

## AVOCADO POLLINATION AND BEES

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This is a report of the progress of tests and studies of the pollination of avocados by bees in the orchard of the Point Loma Theosophical Homestead.

The orchard is located about one mile from the ocean, on the east slope of a ridge. It comprises about three acres of trees, from one to eight years old. There are about 30 varieties and a considerable number of seedlings. The trees are practically all in healthy vigorous condition and of medium size for their age.

During the last blooming season there were 17 hives of bees in the orchard. Because of drought here, as elsewhere in Southern California, there was less outside bee pasture than usual and bees worked very much more abundantly on avocado blossoms here than during any previous season, and produced an abundant honey harvest. This bee work was carefully observed and notes made of it, as has been done for several years past. There seems to be no question that the heavy crop which has set on much of the orchard is closely related to the greater amount of bee work on the blossoms. Growers who have watched this as closely as the several observers here cannot help thinking that the more bees at work in the orchard the better.

Frequently bees do not work as freely on avocados as on most other fruit blossoms. They often prefer other bee pasture to the avocado orchard. When bees are abundant or other bee pasture is scarce they work more freely on avocados. At one time bees work most on some varieties of avocados, at other times on other varieties, partly because of differences in the amount or accessibility of nectar. Close watching showed that bees have a strong preference for sticking to one avocado tree at a time. For these reasons it is not as easy to obtain the maximum amount of pollination and cross-pollination of avocados of the varieties studied as it is of other fruits. But as can be observed bees do cross freely when the foliage of two varieties interlace, with no open space between. Very few insects except bees frequent avocado flowers.

Very few avocado flowers close tightly after shedding pollen. Many remain half open with abundant pollen on their anther valves. Bees are constantly walking across these half closed flowers in search of open receptive flowers. Frequently they probe with their hairy tongues loosely closed flowers which have just been shedding. At times they force open receptive flowers which have not yet opened for the first time but will open within a few hours. They sometimes probe flowers in all stages in rapid succession. They do less of this the fewer bees there are at work in proportion to the number of flowers open.

In our coast climate the over-lapping of the receptive and pollen-shedding periods of many varieties is considerable. This, and the frequent probing by bees of blossoms not fully open provides for the self-pollination of many varieties. They can and do receive

their own pollen, but that does not prove that self-pollination will produce as many mature fruits as cross-pollination. The need of avocados for cross-pollination may not depend entirely on the daily periodicity of the blossoms. It may depend partly, as with many other fruits, on the affinities for pollen. In this regard varieties may vary greatly as to their need for cross-pollination. Pollen affinities of many other fruits vary in different years and in different climates.

To test self-pollination in comparison with cross-pollination we at the beginning of the last blooming season covered parts of eight trees, including four varieties, with netting on framework. On most of the trees considerable care was taken in placing the netting so that half of each tree should be inside the netting and half outside. With one exception the trees used were from five to seven years old.

A full swarm of bees was put under each netting, except one. The bees were fed abundance of honey and were given expert care. Notwithstanding being confined during the long blossoming season they were kept in good working condition and did a normal amount of work on the blossoms. No bees could get into or out of the nettings.

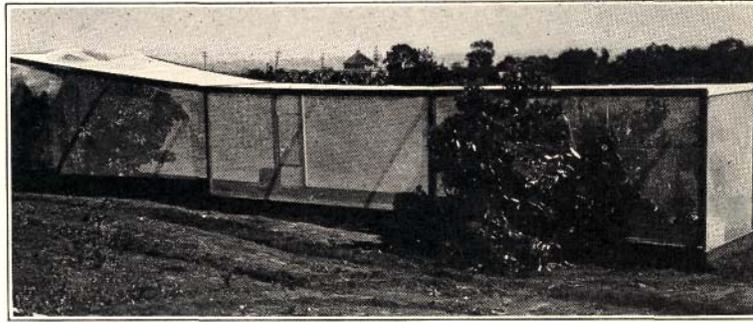
Blossoms inside and outside the nettings opened and closed at the same times of day whenever noted. Great numbers of small fruits set both inside and outside the nettings. A large proportion of these small fruits contained seeds, and the proportion containing seeds seemed to be the same inside and outside the nettings. Abundant self-pollination had taken place inside the nets. The spells of greatest amounts of dropping of small fruits did not proceed at the same times nor in the same amounts inside and outside.

Some of the Fuerte trees used had a very long blossoming season. All the nettings had to be left on from two to six months. When the nettings were taken off it was seen that the small degree of long continued shading and other very light atmospheric conditions produced by the nettings had caused a slight but easily seen effect on the appearance of the foliage under the nets.

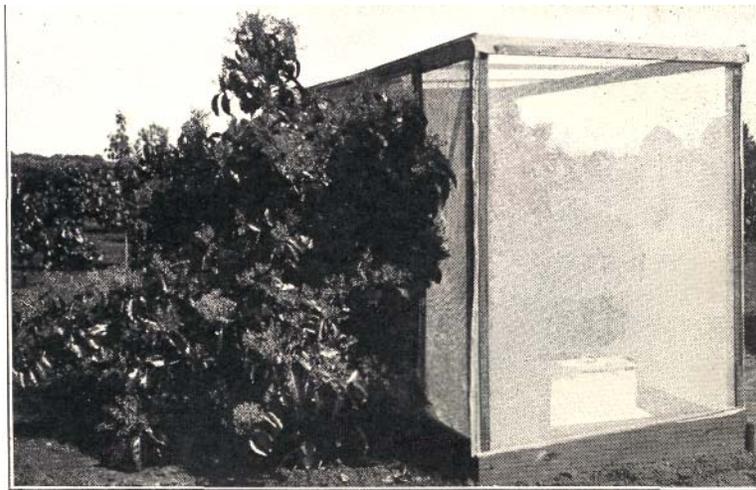
Half of one small young Dickinson tree was covered but with no bees under the netting. On the half of the tree outside the netting great numbers of small fruits set, six of which are growing well and evidently most of these will mature, which is a heavy crop for the half of a tree of its size and age. Inside the netting where there were no bees only three small fruits set and those fell before they reached the size of peas.

We tested one tree of the Tingley variety for self-fertility. Less than half of this tree was under the net. Blossoms which were under the net produced 234 mature fruits; those which were outside the net produced 191 fruits. The daily periodicity of this variety's blossoms is such as to provide sufficiently for self-pollination, and the test with the netting indicates that it is very self-fertile, as the portion of the tree which had been under the netting overbore, as this variety is inclined to do.

One netting was made to enclose parts of two trees and three varieties. The bees in the netting worked freely on both trees, but could not be seen to cross from one tree to the other, except when they were forced to do so by the location of the hive. The experience with this test seems to bear out our observations in the orchard generally, that bees do not cross freely from one variety to another when there is any space between.



*Method of Connecting Two Varieties with Netting. Hive of Bees Included*



*Part of Avocado Tree Enclosed with Bees to Test Self-Fertility*

Some dropping is still taking place from nearly all the trees used in the tests. It is well known that many deciduous fruits drop worse until maturity if only self-pollinated than they do if cross-pollinated. It is likewise well known that fruits which are only partially self-sterile vary in that regard from year to year. The bearing of avocados is freaky. For these reasons I think all will agree that it would not be justifiable to give out conclusions as to leading commercial varieties until tests have been repeated more than one year.

We have kept records of the behavior here of blossoms of the varieties. These show some important facts. The behavior of Fuerte flowers is such as to indicate that pollination must usually take place in the forenoon. When the receptive flowers open in the afternoon it is not until bees have stopped work for the day. A pollinator for the Fuerte should furnish pollen from the beginning of daylight during most of the forenoon. The Spinks usually does do that here. The Dickinson and many others usually do not. The daily periodicity of the Fuerte is such as to provide fairly well, by the overlapping of periods, for self-pollination. This is more or less true in other localities, but does not

prove its affinity for its own or other pollen. The fact that it can pollinate itself does not prove but that it may produce more with cross-pollination.

The Fuerte blooming season begins early, with the Mexican varieties, but it seldom sets fruit that reaches maturity until a later part of its blooming season. The small fruits that set early usually all drop. The important part of the Fuerte blooming season coincides with some of the Guatemalan varieties.

Last year we were shown by growers in San Diego County and in Orange County what appeared to be strong evidence that cross-pollination had caused Fuertes to bear very heavy crops. The record of these same orchards and trees should be noted this year and in future years.

The behavior of the Dickinson here is not such as to make it promising as a furnisher of pollen, though it is our most regular bearer. For the four years of our records it has bloomed very late in the season beginning after the Fuerte bloom is nearly all gone. In addition to this the majority of its flowers do not shed any pollen, and many days none of them shed any pollen, even when the weather is fair and a little warmer than normal. What pollen shedding it does do is of very irregular occurrence as to time of day, but is usually late in the afternoon when there are no bees whatever at work to carry pollen.

The behavior of the Spinks is such as to make it seem very promising as a producer of pollen for Fuerte and perhaps for other varieties. It is a most profuse bloomer during a long season. It usually has large numbers of pollen-shedding flowers open nearly all day. After shedding pollen its flowers only partly close, as is the case with many other varieties. Bees frequent Spinks more abundantly than they do many other varieties. The hairy feet of bees are constantly walking over its half-closed flowers and in this way as well as on their hairy tongues they must carry much pollen to receptive flowers.

We and others have found that avocado blossoms are supersensitive as compared with the flowers of other plants. If its blossom clusters are experimented with or roughly handled they do not set small fruits as they would otherwise have done. They are also sensitive to wind. Many varieties here, as in some other orchards near the coast, produce much less fruit from the blossoms on the sides of the trees most exposed to the strong daily ocean breeze but may bear more than enough to make up for it on the other sides. The Fuerte and Dickinson do not seem to be so affected but distribute their crops rather evenly on all parts of the tree.

We hope to help to discover and prove essential facts in regard to avocado productiveness and thus eliminate guesswork, and make our orchard more productive. We, as growers, aim to apply the facts already worked out by the avocado and horticultural experts, and the more we can do this and help them to collect needed data the sooner we will know what to do and how to do it.

The tests and recorded observations described in this report were made by members of the Horticultural Department of the Point Loma Homestead.