I can hear you ask, “Why are we interested in Honduras?” Perhaps some of you may even be thinking along the lines of the Biblical character who inquired, “Can any good thing come out of Nazareth?”

For several years we have been trying to make Escuela Agricola Panamericana a tropical outpost of the avocado industry. We are situated in the very heart of the region where the West Indian and Guatemalan races may have had their origin. Around us grow wild species of Persea of interest as possible rootstocks. We are afflicted by root disease to a perfectly magnificent degree, thus enabling us to give potential new rootstocks the acid test. Because of favorable climatic conditions, we can propagate new varieties and bring them into production so rapidly it fairly makes your head swim, thus enabling us to get a prompt reading on some of their possibilities for other regions, such as yours. And we don’t have any hurricanes to bother us. We don’t even have respectable earthquakes.

If I have convinced you that something good for Florida might come out of this Nazareth, I will comment on a few of the lines we are following. I will commence by talking about a subject of somewhat recondite interest, but which in the end may have practical importance.

WILD AVOCADOS

For many years I have personally been attempting to trace the three cultivated avocado races back to their wild progenitors. Time and again I have thought I had them pretty well tied down, only to see them slip through my hands when new information was brought to light. For some time now, our California colleagues have been chasing the Mexican race from the Rio Grande down to the Isthmus of Tehuantepec, without having found it, as yet, in a state which was convincingly wild. Carl Crawford of Santa Ana, California, has spent a lot of time and money on this quest, in which it is quite probable that he will ultimately be successful.

I myself have devoted more attention to the Guatemalan race. In the highlands of Central Guatemala, around 8000 to 9000 feet, grows a wild avocado. Our botanist Louis Williams considers this a new species and has given it the name Persea nubigena. There is still a possibility that the Guatemalan race may have had its origin in this wild form, or in one of several others, very similar in character, which are being discovered in Guatemala and Honduras.

The West Indian race has been even more elusive. Recently, however, the botanist Paul Allen has found a wild avocado in Costa Rica which may be the thing. I believe I saw this in Panama, years ago, but I was not able to get botanical specimens.

THE ROOTSTOCK PROBLEM

Apart from what I trust is a laudable curiosity in finding out where our cultivated avocados came from, the search for wild forms has its practical aspect—an aspect which has assumed great importance in California. I refer to the problem of rootstocks. Particularly in heavy soils—which are abundant in southern California—avocado trees have died by the thousands, as all of you are aware. The pathologists are convinced that a fungus, Phytophthora cinnamomi, is responsible. This organism appears to be common in that state and in many other regions. It has been isolated from sick avocado trees in Peru, in Honduras, and I believe in El Salvador. I do not know much about its occurrence in Florida, but some of you who are familiar with the situation can talk about that.

It has been—and is—the feeling in California that commercial avocado culture in that state will be limited to certain areas unless a rootstock can be found that is more resistant to Phytophthora than any of those which has been used to date. Since quarantine restrictions have made it difficult to import seeds of avocados and related species into the United States, we have hoped that we might be of assistance by making some preliminary trials in Honduras. We have been materially assisted in this work through having with us two eminent botanists, one of them Louis Williams, whose name has already been mentioned, the other Paul C. Standley, who is the outstanding authority on the flora of Central
America. These two men have been busily at work rounding up wild Perseas.

So far, only one thing has shown promise here. This is *Persea Schiedeana*, known in Mexico as chinini, in Guatemala as coyó, and in El Salvador and Honduras as chucte and supte. It is a wild, but usually not common tree in all these regions—and goes clear down to Costa Rica where it is known by the name yás. The fruit is good to eat. It is highly esteemed in the state of Veracruz, Mexico, and also in parts of Guatemala, El Salvador, Honduras and Costa Rica. It has been planted in Florida—George B. Cellon had a tree or two at Miami, and there were a few at the old Plant Introduction Garden on Brickell Avenue. All of these were killed by cold, I believe, before they had a chance to come into bearing. The coyó may be slightly more tender than any of our cultivated avocados, but perhaps if we keep it under ground (that is, as a rootstock) it will get by. The interesting facts are that it seems to be a fairly congenial stock for the avocado (we have healthy three-year-old trees budded on it) and that where avocados on West Indian roots have died out, it has so far shown considerable resistance to whatever it is that kills avocados on our heavy, poorly drained soils. There is a tendency for the stock to outgrow the scion, but no more so than has been the reverse case with many of our Guatemalan x Mexican hybrids budded on West Indian.

Several years ago a species which has been determined as *Persea floccosa* was introduced into California from the mountains near Orizaba in Mexico. The budwood I brought from that place was used on West Indian seedlings and we lost it. At the College of Agriculture in Los Angeles it was saved, and Professor Schroeder told me, when I was there a few months ago, that it seemed to be showing considerable resistance to root disease. It also seems to be a congenial stock for the avocado, as far as can be judged at present. When we saw the fruit in Mexico it looked so much like a small avocado of the Guatemalan race that I did not suspect it was a distinct species.

In a plot which we established here at the Escuela to test wild avocados and other species as possible rootstocks, *Persea nubigena* from Guatemala has so far shown no promise. Most of our seedlings died before they were large enough to take the bud. Several species belonging to allied genera of the Lauraceae, such as *Nectandra* and *Ocotia* have so far proved to lack congeniality. The same is true of *Bielschmiedea* (Hufelandia) *ayay*, a tree from Guatemala which bears a fruit strongly resembling a good-sized avocado of the Mexican race.

Incidentally, we have had in our plot numerous seedlings of rather primitive forms of the Mexican race, brought from Mexico and Guatemala, as well as seedlings of the West Indian and Guatemalan races, and up to now the Mexican seedlings have shown a stronger tendency to die from root diseases at an early age than the West Indians; though in our nurseries we have lost many West Indian seedlings before they were a year old. Perhaps not much importance can be attached to this observation. With us at least, the avocado is extremely sensitive to differences in soil texture. In a nursery we established last year, about a quarter of an acre, all the trees did well except those in an area some 40 feet in diameter, where they died before the buds had reached suitable size for transplanting. The soil in this small area was sticky, sandy clay a few inches below the surface.

**New Varieties**

It is exactly forty years since we introduced the Fuerte Avocado from Mexico and I budded the first trees in the West Indian Gardens at Altadena, California. In spite of the fact that Fuerte now accounts for more than 75% of California's commercial production, time has shown that it is not satisfactory in all avocado-growing regions. And in spite of the fact that literally hundreds of seedlings have since appeared and seemed promising commercially, there is still a "variety problem." Most of the local seedlings have turned out to be what George B. Cellon used to call "seven day wonders."

There have been some interesting developments. When David Fairchild started me on a ten-year exploration of tropical America, I was told to look for one-pound avocados of good quality and good bearing habits. At a recent annual meeting of the California Avocado Society I voiced my grievance: they had made me throw away ten years of my life, for now they want nothing bigger than an eight or ten ounce fruit. As you know, there is still a strong prejudice against purple avocados. Which reminds me that George B. Cellon once
told me that he had never ceased to regret having chosen Trapp and Pollock as the first two varieties to be put on the market commercially; he had developed what I believe you folks call “consumer resistance” to purple fruits which exists to this day.

The alternate-bearing habit of the Guatemalan race seems gradually to be driving this race out of the industry, at least so far as California is concerned. Just this year the Variety Committee of the California Avocado Society had to take Nabal, one of my pets, off the approved list. I don’t blame them. Nabal is a magnificent fruit—one of the finest of its race. I chose it in Guatemala, way back in 1916, because it was such a fine fruit and the parent tree was carrying a tremendous crop. I gave it the name “Nabal” which is an Indian word meaning “abundance.” When they threw this back at me in California, not long ago, I defended myself strongly. “Sure it means abundance,” I said, “abundance every third year.”

I am afraid we are not prepared, here in Honduras, to give Florida avocado growers as much assistance in the matter of new varieties as we hope to give the Californians. But I want to tell you briefly what we have been doing. In 1947 Harlan Griswold and others of the California Avocado Society decided it was time to go back to the native home of Fuerte and get some more varieties with the same background—crosses between the Guatemalan and Mexican races. It happened that a resident of Atlixco had got the fever, probably (I assume) from having heard how Fuerte had succeeded in California, and he had planted an orchard of about 4000 seedlings. These were probably 15 or 20 years old, hence of mature size.

Louis Williams and I joined the Californians, and as we went through that wonderful collection of potential varieties I thought to myself, over and over again, “What a time I would have had if I could have dropped into an avocado paradise like this when I was exploring for Dr. Fairchild thirty years ago!” We picked out a lot of promising trees and cut budwood. Some went to California, some went home with me to Honduras.

Of course there were many trees which were not in fruit at the time of our 1947 visit, so we decided to go back again in 1948, at a slightly different season; and this time some of the lads from Texas joined us, and we understood your own Ivey Futch was planning to come. He did not show up—maybe a hurricane blew him temporarily off the map. Anyway, we did our best without him and even visited several other avocado-growing regions.

The result of these two expeditions was some 40 selections, which were planted in California, in Texas, and in Honduras; and subsequently we sent budwood of some of the most promising to Florida, to South America, and even as far as Johannesburg, South Africa. I do not think any of these introductions has yet matured fruit in California, but here in Honduras (because, as I tell everyone, here we have the sort of climate folks think they have in California) we had mature fruit on some of the 1947 selections twenty months after insertion of the buds. Since that time, we have fruited about 25 altogether, and some of them look very promising, so much so in fact that we have named and described two, which we call Aztec and Toltec. We propose to go on giving Mexican names to further good ones which show up; I have already chosen Zapotec and Huastec and was going to use Mixtec until someone mentioned that it would be pronounced “mistake” and might eventually prove to be a bit too appropriate.

I do not know what to expect of these varieties in Florida. If any one of them pans out, I imagine it may prove to be in the Ridge section, rather than South Dade. As far as we can see, there is no West Indian blood in any of them. Some lean toward the Guatemalan side, some toward the Mexican. The former may be the ones most worth trial.

**A TENTATIVE METHOD OF MANGO SELECTION**

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Coral Gables

Those of you who visited the 10th Annual Meeting of the Florida Mango Forum held at Fort Lauderdale on July 11th and 12th, no doubt observed the striking number of new varieties on display. Since most of the new varieties shown at its exhibits have been obtained from hybrid seedlings of unknown or
conjectural parentage, the Mango Forum a few years ago appointed a committee of judges whose task was (and is) to maintain quality standards as high as possible for this material, in other words to stimulate progressive selection by awarding recognition only to the very best new varieties.

Now that plantings of good and reasonably good varieties have become rather extensive, the time has arrived for Florida to put her mango industry on a solid basis by adopting a large-scale systematic breeding and selection program.

**THE PRESENT STATUS OF SELECTION**

The varieties of mangos in Florida at the present time represent the culmination of some 4,000 years of effort by mankind to improve this "queen of fruits." Over the past 200 years, but particularly since the turn of the century, many of the choice Indian and Indochinese varieties have been imported into this country. Through generations of selection of their seedlings, the introduced varieties themselves have undergone a culling process for adaptability to our climate and soil.

With the discovery of the inarching method of vegetative propagation in India, the planting of monoembryonic varieties became feasible on a commercial scale (1, 5, 6). Later, in the United States, the Philippines and Hawaii, the less tedious, cheaper methods of budding and grafting were provided to the rapidly expanding mango industry (5, 7, 13, 14, 22). The budding on polyembryonic varieties has been superseded by budding monoembryonic varieties until at present one rarely finds a polyembryonic variety being planted even in dooryard cultures (12, 16, 18, 21, 23, 25).

The question of stock/scion relation cannot yet be regarded as solved. Important in this connection is Dr. Fairchild's information that buds of superior seedlings of the Saigon, worked on the polyembryonic terpentine seedlings proved to be superior in flavor according to many mango fanciers to the monoembryonic stocks from Indian varieties. Since the polyembryonic sorts come from Indochina and the Philippines, this might indicate intraspecific quality preference between these varieties.

The selection of new varieties in Florida has been aided materially through the formation of the Mango Forum by giving the growers a place where they can display their discoveries (11). In this work of scanning the thousands of trees scattered over the state, the Forum has provided the necessary preliminary selection upon which further improvement must be based.

It should be emphasized that the varieties selected thus far have nearly all been the result of chance crosses or segregations. In a few cases, we know or assume the identity of the female parent of a given seedling but there are few authenticated instances of a properly safeguarded cross having produced a named variety. (This startling fact however was also true of the majority of deciduous fruit crops up to 1900 and is still true of most tropical fruit crops.)

**DIFFICULTIES IN MANGO SELECTION**

While improvement in the mango follows the general principles of crop breeding and selection, it nonetheless encounters many obstacles. The mango has flowers of two types, perfect and staminate, appearing in varying proportions in the same inflorescence. Both normally have but a single fertile stamen and thus do not lend themselves well to pollination. Self-sterility is suspected in many varieties. Usually the mango is cross-pollinated in nature, but varying degrees of self-pollination are also known to occur. Artificial pollinations of mango varieties, both crosses and selfings, have met with very little success, usually less than one percent of the flowers developing to mature fruits (2, 4, 9, 24).

In addition to the above-mentioned characters connected with the flowering and bearing of the mango, the question of embryony must be considered. While pollination of the flower and subsequent fertilization of the egg is considered essential to the development of the fruit, additional embryos may arise in the nucellar tissue. The fertilized embryo is usually hybrid in nature while the nucellar embryos are exact duplicates of the mother tree. While the two types of embryos may be distinguished in the very young stages of the fruits, the lack of distinctive vegetative characteristics in most of the mango varieties precludes a separation of the plants resulting from a polyembryonic seed until they have fruited. Since the percentage of polyembryonic seeds in a variety depends upon physiological and environmental conditions as well as its genetic constitution, the phenomenon assumes a role of considerable importance for the
breeder as well as the grower (8, 9, 10, 19, 20).

The mango provides an excellent example of heterozygosis in fruit crops as evidenced by the numerous varieties which have been produced in the past. In its long history, the mango has been crossed and re-crossed countless times until most of the present varieties now possess a complete or nearly complete lack of uniformity in their offspring, a genetic instability which obviates the possibility of obtaining pure strains. The existence of polyembryony in certain varieties has likewise tended toward the isolation of various characteristics that have persisted through many generations. Thus one finds in the present varieties two lines of development: (a) a behavior leading to constant combination (and recombination) of characteristics through its ability to cross and self pollinate and (b) a source of isolation and perpetuation of characters through polyembryony.

**Selection and Breeding in Other Crops**

In the preliminary stages of selection with other crops, polyclone breeding gardens consisting of trees possessing some good qualities but lacking others are established with a view to combining as many factors as possible. The resulting seeds are sown in large-scale selection experiments and selection for fruit quality and tree vigor is begun on the trees. Such seedling-population gardens are planted many years in succession to obtain as many different combinations of factors as possible. As fast as undesirable elements show up, they are eliminated or the trees are budded with individuals approaching the ideal form. Natural cross-pollination between these selected trees will thus gradually concentrate the desirable characteristics, and new progeny gardens are in turn planted from these selected seedlings. This process is repeated as many times as desirable.

Parallel to this system of poly-clone breeding gardens, mono-clone gardens are necessary to determine the rate of self-pollination and the results of inbreeding and to observe eventual recombinations which might open up new possibilities.

Concurrently with the breeding gardens, the best material available is tested in clone gardens with the clones showing the greatest promise being released to commercial growers and private interests.

The above system was developed and perfected in the East Indies by the Dutch for rubber, coffee, quinine, tea, and other crops. The results obtained have entirely justified the expense, as for example, in thirty years the production of rubber was increased four-fold (from 500 kg. per hectare to more than 2,000 kg. per hectare). Such a breeding and selection program was possible with these crops only through organization of the commercial growers and the concentration of large amounts of capital in the enterprises.

Taking *Hevea*, the chief source of natural rubber, as an example, the Far Eastern plantings were started on a small scale with unselected seedling offspring of the Wickham and Cross importations. By 1910, the area in *Hevea* had grown to over 400,000 hectares, all seedling materials. A short time later the world demand for rubber rose high enough to induce the plantation owners to organize associations which established their own research stations. With government assistance, the research stations began selection and breeding work on an industry-wide scale. The individual tappers on each plantation and native holding marked the highest yielding trees in their tapping tasks. The production from these trees was compared, plantation by plantation, area by area. The next step was the formation of a series of test gardens, on the individual plantations and at central locations for each rubber-growing area, where buddings and seedlings from these high yielding trees could be compared with one another. The great range of climate and soils in Java, Sumatra, Borneo, Malaya, Indo-China, and Ceylon led to the development of varieties selected for their adaptability to certain areas and conditions. At the same time, investigations on methods of propagation, methods of tapping, soil and fertilizer requirements, rootstock studies, and diseases and pests were being carried on. As fast as clones or seedling families were developed by the research stations, they were released to the growers, first for small-scale plantings and tests in their particular locality, later for large-scale plantings. Thus, in the 30 years from 1910-1941 when the Pacific War broke out, the areas originally planted to unselected seedlings were supplanted by selected seedlings and primary clones, then by secondary clones and secondary seedling families. Since the end of the War,
Mango Selection

The development of the mango industry in Florida up to the present time has followed in many respects the history of rubber in the Far East prior to 1910. Choice varieties from India, Indo-China, the Philippines and other Asian sources as well as West Indian selections were introduced by individuals and by the U. S. Department of Agriculture. These varieties in turn have been subjected to a process of acclimatization and selection to meet the tastes and fancy of the American public. Generations of seedlings and budlings from these varieties have been propagated until today there exist many thousands of trees scattered over the southern half of the peninsula.

This area may logically be compared to an immense breeding garden in which the results of the hybridization of the increasingly complicated clones and seedlings obtained from parents improved by mild selection are markedly evident. Although this primitive way of improvement—through slight selection for fruit quality and growth vigor of the trees according to the taste and appreciation of the steadily increasing numbers of growers, nurserymen, and others—has considerably enlightened and to a certain extent has solved some phases of the first step in selection, the time has come to put mango selection on a scientific basis, to apply here some of the lessons and techniques obtained with the breeding and selection of other crops. The cultivation of mangos in Florida has already grown into an important source of income and has an even greater potential. The unique advantage of being the only subtropical area in the continental United States where the mango can be grown successfully on a commercial scale should not be under-estimated. The present financial interest and the future prospects require a planned breeding and selection program. In this connection, the following points are offered towards developing a practicable, balanced program for improvement:

(1) Characteristics of economic importance in fruit selection:

- Pleasing flavor, good aroma, firmness of flesh, bright color of flesh, absence of fibers, small size of seed, absence of pre-ripening around the seed, acceptable size, bright color of peel, disease resistance, resistance to skin blemishes, keeping qualities, shipping qualities.

(2) Characteristics of importance in tree selection:

- Low stature and earliness of bearing (to avoid wind damage), vigor, productivity, hardiness to cold, disease resistance, adaptability to soil and climatic conditions, regularity of fruiting, self fruitfulness.

Judgement of Fruit Qualities

Flavor, fragrance or aroma, fibrousness, pre-ripening around the seed, color, and shipping qualities are among the most important characteristics for the selection of parent trees for further improvement. Of these characteristics, the first two are the most difficult to judge objectively; consequently, to acquire the highest constancy and skill in judgement, as with other products graded on the basis of taste and flavor (tea, coffee, cacao, etc.), the judges should be appointed for life or at least a long period. Every effort should be made to ensure complete objectivity in the testing. For example, samples of the fruits to be tested should be submitted on numbered trays designated in such a way that the identity of the fruit is not known to the committee.

In as much as standard tests for flavor and aroma for mango varieties do not exist, experiments should be made to determine whether the samples should be slices or cubes taken from the outer flesh, the flesh near the seed, or made into puree; whether the samples should be swallowed or merely rolled around in the mouth and expectorated to preserve an uninfluenced taste susceptibility for following samples; whether the samples should be from a single fruit or several fruits of each variety; whether the judges should be blindfolded during the testing; and whether samples should have the peel removed or left on. The question of aroma should especially be given consideration in the testing, mainly to eliminate overly strong or otherwise objectionable scents. In this respect success was obtained in the Far East by olfactometric checking of products as cacao and coffee, which hitherto were mainly graded by taste tests (17).

An exact method for determining the fiber content is difficult to achieve but a workable standard may be derived through the flavor tests; i.e., testing to ascertain whether the fruit is with or without objectionable strings. An additional method is that of halving the
fruit lengthwise to see what proportion of the fibers adhere to the flesh when the two halves are twisted apart.

Standard tests for pre-ripening around the seed, keeping quality, disease resistance, blemish resistance, and shipping quality of the fruit should be set up using statistical methods to record the changes in color and firmness of the fruit in a unit of time, the size, number and prevalence of skin discolorations, and the effect of type of containers, wrappings, temperature, humidity, and light on these.

The size of fruit acceptable to the market can be ascertained through sample shipments to the various wholesale fruit centers and the data obtained used as a criterion in fruit selection in field tests.

**FIELD SELECTION**

During the past few years a number of new varieties have been planted on a commercial scale in Florida; however, in no single case do any of these varieties possess all of the desired characteristics of the ideal mango fruit and tree, nor have productivity and other field tests been made with them. (It may be truthfully said that heretofore selection has been made on the basis of the individual grower’s conception of what he wanted in a variety rather than as a result of a planned systematic program by even a small segment of the industry.)

It is of primary concern to the commercial grower that he knows as much as possible about the variety on which he is risking his capital; to this end, he should insist that adequate tests be made before a variety is released or recommended for commercial planting.

The present 20-odd commercial mango varieties can serve as a nucleus for standard clone tests. While they have been selected by the growers as being suitable for the purposes, few, if any, production and growth records exist. Since these varieties constitute the basis for comparison for the new varieties being developed, it is imperative that they be tested also.

The proposed clone test consists of randomized row plantings surrounded by a buffer row, each planting comprised of 48 budlings per clone (variety) in replications of 6 trees. These budlings should be planted preferably in hedge rows (narrow spacing in the rows), the trees 6 feet apart in the row, with the rows 30 feet apart. This gives a density of 10 clones per 2 acres, 9 test varieties and one standard variety (arbitrarily Haden until enough data are obtained to permit the use of another variety better suited for the purpose). The trees will suppress each other in the rows but will develop strong branches toward the open lanes between the rows.

The use of a hedge row system is amply justified by the results obtained with testing numerous other crops (coffee, rubber, tea, quinine, oil palm, coconut, agave, sugar cane, etc.) as it has been proved that clonal variability towards yield, growth, disease susceptibility, etc., is not affected by the close planting in the rows. The advantages lie in the larger number of test trees per area and the greater protection from wind damage than in the conventional square or triangular test patterns.

The data per replication obtained from the test planting should include yields, individual tree growth (height, girth, and spread), incidence of disease, earliness of bearing, and resistance to drought and particularly for Florida resistance to cold. Pruning to keep the trees low should eventually be included in the test program.

It may be pointed out that the yields obtained from the hedge row plantings will provide an index as to the relative productivity of a test variety compared to the standard but they will not give absolute values as to the yields obtained with conventional planting patterns. One of the prerequisites for the selection of the standard variety should be a record of its productivity in a conventional planting pattern. This apparent defect is also more than balanced through the space-saving features of the hedge row system.

Considerable thought should be given to the location of the testing grounds. These should be located so as to be representative of as much of the entire mango growing area as possible.

The clone tests may also be in concurrent use as a nucleus for the breeding program. Since the varieties represented in the tests will be those with the highest promise for marketability, seedling trials should be planted from those clones selected as the recurrent parent for back-crossing. The selection in these clonal seedlings should be made on the basis of ideal characteristics present in the...
non-recurrent parent. Trees showing the desired characteristics from that non-recurrent parent should be propagated for back-cross purposes. This may be done on a field scale in suitably isolated bi-clone breeding plots or in tubs, if necessary. In the bi-clone plots, pollination between the trees will take place naturally. With the tub plants, the desired crosses may be facilitated by placing a screen over the plants and pollinating them by placing a beehive inside the enclosure. Owing to the practical difficulties involved in the pollination of plants within enclosures the bi-clone plot method is, however, much more desirable.

While clone testing or a breeding program are long-term, continuing projects, methods have been developed with other crops for shortening the fifteen year cycle between generations. With Hevea, a nursery test tap method has made it possible to shorten this period to 10 years. It is possible that a method for the pre-selection of young mango seedlings may be worked out in the future although it is difficult to predict which characteristic common to both juvenile and mature plants will prove to be applicable (3).

Further continued importations of important varieties from the Far East should be undertaken. Some of the most desirable being the Golek, Aru Manis and Mana Lagi from Indonesia (15), and cool climate ecotypes from high altitude belts in South East Indonesia (and possible other regions).

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LITERATURE CITED


STEM PROTECTION OF YOUNG FRUIT TREES FROM FROST

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Ever since Citrus trees have been grown in the United States in regions susceptible to occasional winter frosts, there has been a great deal of thought given to protection against damage from the frosts that strike