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The Avocado in Hawaii

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Address to fourth Annual Meeting of the Avocado Association of Hawaii.

This is the Fourth Annual Meeting of the Avocado Association of Hawaii. As there is nothing worthwhile for me to say in connection with our Association—there having been no meetings during the past year—I thought it might be useful and of interest to our growers of avocados if I confined my remarks at this meeting to the culture of avocados as practiced at Haiku Farm.

It has been said in California that there are as many methods of avocado culture as there are farmers, and I would add that each farmer changes his own methods from time to time, and at Haiku we are no exception to this rule. Therefore, what I have to say is not our final word, nor is it given in any spirit of dogmatism.

The fact that the avocado tree grows practically wild in certain parts of the world, including our Kona district, gives many the impression that the avocado is a hardy tree. It is not hardy. It is at all ages a very delicate tree—except where certain naturally favorable conditions obtain. These natural conditions may be enumerated as follows:

A well drained soil.

A deep and rich top-soil.

A well distributed rainfall, of say 50 inches or more.

Absence of strong winds, especially of continuously strong winds.

A mild temperature, and not too dry climate.

Absence of serious pests and diseases.

And for the cheap commercial production of avocados must be added this further fundamental requirement, namely, varieties that are hardy and strong growers and heavy bearers.

At Haiku we are blessed with only **two** of the natural conditions mentioned, namely, a mild temperature and fairly humid climate, and usually a pretty well distributed and sufficient rainfall—whereas in large districts in Southern California they have **all** the natural conditions except that they have to supplement a low rainfall with expensive irrigation, and occasionally have to protect against frost.

We, therefore, at Haiku have been forced to try to correct certain natural disadvantages, and my thought is that our experience may be of help to other growers who also may not have many of the natural cultural advantages.

GOOD DRAINAGE VERY IMPORTANT

The most important requirement mentioned is that of drainage. This does not mean simply **good** drainage. It means excellent drainage. I know of no other tree that we have that is so susceptible to imperfect drainage. We have lost from 200 to 300 trees in areas that we had supposed would be our best avocado lands, and where such trees as mangoes, macadamias, or bananas would thrive. The trees grew fine for a few years, but when five or six years old, following heavy rains, their leaves turned yellow, and the trees gradually died, one after another. Our sub-soil is a clay-like soil that becomes waterlogged in very wet weather; thus the roots are deprived of air and the tree drowns.

Undoubtedly the damage from our poor drainage was, in many cases, greatly intensified by the fact that we originally dynamited the sub-soil at a depth of four feet, with the idea of improving the drainage, but with the actual result of forming cavities with hard, pot-like, water-holding sides, directly under the trees. Therefore the lesson is: don't use powder, even in the driest weather, unless you dig down and take note as to whether a cavern with impervious sides has been formed, for a tree planted over such a "flower-pot" is in deadly danger from stagnant water in the cavity. Moving water near a tree is perfectly safe, but **stagnant water is poison.**

The roots of an avocado tree are almost entirely in the upper three or four feet of soil, and therefore, before planting, it is this upper four feet of soil that should be carefully studied. If I were planting a new area I think I would dig holes of various depths; then pour water into the holes and note whether it drained away quickly or not. I would not plant a tree in any hole that did not show fairly quick drainage by this test. The trouble, if any, lies in the sub-soil; and surface indications of drainage are no criterion whatever of conditions in the sub-soil. After a heavy rain the water may seep away quickly from the surface, but remain long enough in the sub-soil to drown the tree or to kill it by the poisonous effect of stagnant water; and, on the other hand, we have often seen water standing on the surface near a tree for weeks at a time with no apparent damage to the tree. Our worst areas are in the hollows, but many trees have died on the higher land and even on the hillsides. We have replanted our bad-drainage areas because we did not wish to acknowledge defeat, and are trying an experiment to improve our drainage which may prove of value. This consists of digging a "trench", quite near to each tree, about five feet long, two feet wide, and four feet deep, leaving the "trench" open permanently so that, in "weathering", cracks are formed in the sides and bottom. We have noted that after "weathering" the trenches do not hold water after heavy rains, and we have hopes that they will at least save a percentage of the trees from dying.

FERTILIZATION

The avocado tree has a voracious appetite, and if it is to bear well it must be well fed. The top-soil contains most of the plant food, and therefore it should be deep—it should be at least three feet deep. At Haiku our top-soil is only one foot deep, and therefore the only answer to this defect is to fertilize heavily. The subject of fertilization has been very confusing to us, but at last we think we have settled on the following plan: First, we give

the trees all the stable and chicken manure that we can beg, borrow or steal, putting the manure on the surface of the soil under the "shade" of the tree. Next, we give, twice a year (in the spring and fall), a mixture of equal parts of sulphate of potash and raw-rock phosphate, broadcasting it under the trees; and at the same time, any tree that we think needs an extra dose of nitrogen (over what it has received from the manure) gets an application of sulphate of ammonia. We know that our soil is deficient in phosphoric acid and that the avocado must have it, and that potash is desirable for any fruit tree, and that there is no danger in giving too much of these two elements; but the nitrogen applications must be watched with care, for too much may make the tree grow too rank and bear small crops. We think that a tree that is slightly "off" in color, or looks sickly, or has borne too heavily, should get a dose of nitrogen in addition to the manure, unless it has been recently heavily manured. We place all fertilizer under the tree and a little beyond the "drip" of the branches, for the reason that in a tree of good-bearing age there is a mass of roots close to the surface under the shade of the tree, and it seems reasonable to feed the tree in the area where most of the roots are naturally to be found. Any form of vegetable mulch, such as leaves or straw, if available, is beneficial under the trees—although not necessary, for some of the best growing and bearing trees I have seen have been in poultry yards where the ground has been quite clean of vegetable mulch. It has been said that the avocado needs twice as much fertilizer as citrus trees, and I think that this may be even an under-statement of the fact. I would fertilize quite heavily in even deep, rich soils—unless, perhaps, the price of the fruit drops very low. During the past year we have fertilized much heavier than in the past, and the result has been a much smaller percentage of ill-shaped fruit, and, to our great surprise, the seeds of at least one variety (the Itzamna) are decidedly smaller than formerly.

TREES FOR WINDBREAKS

At Haiku we get the full blast of the trade-wind, and therefore we have planted fairly close in the rows (20 feet)—the rows running in the direction of the trade-wind—so that one tree will protect another when of good size; and we have planted many kinds of wind-breaks, both in the rows, between the rows, and on the sides of the fields. Within the fields we have tried pigeon-pea, koa haori, papaias, and bananas; and surrounding the fields we have had iron-woods, aurecarias, eucalyptus, sisal, Hawaiian holly, and ficus trees. The trouble with planting wind-breaks within the fields is that by the time they are large enough to do much good their roots have spread so far that they rob the avocado tree of its food and water. I think if I were starting all over again I would plant aurecarias or eucalyptus on the windward sides of a field; but within the field I would plant nothing at all, relying on lattice-work (lath) wind-breaks near each tree; I would plant a little closer, say 15 to 18 feet in the row; and plant only varieties that stand a lot of wind—such as the Nabal and Itzamna; and I would plant in check-rows so that cross-harrowing would be possible.

CULTIVATION

The matter of cultivation—hand-weeding, tractor-harrowing, and sub-soiling—has been

an everlasting problem to us. I think in the past we have rather overestimated the value of this phase of the farming, and have harrowed and sub-soiled too often and too close to the trees. Our present practice is to let the weeds more or less run riot during wet weather—for they are beneficial in holding the precious top-soil from washing away during very heavy rainstorms—but when fairly dry weather is expected, our rule is to clean-weed under the trees by hand, and tractor-harrow on the two sides of the tree-rows, being very careful, however, to keep far enough away from the trees so as to cut no roots. The harrow has probably done a good deal of damage in the past by cutting roots, and so our present iron-clad rule is to **CUT NO ROOTS.** The harrowing under of vegetable growth of course adds much valuable humus to the soil. In regard to sub-soiling, it would seem that it would be good practice, in order to aerate the soil, to sub-soil well away from the trees, so as to cut no roots, and to do it in the spring or early summer after the danger of wash from extremely heavy rains.

PESTS AND DISEASES

At Haiku we have our full share of diseases and pests, the principal ones being so-called anthracnose (fungus) affecting the twigs and branches; "black-spot" (fungus) affecting the fruit; so-called "bark disease" (probably fungus) affecting the trunk or larger branches; and red spider. For the fungus diseases we use the universal remedy, bordeaux mixture, both in liquid spraying and in dusting, with power machines; but it does not control the trouble. It only helps, and when the price of avocados becomes very low, I doubt if it will pay to use bordeaux. In the case of "black-spot" I think it is more important to prevent each fruit from touching another fruit or a twig, by thinning and pruning, than to use a fungicide. For the control of "bark disease" we send a trained man around the farm once each month, who inspects each tree, and affected areas on trees are chiseled out and a bordeaux paint is applied. Incidentally, he always finds a dozen or so trees affected, but fortunately the remedy seems to be very effective. This disease is fatal if not treated. The red-spider nuisance requires constant vigilance at Haiku, for if it gets the upper hand, the leaves drop, the branches become sunburned, and if the tree is carrying fruit that are nearing maturity, they also become sunburned and are unsalable. Bed-spider is especially harmful to weak trees, in which case the leaf-renewal is slow and therefore there is sure to be serious sunburn. We have found dusting with sulphur far more rapid and effective than spraying with liquid sprays.

A sick tree, if not treated, is generally a dead tree. Our general remedy for a sick tree—whether the cause be due to anthracnose, sunburn, over-bearing, or poor drainage—is to cut back the branches to healthy wood, often cutting a big tree back to within three feet from the ground. Such treatment often results in renewed life and health to the tree, and although there may be a loss in time of two to three years, yet such delay is better than to have a sterile or dead tree.

THINNING THE FRUIT

We have come to realize the great importance of thinning the fruit to prevent over-

bearing or to relieve a sickly tree. Even if a healthy tree bears two heavy crops in succession, it may sicken from the strain, and, due to its weakened condition, may be attacked by some disease or pest and eventually die. Therefore our practice now is to systematically go over the trees, especially during the summer, removing all the fruit from the sickly trees, and thinning the fruit from overloaded trees, often removing as much as 50% of the fruit. Naturally the misshapen or spotted fruits are the first to be removed.

We do very little pruning, except where it is obviously desirable, allowing the lowest branches to touch the ground, as these branches are generally the heaviest producers. Formerly we propped tip the lowest branches with forked stakes to prevent injury to the fruit from contact with the soil, but now, when the tree is heavy with fruit, we wire the lowest branches to upper branches, and weak ones to strong ones, thus assisting the tree to carry its load without as much breakage or spoilage of fruit as would otherwise result.

Each locality has its own problems, and each farmer must, to a large extent, learn by his own experience and the use of his own brains, with the help of specialized experts; but there are two points at least that I have mentioned that are universally admitted to be of the greatest importance, and these are that an avocado tree **must have good drainage** in order to live, and must have an abundance Of plant-food in order to be profitable.