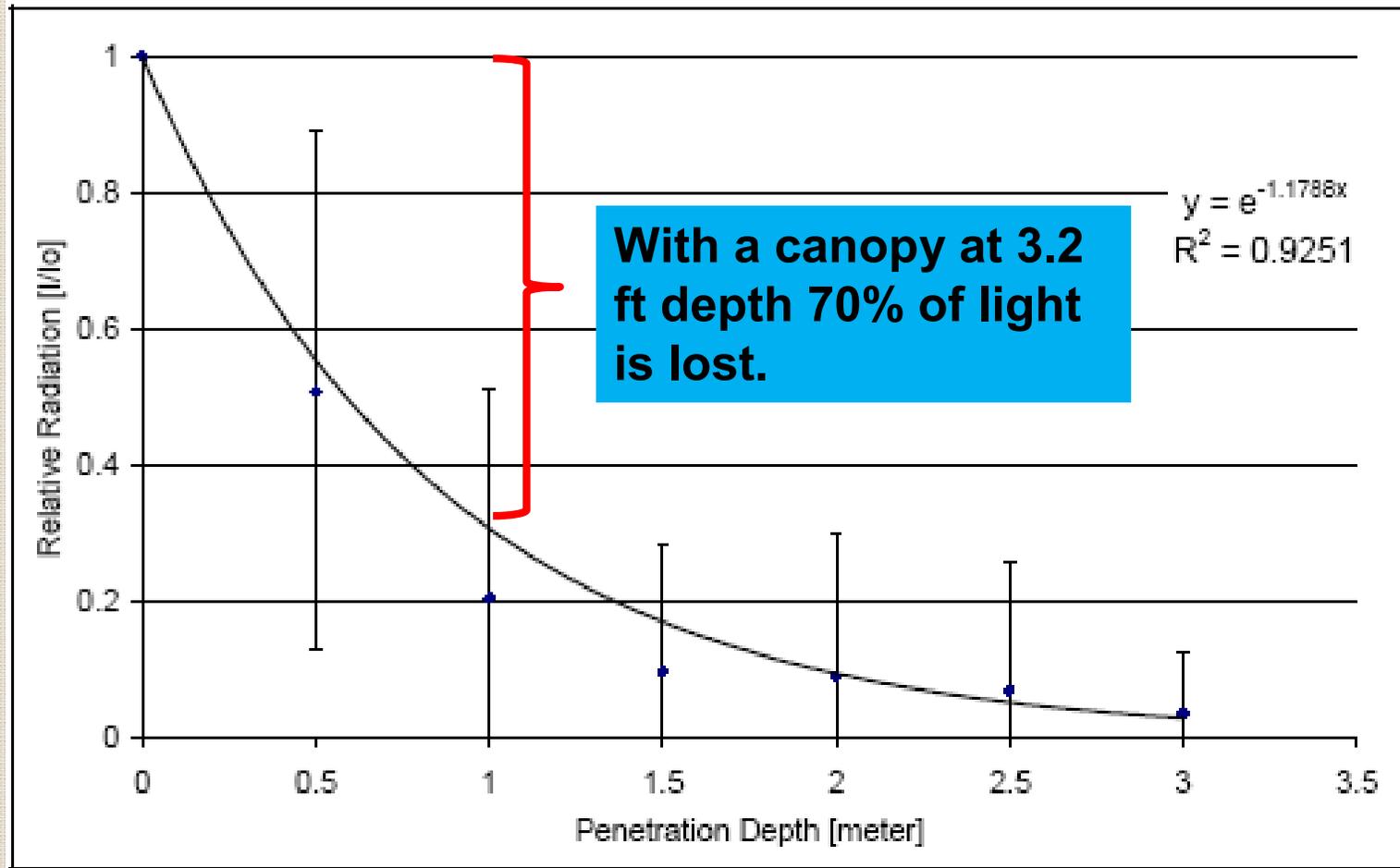








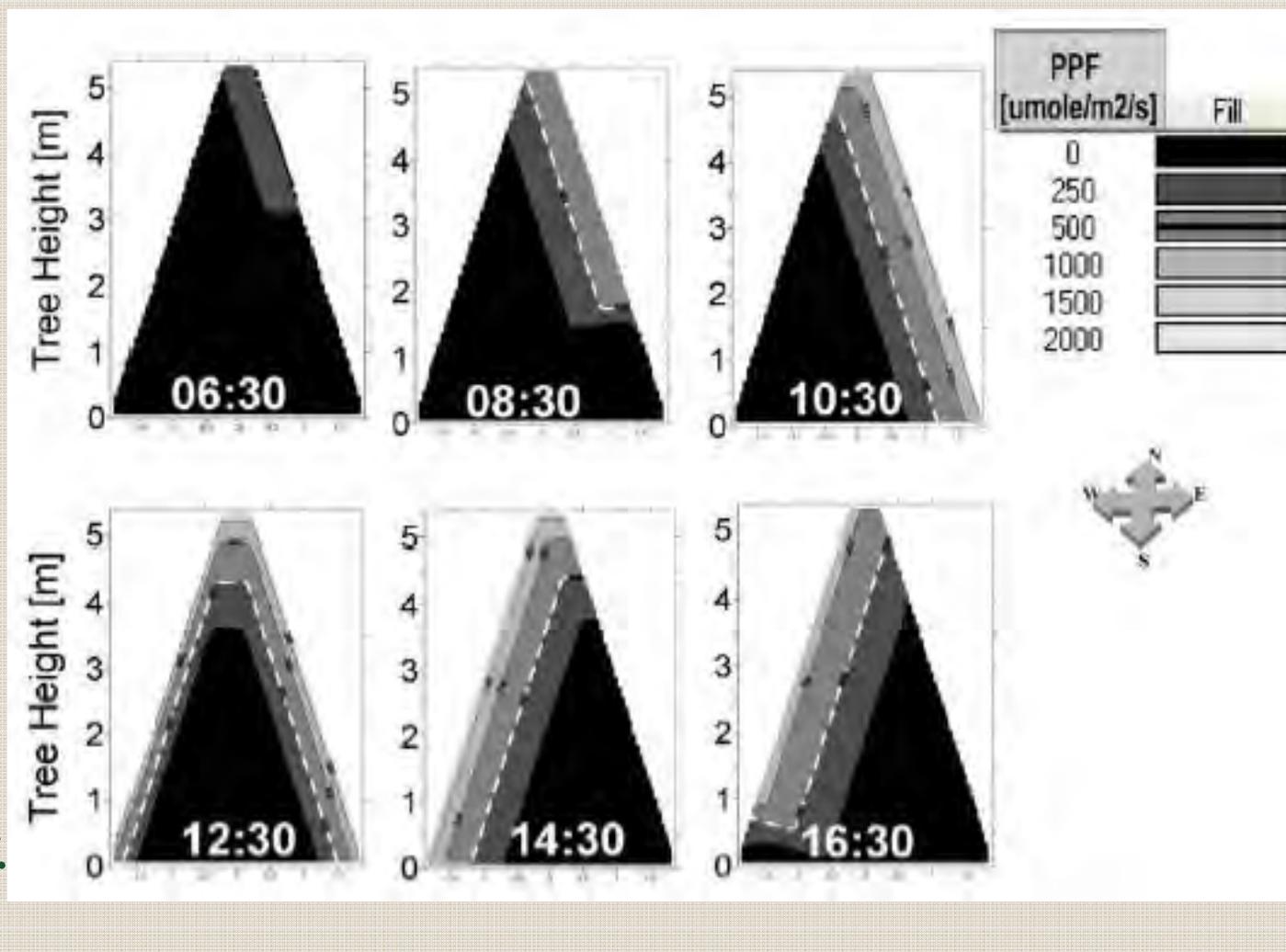




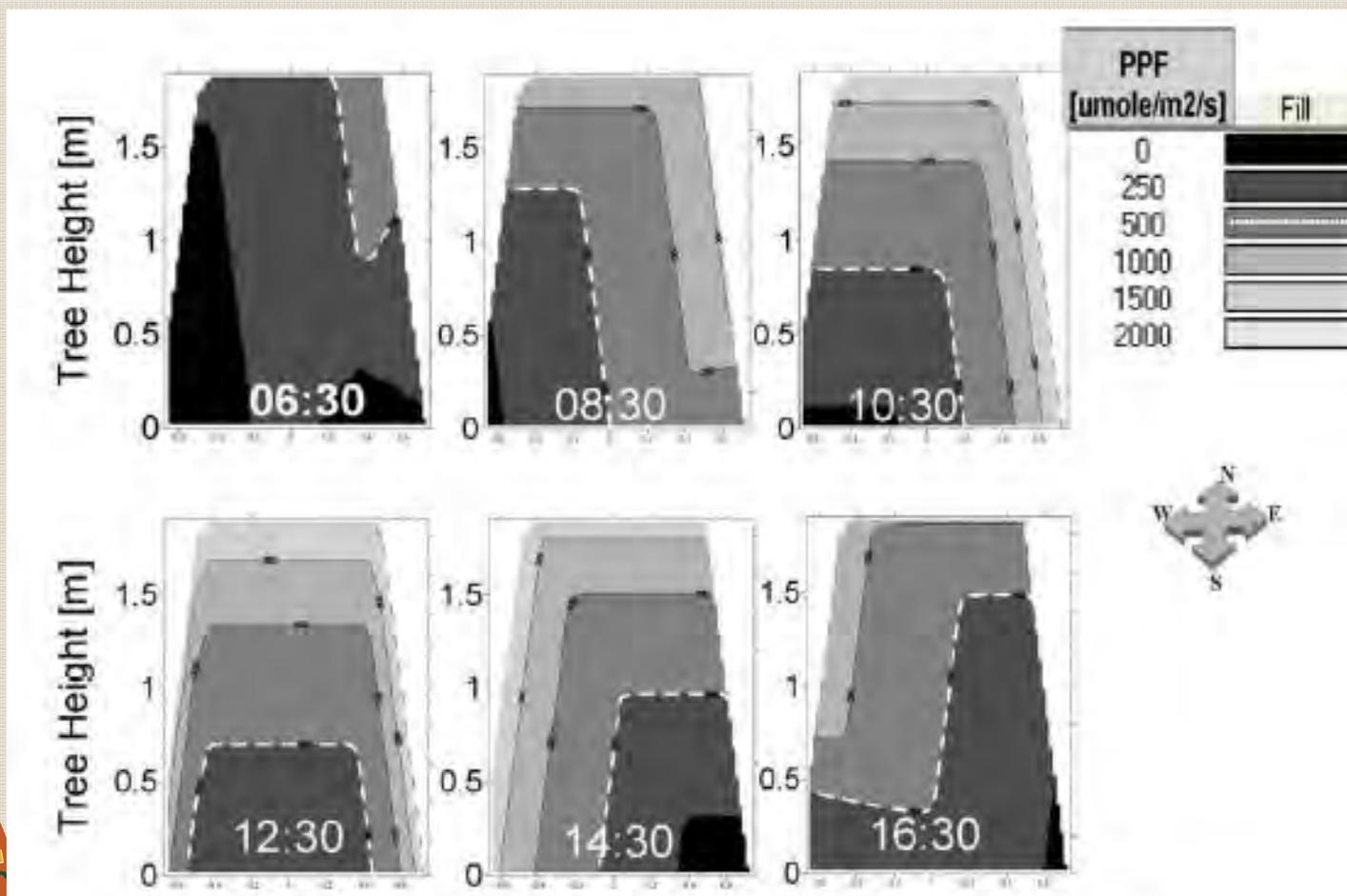
Differences in relative radiation in different canopy depths for cv. Hass (Hadari, 2004).



Simulation of day changes in the use of solar radiation in two canopy models: pyramidal and conical shape (Hadari, 2004).



Simulation of day changes in the use of solar radiation in two canopy models: pyramidal and conical shape (Hadari, 2004).



Avocado pruning has **advantages** and **disadvantages**:

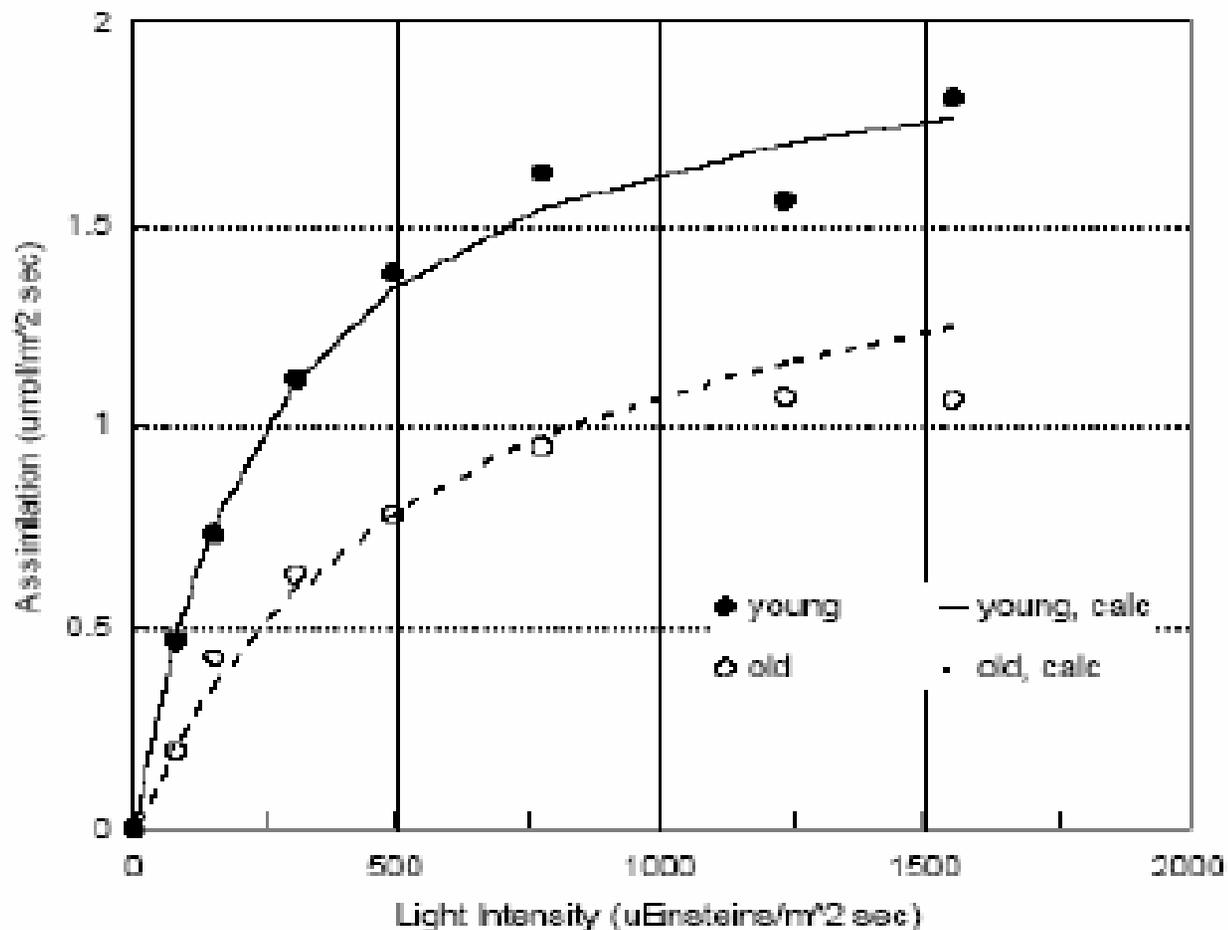
Disadvantages

- a) Initial loss of production (total or partial).
- b) Pruning costs.

Advantages

- a) Reduces alternate bearing.
- b) Improves fruit size.
- c) Higher efficiency of foliar treatments.
- d) Plants are contained in their space, keeping the original number of plants (per acre).
- e) Diminishes salinity effect (in affected zones).





Comparison of the photosynthetic capacity of new and old leaves at different lighting intensities (Heath *et al.*, 2003).



Canopy management should focus on the **circumstances** of each orchard:

a) In older orchards, pruning should aim at correcting canopy shape, renewing old branches, re-illuminating the lower parts of the canopy and controlling tree size.

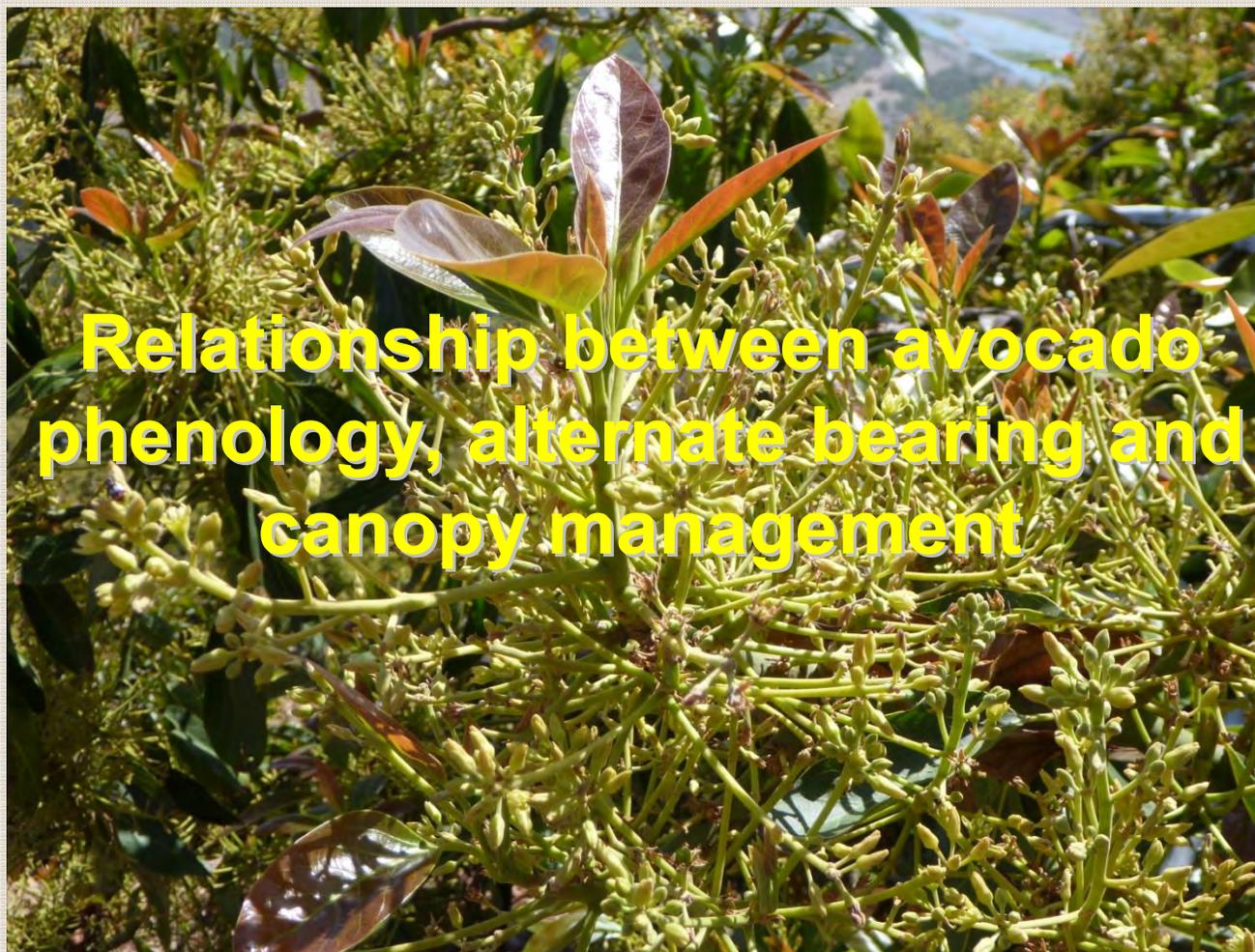
b) In young orchards, with higher planting densities, pruning should aim to maintain canopy illumination at the original level, maximizing the use of light to obtain the highest efficiency.











Relationship between avocado phenology, alternate bearing and canopy management



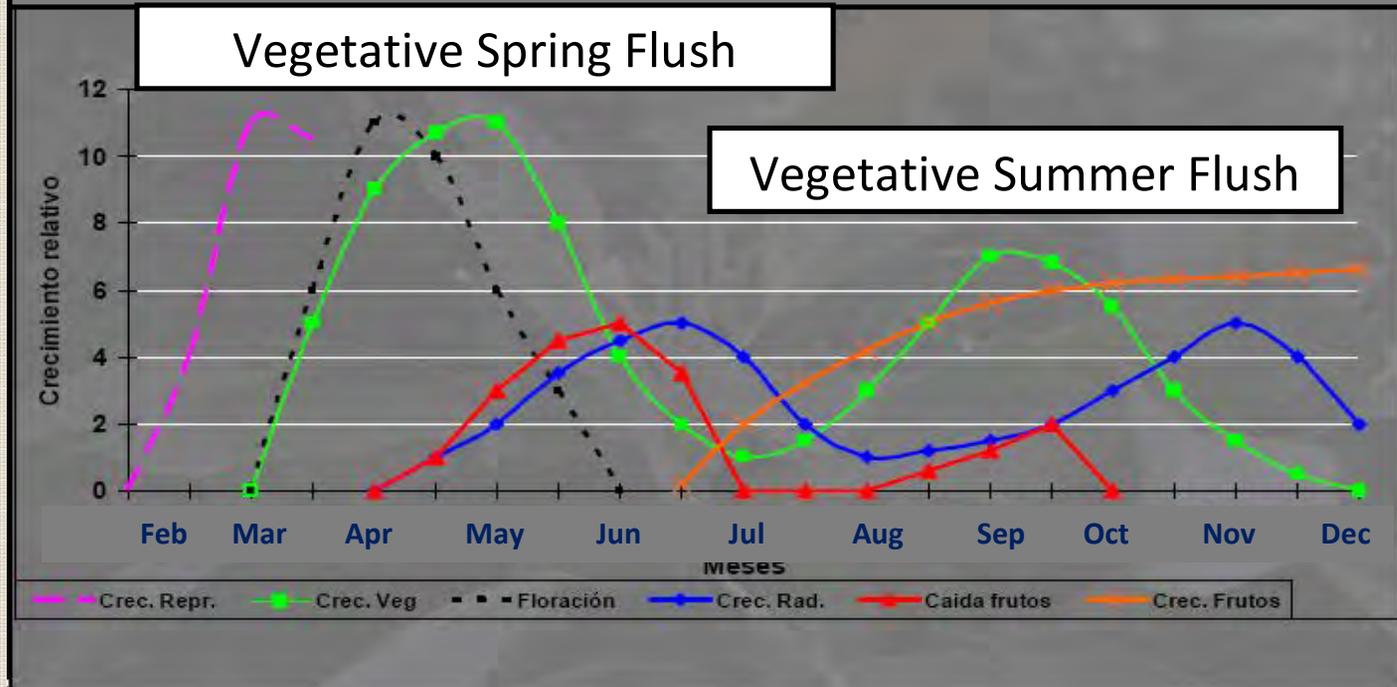
Phenology: Study of the relationship between climatic factors and living beings.

Bloom → Fruit Set → Sprouting → Root Growth → Fruit Development → Harvest

Physiologically: this cycle involves changes in vigour (growth rates) and starts, new growth processes that will lead to floral renewal or vegetative shoot production.



Phenology of avocado in Mediterranean climate



Vegetative Spring Flush: Should cover the new fruitlets, avoid sun damage, and is vital for obtaining good fruit size at harvest.



Vegetative Summer Flush: Starts in mid-January (mid-July in Northern Hemisphere), is the major period of shoot growth for increasing canopy size, produces floral renewal for the next spring, and if vigour is too high, can produce overcrowding. Ideally, it should produce sylleptic shoots.



Alternate Bearing

Avocado trees have alternate bearing. It is a part of their genetic make up, but it can be minimized through pruning and fertilization management strategies, among others.

This produces years of high flowering followed by high production (**ON Year**), which results in reduced flowering in the following spring (**OFF Year**).

This alternate bearing pattern is triggered by:

- a) Genetics of the species
- b) Late harvest
- c) Climatic hazards (frost)
- d) Fruitset problems (producing low production)
- e) Errors in irrigation



High Production Year (ON)



1. Heavy flowering in spring
2. High yield
3. Small fruit size
4. Limited development of spring shoots
5. Increased sun damage on fruit
6. Poor sprouting in summer
7. Reduced intensity of flowering in the following season (low production)

Low Production Year (OFF)



1. Poor flowering in spring
2. Low yield
3. Large fruit size
4. Increased development of spring shoots
5. High vigour in summer flush (potential for overcrowding)
6. Increased intensity of flowering in the following spring (high production)







Therefore:

ON Year: Reduces the floral sites for the next spring (decreasing flowering).

OFF Year: Increases the floral sites for the next spring (increasing flowering).

The intensity and time of pruning will depend on the strength of flowering that is expected. Thus, two general criteria can be established:

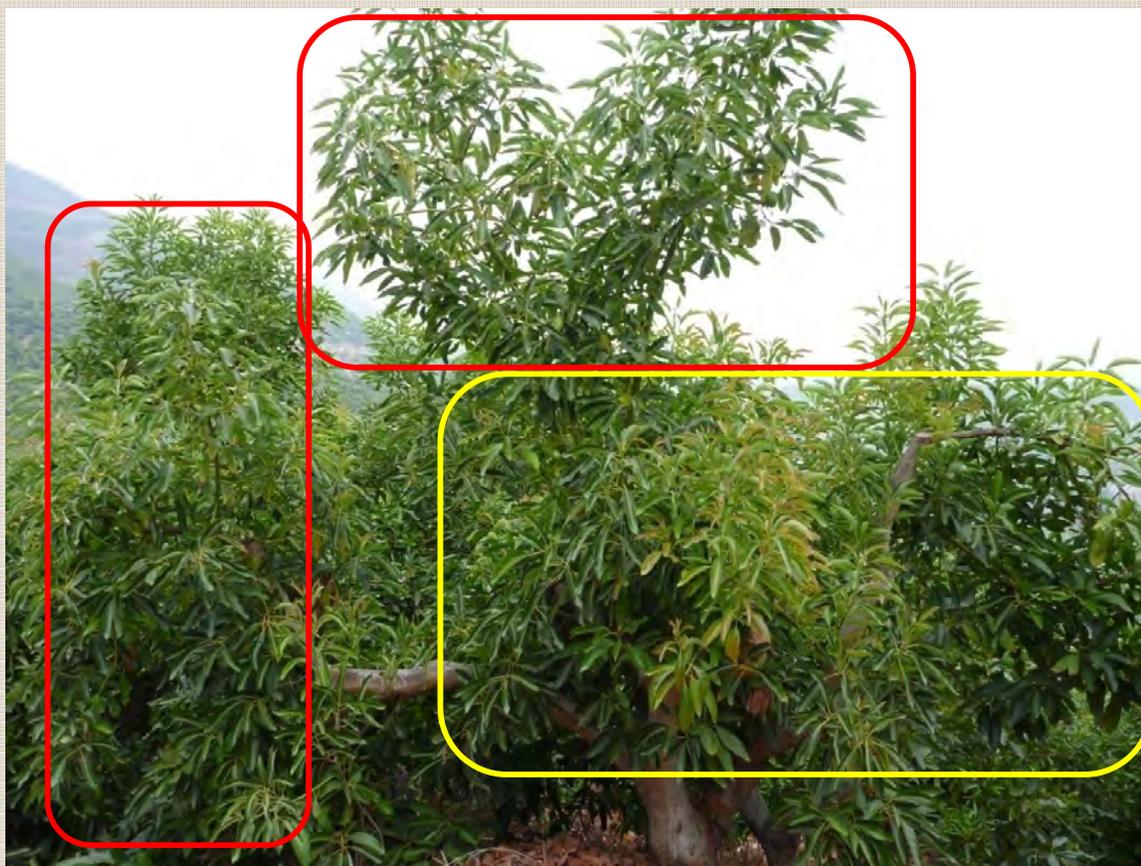
a)ON Year: The pruning should be intense and early in the growing season, the new growth can mature in autumn with buds that will be induced to flowering (scoring). In this manner, we can obtain flowers in the next spring (Off Year).

b)OFF Year: The intensity of pruning depends on the degree of overcrowding, and it must be done in summer. Thus, the new growth will not reach the flowering stage, and will remain in a vegetative state in the following spring. This will decrease the intensity of flowering in the following season (On Year).

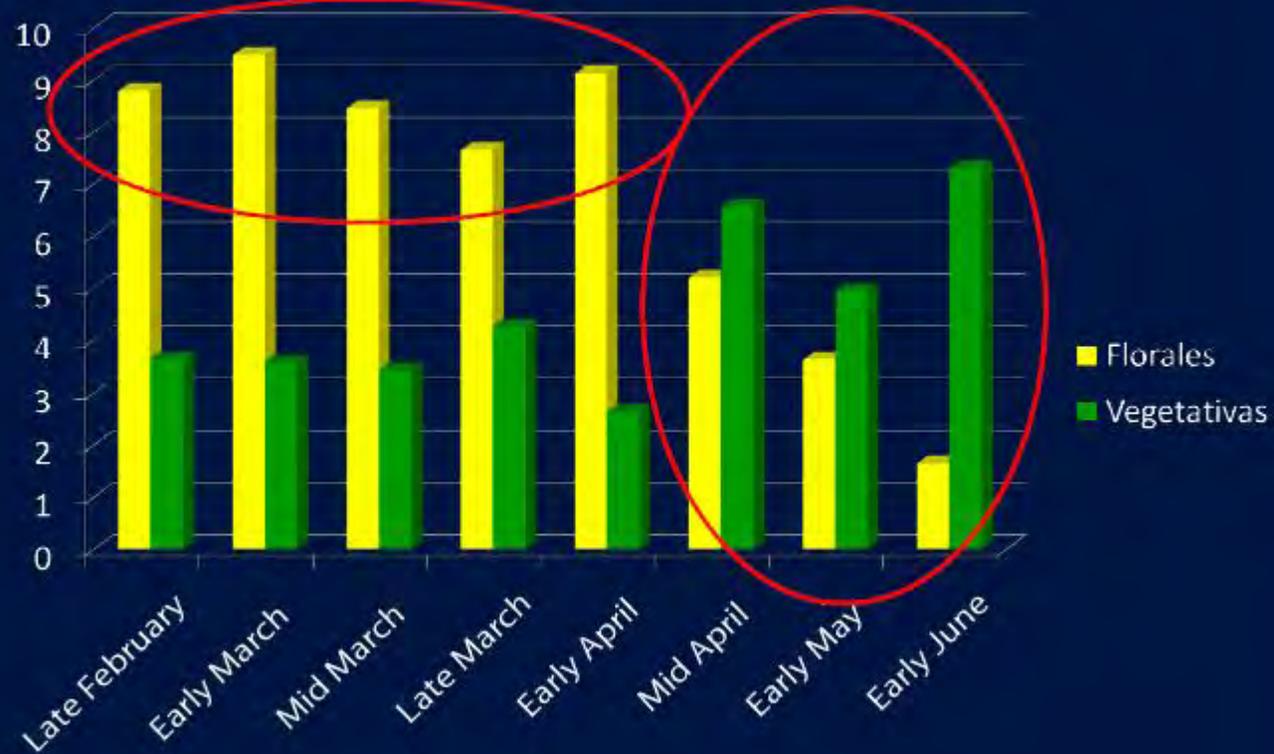


Objective:

You must create a balance between vegetative growth and productive branches, in this way production can be maintained while alternate bearing is decreased.



Timing of pruning – Effect on floral or vegetative buds



ON Year pruning (early in spring)

OFF Year pruning (summer)

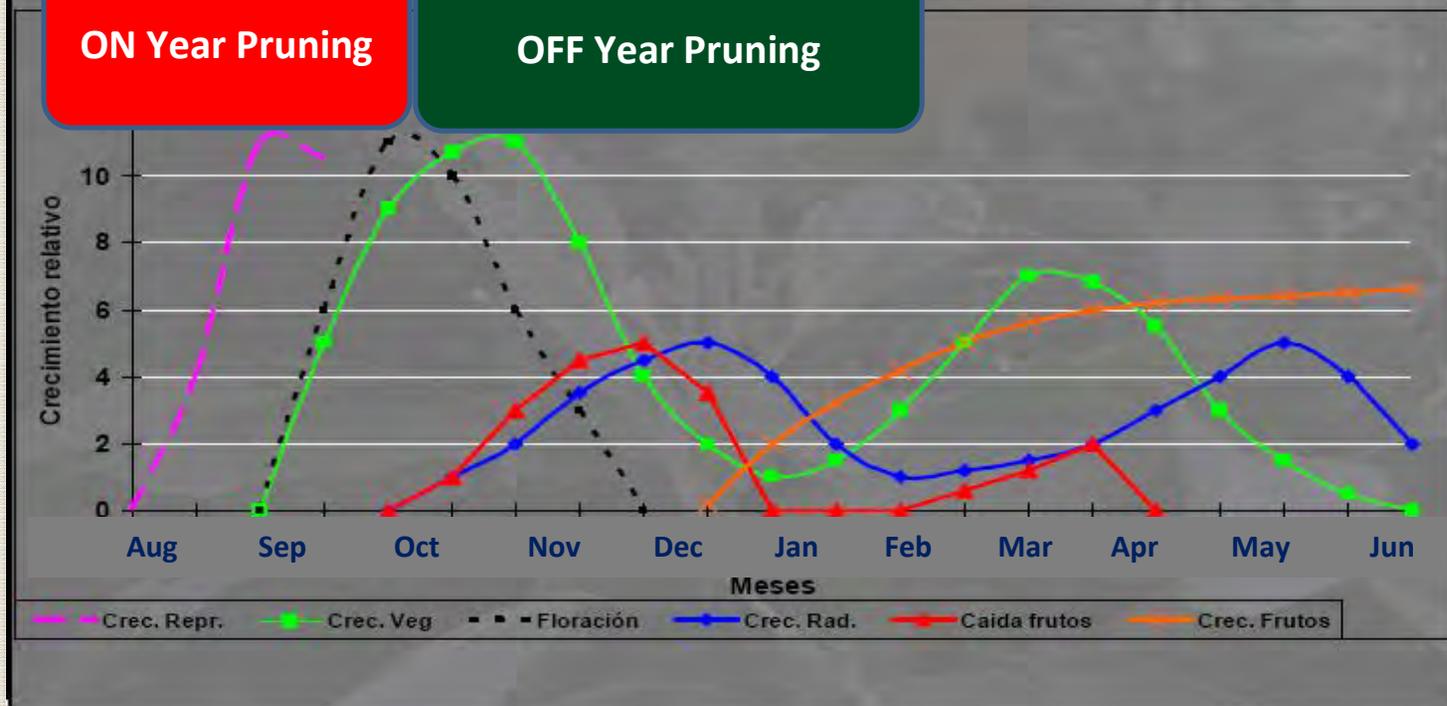
Adapted from Gardiazábal *et al.*, 2011



Phenology of avocado in Mediterranean climate

ON Year Pruning

OFF Year Pruning









Generate new vegetative shoots that are the sites for the next flowering season.











The aim of summer pruning is to maintain the illumination within the canopy, control plant size, and eliminate excess floral buds to increase vegetative shoot growth in the following spring.



Height Control and Overcrowded orchards





Height reduction pruning generates new shoots at the height of the cut.















Mechanical Pruning in Avocados











Effect of harvest time related to the time of pruning

In warmer areas (inlands), fruit harvest typically occurs within 12 months of flowering.

In contrast, cooler areas (coastal) have a range of flowering to harvest time of more than 12 months (up to 18 months in some cases).



Therefore, pruning recommendations vary:

Warm Zones: Prune immediately after harvest, before flowering, followed by management of new growth (great vigour) during the summer.

Cool Zones: Normally pruning will eliminate flowers and developing fruits, so the need for pruning should be evaluated according to alternate bearing. It is advisable to wait for the end of the ON year's harvest when the orchard is on an OFF year to perform the pruning.



Therefore, if decreasing alternate bearing is desired in cooler areas, the pruning should only be done in the spring of the ON Year (with high flowering).

The recommendation is :

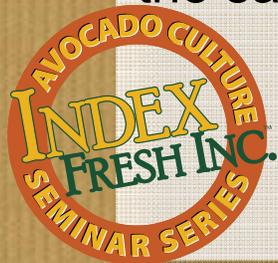
1. Identify one or two central vertical branches whose removal will allow sunlight to reach the lower part of the canopy.
2. Early sweep harvest only in these branches.
3. Prune early in the spring, leaving the rest of the fruit on the rest of the canopy.

Thus, in the ON Year we stimulate new vegetative shoots (floral sites) that will produce flowers in the next OFF Year, avoiding a drop in production.



Conclusions:

1. The grower must be convinced that to sustain high yields, and good fruit size over time, pruning should be done every season (mid – long term view).
2. The grower must accept that a loss of some fruit will contribute to a better crop quality overall (improve fruit size) and reduce alternate bearing.
3. The timing and intensity of pruning that must be done each year varies according to the alternate bearing patterns.
4. The pruning always must have a purpose: growers can't perform the same pruning every year.



Conclusions

5. Pruning early and intensely: When you know that trees will have high flowering (the beginning of ON year).
6. Pruning late (summer): When the flowering in the spring is low (OFF Year).
7. You must always keep the orchard illuminated, to avoid losing production in the lower and interior parts of the canopy.
8. Tree height should be kept under control, and kept the trees within their individual space.



In cold areas with risk of frost, pruning work must be completed by mid-summer, as the new shoots which mature during the fall decreasing the risk for frost damage.

Thank you very much for your attention!

