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# DISCUSSION

# AVOCADO BREEDING AND SELECTION

**Knight:** They are collecting these exciting and interesting things and bringing them back to Dr. Zentmyer and he screens them for their response to *Phytophthora.* If they don't make the grade there, are they tossed out or are they evaluated for cold response or some other characteristics?

**Bergh:** Most of these things from Central America and adjoining areas are of interest for their root rot possibilities, but they are not really of commercial qualities. That 'Yama 381' looked horrible but some of these things look much worse, so really, in those things that Dr. Schieber and Dr. Zentmyer are bringing in, they simply are not looking for horticultural graces. They are looking for things that grow in swampy land or for all the whole spectrum of botanical possibilities. They are not really of any value, I think, for either of us or for you for commercial review.

Now in terms of the broader question, some of the things are too large for California. We think they might be worthwhile here and I have written to Dr. Krezdorn on this and told him we would be glad to turn them over to him and, of course, then we have no strings attached whatsoever like we have to have on some of the others.

**Gazit:** What are they doing with the material that they are developing for rootstocks?

**Bergh:** A different answer has to be given here. These things, I think, are of no value for commercial, scion cultivar breeding, or practically none, but their possible value as rootstocks is something that we are really not looking into in California. The reason for that is that *Phytophthora* dominates our entire thinking on rootstocks there. So we just aren't that interested and don't have the money and time to put into that. Dr. Gazit's point is that maybe in California we're throwing away things that would be at least sensational in Israel where there is not a *Phytophthora* problem, or in Florida where you can live with it in this strange so-called soil. Someone probably should be looking at it from that point of view.

**Dawes:** With regard to the breeding that Dr. Bergh is doing, he is utilizing very well the gene pool of material that he has in California. Wouldn't it be well to look at the gene pool in other areas of the world and particularly in Central America?

**Bergh:** Theoretically, that seems very valid and I am sure that there are things there that we could still be looking for. However, the experience in California was that when we first went down there (and this was, of course, before my time, before I was born), things that came back were exciting, but over the decades, less and less has been found of interest. The last couple or 3 trips down there that were looking for cultivars really didn't find anything very good for California. We have such a tremendous germ plasm repository there now, growing 400 or 500 cultivars of all shapes, sizes and descriptions, that we now find that it is not our most efficient way to go back to the source any longer. We would hope so, but the last trips have pretty well drawn blanks

and we have almost had to say that we have got a lot better stuff than this without traipsing down there and hauling it in.

**Krezdorn:** Carl, would you or Simon want to respond to that further? I believe that the experiment station at Homestead has gathered together a great deal of material even though you don't have a breeding program, do you not?

**Campbell:** I rather agree with Bob Bergh that the idea that there are vast banks of germplasm resources left in these areas is probably erroneous now that the returns are diminishing. We do have a vast gene pool in Florida.

**Krezdorn:** I think it is one of the outstanding features of the Homestead station that there is, in case anyone were interested in it, a rather superb collection of material from the Central American and South American tropics and from the Caribbean. Many of the growers and nurserymen in Florida have collected many of these things. Lawrence Zill, for example, almost carries on his own breeding program or at least selection program. I think that these are available and I am sure could be obtained.

**Galan:** In your breeding program, when you grow out seedlings, how do you reduce the time between planting the seed and bearing fruit?

**Bergh:** Perhaps the greatest problem of the avocado breeder is the length of time required, in conjunction with the large amount of space required. There are 2 ways that we are going at this problem of shortening the juvenility stage. One is to graft the seedlings onto large plants. This is an idea that we thought about vaguely and I finally was stimulated to try in a visit to Israel 2 years ago when I saw it in operation there. Often you can get fruiting the year after you graft or at least 2 years afterwards.

The other way is to breed for more precocious seedlings. The new 'Pinkerton' variety is astonishingly precocious for us and it will be the basis of this precocity breeding. In California we say that the earliest cultivars will come into production in maybe 3 years with a few fruits and more in the fourth and fifth years. Seedlings come in maybe the fifth or sixth year and more in the eighth and ninth year. After 10 years we drop it. Seedlings of 'Pinkerton' have the remarkable ability to start bearing the second year from planting as seedlings. The little seedling is seemingly barely up, as we don't get as much growth in 2 years in California as in Florida or the more tropical areas, and can have maybe 20 or 30 fruits on it. This is just turning up now. The first fruiting is this year because we didn't know about the 'Pinkerton' until 2 years ago.

**Krome:** In regard to the germplasm pool, I know that the highlands of Central America and Mexico have been pretty thoroughly exploited, but I take issue with you on the matter of the American lowland tropics. I don't think that they have been as thoroughly searched for the West Indian types as the highlands have for the Mexican and Guatemalan types and unless Carl or Simon or Dr. Schieber could correct me on that, I wouldn't like to have the impression left that there isn't anything for us in the lowland American tropics.

**Schieber:** That's a good question, but I think that Florida, with Dr. McMillan, has started to collect these West Indian types, so that's why we are concentrating in a different geographical area.

**Campbell:** Let me just add that Bob McMillan is going to be talking about this. He is

cooperating in this project with Dr. Zentmyer and exploring particularly from the point of view of *Phytophthora* resistance but also from the point of view of finding new germplasm. I think you are right, Bill, that we certainly haven't exhausted everything, but at the moment, we're not engaged on a large scale exploration, with the exception of what Bob McMillan is doing on a systematic basis.

**Krezdorn:** If what everyone has been saying about breeding is true, there must be a continuing natural breeding program throughout the American tropics because they plant lots of seedlings down there, so if selfing is good, we might look at some of the selfs and natural hybrids they have there.

**Balerdi**: From your experience, Dr. Bergh, which crosses have the most possibility either in selfing or in hybridizing?

**Bergh:** You can throw out 'Fuerte'. I will never use 'Fuerte' again and I wouldn't advise anyone else anywhere to use 'Fuerte' in a breeding program. 'Hass' certainly is outstanding. We have other less well-known cultivars such as 'Irving' and 'Stuart' that throw an exceptionally high proportion of seedlings. However, now that we have carried our selfing to the second and third generation, we would never go back to the original cultivar. We have much better breeding lines now with fewer bad genes in them. Especially some third and fourth generation 'Hass' (some second generation ones, too) look very good and are having more and more high quality seedlings, proportionately. 'Nabal' turns out to be a very good breeding parent.

'Pinkerton' is the strangest thing. This is one that is exceptionally promising as a new cultivar. I would rate it easily the best looking of the cultivars. Bob Platt will be on later in this program and he may well argue with me but the Pinkerton, I think, is the best looking commercially. In terms of precociousness, in terms of fruitfulness and the one single most important thing—fruit quality—it's outstanding. The remarkable thing is to me that the 'Pinkerton', which has such a tiny seed in itself, even smaller than 'Hass' (I haven't seen any figures on it but undoubtedly it averages smaller than 'Hass') has only large-seed progeny.

So you just can't predict from the parent itself what's going to happen. These precocious things and these straggly, spindly, little 2-year-old seedling have monstrous seeds. So it turns out that you can take a parent with a small seed and get only big seeds out of it (90% big seeds) or you can take parents that have medium-sized seeds and get mostly small ones from it. This is one of those strange genetic interactions that confuse and perturb plant breeders. You really can't tell by looking at them, but there are certain parents that do look very good. 'Bacon' is a pretty good parent for hardiness. 'Zutano' is not a good parent, but just to confuse things, 'Santa Ana' comes out of 'Zutano' and looks very good. The best thing, I think, is to try a couple hundred of a parent that you are interested in, from which you can get a pretty good idea if it is worthless or if it is superior.

**Knight:** In the work you have done in Gainesville, which of the things you tried from elsewhere looked most outstanding?

**Krezdorn:** What we have done at Gainesville is to get everything that we could and simply test it there in addition to just growing out a lot of seedlings from things like

'Bacon'. These are just now coming into fruit, so we don't have much there. We have collected from all over the state, from backyards and dooryards, things that have hardiness and it's surprising what you find and some of the romantic stories that have developed. Somebody brought an avocado back in his pocket from Mexico City or a hide buyer that went down into Mexico came back with a few seeds. It seems that everybody brings back a few seeds from abroad and plants them. It has been rather amazing the number of cold-hardy things that we have been able to pick up through northern Florida.

The real difficulty with all of those things is that in our hot, humid climate, the fruit tends to crack. Another thing that seems rather significant up there is a characteristic that relates to flowering. They start flowering in December and January and they will get frozen again and again, maybe 3 or 4 times, wiping out all of the blossoms. Some varieties or seedlings have the characteristic of putting on another flush and another flush until finally the last group of flowers sets. 'Topa-Topa', for example, is very cold-hardy and it apparently never freezes up there. If we have a warm winter, it sets so many fruit that it actually dies back a little bit—just from the overload of fruit.

The thing that seems to me of the greatest value, having tried the material that's come from Bob Bergh *via* various and circuitous routes has been to get some of the Guatemalan material into it to give it a thick-enough peel so that it doesn't crack. Fortunately, the material that has come from California has apparently had some of that in it and they don't crack. They have been very well adapted. 'Yama 381' looks beautiful up there. It doesn't look at all like it does down here. Look at some of the same material down here and up there and they don't look exactly alike.

So that's about where we are, but certainly some of the material that has come out of California has taken consistently in the area of -6 to -4°C without any appreciable damage while 'Bacon', which produces beautifully there when we have a mild winter, catches it at about -4°C. It's just a little less tender than 'Brogdon', which is about the best thing we have.

**Platt:** Can you relate that to the stage of growth or the vigor of the tree at the time of the cold spell?

**Krezdorn:** No, they are always flowering and often have out some little, tender shoots. The little, tender shoots will be frozen but the remainder of the tree seems to be quite hardy. The material that we have is grafted on West Indian rootstock by Lawrence Zill and I plant the rootstock about 15 cm below the ground, which doesn't seem to harm it, and they go right on through cold weather. I have compared them with material on Mexican rootstock and even as rooted cuttings and there doesn't seem to be any difference in the cold-hardiness of the top like there does in citrus. I am sure that if they were in a tremendous flush of growth, it would be different but it seems that the terminals become tender while the remainder of the tree stays relatively cold-hardy. We had -10°C for a protracted period of time in the 1962-63 freeze when Satsumas were frozen to the ground and killed. The avocados were growing right in the same area as the Satsumas. 'Mexicola', 'Gainesville' and 'Topa-Topa' were killed into 5-cm wood. That's about all that it got to them, so there is very appreciable cold-hardiness in them.

**Krezdorn:** It is true that you don't want to go any larger than a 400-g variety or

something like this in California and we'd really like to have things not any smaller than that in some ways. I wonder if we can get any discussion as to the market acceptability and the wiseness of a large variety *vs.* a small one.

**Kendall:** I disagree with your statement that we don't want anything smaller than 400 g here. I think we should consult the people who have to sell avocados. We have long been selling 450-g fruit for the same price on the market as California sells 225-g fruit, and this gets a little tiresome.

**Krezdorn:** What you are saying is that you would really rather have a smaller avocado than the ones that have been selected and are grown in Florida. We have brought up a good argument here, so are there any more comments on it?

**Krome:** This has to do with what I said about the gene pool of the lowland tropics not being exploited. Most of our commercial varieties here in Dade County - the West Indians - were originally selected for big size when the big fruit was desirable, so we've gotten that kind of genes pretty well into most of our West Indian varieties. Selection was always for size and against the small ones. If there has been any attempt to get genes for small West Indians here, it hasn't come to my attention. People who have to make these selections ought to talk more with the people who have to sell the fruit.

**Krezdorn**: Bob, how have you felt about it in making your selections?

**Knight:** I have felt that it would be nice to get something that looked like an avocado and tasted like an avocado and stood up to as much cold as it could. This is perhaps a somewhat superficial way of expressing it. I have looked at $F_1$'s up until now. We know that a 75- or 80 g seed parent crossed with these larger ones are quite likely to produce some smaller ones in the $F_2$, so I haven't tended to throw out the big ones at this point. I am willing to listen to what the people who sell them say, of course.

**Krezdorn:** I am glad that this is coming out because many growers that I talk to proudly show me 'Choquette' or proudly show me 'Pollock' and that's what they grow. I can only assume that they grow them because they want them.

**Krome:** The growers don't sell them. The growers grow them. If you heard Dr. Bergh's talk, he stressed marketability, palatability and appearance and he said it had to have a good appearance in order to sell. I believe you had a director of your experiment station about 40 years ago, named Rolf. One of the varieties they named at the Homestead station was 'Rolf and it produced a whole lot of fruit, big fruit. When it got to the market place, it wouldn't stand below 10°C so they all got black and we have been cutting them down for the last 30-40 years. Same way with the 'Ruehle'. We've got a lot of it around here and it bears well but it breaks color and yellows when it gets in the market place. I think you people that are doing this experimental work should talk to the people who are going to market them.

**Krezdorn:** You have a very excellent point and if nothing else comes out of this other than that, I think we have made some progress. In my own particular work, ours are so poor that, at Gainesville, we are in the position that if you can't get a horse, get a burro. Carlos, what would you say about the local market regarding fruit size?

**Balerdi:** The local market will accept the large fruit in preference to the small fruit. In fact, the Cuban people here will not accept the small fruit. However, other people in

New York, Chicago, Texas and some other areas do buy the small fruit. I think we can produce the small fruit here. It is just a question of putting more emphasis on it and not throwing away the small fruits.

**Krezdorn:** I might ask Dr. Malo what you have in that vast collection at Homestead that would be smaller than what we grow. I don't know of any of the commercial varieties that we grow that are really very small or of the size that we are speaking of here. The whole retinue of things that we have are fairly large. Has Simon gone? What about it. Carl? You're familiar with the whole collection there. What do you have that might fit more the category of that nice, pear-shaped 400-g and smaller size?

**Campbell:** I have to beg off, as Simon has been the keeper of this collection.

**Krezdorn:** Bill, do you know of anything around?

**Krome:** I really don't.

**Knight:** What about 'Nadir', your own proud introduction? That's closest to it.

**Krome:** If you pick 'Nadir' when I originally intended to pick it, which was in June, it's pretty small, but it wasn't ripe then. It may be inherent in the West Indians that you don't get small ones, but I think that we are a long way from being able to say that for sure. I think we ought to make a lot better search than as far as I know has ever been made.

**Dawes:** One other point is that in view of Dr. Williams' comments about the relationship between the West Indian and Mexican races, there must surely be other genetic material there that could be useful for West Indians.

**Cobos:** The local markets in Guatemala prefer the large avocado because of tradition whereby the entire family will share one avocado. However, when they consider export markets such as Europe, it is very difficult to sell the larger avocado. So the small avocado is more useful to us due to higher prices in the export market than in the domestic market.

Further, what is the situation regarding 'Fuerte'? Is it a pollinizer or a producer and does it maybe require a pollinizer? I have seen many blocks where people have removed it due to poor production.

**Platt:** The experience in California is that part of the reason we are going more to the 'Hass' variety is because 'Fuerte' has been a poor and inconsistent producer. Dr. Bergh will talk about pollination and its effect. In some cases in California, a pollinizer from another variety will increase 'Fuerte' production as long as these trees are adjacent to one another. The effect drops off very rapidly with distance. Overall the reason for going to 'Hass' rather than 'Fuerte' and the removal of 'Fuerte' orchards in California and their replacement by top-working to 'Hass' is because of poor production of 'Fuerte'.

**Kendall:** Is the transfer to or the planting of 'Hass' replacing 'Fuerte' in season?

**Platt:** This is a problem. 'Hass' is not replacing the production of 'Fuerte' during the season that 'Fuerte' produces, which is the winter and spring. Dr. Bergh and others are trying to find a replacement variety which will produce during the former 'Fuerte' season.

'Pinkerton' is one which may take up part of it, but we still are looking further.

**Kendall:** That's what I had in mind when I asked you about 400-g fruit. They're cutting down 'Fuerte' and our natural season is in the fall. It seems that we here in Florida are overlooking the fact that there is a time in the fall and winter months when California is not going to have a variety on the market if they are going to cut all their 'Fuerte' down. We need the genes for small fruit. Unfortunately, we've had this story on big is better.

As a result, we have sold to the trade that would buy big fruit, but we have left part of the business to California with the small fruit. I maintain that we can grow good small fruit in Florida if we get the genes. This would give us an added margin which we don't have now because we're getting pretty heavily dependent upon big fruit which goes primarily to what we call the Latin trade. We have several million people here in the United States that came from Puerto Rico, Cuba and Latin American countries. It's a good trade; they like avocados and so the bigger the better. But we're overlooking here in Florida the small market that California, by cutting down their 'Fuerte', is leaving open to everybody. It's up for grabs, and I think if we had the expertise of Dr. Bergh, we could raise some good small ones here.

**Galan:** Isn't 'Bacon' in the same season as 'Fuerte'?

**Platt:** To a point, yes. However, 'Bacon' is not the quality of 'Fuerte'. It has much shorter tree life and doesn't store well on the tree. One other point I might make, Al, as I didn't want Mr. Kendall to get too optimistic, is that one other factor I think should be recognized about California is that we are growing avocados of the same variety over a wide range of climatic zones. 'Hass' is a good example in that it starts in our warmest locations in February, perhaps March, and ends in our cooler locations in October, November and one little spot in December. So, I think the climatic factor is important in the maturity base of the variety.

**Cobos:** At this time of the year, many trees in Guatemala have a lot of bloom, a very good bloom, but apparently there is a red mite or something that is shedding the bloom and I wonder about what kind of a problem it would be.

**Guerrero:** I wonder if there is, at bloom, enough flies or bees to carry on pollination. In Ecuador, I remember there was some problem with some insects during bloom and what happened was that they applied a chemical control and destroyed the pollination insects. Because of these factors, there was no production in the area. The next year, the insects came back and there was a good fruit set.

**Krezdorn:** I think you can take a page out of the general information on pollination that ties in with what they have mentioned about 'Fuerte'. If you are using honey bees as pollinators, they are very systematic. Bees go out and work a tree and they will go back and forth no more than 2 rows away from the pollinizer row. So all planting plans generally have 4 rows of a variety that you want and a row of pollinizers. In other words, about 20% of the trees have to be pollinizers and that apparently is what is happening if you are using honey bees in avocados. You can't just surround the orchard with a pollinizer and expect to get good pollination, cross-pollination, into the center of the orchard. On the other hand, if you have flies or some other insects, they don't pay any attention to this and that is one of the

reasons why flies are so good.

**Galan:** In California, have you noticed whether there is any influence of rootstocks on the bearing habit of 'Fuerte'?

**Platt:** There have been 'Fuerte' trees in California that have been outstanding in production. We have made attempts to reproduce those trees vegetatively, both the scion and the rootstock, and plant them out in another area. In practically all cases, they revert back to the typical 'Fuerte' pattern and they are inconsistent in production.

**Bergh:** Monday, I am going to go into this in more detail, but in Israel some of the most exciting research on 'Fuerte' bearing or general avocado bearing is being published by Dr. Ben-Ya'acov. He is finding that there are a number of rootstocks that have tremendous effect on 'Fuerte' bearing, like the ratio of 2:1 or 3:1 or even 4:1 in some cases. What makes it more complicated is the presence of interaction so that the best scion may not be best on the best rootstock. Generally speaking, you have to have specific scions for specific rootstocks to get the best bearing.

**Knight:** I have a question for the people who sell the avocados. We got the very interesting point that 'Hass' is replacing 'Fuerte' in California and 'Hass' is, in my opinion, one of the most delicious avocados in the world when it's been properly grown in California. However, 'Hass' is black. Now is that important? It isn't to me, but is it to people who are selling them?

**Kendall:** All I know is that we are looking for less than 400-g size avocados and we are looking for green ones. I do know that the Israeli people would prefer to have a green one in some markets than in others.

**Cobos:** Bees have been good for cross-pollination and I wonder about the spray program because sometimes the bees are kind of erratic. They can move to other places outside the orchard. Are they good pollinators or not?

**Guerrero:** If you are going to spray an orchard, the hives should be moved to another location. You should also use organic phosphate pesticides which are short-lived chemicals.

**Kendall:** As a commercial grower, I'd try not to spray when they are in bloom because I figure that I'm going to kill bees and any other pollinator.

**Krezdorn:** This morning I went out into South Miami where a fellow had written me that he had a seedless 'Temple' orange, which he definitely does. Many of our best varieties in many fruit crops have arisen by mutations. How common are natural mutations in avocados and does that pose a possibility of variety improvement?

**Bergh:** Yes, 'Fuerte' especially seems to be prone to sporting and I think that's why most of the Israeli results have been with 'Fuerte'. It tends to sport for all kinds of things—fruit shape, skin surface and certainly bearing as Dr. Ben-Ya'acov has picked up all over the country there. So I think that the most promising thing in terms of avocado breeding and bud sporting is for better set. And here's where the erratic bearing of the avocado, especially in California, is such a problem. It's hard to pick them up and by the very nature of things, people selecting budwood tend to

find the better buds on that part of the branch that is not mutant or that is mutant for less set and there is a built-in bias against selecting for the higher-fruiting mutations. I think that this is where most of the promise lies in terms of sports because I think they are so common here and important.

If I could say one thing more about fruit size, the best commercial fruit size. The Floridians seem to be having all the fun on this tonight so I would just like to point out that in California, too, there are interesting discussions. Three weeks ago tomorrow, a fellow came to my home to talk to me on a Saturday. He was a total stranger. He stayed for 6 hours. One of the things he wanted to tell me was how foolish we were in California to be selling such small fruit. Now he is an avocado salesman, going right back to Mr. Kendall's point, but in his particular market he had educated his buyers to prefer a big fruit. The size people prefer depends so much on what they're used to and therefore what they're used to paying for it and he said that if only we had more big fruits he could sell 10 times as many as he is selling now. In his particular market, which is part of San Diego, he had taught the market buyers there to demand Florida-sized fruits. We ought to get together on this. You can sell to our former 'Fuerte' markets and then we can bring in your fruit to sell to our San Diego market and everybody will be happy.

**Campbell:** Just a brief comment in regard to what Dr. Bergh was saying, Mr. Krome asked me while we were listening to him how many times I had seen mutations in West Indian avocados and I told him I had seen none. He said then that he had seen one that he recognized readily. So, I think quite possibly in the West Indian material that we have, the rate of mutation may be much lower than the 'Fuerte' that you are talking about.

**Krezdorn:** Of course, a mutation such as a fruiting mutation is not obvious to the eye. You would have to check that rather closely. Would someone comment on whether there are any areas with small-fruited West Indian avocados in South America that you know of?

**Mendoza:** In Venezuela, we are making selections from *criollos* (native types), both round ones and bottleneck types. There are very good varieties that have small seeds and sufficient flesh. They are much better than types like 'Pollock* in regard to flavor. People grow 'Pollock', but they say its flavor is no good compared to the native types and they don't like it. I agree that the native types have better flavor and taste.

There is one area in Miranda state near the coast about 400 m above sea level which has some good avocados. Various selections have been made there, one of which is 'Araira', and there is an 'Araira 1', 'Araira 2', 'Araira 3'. Improvement of this group of avocados is being tried, but it is slow.

We also have small round ones, but they are not such good quality and the public prefers the long ones to these. Consequently, selection has been towards longer, larger avocados with small seeds.

**Guerrero:** In Ecuador, we have a *criollo* which is small. It's an avocado with a diameter of about 5-8 cm. We have very good varieties, which are usually black, and they have very good acceptance in the market because the quality and the flavor are excellent.

Unfortunately, there is not much work done as far as selection of local varieties. The 'Fuerte' variety is the one that is really widespread over the country. However, the problem that the representative of Guatemala has mentioned, we also have. We have orchards that produce and orchards that don't. In one orchard, you could have trees that are heavy bearers and other trees that don't bear very much fruit. The idea of commercialization is now directed to the quality rather than to the appearance of the avocado. We have very large avocados from the lowlands, but they don't have market acceptability because they are kind of sweet, they have veins and they have fibers in the flesh. But 'Fuerte', 'Hass' and some 'Nabal' are being grown in the subtropical areas.

**Guillen:** We have quite a lot of seedling avocados in Nicaragua and we are engaged in making selections from them, particularly in our experiment station in the Atlantic Zone along the east coast, with some selection occurring along the Pacific Coast.

**Mendoza:** I have some comments concerning the shy bearing of the 'Fuerte', which has been mentioned as occurring in California, Guatemala, Ecuador and other places. It seems that the problem has been attributed to pollinizing insects, or dichogamy or different strains of the variety, but I haven't heard any mention of climate, particularly the microclimate in the orchard.

I think microclimate is very important. I have seen isolated trees in Venezuela with very good production year after year. This obviously is not due to pollinizing insects, as there are no bees around. Some of these trees are 30 m tall. Could it be wind or do these trees self- pollinate?

In the *criollos* there, we have no problems with pollination and fruit set. The problems exist with imported varieties.

**Galan:** In the Canary Islands, we have a collection of avocado varieties in which 4-tree rows are planted along a large wall such that 1 end of the rows is close to the wall and the other is quite exposed. I have observed a gradient in production toward the more open areas, which suggests that light may play an important role. This observation holds true for 'Hass', 'Bacon' and 'Fuerte', which are in the collection.

**Martinez:** Microclimate plays a very important role. I am from Mexico, where I have observed that orchards with closer spacing have less productivity than more open spacing between rows.

**Perez:** I will speak about what we have done about varieties in Puerto Rico. There were 2 doctors and 1 sugar cane grower who had a hobby of collecting avocados from all over the world. One of the doctors started planting avocados on his farm, the Semil farm, particularly seeds from good, bearing, native trees. Word came to the experiment station that there were some growers producing avocados all year long, so we sent horticulturists from the experiment station to these farms. They collected 37 different types of avocados from the Semil farm, about 40 different selections on the Gripiña farm and a few from the Melendez farm.

At the experiment station, we ended up testing almost 2,000 different types, which also included 'Hass', 'Nabal', 'Fuerte' and different strains of 'Fuerte'. We obtained some very good native varieties from those farms. We tested 'Gripiña 5' for production and quality and it was better than 'Nabal' and all the other varieties that we have been

talking about. It is a very good variety in Puerto Rico and we have been distributing it to interested people. 'Gripiña 5' and 'Semil 34' are about the same size and they are a little larger than 'Fuerte'. 'Gripiña 5' is of very good keeping and storage quality. We shipped it from Puerto Rico to the New York market and it had an excellent acceptance. Concerning pollination, the other day a woman came to me with the problem that she had a avocado tree that produced fruit continuously, systematically every year, until last year. She wanted to know why this tree was not bearing. So I asked her if there had been some change during the time since the avocado tree stopped bearing, but she had been doing the same practices all of the time. I asked her if someone moved into the neighborhood and did something different in the yard. It seemed that a neighbor about a block from her cut down his trees, which included avocado trees. I explained about dichogamy in avocados and we agreed that her neighbor cut down the pollinizer, so her tree stopped bearing.