The Fertilizer Situation from the View Point of the Citrus Grower

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One of the most important and essential elements in the successful production of citrus fruits is the intelligent use of fertilizers. The trees must be nourished if satisfactory returns are to be expected. All plant life, as well as animal life, requires certain indispensable chemical elements to feed upon. Citrus trees are no exception. The citrus tree responds more generously to good treatment probably, than any other fruit tree. It is this characteristic of the citrus tree that makes us love it. It is so dependent and grateful for any attention bestowed upon it. Neglect it, and, in exact proportion, the tree will resent it and be a corresponding disappointment to its owner; but love and nourish it and it will flourish, bloom and fruit most generously.

The important elements for successful citrus culture may be enumerated as follows:

First. Suitable land, properly located and prepared.

Second. Drainage and irrigation.

Third. Good stock, for which we must depend largely upon the nurseries.

Fourth. Cultivation.

Fifth. Fertilizing.

The first four conditions may be fulfilled according to the best approved standards, but if the fifth is neglected, the net effort, generally speaking, will be a failure. Of course it is necessary to spray for fungi and insect pests, to properly gather, grade and pack the fruit for market; and lastly to sell through the most efficient selling organization in existence, the test of which is the greatest net returns to the grower and the absolute certainty that these returns will be paid, and paid promptly—which the writer firmly believes is The Florida Citrus Exchange.

It is evident that even if all conditions for successful citrus culture are fully complied with, except fertilizing, the effort will be a failure. Therefore, let us consider briefly the question of fertilizing.

I may state as an axiom that the natural fertility of soils suitable for citrus groves varies; that is the soils vary in their content of certain essential elements. It must, therefore, follow that in the absence of these essential elements, they must be supplied or added to the soil in the proportion in which they are absent. I am only speaking of available elements in the soil, as elements not available are pratically absent if they are not made available. In a broad sense any practice, such as the addition of any fertilizing material, or-

ganic or inorganic, the inoculation of the soil with bacteria to aid nitrification, the growth of legumes, the addition of stable manures, as well as ordinary commercial fertilizers, may come under the general head of fertilizing. But in this paper I shall confine myself mostly to the subject of the use of ordinary commercial fertilizers, and more especially under present war conditions.

It is generally understood and accepted that the three indispensable elements to be provided for in the development of the citrus tree and fruit, are nitrogen, phosphorus and potassium. They are usually spoken of as ammonia NH_3, phosphoric acid P_2O_5, and potash K_2O. No soil, however fertile in one or more of these chemical elements, contains them all in sufficient quantity, or in proper proportion. The logical procedure is to ascertain the quantity of each element necessary for the fullest development of the fruit, and the available quantity of each in the soil and supply the difference to the soil. The problem theoretically is simple, but practically most difficult. The equation contains too many unknown quantities that refuse to be eliminated. It does not admit of an exact solution, but, like most practical problems, an exact mathematical solution is not necessary.

Fortunately for us, experience in the grove and scientific determinations in the laboratory have furnished us an approximate solution by which, if we are wise, we will be guided. But having solved the horticultural problem of how to fertilize to produce the greatest quantity of marketable fruit the economic business problem in terms of dollars and cents remains —will it pay? This is more difficult than the horticultural one of how to grow fruit, but the all-important one for the grower. If the golden fruit does not leave golden dollars in the pockets of the grower, it spells failure.

During these war times, with the scarcity, and corresponding high price of fertilizer ingredients, the economic problem is doubly complex, and is made more so by the fact that no one can tell in advance what the prospective crop will bring in the markets, even if we are fortunate enough to escape the dangers of frost, drought, fungi and scale insects. The horticultural problem is not influenced by the war. If a tree in a certain soil, under certain conditions, required so many units of nitrogen, phosphoric acid and potash before the war, that same tree requires the same now during the war. In other words the economic problem is not directly connected with, and in a certain sense is independent of, the horticultural problem.

Let me illustrate: if 10 or 12% of potash was necessary horticulturally five years ago, it is also necessary now. If 2 or 3% of potash, or no potash, is sufficient horticulturally now, it would have been sufficient five years ago. In other words, the needs of the tree are absolute. If we fail to supply the tree with the elements necessary for its fullest development because of the scarcity or the prohibitive price of some of the ingredients, let us not deceive ourselves, but frankly admit that we are doing some violence to the tree because forced to do so

for economic reasons. Assuming that no permanent injury is done to the tree, the greatest net returns in proportion to expenditure, is the object sought. Citrus trees should be so nourished as to enable them, not only to properly mature the growing crop, but also to produce sufficient new wood for the next crop.

The first function of the citrus tree, like other living organisms, is to produce its kind so that the species may not perish from the earth, even if in so doing the tree sacrifices its vigor, or even its life. Feed the tree so that it may be able to mature its fruit properly, thus fulfilling the first functions of its nature, and also sufficiently that it may have a reserve energy to produce new wood, which is the hope of the next crop. Generally speaking, failure to understand the nature and requirements of the tree by using insufficient fertilizer, is the cause of only fair, or perhaps reasonably good crops each alternate year; with the proper treatment, there is no reason that a large percentage of trees in any grove should not produce every year, so that the production of the grove as a whole approaches a constant quantity; the variation being due largely to climatic conditions, some of which are beyond reasonable control.

The prime purpose of the grove is to make money for its owner. It is manifestly uneconomical and bad business to so treat a grove that only one crop every other year can be reasonably expected or hoped for. Why not get returns on your invested capital every year instead of every other year?

There are so many uncertainties in every line of business and especially in the citrus business, that if one is wise and hopes to obtain the greatest success, he should eliminate as far as practical every uncertain element. The intelligent observance of this principle will generally lead to success; its neglect, to almost certain failure.

The location of the grove may be excellent, drainage and irrigation all that could be desired, stock wisely selected, cultivation according to the best standards, but fail to properly fertilize, either as to time, quantity or quality, and the entire effort will be more or less of a failure, but a failure nevertheless. The general problem of fertilizers is the most complex and difficult of any that confronts the grower, especially during these war times. These observations and principles are generally accepted by the most successful growers. Let us follow them as far as practical. The crux of the matter is, how can these principles be applied to the best advantage by the average grower. The determination of how much nitrogen, phosphoric acid and potash to use on any particular grove for best horticultural results, can only be solved approximately. Few can afford, or think they can afford, to have the soil chemically analyzed, both qualitatively and quantitatively, to say nothing of a physical and bacteriological analysis. To add to our difficulties, the soil in few groves is of uniform quality, and therefore requires different treatment. I will say nothing about the physical and bacterial qualities of the soil, except that these should be taken into consideration

in the selection of the grove site. Porosity and bacterial content, both so important for the utilization of fertilizers, may be improved by increasing the humus content, by growing leguminous cover crops, and by correcting the acidity of the soil, if necessary, by adding limestone, or the growing of certain crops, such as watermelons or tomatoes.

Now, how much nitrogen, phosphoric acid and potash is required by the tree and fruit? Manifestly the irreducible minimum requirements, at least, are what the mature fruit contains. These quantities have been determined by many chemical analyses, and these quantities are fairly uniform in all samples of various citrus fruits. They are given by Hume (our President) in his excellent work entitled "Citrus Fruits and Their Culture," p. 302; viz.;

Nitrogen (N)	.149%
Phosphoric Acid (P_2O_5)	.055%
Potash (K_2O)	.249%

On a basis of 80 pound boxes, each 10 boxes represents approximately the following ingredients in pounds:

Nitrogen (N)	1.19
Phosphoric Acid (P_2O_5)	.44
Potash (K_2O)	1.99

Hume states that a fair approximation covering the fertilizer removed in the fruit, and that lost by leeching and required by new growth, will be two or three times the amount estimated for every ten boxes of fruit, which is equivalent to the following quantities in pounds as a maximum, viz.:

Nitrogen (N)	3.57
Phosphoric Acid (P_2O_5)	1.32
Potash (K_2O)	5.97

At present prices the raw material itself would cost about $3.70 per tree, on a basis of ten boxes of fruit, or $1.85 per tree of five boxes, of which about $1.05 represents potash, and $.80 phosphoric acid and nitrogen. By reducing the quantity of potash about one-half, we would have a cost of about $1.32 per tree. I think that an expenditure of from $1.00 to $2.00 per annum per five-box tree for fertilizer is economically justifiable. A less expenditure is false economy. Large, heavy bearing trees justify a correspondingly increased expenditure. In general, intelligent experience on the part of the individual, and especially his ability to profit by the experience of successful growers—a rare accomplishment—must be his best guide.

There are four methods of supplying fertilizer to the trees:

First.—By growing cover crops;

Second—By composting, as advised by State Chemist Rose in his last annual report;

Third.—By buying raw material and making the mixture required;

Fourth.—By buying mixed goods from the most reliable and responsible fertilizer companies, according to formula that best meets the requirements.

A combination of two or more methods is most economical, and is therefore the best practice. We can all grow cover

crops, thereby supplying nitrogen and humus. With increase of farm animals most growers could have a compost heap. State Chemist Rose recommends for compost:

"A cord of compost made of 3 parts muck of good quality (3% nitrogen), 1 part stable manure, (practically a ton), to which is added 200 lbs. of 16% acid phosphate, which will furnish sufficient fertility for an acre of ordinary soil; the manure will add the necessary bacteria, while the acid phosphate will form a medium for the growth of more bacteria and the conversion of the inert nitrogen to an available form."

Mr. Rose also adds:

"The neglect of the compost or manure heap in Florida has been an economic crime and has cost the growers of the State millions of dollars for commercial fertilizers, most of which could have been produced on the farm at a comparatively small cost in labor and care."

Perhaps a few words about the writer's own experience would be in order. He has no compost heap, but intends to have one. He does not mix his own fertilizer, though this too might save some money. He has always in his brief experience bought standard commercial fertilizers, mixed according to formula which appealed to him, from one of the reliable Florida companies, sometimes one, sometimes another, and so far with satisfactory results. This season he is using a standard fertilizer for fall application, analyzing 3% ammonia (NH_3), 6% phosphoric acid (P_2O_5) and 3% potash (K_2O). For January and May, he uses a 4-8-2 formula; before the war, 4-8-12. The potash content was reduced first to 5%, last year 3% and now to 2%.

A fall application is made about October first, of about 15 lbs. per tree; another application about January 15th, of about 25 lbs. per tree, and the third application about May 15th, of about 20 lbs. per tree. These applications are made for trees that produce from four to eight boxes per tree. The fertilizer is thoroughly incorporated with the soil, which the writer considers a very important detail. The grove is supplied with water from several artesian wells about 750 feet deep, and distributed over the surface through a system of underground pipes from 4 to 6 inches in diameter. The grove is irrigated whenever the writer considers that a good rain would be beneficial, but never within two or three weeks after fertilizing, the soil having been put in good condition before applying the fertilizer.

In conclusion I cannot neglect this opportunity to commend the general attitude and invaluable accomplishments of the Department of Agriculture of the State of Florida, from Commissioner McRae, its guiding genius, down to the heads and subordinates of its various divisions. I want to especially commend the work of the State Experiment Station and particularly in reference to the important subject of this paper, the ten years fertilizer test now being conducted for the benefit of the citrus growers of Florida.

I also commend the valuable work of the State Chemist Rose, and I hope the next legislature will enact workable laws which can be easily enforced, thus uphold-

ing his hands in the interest of Florida growers. He is in a position to save the growers and consumers of Florida more money than any other official of the State, if he be properly supported by our State Legislature.

My final advice is to fertilize, do it as economically as possible, but wisely and well; but fertilize.

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