Welcome to Eco Farms' Avocado Grower Handbook, a monthly guide to successfully growing avocados in California. This handbook is focused on basic, down-to-earth growing methods that work in most situations. Let’s face it, some ground just isn’t suited for growing avocado trees. Successfully growing avocado trees does not require micromanagement of the grove. In fact constant inputs and adjustments may even reduce tree vigor and fruit production. And the costs can add up quickly. As a wise grower said “Do the basic stuff and the tree will take care of itself.”

Each monthly section is a list of suggestions for things to do in the grove. These are broad items, leaving room for customization for each unique orchard. On the back of each monthly page you will find information addressing the many facets of growing avocados, from GAP certification to high density planting. In greater detail are instructions on how to plant a tree, how to create berms and other useful information to keep groves productive.

If you are interested in more information please contact Eco Farms. Your Eco Farms Field Representative are happy to help you with all aspects of growing avocado trees successfully.
January

The beginning of a new year is a great time to clean up, catch up, and refresh the orchard. Aside from frost protection, January can be a quiet time in the groves. Take advantage of this time to catch up on those important little things that can make a big difference.

Walk the perimeter of the property. Makes sure all fences are in good repair, all the way to the ground. Small animals, wild and domestic, entering the grove can spread disease, chew irrigation lines and gnaw trunks. These things may seem insignificant in the middle of winter but if unchecked they can become troublesome in the coming months when trees are pushing foliage and flowers.

Mulch with straw or other biodegradable plant material. Mulch is critical for a healthy orchard. Avocados naturally shed some of their leaves each year in order to build their own “aerated” root zone. Any leaves that shed should remain on the orchard floor. New plantings should have mulch applied soon after the first irrigation, after trees are settled into their new location. January is a good time to fill in any spots lacking adequate ground cover.

A note of caution - be extremely selective when sourcing mulch due to the threat of Shot Hole Borer. Protocols for the pest are changing. Stay up to date and be extremely careful not to introduce the pest into your orchard. According to University of California Riverside the most common vector for the pest is by human movement of firewood.

Hass size 60 and smaller released.

Eco Farms is interested in varieties other than Hass. If you have Reed, Pinkerton, Bacon or other varieties please contact us.

Good Agricultural Practices (GAP) Certification

Food safety is the main reason for participating in the GAP program. However another important reason that tends to be overlooked is that GAP Certification opens more markets to avocado growers’ fruit. Many major retailers now require GAP certification, and those retailers buy a lot of avocados. Does a substantially larger marketplace make GAP certification worth the cost and effort? Yes!

GAP certification does not guarantee food safety but it does reduce the risk that a foodborne disease outbreak will originate on the farm. Risk reduction is important. The GAP certification process can initially seem overwhelming but it is becoming more important. Please contact your Eco Farms Field Representative. We will help you through the paperwork.

GAP is focused on five primary areas for growers, land use, water source, ranch security, worker hygiene, pests and pesticides. It takes three steps for fruit to be fully GAP certified, farm review, field harvest compliance, and packing facility certification.

The California Avocado Commission recognizes the increasing importance of GAP certification. According to CAC, “the Commission’s goal is to get a sizeable percentage of the industry GAP certified and to ensure industry uniformity in GAP certification. To help encourage California avocado growers to pursue GAP certification, the Commission approved a GAP Incentive Rebate (GIR). The GIR will reimburse participating growers for actual audit costs, up to $300 per ranch audit, subject to the availability of funds.”
February

Gwen size 32 and 36 are released

Buds will begin to show their development meaning it’s time to do everything possible to encourage flowers. It is best to avoid applying any form of nitrogen until after flowering and fruit set is complete. Nitrogen will encourage tree growth and leaf flush so avoid applying nitrogen during flowering.

Apply potassium and phosphorous to encourage flower and fruit set.

Prepare an area on the property for the upcoming harvest season. Avocado bins will be delivered the day before harvesting. An open area free from overhead limbs and wires is necessary for the boom delivery truck to unload empty bins and load full bins.

Size picking should begin as early in the year as possible and February is not too early. Harvesting only the largest fruit, and thereby relieving the fruit load on the tree, is one method to potentially increase fruit for next year and help reduce alternate bearing.

Begin checking for Scirtothrips. See “March” for full details of how to check for Thrips.

The Avocado Flower

Avocado are not either male or female, as is the case with some fruit trees. Each avocado flower contains both male and female flower parts, but they do not function at the same time.

Each flower is female when it first opens and remains open for a brief two to three hours. The flower then remains closed the rest of the day. The following day the flower opens again but only the male portion is functioning. The flower again remains open for a brief time. Once closed this second time the flower will not open again. (Male and female flower phases differ among varieties.)

Attempting to produce avocado fruit in traditionally cool areas is challenging. Low yields are common unless average temperatures are unusually warm, allowing for vigorous flowering.

The avocado flowering behavior is called “synchronous dichogamy”. An individual flower will be open for two days but the timing of the male and female phases are distinct.

Do Hass trees need another variety to set fruit? Emphatically NO! Avocado trees do not require a separate pollinizer to set fruit. Since all avocado flowers are both male and female all of the equipment is present for fertilization of the flower by the same flower or neighboring flower.

Plant the entire orchard with Hass, the ultimate “A” flower.
March

Continue harvesting the largest fruit on the trees. Eco Farms is ready to help so please call!

Scirtothrips - one of the fastest ways to receive less money for your fruit is through Thrip damage (see photo on p.4). The damage is done when the fruit is the size of a bee-bee so it is critical to reduce this pest. Thrips develop under cool conditions and young Thrips feed on tender leaves right when avocados are setting fruit! Populations increase during late winter to early spring so they are ready to feed when the little fruit is most vulnerable. Populations decrease during dry, warm conditions.

Checking for Thrips is easy. In the orchard, using a white piece of paper, slap avocado leaves against the paper. The goal is to knock any Thrips onto the paper. If they are present you will see them scampering around. Then check with a Pest Control Advisor to see if populations are large enough to advise treatment. A very low population does not necessarily need treating and indiscriminate pesticide use will lead to resistance. Save your pesticide ammunition for when it’s really needed.

UCR has an excellent website for pest management: http://www.ipm.ucdavis.edu/PMG/selectnewpest.avocado.html

Apply phosphite fertilizer at a rate appropriate for the grove. There are many phosphite products on the market, Phosgard, Nutriphite, etc. If the application is by spraying onto the tree be sure to purchase the buffered version.

Organic Certification

The demand for certified organic produce is growing at a tremendous rate. The consumer has spoken. Organic is here to stay and people are willing to pay the premium it demands. Not only do consumers pay a premium but avocado growers are also paid a premium for their certified organic fruit.

Prior to USDA organic certification Eco Farms was on the front of the wave of organic avocados. Because we are growers too we have always recognized the importance of growing organically, not only for the price premium but also for the health of the soil, the trees, beneficial insects and as a dynamic method of farming. However not all groves are suitable for growing with organic certification.

To be USDA organic today requires an official certification process carried out by a third party. Each certifier has their own rules and protocols that can vary slightly but are approved by the USDA. Choose a certifier who you think will work best with you.

Organic certification demands that only certain fertilizers can be used and that strict pesticide protocols be followed. Under less-than-optimal growing conditions it may be difficult to apply enough nitrogen to the grove, especially when the trees are young. This is due to the low percentage of available nitrogen in organic fertilizers. (Young trees flushing vigorously with plenty of available nitrogen will produce a mature tree quickly.) Growing organically certified in root rot conditions may be especially challenging and trees may not thrive. Some useful products that combat root rot are not available to the organic grower.
April

Continue checking for Thrips. Any fruit setting now is susceptible to Thrip damage.

Take note of the budding and flowering happening. Avocado trees are prolific flower producers. Some estimates suggest there are nearly one million flowers on a standard tree. But even with such large flower production most of the flowers are not successfully fertilized and do not set fruit. Bringing bees into the orchard may help to increase pollination, fertilization and fruit set.

Bee-bee sized fruitlets should be seen throughout the orchard.

Apply nitrogen and potassium at an appropriate rate for the grove. Nitrogen and potassium are available in many forms and concentrations. Be careful, nitrogen can be very hot at high concentrations and can burn trees. Be sure to strictly follow application rates on the packages.

Release beneficial insects into the orchard. Contact your local Insectary or Pest Control Advisor. Beginning to release early in the season will give the insects time to establish a population and survive through the winter.

Trees will be losing some leaves as new buds push out from behind the leaf. This is normal and is the method that avocado trees use to make their own mulch. However, full defoliation is not normal.

Consider pruning of older trees and branch nipping on younger trees. There are many techniques for pruning, including not pruning. Contact your Eco Farms Field Representative for guidance.

Harvesting Early

One of the easiest ways to avoid alternate bearing of avocado trees is to harvest fruit early in the spring, according to size, and to continue harvesting periodically until the entire current crop is off the tree. This is especially beneficial when trees are set heavily. The earlier the crop is removed the less of a burden the tree will be carrying, plus it will have more energy to devote to setting and holding good crop for the following year. It is common for trees to carry two crops at the same time during the spring. However the duration of carrying two crops should be minimized by harvesting early.

In some years avocado trees can bear a very large crop consisting of a lot of small fruit. The first reaction is “let the fruit size up.” However, when fruit is allowed to hang on the tree while another crop is setting the tree begins to “manage its fruit” by either not sizing or by dropping fruit. The tree has only so much energy to dedicate to fruit production. Size picking, harvesting the largest fruit several times throughout spring, will help to reduce the overall load on the tree and encourage the tree to set an abundance of fruit for the following year.

If considering harvesting early remember to weigh the benefits of harvesting versus the price of fruit. Early season fruit may be priced lower than fruit later in the season. Or, early fruit may be priced higher than fruit earlier in the season. Watch Eco Farms’ price quotes, talk with your Field Representative and use your best judgement.
May

Lamb size 32 and 36 are released

Monitor leaves for Persea Mite.

Leaves are continuing to drop. If the trees are stressed they may be losing a lot of their leaves. Heavy to complete defoliation is not normal. If you see this happening be sure to whitewash in order to protect from sunburn. The simplest recipe is a mixture of 25% latex paint and 75% water. Fill a backpack sprayer with the mixture and spray the branches and trunk of the defoliated trees. Some of the mixture will inevitably be sprayed on the leaves. This will not harm the tree. It is important to protect trees as soon as possible. Newly exposed branches and trunk are very susceptible to burning.

Release beneficial insects into the orchard.

Keep harvesting to reduce the load on the trees. Check fruit price quotes to determine the best sizes to pick.

Bee-bee sized fruit may still be developing. The flowers leading to these fruit were successfully pollinated and fertilized later than the initial fruit set. It is common to have different sizes of fruit on the trees.

Gypsum is an inexpensive soil conditioner applied easily as a top dressing to the soil. Up to 40 pounds per tree is acceptable. Gypsum is especially helpful with heavy clay soils. No need to mix in with the soil. Top dressing will allow the material to move through the soil for greatest benefit.

As the temperatures increase it is a good time to have a leaf, soil and water analysis performed in the orchard. Do this test annually.

N, P & K - The Numbers on the Bag

Lack of proper nutrition can cause as much trouble as incorrect irrigation. Below is a basic description of tree nutrients, the ones that can be purchased at the local farm supply store. There are many different ways to provide nutrients to the trees.

Every fertilizer bag contains three numbers. These numbers represent the percentage (by weight) of the three major nutrients required for healthy plant growth. The numbers are always in the same order: nitrogen-phosphorus-potassium (N-P-K).

Nitrogen (N) – stimulates overall stem and leaf growth, enables the tree to produce more chlorophyll, greener leaves. Apply nitrogen four times per year. A bag of 10-15-12 fertilizer contains 10% total nitrogen.

Phosphorus (P) – helps with root rot control, aids with root development, can increase flowering ability and bloom size. Apply phosphorus four to six times per year. A bag of 10-15-12 fertilizer contains 15% total phosphorus.

Potassium (K) - guards the plant against diseases, aids in drought protection and cold tolerance, helps with root development and photosynthesis. Apply potassium four times per year. A bag of 10-15-12 fertilizer contains 12% total potassium.

* If leaf analysis indicates, apply calcium, zinc and boron once or twice per year
June

June is a busy time in the orchard. Keep an eye on the overall “look” of the orchard. Early signs of stress can be detected by taking an overall view, trees look tired, droopy or just not flourishing. Try to chase down the cause.

Lamb size 40 and 48s are released

If available, continue to release beneficial insects into the grove

Any remaining fruit should be harvested unless the grove is in the northern-most areas.

Check irrigation systems carefully after each picking. Harvesters do their best to avoid damaging irrigation heads but some will ultimately be damaged. Check carefully all irrigation lines to be sure all trees have adequate water. Trees are entering into a very hot and dry season. They will be stressed even under the best conditions. Be sure the trees do not have additional stress from lack of water due to malfunctioning irrigation. Examine the leaves on the trees. If you notice dots following the leaf veins contact your Pest Control Advisor. If Persea mite populations are low it may not be necessary to treat the orchard.

Check leaves for Persea Mite. Populations typically begin building in mid-summer and increase in warm but not hot weather. A heat spell will help reduce mite population as they begin to die with temperatures over 100 degrees F. The mites cause most damage to leaves by late summer.

Thoughts on Pruning and Stumping

Growers have their own methods of pruning avocado trees to increase production, reduce size for ease of harvest, or bring down and out of control canopy. Pruning can be helpful when trying to increase avocado yield. Ideally it is best to never prune an avocado tree, allowing them to be the shape and size they want to be. But due to high real estate values and water costs in Southern California we have to do things a little differently.

Stumping less productive areas of a grove potentially allows growers to maintain young trees in good health during drought conditions. By significantly reducing water in unproductive areas of the grove and focusing irrigation on the younger and more vigorous areas, it is possible to manage through severe drought conditions. When the rains return the stumped trees can be allowed to regrow and again produce fruit. This option should be used in extreme conditions or as a method of consolidating a grove while maintaining mature trees in the ground.

It is important to keep in mind that stumping causes vigorous vegetative growth. If this growth is not managed correctly then within one to two years the grower will again have a very large tree with a lot of leaves but little fruit. To minimize the robust vegetative growth after stumping it is important, during the next few years to follow up with selective branch pruning and growth pinching. Fruit is borne only on horizontal branches. By lightly pruning vertical growth, horizontal branching and fruit production are increased.

Properly stumped and whitewashed
July

Lamb size 60 and smaller are released

Apply nitrogen and phosphite at a rate that is appropriate for the grove.

Dead limbs may become apparent in the grove. Do not cut the branch with clippers as this will cause the limb to die back beyond the pruning cut. The best method to remove dead branches is by breaking them off by hand. If the branches are ready to be removed they will easily “snap off.” Keeping the dead branches removed will help to increase light penetration within the tree that is key to fruit production.

Continue monitoring for Persea mite. The trees can handle light pressure from the mites with little to no leaf drop. It just depends how heavy of a population is present. So be diligent with your inspections and treat only if necessary. Each unnecessary treatment increases the the possibility of pesticide resistance.

Keep weeds under control. The best method is by applying mulch to the orchard floor. Use weed eaters or mowers if needed. There are many herbicides available as a weed killer. Be sure to check ingredients and understand any long-term effects associated with herbicides.

If the orchard is south of San Luis Obispo County harvest remaining fruit. Be sure to understand the timing of avocado imports allowed into the US market. Imports will impact the price California growers receive for their fruit.

What We Think We Know About High Density Plantings

High Density avocado groves seem to thrive when compared to traditional plantings. Three hundred to 500 trees per acre is a good range of density. Spacing ranges from 7 x 15 to 9 x 15.

Pressure Compensating Irrigation Tubing (PCIT) is the most efficient irrigation system. If planting a new orchard on flat ground, two irrigation lines works well, with one line on each side of the tree. If planting on a steep slope place two irrigation lines on the uphill side of the tree, one six inches from the trunk of the tree, the other 18 inches from the trunk of the tree. And then add a third line below the trunk of the tree, just a few inches from the trunk.

Two PCIT lines, with one-half gallon per hour internal drippers, at 18 inches apart on each line, will emit five gallons of water per tree per hour. Adjust the time and frequency of watering depending on soil structure. A newly planted orchard on berms with mulch will require approximately three hours of irrigation per week when using this system.

Pruning time and costs are higher with a dense planting. It is critical that the trees are pruned to allow as much light as possible to penetrate around the entire tree. Excessive shading will quickly reduce fruit yield. Light pruning is generally well received by the tree. Heavy pruning, especially on young trees, can reduce tree vigor. Nipping the ends of branches or pruning lightly will be received well by the tree. Do not skirt prune. Avocado trees just don’t like it.

Planting on berms seems to allow for more even water flow, especially in heavy soils.

Mulch made from straw, wood chips, or other organic material will have a very positive effect on the trees. Mulching along with leaving the skirts unpruned will dramatically reduce weeds. Young orchards planted in this method use nearly zero herbicide spray.

High density orchards produce approximately 10,000 pounds per acre in three to four years. Of course, cold and wind may reduce the amount of fruit. In six to eight years it is common for production to reach 20,000 pounds per acre.

Start up costs for a new high density orchard are higher than traditional spacing due primarily to the increased number of trees per acre. But, even very small parcels can produce enough fruit to bring profits to the grower.

Alternate bearing appears to be less prevalent in a high density orchard.
August

Apply nitrogen and phosphite fertilizers at a rate that is appropriate for your grove.

General orchard upkeep, keep weeds under control.

Far northern growers begin harvesting if prices are suitable.

Arrange for a water, soil and leaf analysis. Keep in mind that the test may show plenty of nutrients in the soil but lacking in the leaf analysis, meaning that the nutrients are not being taken up by the tree.

Be especially prudent with monitoring of salt accumulation. Wet winters will flush out salt accumulated due to fertilizing and irrigating but ongoing dry conditions will lead to damaging levels for the tree. There is no upside to salt accumulation, especially for avocado trees.

Trees should have plenty of small but expanding fruit. If the orchard is light of fruit try to understand the reason(s) why. Understanding the reasons for a light fruit will help to avoid the same situation in the future.

Irrigate in advance of hot temperatures. Closely monitor soil moisture. Over a long hot, dry summer trees can become stressed over time. If soil moisture is not monitored closely a quick spike in daytime temperature may be all it takes to push the trees into stressed conditions. It is difficult to recover avocado trees once they are in stressed conditions during the hot season.

Trees can wilt with too little or too much water. In very hot conditions, they can also wilt with correct soil moisture. Irrigate only if the soil moisture indicates it is needed.

Good Harvesting Practices

Growers are encouraged to only use GHP certified harvesters

Recalls require traceability throughout the entire food distribution system

Risk for growers, harvesters and handlers

GHP AUDIT PROCESS

Conditions under which an automatic “unsatisfactory” will be assessed:

- An immediate food safety risk is present when produce is grown, processed, packed or held under conditions that promote or cause the produce to become contaminated
- Observation of employee practices (personal or hygienic) that jeopardize or may jeopardize the safety of the produce
- Falsification of records

Know your grove
September

Days are getting shorter but temperatures are likely still high. White wash any defoliated area of the tree. A September sun is still very powerful and can quickly burn newly exposed limbs and trunks.

Santa Ana conditions may develop over the next several months. Temperatures spike high, humidity is very low and winds are extremely strong. Fruit drop and limbs breaking and sometimes trees being uprooted are the main concerns. If the grove is in a traditionally high wind area it is prudent to create a windbreak if possible. Blue Gum Eucalyptus, Beefwood, and Italian Cyprus are the traditional windbreak trees. Planting a windbreak will not eliminate wind damage but it can greatly decrease the severity.

Continue to apply much to the orchard floor if the tree leaf litter is not sufficient to provide a thick ground cover. Mulch also adds nutrients to the soil as it decomposes and provides a natural barrier to weeds.

Order replacement trees well in advance. The demand for trees may be strong and it may be common to encounter a waiting list for trees. Keep your orchard young and replanted with vigorous trees. It is easy to get behind the replant curve, leading to loss of production and overall grove vigor.

There are several choices for avocado nursery stock. Take the time and personally visit each nursery. Pay attention to their source of propagation material, propagation methods, sanitary protocols, overall cleanliness and neatness.

Trying to save a few dollars on nursery stock may not pay off in the long run. In this case, highest price may be the best option.

Salinity

Irrigating increases salt concentration in the soil. Even the best ground water contains various salts and minerals that accumulate in the soil, especially during drought conditions. Normal rainwater will help leach salts from irrigated soils with this method being best remedy for increasing salt concentrations.

Avocado trees are very sensitive to salt accumulation. It is first seen as leaf tip burn but it has additional negative effects such as decreased production, reduction of tree vigor and reduction in photosynthesis. All of these conditions mean less return to growers. Managing soil salinity is critical for a healthy orchard.

Use of chloride-based fertilizers (e.g., potassium chloride, magnesium chloride) can lead to increased salt levels in the soil. These levels can become significant quickly causing trees to suffer.

Some mulches and manures may contain a lot of salt. If salinity is a problem, composted green waste or manure that has sat through one winter of rain could be used instead.

Over irrigating can bring more salt to shallow soil depths.
October

Apply nitrogen and potassium at a rate that is appropriate for the grove.

Apply phosphite fertilizer at a rate appropriate for the grove. There are many phosphite products on the market, Phosgard, Nutriphite, etc. If the application is by spraying onto the tree be sure to purchase the buffered variety. Phosphite has the potential to burn so be sure to follow dilution instructions on the package.

Bacon and Fuerte are released, size 40s and larger.

Hass harvesting continues in San Luis Obispo County.

Fall planting of replants is possible if the grove is in a mild area, generally free of frost and wind. If the winter is mild the trees will be one year ahead. If the winter is difficult the trees will likely languish and not do well in the future. Success of fall plantings depends on what winter brings to the orchard.

Mexico fruit is entering the US market in high volume. The heavy volume will continue through March of next year. The Jalisco area of Mexico is beginning to come into production. With Jalisco’s production it is possible that Mexican imports will enter the U.S. year-round. This may not bode well for future California fruit prices.

Arrange for soil, leaf and water analysis. Water quality can change over time. Monitor salt accumulation.

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2014 Avocado Statistics

![Diagram of planted avocado acres by county]

### 2014 Varietal Distribution

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### 2014 California Avocado Acreage Inventory Summary by County

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*Orange, Los Angeles, San Bernardino, San Joaquin Valley, Monterey*
November

Large shipments of Mexican avocado imports continues throughout the US.

- Hass size 40 may be released before the end of the month
- Zutano size 40 and 48s released
- Pinkerton size 28 are released
- Bacon size 48 and 60s are released
- Fuerte size 48 are released

Prepare for cold weather. Make sure wind machines have been checked and are ready to operate if needed. Check irrigation lines. Running water during a freeze can raise the ambient temperature in the orchard just enough to prevent severe damage.

Make sure any tree replant orders are confirmed with the nursery well ahead of time. Historically avocado nursery trees have been in very high demand. Secure your order well ahead of time.

Early harvesting can begin with size 40 Hass late in November. This can help reduce alternate bearing and encourage the remaining fruit to increase size, which usually means higher price.

Maturity Release Dates

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Source: Avocado Inspection Program Inspection and Compliance Branch Inspection Service
December

Large shipments of Mexican avocado imports continue throughout the US (are they limited to specific regions of the US during some times of year?)

- Hass size 40 may be released before the end of the month
- Zutano size 40 and 48s released
- Pinkerton size 28 are released
- Bacon size 48 and 60s are released
- Fuerte size 48 are released

Prepare for cold weather. Make sure wind machines have been checked and are ready to operate if needed. Check irrigation lines. Running water during a freeze can raise the ambient temperature in the orchard just enough to prevent severe damage.

Make sure any tree replant orders are confirmed with the nursery well ahead of time. Historically avocado nursery trees have been in very high demand. Secure your order well ahead of time.

Early harvesting can begin with size 40 Hass late in November. This can help reduce alternate bearing and encourage the remaining fruit to increase size, which usually means higher price.

Managing Frost Damaged Trees

After a freeze event your trees are stressed even if they don’t initially seem to be. If your trees have been damaged it will take several days for the full extent of the damage to be seen. Try not to be discouraged as you watch your trees as they will look unhappy. Do not add stress to the trees by doing the things that may seem intuitive but can actually do more harm than good.

Resist your urge to prune any dead branches. You will want to clean up the tree and remove all of those dead branches but it is best to allow the tree to do it itself. If you prune off dead branches too early many times this can lead to even more die back. Let the tree decide when to lose the dead branches. If the freeze is very hard it is critical to apply whitewash to prevent the tree from sunburn (70% white latex paint mixed well with water is an excellent “sunscreen” for the tree.) Liberally spray the solution on the branches. You will get paint in the leaves but don’t worry about it just get the protection on right away.

Hold off on fertilizing until the tree begins regrowth. Fertilizing too soon will add stress to the tree and can delay recovery. Check with your packinghouse representative to see if there is any salvageable fruit.

Early signs of frost damage usually begins with the leaves drooping and somewhat chlorotic. The trees obviously do not look happy. The leaves will eventually become crispy brown and fall to the ground. This is all normal and part of the tree’s natural recovery process. There is nothing you can do to prevent the damaged leaves from falling. With patience, and little white wash most trees will recover,
Trivia But Not Trivial

There are more than 500 (and counting) avocado varieties.

The Aztec word for avocado was ahuacatl, which means “testicle tree”.

Avocados were first introduced to the United States in 1871, when Judge R.B. Ord planted three trees in Santa Barbara, California.

Rudolph Hass, a postman, patented the Hass avocado tree on August 27, 1935 (U.S. Plant Patent No. 139.) Mr. Hass was a little early with his patent to take advantage of the strong demand for Hass we have today. His patent expired in 1952.

Hass accounts for 95% of avocado production in California.

The original Hass tree is the mother to millions upon millions of avocado trees. The Mother Hass tree is not longer alive but her legacy will continue well into the future.

Avocados have the highest protein content of any fruit.

Increasing Avocado Production

There is little doubt that avocado trees can be a challenge to grow and even more of a challenge to keep the fruit on the tree until time to pick. However there are a number of cultural practices that can be implemented on regular basis that will help to increase the vigor of the tree AND the amount of avocado fruit. Keep in mind that inherent in farming are variables no one can control, like unexpected snow or high winds or dry winters, but follow these five steps and your chances of success will increase.

One – Irrigate correctly. By far, over or under watering is the main reason for lack of vigor in avocado orchards and thereby lack of fruit production. So, what is correct irrigation? It will depend on your soil conditions as no two orchards are exactly the same, but keep in mind that avocado trees are endemic to temperate rain forests as an understory trees. Their natural habitat is light, daily rain with the soil being constantly MOIST, never dry and never wet. Your irrigation should mimic these conditions as much as possible. You may choose to irrigate lightly and often or once per week.

Each method has its own benefits and problems. Check the soil with a probe before irrigating and believe what it is telling you. This will keep you on track. Our Field Representatives are available to help you with questions. Please email or call.

Two – Monthly applications of a buffered phosphorous acid fertilizer sprayed onto the leaves or injected into the irrigation system. Some of the common names are Phosgard and Nutriphyte. These phosphorous fertilizers are not a fungicide they are a fungistat so it does not kill Phytophthora cinnamomi but it inhibit its growth. These fertilizers also acidify the root zone that helps in the battle against avocado root rot, they are readily available without any special license and are inexpensive. Follow the label closely for dilution and application instructions.
Increasing Avocado Production  (continued)

Three – Monthly application of a nitrogen fertilizer such as urea. This is especially important when cultivating a new orchard. The idea is to put as much growth on the tree as fast as possible without being concerned with fruit set. Creating large vigorous tree in the shortest time means faster fruit production and a stronger tree that is more resistant to harsh weather disease. One note, high nitrogen fertilizing can inhibit flowering and thereby fruit set. When setting fruit is the goal, reduce the nitrogen and increase potassium, phosphorous and calcium. These nutrients will encourage flowering.

Four – Creating mounds or berms, especially in flat heavy ground, when planting or replanting individual trees is the best method to improve drainage and reduce the likelihood of root rot.

Five - Harvest early. One of the best ways to help the tree set fruit for the following year is to reduce the fruit load as early in the season as possible. Of course you will use your best judgment regarding fruit price but the longer you hold fruit on the tree the less fruit you will likely have the following year.

Here is a young orchard that was planted and is being maintained using these five easy steps. The trees are extremely vigorous and have put on a tremendous amount of green, lush growth over the past several months. Even though the trees were planted mid summer 2014 I expect a good fruit set Spring 2015. I have seen very heavy fruit sets in and orchard’s second year two using these cultivation practices. And these trees are planted into heavy root rot conditions.
Rethinking How We Irrigate

**Pressure Compensating Inline Drip Tubing (PCIDT)** is being used in avocado groves as a successful way to reduce overall water consumption AND maintain fruit production.

PCIDT is not the common drip line strung though orchards with spaghetti tubing and mini sprinklers. It is a sophisticated and inexpensive product that is being used in new avocado plantings with tremendous success. I suggest that during this time of water insecurity older orchards will also benefit from this system.

Here’s what it looks like in a new planting prior to mulching. One irrigation line on each side of the young trees. Notice there is no spaghetti tubing or above ground drippers. Mulch on top.

Existing Orchards Successfully Refitted with Pressurized Internal Drip

There is an option of reducing water in existing orchards without compromising the health of the tree. Using the pressurized drip tubing, lay down three lines per tree to cover a large portion of the previously irrigated area. If your trees are on a hillside place two lines above the tree and one below. The one line below the tree should be within a few inches of the trunk. You may initially have some root dieback on the outer fringes of the drip line but overall the trees will do well with diligent management.

You should also change the frequency of your irrigation with the pressurized internal drip method. Avocado trees like light, frequent watering. Some growers have success by irrigating a little every day, followed by a monthly heavy irrigation to flush salts. You should consider irrigating approximately three times per week, two to three hours per irrigation day. Customizing your irrigation duration and frequency is essential for success when using any irrigation method. Every orchard is unique, therefore every method of irrigation should be adjusted specifically for each orchard. (This is a disclaimer.) Presented here is the basic idea of retrofitting existing orchards with pressurized internal drip tubing. Each grower should customize the idea for each individual orchard.
Irrigation Points to Ponder

1. Growers cannot cut the water back on the entire orchard while using the same irrigation method and expect trees to thrive. If the grove was not overwatered in the first place you will give ups something, like fruit production or tree health.

2. The lower the water quality the greater impact your irrigation methods will have on the orchard. If the water quality is good you can get away with mistakes in the orchard without immediate impact that poorer quality water shows quickly.

3. If there is not enough water to irrigate all trees adequately stump- ing sections of orchard is an option. Extreme measures, such as stumping, should at least be considered if not implemented during times of water insecurity.

4. Under optimal conditions it usually takes three years for stumped trees to begin producing fruit. Under stressed conditions this can take longer.

5. Salt accumulation can sneak up on a tree. Every time you irrigate or fertilize it is likely that salt is accumulating around the root zone. This can add up very quickly and cause trouble for the tree and salinity can especially have a very negative impact on trees.

6. Incorrect irrigation practices may not be immediately apparent. “Suddenly” trees may spiral downward but the cause has been happening over time. Be diligent with irrigation.

Benefits of Pressure Compensating Inline Drip Tubing

- Greatly reduces water usage.
- Emitters are contained inside the tubing thereby no need for spaghetti tubing or micro sprayers.
- Harvesting and pruning will not harm the tubing.
- Very simple installation – just roll it out.
- Can be used to refit existing orchards.
- Cost effective and easy to use
- Works well with high-density berms and slopes
- Delivers precise irrigation
- Continuous self-flushing dripper design removes debris as it is detected, not just at the beginning or end of the cycle.
- Easily ordered through local farm suppliers.
- Maintenance is easy.

Yes it saves water. Over time the Pressure Compensating Drip Tubing saves a lot of water. See calculation on next page developed by Ron Watkins, Yuima Water District, Pauma Valley.
Are Significant Water Savings Really Possible?

The calculations below are actual water savings experienced in a high density orchard located Yuma Water District using pressure compensating inline drip tubing. The irrigation system will remain for the life of the orchard.

**Traditional 10-acre Avocado Ranch**
- 100 trees per acre
- 10,000 pounds per acre production
- $1.00/lb fruit = $100,000 revenue.
- Water usage @ 3.5 acre feet/acre per year = 35 acre feet
- Water cost @ $1,000/acre ft = $35,000/yr

**High Density 5-acre Avocado Ranch**
- 200 trees per acre
- 20,000 lbs/acre
- $1.00/lb/fruit = $100,000 revenue.
- Water usage @ 2 acre feet/acre per year = 10 acre feet
- Water cost @ $1000/acre feet = $10,000/yr

Annual water savings = 25 acre feet
**Annual water cost savings = $25,000** ($35,000-$10,000)

Successful Orchard Development

Not all ground is suitable for avocados. Incorrect site selection is an expensive mistake and one that is not easily corrected. There are a few key traits for proper avocado site selection. Ideally, make sure the area:

- Is not prone to frost or freezing
- Is sheltered from the wind
- Has good soil drainage

The advantage of good soil drainage is often overlooked. Avocado roots have few root hairs, making water uptake relatively inefficient. Therefore avocados need adequate soil moisture to thrive but not too much to suffocate roots. Excessive water in the soil also provides a perfect environment for the avocado root rot fungus (*Phytophthora cinnamomi*). However, even if the fungus is not present, excessive water in the soil will quickly compromise the roots through suffocation and the tree will begin to decline. Once the downward spiral begins it is difficult to reverse.

Avocado trees thrive in well-drained soils. There should be no layers of clay, hardpan, or solid rock within the first three feet of soil. Heavy soils do not automatically indicate failure but it does require more attention to soil moisture. Most hillsides contain rock in the subsoil, but the rock is usually cracked or fissured allowing free drainage. However, some slopes have solid, un-cracked rock just inches below the soil surface. During irrigation or rain the soil just above the impermeable rock becomes saturated, which without drainage, can rapidly P. cinnamomi. Pay very close attention to the type of soil and the soil strata.
Are Significant Water Savings Really Possible?

**Wind**
Avocados do not like wind. Strong Santa Ana winds can strip fruit from trees leaving a costly crop useless on the ground. If the grove is open to high winds it is critical to plant a windbreak. This will be time and money well spent.

**Tree Spacing**
When planting an avocado grove one of the keys to good fruit production is the maximization of light available to the tree. More light means more photosynthesis, trees growth, fruit production and oxygen production.

Historically in California avocado tree spacing was set at 20’ x 20’, which equates to 110 trees per acre. This spacing allowed for plenty of sunlight penetration of each tree. Plenty of sunlight means more fruit production. However, just a little more compact spacing of 16’ x 20’ equates to 136 trees per acre can make quite a difference in fruit production, especially in the earlier years of the grove when the trees are most productive. With this tighter spacing it is critical that the grove is managed through annual light pruning to prevent the trees from shading each other and reducing production. It is common to see older groves that have not been maintained for maximum sunlight to have fruit only in the upper canopy. This greatly reduces fruit production and makes trees so tall that they are expensive and difficult to harvest. It is also becoming more common that, due to increasing insurance costs and potential injury, harvesters are no longer able to climb tall ladders to pick all of the fruit.

**High Density Plantings**
Dense plantings are becoming popular as a way to increase production in the early years. It is also a good approach when planting smaller acreages. With a dense planting, the number of trees and fruit production that used to require 20 acres now can be accomplished with only five acres. Additionally, due to the high number of trees planted per acre, the total fruit production with dense planting will produce the same pounds per acres in about half the time as will a conventionally spaced planting.

Successful Orchard Development

**Mounding and Berms**
Mounding and berms can improve soil drainage around the root ball and greatly improve chances of success when planting into soil with Avocado Root Rot. Mounds are often built when replanting in an older orchard, where young trees and older trees must grow well together. It is best to use the native soil at the replant site when constructing a mound, and not use imported soil to make the mound, due to the interface that often occurs between the native soil and the imported soil.

Berms are basically a continuous mound usually built with heavy equipment like a bulldozer or an excavator. It is used in areas that have not been yet planted, or where an older grove has been completely removed and is started over again.
Order trees early for replanting

If you are planning to replant areas of the grove be sure to secure the nursery tree order well ahead of planting time. Do all groundwork in the fall of the year before you plan to replant. Young vigorous trees planted early in the spring have a chance to flower and bear fruit during the first season in the ground.

When to Plant
Avocados can be planted any time of the year, except during frost, wind or heat, however trees are best planted in the spring. Roots begin flushing in May so it is best to have the trees in the ground in March or April. If trees are planted in the summer, careful irrigation must be maintained until roots grow into the surrounding soil. This means that trees will usually have to be watered every two to three days in the summer, but care must be taken not to over-water.

Overwatering
Over-watering, and under-watering, are the most common reasons for tree failure at planting. The ball should never be allowed to dry out. Remember, trees get watered often in a nursery setting, but when planted as inter-sets in a grove, they often get over-watered once per week. The trees are either being drowned or being starved for water. Trees should never be soaked and never allowed to become dried out. Any easy rule of thumb, five to ten gallons per tree split between two to thee irrigations per week. Each grove has different soil conditions so monitor the soil moisture regularly.

Holding Trees in the Field After Delivery
If the trees are not planted immediately after arriving from the nursery, keep the trees in a sunny area and water daily. Trees should be planted immediately after delivery if possible, and certainly within a week of delivery.

Successful Orchard Development

Digging the Holes
Dig holes after the tree spacing is marked and the irrigation system is installed. Pre-irrigate the soil so it easier to dig AND so the soil does not suck the water out of the damp root ball. On flatter ground, a tractor-mounted post-hole digger can be used; steep slopes are usually dug by hand. Dig the hole approximately about 15” deep, or about the same depth as the root ball. Holes dug too deeply are troublesome and can lead to poor drainage.

Carrying Trees in the Field
Carrying the trees to the site. It is tempting to carry the trees to the planting site by grasping the trunk and lifting, but trees will be ruined if the scion breaks off at the graft union. Also, with open bottomed sleeves, large chunks of soil and roots may break off. The correct way to carry a tree is to carry one tree at a time, with one hand supporting the bottom of the root ball and the other hand supporting the side of the pot or sleeve.
Placing the Tree in the Hole and Filling

Most clonal avocado trees are grown in an open-bottomed, polyethylene sleeve. The tree is initially placed into the hole with the sleeve intact to support the roots. The tree is positioned so that the ball is resting on firm soil to avoid settling, and the top of the potting mix is slightly above the soil line.

The polyethylene sleeve is then slit with a knife and the sleeve is peeled away. Do not to cut the avocado roots when slicing the sleeve. Fill the hole with soil and lightly tamp with a shovel handle as soil is added. This will minimizes air pockets and voids in the hole.

Do not add composites or other amendments to the hole as this will disrupt the natural structure of the soil and impede water flow. In some situations, if manures or green waste are added to the hole, ammonia gas emanating from the decomposition of the manure can easily suffocate roots. Don’t risk it. Whatever comes out of the hole just put it back in, without amendments.

Do not place additional soil on the top surface of the root ball. This is left uncovered it can readily absorb water. After tamping is complete start the initial irrigation. Do not be cautious with water at the first irrigation. The soil should be thoroughly moistened to settle the trees, eliminate all air pockets and provide water to the roots. A final irrigation is then done which will fill the basin. If a dripper system be sure to place the dripper on top of the ball, two to three inches away from the trunk, to allow water to dampen the roots but not soak a large around the tree where there are no roots.

Mulching

The young tree is then mulched with several inches of straw or wood chips for moisture retention and cooling of the soil. Manure is not used as mulch because it usually adds too much salt to the soil. Green waste can be placed on top of the mound or berm after planting, to maintain coolness of the topsoil and suppress weed growth.

Staking

Most trees come with a thin stake from the nursery, but these are little use in supporting a growing tree in the field. It is best to support the young tree with two stakes, one on each side driven into the soil outside the root ball. The tree is loosely tied between the stakes with 1 inch wide grafting tape. Most growers use one stake per tree (a substantial 2” x 2” stake) and in most cases (non-windy areas) this is sufficient.
Monitoring Soil Moisture
According to California Avocado Commission

1. Fill the tube with water and place it in a bucket overnight. Use a portable vacuum pump to draw air bubbles out of the clay cup and have water fill the clay.

2. Place tensiometers about 2-3 feet away from the sprinkler in the wetted area of the root zone.

3. Use an auger or other tool to create a hole for the tensiometer.

4. Pour a cup of water into the hole and place the tensiometer at the correct depth. Do not pound on the tensiometer — the clay cup is fragile.

5. Pack loose soil around the tensiometer and tamp it down.

6. Run the irrigation system to help settle the soil around the tensiometer.

7. Protect the tensiometers from pickers by covering them with a bucket or garbage can.

8. If the soil becomes too dry (80 cb), the clay cups will lose suction and draw in air bubbles. If this happens, the tensiometer must be removed, put in a bucket of water and a pump used to draw out the air bubbles.

9. Annual tip changes and gauge checks will help ensure the tensiometer is working properly.

Weed Control

Weed control is important because weeds steal water and fertilizer from the young tree. Weed control should be accomplished by mulching and hand weeding.

Rodent Control

Make sure gophers and squirrels are eliminated year-round. Check the perimeter of the grove for rodent encroachment.

Fertilizing

Fertilizing is initiated right after planting with urea applied once a month during the growing season. Also, start immediately with your phosphorous acid injections, either via the irrigation water or foliar spray, also applied monthly.

- Add more for fertilizer timing, amounts, etc
- Include phosphorus acid recs
- Gypsum
- Note to push trees for growth immediately after planting.
One Page Planting Instructions - English

1. Build a small mound using soil at the planting site. The mound should look like a volcano with a flat top. The dimensions are approximately three feet wide at the bottom, and twelve inches high.

2. Dig the hole in the mound about fifteen inches deep.

3. Place the tree in the hole. Slice the plastic wrapper

4. Install a dripper in the hose and put the dripper close to the tree trunk.

5. Apply 10-20 gallons of water per irrigation during the first year. Irrigate once or twice a week depending on weather and soil conditions.

Un Pagina Instrucciones de plantando:

1. Construir un pequeño montículo usando suelo en el sitio de plantación. El montículo debe ser similar a un volcán con la parte superior aplanada. Las dimensiones son aproximadamente de un metro de ancho en la parte inferior, y doce pulgadas de alto.

2. Escarba el hoyo en el montículo cerca de quince pulgadas de profundidad.

3. Planta el árbol en el hoyo.

4. Instale un gotero en la manguera y poner el gotero cerca del tronco del árbol.

5. Aplicar 10-20 galones de agua por riego durante el primer año. Regar una vez o dos veces por semana, dependiendo del clima.

Caption?
Historical Hass Consumption

CONSUMPTION PROJECTIONS (YEAR/POUNDS)

GROWTH IN AVOCADO CONSUMPTION - LAST 30 YEARS (POUNDS/WEEK)

USDA 2014 Organic Survey Report

California leads the nation in organic sales at $2.2 billion. The total sales of organic products in 2014 were $5.5 billion, a 72 percent increase from 2008.

California reported 2,805 organic farms in 2014 with a total of 687,000 organic acres

California accounted for 41 percent of all organic sales in 2014

Nationally, 78 percent of all organic sales in 2014 were to wholesale markets

Nationally, the majority of organic farms (80 percent) sold some or all of their organic products within a 100-mile radius of their farm

The two largest expenses for organic farmers were feed and hired labor (representing 46 percent of production expenses)

The most popular organic practices were use of green/animal manures (67 percent), utilizing buffer strips/rows to isolate organic products (66 percent), water management practices (53 percent) and use of organic mulch/compost (50 percent)

Organic production is expected to grow — 39 percent (5,000 farms) of respondents indicated they planned to increase organic production over the next five years.
Thanks to:

UCR IPM  http://www.ipm.ucdavis.edu/PMG/selectnewpest.avocado.html

University of California avocado researchers

Dan Grant

California Avocado Commission

University of California Cooperative Extension

California Avocado Society

All avocado growers in California

Avocadosource.com

California State Water Resources Control Board

United States Department of Agriculture

California Department of Agriculture

FreshFruitPortal.com

Yiuma Water District