

POSSIBLE FERTILIZER TESTS FOR THE AVOCADO

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In order to meet the pressing demands for more adequate information on citrus fertilization the Agricultural Extension Service, cooperating with the Farm Bureau, has laid out an extensive fertilizer test project in Los Angeles County and has at the present time over fifty plots scattered throughout the county. With the establishment of this work some of the avocado growers have asked whether or not similar work might not be undertaken for that industry, and your president has asked that a paper on the possibilities along this line be given at this spring meeting.

The avocado industry has now become firmly established as a commercial enterprise and with its establishment have arisen problems whose solution will go far toward the success of the industry. The problem of marketing has been already worked out by the Avocado Association. The problems of production are becoming general throughout the avocado growing districts. The association is to be complimented upon the splendid work it has done in working out the commercial varieties which are most desirable. The fertilizer problem presents a situation which will require much experimentation carefully conducted over a long period of time before any adequate results may be obtained. It might be well at this point to mention two agencies within the College of Agriculture which are today working with the other fruit industries of the State in the solving of their problems and upon which the avocado growers and the Avocado Association might call should they desire help. I refer to the Experiment Station and the Agricultural Extension Service. There are certain problems that can only be solved by intensive research in the laboratory and in experiment station plots under the closest of observation and by highly and specially trained men. Of this type of problem the study of the analyses of avocado varieties, the periods of ripening, the effect of nitrogenous fertilizers on protein content, and the study of the enzymes of the avocado, are examples. There is another class of problems which can be solved through co-operative effort by growers themselves in conjunction with the agricultural college, through careful co-ordination and supervision, and which require extensive field tests under many different conditions. The testing of fertilizers, the testing of spray materials for control of insect and plant disease, are examples of this class which are to be found generally throughout the State today. The Experiment Station and the Extension Service have heavy demands made upon them and the time spent on any industry is partly proportionate to the relative importance of the industry and partly proportionate to the demand made by the representatives of that industry. These two agencies stand ready to help upon request. Citrus growers, grain growers, walnut growers, and growers of deciduous fruits are already making use of both agencies. It is my purpose to present briefly some tests that could be undertaken to advantage in the beginning of a solution of some of the fertilizer problems connected with avocado growing.

Before going into the discussion of individual fertilizers, it would be well to state clearly some of the general principles underlying soil composition and fertilization, especially because there seems to be so much misapprehension concerning some of the necessary fundamentals. There are nine or ten elements in the soil whose presence is essential to plant growth. Of these, three are commonly considered as most liable to be deficient. These are nitrogen, phosphorus, and potassium. In the past there have been several methods used to determine the needs of various soils for these elements. (1) The determination of total amounts present by complete analysis. (2) The determination of amounts soluble in strong and weak acids. (3) The determination of the amounts soluble in water, and (4) the amounts removed by a year's crop. Investigations made in recent years seriously question all these methods in one way or another. The great difficulty has been that while the amount of a given element may be determined, the questions as to whether or not it is in an available form, as to the rate and amount which becomes available, are not well understood. There is altogether too little research back of our present knowledge. But there is sufficient to indicate that a mere soil analysis is no certain indication as to what will solve the fertilizer problem of a given body of soil.

Soils in California in common with soils in the other arid regions of the west show certain well defined characteristics that are well established. They are almost all uniformly low in nitrogen, in both available and unavailable form, and in organic matter, but have as a rule a high content of phosphorus and potash. The latter two elements are not in a readily available form, but are sufficient in quantity for a long time when rendered available through proper handling. The acids formed in the presence of decaying organic matter such as manures, cover crops, and straws, are a common means of rendering these elements available. It is not infrequently claimed that because both potash and phosphorus are in an unavailable form that trees will benefit by an application of a readily available form. However, when applied to the soil in a quickly available form, chemical reaction sets in almost immediately and they revert to a comparative unavailable form for plant use until acted on by soil acids. As an illustration of what may happen to readily available forms of certain plant foods, Dr. Kelley of the Citrus Experiment Station, made among others, the following experiment. He took a six-foot cylinder of pure sand and introduced at the top a saturated solution of potassium chloride, this material being even more soluble than ordinary salt. The solution was caught at the bottom of the cylinder and tested for potassium. Not the slightest indication of potassium was obtained. In other words, in passing through six feet of pure sand the solution had lost all its potassium and it had been locked up by the sand particles. The same thing would happen as readily, if not more readily, in an ordinary soil and the material would not be available for plant use. However, we are laying out some test plots on these two elements in citrus orchards, together with lime, gypsum, sulphur, etc.

The great need of citrus trees is for nitrogen. The avocado in many respects is similar to this group, being evergreen from semitropical and tropical regions, but producing a crop which contains a much higher per cent of nitrogen than citrus fruits, due to the higher protein content. Without adequate supplies of nitrogen, citrus trees fail to bear and mature adequate crops. One of the big problems facing the avocado industry is the shy bearing and non-bearing of budded avocado trees. The bulk of our fertilizer tests with citrus trees are with the various nitrogenous fertilizers, organic and inorganic, and it is

believed that it is in this same field that work with avocados could be most profitably carried out. In Florida indications are that the avocado requires more nitrogen than citrus trees and that while citrus formulas had been used, they had not been satisfactory generally, according to Krome, where derived from chemical sources. This conclusion has already been reached as far as citrus is concerned in this state.

What then do we need to try here? Beginning with the accepted fact that a minimum application of ten tons of stable manure per acre is used as a regular orchard practice, the use in addition of such materials as tankage, dried blood, chicken manure, cottonseed meal, sodium nitrate, calcium nitrate, ammonium sulfate, bean straw and alfalfa hay should be tried in connection with check plots. Test plots of ten uniform trees are sufficient for the work, the tests to run for a minimum of three years. The use of lime, gypsum, etc., should likewise be tested. The amounts used per tree are based to begin with on a suitable supply for citrus trees, two pounds of nitrogen per tree per year, one-half to come from organic matter and one-half from other sources.

The times of application of fertilizer need also to be studied. It would seem that a desirable practice would be to make one application shortly before the blooming period, one immediately following the blooming period, and one or two more during the growing season while the fruit is developing. There has been some trouble in Florida caused by mature fruit not holding on the tree until the season of better prices. Some work has been attempted to better this condition through fertilizer practice. Whether or not this problem will arise in California remains to be seen.

The first step in avocado fertilizer test work has been taken with the laying out of several plots in the four-acre orchard of Mr. F. O. Popenoe in Altadena. Such tests, to be of any value at all, must be made under orchard conditions where there is a sufficient number of trees to insure adequate field conditions and where check plots can be maintained. A period of at least three years will be necessary and the possibility of a longer period is most desirable. Continuity of the work and proper care of the orchards should be assured during the entire time the work is under way. Any value that would come from such tests would lie in the results being free from any possible question and that they come from carefully planned work uniformly carried out, with complete observations throughout the entire period.

As far as possible trees in a given plot should be of a given variety and should be of a uniform age and condition. It is well recognized that certain varieties grow very differently from others and that perhaps an abundance of nitrate material would stimulate vigorous growth and that this would entail extra work in shaping the tree. It is very possible that the results on light soils and on heavy soils may be markedly different. It is one of the things upon which we need further light. In this work we are starting with practically no past experience to draw on, the field is new, the entire subject is yet to be investigated. It is only by careful tests over relatively long periods of time that useful facts may be gained. It is well recognized that the entire understanding of the relation of plants to soils and the nutrition of plants is very limited. However, if we wait until complete scientific investigations are carried out through all the ramifications of this broad field, we will be pressing Methuselah for longevity. The avocado industry is a commercial activity. We desire some aid for our present activities. One of the things which can be done is to make such tests as are possible with limited facilities and with

what knowledge we now have, striving in some measure to help ourselves, believing that out of much work and repeated efforts practical results of commercial value will be obtained.