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HOW TO MAKE THE AVOCADO TREE BEAR

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It may be taken for granted that the selection of the above subject as the chief topic for one meeting of this association indicates that the unfruitfulness of many budded trees of commercial varieties has caused some concern on the part of avocado growers of Southern California. In fact we do not have to look far to find many specific instances of an almost total failure to produce fruit under what are apparently ideal conditions. At the El Mirador Ranch at Pasadena there are ten trees of the Walker variety, six years old, all having the tall columnar growth characteristic of the variety, and growing as far as one can see under similar soil conditions. Two of these trees have for several years past borne more than a hundred fruits each. The others bear nothing although the bloom is equally heavy and thrifty on all. These trees are in a row adjoining Spinks and Fuerte and would seem to be equally exposed to cross-pollination.

At Yorba Linda Mr. Wheden has a number of Fuerte trees. Some bear heavily and consistently; some did bear well but no longer do so; while some have never borne—yet they all appear to be typical Fuertes and are amply exposed to cross-pollination.

In a great many places the Taft variety is barren even after the trees are six or seven years old and are large enough to bear several hundred fruits. On the other hand, at the Murphy Ranch at East Whittier, at Yorba Linda, and in some other places small and comparatively young Taft trees have borne heavy crops of fine fruit. In striking contrast with these cases are the Spinks and Dickinson varieties which are precocious and consistent bearers under many and varying conditions.

In order to more easily analyze our subject, let us divide it into two parts, viz.: how to make avocados bloom; and how to make avocado blossoms set fruit.

In the higher fruit bearing plants, the function of vegetation is adverse to the function of fruit bearing. Countless examples of this might be given but it is best illustrated perhaps, by the commonly observed dimorphism of branches on such plants as the climbing fig, English ivy, blue gum, Australian bottle tree, and many fruit trees. Vegetation is a function of youth; fruitfulness is a function of age. Young trees placed in a position to grow without competition devote their energies to rapid expansion, following out the "grand period of growth" until curtailed soil food, competition between the branches, increase in inhibitors from the greatly increased number of growing points brings about a concentration in certain elements of the elaborated sap which ushers in the period of fruitfulness. This period may be hastened or delayed by manipulating the casual factors. Pruning and heavy fertilization defer the fruitful period, while girdling, root pruning, and nitrogen hunger hasten it.

I have discussed girdling and root pruning before this Association on a previous

occasion and will therefore proceed to the second phase of our subject, viz.: How to make the blossoms set fruit.

Temperature

Avocados bloom in the cool season of the year, beginning with the Mexican varieties in October and continuing in succession until May. Undoubtedly blossoms which may not be actually frozen on cold nights; may be so chilled as to cause them to fall. High temperatures such as occur on an unusually warm spring day may result in shedding of the blossoms and young fruits, but in my opinion, it is the water relations within the tissues of the plant which are unfavorable to fruit setting rather than the actual high temperature. It is manifestly unfair to ascribe failure to set fruit to unfavorable temperatures when of two similar trees growing side by side, one may set much fruit and the other nothing.

Humidity

The avocado is a native of a humid climate. The foliage is not adapted to resist water loss. Consequently we find the tree much more fruitful near the coast and within the influence of the moist air from the sea. But here again we note that it is the failure to bear of certain trees growing under seemingly ideal climatic conditions which causes us the most concern.

Soil Moisture

While soil moisture is a prime factor in the setting of fruit, and while it is true that our soil types often vary markedly within short distances; it is a fact that at Mr. Whedon's place the most barren Fuerte tree stands next the most fruitful one, and considering its vigorous healthy growth, it would require a considerable stretching of our credulity to believe that the cause of un-fruitfulness here is due to any lack of water.

Soil Nitrogen

Certain investigators have recently found that in the case of some plants, such as the tomato and orange, fruit setting is profoundly influenced by the balance between available soil nitrogen, soil moisture and certain other factors. It has been my observation that the nitrate supply has much to do with the proper setting of oranges. The unfruitfulness of the Walker avocado trees referred to above can hardly be ascribed to a lack of nitrates because all the trees received a generous and approximately equal amount of alfalfa-fed manure and cover-crop.

Pollination

In the case of most fruits the pollination of the flowers has much to do with the setting of the fruits. Some varieties are self-sterile and require cross-pollination while others are self-fertile. Between the many varieties of stone fruits such as plums, peaches, cherries, and almonds, the various degrees of compatibility have been worked out experimentally with more or less finality. So far as I know no similar work has been carried on with the avocado in California, and little or nothing is known concerning the pollination and fertilization of the varieties with which we in California are concerned. A long period of rainy weather during bloom interferes with pollination and results in the formation of many small seedless fruits, but it cannot be conceded that unfavorable weather

conditions could have an opposite effect on adjacent trees of the same variety.

Hybridity

It is characteristic of many hybrids that they fail to set fruit satisfactorily. This may be due either to a failure to bloom or to imperfections in either the male or female organs of the flowers. The Fuerte is generally accepted as a hybrid and may possibly owe a part of its unfruitfulness to its hybrid nature, yet some Fuerte trees bear regularly while on the other hand the Walker and Taft varieties above referred to have not so far been suspected of being hybrids.

Influence of Root-Stocks

Most of the avocado trees which are now complained of as being unfruitful were propagated at a time when little was known of the comparative value of root-stocks. Seeds of both the Mexican and Guatemalan races were used by nurserymen and in recent years much of the California grown Mexican seed gives rise to hybrid root-stocks, on account of its having been grown in mixed plantings. A casual inspection of any Mexican seed bed will show many individuals of unmistakable hybrid characters and varying widely as to type of growth. May it not be possible that our barren trees are growing on incompatible root-stocks? I have no definite knowledge on this subject and merely make the suggestion in order to indicate a line of investigation which is needed. The walnut growers passed through a similar period of uncertainty when the comparative value of different root-stocks was under discussion. The result was that the Paradox and Royal hybrids were eliminated and only recently it has been found that the Southern California black walnut is unsuited to irrigation conditions and its use has been discontinued in favor of the Northern California black walnut. The citrus growers have noted certain variations in yield which could not be attributed to sporting. They have recently sent a man to Florida to study the sources of seed stock, and if possible arrange for a better and more uniform supply of seed. Might it not be a good thing for the Avocado Association to secure an ample supply of pure seed from Mexico and arrange for its importation by the Federal quarantine officials in such a way as to prevent the introduction of the avocado weevil?

Bud Selection

The object of bud selection is to avoid propagation of undesirable sports and occasionally to perpetuate any sport which may appear to have peculiar value. The importance of bud selection depends on the frequency of sporting within any variety. Some varieties of avocados have thrown sports of various kinds and it may be that a part of the unfruitfulness noted may be due to the propagation of undesirable sports. It is begging the question however to assume that all of our difficulty is due to this cause. Sports usually vary in more than one character. The Thomson Improved Orange has a smooth skinned, early maturing fruit and also the tree has different characteristics of growth. Many of the Fuerte and Walker trees are, so far as one can see, typical of the variety except that the blossoms do not set fruit.

Nevertheless we cannot afford to take any chances, particularly with the Fuerte. All buds should be cut from the best bearing trees we have. The difficulty is, in buying trees, to be absolutely sure of the source of the buds.

This is one of the great problems of the nursery business. What we need is to have an agent of the Association, who has no interest in the trees, be present when the buds are cut, care for the buds himself, and be present when they are inserted. He might attach to each budded tree a wax or lead seal bearing the insignia of the association and the index number of the parent tree. This would establish the identity of the particular trees as the labels could remain on the trees until they were planted in their permanent position in the orchard. It appears to me that eventually some such plan will have to be worked out for the protection of the majority of nurserymen who do an honest business and for the public in general. Undoubtedly the public is ready to pay more for recorded trees so propagated.

Conclusions

In summing up, I would say that in order to make avocado trees bear:

1. Select buds from the best full bearing specimens of varieties which are known to bear regularly and well.
2. Place these buds in pure Mexican stock free from hybrid variants.
3. Plant the trees in a locality where environmental conditions are favorable for fruit setting.
4. See that the trees have ample food, but do not crowd them too hard with manure as this may prolong the vegetation and defer the fruit bearing period.
5. Do not depend on winter rains but irrigate during bloom whenever the soil moisture falls below the optimum.
6. Plant several varieties together so that they may have the benefit of any value which may be found to attach to cross-pollination.
7. Plow deeply only in fall and confine spring and summer tillage to cultivation not more than four or five inches deep.
8. If some trees still fail to bear, girdle them in October until the vegetative growth is checked and they assume the bearing habit.