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FIELD PRODUTION PROBLEMS IN THE CARIBBEAN FRUIT-TREE INDUSTRY

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INTRODUCTION

The traditional approach in discussing field problems associated with any tree crop, is to deal with the sequential topics of site selection, site development, planting, crop establishment and maintenance, crop protection, yields, harvesting, etc., etc. However, my talk today will be focused mainly on the areas which constitute the major constraints to fruit tree development in the Region. So do not expect from me a comprehensive treatise on the Principles of Tropical Tree-Fruit Culture--this can be found in any good textbook or report on the subject.

Having said all this, however, I will have to start by saying something about Site Selection and Development, as these can indeed be regarded as areas of deep concern in fruit-tree development in the Caribbean.

SITE SELECTION AND DEVELOPMENT

As all of you already know, most of the fruits produced in the Region do not come from established orchards, but from hundreds of thousands of fruit-trees scattered all over the Caribbean--in back-yard gardens, on small farms, or growing in the wild and semi-wild state!

By and large, citrus (oranges, grapefruits, limes and mandarins) are the only fruits which are found predominantly in oarchards. However, in recent years, mangoes, avocadoes, and many non-traditional fruit trees (paw-paw, guaves, W.I. cherry, ackee, etc.), have been established under orchard conditions in several territories--Jamaica, Belize, St. Lucía, Dominica, St. Vincent, Antigua, Montserrat, Grenada.

Ideally, choice of a location for fruit-tree culture should be made on the basis of selecting the best optimum in all respects. But ideal sites no longer exist. Site selection is more often made to fit the requirements of a particular crop or group of crops or on the basis of providing the highest potential monetary return. Either of these choices represents the situation where a plantation is to be established on virgin

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or on old cropped land. Site selection is much more restricted for small farmers--who already possess the land--but whose problem is to determine the best crop mix for their own location--often a consideration of various mixtures of intercrops or of small, separate monocrop plots.

Site Factor

Although level or gently rolling land is most desirable for fruit crop establishment--population pressures in many territories necessitate utilization of hillsides (often steep slopes) for fruit tree farming. Under these conditions much intensive rehabilitation and soil conservation measures will be required to combat excessive erosion.

Site selection factors fall into 2 general categories--(a) environmental and (b) economic.

The environmental factors are more than obvious--climate--soils and pests. Moisture is the climatic variable most likely to be limiting under Caribbean conditions--and will be discussed further under irrigation and drainage. Too much rainfall--or too little--may prevent the growing of certain tree crops.

Temperature and sunlight under our conditions are a function of altitude - temperature is of great importance in the growing of certain crops which prefer a cool period during certain stages of their production cycle, e.g. ortaniques, lichi.

Wind is important for its effect on plant growth and for certain wind-sensitive crops such as avocado and papaya, as well as citrus, windbreaks are essential for proper establishment.

Soil fertility is less likely to be critical than soil physical structure, because of the difficulty and expense entailed in modifying adverse soil physical conditions. Adequate depth for rooting, good physical structure, unimpeded drainage and proper aggregation of soil particles are desirable. High acidity or alkalinity may preclude the growing of certain tree crops.

Possible site of root rots, presence of parasitic nematodes, vectors and non-crop hosts are critical pest variables.

Economic Factors

Topography imposes a limitation on cultural and harvesting operations since field costs rise almost geometrically as the slopes increases.

Large mechanical equipment cannot be used on slopes much steeper than 5-10%.

Availability of labour for routine and labour intensive operations, such as harvesting must be assured.

Proximity and access to markets via roads are important cost factors.

The impact of a large planting or a group of small plantings on the social and economic structure of the surroundings must be taken into account.

Basis for Site Selection

The fullest and most complete information should be obtained on crop requirements and limitations, climatic variables, soil conditions, natural vegetation, incidence of pests, topography, water supply and quality, labour and equipment sources, transportation facilities, etc.

These data should be studied by someone familiar with tree-crop culture. Many ventures into fruit-tree production have failed miserably due to ill-concieved and poorly planned and executed enterprises. The safest procedure is to hire a consultant with known qualifications and experience! Government agencies must be relied on for providing useful information and assistance. However, it must be borne in mind at the outset, that fruit crop culture is as much an art as it is a science--no two sites will respond the same when the identical cultivar is used in both!

LAND PREPARATION

There is no firm recommendation in the Region concerning the appropriate methods for preparing land destined for tree crop production. The practices currently followed are mostly borrowed from other areas--notably Florida and Puerto Rico--and often the procedures adopted are not ideally suited for the crop or for the soil.

Time and money spent in building up the fertility and in establishing a good physical condition of the soil prior to planting is worth many times more than similar efforts after the trees have struggled on indifferently for a period of time. Probably the most important period in the life of an orchard is the first 4 to 5 years--when the future vigor and shape of the trees are being determined.

Clearing and cleaning of land should result in minimum disturbance of the equilibrium among climate, soil and vegetation. Erosion may not pose the immediate serious threat on a relatively level site that it does on slopes greater than 2 to 5%, but substantial loss of organic matter can also occur on the former if the soil is left bare.

Land Clearing

Land clearing may be done either manually or mechanically. On small areas, or on steep slopes, clearing may be done manually, provided reasonably inexpensive labour is available. However, as labour costs rise, it is likely that most manual labour will be replaced by mechanical clearing. However, these machines have to be used with caution to prevent soil compaction and loss of topsoil.

There is much controversy over the question of burning the huge mass of debris accumulated during clearing and land preparation. It is not convenient to leave the material in the field for subsequent rotting--as this would interfere with cultural operations. However, any burning of such large piles must be done carefully from the top down--utilizing the lower layers as insultation to minimize sterilization of the soil beneath.

Tillage

The amount of tillage needed varies with the depth, structure and texture of the soils. On deep, well drained light textured soils such as most of the volcanic soils in the Eastern Caribbean--sandy loams, loams and silt loams, tillage should consist of plowing, disking and harrowing--with grading and levelling where necessary to promote surface drainage. Surface drains should be provided so that excess water flows readily from the orchard area.

In heavy clay soils, land preparation shold be focused primarily on providing adequate soil drainage. This is particularly true in the more humid regions of the Caribbean--but it should not be neglected even in drier areas. Restricted root development and acidic and salt problems may result from poor drainage.

Cambered Beds

In Trinidad and Surinam "cambered beds" are very common in poorly drained areas--these are usually 1 to 10 m wide--but can be as wide as 30 m in more permeable clay soils.

On certain soils in Central Trinidad, drainage is so poor and rainfall so heavy, that "box drains" were once used to provide a system of surface drains all around every tree. This obviously is very expensive and is no longer feasible.

Mounds

In Jamaica mounds are commonly used in planting young citrus and avocado plants but the use of mounds is recommended for most tree crops planted on impermeable soils. The mound is made by scraping topsoil from the area surrounding the position the tree is to occupy and heaping it to form a rounded cone 4 to 6 ft in diameter at the base and up to 2.1/2 ft high--on soil where extensive shrinkage is expected--as on clay lands. The top of the mound is levelled off to encourage collection and retention of moisture and also to hasten weathering of the mound. The mound should be made about 3 months before anticipated planting. As a general rule the more impervious the soil, the larger the mound and the longer the weathering time needed.

(The use of mounds is strongly recommended for young avocado plants. Many orchards of avocado established on clay soils without use of mounds have been destroyed by Phytophtora root rot.")

PLANTING

Since irrigation in fruit-tree culture is not practiced in the Region, planting must be carried out at the beginning of the rainy season, holes (and mounds) having been made the previous dry season. The size of holes is not too important--providing the soil is permeable. It is not worth the trouble (and cost) of making them bigger than is necessary to accommodate the roots of the planting material.

It is advisable to incorporate compost or well-rotted manure or a slow release fertilizer, with the soil in the planting hole. Most growers prefer to use only organic materials in the hole and begin fertilizing after a few weeks to avoid any possible burning of roots. On certain soils which are very low in phosphate, e.g. bauxitic soils of Jamaica--it is advantageous to add rock-phosphate to the planting hole. On very sandy soils--low in most nutrients addition of manure or slow-release fertilizer to the planting hole is recommended.

Not much care is normally given to newly set plants. They require several months up to a year or more to become fully established. During this time they are very vulnerable to drying out, pest attacks, sun or wind damages. Frequent inspection and prompt treatment of disease or insect attacks will reduce initial loss of plants--which should be less than 5% under good management. Values of up to 20 to 30% mortality are probably the norm in the Region.

Planting Distances

Plant density and spacing depend very much on the nature of the crop--thus a mango needs more shade than an orange tree, and a pineapple

plant can do with far less space than a banana. Soil and climate have to be considered too--where water and nutrients are in short supply, more root space per tree is necessary. Trees with terminal inflorescences must not be crowded. Some trees are sun-lovers, other tolerate or even need shade.

There has been a tendency to closer planting in the Region during the last 2 decades. Rising rates of interest on capital necessitate higher and earlier yields. However, use of increased planting densities means that the life cycle of the trees will be shortened. The choice between wide and close spacing often depends on the inclination and intensions of the grower, or his willingness to meet operational problems and whether the planting is to be a short- or long-term venture. It may be a compromise between the ideal and the feasible.

Most of the new-close spacings for tree crops being used in the Caribbean were adopted from Florida--where growing conditions are quite different from in the West Indies. In the case of citrus, a few growers in Jamaica have attempted to use the system of double or hedgerow planting--(10 x 20)--not with much success. On more fertile soils and more humid conditions tree growth is quite rapid--resulting in rapid overcrowding in the young orchards. The grower is thus faced with regular pruning or early removal of half the trees in each row--this loss of revenue thus defeats the overall advantage of the technique!!

Mango Trees

Fruit produciton on mango trees is mostly on the outside of the canopy of branches. When side branches of adjacent trees meet due to overcrowding there is a tendency to produce fewer fruits which are apt to be poorly coloured and infected with anthracnose. Overcrowding not only creates conditions more favourable for disease, but increases the difficulty of spraying thoroughly.

Planting distances of 35 ft are necessary to prevent overcrowding. For semi-dwarf varieties such as "Julie", distances of 25 to 30 ft are possible.

Planting Pattern

Planting is normally done on the square unless there are good reasons for deviating from this system. Trees with lateral inflorescences such as citrus and avocado can just as well be set out in a rectangular pattern of 6 x 8 m, as 7 x 7 m--the former will give more room for manoeuvering between rows and for intercropping during the early years.

SELECTION, IMPROVEMENT AND MULTIPLICATION OF TREE CROP VARIETIES

It is generally accepted by agriculturists throughout the Region that the major constraint in the development of tree crop industry is the non-existence of locally improved cultivars of each crop for propagating purposes.

The abundance in which these fruit crops occur in the various territories is often a handicap to their economic development. Thus we find that with few exceptions (citrus, mango, avocado) there is a tendency to refer to these fruits by crop, not by variety within a crop. It if of great importance that early attention be given to vegetative propagation of the best cultivars of each fruit-crop for commercial planting, and at the same time to cultivar description.

Possibilities for Improvement

Because of the existence of polyembryory (many seedlings from one seed), in some tree fruits, it is possible to grow uniform populations of pomerac, by carefully selecting out seedlings of exactly similar appearance (as is done in the Citrus Nucellar Program). Individual plants subsequently selected for particular qualities can then be reproduced and multiplied vegetatively, with reasonable expectations of preserving their characteristics.

For each fruit crop, there is a need for assortment and selection of types, followed by improvement and multiplication of types that appeal to the markets--the ideal being kept constantly in mind. Capacity of high yield, superior quality and disease resistance are frequently the main criteria for selection of improvement. These can be "fixed" in a population, by adopting procedures for vegetative propagation in the multiplication process. Devising improved methods of vegetative propagation should be an important aim of future investigations.

Propagation

Throughout the Caribbean most tree crops are still being produced in Government nurseries--mostly by use of seeds. Only in a few tree crops is propagation being done using vegetative means.

With the possible exception of mango steen and sugar apple, propagation by seeds usually results in much variability in the marketed produce. As mentioned before, vegetative propagation is not possible for most Caribbean tree crops, due to the absence of local sources of known identifiable propagating material for most tree crops. In addition,

very little is known about the methods of propagation, rootstock-scion compatibility, growth habit and vigour, field spacing, etc., for the various tree crops.

It is thus clear that much research is needed in the Region on the selection, improvement and multiplication of most tree crop varieties as well as on the most effective methods of vegetative propagation.

For some fruit crops such as citrus, mangoes and avocadoes, numerous varieties and cultivars have been introduced into the Region and many have been successfully grown, and techniques for their multiplication present no problem.

Use of Seeds

As mentioned already, very few tree crops can be safely reproduced by using seeds because of the resulting variation in vigour, disease resistance and fruit qualities. By and large, vegetative propagation is the only safe method for developing and perpetrating the desired characteristics of a clone or variety. Budding and grafting are by far the most common methods of vegetative propagation used in tree crops.

Use of Rootstocks

Unfortunately in the Caribbean very little work has been done on the best rootstocks to be used in propagating local tree crops--and most nurseries will utilize whatever seeds they can obtain in quantity. This has resulted in many problems in the Caribbean fruit tree industry.

Experience in citrus production has shown that no tree crop industry can be built successfully by simply imported technology, e.g. rootstock developed for Florida and California are invariably of limited use in the Caribbean.

Developing rootstocks for any tree crop is a long-term venture--usually requiring in excess of 10 years research. Limited work on citrus rootstocks was started in the Region during the early Sixties--this was unfortunately terminated in the early Seventies. The result is that there is still no ideal rootstock for citrus in the Region--despite the prevalence of Sour Orange!

Development of virus-free top-quality scion material for the various tree crops has also never been seriously undertaken. Some attempts were made to do this for citrus, but as in the case of rootstocks, these investigations were prematurely aborted.

Many individual growers have attempted to "do their own thing" by illegally bringing in planting material and rootstock seeds from

other countries--but quite unknowingly they could introduce viruses, fungus spores or insect pests into the area with possible devastating effects. As an example, the Region is currently faced with the possible introduction of one of the most virulent banana diseases--the BLACK SIGATOKA--which has already been identified in Belize and Martinique. If this disease spreads in the Windward Islands, it could wipe out the entire banana industry. Careless movement of plant material from territory to territory could facilitate this spread of Black Sigatoka.

A similar case if point is the Coffee Berry Borer, which has recently been found in Jamaica--causing great losses to the coffee industry.

For citrus there are fears that the dreaded TRISTEZA VIRUS could be introduced into the Region, possibly from South America. What is the most disturbing is the fact that the very popular citrus-rootstock-sour orange is one of the most susceptible rootstocks to Tristeza virus. There is an urgent need to tighten plant regulations as they relate to the movement of planting material within the Region!!!

SOIL MANAGEMENT

The level of soil management in established tree-crop orchards is very low, resulting in much erosion losses and destruction of soil structure. For most tree crops it normally takes several years after planting before trees form extensive canopies that can provide adequate protection to the soil. Proper weed control, judicious use of intercrops and permanent cover-crops are the major aspects of soil management.

Weed Control

Weeds compete with crops for light, water and nutrients, so most growers try to get rid of them. However, in the wet tropics, excessive chemical weed control can be hazardous as a clear bare surface will lead to loss of organic matter and to erosion--even on flat land.

Cultivation with ploughs, discs, harrows and other implements is also not advisable in tree fruit farming, except just before planting. Intercropping between the rows of trees with annual cash crops provides good cover, suppresses weeds, and can improve soil fertility, if legumes are grown.

Manual Weed Control

Where labour costs are not too high weeds should be cutlassed periodically--as the cut weeds are left in place, it results in a form

of mulching. Three forms of cutlassing are recognized in tree crop orchards: (i) short-weeding (close to the ground) (ii) round-weeding (around trees), and (iii) long weeding (to a height of 15 cm). Short and round weeding cause much erosion - long weeding does not - in addition it is much cheaper! Long weeding thus results in reduced erosion, better soil structure and lower costs.

Other methods of weed control involve using mowing-machines such as tractor-drawn rotary mowers which cut a swath 2 m wide. Regular mowing favours the grasses and a sort of lawn will develop in the orchard. But although this method reduces erosion, the disadvantage is the resulting compaction of the soil.

However, some amount of chemical weed control must be done. A compromise is usually achieved - combining chemical sprays in strips along the tree rows with machine mowing between the rows. Ditches can be kept clean with "total" weed-killers.

Soil Conservation

Since most tree crops in the Region are established on hillsides and sloping lands - control of soil erosion is a challenge facing all tree-crop farmers. Very steep slopes should be left under forest or permanent pasture, gentle slopes may be used for fruit trees and other crops which provide some protection to the soil. Soil conserving methods include contour planting of trees, cover crops, terraces and silt pits. An experiment was carried out in Taiwan with bananas planted on a 24% slope, on a clay loam soil - clean cultivation, terracing, vegetative barriers, a cover crop and mulching were compared. Erosion losses were 400 times less using cover crop or mulching than with clean cultivation! In addition yields were lowest in clean cultivated plots.

In 1980, I was brought in by Alcan Jamaica Ltd., to advise on the continued poor performance of their citrus - in particular ortaniques. Alcan's 200 acres of ortaniques are located in the rolling limestone hills of Manchester in Central Jamaica - on moderately deep, yellow-bauxitic soils. After extensive investigations it became clear that years of using KARMEX weedicide had left the soil surface almost bare during the rainy season. Massive erosion resulted - and today the trees are growing on the acid sterile sub-soil. All sorts of nutritional deficiencies abound - notably Ca, K and P.

Irrigation

Although most tropical fruit tree crops (e.g. citrus, mango and cashew) need 2 or more dry months for proper blooming and fruiting, in many areas in the Caribbean rainfall is not well distributed to meet tree-crop needs, and periods of seasonal deficit occur. In a

citrus crop, it is the fruit, not leaves, that should be checked to determine the need for irrigation, as the leaves draw water from the fruits.

Before installing irrigation facilities, data on climate and hydrology of the region should be obtained and analyzed. In addition the social and economic aspects have to be considered.

Two common types of irrigation are commonly used in tree-crop orchards:- by gravity and under pressure.

Gravity irrigation (furrow, basin flooding or border method) is very useful on land with a gentle slope and smooth topography. Capital investment is low but labour costs are high.

Irrigation by pressure (sprinkler, rain guns or drip) involves higher capital costs and lower labour. In drip irrigation - water is applied under low pressure to the root zone only; water saving is achieved and weed growth around the tree is reduced.

PRUNING, HEDGING & RESUSCITATING FRUIT TREES

As mentioned before, many farmers are making use of the system of close planting or hedgerow planting - whereby the closely planted trees are pruned mechanically every year on either the left, right or top of the row. The pruned one-third of the tree will not bear much fruit for one year but will make up for it in subsequent years. Picking costs are reduced in this system as the trees remain relatively small. This hedgerow system, although very popular in citrus cultivation in Florida, is not too appropriate for the Caribbean because of the high capital costs for hedging equipment. In addition, our orchard sizes are too small to warrant use of such expensive equipment - and the terrain on which most orchards are situated is not conducive to the use of mechanical equipment!

Resuscitation or "Rejuvenation" Pruning

Many citrus orchards in the Caribbean are in a debilitated and "run-down" condition. Numerous reasons can account for this: (a) old-age of most orchards, (b) poor crop returns, (c) high incidence of pests, (d) extended periods of drought, etc. In Jamaica it is estimated that about 40% of the citrus acreage is in need of resuscitation.

Rejuvenation pruning can bring trees in decline back into production. The tree is severely cut back, so that dormant buds can develop, the best-placed branches being retained. "Hat-racking" is

a term used for very severe pruning. It is often necessary to protect the stem against bright sunlight by whitewashing.

Many citrus orchards in Trinidad are also in an advanced state of decline. Resuscitation could perhaps bring back some of these orchards into production if the trees are not too old. The alternative is to plough-out the old trees and replant.

Hedging and Pruning

The basic purpose of pruning is to establish a balance between vegetative growth and fruit bearing. A certain minimum leaf area has to be maintained for optimum fruit production. But, too dense a canopy will shade lower leaves and reduce fruit production, as well as increase the incidence of diseases!

Some trees need more pruning than others. Grapefruit trees, for example, need much less pruning than lemon, orange or mandarins. Lemon trees produce very much foliage - and need regular pruning. In general trees with terminal inflorescences such as mango and cashew may profit from regular pruning - as this allows for closer spacing.

Basically, 3 types of pruning are recognized:- Frame, Maintenance and Rejuvenation pruning.

Frame - A framework is best formed in the nursery consisting of a single stem split up in 4 main branches - each occupying a sector. A similar division of space takes place with the second and third order branches. However, fruit trees should not be forced into a growth pattern that is foreign to them.

Maintenance pruning aims at the preservation of the status quo. Some growers remove only "water sprouts" which arise from dormant buds on older wood. But often water sprouts grow into full sunlight, lose their wild habit and start to behave like other branches. There is often no need to remove them unless they grow straight up or obliquely through the tree.

Intercropping

Intercropping in tree-crop orchards should not be done for more than 2 to 3 years after planting - the exact time depending on the kind of tree crop being grown.

Intercropping is important in that the revenue from this activity can pay for the early maintenance expenses for the main tree crop. In addition, the inter-row tillage can be of benefit to the young trees.

There are certain important rules which must be followed:

(i) within the first 6 months, the inter-crop should not be planted closer than one meter from the main trees;

(ii) the distance of intercropping from the base of the mound should be progressively increased at each planting of the inter-crop, and

(iii) permanent or semi-permanent crops (such as bananas) which grow to a greater height than the man tree crop, should not be planted.

In some highland areas yams may be planted providing the yams are adequately mulched and fertilized and that the yam rows run from East to West, to allow trees the maximum sunlight. If after 3 years, there is still sufficient space between rows to encourage inter-cropping - it is a sign of poor tree crop husbandry and continuation of inter-cropping will only serve to aggravate the already poor development of the main tree-crop.

CROP PROTECTION

We begin with a few definitions. The term crop protection here used to comprise all activities, agronomic and legal - to protect crops against injury. Injury is every change leading to lower quality of product - damage results from injury and loss is the social and economic result.

Causes of injury are of 2 kinds:

(a) biotic (living) - fungi, bacteria, viruses, mycoplaora, insects, mites, nematodes, birds, snails, rats, weeds, etc.

(b) abiotic (non-living) - drought, flooding, deficiency or excess of nutrients, salinity and chemical burns, e.g. weedicides.

Pathogens - biotic causes of injury called PATHOGENS.

It is impossible, and would cost too much, to keep tree crops free from pathogens. Control measures only become justified above a certain level of pest population. The "economic threshold" differs very widely, depending on pathogen, crop, prices, and econological conditions - thus the whole ecosystem must be considered before control measures should be undertaken.

Control

Methods of control of diseases and pests (pathogens) comprise:

1. legislation - quarantine laws.
2. sanitation - eradication, disinfection, rotation.
3. resistance - use of resistant or tolerant cultivars.
4. mechanical means - handpicking, banding.
5. biological means - predators, parasites.
6. chemical means - spraying, dusting.
7. integration - a combination of methods.

Sanitation - citrus canker was twice eradicated in Florida by strict sanitation - millions of plants and trees were destroyed.

In Israel, Tristeza virus is kept under control by destroying every infected tree.

Mechanical means - warranted when damage is clearly visible and hiding places of pests not hard to find, e.g. caterpillars, ants, bees and wasps. Bagging of young sour-sop fruits in muslin is recommended as a control method against certain insects.

Biological means - utilizes predators and parasites - either locally present or deliberately introduced.

Chemical methods - it would be impossible to grow fruits without the use of chemicals, which are relatively cheap and easily applied. But they have disadvantages:

(a) phytotoxicity - the substance is toxic to the host plant.

(b) drift - the chemical gets onto the wrong crop, or into a canal where it kills fish.

(c) residue - the chemical remains on the fruit in unsafe quantities.

(d) accumulation - the chemical accumulates in chains (man, birds of prey).

(e) pollution of air, soil and water.

(f) resistance - when ever increasing quantities of a chemical are needed to kill a pathogen.

Alternatives to Pesticides

By their very nature, pesticides are toxic - they are developed to kill insects, bacteria, fungi, weeds, and a host of other organisms.

Those who speak out against continued use of pesticides point to a large number of alternate methods for pest control such as biological control methods, cultivation for weed control, sanitation, crop rotation, companion planting, etc. There is no doubt that these do assist in pest control but by themselves they are seldom the answer--they are not dependable.

Integrated pest management (I.P.M.) is a most useful approach to controlling pests. This concept states that in order to achieve a maximum yield of high quality crop, it is not necessary to get 100% control of all pests, but rather keeping pest populations below levels where they will cause economic damage. I.P.M. advocates use of non-chemical methods as much as possible, but experience has shown that without pesticides, the other methods of pest control will not provide adequate protection.

At the present time in the Caribbean fruit producers have little alternative but to rely heavily on pesticides, as the other alternative control methods have not been developed.

Application of Pesticides

Fungicides and insecticides are by far the 2 most widely used pesticides in tree-crop production in the Region. For optimum results, they must be applied at the correct time - as it is crucial to know when to spray. Those of you who are well acquainted with the pattern of fruit-set in a crop such as citrus or mango, will know the problems of trying to produce clean fruits! The numerous periods of flowering and fruit-set mitigates against effective spraying programs.

In addition adequate spray coverage is almost impossible due to the inaccessible nature of the terrain and the height of the trees. Some tree crops such as citrus, cherry, and grafted mango and avocado, normally present little problems for spraying. But seedling mangoes, cashew, and avocadoes cannot be adequately sprayed with knapsack or motorized mist blowers commonly used by small farmers in the Region.

Fertilizer Needs of Trees

Sizeable amounts of nutrients are removed from the soil when fruit crops are grown. For example, 20 tonnes of bananas remove 80 kg N, 8 kg P and 200 kg K.

The grower has to watch his crops constantly and look for signs of nutrient deficiency or even excess. Symptoms vary widely among nutrients and between crops.

Usually a lack of Nitrogen is shown by a light green color of the leaves.

Potasium deficiency is recognized by a marginal leaf scorch and Magnesium by a loss of chlorophyl - often in a distinct V-shaped pattern as in citrus and sugar-apple.

Leaves low in Iron show a very fine network of green veins against a lighter background.

Zinc deficiency - narrow leaves with yellowish bands between the veins.

Manganese - similar symptoms to zinc, but with normal leaves - also there are usually light green bands between the veins.

Symptoms of Boron, Copper, Sulfur and Molybdenum are rare in the West Indies.

Calcium deficiency is fairly common on acid soils - but there are no reliable leaf symptoms for tree-crops.

Since the Seventies, the prices of most fertilizers have more than tripled in the Caribbean - due to the energy crisis. As prices will continue to increase, we should give preference to using natural or organic fertilizers whenever possible. Although the mineral content of farmyard manure is rather low (0.45% N, 0.2% P, 0.4% K) - it has beneficial effect on the soil, promotes microbial processes, improves soil structure, aeration and water holding capacity. An application of 20 tons/ha/year supplies 90 kg N, 40 kg P and 80 kg K.

Green manure crops for mulching and cover crops are not widely used in tree-crops in the Region. Cover crops differ from green manures in not being ploughed under. Various leguminous cover crops, e.g. kudzu, have been tried in the Caribbean - but with little success. Many of these cover crops are too vigorous and tend to climb and smother the main trees. In addition they compete for water in the dry season and might even become a fire hazard. Where the dry season lasts for a long time, it is undesirable to maintain a permanent cover crop.

root crops backward from the Mature stage to the Embryonic stage along the production life cycle.

Consumption Patterns

Regional consumption of fruits and vegetables are expected to rise by about 30 per cent over all by the year 1985. A recent study done by the Inter-American Development Bank for Barbados shows that domestic vegetables requirements (including onions) are expected to rise by 55% by 1990 (93 lbs per capita/year) due to rising incomes, changes in diet, and increased tourist requirements.

For the Eastern Caribbean, present consumption is estimated at 287,000 M.T. per year, which in 1985 is expected to grow by almost 30 per cent to 372,000 M.T. an addition of 85,000 M.T. As market volumes are grossly estimated at about 60% of total consumption, at least an additional 50,000 M.T. of produce will be marketed over the next three (3) years which will be an additional burden to the already strained marketing system.

Special attention needs to be paid to:

(a) off season production during the months of July - December;
(b) production and marketing intelligence systems;
(c) improved private sector (especially hucksters/higgler trade) marketing infrastructure; and services;
(d) reorganization and/or redefination of marketing management and the role of Government marketing organizations.

Table 3.--Fruits and vegetables consumption perspectives in the Eastern Caribbean (000 MT)

	Consumption Estimates 1/		
	1980	1985	% Increase
Major Markets			
Trinidad and Tobago	107.4	154.7	44.0
Barbados	22.8	32.2	41.2
Martinique	44.4	49.3	11.0
Guadeloupe	45.9	52.0	15.7
	220.5	288.2	30.7
Lesser Markets			
Grenada	12.9	15.5	20.1
St. Vincent	14.2	18.5	30.3
St. Lucia	14.1	18.4	30.5
Dominica	9.9	12.4	25.2
Antigua	9.0	11.4	26.7
St. Kitts/Nevis	5.3	6.3	18.9

1/ Preliminary indicative estimates.