

serious problems in the growing of Papaya have been rather well solved. In plantation form at least, the Papaya fruit fly is no longer a serious menace. The Papaya White Fly and the Web Worm can be controlled, even the degrading of fruit by Anthracnose diseases is controllable, but we now have in Florida the problem of virus diseases of Papaya and this one will be a real test for the ingenuity and ability of horticulturists and technicians alike. These virus diseases invaded Dade County in the ten year period between 1935 and 1945. There seem to be four distinct types of them and in combating virus diseases we so far do not have too much to go on.

The first item with the regard to virus diseases to have thoroughly understood is that there is nothing to do with a diseased plant but chop it out, dig up the stump, and either burn or bury the whole business as soon as the first symptom appears. There is no cure and in the sense of spraying for virus disease as such, there is no preventative.

The matter of the transmission of virus diseases is still somewhat cloudy. There is a very general supposition on the part of plant pathologists and entomologists that these virus diseases are carried and must be carried by insects from a living plant having the disease to another living plant. The catch is, that the specific insects have not been identified and of course, without knowing the specific insect it is a little difficult to set up an adequate spray program. Theoretically, if you could ward off the visits of the particular type of insect you could prevent the disease.

Of the few items of proven knowledge of these virus diseases the number one item is, no virus has yet shown up on Papaya that is transmitted by seed. The number two thing of importance is, the isolation of a Papaya planting from other plants is of primary importance in protecting that plantation from infection. Generally speaking, if there are no Papaya being grown within 4 or 5 miles of a selected site for Papaya plantation then it is reasonably safe.

This matter of the need for complete isolation from other Papaya plantings from wild Papaya in the woods and from scattered back yard gardener plants in towns would seem to point to the fact that the most advantageous place to grow Papaya will be from here out in areas where occasional frosts and freezes prevent the growing of the wild Papaya in the woods and discourage the back yard Papaya growers.

The would be Papaya grower should supply himself with seed of satisfactory character, produced by a breeder who knows what he is doing. He should then produce his own plants on his own place from that seed and set his planting at least four miles from any other Papaya and 5 would probably be better. Papaya prices are good and for fruit of good quality are apt to remain good. The rewards to the successful Papaya grower have been and will continue to be large, but Papaya growing is a difficult and highly technical enterprise, but for that matter, what venture in horticulture isn't in the same condition today.

## ESMERALDA PINEAPPLES — CULTURE AND NEW PROPAGATION METHODS FROM JAMAICA

SCOTT U. STAMBAUGH

Miami

Last year, I read before the Krome Memorial Institute, a paper on new practices in the growing of pineapples in Florida. That paper dealt largely with new practices in the fertilization of pineapples and the marketing of pineapples in the northern markets in a ripe condition. This year I wish to go a little further and discuss the accomplishments of

this particular season past in the production of pineapple planting stock by an entirely new practice.

All of these items in the culture and marketing of pineapples are important because they contribute to the economics of the enterprise. Florida, at one time, had a 9000 acre pineapple enterprise, and marketed pineapples up into the millions of crates. That enterprise disappeared about 1916. Many reasons were given for its disappearance. Strict fact is,

however, that that old pineapple industry disappeared because it was no longer profitable to the farmers of Florida.

Up to this point it has now been proven on a field basis in commercial plantings of pineapples that we can grow pineapples with ordinary fertilizer ingredients applied direct to the soil. We can pay ordinary fertilizer prices for the materials, we can grow pineapples, harvest them ripe, and ship them to the northern market. The buying public will pay prices for those ripe pineapples such as pineapple growers never have dreamed of in the past. So far, so good. There, however, has always been, and still remains one hazard in the pineapple industry in Florida.

The one great problem in the growing of pineapples for the beginner is, and always has been, the high cost of planting stock, to be able to get any sort of a start in the pineapple business.

In the old days, that is previous to 1916, when there were 9000 acres of pineapples on the east coast of Florida, the pineapple industry was based on the Red Spanish Pineapple. All costs, of course, were much lower. Wages were \$1.50 a day, fertilizer was \$28 a ton, pineapple slips could be bought at the roadside for \$6 a thousand. This still meant, in terms of the economic condition of that day, quite an outlay for an acre of pineapple slips, as pineapples have always been set out at the rate of 10,000 or more plants to the acre.

During the past twelve to fifteen years, there has been an effort to bring the pineapple industry back to Florida with new and better varieties of pineapples. That effort has been seriously handicapped from the start by the excessive cost of pineapple planting stock. The new varieties that have been used, at least in small commercial plantings, are: The English Pineapple, locally called the Eluthera, the Smooth Cayane, The Esmarelda of Mexico, and the Abbacca, and to some extent the Natal has been used. These varieties have existed in Florida for a considerable time. They are closely held by planters who usually didn't have more planting stock than they wanted to use. When they sold pineapple planting stock of these varieties at all, they wanted something like a \$100 a thousand for them.

This condition, up-to-now, has imposed an initial expense for planting stock for an acre

of pineapples of \$1000. For the grower who wanted to start in pineapples it has been a crippling handicap. The accomplishments of this past season in the production of planting stock of pineapples by an entirely new process would seem to have overcome this handicap and opened up the possibility for the production of pineapples in Florida on an even greater scale than in the days of the Red Spanish Pineapple with low wages and low costs all down the line.

There is a great deal of land in Florida that probably could grow pineapples on a commercial basis, but only a small fraction of that land has ever been tried for pineapples. Primarily because of the high cost of pineapple planting stock of any value.

In my practice as Consultant in Tropical Agriculture, I travel a great deal south of here. On one of these trips, I picked up in Jamaica a new practice in the propagating of pineapple plants that promises a production of very large quantities of pineapple planting stock on an economical basis and should put pineapple growing within the reach of any farmer who wants to grow pineapples, and has a small amount of capital and plenty of time. By the same token, it should put the growing of pineapples within the reach of any back yard grower who wants to grow a few pineapples in the door yard for the use of his family.

The chronology of this new practice in the production of pineapple planting stock is as important as are the basic facts of the routine. First in terms of a single pineapple plant so that this may be understood easily—A man can set out a single plant, care for it for something like 18 months, produce a pineapple, and after the pineapple has been produced then he can take up the old pineapple plant, strip off the leaves, and cut the old pineapple trunk in sections, one-inch-thick. These one-inch-sections of the old pineapple root can then be planted in a box with a mixture of planer mill chips and peat moss. Each of these one-inch thick chunks of pineapple root will then make from three to ten pineapple plants in the following six or seven months.

This makes it possible to set out a pineapple plant, or a group of pineapple plants, that have been purchased, and in the course of 18 months grow a pineapple on each one of them. Then dig up the plant, strip the leaves off of

the trunk, cut the trunk in sections, pack them in boxes in peat moss and planer mill chips, and for each plant originally purchased in six or seven months following the production of a pineapple, you can make from 80 to 100 pineapple plants for each single original plant purchased.

Now, from the standpoint of the man who wants to get into the growing of pineapples commercially and has limited capital but plenty of time. He can purchase 100 pineapple plants at a cost of \$10 to \$15, set them out, and in 18 months, he can harvest pineapples from them. He can then dig up the plants, strip the trunks of leaves, slice them into sections, plant them in boxes, and in six or seven months more, he will have 8000 to 10,000 pineapple plants in the field. That man is then in the pineapple business. Still in a modest way, to be sure, but he hasn't a great deal of money involved in the planting stock and he has only been at it 25 months.

The cost in the nursery has so far not been too well worked out. It will probably be on the near side of \$20 a thousand for the production of plants ready to go into the field. Most of that cost is represented by labor and, of course, for a man who is trying to get into the pineapple business on his own farm, in a small way, the labor he can do himself. So that the out-of-pocket cash involved still remains a small item.

This is probably a good place to discuss the names commonly used for different types of planting stock. First, comes the crown, a tuft of leaves that grows on the top of the pineapple fruit, itself. This is the least desirable of all types of planting stock. The reason being, that it is much too short in the shank and cannot be set deep enough in the soil to make a good and rapid growth. Then most varieties of pineapples produce plant buds on the fruiting stem that result in small plants called pineapple slips. From three to ten of these pineapple slips are usually produced on the fruiting stem, in those varieties that produce them. They are to a very large extent, the type of planting stock on which the pineapple industry, in the past and the present, has been and still is dependent. Then come the plant buds that show up on the trunk of the pineapple plant itself during the time that the pineapple is being produced and im-

mediately after. These are called Rattons, and are produced in terms of from two to as high as six. The average is probably as low as four.

There are a number of rather specific implications to this business of growing pineapple Rattons from plugs cut out of the old root. The first item, and the one of primary importance, is that instead of getting from three to seven natural rattons from each plant after it has ripened pineapple, by this practice it is possible to get from 60 to 100 rattons. This presents an entirely different picture in the matter of pineapple planting stock.

Then there is the matter of the selection of planting stock. In the past, it has been almost necessary to use anything that was a pineapple plant, even pineapple tops to get started. As a matter of fact, I used pineapple tops to get my start. It was all I could get. As a result of that, it took nearly two years to get my first pineapple. And a little more than three years to harvest all of my first crop.

Pineapple plants produced by this new method, then, can set out in the field under seed bed conditions in nurseries 6 inches each way. They are left in nurseries until they grow to the size wanted for planting directly into the field, usually about 18 inches high and  $1\frac{1}{4}$  to  $1\frac{1}{2}$  inches in diameter and butt. Then, when the time comes to put such plants into the field, because they have been produced in large quantity and economically, it is possible to go through and select out any of those that have not grown well and cull them. Throwing out a few culls in such quantity production will not materially affect the growth of the enterprise.

There are a number of indirect advantages in the setting of such plants in the field for the production of pineapples. They are of uniform size and degree of development and if set in a field that has been prepared in uniform manner can be expected to go ahead and within a specific number of months produce pineapples of more or less regular size and degree of development and marketable quality.

There is another item in the use of this sort of pineapple planting material. A large quantity of plants can be grown in the nursery and once grown to size suitable for planting in the field, the nursery becomes a storage place of planting stock. Plants can be held

for a considerable time in the nursery, as they set so close and compete with each other so intensely that there will be little or no tendency for them to form a bloom or fruit in the nursery. This leaves the grower in the position when he has a considerable number of plants grown to size and storage in the nursery to say just how many plants he will set out in the field for fruit in each specific week or month and at what time of the year he will set those plants out. For that reason, he will be more or less in a position to control not only the time of the year that the pineapples are harvested but the number of pineapples that will be harvested in any given portion of the year. This will put the grower in a much better position to have pineapples come off at the time of the year when the market is best. There is also a possibility of separating the harvest in different fields or even separating the harvest in different parts of the same field.

There is a good presumption that has not yet been proven, that the use of this type of improved planting stock of pineapples will solve the old problem of fighting weeds and grass in the pineapple planting. In the past, it has been the desire of the grower to set out a pineapple planting, and keep that planting in production for from three to as much as ten years. The difficulty has always been the cost of controlling weeds and grass among the pineapple plants with the hoe. Under modern wage conditions, this business of controlling weeds and grass has become an almost insurmountable obstacle. With this new type of planting stock, a different practice can be followed and it may be possible to detour the difficulty with weeds and grass.

With this new type of planting stock, there is a definite possibility that pineapple plantings will only be on the ground for one year or one year and a small fraction. It is now possible to prepare a field, eradicate the weeds, bring the field up to an excellent condition of tilth by a preliminary fertilization and soil treatment before the plants are set out. Good, big plants from the nursery can be set in field formation for fruit and will have an excellent chance to come along and make their pineapples in a year, or possibly something less, from the time they are set out. Then, once the plants have produced fruit,

they are not going to be left in place, as has been the practice of the past, they are going to be dug up and cut in sections to produce more planting stock, so that the pineapple planting of the future may turn out to be a more or less annual enterprise. That is, a piece of land will be prepared, set out to the plants for fruit, a crop grown, crop harvested, with the plants dug up immediately for the use of the propagation of new plants, the land will only be in pineapple for one year to a year and a fraction and weeds and grass will not have time to become a serious problem.

There is another distinct advantage to the use of this kind of pineapple planting material. There has always been in the past the problem of how, and when, the pineapples were going to bloom. A number of factors have contributed to this. Because of the problem of fighting weeds and grass, the tendency was to plant a great many plants to the acre, from 10,000 up to as high as 18,000 have been used. This resulted in too much competition between the plants and a great many plants in the field did not bear fruit in each season and some of them did not bear fruit at all. The efforts to overcome this have been along the line of dosing the plants with Calcium Carbide, Indole Buteric Acid, and other stimulating substances to make them bloom. These practices have only been moderately successful. Some of them worked very well in the matter of making pineapple plants bloom in out-of-season times. It is also true that they made pineapples bloom to some extent against their will. And the result of this has been a crop of pineapples, but a crop of pineapples that was mostly too small to be satisfactory for the market.

With this new type of planting stock, we can go back to the idea of letting pineapple plants attain a certain size and degree of development and they will bloom naturally. The Esmeralda Pineapple plant particularly has, in the past three years here, shown a definite tendency to bloom and produce fruit regardless of the season of the year, if and when that plant reaches a certain degree of size and accumulation of plant foods stored in the trunk of the plant itself.

That, of course, is the natural process and with this new type of planting material, we are probably going to be able to be in much

better shape, particularly with the Esmeralda Pineapple, to have whole crops produce pineapples on this basis of blooming naturally when they reached a size and maturity and degree of development that would enable them to bloom and bloom naturally and make a nice large pineapple. This will cut down the number of barren plants to the acre. However, this probably should be attained by the process of planting not more than 5600 plants to the acre. Because of the larger fruit produced by the smaller number of plants the probability is that the same tonnage of pineapples will be produced on an acre for 5600 plants as would be produced by more than 10,000 plants to the acre, by any other process. Then, there is the matter of having these plants in the nursery, probably  $\frac{1}{2}$  of their life. When these plants come from the nursery, they have attained a size and degree of development, so that, they can be set in the field and the time to the fruit from the time of setting out plants in fruiting formation in the field will be much shortened.

Then there is the matter of care of these plants in the nursery. All phases of care from fertilization to protection from frost will be simplified, particularly during the time that the plants are in the boxes, which will probably be six or seven months. The boxes, of course, will be portable, in case of frost, they can be stacked and covered, and the plants kept safe from frost during that period. In the nursery, there will be a vast lot of plants in a concentrated territory. They can be regularly fertilized with liquid fertilizer without too much cost. They can be covered with hay, or old sacks, or any other material, in case of frost. So that, while these plants are in the boxes and in the nursery they can be

cared for through fertilization, protection from frost and protection from insect pests on a concentrated basis in a small area.

There is another item that is going to be important over most of Florida. Actually, I think it is important over all of Florida. It will be possible to so arrange this nursery enterprise that the plants are in the nursery or in the boxes during the winter period when frost conditions are probable and that they go into the field in fruit formation early in the spring and produce their fruit during the fall and early winter. This will greatly lessen the hazards from cold,

To summarize the accomplishments of the moment, we can now fertilize pineapples with ordinary fertilizer ingredients at ordinary costs. We can now harvest pineapples full color and serve the Northern market with ripe pineapples, and this has never been done before. The market has already demonstrated that it will pay from  $2\frac{1}{2}$  to 4 times the going price of the market at the moment for ripe pineapples as opposed to pineapples harvested green and shipped to the Northern market. We can now produce planting stock in almost any quantity that is desirable and that will enable us to have planting stock for a new enterprise in pineapples all over the State of Florida wherever there is suitable land. It seems quite possible that all of these items added together will make a comeback of the pineapple industry in Florida a certainty, where before it has only been a conjecture. It is quite possible that all of the items in this paper are applicable to all varieties of pineapples. I wish to stress the fact, however, that up-to-the-moment these practices have only been tried with the variety known as Esmeralda from Mexico.

## BURROWING AND MEADOW NEMATODES ON AVOCADOS AND MANGOS

T. W. YOUNG AND GEO. D. RUEHLE

*Sub-Tropical Experiment Station*

Homestead

AVOCADOS — The burrowing nematode, *Radopholus similis* (Cobb) Thorne, and the

meadow nematode, *Pratylenchus brachyurus* (Godfrey, 1929) n. comb., are closely related endo-parasitic nematodes of great economic importance. Suit and DuCharme (4) found the burrowing nematode to be the cause of "spreading decline" disease of citrus in Florida. According to Steiner (3) meadow nematodes apparently are the most destructive and