Proc. Fla. State Hort. Soc. 32:88-104. 1919.

Avocados, Particularly Guatemalans

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Three years ago, when I left the United States to carry on agricultural explorations in Guatemala and Mexico, the term "Guatemalan avocado" was rarely heard in Florida. Upon picking up the proceedings of this Society for 1918, I find it filled with references to this valuable race of that most valuable of all fruits. What are the reasons for this sudden increase of interest in the Guatemalan avocados? I believe they are two: in the first place, the cold winters experienced in Florida recently have awakened avocado growers to a fuller realization of the desirability of planting the hardiest varieties obtainable; and, in the second place, the Guatemalan avocados promise to furnish an abundance of fruit during the winter and early spring, at which season high prices are obtained.

We have had plenty of avocados in Florida during late summer and early fall, and a few in late fall and winter; but until the Guatemalans were introduced it has not been possible to have them abundantly during the winter months. These two points, hardiness and winter bearing, are the characteristics of the Guatemalan race which should have unlimited emphasis. There are several other characteristics which merit our attention, notably the thick, hard skin of some varieties, and the vigorous growth of others.

Three years ago several pioneer avocado growers on the lower East coast recognized the possibilities of the. Guatemalan race and began to plant a few trees experimentally. At that time we did not know how this race was going to behave in Florida, except in so far as we could judge from the performance of a few seedling trees in the Plant Introduction Garden at Miami. Today, however, we have enough experience back of us to warrant the belief that it is destined to play a very important part in the future of the avocado industry. While in South Florida recently, I asked several of the most prominent avocado growers what they thought of the Guatemalan race. All of them, without the slightest hesitation, replied that it was the coming race for commercial cultivation. It only remains for us to thresh out the question of varieties. We know less about this subject than about any other phase of avocado growing, and it will take several years to determine which varieties are the ones to plant in different sections of the State,

Realizing the importance of obtaining for North American horticulturists the best avocados the world affords, the Department of Agriculture several years ago undertook a series of explorations of the principal avocado regions of tropical America, a series which we hope to continue until all of the promising territory has been covered. Then we can proceed with the development of the avocado industry in this country feeling that we have built its foundations upon the best available material. This work is particularly urgent just at this time, when the industry is still in its infancy. If the avocado groves of

this country are planted to inferior varieties, they must ultimately be worked over to better ones, entailing enormous losses of time and money. If, on the other hand, we can secure really excellent varieties before the industry has attained large proportions, most of the groves will be planted with satisfactory varieties in the beginning.

One result of my sojourn in Central America has been that I have, come to realize more than ever before the intrinsic value of the avocado as a food, and the enormously important part it is capable of playing in the dietary of a people.. Ever since the early days of the avocado industry in the United States, we have harped upon the food value of this fruit, pointing out its similarity to eggs, milk, beans, beefsteak, or any other staple article of diet for which we chanced to possess a predilection; but it took a trip to Guatemala to impress me, not with the food value of this fruit as expressed in calories, but with the extent to which it can replace meat in the every-day life of a people. I wish you could have been with me on some of my trips across the Guatemalan mountains, to see the Indian *cargadores,* men who carry immense burdens upon their backs across a hundred miles of broken country, sitting beside the trail at noonday, eating their frugal meal of tortillas (corn cakes) and avocados. I asked my own Indian servant, a boy from the mountains of northern Gautemala, "What do you consider a good meal?" "Four or five tortillas, an avocado, and if I can afford it, a cup of coffee," was the reply. The amount of work which the Indians are capable of performing upon such a diet as this is perfectly amazing. I have often wondered how one would be affected by living exclusively upon avocados for a time. I do not believe the avocado contains enough roughage to satisfy the appetite of a man doing outdoor work, no matter how much nourishment it might give him.

The Department of Agriculture has just published bulletin No. 743, "The Avocado in Guatemala," which contains in full the observations which I made during my sixteen months' stay in Guatemala. In this paper I will limit myself, therefore, to a brief consideration of certain points which I feel should be of particular interest to the many horticulturists in South Florida who are embarking upon the cultivation of this promising fruit.

While traveling through Florida last month, I was several times asked, "Why are the Guatemalan avocados hardy? They come from way down in the tropics, where it ought to be much warmer than it is here." To answer this it is only necessary to explain that Guatemala is a mountainous country, many of its towns and villages lying at elevations of 5,000 to 8,000 feet. With every thousand feet of altitude there is a certain difference in the temperature, some of the higher levels being subjected to lower temperatures than are usually experienced in South Florida. Citrus fruits are not grown in Guatemala at elevations greater than 7,500 feet, because of the danger from frost, but I have seen occasional avocado trees at elevations of 8,500 feet. This does not prove that any of the Guatemalan avocados are hardier than the orange; I suspect that other factors than frost resistance entered into the matter. But it does give, us much encouragement, and, I think, grounds for the belief that it will be possible and practicable to cultivate avocados commercially throughout the same region as oranges and grapefruit.

In regard to cultural methods, it is not safe to be guided by the observed practices of the Guatemalans. Everyone who knows the tropics realizes that horticulture in that part of the world is, generally speaking, altogether primitive in character, and that groves of fruit

trees, planted in straight rows and well cared for, are almost unknown. In Guatemala the avocado is essentially a dooryard tree. It springs up about the houses of the Indians from seeds cast aside after the fruits have been eaten, and it is found here and there in coffee plantations, where it serves as one of the several species of large trees which furnish shade for the coffee bushes. It is never propagated by budding or grafting, and no pruning or manuring is done, with very rare exceptions. Insect pests are allowed to work unhindered, and no water reaches the tree except that supplied by nature. It is not safe to argue that because the avocado exists under such conditions, they are best for it. Observing the behavior of the trees in different regions, I came to believe that they did best when on moist and reasonably heavy soils in which there was an abundance of humus. For this reason I feel that it will be important, here in Florida, to increase the humus content of the soil by every possible means (except in those instances where it is already great), and to insure an abundant water supply at all times of the year. True, the avocado succeeds in parts of Guatemala where there is a dry season of about six months' duration, but it also succeeds in other parts of the same country where the rainfall is 140 inches per annum, distributed throughout the twelve months. Moist subsoil seems to be essential if the region has no rainfall during part of the year.

Years ago it was recognized that there are several distinct races or species of avocados. Some of these races are hardier than others, and some, varieties of each race are hardier than other varieties of the same race. The large, thick skinned fruits of the West Indies and the small, thin skinned ones of Mexico have long impressed all who studied them as distinct in some manner. The researches of recent years have carried us far toward the solution of this problem, and it is reasonable to hope that another two or three years will give us a satisfactory understanding of the whole matter. Horticulturists are now classifying the avocados cultivated in the United States into three groups, to which a fourth will have to be added. These three groups are the West Indian, Guatemalan, and Mexican races, so-called. The fourth group which must be added is a category to include crosses or hybrids, of which we already have one, the Fuerte.

The three groups which we term races, when studied minutely, seem to form in reality two botanical species. One of these includes avocados of the Mexican race. This is such a distinct group that we believe it will be necessary to restore it to the standing of a botanical species. It was described as such (under the name of *Persea drimyfolia)* in 1831, but recent botanists have reduced it to a variety of *Persea Americana.* The Guatemalan and West Indian races possess sufficient similarity in botanical characters so that we must consider them nothing more than two expressions of the same species; in all probability the West Indian race is the lowland or tropical form of *Persea Americana,* and the Guatemalan race is the same species as it has developed in the cool highlands of the tropics.

To the horticulturist, all this may seem irrelevant, and of no practical application; but we must understand our avocados thoroughly before we will know exactly how to work with them in the orchard, and first of all, we must know with what we are dealing. I believe it is safe to say that no other feature has played a more important part in the development of the avocado industry than our knowledge of races (or species, if they are such) ; if we.had not realized that there were distinct races of avocados, differing in their climatic

requirements, we might still be attempting vainly to grow Cuban avocados in California, and Florida would never have paid any attention to the hardy, winter bearing Guatemalan race. It is essential to the success of the industry that every horticulturist who is cultivating avocados should acquire a thorough understanding of the characteristics of the cultivated races. This is not altogether easy. He can depend upon his nose to tell him when a variety belongs to the Mexican race (unless he. happens to strike a hybrid like Fuerte, and they are exceedingly rare), but the.differences between the West Indian and the Guatemalan are more subtle. The anise-like odor given off by the crushed leaves of the Mexican race is an infallible guide. The hybrid Fuerte, however, also has this characteristic, and would have to be classed as a Mexican did we not have sufficient grounds for believing it to be a hybrid between the Mexican and the Guatemalan. Neither the Guatemalan nor the West Indian ever have the faintest trace of anise odor in their foliage. The differences between these two races are rather vague, but in general it may be said that the Guatemalan has a fruit with harder skin (often thicker as well) than that of the West Indian, with the seed always tight in its cavity (as opposed to the oftentimes loose seed of the West Indian), and that as a rule the Guatemalan varieties are considerably hardier than the West Indian. I believe there are avocados which are intermediate between these two groups, and which it may be impossible to classify with accuracy as belonging either to one or the other. As previously stated, the West Indian is probably the lowland expression and the Guatemalan the highland expression of one and the same species. At intermediate, elevations may have originated intermediate forms, which have neither the distinguishing characteristics of the West Indian group nor those of the Guatemalan. We will perhaps have to take the extreme form of each group as our standard, and classify many varieties as intermediates. The Guatemalan group should be kept for hardy, winter bearing varieties, and the West Indian for tender varieties which ripen in summer or fall.

Now as to the behavior of these three races in Florida and the possibilities of each as we see them today. I have recently traveled through the. Southern and central portions of the State, and have been tremendously interested in the results which are being obtained there.

We cannot rightly enter into this subject without first touching upon the question of stocks. I use the word "touch" advisedly, for I do not believe we can do much more than that until we have more experience than at present.

No experienced horticulturist purchases an orange tree without first knowing whether it is budded upon rough lemon, sour orange, or other roots. He sizes up the conditions, decides upon the stock which will probably do best, and then orders trees which have been budded on that stock. The application of this principle of stocks to avocado growing is one of the most interesting developments of the last few years. It is true, of course, that the Californians have been using Mexican seedlings for some years, with the idea that they would produce hardier plants; but the comparative testing of different stocks under the same environmental conditions is as yet a very new subject, and one on which we have relatively little knowledge. In California, West Indian seedlings have been found altogether too tender to serve as stock plants, and the use of Mexicans, as opposed to Guatemalans, has come about largely through the lower price and greater

abundance of Mexican seed. In Florida everything has until very recent years been grown upon West Indian stocks. We now begin to see tests of the other races, with some interesting results already evident. It is becoming clear that the individual varieties of each race differ greatly in habit of growth and consequently in their suitability for use <-s stocks. I believe it is safe to say that next to the question of varieties, the question of stocks *is* the most important one to be solved within the next few years. I should not be surprised to see certain varieties selected as the best for stock plants, and thousands of seedlings of these varieties grown for this purpose. At present no one thinks of inquiring into the matter any further than to determine the *race,* and few people, unfortunately, go even this far.

In the Miami region Guatemalan avocados have been tested more thoroughly than in any other part of Florida. I presume as many as fifty varieties have been planted there experimentally, but not all of them have yet come into fruit. From these experiments we learn that individual varieties differ enormously in their reaction to the soil and climate of the region, and in learning this we hit upon a point which it would be well for every prospective avocado planter to keep firmly in mind. I would like, in fact, to put this statement in sixteen-point, black face capitals, or something similarly conspicuous: *No Guatemalan variety should be planted extensively in any given locality until it has been tested in that particular locality.* Perhaps we may some day have sufficient experience with certain varieties so that we can waive this rule, and plant them with confidence throughout the southern end of the State, even in sections where they have not previously been tried; but when we see the Taft doing famously at Homestead, and a complete failure (so far) at Miami, it makes us realize that a commercial planting of Tafts in any region where the variety had not yet been tested would be a precarious undertaking. The Guatemalans, in some instances at least, are delicate creatures, succeeding in certain places and utterly refusing to succeed in others. Further than this, we have discovered that several varieties which have been propagated on a very limited scale, have the unfortunate habit of pining away about the end of their first year in the orchard (or perhaps earlier), and after lingering for a few weeks in a moribund state, giving up the ghost. This same peculiarity was noted in California a few years ago, and because of it a number of otherwise promising varieties had to be discarded. I repeat, therefore, that it is necessary to proceed with caution. The proper procedure, for those who wish to embark upon avocado culture in sections of Florida where the Guatemalan varieties have not been thoroughly tested, is precisely that which is being followed by Mr. Krome at Homestead, Mr. Johnson on Pine Island, Mr. Niles and Mr. Carrier at Winter Haven, and several others in other sections, namely, to plant a small experimental orchard, including in it the most promising varieties available, and then wait three or four years to determine which are the most successful, before setting out a large acreage devoted to any one variety. This experimental orchard need not contain more than two or three trees of a variety, and at present I do not believe one needs to plant more than a dozen varieties to be reasonably sure of getting the best that is available. The variety question is a rapidly shifting scene, anyway, and we see new ones coming to the front every year. There will, of course, be many people who will want to plant commercially without waiting for such a preliminary test as that outlined. To such we can only give the old admonition which treats of eggs and a basket; don't limit yourself to a single variety unless you are certain that you have picked a winner,

and never be certain that you have picked a winner. Use several of the most promising varieties, so that in case one of them should not prove profitable, you will not stand to lose everything. To the end of this paper I append some notes concerning the more promising varieties now being propagated in Florida.

George B. Cellon of Miami tells me that he finds the. Guatemalans do not require as much fertilizer as Trapp and other West Indian varieties. There is cheer in this, but I hope none of you will take it as sufficient cause for ceasing to feed your trees. It is my personal belief that avocados in general need more fertilizer, particularly in regard to organic nitrogen, than they usually receive. I find that nitrate of soda is being used on avocados in some parts of Florida, and while I am not competent to speak with authority on the subject, I have a suspicion that nitrogen in an organic form would be much better. I wish some of you people who are on the ground and can give attention to this matter would test it thoroughly and let us know the results.

Before going any further, I wish to pause for a moment to pay my respects to George B. Cellon. Some day we are going to appreciate his work. So far as Florida is concerned, he put the avocado on the map. He stands particularly high in my esteem because he was one of the very first to see the possibilities of the Guatemalan race. He obtained a collection of Guatemalan trees from California some years ago, and I suspect that the fruits produced by them were the first budded Guatemalans grown in Florida.

So far as the Miami region is concerned, the prospect of the Guatemalan race, when budded on the right sort of stock, looks very bright. On Mexican roots, the trees have proved to be very slow growers. On West Indian roots, which are the only ones being used extensively by the nurserymen at present, they do well. But the finest stock plant which we have yet seen at. Miami is the Collins, a variety of the Guatemalan race. As a market fruit Collins is scarcely up to our requirements, but the tree is such a vigorous grower that we believe it is worth planting for the production of seed, which can be used to grow stocks for budding with the commercial varieties.

In the Palm Beach region the Guatemalans have not been tried so extensively as at Miami, yet John B. Beach has fruited a number of varieties and I see no reason why this section should not be an excellent one for commercial avocado growing. On deep, sandy land the trees will require much water, and preparations should be made by every planter to irrigate them liberally.

We do not yet know how far up the East Coast the Guatemalans will succeed, but we are recommending experimental plantings as far north as Merritt's Island.

The results obtained by Jack Taylor on Ritta Island, in the southern end of Lake Okeechobee, are so remarkable that we have co-operated recently in some further experimental plantings at several points around the shore of the lake. It is hard to say what effect the unique conditions of the Everglades region will have upon the avocado, but the way to find out is to plant some trees. The growth made, by Taylor's trees at Ritta (they are all West Indian seedlings) is simply tremendous, and up to the present they are fruiting well.

In the Fort Myers region there are as yet very few plantings of Guatemalans. A tree of the Walker variety, growing in the yard of James Hendry at Fort Myers, is bearing

heavily and gives every indication of being satisfied with conditions. By far the most interesting planting in this region is the grove, of Harry Johnson near Bokeelia, at the north end of Pine Island. This grove, which is under the care of Vincent Hone, contains about forty varieties, and I have never seen finer trees for their age.

A question of outstanding interest is this: Can avocados be planted on land which is only a foot or eighteen inches above the permanent water level? It seemed to be the consensus of opinion among those with whom I talked that it is not safe to set out a grove on land where the water table stands less than three feet below the surface of the soil. We need observations on this subject. It has always been my own belief that the avocado is less tolerant of wet feet than almost any other fruit tree which we cultivate, and were I looking for an orchard site I certainly should not select ground which had less than three feet of "freeboard," if I may be permitted to steal this nautical term for horticultural use. It is also worth while in the Fort Myers region, and in many other parts of Florida, to look for soil which has a reddish, brownish, or yellowish color. Most of these soils are excellent for avocados.

Going north from Fort Myers, we find a considerable interest in avocados about Bradentown, due mainly to the efforts of the indefatigable Mr. Reasoner. In order to eliminate the frost menace as much as possible he has concentrated upon the Mexican race rather than the Guatemalan. A number of interesting varieties of this race, as well as several Guatemalans and the hybrid Fuerte, are receiving a test in this region and we will soon know what to expect from them.

The country between Winter Haven and Sebring impresses me as having excellent possibilities, once we have determined the proper varieties to cultivate. The extensive experiments of Mr. Niles at Lucerne Park and Mr. Carrier at Winter Haven should do much toward this end. It is my own feeling that we. have, here in the Lake region, almost ideal conditions for the hardier Guatemalan varieties, and hybrids of the Fuerte type. A lusty Perfecto tree, fully 15 feet high, on Mrs. Stevenson's place at Avon Park, lends strength to the belief that this region is admirably suited to the cultivation of the Guatemalan avocados. There are several small groves of Trapps scattered through this region, but the experience of the past tends to make me believe that a Trapp grove in this part of Florida is a liability, not an asset. I could wish that all of these plantings in the. Winter Haven region had been confined to Fuerte and a few of the best Guatemalan varieties. The experience, of the first few years during which avocados are planted in any given region practically determines the extent to which they will be grown there, in later years. If a beginning is made with Trapp, and the first plantings are killed out, people become discouraged and many of them do not want anything further to do with avocados; if, on the other hand, the first plantings are devoted to varieties which are highly successful, everyone hears of them and immediately becomes interested in the possibilities of this new fruit. I must confess that I believe the Trapp has enjoyed an undue amount of prestige in certain parts of Florida. The fact that it has been the only fruit available during the early winter is in a large measure responsible for this. When they have seen the returns from the last few crates of Trapps shipped at the end of the season, —say in January,—people, have forgotten all about the susceptibility of this variety to frost, its rather weak growth, and the fact that the bulk of the crop is picked long before high prices rule the market. To make this latter point clear, I may say that

prices of $20 and $25 per crate are often quoted for Trapps late in the season but the average returns from two of the largest groves in South Florida, taking the entire crop, beginning in October and extending into January, have been $5.50 to $6 per crate. The point I wish to make is precisely this: In the case of Trapp, high prices are only obtained for the few fruits which hang on the trees until January, while, the Guatemalan varieties will give us nothing but high priced fruit, if we consider this term to imply fruit which can be marketed during the winter months.

When we get north of Winter Haven we get into the *terra incognita* of avocado growing, in so far as everything except the Mexican race is concerned. We know that there, are large trees of this letter within fifty miles of the Georgia line. We are gradually obtaining better varieties, and it may yet be practicable to extend commercial avocado culture into almost every corner of the state.

In regard to the relative hardiness of the different races, I can speak only in very general terms, inasmuch as there is a considerable range of variation within each race. Mr. Krome of Homestead, who is doing so much for the industry through his energetic study of cultural practices and the extensive variety tests which he is conducting, tells me that he has found Meserve and Oro, two Guatemalan varieties, to be as tender as the average West Indian. As a rule, however, the Guatemalans will stand three or four degrees more frost than the West Indians without injury. We hope it will be possible, to grow the hardier of the Guatemalan varieties in those parts of Florida where oranges and grapefruit can successfully be grown, though it is as yet open to question whether this race is as hardy as the orange or the grapefruit. Several growers believe it is more nearly comparable to the lemon in hardiness. The Mexican race, in its hardier varieties, will certainly stand more frost than the orange, having passed through freezes of 18 degrees above zero without serious injury. In all cases the trees will stand much more frost when four or five years old than they will the first year or two after planting.

Returning to the question of stocks, nurserymen who are budding the Guatemalan varieties are using, as a rule, West Indian seedlings as stock plants. This is chiefly due to the fact that Guatemalan seedlings can not be obtained in sufficient Quantity for nursery purposes, and also because we do not yet know how many of the Guatemalan varieties are going to make good stock plants. Unless the trees are to be planted in particularly cold locations, there seems to be no objection to 'his, so far as we can see at present. In the avocado sections of Florida there is little danger of the root being killed by frost: it is nearly always the top that suffers, hence it is not dangerous to plant a Guatemalan variety budded on a West Indian root, provided it is budded low so that all parts of the plant which are above the surface of the ground are of the hardy Guatemalan variety. In California I have seen hardy tops budded high on tender stocks—two feet above the ground in some instances—and when the frost struck them the tops were not injured, but the stock plants were killed. It was a strange sieht to see thrifty green tops upon dead trunks, and needless to say it was a sight which lasted only a few days, for the tops had to die. In regions where it is a bit frosty it would probably be desirable to have trees budded on Guatemalan roots, in order to insure as great a degree of hardiness as possible. We used to think that we could get a still hardier tree by budding on Mexican roots. We do not know, however, that this is really the case, and even if it is, we have found generally in Florida that the Mexican is not desirable as a

stock, because of its slow growth and apparent lack of vigor when grown on this soil. Perhaps we will find certain varieties which will succeed as stock plants in Florida, and which will be valuable for the colder regions.

If I were planting an orchard of Guatemalan avocados today, I would ask nothing better than to have them budded on Collins stock; lacking this, I would not hesitate to take them on West Indian, if they were budded low, and I was in a region reasonably free from heavy frosts.

I come now to the question of varieties, and I feel the water getting deep. Before I finish with the subject you will probably see nothing more than a few bubbles coming to the surface; for if there is any question connected with avocado culture on which we must admit that we are still at sea, it is the matter of varieties. When anyone says to us, "Yes, I am interested in Guatemalan avocados, but what varieties shall I plant?" we are completely, entirely and effectively stumped. We can name a good many varieties which we would recommend you not to plant, but as for picking out the best ones, it is not so easy. As I stated previously, the only safe way is to test out the most promising ones in every particular region before going ahead with an extensive commercial plantation.

Naturally enough, I feel that the varieties we introduced from Guatemala a year ago are, in some cases at least, going to prove of value. If I had not thought some of them better than anything now growing in the United States I would not have climbed those hot Guatemalan mountain-sides so many times, nor punished myself with so many of those frightful black beans and those ghastly tortillas. But they have, not yet been tested in South Florida, and until they are we cannot recommend them for commercial planting.

On my recent trip through Florida I talked with most of the nurserymen, as well as the orchardists who are testing different varieties, and I wish to append hereto a list of what appear to be the most promising varieties, as far as can be judged at the present time. This is not a series of variety descriptions; it is a heterogeneous lot of notes and opinions acquired during conversations with nurserymen and growers, plus some of my own observations. I have not listed the varieties in their order of merit, for the simple reason that we do not know which to place at the top of the list.

Atlixco.—This variety was introduced into California from Atlixco, state of Puebla, Mexico, and from California was sent to Florida. It belongs to the Guatemalan race, and has recently fruited at Miami and Homestead. Mr. Krome considers it very promising. It is a strong grower, inclined to send up long shoots which do not branch very freely. The fruit is broadly pear-shaped, not necked, and weighs 20 to 26 ounces. In color it is deep purple. The flesh is of that rich yellow color which I consider essential to a first-class Guatemalan avocado, and the quality is excellent. At Homestead the ripening season is January and February.

Fuerte.—No other variety is attracting so much attention at the present time as Fuerte. In several respects it is the most remarkable avocado yet tested in the United States, and it seems likely to win a permanent place in the industry. Fuerte is unique in that it is a hybrid between the Guatemalan and Mexican races, the only one which we now have in cultivation.

Nurserymen have, sometimes listed Fuerte as a Guatemalan. For several years,

however, the conviction has been growing that it is a hybrid, and now that I have visited the town of Atlixco, in the state of Puebla, Mexico, and seen the parent tree, I am satisfied of its hybrid origin. We thought it might be representative of a race which occurred in southern Mexico, and which was not yet well known to us. I found, however, that practically all of the avocados in Atlixco belong either to the Guatemalan or the Mexican race, there being no other varieties similar to Fuerte in character. We have evidence of its hybrid origin-in several characters of the tree and fruit, and further evidence in the behavior of its seedlings. Some of the latter which are now being tested at Miami are very interesting. Fuerte itself has anise odor in the leaves, indicating Mexican blood. Some of the seedlings have the appearance of true Guatemalans, the foliage being entirely devoid of anise odor, while others seem to favor the other parent by taking on the character and appearance of the Mexican race. I do not believe this question is any longer open to dispute; Fuerte is a hybrid, and should be listed as such, in place of being classed as a Guatemalan.

Fuerte is one of the most vigorous growers we have. Mr. Krome finds at Homestead, however, that it is subject to the avocado scab, and must be sprayed if it is to be kept clean. The feeling among nurserymen in this state seems to be that Fuerte will not be particularly valuable for Dade County and the Fort Myers region, but for sections farther north it is likely to prove the best commercial variety yet discovered. A grove of more than ten acres has recently been planted near Winter Haven. For Polk County I consider Fuerte especially promising.

The fruit is slender pear-shaped, green in color, weighs a pound or slightly less, and has a skin somewhat more thin than is common in the Guatemalan race. The flesh is rich yellow in color, contains more oil than that of nearly any other variety which has been planted commercially in this country, and is of rich, nutty flavor. The seed is small. The ripening season is not yet fully determined for Florida. Trees which have fruited near Miami have ripened their crops all the way from November to April. Some growers think the season is going to be November and December, which is slightly too early for the best markets; others believe it will be December or January to March, which would be ideal. In any event, it will probably be a month later in Polk County than at Miami. Fuerte is hardier than any other commercial variety yet planted; it ranks midway in this respect between the Guatemalan and Mexican races, and for this reason cannot be too strongly recommended for planting in those parts of Florida where there is danger from frost.

Gottfried.—This is a Mexican variety which originated at the Plant Introduction Garden in Miami, from a seed which was sent by a man living on Key Largo. I have never been able to understand how we came to get an avocado of the Mexican race from Key Largo, but we have it, and it looks like a good one Gottfried. is of importance mainly for the northern edge of the avocado belt, as it is hardy, and at the same time produces a fruit of good size, which latter feature is not characteristic of the. Mexican race. The parent tree at Miami withstood a freeze of 22 degrees without turning a leaf.* As Mr. Simonds says, it actually seemed to enjoy the cold. Of course this tree is mature, and a young plant probably would not stand such rough treatment. The fruit ripens at Miami from August to October. It is oblong, about a pound in weight, with a thin, smooth skin and yellow flesh of very oily texture and rich flavor. This variety merits experimental planting in those sections where the Mexican race, is the only one which can safely be

grown.

Grande.—A variety which, like Atlixco, came to Florida from southern Mexico via California. It is showing up well at Miami, Homestead, and Winter Haven. It is a Guatemalan, and apparently as hardy as the average of that race. Mr. Krome considers it promising. It ripens in Dade County during late December and January, and is of good quality.

***The temperature of *23* degrees was registered by a self-recording thermograph in the Plant Introduction Garden at Miami, February 3, 1917. A mercurial thermometer not six inches distant from the thermograph registered only 26.5 degrees. One or the other of these instruments was in error, and it seems more likely that the thermograph should be incorrect than the mercurial thermometer. Both instruments were of standard manufacture and tested by the U. S. Weather Bureau.**

Knight.—A true Guatemalan introduced into California from Guatemala by E. E. Knight. So far as known, it has not yet fruited in Florida, but Mr. Knight states that its quality is good. It makes excellent growth in Florida, and should be included among the varieties to be planted experimentally in different parts of the State. It must be kept in mind by everyone planting Guatemalans that the habit of growth is one of the most important points to be considered in connection with every variety. Some are weak growers, others strong. No matter how good the fruit may be, a weak, straggling grower will not be a satisfactory variety to cultivate commercially.

McDonald.—Formerly called Beardsley. A Guatemalan variety introduced into Florida from Hawaii, where it originated. It has fruited at Miami and seems to be reasonably good. It is a strong grower, and bears round fruits, purple in color and about a pound in weight. The season at Miami is late, perhaps February to April. It is doubtful if this variety will be found among the commercial varieties of ten years hence, but it is worth a more extensive trial than has yet been given it.

Northrup.—A Mexican variety which originated in California. It is interesting to those who live in the northern part of the avocado belt, and who require the hardiest varieties obtainable. Northrup is a small fruit, pyriform, shining deep purple in color, with flesh of rich and nutty flavor. The tree is a strong grower and will probably stand as much frost as any avocado at present known to us. It is scarcely worth while for those who live in regions where the Guatemalans can safely be grown to plant this variety. Its principal virtue is its resistance to cold.

Perfecto.—Another Guatemalan variety which has come to Florida from southern Mexico via California. Mr. Krome tells me this has proved to be about the hardiest of all the Guatemalans he has tested at Homestead, having stood the cold as well as Fuerte. It is a good grower but subject to avocado scab, for which reason it must be sprayed frequently if grown in regions where, the scab is troublesome. Mr. Krome says that the tree bears heavily with him, but he has not found the fruit to be of the best quality. The ripening season at Homestead is October and November, so far as observed up to the present. There is a fine tree of this variety on Mrs. Stevenson's place at Avon Park. I

believe it is worth a more extensive trial than has yet been given it, particularly in the cooler portions of the avocado belt.

Puebla,—Although this variety has been listed in the past as a Guatemalan, it has proved upon examination to be a true Mexican. I picked fruits from the parent tree in Atlixco, Puebla, Mexico, in December, 1918, and was able to satisfy myself that there is no Guatemalan blood in the variety. It differs from the average Mexican only in its slightly later season of ripening. In California Puebla is attracting considerable attention because it ripens at a time when avocados are rather scarce — December and January. In South Florida, where many of the Guatemalans ripen at this time, it is doubtful if Puebla will prove to be of great value. It seems more probable that it will be useful in those sections slightly too cold for the Guatemalans. It is a strong grower, and produces egg-shaped fruits weighing about eight ounces. The seed is rather large. The flesh is of rich flavor and excellent quality.

Queen.—Like the Knight, this is a Guatemalan variety introduced into the United States by E. E. Knight of California. It has not yet fruited in Florida, so far as known to me, but is recommended by Mr. Knight as being of good quality, and its behavior at Miami. Winter Haven and on the lower West Coast indicates that it is going to do well in Florida. It should be included among the varieties recommended for experimental planting in different regions.

Solano.—Mr. Cellon of Miami is propagating this variety extensively and recommending it for commercial planting. It is a Guatemalan which originated in California. As Mr. Cellon points out, it is a vigorous grower, making a strong, shapely tree, and it produces abundantly fruits of good size, form, and appearance. It ripens in early winter and seems likely to be a good commercial fruit. It is not as rich in oil as some other varieties, hence not quite so good in quality, but Mr. Cellon believes that it will prove satisfactory as a commercial fruit.

*Taft.*__This is a Guatemalan variety which originated in California. Its behavior in Florida has been somewhat puzzling; at Miami, where it was first tried, it did not grow well, but at Homestead it has made excellent growth and Mr. Krome's trees are fruiting well The objection to it in California has been that it does not come into fruit at an early age. It does not appear that this objection will hold in Florida. The fruits grown by Mr. Krome have been of large size and excellent quality. The season is midwinter. Mr. Krome considers Taft one of his very best varieties, and if it will behave elsewhere as it has at Homestead, it will be an excellent commercial fruit. I have seen trees doing well at Winter Haven, and in Johnson's grove at Bokeelia. All in all. Taft looks like one of the varieties it will pay to plant commercially in certain sections; but before putting out a large plantation in a section where it has not been tested a few trees should be planted experimentally and watched for several years.

Taylor.—We have as yet very few Guatemalan varieties which have originated in Florida. Taylor is one of the best of them. It was grown at Miami from a seed produced in California. It has fruited in several places and has proved to be a good variety, though it cannot be classed among the best. The tree is a reasonably strong grower, and the fruit somewhat resembles Taft in form and appearance. It is smaller, however, and perhaps not so good. It ripens at Miami from January to March.

Verde.—This is another variety which has come to Florida from southern Mexico via California. It is a Guatemalan, and a fruit which looks quite promising. The tree is a good grower, and the fruit is pear-shaped, about a pound in weight, green in color, with a thick skin and flesh of very rich flavor. It has a relatively small seed, and I consider its quality to be excellent. It ripens at Miami from January to March. I believe it is worth testing pretty generally in Florida.

Wagner.—Though of more recent introduction into Florida, Wagner, like Taft, came, to this state from California, where it originated as a Guatemalan seedling. I know very little about the Wagner myself, but Mr. Krome's confidence in its value makes me feel that it is promising. It is a good grower at Homestead, and produces fruits of nearly round form, weighing 19 to 20 ounces—occasionally up to 24 ounces. The color is green, the skin thick and brittle. The flesh is of good flavor and quality, though I would not rate it excellent. At Homestead the season of ripening is January to March.

Window. — A Guatemalan variety which originated at the Plant Introduction Garden in Miami. The parent tree is fruiting regularly in the Garden, and we have never considered the fruit to be of great value. At Homestead Mr. Krome has some budded trees in bearing, and he concurs in thinking the variety rather inferior. At West Palm Beach, however, it seems to have done much better. Mr. Beach gave me a fruit from his tree which I found to be of very good quality. I am forced, therefore to suspend judgment on the variety, though its behavior at Miami and Homestead would deter me from recommending it for anything but experimental planting on a very limited scale. It is a small fruit, having at Miami a relatively large seed. The season of ripening is late; Mr. Beach tells me his tree does not mature its fruits until April or May.

Mr. Krome: I want to call your attention to this avocado (exhibiting avocado). It looks a good deal like a hand grenade. The avocado (or as most of you know it—the West Indian avocado), at the time it is sufficiently matured to be picked from the tree and allowed to ripen, is about as tender a fruit as we have to deal with. In shipping them we have to handle them almost like eggs; in fact fully as carefully. The Guatemalan is a different specimen entirely.

Question: What variety is it?

Mr. Krome: This is the Winslow. It is not particularly attractive. It is an avocado of fair quality, and the trees are prolific bearers, but it has a considerably larger seed than the average Guatemalan. The seed of the average Guatemalan is very small, in comparison with the. West Indian. This, however, has a quite large seed, and a freeze of 26 to 28 degrees will cause the fruit to drop off, but will not hurt the tree. It will only cause the fruit to drop. Therefore, it is not a specially good variety for commercial use. As Mr. Popenoe says, we undoubtedly will develop varieties that are, in a great many cases, better than the best that we have now, but the. Winslow is not going to be one of our standard varieties I am certain. It is worth while planting them. By using the Winslow, May and June, I have had avocados every month of the year. This (exhibiting fruit) is very near the average size. Quite, a number of the Guatemalans which have been fruited during the last few years, are larger than that. The market now calls for a larger avocado, and some of the. Guatemalans that have been fruited during the last year—the Taft, Perfecto, Smith and one or two others—are avocados that ranged from

one and a half pounds to almost two pounds. The general range of the larger varieties is from eighteen to twenty-six ounces. Those same avocados, strange to say, will run one-third smaller in California. An avocado which has fruited there for a number of years and established a result as having an average weight of about twelve ounces, we can bring into Florida and count on it being about an eighteen-ounce. Some of their Guatemalans out there which proved very shy bearers, were brought into Florida and proved very prolific. If there are any questions about Guatemalans that any of you care to ask, if I can answer them at all, I will be glad to do so.

Question: Can you plant the avocado on any higher land except under irrigation?

Mr. Krome: Yes. We think today that, except what we term in this state as low land, any avocado grove will be considerably benefited by irrigation. At present I don't know of but possibly three or four avocado groves which are actually irrigated. A number of the best producing groves along the lower East Coast have no irrigation whatever except the natural rainfall, and they are planted at elevations where the land is from eight to twelve feet above the standing water.

Mr. Niles: At Lucerne Park we had about fifty trees of the Pollock and Trapp. People coming from Dade County stated that they were as large trees as they ever saw for the age. They were six years old. Some were fifteen feet wide, and nearly that high. They were grown in Polk County, and had practically no irrigation. The trees were mulched with cowpeas or velvet beans that we could grow on the soil, and put around the trees. Up to the freeze of 1917 I doubt if there were any better avocados in Florida than those that were grown on those high Pine Hills. We felt that they would grow on those high pine lands very successfully.

Mr. Krome: I have never seen any land in Florida that was climatically suited for avocados, which I thought was too high, but I have seen plenty that I thought was too low. Even the low land will fool you once in a while. I have seen avocados on several occasions, young trees two or three years old, killed back by water standing above the ground roots for as much as two or three days. So if anyone asks as to planting avocados on land that is subject to overflow, I advise, them to go carefully. I saw avocados that were planted on prairie land of south Dade County, which is overflowed during the rainy season. There was a canal which drained this land and kept it free of water ordinarily. This whole prairie went under water, and those trees went clear out of sight and stayed that way for five or six days. I would not have given five cents for the whole thousand trees. Two or three weeks afterwards I was on that prairie, and those trees had come out of the water, and the owner informed me that they were doing better than before. Question: I wonder if any explorations have been made in Chili. Down south in Chili, where it is cold, I found avocados planted. They are small in variety, about the size of a goose egg, and a long way south of where I found oranges. I found no oranges until I got to Santiago, and I took a few specimens to see if I could plant the seed, but way down south, in the Valley of Chili, I found avocados, and knowing the transportation facilities of that country, I doubt very much if they have been shipped very far north. In all South America I have never seen large fruit groves. They are in scattered bunches. As you go on further north, up into Peru, the avocado gets very much larger. The avocado is a high priced fruit there, as compared with other fruits, although very cheap as compared to what it would be in this country. It seems that they

would have varieties down there that would grow in Georgia and the Carolinas, and it seems that it might be well to investigate that country before, feeling that you have the most hardy varieties.

Mr. Krome: A number of years ago a number of seedling Peruvian avocados and one or two Chilian were brought into this country. They sent me several Peruvian and I think two Chilian. The Peruvian fruited, but I never got any fruit from the Chilian. The Peruvian were distinctly of the West Indian type. The Chilian gave evidence in their foliage, of being also of the West Indian type, but what their fruit would have been we could not determine. I don't know what part of Chili they were from.

Mr._____: I have grown a few experimental avocados at my place in Texas, under irrigation. I got them from California, and we have a sandy soil, well drained, and I can hardly put on too much water for them. I found it absolutely necessary there to mulch the soil. Those that I did not mulch died those that I did have grown well.

Question: For the culture of these would you advise the use of commercial fertilizer, or use something like stable manure?

Mr. Swingle: Use the stable manure as mulch, or some other organic stuff.

Question: One could not depend altogether on commercial fertilizer?

Mr. Swingle: Yes, you could depend altogether upon commercial fertilizer, and probably have a very good avocado growth, but stable manure, as compost on avocados, is hard to beat, but it is also hard to obtain in quantities necessary. We have tried out a good many avocado fertilizers, and the fertilizers compounded of organic materials containing cotton seed meal and blood and bone, have workd very well with avocados. That will not hurt your tree any. You will not get the same amount of value from it that you would on the citrus tree, nor that you would on the avocado from the organic.