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CENTRAL AMERICAN FRUIT CULTURE

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FEW REGIONS PRODUCE A WIDER RANGE OF FRUITS than Central America. Delicate and exacting exotic species such as the mangosteen flourish on the Caribbean littoral. Oranges, bananas, pineapples, mangos and avocados are abundant in many places; while in the highlands numerous species of the Temperate Zone such as apples, peaches, plums and pears are cultivated successfully, especially where attention is given to planting suitable varieties.

Central America, nevertheless, has not yet realized its pomological opportunities. In many regions fruit is still a rare item in the human diet. And with regard to numerous species, particularly native ones, man has failed to take advantage of the simplest means at his command for improving them. That is to say, he has not had recourse to vegetative propagation. It is safe to say that more extensive use of grafting is the greatest single step which can be taken for the improvement of tropical fruit culture in general.

It is the purpose of this brief treatise to discuss in the

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simplest possible manner the requirements of climate and soil, as well as the propagation and care of those fruit-bearing plants most commonly grown in Central America, as well as others not so well known which seem especially worthy of attention.

Obviously it is not feasible to enter into many details. The main objective is to provide essential data for the guidance of those many Central Americans not professional horticulturists who wish to have on their farms or in their home gardens the best fruits which can be cultivated under their particular climatic conditions.

Those persons interested in the more technical aspects of tropical fruit culture will find a wealth of information in the book entitled "Evergreen Orchards", written by W. H. Chandler of the University of California and published by Lea & Febiger at Philadelphia in 1950. In this excellent work Professor Chandler has summarized the results of research and investigation in the entire field of tropical and subtropical pomology.

To render more intelligible to the inexperienced horticulturist the information under each heading in the present treatise the following explanations may be useful:

FAMILY

The arrangement of fruit-bearing plants in accordance with their botanical classification may seem at first glance to be of little importance, for some families contain species of very diverse character, for example, the Rosaceae which includes the small herbaceous plant the strawberry, as well as trees such as the apple and the peach. But there is at least one excellent reason for knowing the family relationships of a plant: it is sometimes possible to graft one species onto another of the same family, but it is never possible to graft onto a species which belongs to a different family.

GENUS

Within the broad groups known as families, botanists recognize smaller groups of plants which seem closely related to each other. Each of these groups is known as a genus (plural genera), and may include a few species, or a large number.

Species are groups of individuals which when grown from seed remain very much alike in regard to characters of botanical importance.

SPECIES

Common names of plants vary from region to region. Throughout Central America the avocado is known by the name *aguacate*. In parts of South America it is called *palta*. *Chinini*, *coyó*, *chucte* and *yás* are different names for one and the same tree, *Persea Schiedeana*, a close relative of the avocado.

The only way in which much confusion and many mistakes can be avoided is to know the botanical name of a plant, and even then difficulties may be experienced due to the presence of synonyms, that is, two or more botanical names for the same plant, which not infrequently occur because of varying points of view among botanists or the discovery of an early name which had been given by one botanist and overlooked by others. In books published a hundred years ago the avocado went under the name *Persea gratissima*. In modern works it is *Persea americana*, a name given to the tree by a very early botanist and then lost to science for many years.

In the present work an effort has been made to bring the botanical nomenclature into line with accepted modern usage. To that end it has been revised by Paul C. Standley and Louis O. Williams. Synonyms are given where it is believed they may prove useful.

RACES

These are groups of plants all belonging to the same species but having in common certain characteristics of horticultural importance which are not lost when the plants are propagated by seed. For example, there are three races of avocados, the West Indian, the Guatemalan and the Mexican. These differ somewhat in climatic adaptations, in character of fruit, and in a few other details.

VARIETIES

Botanically speaking varieties represent minor forms of a species. Horticulturally they are extremely important, so

much so that in many cases they are the keys to successful cultivation. They also provide us with differences in size, color, quality of fruit, as well as different seasons of ripening and many other factors of interest to the grower. In short, knowledge of races and varieties is essential to the horticulturist.

In Central America, nurseries producing and selling grafted fruit trees are rare. For this reason young trees are often imported from far-distant regions such as California and Florida. Commercial nurseries in those regions offer many varieties of such species as the orange, the avocado and especially Temperate Zone fruits such as the apple, the peach and the plum. Lack of tropical experience often makes it impossible for them to recommend the best varieties for other parts of the world. The indications given in the present work regarding suitable varieties for Central American conditions are based largely on experience and it is believed they will prove helpful to the horticulturist. It should be remembered, however, that new varieties are constantly being developed and placed on the market. The best varieties of today may not necessarily be the best ten years from now.

CLIMATE

The principal factors which enter into the complex called climate are temperature, moisture and movements of the air. The horticulturist is interested mainly in the range of temperature from day to day and month to month and in the amount and distribution of rainfall. To a somewhat less degree he must take into account the relative humidity of the atmosphere during dry periods, and air currents, especially when these become strong enough to have a marked effect on plant life.

It has long been the custom in Central America to speak of three zones of temperature: *tierra caliente, tierra templada* and *tierra fría*. While these three zones have no absolute limits (much depending on latitude, northern or southern exposure, and the like), for general purposes the classification is sufficient. To make it more useful rainfall must be taken into account. A climate can be wet, semi-arid, or arid.

It would, of course, be ideal if exact limits of altitude could be set for the three zones of temperature and exact limits of rainfall for the three zones of moisture. These can be established only in a general way which for practical purposes is about as follows:

Tierra caliente includes regions between the level of the sea and 750 to 1000 meters.

Tierra templada extends from 750 or 1000 to 2000 meters, more or less.

Tierra fría extends from 2000 meters or slightly lower to the upper limits of cultivation, about 3500 meters.

In each zone, if the annual rainfall is less than 30 cm. the climate may be called arid (a condition which perhaps does not exist anywhere in Central America).

If the rainfall is between 75 cm. and one meter, not distributed fairly evenly throughout the year, the climate may be termed semi-arid, a common situation.

If the rainfall is more than 200 cm. and is fairly well distributed throughout the year, as usually is the case on the Caribbean coast, the climate may be called wet.

SOIL

Insufficient attention is usually given to knowledge of the soil. Every horticulturist should have a soil auger and use it before selecting land on which to plant fruit trees. With this instrument it is a simple matter to determine the texture of the soil down to a depth of one meter or even more. Without it one may make the mistake of planting trees on land which looks good at the surface but which has an impervious layer of heavy clay or has coarse gravel or some other unfavorable condition a short distance below the surface.

An auger can be made at very little cost by purchasing a 3/4 or 1 inch bit and attaching it to a one meter length of half-inch pipe with a cross piece soldered to the upper end to serve as a handle.

Soils are classified by texture, that is to say, the size of the particles which form them. As many as fifteen or more kinds are recognized by technicians. To determine some of these accurately access must be had to a laboratory. But if the horticulturist is able to classify the more important ones by rubbing a small sample between his fingers, he knows enough to protect himself against serious mistakes. The ones

which he should be able to recognize, beginning with that which contains the largest proportion of coarse particles and ending with that which contains the largest proportion of fine ones, are as follows: sandy, sandy loam, clay loam, light clay and heavy clay. At times combinations will be encountered which are somewhat puzzling but important, as, for example, sandy clay, which may be a mixture of heavy clay and coarse sand. The clays, in fact, constitute the group which is likely to present the most difficult problems since there are heavy clays which nevertheless have good drainage qualities, and there are others which are almost impossible to drain.

Soil scientists, after conducting extensive surveys, are able to elaborate on the textural classification by grouping together soils of common origin in what are called types. A preliminary classification of this sort has been made in parts of Guatemala.

PROPAGATION

As far as concerns fruit-bearing plants propagation is basically of two kinds, by seeds and by vegetative parts of the plants themselves. These latter may be suckers which arise from an underground stem, as in the banana, or they may be sections of good-sized roots which are planted as cuttings, or they may be cuttings made from branches of the plant, or they may be air layers made on branches, or (and this is the most important form horticulturally) they may be grafts. There are other forms of vegetative propagation but these are the ones most commonly used.

Grafting is an ancient art in the Asiatic tropics. Almost unquestionably the presence of so many excellent mango varieties in India is due to the use, through many centuries, of what is perhaps the simplest form — inarching, or grafting by approach.

The chronicles of early voyagers to the Americas indicate that the inhabitants of the New World did not know the art of grafting, or if they did it was not widely practiced before the Discovery.

In nature plants grown from seed tend to show a considerable amount of variation. Generally speaking this is greater in plants which have been "improved" (developed by man better to satisfy his desires) than it is in wild plants. When

fruit trees are propagated only by seed, as has been the case until very recent times with the avocado in tropical America, improvement can be and has been realized gradually — it is necessary to raise the general level of the whole species. But when vegetative propagation is employed the characteristics of a superior individual can be perpetuated.

Improvement of the pineapple, a native American fruit, was achieved by the inhabitants of pre-Columbian South America because individuals which showed superior characteristics could be propagated by suckers.

The use of grafting not only provides a simple means for preserving the valuable characteristics of a superior individual; it offers other advantages in many cases. Grafted trees usually come into bearing earlier than trees of the same species grown from seed. Grafting commonly tends to produce a smaller tree thus making it easier to harvest the fruit. In some cases, as for example the citrus fruits, resistance to certain diseases is obtained by grafting onto rootstocks which are not of the same species or variety; and again, by using rootstocks of a different species or variety it may be possible to grow trees on soils which are inimical to them when on their own roots.

While many kinds of grafting are described in horticultural literature, the forms commonly employed in Central America are basically two: (1) budding or bud-grafting, using a small piece of bark with a single bud; (2) grafting proper, using cions which are small sections of branches each carrying one or more buds.

Some of the tropical fruits are quite difficult to graft, for example the members of the family Myrtaceae. Others lend themselves more readily to this practice, the citrus fruits and the avocado. Budding or bud-grafting is more widely used for nursery work than any other form of grafting.

To be successful in grafting the horticulturist must take into account numerous factors. He must know how to choose the right material, either as buds or cions. There are differences in the kinds of material produced not only by different species but even more important practically, by different varieties of a given species, for example the avocado. He must see that the plants which are to serve as rootstocks are in proper condition, which means that they should be of the right

size and in the tropics it usually means that they should be in vigorous growth. He must know the most favorable season of the year for grafting each kind of plant, and he must have a skillful experienced hand and a sharp knife.

CULTURE

Not many cultural details can be touched upon in a treatise so brief as this one. The good horticulturist should not require much information on this subject: his trees tell him what they need and he understands their language. Some years ago a horticulturist was being shown through a banana farm in Costa Rica. The owner asked: "Is this good soil for bananas?" The reply was: "Don't ask me, ask the bananas. Here they are!"

Nevertheless, it may be helpful to the prospective fruit grower to include a few notes on certain points such as suitable distance between plants, pruning, fertilizers, and irrigation. And everyone wants to know how early he many expect the first crop from a fruit tree.

The optimum spacing distance is that which will produce the maximum amount of fruit per hectare or other unit of land without sacrificing size or quality. For any given species optimum spacing varies to a certain extent with climate and soil as well as with the variety. For example, *Julie* is a dwarf mango and needs only six or seven meters between trees, while the majority of other varieties need twice as much space.

The efficient and economical use of fertilizers, organic and chemical, is a very important subject. In most tropical soils the main thing is to keep the organic matter content at the optimum level, which usually means more organic matter than the soil contains if it has been in cultivation for a few years. There is no better fertilizer for general orchard purposes than stable manure, but oftentimes this is not available in sufficient quantities and the horticulturist has to do something about it. He may add organic matter by growing leguminous plants and incorporating them with the soil, or he may use commercial fertilizers, or he may combine the two systems.

In Central America commercial fertilizers frequently are costly, due in part to expensive transportation. When he buys them the horticulturist should remember that he has to pay

for all the elements which they contain. He should, therefore, know if he needs all these elements. For example, if his trees do not need phosphorus and potash, if they need nothing but nitrogen, he should not buy a fertilizer containing all three. And he should not think that a laboratory analysis of his soil will necessarily tell him exactly what he should use to fulfill the nutritional requirements of his trees. Carefully conducted fertilizer experiments should be the guide.

Pruning is a subject which must be approached with fear and caution. Like grafting, it is still as much of an art as a science, especially in the tropics where it has received relatively little study. In the minds of many tropical horticulturists the conviction still exists that it is good for a tree to give it a severe pruning now and then, to cut off branches here and there, to shorten new growths, to reduce temporarily the size of the tree with the idea that this will ultimately result in a larger, more vigorous specimen and better fruit.

Pruning must take into account two objectives, those of the tree, and those of the grower. Both have their place.

Some of the legitimate purposes of pruning follow. (1) It may be desirable to keep the tree within manageable size. (2) Pruning may reduce vegetative growth and produce more fruit-bearing wood, as in the case of grapes and the various species of Rubus. (3) It may open a tree to light and air for the betterment of the crop. (4) And, most important of all, in most instances, it may be used to remove dead, crooked, or surplus parts such as watersprouts.

Many tropical fruit trees, for example, citrus, mangos and avocados, require little pruning except for the purpose last named. During the first few years it may be necessary to prune judiciously in order to form the tree, to develop a sufficient number of main branches so that the ultimate result will be a well balanced crown with abundant fruit-producing wood. Once such a crown is formed many species need little pruning. The horticulturist should remember that leaves are the factories of carbohydrates, and carbohydrates mean flowers and fruit.

PRINCIPAL ENEMIES

Books have been written about the insect pests of the citrus fruits. There is a good-sized volume about the diseases

of the banana. Many insect pests and diseases are of minor importance to the average Central American who is growing fruits on a small or even a fairly large scale. But there are certain enemies which practically every grower must face and fight. For example, gummosis or foot rot of citrus trees; scale insects; and the larvae of several flies which infest many tropical fruits.

Only the most important and widespread enemies are mentioned in this treatise, those which are likely to be faced by the average grower. Those methods of control are suggested which are easily within reach, such things as Bordeaux mixture for the fungous diseases, oil emulsions for the scale insects, and nicotine for the sucking insects.

Many new insecticides and fungicides are coming upon the market. Some of these are tremendously efficient and will become more readily available in time. In the meanwhile the Central American horticulturist with a spray pump and the more easily obtainable materials can protect his trees and fruit. If he is to be fully successful in this he must do a thorough job. He must mix his materials carefully and do his spraying conscientiously.

SYSTEMATIC POMOLOGY

"Systematic pomology", wrote the late Professor U. P. Hedrick, who was a master of the subject, "is the study of the kinds of fruits and their relationships."

When fruit trees are propagated only by seeds there is not much need for this branch of pomological science. Since widespread use of vegetative propagation — more particularly the art of grafting — is the next great step to be taken in the development of tropical fruit culture, the time may rapidly be approaching when it will be essential to devote more attention to "the kinds of fruits and their relationships."

This need has already been recognized to a certain extent. The citrus fruits, the mango, and the avocado are good examples. When grafted trees of these species are brought to Central America from other regions — as is not infrequently the case these days — they come properly named; accurate and usually complete descriptions of them are available in

books or catalogues; and they have been classified as to racial affinities, or at least with regard to cold resistance, or season of ripening, or some other important character. In other words, they have received attention at the hands of systematic pomologists.

Little has been done, however, to apply this branch of pomological science to fruit varieties developed locally. When a superior avocado tree, grown from seed, is propagated by grafting in order to perpetuate its desirable characteristics, a careful *description* of the fruit should be prepared, following the method used in other parts of the world; the variety should be given an appropriate *name*, preferably consisting of one word only, and it should be *classified* according to an accepted system.

In connection with this latter point, Professor Hedrick wrote: "As far as possible, systematic pomology is a classification of fruits according to their natural relationships. It is now agreed that the best systems of classification are those which show natural affinities as opposed to purely arbitrary methods which do not have in view the expression of relationships and that seek but to name and place a plant. One cannot avoid artificiality, however, in systems which are natural."

In the beginning, purely artificial sytems are often used. Years ago, avocados were sometimes classified in groups such as the following: round green varieties, pear-shaped green varieties, round purple varieties, pear-shaped purple varieties. Such a classification is of little value compared with that of the present day, which throws avocados into three natural races, the West Indian, the Guatemalan, and the Mexican. These races differ in resistance to cold, in productiveness, in season of ripening, and in size and quality of fruit.

The same applies to mangos. To say that a certain variety is a long yellow mango does not mean much, but when the statement is made that a variety belongs to the Philippine race it means a good deal.

Once more to quote Professor Hedrick: "The first task of a man contemplating fruit-growing is to make a systematic study of fruits and varieties... The progress of his profession depends very largely on the introduction of better varieties, which, in turn, is dependent on intimate knowledge of existing varieties."

The preparation of a complete and accurate pomological description requires the use of certain technical terms, some of which may only be applicable to one species. No great amount of study is required for one to become proficient in making these descriptions. With regard to the more important fruits which are propagated vegetatively, excellent ones are available in the literature, which can be used as models. Slight changes only are required to take into account important characteristics of others which have not yet received the attention of systematic pomologists. In all cases the same sequence is followed — size, form, color, and the like — though slight variations are admissible.

The development of satisfactory natural systems of classification, however, is a process which may require, in the case of those fruits which have received scanty horticultural attention, long and painstaking investigation. Much remains to be done before the science of pomology can be placed upon a satisfactory basis, not only in Central America, but in the tropics generally. It is an interesting and profitable field in which to work.

FAMILY PALMAE (PALMACEAE)

While there are some 1400 species of palms, which for convenience may be divided into two groups, fan-leaved and feather-leaved, only a few of them produce fruits of economic importance. One of these, the coconut, is well known to almost every resident of Central America. Many native palms, such as the coyol (Acrocomia) produce edible fruits which are seen in local markets, but since they exist almost solely as wild plants they need not enter into a discussion of cultivated fruits.

The coconut (*Cocos nucifera*), probably native to the Asiatic tropics but now widely distributed and cultivated, will not be discussed here as it is scarcely to be considered a fruit in the popular sense of that term. Its zone in Central America extends from the seacoast up to elevations of about 1400 meters. Commercial cultivation of coconuts seems to be declining in this part of the world, due to the ravages of several diseases and insect pests which are difficult to control.

The date palm (*Phoenix dactylifera*) is, like the coconut, a plant of such ancient cultivation that its exact origin is uncertain, but in all probability it comes from northwest India or some adjacent region. Around the Persian Gulf and in Mesopotamia, Arabia, and the northern part of Africa its fruit is not only a staple article of diet but also is exported in great quantities.

Undoubtedly date palms were brought to the New World during colonial times, for the Conquistadores were familiar with this fruit in southern Spain, where it is successful on a limited scale, and esteemed it highly. Mature palms are to be seen today throughout Central America, from the seacoast to elevations of 2000 meters or more. They resist lower temperatures than those which occur in any of the cultivated areas of this part of the world, but commercial production of properly ripened dates has never been achieved between Mexico on the north, and southern Peru. Strictly speaking, the date palm is not a tropical plant; it is subtropical. For proper ripening of the fruit temperatures of at least 40° C. plus extremely low relative humidities are required and, strangely enough, these conditions are found in the subtropics but not in the tropics.

In the vicinity of Soatá, Department of Boyacá, Republic of Colombia, dates are grown on a small scale and sent to the market of Bogotá; but they are good only after they have been boiled in syrup. Soatá lies at an altitude of about 1800 meters and the climate is not hot enough for dates to ripen on the tree.

The date palm is dioecious, hence it is necessary to have both male and female palms in the plantation. Since time immemorial it has been the practice in date-growing regions of the Old World to insure good productivity by tying small twigs of male flowers in the clusters of female flowers.

Propagation is by means of suckers which are produced by the palms during their early years; the fine varieties, of which several hundred are known (*Halawi, Khadhrawi, Fardh* and *Deglet Nur*, are probably the most important), do not come true when propagated by seed.

Two distinct kinds are grown: the dry or bread dates, and the softer kinds which are practically the only ones which enter into world commerce. Palms are slow to come into production; they usually take seven or eight years but they often live for a century or more.