

Terminal buds were removed from girdled branches of the Haden variety of mango, and all leaves were removed from the area between the girdle and the cut end at various intervals to determine the minimum length of time that was required for the hormone to influence floral development. In 1945, growth from these lateral buds was vegetative if the leaves were removed 24 hours after girdling and the removal of the terminal bud. When leaves were allowed to remain for 96 hours or longer flower clusters developed.

In 1946, an attempt was made through histological studies to correlate the length of this period with cell division. A longer period was required because drought delayed growth. Evidence from these studies indicates that the hormone does not initiate growth and cannot affect the course of the development of a bud until cell division has started.

Studies of the movement of the floral-inducing hormone and the growth-inhibiting

effect of the terminal bud upon the lateral buds were conducted on forked branches. When the terminal bud and the leaves were removed from one branch of the fork and the lateral buds were removed from the other branch, lateral flower clusters appeared from the buds at the end of the leafless branch (Fig.1). The hormone produced in the leaves moved down that branch and up the leafless branch and caused growth in those buds to be floral. The inhibiting effect of the terminal bud was not observed to move into an adjacent branch. However, flower clusters appeared from lateral buds below the girdle which indicates that the transmission of the inhibiting effect was intercepted by the girdle.

Flower formation was caused by the action of the hormone in buds previously unspecialized as late as March 4, 1946. The fact is emphasized that floral initiation begins shortly before the flower cluster is clearly discernible.

EARLY EXPERIENCES WITH THE CHAYOTE

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When the members of the Florida Horticultural Society see on the program the name "Chayote," and that I am giving some notes on it, I am sure there will be those who will smile and say: "Fairchild is back at his old game; trying to cram this so-called 'new' vegetable down our throats again."

Nothing of the kind. Fifty years ago I did get a lot of people to grow the chayote and thousands of them learned to like it, but a combination of the root knot and other factors which I propose to describe, discouraged them. Now, however, with the possibility in sight of controlling its worst enemy, the nematode, it seems to me that

it should be given another chance to take its place among the excellent vegetables of our southern states.

Feeling as I do that the chayote is worthy of a more extensive trial than was ever given it, I thought it would be helpful to give you some account of the experiences my colleagues and I had with it in the early days of the Section of Seed and Plant Introduction of the Department of Agriculture.

It was at Christmas time in 1895, forty-nine years ago, that I first saw a chayote arbor. I had stopped off in New Orleans on my way to the West Indies and was in the seed store of Stechler and Co. interviewing them about the various local fruits and vegetables.

They told me of a little French horti-

culturist in the suburbs who had an arbor of chayotes, so of course I went out to see him.

There were no fruits on his vine at that season, and he told me that not many were being grown around New Orleans. They were usually known as "Merlitons" or "Vegetable Pears."

I saw them again when we got to Jamaica and became fond of them and sent some home.

Mrs. Fairchild and I spent several weeks in Maderia some years later and saw them grown to perfection. In this tiny island in mid-Atlantic it seemed to play a really important role in the dietary of the people. There was a fine large arbor near the hotel where we stopped that furnished fruits for the table. There seemed to be but one variety grown; an ivory-white kind. We bought dozens of them and photographed them in fancy baskets.

We got to like them very much and I sent some to the office for we were convinced that the chayotes deserved to become a regular vegetable on the American market.

Our first efforts to grow them had already been made, at Cat Island, on the estate of General Alexander, a remarkable soldier of the Confederacy and one of the witnesses of Pickett's famous Charge. They were carried on by John Tull, who was experimenting with the General's wild rushes. For two seasons Tull grew chayotes and rushes in the abandoned rice fields on the old plantation with "encouraging results" so far as the chayotes were concerned. A two year old vine together with a three year old one produced 250 fruits in 1905.

We also subsidized a cucumber grower in the outskirts of Jacksonville, thinking he might take up their culture, but we soon saw that there was too much yet to learn about the plant and how it could be made a commercial success. It is surprising to find how many problems arise when you try to introduce and popularize a new vegetable like the chayote

As soon as we started the Plant Introduction Garden in the wilds of western Florida, cutting down great forest trees in a hammock near Brooksville to make room for it, we began to experiment with the chayote in earnest.

To begin with, there was the question of whether we had the best varieties. The chayote, *Sechium edule*, belongs to what is known as a monotypic genus; that is, a genus with only one species in it, so that there were no close relatives. But were there not perhaps many different varieties? Two, a white and a green more or less spiny form were all that had been tried in America or in North Africa, where it was grown for the French market, or in the West Indies or Madeira so far as we knew.

We ransacked the world for other sorts and discovered that the ones we already had were the usual types. However, from Costa Rica a keen observer named Carlos Werckle sent, among others, a kind that had no fibers around the seed and William Harris of Kingston, Jamaica, sent five varieties. The J. Steckler Seed Co. of New Orleans supplied us with their green, spiny sort; a large green and a large white we obtained from Puerto Rico; from Guadeloupe came five kinds we had already seen; Dr. Trabut contributed the white spiny one grown in Algiers for the Paris markets.

But it was not until Wilson Popenoe, then our Agricultural Explorer in Central America, made a study of the Gautemalan chayote and wrote them up with his usual care that we felt we had our hands on something more than merely a few slightly different varieties of the fruit.

He distinguished between the common "guisquiles" as they are called in Guatemala, which were what we had been experimenting with, and the Peruvian guisquiles called commonly "peruleros." The guisquiles were furrowed, with more or less deep sutures and might be either spiny or smooth and in color either light green,

deep green or white, and in form either pyriform or round, but the peruleros were devoid of spines, round, without sutures, and were either green or white. They varied in size, weighing from three to nine ounces. They were most attractive and their smoothness made them easy to prepare. They also had a superior flavor.

This careful work of Wilson Popenoe was done in the autumn of 1916. When his shipment arrived it showed us that we were just beginning the study of this new vegetable. The collection was carefully planted, on well-made trellises, but as often happens when species from the high mountains—in this case from an altitude of 5,000 feet—are transplanted to sea level, even though it is farther north, they grew poorly, produced only a very few fruits and gradually disappeared.

There was something peculiarly exciting to me in walking under an arbor of chayotes,—there still is. In the first place the fruits are as handsome as though they were carved of green jade or white ivory. I can never keep my hands off them they are so clean and so pleasant to handle. If the plant is well grown and vigorous, hundreds of them hang down from the canopy of green leaves and the picking of them is easy.

The tendrils, a foot or more in length, are so sensitive that they will curl about a pencil if you whirl it under their tips, and once they have made a turn around it they begin that cleverest of the tricks of a tendril which is to twist a short portion of the center of itself so that one half becomes a right-handed and the other a left-handed spiral and this shortens the tendril and raises the branch close up to its support.

When the small yellow female flowers are fertilized and the miniature fruits have set, they grow with astounding rapidity and it seems only a few days before they are ready to pick.

Fabulous were the stories of the produc-

tivity of the chayote. Not until we had the authenticated account of one vine that climbed, in twelve months from seed, up over a porch, half way round the house and over some telegraph wires into two oak trees and, beginning to bear in August, produced before frost cut it down in December, over four hundred fruits, did we believe any of them.

Later on, Mr. Pierpont of Savannah, Georgia, topped all the other records with two plants which, in the rich alluvial soil of the Isle of Hope, covered trellises nearly an acre in extent and bore over 1500 fruits in one season.

One of the curious complications, which I believe is rather a unique one, in growing the chayote, comes from the fact that its fruits have only a single large seed and that this seed is imbedded in the flesh of the fruit in such a way that you have to plant the whole thing—fruit and all. This fruit as it shrivels up and decays furnishes the nourishment for the young plant. In planting, the whole fruit is set in the ground so that its large end lies deepest in the earth and the whole is covered with two inches of soil.

Our experiments at Brooksville and elsewhere, over which Robert Young presided, taught us how to grow the vine and handle it in the various regions of Florida, and those of David Bisset in Savannah showed us how the plant could be protected from freezing in Georgia by putting a box filled with straw over the crown, leaving air for the plant to breathe but shutting out the worst of the cold.

Planted in spring when the danger from frost is passed, in a hill made in well-drained, rich garden soil, one fruit will grow before autumn into a vine requiring a strong, well-made, head-high arbor, for as I have said, it is a rampant grower.

Fifty pounds of well-rotted, barnyard manure, supplemented on poor soils with a pound and a half of any standard commercial fertilizer that is rich in potash, will

keep the vine growing if the other conditions are favorable. Mulching is necessary in dry weather, for the plant is not accustomed to drouths, and in irrigated countries a good supply of irrigation water is always required. Since the vine is a perennial it need not be planted every year although after four years plants usually run out and should be replaced by new ones.

My friend Homer Skeels and I got a good deal of amusement out of growing this tropical vegetable in the latitude of Washington. When the seasons were long we got a modest crop of rather small fruits of good quality, but we could never count on having a long autumn without killing frosts, and this uncertainty proved a "limiting factor" as they say. Even when the fruits were started in boxes indoors and set out as soon as possible in the spring, preferably in cool weather, the growing season was too short.

It was also a good deal of a problem to keep the chayotes we wished to plant out in the spring from sprouting during the winter, for they had a tendency to do this whenever there was any considerable change in the temperature about them.

This difficulty was in our minds when one autumn day Mrs. Fairchild and I took our little children to the Luray Caverns which were then run by their owner, Col. Norcott, a man of very considerable imagination.

As we were walking through the caverns he remarked that the temperature did not change more than a degree or two, summer or winter; always about the same, always a practically saturated atmosphere with the temperature around 54.

I told him of our problem with the chayote and he suggested we send him a crate of the fruits to store in the cavern. He would watch them and give us a report on their behavior. As I recall it, the experiment was a success; the fruits showed little or no signs of germinating. His reports will be found in the records of the office. But

we were in no position to follow the matter up commercially. We had no tonnage of chayotes of course.

We were satisfied that changes in temperature induced germination in the chayote fruits. How far this applies to root or tuber vegetables, I do not know. Since most fruits have seeds which wait for the decay of the fruit-flesh before they germinate, this experiment may have a certain significance.

There was a feature of the chayote which, perhaps owing to our short seasons, never took on any importance in our minds. I refer to the large fleshy root which, among the Indians of Guatemala is considered a valuable starchy vegetable. It is boiled and eaten much as is the yam or sweet potato, and has a flavor of its own which one easily becomes accustomed to and learns to like.

Once we had learned how to produce the fruits of the chayote it seemed as though our problems had only just begun. We had before us the most difficult of all; the problem of getting people to eat them.

It was easy enough to prepare them for the table and when boiled they taste something like a squash or a cucumber or a vegetable marrow. I think the chayote lends itself to more different recipes than does the squash because of its firmer, more agreeable texture. Chayote salad, chayote fritters, chayotes fried, creamed, stuffed, baked and made into pickles; these are some of the ways chayotes can be eaten. Even a rather close approach to apple sauce can be made with boiled and mashed chayotes flavored with fruit juices and spices.

So it was up to us to cook the chayote and test it on ourselves and our friends in as many ways as we could devise and in doing this we had some interesting experiences. Naturally I was desirous that my superiors in the Department should take a fancy to it and help create a market for it.

I recall serving creamed chayote at a luncheon we gave for Mr. and Mrs. Houston

when Mr. Houston was Secretary of Agriculture. We watched with curiosity and satisfaction as Mr. Houston ate it, only to have the whole effect vitiated by a remark of Mrs. Houston's that her husband never knew what he was eating.

Mr. Graham Bell took a liking to the chayote and served it at one of his "Wednesday evenings," which gave me a chance to discuss its qualities. He suggested that it would be a good vegetable to try on the guests of the National Geographic Society at one of the Annual Banquets which in the earlier days of the Society were a feature of Washington life.

The Society printed a folder with illustrations describing it and Mr. Haight, the then manager of the Willard Hotel, took the trouble to interest his Chef in it and it was well served; boiled, in cubes, with a white sauce. Everybody ate it and seemed to like it. I had many compliments and still more enquiries as to where it could be gotten and if it were on the Washington market. Libby, Libby & Co. discovered they made good pickles and wanted to know where they could get carload lots.

Of course it was not on the market. We were trying to interest growers to plant it, but no grower had yet had the temerity to put out so much as a dozen acres of it on the gamble that he could sell it at a profit without advertising, especially when he knew very well that as soon as he did make a profit, others would go into the raising of them and undersell him on the market, taking advantage of the advertising his success had given it. This was the joker in the whole game of starting a new plant industry. Who was going to start it? With no protection of any kind against miscellaneous competition, no way of preventing the market being flooded with inferior fruits which had the right to be sold under the same name, what man of capital would be interested in backing the gardener who was willing to grow chayotes?

As no less a speculator in new things than Glenn Curtiss once said to me when I

suggested he grow dasheens: "Lets try something easier, Fairchild." He tried what he thought was easier and built the town of Hialeah, getting hundreds of people to gamble in real estate with him.

I cannot remember now how many years we of the Office kept our propaganda going, for in April of 1917 the First World War came with its upsetting new programs put up to us and, although the stream of new plants coming in did not slacken, much experimental work had to be given up and propaganda for the chayotes was curtailed when that for Dehydrated Vegetables had to be started.

But scattered here and there through the South there remained some adventurous planters who still persisted in growing it. In 1920 there were some 1275 on our lists who had received chayotes to experiment with and we hand-printed and distributed widely thousands of illustrated leaflets showing how to grow and how to cook the vegetable.

Most of them however lost their seeds—ate them or fed them to stock—and when in 1929 I tried to get some chayotes to grow on my own place in Florida it was with difficulty that I could find a few fruits with which to start.

These grew however and I gave away many fruits and some of them came to the attention of my friend Col. E. C. Prentice, a retired Army officer, known for his pioneer work in aviation. The colonel took up their culture with vigor and for two years sold all he could produce, on the Miami market.

After his death Messrs. Hubbell and Stambaugh grew beautiful chayotes under cloth shade, but I have seen no printed account of their experiments and chayotes are seen much less often in the market.

In DeLand, Florida, several pioneers took up their culture, among them an expert accountant, Mr. Dickinson, who told me the following story:

Enough men became interested in chayote

growing around DeLand to produce a large crop. What to do with it was the question. Someone suggested that they combine and ship a carload to some Northern city. Some other person said he knew a dealer in Chicago who would handle a carload, so they filled the car. Just as they were about to ship, a wire came from the dealer saying he could not or would not handle so many.

The car was already loaded and since someone else had the name of a Philadelphia dealer it was decided to ship to him, with the result that was to be expected. The dealer found himself in possession of a white elephant.

"How do they expect me to sell an entirely new vegetable which has never been advertised and which nobody ever heard of? There is no demand for the thing. What shall I do with it?" And a carload of delicious chayotes was dumped.

"What's the use of growing something for which there is no market?" was the universal question.

It is customary for people to look upon any new vegetable as unimportant until it gets into common use where they live, and they cannot realize what this chayote means to the inhabitants of Guatemala; to Guatemaltecos the guisquile is one of the most valuable vegetables grown.

When in 1941 Mrs. Fairchild and I visited the mountain region of Guatemala we saw piled up in the picturesque markets great heaps of guisquiles and peruleros which Quiche Indians had brought down from their cornstalk towns on the slope of the Volcan de Agua. Maria served them to us in Casa Popenoe in Antigua with a butter sauce and we realized that we had formed a very inadequate idea of the delicate character of this vegetable we had grown years ago; that here there was a real and important problem for some good horticulturist; the breeding and selection of these strikingly different forms of chayote.

We visited the town of Santa Maria de

Jesus near the cinder cone of the volcano and saw every little house embowered in a vine of the chayote from which hung hundreds of fruits in easy reach of the "cook" whose "kitchen" was only a step away. Little children in pretty hand-woven dresses stood about, eating the small green peruleros which had been boiled and salted for them. For how many centuries these Indians have been eating guisquiles and peruleros with their corn, someone may sometime discover in the fossilized remains of the kitchen middens of their ancestors.

Of course the chayote is not free from diseases. Plant lice attack it, but they can be controlled by nicotine sulphate sprays. Melon and pickle worms sometimes feed on the fruits and have to be fought with arsenical sprays. When the soil conditions are not quite to its taste a fungus disease sometimes attacks the leaves and Bordeaux mixture had been the best remedy for this. But the most disturbing, even tragic factor, was the root knot disease. In the course of a year or so the vines usually became infested with this, the greatest curse of gardening in southern latitudes, and it was necessary to shift the plantation to new ground, and plant again the new spot, which is a discouraging procedure.

There have now appeared upon the scene new, and I am assured, very efficient means of rendering a plot of ground comparatively free from nematodes. I refer to the use of Dow Chemical Co.'s "Dowfume," Shell Chemical Corporation's "D-D" and "Larvacide," a product of Innis, Speiden & Co.

This discovery will, I hope, give a new impetus to chayote growing and perhaps some other amateur will originate sorts better suited to Florida conditions than the ones Col. Prentice worked with, and which may have as fine a flavor as the peruleros.

The slow growth in popularity of the chayote will hardly satisfy anyone with a manufacturer's point of view. He will speak of the radio, good roads, modern automobiles as having all become necessities during the years in which the chayote has been so

slowly establishing itself in the taste of Americans. But I am not convinced that these things are comparable. Consider the millions of dollars that have gone into the advertising of any manufactured product with the almost complete lack of any put into attempts to push the chayote and you become aware that a comparison is impossible. I venture the statement that more money was spent in advertising instant postum than was expended by the Government in the introduction of new foreign plants for the whole country during the past 32 years.

It is slowly and tediously that a new vegetable such as the chayote must work its way into the good graces of a people and earn its right to be classed as an established table vegetable on their menus.

A dealer in one of our big cities found himself burdened with a large shipment of chayotes which he could not sell under their strange name but when he called them "Trellis Squashes" he sold them readily.

Perhaps people hesitate to buy a vegetable the name of which they don't know how to pronounce.

RESEARCH IN TROPICAL HORTICULTURE AT THE UNIVERSITY OF MIAMI

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Ever since the establishment of the University of Miami, its trustees and officials have been cognizant of the important role that agriculture, and especially horticulture, plays in the economic and aesthetic life of the South Florida area and tropical America. Even though they have been over-busy in building up a material as well as a first-class scholastic institution, they have not lost sight of the fact that teaching and research in tropical agriculture are important contributions of a university so situated climatically and geographically as is the University of Miami.

There is no place in the United States better situated to undertake the establishing of a well-rounded educational center for research and teaching in tropical agriculture than the University of Miami. Miami is 600 miles farther south than San Diego and approximately 80 miles from the Tropic of Cancer. It is 280 miles farther south than Cairo, Egypt, and has the same lati-

tude of Central India and Arabia. It is so located that it is easily accessible by boat, rail, and air to all the tropical American countries.

Dr. Wilson Popenoe, who is an expert on tropical and subtropical fruits, has this to say concerning research on tropical fruits: "The thickly populated countries of the temperate zone must look more and more to the tropics to supplement their own food resources by direct supplies made possible in ever-increasing measure by ever-improving means of transportation. Many fruits of the tropics, not all of them so important, yet all valuable in degrees in the dietary of the race, must be grown in ever increasing quantities, not only to supply temperate zone markets, but also, and even more important, to enable the native populations of the tropics to obtain abundantly and cheaply this most wholesome source of human energy."

Some of the staff of the University of Miami have already made valuable contributions to horticulture. Dr. Walter M. Buswell, curator of the herbarium, assisted by Mr. Roy C. Woodbury, has built up a splendid herbarium of tropical and subtropical