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POLLINIZERS AND POLLINATORS – DO THEY MAKE A DIFFERENCE?

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*University of California, Riverside; *Del Rey Avocado Co.*

Note: For an expanded view on avocado flowering terminology, refer to the enclosed Avocado Flowering Basics insert on page 4.

Two common questions for those considering ways to increase Hass avocado productivity are: 1) Will pollinizer varieties (these are avocado varieties which can serve as pollen donors to Hass) enhance yield and 2) Is it worthwhile to use honey bees as pollinators? The answers to these questions are complex and depend on a number of factors. Previous research supports the use of pollinizers for enhancement of yield, but other findings suggest no substantial benefit. The introduction of pollinators into orchards to enhance yield is also contentious. Questions regarding the actual need for honey bees, spatial placement in the grove, and hive density are controversial. A project currently funded by the California Avocado Commission is looking for answers to these questions. Below we present some of the preliminary evidence gathered during the first year of the project.

Do pollinizers enhance yield?

In 1999 M. L. Arpaia and B. Faber established a research plot in Ventura County designed to look at whether there were differences in the siring capabilities of pollinizer varieties and whether distance between pollinizer and Hass trees can affect yield. We selected seven varieties of "B"-flower-type avocados grown on clonal Duke 7 rootstock. These were Zutano, Bacon, Ettinger, Fuerte, SirPrize, Nobel (BL667), and Marvel (BL516). We also included Harvest, which is an "A"-flower-type. The latter three varieties are unreleased

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Canopy Management as a Strategy to Increase Returns

Guy Witney, Production Research Manager, California Avocado Commission

UC Farm Advisors have long advocated that the most cost-effective way to increase per-acre production in the immediate future is to renovate existing acreage and return low-yielding, crowded orchards to their full-yield potential. This, they surmised, could be achieved and sustained through careful canopy management.

The Production Research Committee (PRC) has bought into this concept, using the CAC Visiting Researcher Program to invite world leaders in the field of canopy management to California to help growers learn the concepts of grove renovation. Piet Stassen (South Africa), Cliff Lahav (Israel), and Greg Partida (Cal Poly Pomona) have recently presented both

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RESEARCH UPDATE

Research in Dr. Joe Morse's lab indicates that avocado thrips have developed resistance to sabadilla (Veretran D) in groves where the product has been used multiple times. This is of real concern and growers should limit the number of sabadilla treatments to preserve the efficacy of this thrip control tool.

Although the abamectin (Agri-Mek) label limits treatments to two per year, resistance potential with this material is perhaps of greater concern because of its much longer persistence (field and lab studies indicate a two to three month impact on thrips mortality). Dr. Morse continues to monitor potential resistance development this season.

Watch for meeting notices in the CAC *Greensheet* or log onto www.avocado.org/growers for more information.

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California AVOCADO COMMISSION

POLLINIZERS AND POLLINATORS

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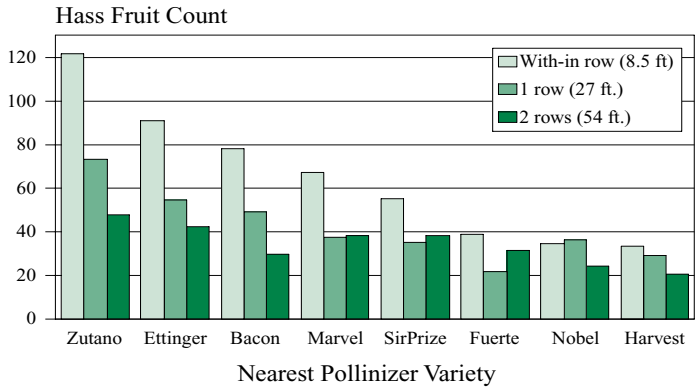
selections from the UC Avocado Variety Selection Program and are currently being evaluated for commercial release. All varieties were interplanted into an established two-year-old Hass planting on flat ground in the Oxnard plains. Currently, none of the trees are touching and there is plenty of free space surrounding each tree. Hass tree spacing at the experimental site is 17 x 27 ft. The pollinizer varieties are planted every sixth row. In the pollinizer row, the pollinizer trees are offset at a distance of approximately 8.5 ft. from the Hass trees. We are then able to examine yield of Hass at the following distances from a pollinizer variety: 8.5, 27, 54 and 81 ft. The trees that are three rows (81 ft.) away are actually equidistant from two of the pollinizer varieties.

In March 2001, we harvested three of the six replicated blocks for a total of 340 three-year-old Hass trees. We looked at yield of the Hass trees as a function of distance from the pollinizer row. The preliminary harvest results are presented in Figure 1. The data corroborate the fruitlet count data that were presented both at the Fall 2000 Avocado Research Symposium and at recent avocado grower meetings. These data strongly suggest that distance from the pollinizer influences Hass yield. The data also suggest that there may be pollinizer varietal effects on Hass yield. The data from this first year show that the highest fruit counts were obtained when Zutano was the pollinizer variety followed by Ettinger and then Bacon. Of the two unreleased "B"-flower-type selections, it appears that the Marvel may also serve as a good pollen donor. This is of

FIGURE 1



interest since the Marvel tree is considerably smaller than the three top pollinizer varieties (Figures 2 and 3). The SirPrize, which has already been commercially released by UC, performed better than the Fuerte, although we suspect that the Fuerte did not bloom in 2000. Hass trees planted near Harvest, which is also an "A"-flower-type, had the lowest yields.

This season we are monitoring the flowering behavior of these pollinizers in more detail so that we can better understand potential differences when we harvest the Hass trees again in 2002.

Do pollinators enhance yield?

Research in Israel by Dr. Gad Ish-Am and others clearly demonstrated that the honey bee is an effective pollinator of avocados although it prefers other flower species such as citrus and wildflowers. As part of this project, we have been examining potential race differences between the Italian race honey bee and the New World Carniolan race honey bee as avocado pollinators. We monitored the percent of the honey bees visiting avocado flowers during the day. We used the presence of perseitol, a sugar unique to avocado, to assay for honey bee visitation to avocado flowers. We noted differences between the two races with regard to avocado visitation with the Carniolan race tending to have a higher visitation rate to avocado, depending on the research site.

FIGURE 2
Relative tree size of Zutano

FIGURE 3
Relative tree size of Marvel

This part of the project is being conducted in collaboration with Dr. Arnon Dag and Dr. Sharoni Shafir in Israel who are carrying out similar studies. The 2000 Israeli research results suggest that there are indeed race differences. The Israeli data showed a significantly higher percentage of perseitol in the honey of Carniolan race honey bees as compared to the Italian race honey bees. We are continuing this collaborative effort for the 2001 flowering season. This work is being carried out at two sites representing a coastal (Oxnard plains) and an inland (Fallbrook) environment. Additionally we are collaborating with Dr. Tom Davenport from the University of Florida and Dr. Thomas Chao from UC Riverside. With them, we are investigating whether pollination and subsequent fertilization can take place in the male phase of flowering. Dr. Davenport is also investigating pollination efficiency in an environment without insects. He is doing this by caging trees and collecting airborne pollen at a coastal (Oxnard plains) and an inland (Fillmore) site.

What does it all mean?

Our results from this first year suggest that at least under certain conditions pollinizers can indeed enhance yield. More importantly, we also have data from young trees that there are differences between pollinizer varieties. Whether we will observe the same trends in the data in the upcoming year remains to be seen. We have also collected preliminary data, supported by the data from Israel, that suggests there are honey bee race differences in avocado flower visitation. These data will be important as we continue our efforts in identifying the many factors, which can enhance avocado productivity.

What Should You Do in the Face of International Competition?

Reuben Hofshi, Chair, Production Research Committee, California Avocado Commission

Chile is now the third largest Hass producer in the world, behind Mexico and California, and has become a formidable competitor for US avocado consumer dollars. It currently has 45,767 acres (Chilean Fruit Growers Association) as compared to the California industry with an estimated 58,987 bearing acres (CAC Industry Statistical Data). Many of Chile's orchards are younger than five years. The California avocado industry experienced a similar rapid expansion period from the mid 70's to the mid 80's, a time in which the increases in planted acreage and production exceeded market demand. From 1974/75 to 1984/85, the California industry grew from 20,715 to 72,861 bearing acres. As California's groves have matured, and ultimately many have become too crowded, productivity stabilized at 5,000 to 6,000 pounds-per-acre.

For several years now, successful promotion by CAC and shifts in the ethnic makeup in the US market have increased demand for avocados that has outstripped supply, resulting in very profitable returns. Recognizing this market opportunity, Chilean avocado growers have focused their efforts on the US as their major export market. New Zealand, which exports fruit to Australia, has also targeted the US as a means to expand their market opportunities.

The good returns, in turn, have brought about a wave of new plantings in these countries; Chile is projected to surpass 200 million pounds in 2001 and New Zealand will reach over 100 million in the next four to five years. Both countries need to export the bulk of their avocados, and the only available and profitable destination in the foreseeable future is the US market.

With the inevitable increased competition in the US market from foreign producers, California growers must critically analyze their orchard management strategies to optimize production and minimize costs. The avocado is becoming a world commodity like the banana and it will achieve price equilibrium within international markets. Having to compete on an international price basis will bring, at least in the near term, returns much lower than those that we are accustomed to receive. These returns could be in the 40¢ to 80¢ per-pound range on a multiple-year basis. Given the relatively low average production per acre in California and the high costs of this production, prices in this range will make it very difficult for small growers to survive. Table 1 provides a breakdown of gross income and production costs if one were to harvest 10,000 pounds-per-acre under the competitive world market prices. Note that 10,000 pounds-per-acre, a seldom-achieved goal by most, is almost double our industry's average. No debt service and depreciation is added to these calculations and there is no assignment of value to owner participation in management and grove care.

TABLE 1
Gross income as a function of fruit price and average production costs for an avocado orchard producing 10,000 pounds-per-acre in California

GROSS INCOME	
@ 80¢ per pound:	$8,000
@ 60¢ per pound:	$6,000
@ 40¢ per pound:	$4,000
PRODUCTION COSTS	
Harvest costs @ 8 to 12¢ per pound:	$800 to $1,200
Water costs:	$1,000 to $2,500*
Pest control:	$100 to $300
Cultural costs:	$300 to $500
CAC Assessment @ 3.75%:	$112 to $150
TOTAL PRODUCTION COST:	$2,312 to $4,650

** Recent increases in energy costs can significantly increase the cost of water, particularly to those who have pumping charges or pump their own water.*

With total costs ranging from $2,312 to $4,650, net returns become very low when prices dip below 60¢ per pound. It would be difficult for the small-to-medium size grower (with one to 40 acres) to continue at this low rate of return.

In order for our industry to remain strong and move forward, we will have to accomplish two important goals: 1) We will need to continue to capitalize on the quality of the California avocado and on the fact that we can harvest our avocados, precondition them and deliver them ready-to-eat within a week from harvest – and 2) We need to increase the efficiency of production by producing more fruit per acre at a lower cost.

While farming efficiency is multi-faceted, one of the most dramatic ways to achieve increased productivity is to adopt a rigorous canopy management program in the orchard. Management of the canopy (tree size) can help the grower achieve the following:

1. Rejuvenated canopies tend to consistently produce more fruit. The fruit are usually larger and can be size-picked earlier. Pre-bloom size picking decreases the potential for alternate bearing.
2. Smaller trees (maximum height 15 ft.) will cost less to harvest.
3. Shortage of labor, especially during critical months when size picking is practiced, would be alleviated through increased harvest efficiency of individual pickers working smaller trees, i.e. a picker can harvest more fruit from smaller trees.
4. In the event "snap" harvesting becomes an industry practice, savings would be even greater if trees are smaller.
5. Safety issues are likely to be less critical if trees are kept below 20 ft.
6. The cost for pest control will be lowered with smaller canopies by allowing for better coverage by aerial application and the potential for use of ground spray rigs.
7. Managed tree canopies will allow for more efficient honey bee movement throughout the orchard.

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Avocado Flowering

M. L. Arpaia, A. E. Fetscher, and R. Hofshi*; University of California, Riverside; *Del Rey Avocado Company*

THE FLOWER

The avocado flowering behavior is atypical in many ways. The mature tree may produce in excess of a million flowers during the flowering period. The flowers occur in panicles of several dozens to hundreds of flowers borne on two different types of avocado inflorescences: determinate and indeterminate (Figure 1). In a determinate inflorescence, the tip of the shoot that bears the flowers will end in a floral bud. Indeterminate inflorescences, which tend to be more common in our environment, terminate with a vegetative bud.

The avocado flower has both functional male and female organs. The male floral organ, which produces pollen, is comprised of the anthers and stamens. The female floral organ is comprised of the stigma (which receives the pollen), style and the ovary. The avocado exhibits a type of flowering behavior known as "synchronous dichogamy." An individual flower will normally open twice over a period of two days with distinct timing of the male and female phases under normal temperatures. When the flower first opens it is in the female phase and the stigma is receptive to pollen. At the end of the female phase, which typically lasts up to four hours, the flower will close. On the second day the same flower re-opens in the male phase and sheds its pollen. See Figures 2 and 3 for an illustration of the female and male-phase flowers.

The avocado is also unusual in that the timing of the male and female phases differs among varieties. There are two flowering types, referred to as "A" and "B" flower types. "A" varieties open as female on the morning of the first day. The flower closes in late morning, and will remain closed until the afternoon of the following day when it opens as a male. "B" varieties open as female on the afternoon of the first day, close in late afternoon and re-open in the male phase the following morning. See Figure 4 for a diagrammatic representation.

FIGURE 1
Example of determinate and indeterminate inflorescences in avocado

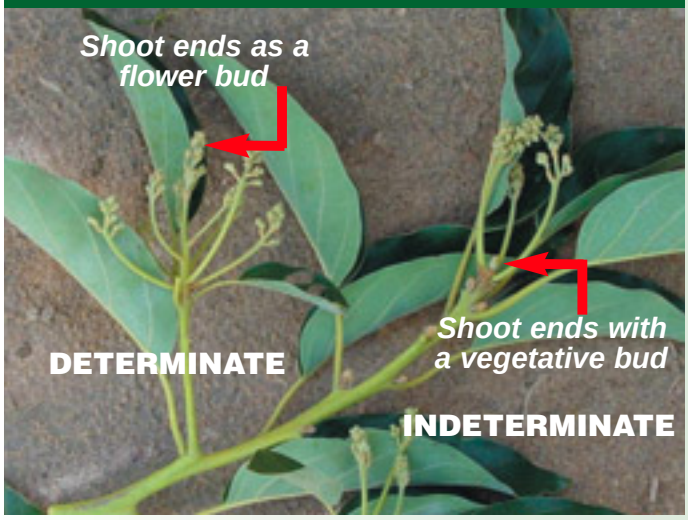


FIGURE 2
Examples of male and female-phase

There are hundreds of open flowers on an avocado tree at any one time. Figure 5 shows the interaction between complementary varieties in the field. The arrows in the figure denote the movement of pollen between "A" and "B" flower types.

WHAT ARE THE PRACTICAL RAMIFICATIONS?

Table 1 lists some of the common commercial varieties and their flower type. The avocado's flowering behavior is believed to promote cross-pollination since the male and female phases of an individual flower occur at different times within a given variety. It is believed that the interplanting of complementary flower types can boost fruit set and therefore yield by making pollen available when female flowers are receptive. The variety that provides pollen to the female-phase flower is termed the **"pollinizer"** (Figure 6).

FIGURE 4
Timing of avocado flowering for (A) and (B) flower types

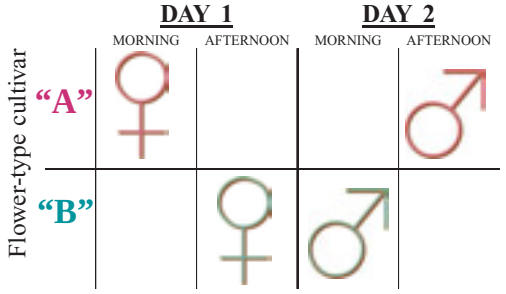


FIGURE 6
Pollination terms

Pollinizer:
A cultivar that donates pollen to another cultivar

Pollinator:
The organism which transfers pollen from the male to the female-floral organ

FIGU
A hone

owers

FIGURE 3
Diagrammatic representation of the female (A) and male (B)-phase flowers in avocado

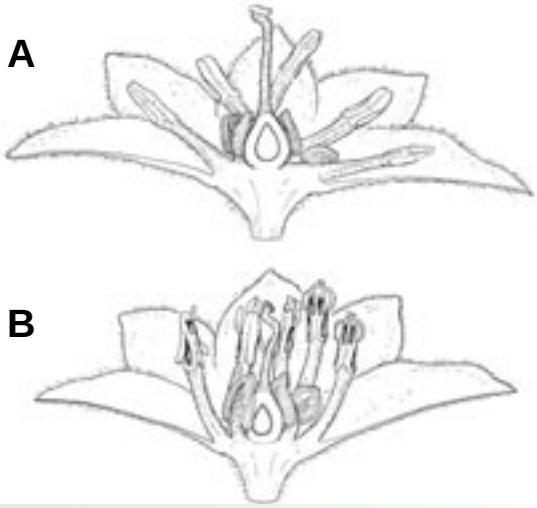
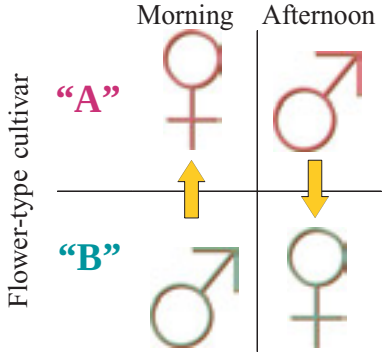


FIGURE 5
The sequence of timing for (A) and (B) flower types under field conditions



E 7
ee visiting a male-phase Ettinger flower

Table 1: Avocado varieties and flowering types

"A" VARIETIES	"B" VARIETIES
Hass	Bacon
Gwen	Ettinger
Lamb Hass	Fuerte
Pinkerton	Sharwil
Reed	SirPrize
	Walter Hole
	Zutano

The planting of pollinizer varieties is controversial from several standpoints. First, there is much discussion as to whether the planting of pollinizer varieties is worthwhile to enhance productivity. Some argue that solid blocks of a single variety, like Hass, will yield adequately. A recent study conducted in South Africa would support this contention. However, there is ample evidence from research conducted in Israel and California that including pollinizer varieties in the block enhances yields.

Under certain environmental conditions flower phases may overlap, allowing for close pollination, which is pollination within a single variety. This may help explain why solid blocks of a single variety sometimes set abundantly. This phenomenon has been demonstrated under controlled temperature conditions by researchers in Australia for Hass and Fuerte. Finally, most of the currently available "B" varieties are classified as greenskins, which bring low returns to growers. There are two "B" varieties that produce a black Hass-like fruit currently under evaluation by the UC Breeding Program, Nobel and Marvel, previously known as BL667 and BL516. They have been included in a pollinizer trial in Ventura County comparing many of the commonly-used pollinizer varieties.

Do we need pollinators?

The separation in time of the male and female phases has led most observers to believe that a **pollinator** is required to move pollen from a male-phase flower to a female-phase flower (Figure 7). The European honey bee is the commonly used pollinator. Data from the pollinizer trial in Ventura suggest that the proximity of pollinizers to the Hass trees may significantly influence yield. Honey bees tend to forage in a relatively small radius of one to four trees and having pollinizer trees in close proximity will increase the potential for cross pollination.

There is much yet to learn about the flowering behavior of the avocado including questions regarding the necessity for pollinizer varieties and their spatial placement in the orchard. Additionally, the use of pollinators and their placement in the orchard needs further elucidation.

A portion of the research presented was funded, in part, by a grant-in-aid from the California Avocado Commission.

California Avocado Commission

Canopy Management as a Strategy

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the theory and practical aspects of canopy management to local audiences. In the field they have demonstrated pruning techniques used to return groves to their yield potential.

General Concepts

Even though there are several different approaches to canopy management, they all work around the idea that both light penetration and interception are critical components of overall tree productivity. In order to produce fruit, avocado trees need to initiate floral buds. This process occurs from late July through November (based on data developed on Hass by S. Salazar and C. Lovatt). Shoots that are fully exposed to sunlight tend to produce more flowers that will set fruit as compared to shaded shoots. So when pruning trees, we need to constantly examine whether we are maximizing both light interception and penetration into the tree canopy. If all the light and growth is near the top of the tree – this is where the fruit will be next year!

A pyramid-shaped hedgerow

Piet Stassen and Cliff Lahav both advocate a pyramid-shaped tree, which is essentially a central leader tree with the base of the tree wider than the top. This shape, they argue, provides the maximum amount of leaf canopy area per acre exposed to sunlight and so, in turn, will produce the most fruit. The basic shape can be achieved by having a single central leader (a main limb that dominates the central axis of the tree) with a hierarchy of side branches forming a wide base with sequentially shorter and weaker branches to the top. However, they acknowledge that in avocados it is often more feasible to have two or even three major limbs as central leaders forming the axis of the pyramid (this is sometimes called a closed-vase system).

Their idea is to manage the trees in a hedgerow if possible. Ideally, tree rows should be oriented in a north-south direction and planted at a spacing of 20 x 10 ft. (225 trees per acre). Training the trees to fill the pyramid-shaped hedgerow can be achieved by developing the central leader early on in the nursery or just after planting by selecting or forcing a strong vertical shoot just above the graft union. When starting a newly-planted tree in their system, Cliff and Piet recommend that any strong branches growing from the central axis that are more than 1/3 the thickness of the leader should be removed and replaced with a weaker branch. Also, all side branches should be selected so that they are nearly horizontal, because vertically-growing branches (with an acute angle to the leader) will grow too vigorously and produce few flowers and fruit. Side branches should form a whorl (spiral) around the central axis of the tree and should be selectively pruned out and replaced so as to open up the tree for light penetration. These pruning rules are followed through the life of the orchard.

In most California groves, however, we are dealing with older, over-crowded trees. This involves making large cuts to get existing crowded orchards into a general pyramid shape and then following up with small cuts to manage re-growth and maintain the trees in place. This system requires trees to be no higher than 80% of row width on flat ground (15 to 16 ft.). On slopes, tree height should be adjusted lower to ensure that the base of each tree receives enough light to flower and set fruit.

If left unpruned, avocado trees have a tendency to return to having several large limbs without a dominant leader. So to maintain a central-leader pyramid shape, follow-up pruning is essential.

If the orchard requires major cuts to get the trees into a general pyramid shape, this should be done from late January on (after fruit is harvested) and should always be followed up by whitewashing exposed bark on major limbs. The frequency of follow-up pruning cuts will depend on the vigor of the trees and the availability of manpower.

> *"Even though there are several different approaches to canopy management, they all work around the idea that both light penetration and interception are critical components of overall tree productivity."*
>
> *– Guy Witney*

An open vase

Greg Partida has spent more than 10 years experimenting with canopy management systems at Cal Poly Pomona's Pine Tree Ranch in Santa Paula. Greg advocates a different canopy management system based on his experience with California orchards and growing conditions. Because more than 90% of our acreage is mature, planted on slopes at a spacing of around 20 x 20 ft., and much of it over-crowded, Greg considers pruning trees back to an open-vase system an easier option under many local conditions.

Much of the same principles apply that were outlined above for the pyramid-shaped hedgerow system, so to avoid repetition I will cover the main differences between systems.

In an over-crowded orchard, Greg recommends selecting three or four well-spaced major limbs per tree as the main structural components of the tree. These major limbs will form the basic vase-shaped structure of the tree. This will generally mean cutting back or removing over-dominant leaders (branches), leaders that encroach on neighboring trees, and poorly-positioned branches (crossing one another, etc.). The object is to achieve a balance in the vigor of the remaining structural limbs by pruning them back so that the overall tree height is reduced to 15 to 20 ft.

As in the previous system, the open-vase system requires diligent follow up pruning to keep the trees shaped, allow light to penetrate the canopy to lower limbs, and to maintain the trees at a manageable height. Also, side branches are selected to carry fruit that are well positioned around the tree, at a wide angle to the main scaffold trunks, and no more than 1/3 the diameter of the main trunks at their point of attachment. Upper

branches that are too large or shade out the lower parts of the tree are selectively removed. Greg has several demonstration blocks at Pine Tree Ranch and Cal Poly Pomona and several growers are testing the method in their own blocks.

The PRC has set up three long-term demonstration trials that are being used to teach these concepts and demonstrate long-term canopy management techniques to all interested. Please watch for field meeting notices in the California Avocado Commission *Greensheet* for opportunities to visit these trials.

Canopy management trials at ACW Ranch, Fallbrook

AN IMPRESSION OF NEW ZEALAND

Ben Faber, Farm Advisor, UC Cooperative Extension, Ventura County

New Zealand consists of two large islands located southeast of Australia. About 70% of New Zealand's avocados (primarily Hass) are grown around the Bay of Plenty area on the North Island. This area has a southern latitude comparable to Ventura. The winters are warmer than Ventura and the summers are cooler. There is always high relative humidity and plenty of rain. In the Bay of Plenty there is approximately 48 inches of rain per year. There are even some areas where rainfall can be as high as 120 inches per year.

The total planted acreage is around 4,000 acres which last year (2000) produced 17 million pounds. Three quarters of the acreage is under 10 years of age and production in the year 2010 is projected to reach 88 million pounds. Avocados are the third most important export crop after kiwifruit and apples. The bulk of this fruit is exported to California and Australia, the majority going to California. Four companies export most of the fruit and have allied themselves with some California packers for distribution in the United States. Domestic fruit is sold at a fraction of the export price. Additionally, two domestic companies produce oil from lower quality fruit.

The majority of the acreage is planted on flat ground and harvested with cherry pickers. Partly because of the young age of the trees and also the wonderful climate, fruit sizes tend to be large.

Because of all the rainfall, postharvest fruit decay is a major problem. Prior to harvest the grower may apply as many as 12 copper sprays a year to control both stem end and body rots. This material is not very effective, unfortunately, against the anthracnose fungus, which is responsible for much of the decay. Great care is used in picking the fruit to avoid damage and thereby reducing the incidence of fruit rots. For example: in the packing-shed, the bins are gently emptied onto the grading line to minimize damage. To further reduce fruit quality problems, the fruit is off the trees and onto the boats in just a few days. Another technique they use is to set aside a "library" tray of fruit. This is a representative sample of fruit from each grower and picking date that the packinghouse keeps to determine if problematic fruit arriving at the export destination was a result of practices in the field and packinghouse or in transport. In order to reduce the amount of postharvest problems in the US market, fruit bound for California is picked early in the season and shipped often under controlled atmosphere. The trip to the US even on the fastest container vessels can take 12 to 14 days to reach Long Beach. In previous years, the voyage often took as long as six weeks and major problems of fruit quality were an issue. Fruit that is picked later in the season that is destined for Australia is frequently air transported in order to insure good fruit arrivals.

Root rot is present, but even with the high rainfall it is limited in scope. The lack of a serious root rot problem is probably due to the high levels of soil organic matter and its sandy texture. Regular trunk injections with phosphorous acid control the disease when it is present. This is also an environment that pests love. There are five native leaf roller species that require control. These leaf rollers are a challenge for the avocado grower. *Bacillus thuringensis* is not very effective in this environment and many other chemicals are used to combat these lepidopteran pests. Greenhouse thrips is also a problem and *Thripobius semiluteus* was recently introduced from California to control this pest. The whole agricultural community from dairy to apples is attempting to go "Clean Green," similar to what we call IPM (integrated pest management).

On the whole, New Zealand is a country that is extremely reliant on agricultural exports to survive. Avocado production is expected to continue to increase and they will need to hunt out new markets in the world for their avocados. In the future, expect to see more New Zealand avocados in the US market.

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In the Face of International Competition

High density Lamb-Hass grove and abundant set in Moorpark, CA

8. If new plantings are contemplated, high-density plantings should be considered for high production and a faster return on investment.

The Hass avocado tree, under proper management and cooperating weather conditions, has the potential to produce above 15,000 pounds-per-acre on a sustainable basis, a volume we should strive to achieve if we are to survive and compete with imports. Dr. Stefan Köhne (Director of Research, Merensky Technological Services, South Africa), in a recent CAC-sponsored visit to California, reviewed South African canopy management practices with local growers. Their company is the largest single producer of avocados in South Africa with several thousand acres in production. Dr. Köhne stated that converting to an aggressive canopy management program has made all of the difference in boosting tree productivity. He stated that they had increased Hass production to 15,000 to 20,000 lbs. per acre annually by adopting a hedgerow system through mechanical or manual pruning. Reports of similar accomplishments are emerging from Australia and Israel.

We may find ultimately, with complacency for the status quo in orchard management and the lack of conviction to manage our trees in an efficient manner, that we will pay a far greater price than the costs associated with pruning the trees.

Editorial comments should be addressed to Guy Witney: **gwitney@avocado.org** or to the address below.

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