can be done. It is undoubtedly true, that in the years to come, we will find them more used, but until their beneficial results have been demonstrated, I stick to my guns and say that you had better not use them promiscuously.

Superphosphates, and nitrates as they come from Chile, and also organics contain many of these elements in small amounts and they undoubtedly beneficial and the common use of them has provided these elements. The reason that any need is just showing up now is that the use of the above materials is not as common as in the past.

In connection with borax on celery, we found that ten pounds per acre would eliminate cracked stem, but at the same time, using twenty to twenty-five pounds to the acre, we would have decided injury. Another thing, we do not know just what happens. We hope before many years to know definitely what the facts are.

CITRUS GROWING IN INDIAN RIVER COUNTY

Harry S. Jones, Vero Beach

The exact date of the first citrus plantings in this county is not definitely known. It is a fact, however, that there were bearing orange trees at what is known as Barker’s Bluff as early as 1883. This bluff is a relatively high point on the west bank of the Indian River and on the south bank of the Sebastian River, about fifteen miles north of here and near the present town of Roseland. At this point a Mr. Barker for whom the bluff was named ran an Indian trading post previous to 1883. He had undoubtedly planted some sweet orange seed and these became the first sweet orange trees in Indian River County.

Mr. Frank Forster made the first planting on the island, that is, on the east shore of the Indian River and about nine miles north of here, in 1883, and Mr. Michael, father of Mr. A. B. Michael of the American Fruit Growers, planted some groves at this same location in 1887. Nearly all of these early plantings on the island were killed by salt water in a severe tropical storm in the fall of 1893. A few trees, however, survived this salt water bath and were only slightly damaged by the freeze of 1894-5. The coldest temperature experienced on the island since 1883 was on December 30, 1894, when the temperature went down to 26 degrees.

The earliest plantings in the immediate vicinity of Vero Beach were made by Mr. Gifford, father of Charles Gifford, one of our present successful growers. These plantings were made in 1890 and were well within the present city limits, in fact only about three blocks from this building in which we are now assembled. Some of these trees are still living and still bearing. They were hurt some by the freeze of 1894-5 and in 1896 produced no fruit. That is the only year in forty-five years that these trees have missed bearing a crop. In the early nineties the West Grove and the Helen groves were planted on the sand ridge four to five miles south of this city. About this same time, Mr. Eli Walker planted a grove in a high hammock about three miles west of the city.

Previous to the freeze of 1894-5, prices for oranges and grapefruit were not particularly high, one dollar per box on the tree being the usual price. After the freeze, however, prices advanced considerably and Mr. Gifford relates that many a box of grapefruit was sold on the tree for two dollars per box. This was before the day of standardized containers and each grower was quite at liberty to make boxes that suited his own ideas as to capacity. What with grapefruit bringing two dollars per box on the tree and boxes of a size to suit the grower, those were the good old days.

These early plantings which certainly did not exceed 100 acres were pretty generally located where there was good natural drainage into the Indian River. To the west of these naturally drained
locations lay several thousand acres of good land, but low and flat, with a high water table and no natural drainage.

It was long realized that before this land could be utilized and our back country developed, artificial drainage must be provided. Accordingly, a drainage district was planned and a company known as the Indian River Farms Company, was organized by Mr. Herman J. Zeuch in 1912 to carry out the plans for draining this territory. Money and equipment was provided to drain 48,000 acres. A ditch was dug on the north, west and south sides of this entire area, with the spoil bank forming a dyke of sufficient height to keep out the surface water from the surrounding territory. A total of 480 miles of large and small canals was dug within the district.

Briefly the system of drainage is this: Three large canals are connected by lateral canals running east and west and one-half mile apart. Into these sub-laterals the private farm and grove ditches empty their excess water. This has given this entire area excellent drainage. The management and control of this drainage district is vested in a board of supervisors elected by the land owners of the district. This board has charge of the maintenance of these canals, laterals and sub-laterals and for this service the land owners pay approximately fifty cents per acre per year.

Following the completion of this drainage system in 1914 the business of producing grapefruit and oranges expanded rapidly until we now have some 8,800 acres devoted to the growing of citrus fruit. This acreage and the fruit produced therefrom enables this county to rank thirteenth among the thirty-five citrus producing counties in the state. Sixty-eight per cent. of our 8,800 acres are devoted to the growing of oranges and the balance to grapefruit and tangerines. Of the oranges produced, approximately ninety per cent. are divided about equally between Pineapple oranges and Valencias. The balance is made up of Parson Browns, Hamlins, Connors seedless, Jaffas, Temples, Kings and a few seedlings. At the present time the bearing grapefruit trees are divided about equally between Duncan and Marsh Seedless. In recent years the plantings of grapefruit trees have been almost entirely of Marsh Seedless. There is a noticeable tendency in recent plantings to plant more heavily to Hamlins and some growers have recently planted a few pink grapefruit.

Trees within the drainage district are all planted on beds or ridges. This bedding of the land is accomplished, of course, by plowing in such a way as to throw the furrows together forming a ridge. Two or three plowings are usually required to get this ridge to the proper elevation. Then mounds are built on top of this ridge where each individual tree is to be set. These mounds vary from three to four feet in diameter and are made six to twelve inches higher than the ridge, dependent upon how high the grower thinks it necessary to set his trees. For the next two or three years additional plowings are made, the dirt being thrown to the mounds so that the final result is a gradual slope from the crown roots of the tree to the water-furrows between the beds. These water-furrows serve a double purpose. Not only do they aid in carrying off the surface water from the grove, but they serve as distributing channels when irrigation is resorted to.

The width of the beds on which our trees are planted varies all the way from 20 to 40 feet dependent in the past upon what distance suited best the fancy of each individual grower. It is becoming quite the standard practice, now, however, to plant orange trees on 25-foot beds and 20 feet apart in the row, grapefruit trees on 30-foot beds and 25 feet apart in the row. These distances allow ample room between the rows for the use of all kinds of grove equipment, provide sufficient space for the trees to reach maturity without crowding and permit setting about 85 orange trees or 55 grapefruit trees to the acre.

In recent years the practice of planting trees on so-called double bed has become quite popular. These double beds have a water-furrow only every 50 feet where oranges are planted, and only every 60 feet in the case of grapefruit. It is the contention of those who favor the double bed that this method provides a greater area of surface soil for the feeder roots, that the double bed will not dry out as quickly as the single bed,
and that the middle where there is no water-furrow provides a much better roadway for the sprayer, for hauling fertilizer into the grove, and for hauling out fruit than is the case with the single bed where there is a water-furrow in every middle.

One of the most valuable assets from a grower's point of view, of which this section can boast, is its abundant supply of artesian water. This water is obtained by drilling to a depth of 500 to 600 feet. One four-inch well drilled to this depth, at a cost of about $450.00, if correctly located, will furnish sufficient water for irrigating a forty-acre grove. With such a well properly located and the water correctly distributed, no tree in any grove need ever have a wilted leaf.

This water is good for every purpose for which man could possibly use it. It is good for humans to drink. From the standpoint of being uncontaminated it is, of course, extremely pure. It is good for livestock and good for irrigating the grove. It is perfectly satisfactory to use with every kind of spray material used in a grove.

There is one exception to this. There is one kind of spray material, a mercurial compound, in which the artesian water is not suitable, but we get around that by not using this material.

This water is alkaline in its reaction and contains a relatively high amount of minerals. These wells have sufficient pressure to operate a small generator which will furnish electricity for the farm house and farm buildings, and sufficient pressure to operate a stand pipe for filling the spray tank so that pumps or other filling devices are unnecessary. The most amazing thing about this artesian water is its apparently inexhaustible supply. In one recent summer we experienced a drought of about ninety days duration. During this time it is safe to assume that every well in the Indian River district (and there must be thousands of them) was wide open and yet none of them stopped flowing because of a lack of water. Toward the end of this period there was a slight decrease in the flow but the amount of water being obtained was still ample.

With such a supply of water as this, irrigating a grove is a relatively simple matter. At least each twenty-acre block of trees is surrounded by ditches which of course, aid in draining the grove. When it is desired to irrigate, the outlets to these ditches are closed and the ditches filled with water. From these ditches the water flows into all parts of the grove by means of the water furrows already described. Irrigating a grove is largely a matter of opening a four-inch valve. This is neither laborious nor expensive. There is no money tied up in pumps, engines, slip-pipe or other distributing media. Nor is there any equipment to rust and deteriorate. About the only equipment required is a good shovel and a darky with a strong back.

Strangers seeing our groves for the first time often ask why we do not disc and prevent the growth of grass and weeds in our groves. The answer is, we want the grass and weeds. Frequent mowing of this growth and permitting it to lie on the ground where it rapidly decays means that we are continually renewing the supply of humus in the soil. A soil well supplied with humus is always a well aerated soil. It is not nearly so apt to become water-logged at the time of excessive rains, nor does it dry out as rapidly in dry weather as does soil that is devoid of humus. Furthermore, this carpet of vegetation forms a protective blanket during hot weather for the feeder roots of the trees which are very close to the surface. The growing of the grass and weeds is an excellent method of removing during heavy rains, a large portion of the excess surface moisture.

It is often asserted by those unfamiliar with our methods that a great deal of our fertilizer goes to growing grass and weeds. That is true but so long as we mow frequently we are converting this fertilizer into a form most readily assimilated by the trees—decayed vegetation. I would call your attention also to the fact that there is very little leaching of the nitrogen in the decayed vegetation as compared to the heavy leaching of nitrogen when applied in the mineral form. To get the maximum results from our fertilizer and from our vegetation it is essential that we mow often enough to get the greatest amount of growth. Let me explain this by saying that after grass and weeds reach maturity no further growth takes place, whereas there is
immediate growth after each mowing. Then too there is very little value in vegetation that has been allowed to die standing up, but grass and weeds that are mowed while green and succulent are high in plant food.

There is one more advantage to mowing frequently. Green and growing grass will not support combustion, but grass and weeds that have been allowed to mature and die standing up are excellent fuel for a fire and will furnish sufficient heat to completely destroy a fruit tree. One method of attempting to keep fires out of groves is to keep a fireguard around the grove disced clean of all vegetation. It is claimed by some that this is of little value, except as a place to start a backfire, as in a high wind burning embers are carried over the fireguard and into the grove. But if the burning ember falls in green grass it will not last long. It is possible to find groves in this section that have been kept well mowed and in which there has been no damage from fire in the past ten years.

The question of keeping down to a minimum the damage from fire is in a fair way of being answered now, so far as this community is concerned. A fire protective association of grove owners has recently been formed, fire fighting equipment has been purchased and this equipment is available to any grove owner who has contributed to the cost of the apparatus.

Fertilizing, here as elsewhere, is done by about as many methods as there are growers and the surprising thing is that all of these methods work so well. If we knew exactly how to fertilize we might grow two oranges where only one grows now, but what would we do with the other orange? Fertilizing in this section differs from that of other sections probably in only two particulars; the low per cent. of ammonia in our mixtures and the small amount used. In many groves, grapefruit trees 15 to 20 years old receive in a year not more than 25 pounds of fertilizer containing only 2 to 3 per cent. ammonia. These trees bear well every year and almost never show any signs of nitrogen deficiency. One grove containing a 10-acre block of 825 11-year old Valencia trees has this year produced 4,703 field boxes of oranges. This is the fourth consecutive year that these trees have produced a good crop and yet they have never received more than 16 pounds of a 3-8-8 fertilizer per year. That is exactly what they were given this past year and they have had no fertilizer since November. Yet after carrying this heavy load they show no signs of insufficient feeding.

There are four samples of soil on display here which are representative of our best citrus land. No. 1 is a sample of our heavy hammock soil having a dark, rich top soil containing a large amount of decayed vegetation. Underneath this is a layer of marl and clay and still further down is a deposit of shell and marl. The lime in this marl is in the carbonate form and since these particles are finely divided this line is quite readily available. The shells are also carbonate of lime, but since these particles are coarse this is only slowly available. This subsoil, with its marl, clay and shell is the chief characteristic of the Indian River District and is the basis for setting legal and geographical limits to this section bearing the Indian River name. No. 2 sample shows a top soil of fine gray sand with a layer of yellow sand underneath. Further down at a depth of about 3 feet is a deposit of blue clay. No. 3 is from the Island east of Wabasso where Mr. Michael grows such fine grapefruit. No. 4 is a sample of the soil in the Oslo Hammock where Mr. Sexton grows his price winning oranges and grapefruit.

There are places in this section where this marl subsoil is so close to the surface that it becomes a top soil. Trees growing or trying to grow in these spots get into a lot of trouble. They french badly, dead wood develops rapidly, and a condition of almost permanent dormancy develops. There is very little new growth and almost no bloom. Happily, however, a solution to this problem has been found. The work of the Experiment Station with Manganese in the tomato growing section of Dade County where the soil is of a calcareous nature gave us some good ideas. At first the results of using Manganese in these marl areas were rather discouraging. Experiments were then tried using much
larger amounts than formerly and this gave the answer we sought, when applied to grapefruit trees. Fifteen pounds of Manganese Sulphate applied in 3 applications of 5 pounds each over a period of one year will actually make a grapefruit tree go to work. In 18 months after the first application the frenching will almost entirely disappear. Deadwood will cease showing up, the tree will put on a rich green color and a heavy bloom. With orange trees growing on these outcroppings of marl, the Manganese produced no outstanding results. However, Dr. Camp's work with Zinc Sulphate on Tung Oil trees and his experiment of spraying badly frenched orange trees with Zinc Sulphate and Lime Sulphur gave us another idea. After listening to Dr. Camp's discussion of the use of Zinc Sulphate at the meeting of this society last year in Orlando, we came home and sprayed a group of badly frenched orange trees which had persistently refused to respond to Manganese, or Blue Stone or Copperas. These trees were sprayed with 5 pounds of Zinc Sulphate and one gallon of Lime Sulphur to each 50 gallons of water. We repeated this spray last January and today these trees show almost no signs of frenching, they have taken on a good rich green color, and this spring put out a heavy bloom.

You will not want me to stop, I am sure, until I have told you something of the effects of last December's cold spell. A state wide survey of the cold damage made by the Florida Emergency Relief Administration, co-operating with the Citrus Control Committee, showed that this county suffered 0% loss of growth to its bearing trees, that non-bearing trees suffered a 5% loss of leaves and growth and that the fruit damage was: Tangerines 20%, Oranges 3% and Grapefruit 0%.

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THE EFFECT OF HEATED WATER AND DYE SOLUTIONS, BRUISING AND FREEZING ON FLAVOR AND STORAGE QUALITY OF ORANGES

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About the middle of last December Florida Pineapple oranges showing a peculiar type of pitting or rind injury began to arrive on northern markets. In some cases the fruit looked as though it had been seared with a hot iron over a strip of varying width—sometimes encircling the entire fruit. The affected surface usually was characterized by collapsed oil cells, a darker color, a more leathery texture and by being sunken and having the general shrivelled appearance of "ageing." In other cases the fruit was severely marked with a type of pitting not previously observed and not at all characteristic of the pitting which develops in storage. Many of the pits were elongated and of irregular shape, appearing as though the orange had been bruised by dropping onto a small broken branch, a nail or some similar object. In some cases the injury gave the oranges something of the appearance of being "creased." Some of the same characteristic symptoms have since been observed on Valencia and other varieties of oranges after being picked and packed late in their season.

The development of these characteristic injuries on Pineapple oranges was practically coincident with the rather widespread adoption of the use of chemical dyes to color the fruit in Florida, and also coincident with the arrival of fruit on northern markets which had been subjected to the severe freezing weather of December 11 and 12 when temperatures as low as 19° F. were reported from different parts of the Florida citrus producing area. The later varieties upon which the same effects have been noted were similarly subjected to the same freezing temper-