ity, a factor which seems to have declined in recent years, causing considerable loss to citrus producers. Means of improving the marketable quality of citrus have been studied by growers and commercial organizations from the field point of view, by commercial organizations through packing house treatments, and by scientific organizations through many lines of attack. The instrument developed makes it possible to give definite expression to firmness of citrus fruit. It is valuable as an instrument of research in testing citrus fruit rigidity, thus determining keeping quality of citrus grown in scientific experiments designed to study the influence of soil type, fertilizers, soil amendments and grove practices on quality of citrus fruits. It promises to be valuable as a means of checking commercial citrus fruit grades, should it be considered advantageous to use fruit firmness as a criterion in establishing grades.

MAKING SIZE AND QUALITY IN CITRUS FRUIT

L. P. Kirkland, Auburndale, Fla.

I wish to make just a little explanation before reading my paper. We have been actively engaged in the commercial production of citrus fruit for twenty-one years. The paper which I give you today is on the methods and practices carried out on the properties of the Adams Packing Co., of which we have some 4000 acres. I am simply giving you the general methods used.

A few years ago it was unnecessary for the grower to devote a great deal of time and money to the production of quality citrus. Our markets had not been educated to demand certain grades and packs. Our production was not great, hence it was not difficult to sell any grade of fruit, so long as it was sound and well flavored.

In recent years, we have had a steadily increasing production. Our markets have not increased in proportion to our production, hence it has progressively become more difficult to dispose of to advantage anything but the best quality. This not only applies to citrus fruits but to most other commodities. The American people have been educated to demand the best, and the man today in any line of business is doomed to failure if he does not devote his time and energy toward building and maintaining a high quality product.

I said the production of quality fruit was not difficult. I maintain it is not, eliminating, of course, unforeseen agencies such as storm, hail, or other causes beyond the control of the grower. There are several factors entering into the production of quality fruit which must be given careful study and sound judgment used in applying these principles. I name them in the order of their importance—Fertilization, spraying, cultivation.

I name them in the above order because on our Florida soils, it is not possible to maintain a grove and produce fruit very long without fertilization. In practically all localities it is not possible to
grow quality fruit without spraying, but if enough fertilizer is used and weather conditions are not extremely dry, it is possible to grow quality fruit without cultivation. But it must be taken into consideration that two factors especially are of importance if fruit of a good quality is to be produced, first the tree must be healthy and vigorous—not overly vigorous but sufficiently so to maintain a crop of fruit—and second a good crop must be secured. It is extremely difficult, almost impossible to grow good quality fruit with a light crop. A tree not in vigorous condition cannot put on a heavy crop. It is, therefore, essential that ample fertilizer of a proper ration be applied to maintain a grove in satisfactory condition. While I am on the question of fertilization, I might say the grower who attempts to economize on his fertilizer, either in amounts or quality, is sure to run into trouble. The grower's business should be the production of citrus fruit—not the fertilizer business. We do not have time to study the reaction of fertilizer materials in combination with each other or the reaction of those materials in the soil, but we are fortunate in having several good fertilizer companies in Florida, in addition to our experimental station, who have made an exhaustive study of these problems. We have found in our work that a great deal of assistance can be secured from a reliable fertilizer company in working out our fertilizer program. Contrary to the opinion of many, they are not in the field to sell as much fertilizer as possible whether it is needed or not and at as high a price as can be secured for it. The success of their business depends on securing maximum results for the grower at as low a price as possible, just as much as the success of the grower depends on the production of quality fruit.

The time of the fertilizer application should be regulated somewhat by varieties. I consider the fall application of greatest importance and if three applications per year are being made, I would divide the amounts about as follows: Fall, 50% of the total year's requirements—Spring or early Summer, 35%, Midsummer 15%. In making two applications per year, I believe that best results will be obtained by applying 60% of the total requirements in the Fall and 40% in the Summer.

Fertilizer applied in the fall is taken up slowly by the tree, stored away and ready to do work just as soon as the spring opens. This application should be high in organics of good grade. Approximately 50% of the Ammonia in the Organic form should be used. We have found Bone Meal, Castor Pomace and Bird Guano to be most desirable organic materials.

We believe that a spring application on seeded varieties is desirable. Especially early grapefruit and pineapple oranges have a tendency to break under a heavy crop. We believe that an application in February of a quickly soluble fertilizer is desirable. Some of the commercial top dressers have been most ideal for this application.

The summer application should be made early, certainly not later than the 10th of May. This application should contain 35 to 40% Organic Ammonia.

It must be borne in mind that in order to get size on fruit it must be done early. Proper fall application will have a great deal to do with producing good size fruit. If a tree is not in a vigorous condition when it produces its bloom, good size cannot be expected. On the other hand, if a light crop is secured then it is almost impossible to maintain a tree in a satisfactory condition without getting the size too large. It is, therefore, essential to maintain trees in a vigorous condition and a sufficiently vigorous condition to get good crops in order to keep the size down and get a good textured fruit. A tree with a small amount of foliage, no matter how heavy its crop is, will produce poor fruit because the vigor that would go into the foliage, in the absence of such foliage, will go into the fruit.

I am of the opinion that if the Florida grower would put over the proper advertising program, and if we would make it our business to produce a good golden fruit, we could maintain our shipping season for a longer period, and we could all cash in on it in the markets, and I am of the opinion that if California could do with that little insect known as rust mite what we could do in Florida that they would cash in. I don't mean you could, by doing this, abandon rust mite spray
altogether. Judgment must be used in keeping the mite from the fruit until such time as is necessary to make the proper size as well as the proper color.

The class of spraying and the amount to be done follows:

**SPRAYING**

Next to fertilization, I consider proper spraying of the greatest importance to the grower. The class of spraying and the amount to be done varies according to localities. In my opinion, the diseases and insects affecting the citrus tree come in the following order: Scale, Melanose, Rust Mite, Citrus Scab. That order might be changed for some sections. On some of our hammock soils, Scale is of little importance and ordinarily on our higher and lighter soils Scab is of little importance. In the southern part of the state and along the Coast, however, Scab is probably of greater importance than any of the others named unless it is Melanose.

For a number of years, the only method known of successfully controlling Scale was the oil emulsion spray. Scale can be very successfully controlled with an oil spray but unless there is an extremely heavy infestation, I do not believe oil spray is justified, especially if the grower is using the best methods of controlling Rust Mite. A great many growers control their Rust Mite by dusting with Sulphur and control their Scale by spraying with oil. In my opinion, this is not the best method, will not produce the best quality fruit and will not maintain the tree in the best condition. An oil spray at its best is somewhat detrimental. We now have on the market several brands of prepared Sulphur sprays in the dry form. These have the advantage over the old style Lime Sulphur Solution of lasting longer, better sticking qualities and greater killing power. If these materials are wisely selected and wisely used, scale infestation will be reduced to such an extent that an oil spray for that purpose will be unnecessary.

Ordinarily about five sulphur sprayings are necessary during the year in order to produce bright fruit and keep the grove commercially free of scale. I do not believe the same quality of fruit can be produced from dusting that can be produced by spraying. It has been my experience that dust tends to produce coarse texture, whereas sulphur spray seems to improve the texture.

Melanose is most detrimental in some sections. In many cases it can be successfully controlled by proper pruning but once it is thoroughly established, pruning and spraying are necessary. For this purpose there is but one spray and that is Bordeaux Mixture. Usually it will be found advisable to make two sprayings—a dormant one before the growth begins and another some time during April, depending on weather conditions. Regardless of what I have had to say about oil sprays, it is very essential that one be used after Bordeaux is used. Otherwise the chances are that a heavy scale infestation will follow. The dormant Bordeaux Spray is sometimes made in combination with one-half per cent. solution of oil. This has worked very successfully and has to some extent aided in keeping down the scale infestation. But where the second Bordeaux spray is used, it is customary to use it without the oil. It is then necessary to follow with an oil spray a few weeks later.

A great deal of money has been wasted in improper spraying. Like fertilization, if it is worth doing it is worth doing properly and only the best materials should be used. It is poor economy to go to the expense of applying a spray material and using a cheap material from which uncertain results at the best can be expected.

**CULTIVATION**

After years of experiments on our own property and from the observations I have made of others, I am convinced that a few years ago we were cultivating too much and I know today some are not cultivating enough.

The cover crops were destroyed a few years ago in a good many groves by cultivating too late in the spring and I think it necessary that we arrange to leave off all cultivation not later than May 10th. I think there is a medium between the two extremes and we are using the following method of cultivation:

We plow all of the groves once each year, be-
ZINC SULPHATE AS A SOIL AMENDMENT IN CITRUS GROVES

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INTRODUCTION

Interest in the use of zinc sulphate on citrus trees has been steadily increasing in Florida, due primarily to the continued publications in California citrus magazines of reports on this subject by various California officials; notably, Dr. W. H. Chandler and Messrs. J. C. Johnston, L. D. Bachelor, Warren Schoonover, H. L. Thomason and others. Interest in the matter has been further increased by the fact that the Horticultural Department of the Florida Experiment Station has been experimenting with zinc sulphate for several years, and in the last two years has developed the use of this chemical on a wide commercial scale in the treatment of bronzing of tung trees. Without going into detailed discussion of the various papers published in California, they may all be summarized as follows:

In attempts to find a cure for mottle-leaf of citrus, which is commonly called “frenching” in Florida, it was found that iron sulphate gave favorable response, but later it was found that pure samples of iron sulphate failed to give satisfactory results. In studying the impure samples which were originally used, it was found that a considerable amount of zinc was present in the chemical as an impurity and subsequent experiments showed that it was the zinc rather than the iron which was having the corrective effect. As a result of this finding, extensive experiments were carried on on citrus mottle-leaf in 1932 and 1933, and the latest report would indicate that the results are about as follows:

In a large number of experiments on the use of zinc sulphate on the soil it has been found that many cases of mottle-leaf showed a startling recovery, but that in other cases no results or unsatisfactory results were obtained. The zinc sulphate was applied to the soil either broadcast under the tree or in a ring at the base of the tree. In some cases almost immediate response was obtained in the form of new and normal growth, and in other cases damage to the tree or failure to obtain any results at all occurred. The amounts used varied all the way from one-fourth pound to forty or fifty pounds per tree. The use of zinc sulphate in sprays has apparently given more consistent results than soil applications. Sprays consisting merely of zinc sulphate and water with an added spreader gave favorable results in many instances, but were likely to cause damage, and at the present time are not recom-