developments concerning the need for and use of so-called minor or rare elements, such as magnesium, manganese, zinc, boron, copper, etc. Zinc sprays and a few of these minor elements have been used on about two acres of this grove where the soil was apparently somewhat different from that in the rest of the grove. Based on tree condition, quantity and quality of fruit produced, and having in mind that this grove is practically forty years old, it would seem that the fertilizers used have contained sufficient quantities of such elements. Undoubtedly they are necessary in some cases, but in this case the regular fertilizer mixtures have apparently been sufficient within themselves. It would be well to again call attention to the fact that various organic as well as inorganic materials have been used.

It may seem to many that a production cost of $215.00 per acre is somewhat high, but this would seem to be justified by a net profit of $340.00 per acre. It goes without saying that such a profit cannot be obtained by raising poor quality fruit, and it has been the experience of the speaker that the other kind cannot be produced by penny shaving practices.

CITRUS FRUIT BUDS AND SOME FACTORS INFLUENCING THEIR DIFFERENTIATION

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During the course of the last few years, investigations have been carried out with a view of determining the factors involved in the yield capacity of various fruit trees. Fruit production in all trees and plants depends upon two very fundamental factors, viz., the formation of fruit buds and the ultimate setting and maturing of fruit from these buds.

Most fruit trees bear blossom buds that are easily recognized during the dormant season. This is particularly true with many deciduous trees. Such, however, is not the case with evergreen trees, especially those belonging to the genus Citrus.

The species of Citrus studied presents an entirely different problem to that of most deciduous trees, in that it is impossible to distinguish, with any degree of accuracy, between what ultimately will be a fruit bud and a vegetative bud, either by the position of the bud on the tree or by the size and shape of the bud prior to the beginning of a growth flush.

It was not until the close of the last century that horticulturists, realizing the probable importance of the time of application of measures designed to control fruit bud formation, set themselves the task of determining microscopically the time of year at which this blossom forming process was initiated.

The question, therefore, resolves itself into a study of the changes that take place in blossom bud development, the time when these changes occur and the conditions that influence them. Such a study has been undertaken by the speaker.

The materials used in this study were collected from trees growing in the grounds of the College of Agriculture at Gainesville. The varieties studied were the Duncan Grapefruit, Pineapple Orange, Owari Satsuma and Nagami Kumquat.

The collection of material was started in November of 1927, and after that collections were made from orange and grapefruit trees at weekly intervals during the greater part of each year until March, 1932, with two exceptions. During late December, 1927, low temperatures destroyed the buds and in many cases killed the grapefruit and orange branches back for a considerable distance, thus destroying all bearing wood. Then again in 1930 it was thought unnecessary to collect materials due to the weakened condition of the trees following the maturing of a very heavy crop of fruit the previous season.

The satsuma trees were not injured as badly by the low temperature as were the grapefruit and orange trees. Therefore, it was possible to make a complete series of collections during 1928 as well as in 1929.

The kumquat buds were collected throughout the season of 1930.

The buds after being dehydrated were embedded in paraffin and cut in longitudinal sections by the use of a rotary microtome. The sections were mounted on glass slides, stained and examined under the microscope.

In this work it was found that differentiation of blossom buds in the species of citrus studied does not take place until the beginning of growth in the spring or upon the resumption of growth at any other season of the year following a period of environmental conditions favorable and of sufficient duration for the accumulation of a reserve food supply. Therefore, the time of differentiation will vary slightly from year to year with climatic and seasonal variations. This is evidenced by the occasional blossoming of citrus trees during the summer or early fall when forced into growth following a prolonged dry period or after branches have been girdled for a sufficient time and later forced into growth. The prolonged check in growth during the winter months in the absence of limiting factors seems to be especially favorable for bringing about proper conditions for abundant blossom bud differentiation during the spring, especially in the grapefruit, orange and satsuma.

The growth and fruiting habit of the Nagami kumquat differs somewhat from that of the citrus species studied, in that the majority of the fruit buds formed for the crop of the current season are differentiated during late May and early June on wood that was formed during the spring of the current season. However, a few flower buds were observed to come out on older wood which was produced the previous season, or perhaps earlier. The failure of the Nagami kumquat to differentiate and push out blossoms in great numbers at the first flush of growth in the spring of the year following the prolonged winter check in growth is evidently due to specific and generic characteristics.

In the grapefruit and orange it was found that most blossom buds are formed towards the outer extremity of the last flush of growth on the branch, regardless of whether the flush of growth was made during the spring, summer or early fall. However, blossom buds have been observed to occur further back on the branches where the wood is much larger and older. This is especially true on trees that blossom very heavily following prolonged moderately dry seasons, which apparently are most favorable for stimulating blossom bud formation.

The "June bloom" or blossom buds which usually occur during the summer following a moderately dry period, are differentiated at the initiation of the June or summer flush of growth on trees, or parts of trees, that set few or no fruit during the spring. Buds collected in 1930 from spring flush of growth on grapefruit trees from which the fruit set during the spring had been removed, showed blossom bud differentiation May 31. In 1931, June blossom buds were not differentiated until about the middle of July. This evidently was due to the limited rainfall during the months of April, May and June, associated with a light set of fruit during the spring.

The first sign of fruit bud differentiation as seen under the microscope is the flattening of the top of the growing point, which is usually loosely covered by bud scale. The next stage is the development of the calyx (sepals), followed by the development of the corolla (petals), stamens and pistil. The stigma, located at the top of the pistil, is the last flower part to be formed. This order of development is the same for all flowers studied.

Fruit bud formation is undoubtedly influenced by such orchard practices as pruning, irrigation, cultivation and fertilization. Other factors that may have a rather marked influence on the number of blossom buds differentiated are ringing, shading and the kind of stock on which the trees are growing.

We do not have experimental data to show the exact influence of all these factors on the number of blossom buds formed in citrus. However, in this study we are doing some work on ringing, shading and withholding moisture. The work is not yet complete, therefore the data cannot be taken as final.

The ringing experiments were started in the spring of 1930. At that time six branches, ranging from one to one and a half inches in diameter on each, grapefruit, orange and satsuma trees, were ringed on March 25, by removing one-fourth inch section of bark completely surrounding the branch. Each wound was carefully wrapped with budding tape to prevent drying. Upon examining the wounds May 1, it was found that every ringed branch on grapefruit, orange and satsuma trees had healed perfectly, and the foliage, which had become slightly yellow about two weeks after ringing, had returned to a healthy dark green color. Materials collected at weekly intervals from these branches showed no increase in the number of blossom buds differentiated due to ringing as compared with unringed portions of the various trees.

On May 3 other branches were ringed on grapefruit, orange and satsuma trees, the same as above, but precautions were taken to prevent the rapid filling-in and healing of the wounds. Buds were collected from these branches at weekly intervals throughout the season. The leaves soon became pale yellow in color, and all visible vegetative growth ceased. The leaves remained yellow throughout the growing season and many dropped during late summer. The ringed branches did not make a "June flush" of growth as did the unringed portions of the various trees. Materials collected from the branches September 6, at the time when the buds were just swelling and starting growth, showed the first evidence of blossom bud differentiation, and on September 27 the ringed branches on all trees were in full bloom.

After it was learned that blossom bud differentiation definitely took place at the beginning of growth in the spring, other branches were ringed. Two methods of ringing were used, viz., the removal of a strip of bark as described above and by simply ringing the branch with a sharp knife without the removal of any bark. The first ringing was done during the first week in October, and thereafter at intervals of about four weeks through December.

It was found by actual count that branches ringed by the removal of a strip of bark in October, November and December, produced 25.1 per cent., 24.9 per cent. and 25.4 per cent. more blossom buds, respectively, than were produced by comparable unringed branches used as checks. The other set of branches which were ringed at the same time as the above, but without the removal of the bark, produced 18.8 per cent., 20.7 per cent. and 25.1 per cent. more blossom buds, respectively, than did the check branches.

These figures seem to indicate that ringing by the removal of the bark is just as effective in stimulating blossom bud formation when done in October as when done either in November or December. This perhaps is due to the longer lasting effects of the more severe form of ringing. Where the bark is not removed the wounding is not so severe and the effects are not so long lasting. Thus a smaller number of blossom buds were produced on branches ringed in October than on branches ringed in either November or December. This conclusion is supported in part by the results obtained from ringing during March. Ringing at this time gave no increase in the number of blossom buds formed over unringed portions of the tree, even though a band of bark had been removed.

To determine the effects of withholding moisture on the number of blossom buds formed, twelve two-year-old trees, each, of Pineapple orange and Duncan grapefruit, all budded on Poncirus trifoliata root-stocks, were secured in February, 1929. The trees were set in one-half barrel tubs made by sawing 52 gallon Coca-Cola barrels in two. The soil used in the tubs was a fairly good grade of potting soil, made up largely of approximately equal parts of leaf mold, muck and sand. The trees made an excellent growth and in the spring of 1931 the trees produced what we considered a good crop of blossoms. The entire crop of blossoms was removed from all trees at about the time the petals began to fall, thus avoiding the drain of developing fruit on the tree as far as possible.

On April 25 eight of the largest and most uniform trees of each, orange and grapefruit, were selected for the experiment. Each of these groups was further subdivided into two groups of four trees each. Four of the trees in each case were designated as checks. The tubs in which each of the other trees were growing were covered with heavy wrapping paper, which after being placed in position over the tub was waxed thoroughly so as to make sure that no water, other than that applied, could reach the roots of the trees. These trees were allowed to wilt slightly during the day. Late in the afternoon each tree was given enough water to bring it out of the wilt during the night. The amount of water required varied according to weather conditions. In most cases the amount applied ranged from about one pint to one quart per tree per day. There seemed to be very little difference in the amount of water required by the two groups of trees.

The tubs of the check trees were left uncovered and the trees were kept well watered. In no case were the check trees allowed to wilt or suffer for lack of moisture.

On May 16, twenty-one days after covering the tubs, the covers were removed and the trees thoroughly watered. Six days later the trees showed growth activity and on the ninth day the buds were far enough advanced that blossom buds could be seen without the aid of a magnifying glass.

On June 13 the shoots or branches on all trees which had made a flush of growth were counted. On the orange trees it was found that 287 branches had made growth. Of these 170, or 59.2 per cent., of the branches produced blossoms.

The grapefruit trees which were treated the some as the orange trees, had 111 shoots or branches that made a flush of growth. Seventeen, or 15.3 per cent. of these branches, produced blossoms.

The check trees of both orange and grapefruit behaved quite differently from the trees under treatment. There were 170 branches on the orange trees that made a flush of growth, none of which produced blossoms. The check grapefruit trees had 109 branches that made a flush of growth and like the oranges none of the branches produced blossoms.

The blossoms and fruit formed on the trees under treatment were removed soon after the petals dropped and the trees were allowed to mature the growth before the next experiment was started.

In September the experiment was repeated on the same trees. The covers were placed over the tubs September 6, in the same manner as before and were allowed to remain for 23 days. The covers were removed September 29 and the shoots making growth were counted October 31.

It was found that 57 branches or shoots on the orange trees had made a flush of growth and of these 45, or 78.9 per cent., had produced blossoms.

There were only 22 grapefruit branches that made growth and of these 10 branches or 45.4 per cent. bore blossoms.

The check trees of both the orange and grapefruit plots failed to make a visible growth of any kind.

It was found in other tests that trees growing in the open could not be forced readily into growth during November or December after the nights get cool, following the withholding of water for a period of three or even four weeks. Apparently something more than water is needed in order to start growth in trees at this season of year.

These experiments have shown definitely that both ringing and restricting the moisture supply encourages fruit bud formation, but neither is considered a satisfactory method of increasing the crop of fruit. The former method is too injurious to trees or parts of trees so treated and the latter cannot be controlled in a region of heavy rainfall, such as prevails in Florida.

The question then arises, what can the grower do to increase the number of blossom buds formed so as to avoid light crops or prevent the alternate bearing of his trees.

The answer to this question might involve many factors, especially since fertilizer and cultural practices vary widely from district to district, and give rise to endless controversy amongst growers.

In recent years attention has been directed to the carbohydrates and nitrogenous compounds in the tree; and it is now considered that the balance between these two components or, as it is usually termed, the carbohydrate-nitrogen ratio, largely decides the type of vegetative growth made, and the degree of fruitfulness of the tree.

It is considered that when the carbohydrates are relatively very high, and the nitrogen low, the plant tends to be stunted and weakly in growth, and unfruitful. When the nitrogen is relatively high and the carbohydrates low, very strong vegetative growth is produced, but in this case also the tree is unfruitful.

The fruitful condition is associated with moderate growth and an intermediate ratio of carbohydrate to nitrogen. The actual quantities of these substances present are not so important in deciding growth type as the balance between them. It is not suggested that the carbohydrate-nitrogen ratio is the sole factor of this type. The balance between other elements in the plant probably will be found upon further investigation to be equally important.

Consideration of the carbohydrate-nitrogen ratio leads one to realize that the effects of such orchard practices as ringing, pruning, the application of nitrogenous fertilizers, and clean cultivation as compared with the growing of trees under a non-cultural program may be expected to vary in accordance with the chemical composition of the trees subjected to such treatment. The chemical composition of the trees in any district will be determined largely by the climate and soil type met with.

In view of the evidence now at hand it would seem that the citrus tree should enter the dormant period in the fall of the year in a healthy, well fed condition, in order to insure sufficient storage of food materials in order to differentiate blossom buds for the next crop.

DEVELOPING THE HOME MARKET FOR FLORIDA CITRUS FRUITS

Miss Isabelle Thursby, Economist in Food Conservation, Tallahassee

A teacher asked a group of first grade children a few years ago, "Why do you like Christmas?" Hands waved frantically and eager voices shouted, "Because Santa Claus always brings me an orange." There really are, unfortunately, hundreds of children in Florida, who look upon oranges as luxuries and who associate them with Christmas and Santa Claus. There are hundreds of grown-ups in this state who know little about our glorious array, not only of citrus fruits, but other fruits, that grow luxuriantly here. While we have been busy developing outside markets, we have failed to capture one of our very best bets.

As I was thinking over the subject assigned me, I kept trying to figure how many oranges it would take for every child to have at least one a day, every day in the year, and how many carloads of citrus fruit would be consumed here at home if every family in Florida knew its food value and used it freely in some form every day in season, as should be our privilege and pleasure, in this land of bounteous supply, which even now there are those who call it "over production."

It is only within comparatively recent years that the average person began looking upon fruit as food essential to health. To many it is still a frill and belongs in the luxury class.

The established importance of citrus fruits in nutrition is so generally well known to this audience, and their importance as sources of the needed vitamins and minerals and have been discussed so often before this body, their importance in clinical medicine, in both preventing and curing disease, I need not dwell upon this phase of the subject.

We do, of course, stress the nutritional value of our citrus fruits, as we work in the interest of a more adequate food supply for our Florida rural people, in particular.

We, of course, stress their Vitamin C content as one of the necessaries of human life, and the