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THE CULTIVATION AND FERTILIZATION OF THE AVOCADO IN FLORIDA

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While the avocado has been grown in Florida since the days of the earliest settlements along the lower East Coast, the planting of orchards and the production of the fruit on a commercial basis dates back little over a single decade, and it has been only in the past few years that the industry has begun to assume proportions of real importance in the horticulture of the state. It can therefore hardly be said that any very definite systems of cultivation or fertilization have been determined upon, but while the various cultural methods have been almost as many as the number of actual plantings, and have all been more or less experimental in nature, some of the general principles are becoming fairly well understood and are gradually being adopted by those interested in avocado growing.

One of the first points upon which observers came to agree, was that though the avocado tree demands a plentiful supply of water and flourishes under irrigation, it will not thrive except upon well drained land and any conditions that make towards a soggy or water logged soil are almost prohibitive to the success in its growth. The trees, particularly when young, are damaged to a greater extent than citrus by prolonged droughts and at the same time there are many fine orange and grapefruit groves, budded on sour orange stock, growing on land that is too low and wet for the avocado.

It has also been accepted as a fact that the avocado is a gross feeder and to do its best requires a heavier supply of plant food than citrus trees of the same age. This is evidenced on the Florida Keys where lime trees thirty years old are to be found, in good condition of growth and producing heavy crops of fruit annually, without any other source of food supply than that obtainable from the deposits of humus filling the interstices of the coral rock where the original hardwood jungle has been cleared away. The avocado on this type of land makes a rapid growth when young and will produce two or three good crops but after reaching an age of five to six years the tree ceases to put on growth, begins to die back and in a comparatively short time will die from starvation, unless the supply of plant food available from the soil is augmented by the application of fertilizers. The same fact has been demonstrated repeatedly in the avocado groves on the main land and the writer has had frequent opportunity to observe that where fertilizer has been applied sparingly not only have the trees shown the effects of the insufficient food supply, but any fruit which may be borne on them will invariably be small in size, with thin meat and poor color. The flavor of such fruit, however, seems fully equal to that produced upon trees in better condition.

The nature of the plant food required by the avocado has not been very satisfactorily

determined, but it has become evident that a scheme of fertilization must be worked out differing considerably from that which has been generally adopted for citrus. Broadly speaking the application of commercial fertilizers deriving their elements of plant food from wholly chemical sources has not proven successful. In many instances, through lack of more definite information, growers have given their avocados the same fertilizers which they have used on their citrus trees. Where the formulae have been those most frequently applied to citrus, with nitrogen derived from sulphate of ammonia or nitrate of soda, potash from sulphate of potash, and phosphoric acid from acid phosphate, the results with the avocado have been generally unsatisfactory. However, when the formula used has been of the type known as "young tree" fertilizer, carrying a proportionately higher percentage of ammonia, largely derived from organic sources, better effects have been obtained.

Many isolated avocado trees are to be found throughout the Southern part of Florida, chance seedlings usually of unknown origin, and it has been commonly observed that such of these trees as are located in the vicinity of cow pens, chicken yards or where kitchen slops are thrown out, are almost invariably lusty growers and heavy bearers. This has given ground for the theory that the avocado is partial to a food supply derived from organic sources and chance applications of such fertilizers as cottonseed meal, tankage or stable manure have borne out the same idea.

During the past few years the writer has done more or less experimental work in an effort to arrive at formulae best suited to the avocado and also to determine the frequency and approximate seasons of the year at which to apply the fertilizers. Along these lines several problems must be solved and the probabilities are the same solutions will not fit the West Indian, Guatemalan and Mexican types equally well.

Avocado trees of the West Indian types, when in good condition of growth, are prone to put on a tremendous bloom from which a setting of fruit is apt to result so heavy as to be entirely beyond the carrying capacity of the tree. Following this abnormal effort there is often a period of apparent exhaustion during which the tree seems to realize that it has "bitten off more than it can chew", and to be seeking the best method to recoup from its over-exertion. This is a critical time in the life history of the tree and calls for intelligent handling on the part of the grower. If left to its own devices the tree will endeavor to carry the over crop, draining upon its reserves until its vitality has been seriously impaired. Evidences of this condition are usually very apparent. The tree drops a large portion of its leaves, the younger branches change in color from a dark green to a saffron yellow and no new growth is put on. Lack of sufficient foliage to provide proper shade often results in serious sun-burning of the more tender branches, and the low state of vitality lays the tree particularly liable to the inroads of disease, especially the anthracnose fungus which seldom loses such an opportunity for making an attack. Finally the tree is compelled to drop practically its entire crop of fruit and is left in a condition which means, at the very best, a set-back of two seasons in its-development-and not infrequently results in its actual death.

To obviate over-blooming, particularly in the case of young trees, is very difficult, for the better the cultural condition of the tree, the more likely this is to occur. The usual procedure has been to thin the over crop of fruit and this method of handling works quite satisfactorily provided the set-back to the tree has not already been brought about

through the excessive bloom. However, the avocado requires a longer period than most fruits between the first appearance of the bloom and the setting of the fruit and it often happens that the damage to the tree has made considerable advance before relief by stripping can be obtained. In this event removal of the entire crop and further careful attention is necessary. In an effort to overcome this difficulty, the writer has during the past two seasons, resorted to frequent applications of fertilizer, in order to offset the heavy drain upon the vitality of the trees during the blooming period. In the spring of 1916, following a season favorable to growth, the avocado trees at Medora Grove began to bloom about the middle of March. Immediately afterward a light application of fertilizer, carrying ammoniates from readily available sources was made. The bloom was the heaviest known in a number of years and persisted until about the middle of April. Between April 15th and 20th another light application of the same fertilizer was made and this was followed by a third application the latter part of May, when a fertilizer somewhat higher in phosphoric acid, largely derived from low grade tankage, was used. As a result of this treatment a full crop of fruit was set and in most cases carried through to maturity without damage to the trees. When an over crop was set at first, as a rule dropping took place without a reduction in vitality, until the proper carrying capacity had been reached, and the remainder of the crop was matured. In a few cases stripping was necessary, but among nearly two thousand trees of varying ages, not more than eight or ten showed any appreciable damage.

A second problem in regard to fertilization arises later in the season. Avocados of the West Indian type begin to ripen in Florida about the middle of July and the heaviest portion of the seedling crop matures between August 20th and October 10th. At that period the crop from Cuba and other West Indian islands is likewise being shipped and the large quantity of fruit thus thrown on the market, together with the fact that during the summer and early fall the avocado must compete with northern-grown fruits and vegetables, tends to force prices so low, that at times it is difficult to dispose of the Florida seedlings with any margin of profit. After the middle of October the price of avocados begins to climb and during November and December very satisfactory figures are usually obtained. For this reason the large plantings of budded trees which have been made during the past few years have practically all been of late maturing varieties such as the Trapp and Waldin. These varieties mature their fruit so that it may be picked early in October if desired, but under proper conditions will carry at least a portion of their crop into December and in some cases until well along in January.

To so fertilize and cultivate the trees that the fruit may be held for this later market constitutes the second problem to which I have referred.

It has become fairly well established as a fact that of two avocado trees of the same variety, one which is well nourished and kept in growing condition during the entire summer and fall will produce larger finer appearing fruit than one which is permitted to become more or less dormant through lack of fertilizer, but it is quite certain that the semi-dormant tree will carry its fruit with out dropping for a considerably longer time. There is therefore a rather delicate adjustment to be made in order to bring the tree into condition such that it will hold its crop until late in the season and at the same time will not "go back" to an extent that will be seriously detrimental to its further development or jeopardize the crop for the following season.

Following such applications of fertilizer as are made to restore the tree to good condition after it has passed through the period of bloom and fruit setting there should certainly be at least one further fertilizing during the summer or early fall to provide the nourishment necessary for the production of the crop. And it may be added here that the drain on an avocado tree in bringing its fruit to maturity seems to be vastly greater in proportion than the same effort on the part of a citrus tree. The writer cannot vouch for the soundness of the theory, but it has been his thought that this is probably due to the different character of the fruit. In the case of any citrus, water constitutes a large percentage of the fruit either by weight or volume, while with the avocado the proportion of oils is much higher and it would seem reasonable that to supply these components would be a heavier draft upon the tree. At any rate the fact is certain that an avocado tree must be furnished with a sufficiency of plant food if it is to be expected to produce full and regular crops.

Just how late in the season an application of fertilizer can be made without bringing about a tendency for the tree to mature and drop its fruit at too early a date depends somewhat on weather conditions. Fertilizer applied to Trapp trees about the middle of August of the season just passed, apparently had no detrimental effect as to the fruit holding well, while an application of fertilizer given the same trees about the first of September of the proceeding year was followed, within a few weeks, by heavy dropping of fully matured fruit. The application made in August of the present year was at the beginning of several weeks of dry weather, while that of the previous season was followed by heavy rains and these differences in moisture probably had considerable to do with the effects of the fertilizer.

This second problem is one of great importance to the Florida avocado grower as between December 1 and December 15 the value of his product not infrequently more than doubles and the premium to be gained by being able to carry his fruit until the latest possible date is well worth his very best efforts.

It is our plan at Medora Grove to give the trees a heavy fertilizing immediately after the crop has been picked and a light application about the first of February, which brings them to their blooming stage in good condition, quite thoroughly recuperated from their fast during the fall.

This program provides for five or six applications of fertilizer during the year, which is probably one or two more than is given by most growers, the difference being in the method of carrying the trees through the spring period. The quantity of fertilizer used at each application varies of course with the size of the tree, quantity of fruit it is carrying and the analysis of the fertilizer. For ten year old trees as high as 25 pounds at a single application has been used with good results. For four year old trees, bearing their first full crop, four applications of from three to four pounds each, one of four and one half and one of five pounds have brought the trees through the year in fine shape. As materials from which fertilizers suitable for avocados may be compounded, cottonseed meal, castor pomace, tankage, ground tobacco stems and ground bone are to be recommended, with a certain amount of nitrate of soda used as a source of nitrogen when quick results are sought as in the case of trees which have "started back". Previous to the war scarcity of potash, it was thought advisable to use formulae giving from four to six per cent of that element, but the enforced limitations to the percentage of potash obtainable during the past two years has had no apparent ill effects upon the

trees or fruit and seemingly a range of from zero to four percent will provide all the potash that an avocado tree requires under Florida conditions. A formula that has given good results is built up of cotton seed meal, castor pomace, tankage and ground tobacco stems, analyzing 4 per cent to 5 per cent ammonia, 6 per cent to 7 per cent phosphoric acid and 2 per cent potash.

The trees are usually cultivated by hoeing three times each year and a heavy mulching of dead grass or weeds during the dry winter season. If instead of the dead grass a mulching of compost or well rotted stable manure is used the results are even more satisfactory and the February application of fertilizer may then be omitted entirely.

The foregoing methods are those which have been used by the writer and others, largely with the avocados of the West Indian type. When applied to Guatemalan or Mexican varieties budded on West Indian stock, the results have been entirely satisfactory, but just what changes may become necessary when Guatemalan or Mexican stocks are used it is yet too early to say as these stocks are of quite recent introduction in Florida and the opportunity for observation has been quite limited.

Climatic differences and soil conditions will undoubtedly make many changes from the Florida methods advisable in the culture of avocados in California, but a few of the essential principles apply to these trees wherever they may be grown and it should not be difficult to work out a cultural program for any locality, the climate of which is suited for the avocado, providing the following points are borne in mind:

The avocado demands plenty of moisture, but must be planted only on well drained land.

The avocado is a gross feeder and prefers plant food derived from organic sources.

The production of a full crop of fruit is a severe drain upon the vitality of an avocado tree and this must be compensated for by adequate nourishment.

Mulching is beneficial and almost essential. The avocado does not thrive best under conditions of clean culture.