

GETTING STARTED IN AVOCADOS ON THE LIMONEIRA

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With very small trial plantings of Avocados first made in 1943 and the first plantings of any size planted in 1947 and later, we are in truth, just getting started in avocados at the Limoneira.

The question might well be asked, why get started in Avocados at all. As is well known to so many of you, the Limoneira Company was established in 1893, 61 years ago, and has been engaged principally in citrus since. The company has grown through a series of property acquisitions, the last of which was in 1924, some 30 years after the first. The several new developments served to mask the severity of what has become the company's most difficult problem, namely, the continual cropping of the same land to one crop, in this case citrus.

By the middle 1940's, some 20 years after the last land acquisitions, it was apparent the profitable replacement orchards could not be grown with our then current methods. Growth and production of such crops as beets, beans and tomatoes showed that there had been no loss of fertility of our soils, but the soils had become unsuitable for citrus. Experiments with soil fumigation begun in the late 1930's gave some promise that the unfavorable conditions might be improved, but this was by no means certain. It was soon recognized that rocky soils, and terraced and contoured hillsides presented especial problems in soil fumigation, and furthermore, that these conditions were also unsuited to profitable field or truck farming.

Therefore, a new tree crop for such conditions was desired and the best bet seemed to be avocados. Whether or not avocados are a solution to this problem is a question which remains to be answered. I will attempt to review briefly what we have learned thus far and to tell you about our current cultural method. Later I will show you a few tables and slides illustrative of what we are now doing.

There is one perplexing question in connection with growing avocados on the Limoneira on which we are gathering no information at the present time. This question briefly stated is, what will happen to our orchards during a wet rainfall cycle? While care has been taken to avoid locations with compacted subsoils and impaired drainage, most of our soils are heavy clay and silt loam types which are highly retentive of moisture. During a wet winter these can well remain at or above field capacity for a long period of time. It would seem that under these conditions, root rot will undoubtedly result.

Cultural Practices

TREE PROPAGATION

Being citrus growers and having a well established and successful nursery technique, we at first tried to grow avocados in the same manner. As a sidelight here it might well be mentioned that we soon found out that fumigation of old citrus soils did not make an avocado nursery grow better than old citrus soil not fumigated. We soon found that our citrus nursery technique was inadequate in growing avocado trees.

Two troubles were encountered—first, a reasonable stand of living buds of all varieties could not be obtained and, secondly, that the trees died in unreasonable numbers in being transplanted to the orchard. Both year old and first season or so-called "tied-up buds" were tried, with indifferent success. The next method tried was to move well grown year old seedlings to the orchard and graft them when well established there. A somewhat better stand of trees in the orchard was obtained by this latter method but it was not entirely successful as some of the grafts died and often the trees turned yellow.

Finally, a hot-house was built and the tip-graft method adopted. This has been very successful in all respects. Good quality trees can be uniformly grown at reasonable cost. In addition to the ability to grow good quality trees uniformly two other sideline advantages have developed for us in the tip-graft method. The first of these is brought about by the ability to grow trees from seed to orchard planting in some 6 months time, and as you can see this reduces the strain on the crystal ball department considerably. Under the two former methods the decision had to be made a year and a half to two years in advance of planting the orchard. With tip-grafts the desired varieties can be grown when the decision has been made only 6 months before the necessity to plant the orchard. Furthermore, we have been able to make a very advantageous use of the hot-house facilities, inasmuch as one crop of avocado trees and one of citrus seedlings is grown consecutively in the same house each year. The latter has proved of more use with the citrus seedlings than for the avocados. I believe that our methods of growing tip-grafts are entirely conventional and so will not go into this subject.

FIELD CULTURE

TREE SPACING. One and one half to four times the finally desired stand of trees have been planted in most orchards. This was done partly because it was not known how large the trees would grow, partly to achieve high early production, and finally because many of the orchards were started as inter-plants among existing citrus trees. It is now becoming apparent that we have planted too many trees per acre and that to avoid crowding it will be necessary to remove many trees that have not yet achieved significant production. The best orchards have been obtained in the least time where the old citrus trees were removed prior to planting the avocados. A further factor to be considered here is the cost of the disposal of the old citrus trees. A few dollars per acre will do the job when they can be piled and burned, but, \$200 to \$300 per acre would be a reasonable cost if it is necessary to do this work after the avocados have been

planted. One more "don't do it" on orchard planting, not being certain which varieties would bear in our location, we, in most instances planted alternate trees to different varieties in the same tree row. The thought here was that if one variety proved to be a non-bearer it could be removed and a satisfactory orchard would still remain. However, this has generally proved to be unsatisfactory, for the following reasons. The intermingling of trees of various sizes and shapes has made ordinary cultural operations more difficult. Irrigation and moisture control has been seriously complicated where continuously heavily foliated varieties such as Fuerte have been mingled with varieties such as Hass which occasionally almost completely defoliates. Finally, picking convenience and picking costs are adversely influenced when varieties are intermingled.

CULTIVATION. In some of our orchards weeds are controlled by cultivation and in some by spraying. The growth and vigor of the trees does not indicate that they have a preference for either method, and either seems satisfactory. As cultivation is the less expensive method of weed control this method has been used until the trees are large enough to themselves shade out weed growth.

IRRIGATION. Furrow irrigation is used in all of our orchards because the system was in existence when they were planted. Sprinklers have been used in limited experiments but again trees have shown no preference as to the method of water application. The timing of irrigation and amount of water applied is judged by soil sampling and the requirements seem to be the same as citrus trees at the same location. It seems just as easy to over irrigate avocado trees on our heavy soils as it is to over irrigate citrus trees under the same conditions. At the other end of the scale, well established and vigorously growing avocado trees seem to have as wide a tolerance toward reduced water application as do citrus trees under similar circumstances. In other words, over irrigation seems to be a greater and more usual hazard than under irrigation.

FERTILIZATION. For many years we have endeavored to maintain by laboratory analysis between 5 and 10 ppm of nitrate nitrogen in citrus soils during the growing season. This has been done by adding nitrogen in various forms to the irrigating water. The same practice has been followed with the avocados, with no present indication that the practice is inadequate or incomplete. Disappearance of nitrogen from our avocado soils seems to occur at a slightly lower rate than citrus soils. This means that whereas from 125 — 225 lbs. per acre of nitrogen are applied to citrus soils, similar soils growing avocados will receive from 50—75 lbs. per acre less annually.

An annual spring foliage application of zinc and manganese has been made to our avocado orchards. This has been done because of the leaf symptoms which appear in the absence of spraying and because of zinc and manganese deficiency troubles experienced with citrus trees which grew in the same locations previously.

We have had a good deal of trouble with trees turning yellow. This occurs especially after grafting and top-working and has been thought to be due to iron deficiency. If the trouble is not severe we have been able to improve it somewhat with soil applications of chelated iron at 10—15 gm. per square foot of soil treated and by spraying with chelated iron and ferrous sulfate at 200 ppm actual iron. These spray applications have given some burning of tender foliage, but have improved tree condition if the chlorosis

was not too severe. In cases of severe chlorosis the tree goes ahead and dies anyway.

INSECT CONTROL. Most fortunately insect control has been a minor problem on our avocados thus far. A small amount of miticide for spider control has been added to the minor element sprays to reduce brown mite damage to susceptible varieties such as the Hass. There is some indication that latania scale is becoming more prevalent and troublesome and attempts to establish the natural insect enemies of this scale in our orchards have not been too successful. We feel that argentine ants complicate the natural control of this scale insect and are beginning a program to eradicate them from our orchards. It is understood that the citrus experiment station at Riverside will soon have some new parasites and predators ready for release to attack this insect, and we are eagerly awaiting their assistance.

PRUNING. Limited pruning has been carried on in our orchards to first establish better shaped trees, second, to permit necessary access to the orchards for cultural operations, and third, in an attempt to restrict the upward growth of the trees. This latter is of course an attempt to reduce picking costs as the trees come into bearing. Whether or not it turns out to be an economical practice remains to be seen.

FROST PROTECTION. Most of our avocado orchards have been on sites where frost protection for lemons has been proved through the years to have been unnecessary. Our experience with frost protection of avocados has been so limited that we know little about it and hope our inexperience will continue.

VARIETIES. This is of course a pay-off question, and our experience is so recent and so limited that we have no definite answers as yet. I will show you some tables which give the story on what has been planted and what the results are to date.

The first table shows the per cent of each major variety as compared to the total. The second table lists those varieties whose number of trees is less than one per cent of the total. You will note that there are all together some 41 varieties and each year we add a few more, trying to find the right one. The third and fourth table show the dollar income per tree of the varieties on which we have the best information. In referring to these tables it should be born in mind that the results are not for the same calendar year but for the same tree age. For example year 5 for the Hass is the same calendar year as year 6 for the MacArthur. Of the varieties for which no returns are yet available the Silliman looks fairly good. On the basis of the results shown here and the prospect for a crop for next year we believe that the Hass is probably our best bet as a fairly regular producer of quality fruit.

Table 1. Avocado Varieties

Variety	Percent Total
Anaheim	8.4%
Carlsbad	1.7
Dickinson	8.2
Hass	35.9
MacArthur	29.6
Rincon	10.0
Others (less than 1% each)	5.0
41 Total Varieties	100.0%

Table 2. Miscellaneous Avocado Varieties (Less than 1% of total)

Bays	Clifton	Irving	Ryan
Bacon	Dewey	Mesa	Silliman
Benik	Edranol	Monica	Tantlinger
Bonita	El Arcó	Nabal	Fuerte tantos
777	Emerald	Nowels	Topa Topa
Colorado	Gurkin	Pueblo	UCLA
Corona	Halstead	Regina	Westwood
Covocado	Hellen	Routh	Wurtz
	Zutano		

Table 3. Income per tree at Santa Paula

Tree Age	Anaheim	Fuerte	Hass	MacArthur	Rincon	Zutano
4	\$.19	\$.42	\$.07	\$.18	\$.14	\$.24
5	1.06	3.64	2.36	13.91	1.47	5.28
6	3.82	8.78	9.04	17.72	.14*	9.96
7	--	--	2.06*	.80*	--	--
Total 6 yrs.	\$5.07	\$12.84	\$13.53	\$32.41	\$1.75	\$15.48

* Estimated

Table 4. Income per tree at Ventura

Tree Age	Dickinson	Hass	MacArthur
3	\$--	\$.02	\$.02
4	.02	2.63	.36
5	3.26	11.90	2.64
6	2.14	21.50	.79*
7	2.00*	10.62	--
8	--	1.63*	--
Total 6 yrs.	\$5.52	\$36.05	\$3.81

* Estimated