
A Guide To Growing Bananas On Guam

Brian T. Scully
Horticulturist

Robert Bevacqua
Agricultural Extension Agent

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*Wilfred P. Leon Guerrero, Director
Jose T. Barcinas, Associate Director
Cooperative Extension Service
College of Agriculture and Life Sciences
University of Guam*

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Foreword

Bananas (*Musa spp.*) have been a traditionally important crop on Guam. In recent years, production has fallen primarily due to the introduction of serious pests from overseas. Bunchy top disease, in particular, is a threat to the island's plantings. The goal of this publication is to provide the technical information for reviving production. The publication stresses the importance of pest prevention and good field management. The information has been drawn from other areas of the Pacific and Asia, and has been adapted to meet the growing conditions of Guam.

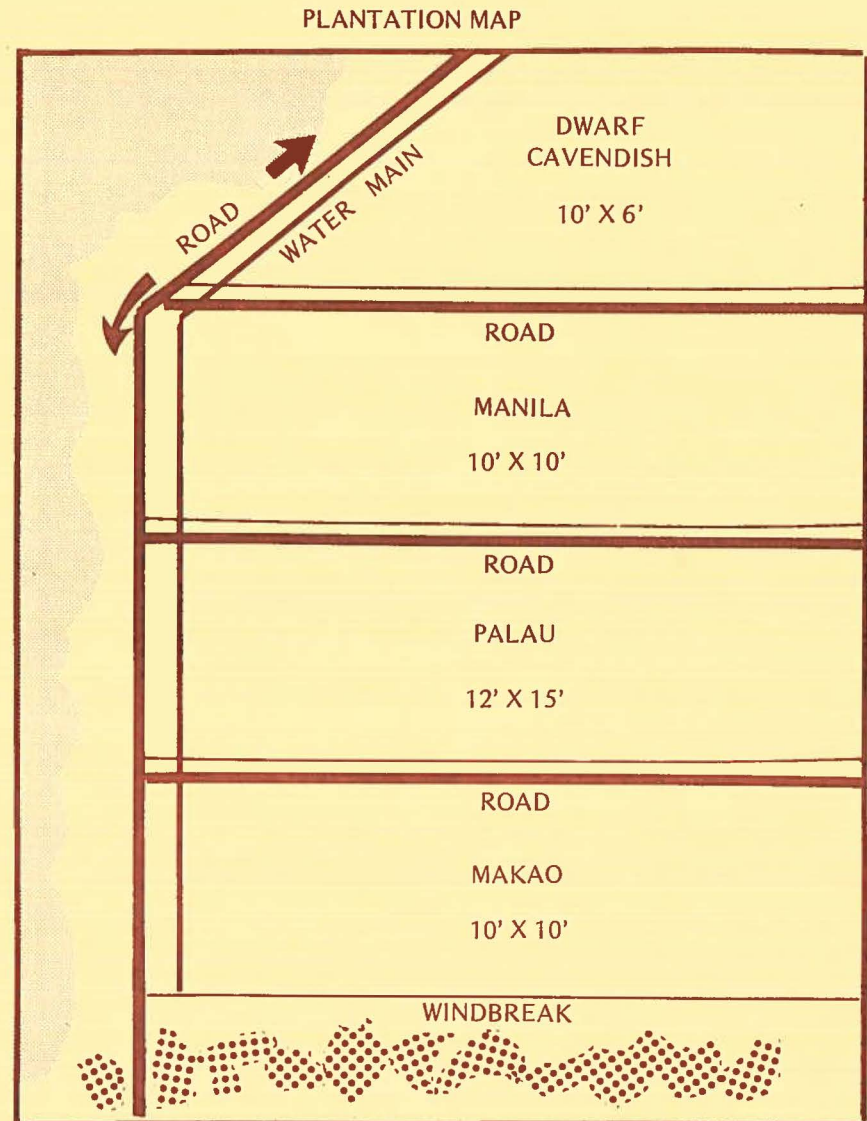
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Site Selection

The banana is a large tree-like herb native to the tropical regions of Asia and Africa, but is now grown throughout the tropics. Its commercial cultivation is confined to areas where a continuously warm, moist climate prevails. Temperatures on Guam are ideal for banana production, however, moisture deficiencies may exist. From November to April extended periods of dry weather may necessitate the need for irrigation. Between 1 and 2 inches of rain per week is considered optimum.

The best soils for production are the well drained, deep, loamy soils of the flat lands. Because bananas are very sensitive to waterlogged soil conditions, it is important that a site with well drained soil be selected. However, poorly drained soils can be made suitable for production through proper management and cultivation. A wide range of pH values are acceptable for production, but 6.0-7.0 is preferred.

Another consideration when selecting a planting site is that of windbreaks. Winds of 60 mph can knock plants over, and sustained winds of 25-30 mph can cause severe leaf tearing. It is essential that shelter be provided if it does not exist. Bamboo (*Bambusa spp.*), eucalyptus (*Eucalyptus spp.*), and certain varieties of tangantangan (*Leucaena spp.*) provide excellent protection from the wind when belt planted around a plantation.



Land Preparation

Land preparation includes land clearing, site preparation, and soil preparation. If new land or land that has become overgrown with vegetation is to be planted, then the first task of the grower is to remove the unwanted vegetation. A bulldozer is best for clearing away tall brush. However, growers should insure that the topsoil is not dozed away with the vegetation. Steeply sloping land with clay soils should not be cleared because it is very susceptible to erosion, and bulldozers should not be allowed to operate on a soil that is wet because this compacts the soil and may reduce yields.

Site preparation and soil preparation activities usually occur simultaneously and normally follow land clearing activities, but this depends on each individual's management program. An example of an activities schedule is provided in Appendix I.

Site preparation is the improvement of the land with fences, sheds, irrigation systems, and roads. A map should be drawn showing the layout and plan for the plantation, including all permanent improvements to the property (see plantation map). The purpose of site preparation is to insure that all support systems for the plantation are close at hand and easily accessible. This is especially true with access roads and the water systems which are crucial to a successful plantation.

Soil preparation is very important during the planning and establishment phase of plantation development. The particular soil treatments and kinds of plowings selected are dependent on the previous history of the land. Newly cleared land may be prepared with one deep plowing, two discings, and one harrowing. Soils that have been compacted, or have impeded drainage should be ripped to break up hard pans or plow pans, thus allowing better water infiltration. If a field has been previously planted with bananas, it may be worthwhile to have the soil checked for nematodes and Panama wilt. If nematodes are a serious problem, a preplant application of granular nematicides should prove effective, and may easily be applied prior to one of the discings. After the soil is ready for plantings, tags should be placed where plants are to be set.

Propagation Material

Most types of bananas grown on Guam do not produce seed, therefore, the young plants which develop from the corm of the parent plant are used as propagation material. The corm is the underground portion of the stem of the plant. There are two different kinds of young plants: sword suckers and broad-leaf suckers which develop in established banana mats. A mat is a clump of plants.

The sword suckers are considered the best type of planting material because they bear earlier and tend to carry a heavier crop. They may be recognized by the long, narrow, bladed leaves which have the appearance of a sword. When selecting sword suckers for planting it is advisable that they meet the following criteria:

- a) The stem should be 5'' wide at the base.
- b) The suckers should not be older than six months.
- c) Suckers should arise deep on the parent corm.
- d) Sword suckers are best if the tapered leaves persist till the plant is 2' or more tall.
- e) Suckers should be selected from disease free mats; particularly free of bunchy top.

Suckers that are larger than mentioned above will tend to give lower yields. Broad-leaf suckers, water suckers or peepers as they are sometimes called, usually lack vigor and are slower to bear. Other planting materials include: maidens, which are large, young plants older than six months that have not produced a bunch; and bullheads which are plants that have already flowered. With maidens and bullheads, usually only the trimmed corm is planted; the bullheads may be divided to obtain more planting material. There should be at least one good bud on each corm or on the section of corm being planted.

When collecting planting material, only those shoots

arising from mature vigorous mats that are apparently free from diseases and pests should be selected, and in accordance with the criteria set for sword suckers. Also, suckers should be selected away from the plant that is carrying fruit so as not to damage roots and hinder bunch development.

When digging the sword suckers, a mattock and facinos are useful tools. The roots of the sucker should be cut and the soil loosened around the corm; this allows for removal of the corm with minimum damage to the mat and the desired sucker. The separating cut should be made where the sucker corm joins the mother corm. The sucker is freed by gently pulling the banana seedling while lifting with the mattock. It is important to take all the corm that has developed on the sucker as this will provide needed food for the new plant. All tools should be cleaned with kerosene or diesel oil after lifting each sucker; this prevents the spread of diseases.

After the planting material has been dug it should be removed from the plantation for trimming. The roots and soil should be trimmed off until the white portion of the corm is visible. All red or discolored spots should be gouged out because these are sites where weevils and nematodes may be feeding. Seriously discolored or rotten corms should be discarded. The stem is then cut 2-3'' above the corm and 2 layers of outer leaf sheaths are removed. The seed corms are then allowed to air dry a few days. The finished corm should weigh 2-3 lbs.

This process of trimming is not traditionally performed on Guam, but if followed will result in a more uniform plantation with reduced disease and pest problems.

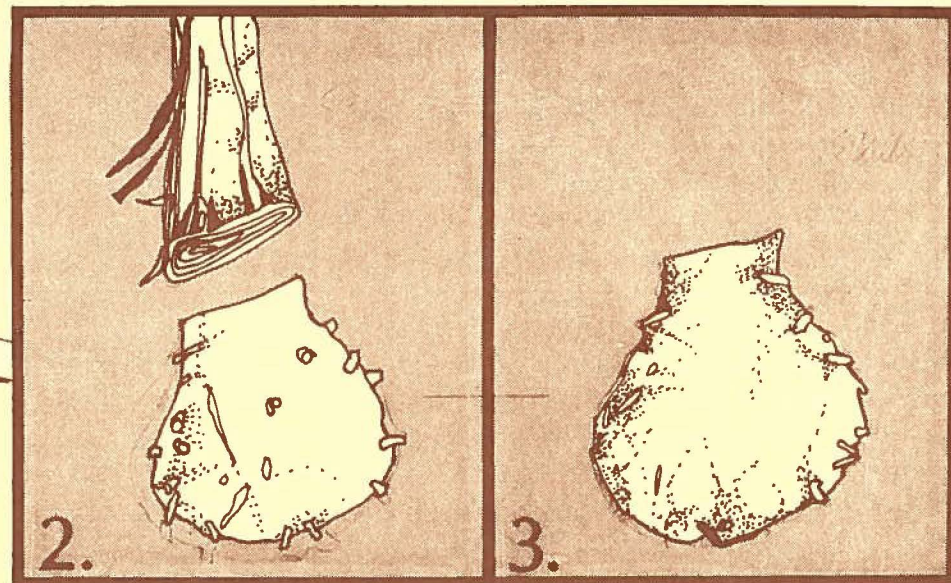


Fig. 1. In preparing a seed corm: (1) Select a healthy sword sucker; (2) Remove the roots and trim the corm till the clean white tissue is exposed. Cut off the pseudostem 2-3" above the corm; (3) The prepared seed corm should weigh 2-3 lbs. Allow to air dry for several days before planting.

Planting

Prior to planting it is important to thoroughly disinfect the planting material. This is done to prevent the introduction of parasites into the field. This disinfection process can be accomplished by a number of methods:

- a) Dipping the planting material in hot water at 122°F-130°F for 10 minutes.
- b) Dip the corms in a formaldehyde or chlorox solution.
- c) Other methods include dipping the corms in a mud slurry with various pesticides.

After the seed corms have been treated they should be set out to allow drying. If this procedure of seed treatment cannot be performed it is suggested that growers pare and trim the corms, being sure to remove all dead or discolored tissue, then allow the material to air dry before planting. After treatment, the corms should be sorted into categories of equal size for planting. Disinfected corms should be sorted into categories of equal size for planting. Disinfected corms should be kept well away from those not yet treated. By following this procedure growers will prevent the introduction of diseases and pests into their planting stock and plantations.

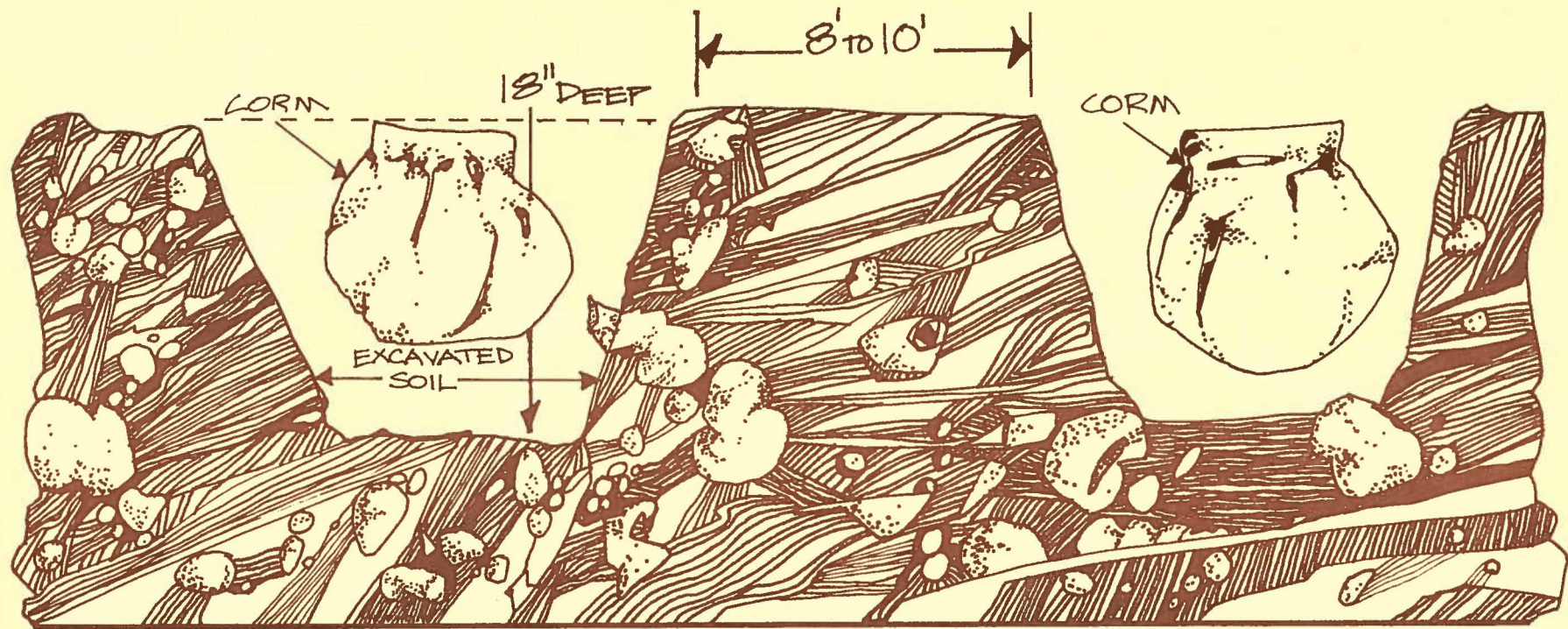
The hole where the seed corm is to be planted should be 18" deep and 18" wide. This is as deep as the length of the arm from elbow to fingertip. The bottom portion should be filled with a mixture of compost, chicken manure, one lb. of 10:20:20 fertilizer and soil. The seed corm is placed in the hole and soil is packed tightly around the corm. Be sure the bud or sucker is pointing upward. The corm should be completely covered with soil to prevent weevils from laying eggs in it. Insure that the soil is replaced to the original level. Within a month shoots should begin to emerge. If more than one emerges only the stronger should be allowed to continue; the rest removed. Replanting may take place in 6-7 weeks after planting.



Various spacings are used in banana plantings. Variety, location, and machinery all affect the spacing selected. 8' x 12', 8' x 10', 10' x 10' and 10' x 12' are the more common spacings used, and result in about 400-600 mats per acre. More than 700 mats per acre will result in lower bunch weight and a longer fruit maturation period.

Bananas may be planted at any time during the year. It

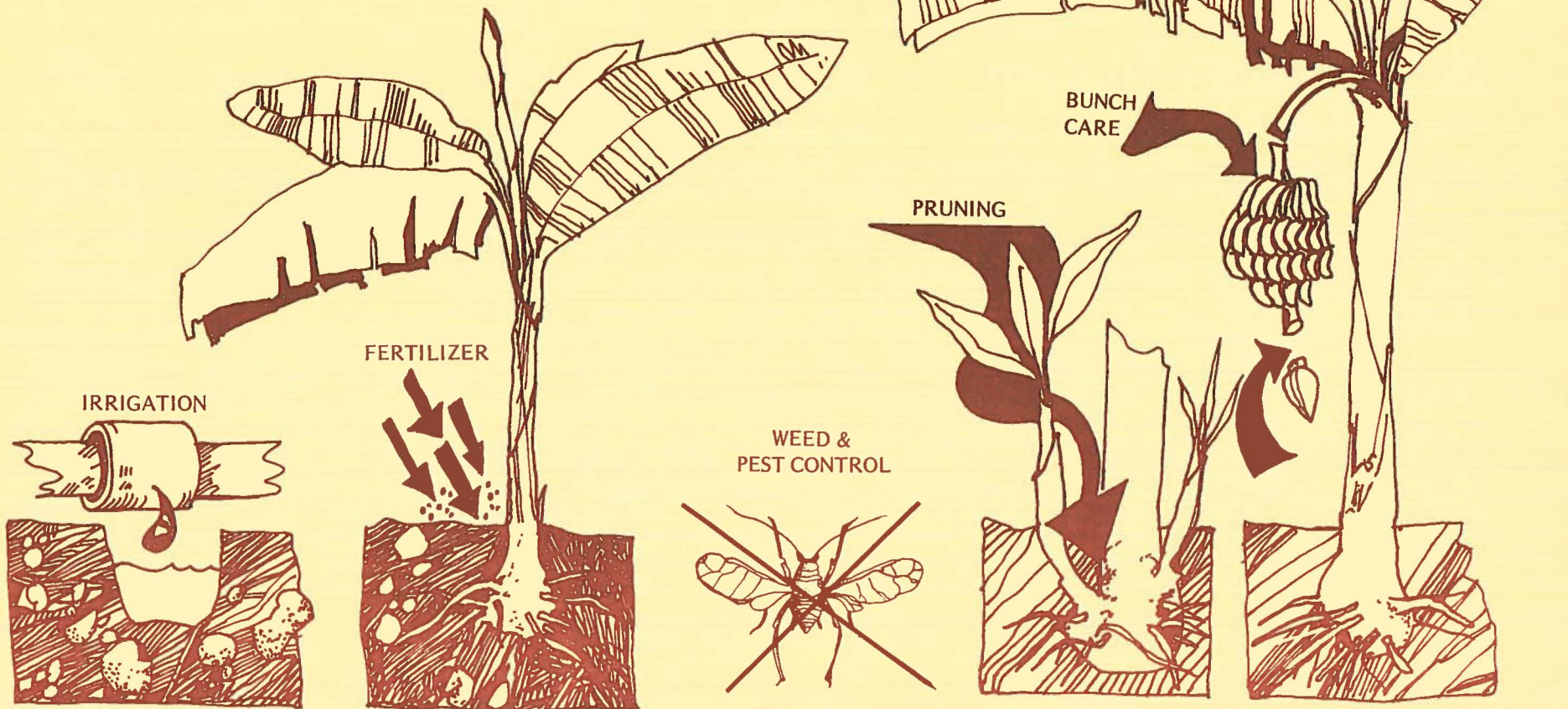
will be just over a year before the first crop may be harvested. Experienced growers can predict the harvest date of their crop and thus schedule their plantings to accommodate particular markets. This is an important consideration when market prices are fluctuating greatly. The plantation site, management and the variety grown will also affect the time needed for the crop to mature.

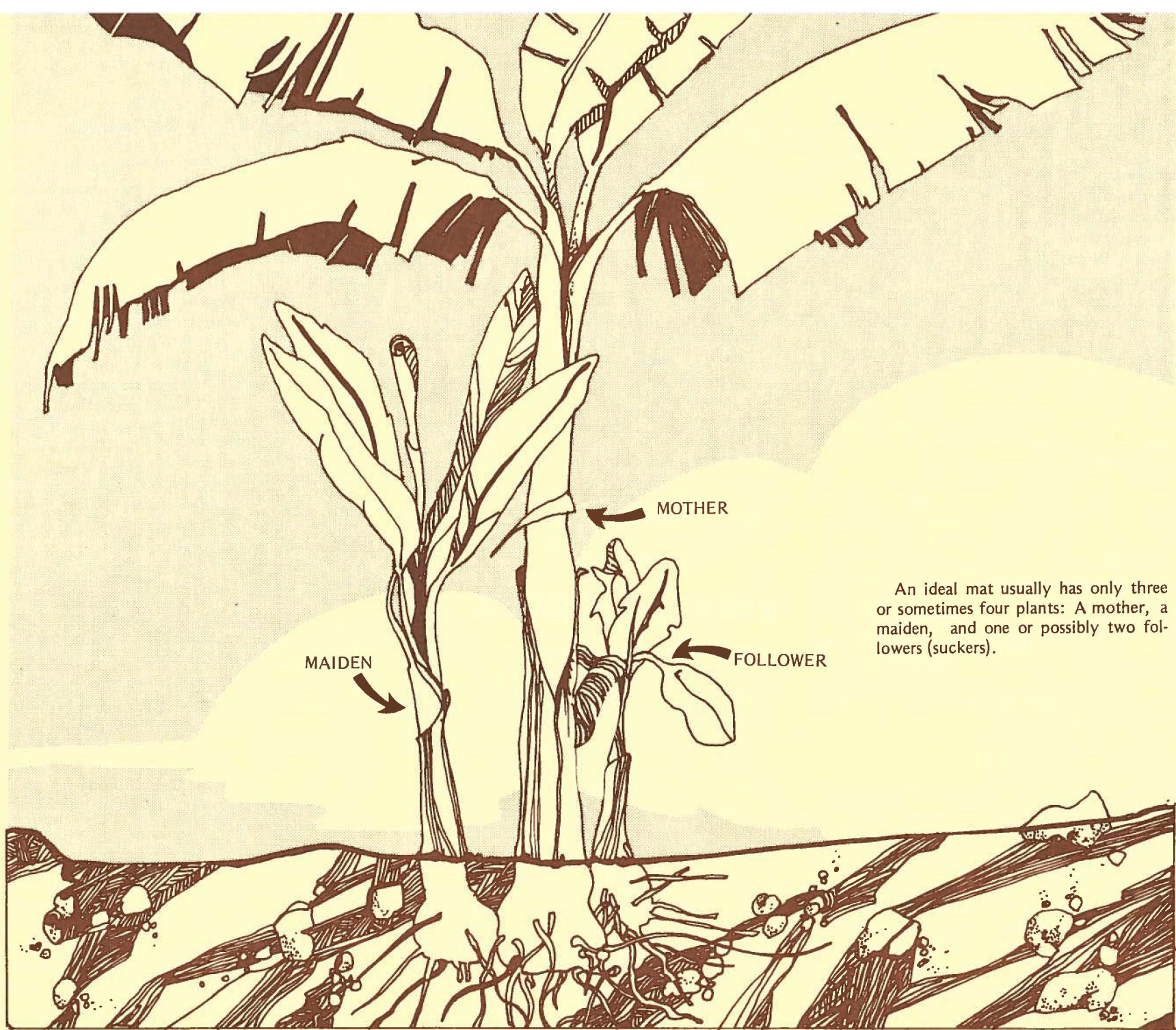


The prepared corm is planted in an 18" deep hole. One pound of commercial fertilizer, such as 10:20:20, and ten pounds of dried chicken manure should be mixed into the excavated soil.

Plantation Management

After the crop has been planted a variety of activities must be performed in order to insure a successful plantation. Activities such as irrigation, weed control, fertilization, pruning, crop protection and pre-harvest bunch care are all important aspects to be considered. Growers should attempt to prepare a schedule of activities that will be conducted over the production period. Although it is sometimes difficult to precisely schedule work activities, a general format should be outlined and adhered to. An example of a schedule is attached as Appendix 1.





An ideal mat usually has only three or sometimes four plants: A mother, a maiden, and one or possibly two followers (suckers).

Irrigation

With dry season lasting up to six months it is essential that irrigation be provided for that part of the year. The system should be designed, constructed, installed and functional prior to planting. No particular system is best; what is satisfactory for one grower may not be for another. It is important that a system be designed in response to the various factors affecting production. These include soil type, shape of the land, water quality, water availability, labor and budget. Drip irrigation, drag lines, travelling sprinklers, basin and furrow irrigation techniques all have their merits and disadvantages (Appendix 2).

The determination of when to water and how much water to apply is important. The age of the crop, the irrigation system used, the permeability of the soil and the prevailing weather conditions all affect irrigation timing. Usually when the rainfall is below 1-2 inches per week irrigation is needed. Currently available on the market are instruments which can be placed in the soil to determine the quantity of available moisture. Tensiometers, soil moisture blocks and portable field meters are just a few such instruments which can assist the grower in determining the irrigation needs of a particular crop.

Fertilizers

The banana is a fast growing plant which quickly yields a heavy crop and because of this, it requires repeated applications of fertilizers. Fertilizer rates should be based on soil or tissue analysis. If this information is not available then a general rule of thumb is: 2 lbs. of complete fertilizer per mat applied every 2 or 3 months. Because bananas require large quantities of potassium, fertilizers such as 10-5-22 or 10-20-20 which are high in potassium are best. On Guam, soil micronutrients are often in short supply and must be additionally supplied through the use of manures or foliar

sprays containing micronutrients.

The fertilization of new plantings has been outlined in the previous section. The first application of fertilizers using the above scheme may be initiated two or three months after planting and should continue through flowering and throughout all ratoons. Ratoons are subsequent crops from the same mat.

The merits of an organic fertilizer program should not be overlooked. On Guam chicken manure is widely used and is presently the only organic fertilizer available in quantity. Organic fertilizers improve soil structure and water holding capacity in addition to supplying needed nutrients. Organic fertilizers are an excellent source or nearly all the essential elements for plant growth, but sometimes the quantity of a nutrient is insufficient. In order to compensate for the inadequate levels of nutrients in the manure, large quantities must be applied. A preplant rate of 5-10 tons per acre is not uncommon for a crop.

Weed Control

Weeds inhibit crop production by competing for nutrients and irrigation water, as well as harboring diseases and pests. It is therefore, important to establish a good weed control program from the outset. Weed control is best accomplished by hand hoeing, mowing, mulching or through the use of herbicides. A good weed control program uses all of these practices. Mechanical cultivation, because it may damage shallow feeding roots, is not recommended except for a weed-free zone around the plantation.

The use of herbicides is an efficient and labor saving method of controlling weeds in young plantations. There are four herbicides available on Guam which have been cleared for use on bananas. These are: Ametryne, Dalpon, Karmex and Paraquat. Before using these chemicals it is very important to apply the herbicide first to a small area in order to evaluate its effect. This is because herbi-

cides perform differently on different soils and vegetation. Basically there are two types of applications: pre-emergent and post emergent. Pre-emergent sprays are applied to the bare soil to kill the weeds as they germinate. Post-emergent applications are sprayed on weeds after they have sprouted and are established. Paraquat is an example of a fast acting post-emergent herbicide while Ametryne, Dalpon and Karmex have both pre-emergent and post-emergent effects. These weed killers should be applied early in the morning when wind velocities are low enough to prevent spray drift. Care should also be taken not to apply herbicides close to the foliage or near the newly planted suckers as this will cause leaf burning and slow the plants' growth.

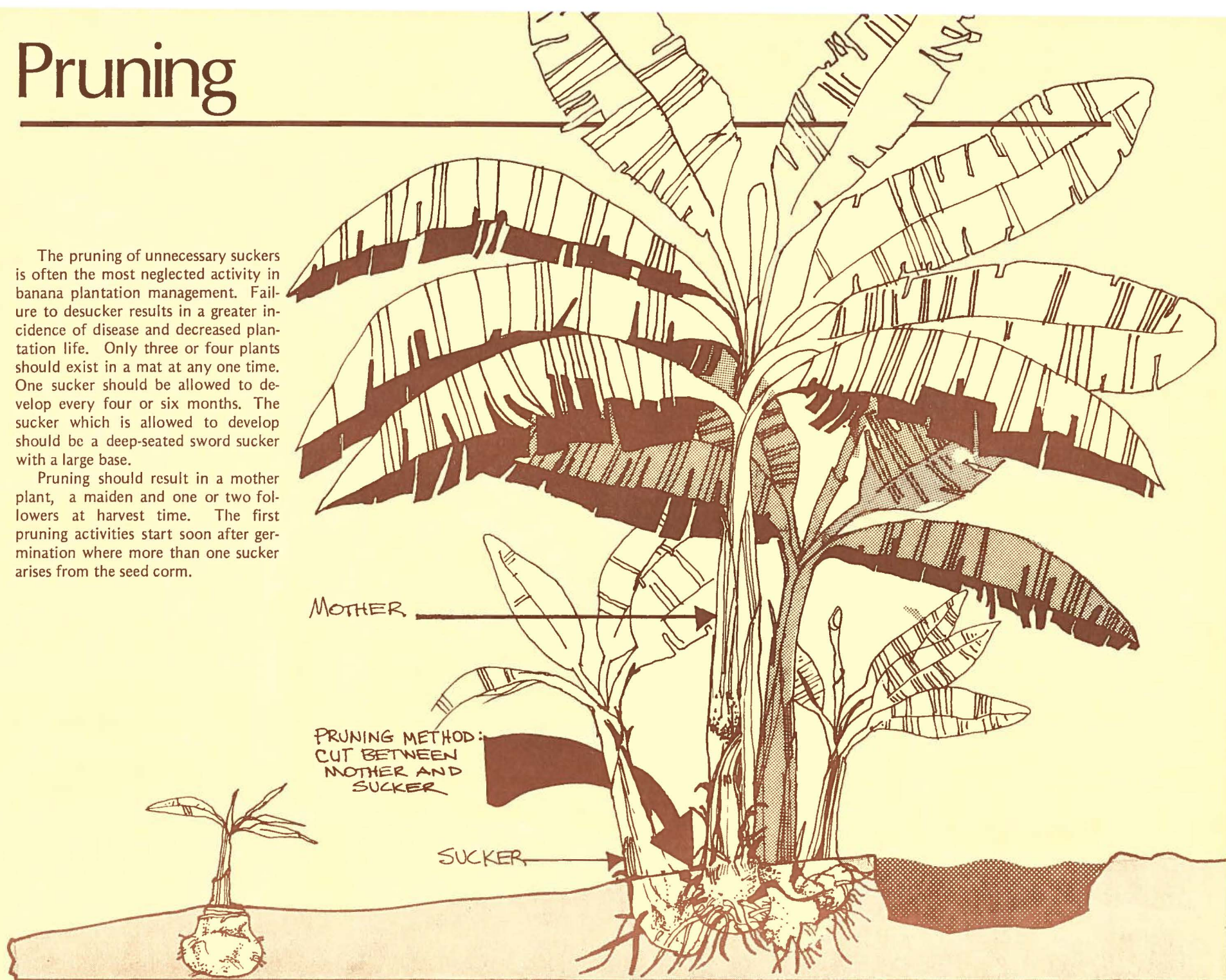
When removing weeds with a hoe or facinos, growers should be careful not to injure the feeder roots around the base of the plant. After the weeds have been eliminated, they may be left between the rows as a mulch. Mulches help retain ground moisture, add nutrients to the soil and form a layer over the soil which inhibits weed growth. In addition to the mulching of weeds, the easiest mulch to use is the old banana plants. Mulches have been shown to be very helpful in banana plantings and growers are encouraged to make use of this resource.

A weed control program should integrate all available methods to the maximum efficiency of the grower. Immediately around the base of the plant hand hoeing or a facinos may be used. Around the mat there should be a five foot weed-free zone which may be accomplished with the use of herbicides, or mowing may be employed depending on the individual's preference. On sloping sites susceptible to erosion some vegetation should be left to bind the soil; this type of situation is best suited to mowing. If diseases and pests are a major problem then mulches are not recommended. No matter what situation exists, weed control is a constant activity until the plants have enough foliage to shade out the weeds.

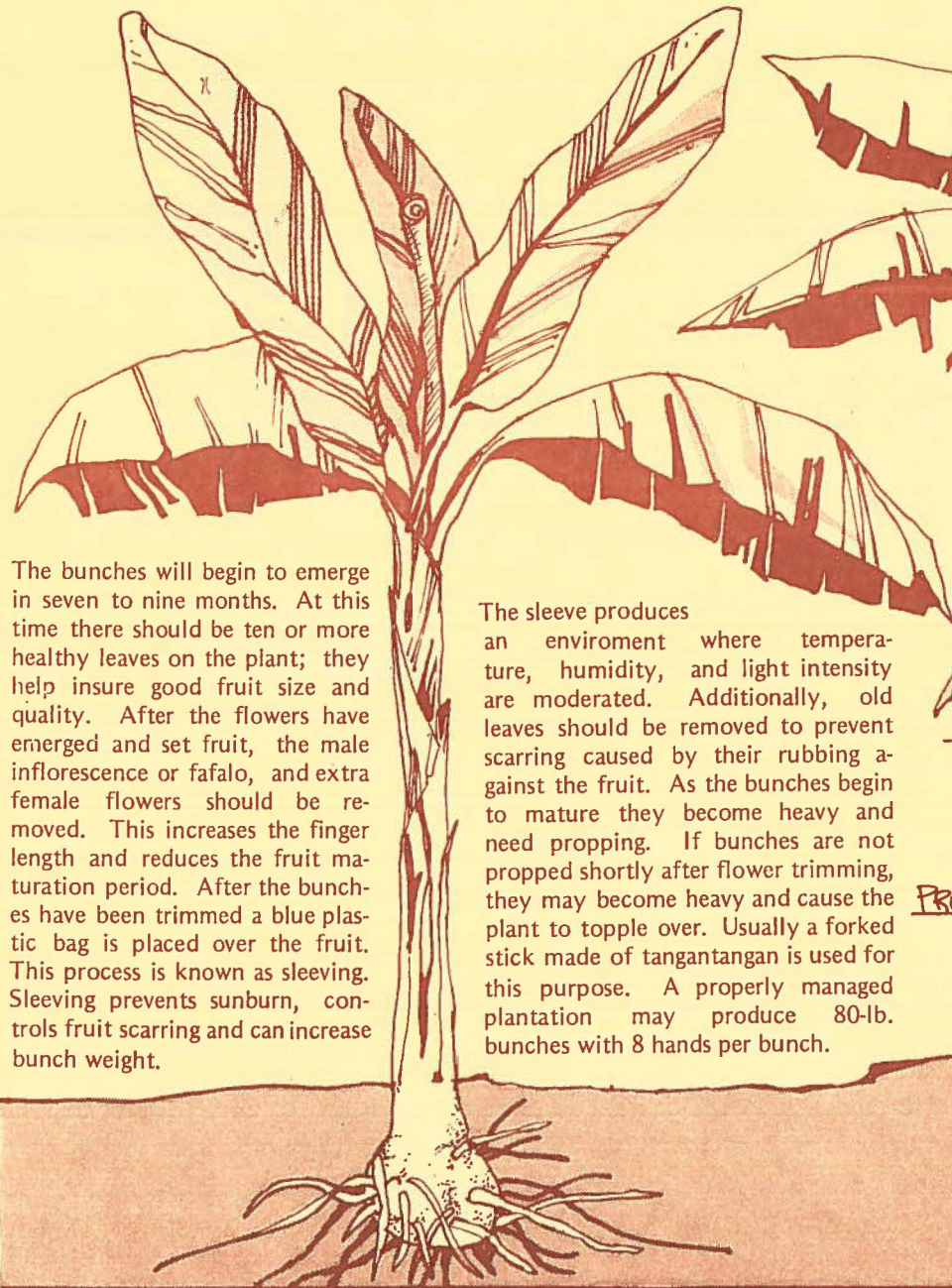
Pruning

The pruning of unnecessary suckers is often the most neglected activity in banana plantation management. Failure to desucker results in a greater incidence of disease and decreased plantation life. Only three or four plants should exist in a mat at any one time. One sucker should be allowed to develop every four or six months. The sucker which is allowed to develop should be a deep-seated sword sucker with a large base.

Pruning should result in a mother plant, a maiden and one or two followers at harvest time. The first pruning activities start soon after germination where more than one sucker arises from the seed corm.

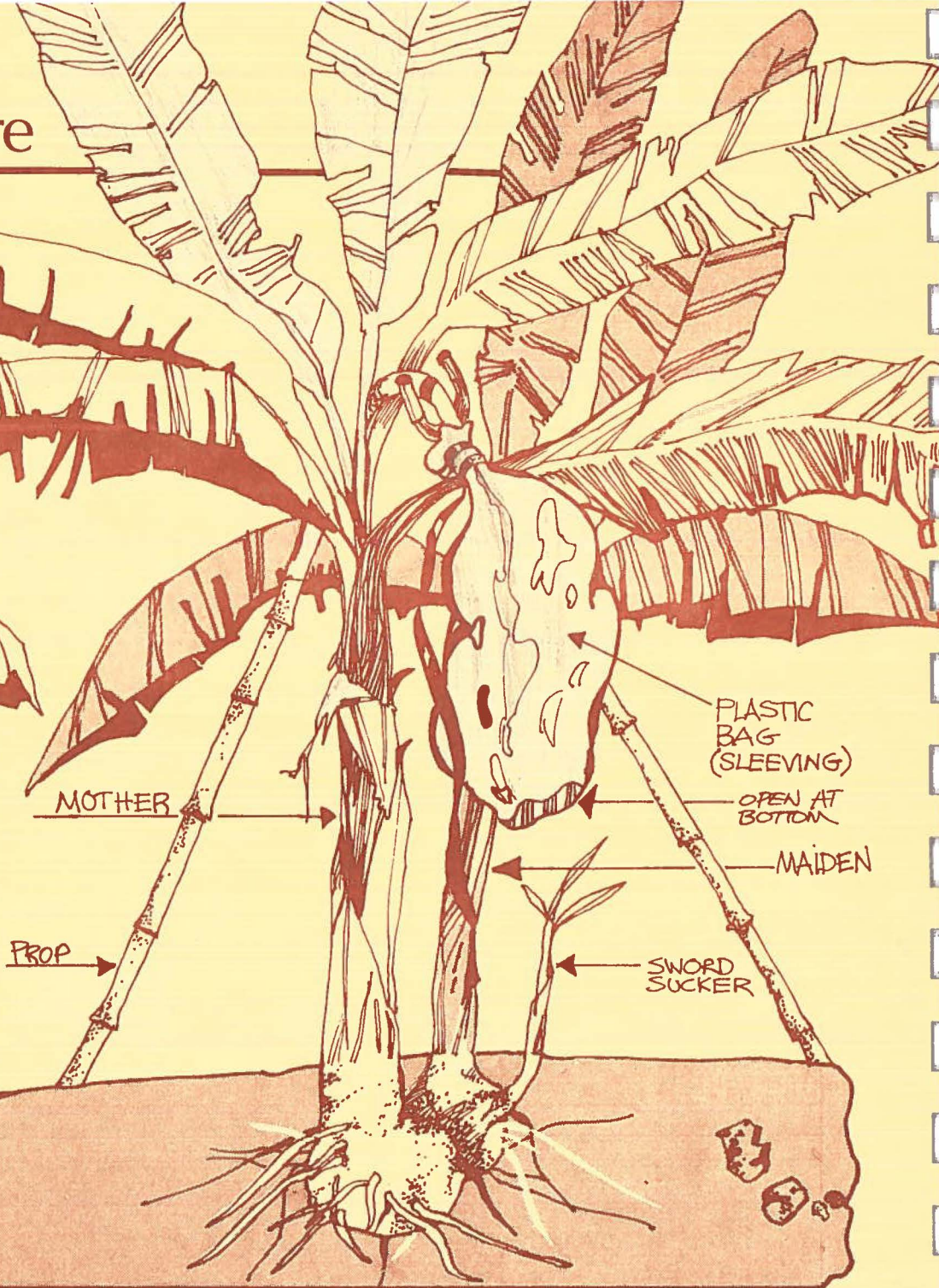


Pre-Harvest Bunch Care



The bunches will begin to emerge in seven to nine months. At this time there should be ten or more healthy leaves on the plant; they help insure good fruit size and quality. After the flowers have emerged and set fruit, the male inflorescence or fafalo, and extra female flowers should be removed. This increases the finger length and reduces the fruit maturation period. After the bunches have been trimmed a blue plastic bag is placed over the fruit. This process is known as sleeving. Sleeving prevents sunburn, controls fruit scarring and can increase bunch weight.

The sleeve produces an environment where temperature, humidity, and light intensity are moderated. Additionally, old leaves should be removed to prevent scarring caused by their rubbing against the fruit. As the bunches begin to mature they become heavy and need propping. If bunches are not propped shortly after flower trimming, they may become heavy and cause the plant to topple over. Usually a forked stick made of tangantangan is used for this purpose. A properly managed plantation may produce 80-lb. bunches with 8 hands per bunch.

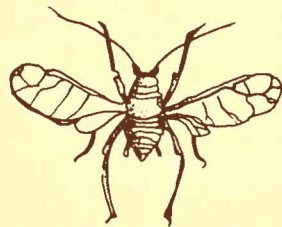


Diseases and Pests

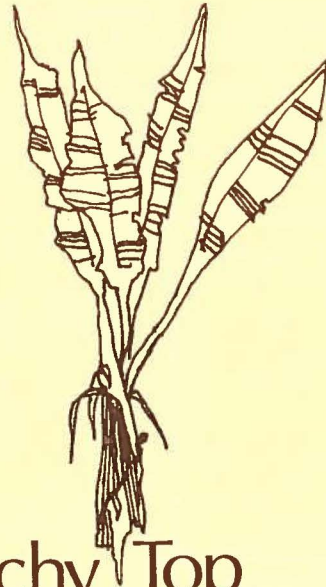
On Guam there are six diseases and four insect pests which may cause problems on bananas. Of these, only two diseases and two insects pose a serious threat to banana production. Through constant watchfulness and immediate attention to problems, growers may avoid serious threats to their crops. There are a number of possible systems or combination of systems that will provide adequate crop protection.

The simplest method of controlling banana disorders is prevention. By taking precautionary measures such as treating and using only disease free planting material, disinfecting tools and controlling the movement of soil, a number of diseases and pests will not gain entry into a plantation. Additional methods include eradication, chemical spraying, and other management practices. The eradication of an established disease is simply the removal of diseased plants or plant parts and their destruction. Chemical control is the use of pesticides to control problems that may arise during the course of production. When applying pesticides proper safety clothing and apparatus should be used and label recommendations should always be followed. Other practices that may be utilized to decrease the incidence or eliminate problems are field following, resistant varieties, biocontrol agents and weed suppression.

The following pages include information about each disease or pest found on Guam and how the grower may best manage the problem.



Banana Aphid



Bunchy Top

(Virus)

Bunchy top is the most serious disease of bananas on Guam. The most alarming symptom is that infected mats do not produce any fruit. Other symptoms include leaves that are erect, narrow, stunted and often have yellow leaf margins. As the disease progresses, the leaves become smaller and eventually the crown of the plant becomes composed of only stunted leaves, and develops a "bunchy top" which gives the disease its name.

This disease is caused by a virus and is spread by the brown banana aphid (*Pentalonia nigronervosa*). Wild bananas (*Musa spp.*), bird of paradise (*Strelitzia spp.*) and gingers (*Zingiber spp.*) can harbor the disease and should be removed from the area surrounding the plantation.

There is no cure for bunchy top. The disease can be avoided by using disease-free planting material, controlling the aphid vectors with insecticide sprays, and removing and destroying infected mats.



Panama Wilt

(*Fusarium oxysporum f. cubense*)

Yellowing, wilting and drying of the leaves are early symptoms of Panama wilt. Eventually, all the leaves will collapse, die and then dangle from the pseudostem.

The most reliable way of identifying the disease is to slice open the stem. Normally it will have a clean white interior, but Panama wilt produces characteristic reddish brown to black discolorations and sometimes a rotten or fishy smell.

The disease is caused by a fungus that lives in the soil for many years. It is spread with infected planting material and transported with soil. Panama wilt has been recently identified on the island and has been a serious problem where observed. Growers should take care to obtain disease-free suckers and, thus avoid contaminating their fields.

The best management techniques are to destroy infected mats and replant with resistant varieties such as Taiwan, Williams Hybrid and Dwarf Cavendish (Guahu).

Black Leaf Streak

(*Mycosphaerella fijiensis*)

This disease results in reddish brown specks occurring on the lower leaf surfaces. These specks develop into dark brown or black streaks as the infection becomes more severe. Hot humid conditions favor its development.

The disease is caused by an airborne fungus. The pruning and burning or burying of infected leaves will reduce the incidence of the disease.

The following chemical control methods have proven satisfactory. These control measures should be applied every three weeks during the rainy season and every six weeks during the remainder of the year.



Spray per acre:

½ gallon Gavicide 145

1 lb. Dithane M-45

100 gallons of water

Mist blower:

1-2 ounces of Benlate

1 pint Gavicide 145

3 gallons of water

Sigatoka Disease

(*Mycosphaerella musicola*)

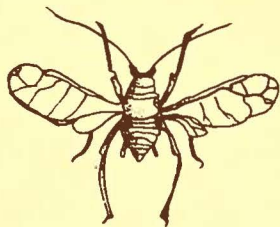
Sigatoka disease is very similar to black leaf streak except less virulent. Sigatoka disease does not cause black streaks but rather yellow streaks which later give way to dead tissue. The control for Sigatoka disease is the same as for black leaf streak.

Banana Aphid

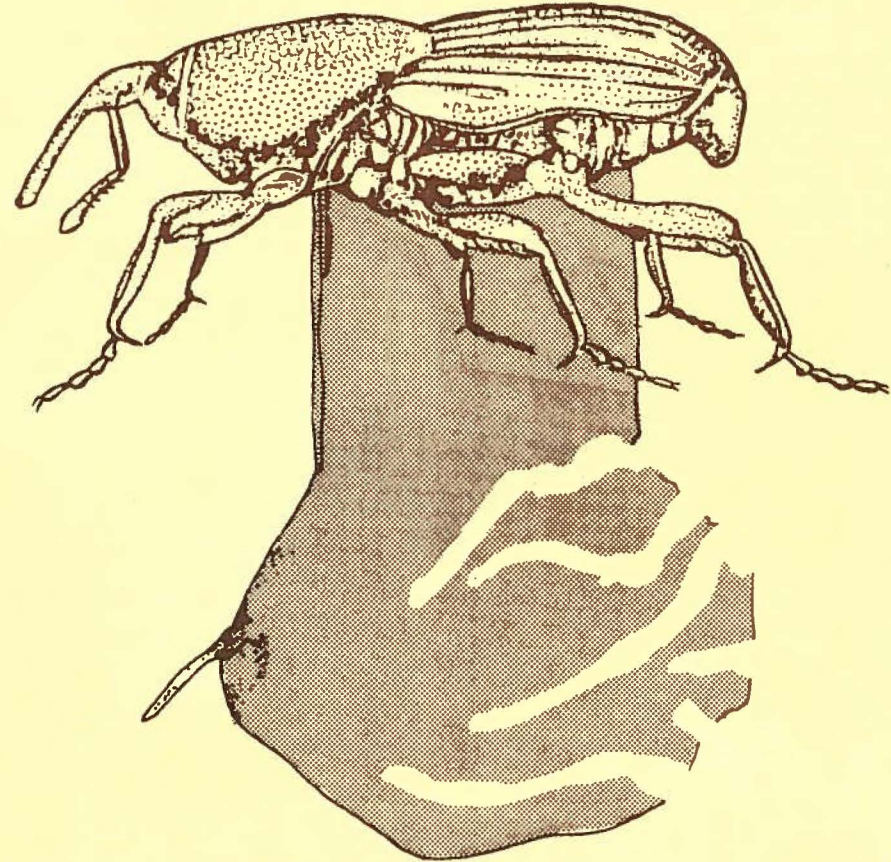
(*Pentalonia nigronervosa*)

The importance of this insect is due to its ability to transmit bunchy top disease, rather than any direct injury caused by feeding. The aphid is usually found on the base of the plant, in the throat and on the small suckers. They pierce the tissue and suck fluid from the plant. Bunchy top disease is passed to the banana while the insect is feeding. Usually ants may be seen tending aphids on infested plants. The aphid is a very small (1/16") brown or black bug which is either winged or wingless.

No spray program can effectively prevent this insect from entering and infecting plants with bunchy top. However, the spread of this insect throughout a plantation can be retarded by the use of insecticide sprays. Plants infested with aphids should be sprayed promptly and those mats exhibiting bunchy top symptoms should also be sprayed and immediately destroyed.



Banana Aphid



Banana Corm Weevil

(*Cosmopolites sordidus*)

This black weevil, 1/2" - 3/4" long, lays its eggs in exposed portions of the corm. The eggs develop into white larvae which can riddle the corm with tunnels. These burrows reduce the plant's vigor which results in smaller bunches being produced. The plants are also more susceptible to toppling over from the wind and contracting Panama wilt. The control of this weevil is primarily preventative. Planting material should be cleaned and dipped in hot water or insecticide. When planting, the corms should be completely covered with soil to prevent egg-laying.

Chinese Rose Beetle

(*Adoretus sinicus*)

This insect is a light to dark brown beetle, 3/8" long, with a fairly narrow body. The adult beetle damages the leaves by chewing from the leaf margin to the midrib, usually starting at the leaf tip. The larvae live in the soil and feed on plant roots.

The Chinese rose beetle is also a pest of many other commercial crops and local flora. It is a difficult pest to control with insecticides. Maintaining a clean, weed-free plantation and buffer zone is an important step in keeping populations low. It is also advisable to tolerate minor damage.

Chinese Rose Beetle



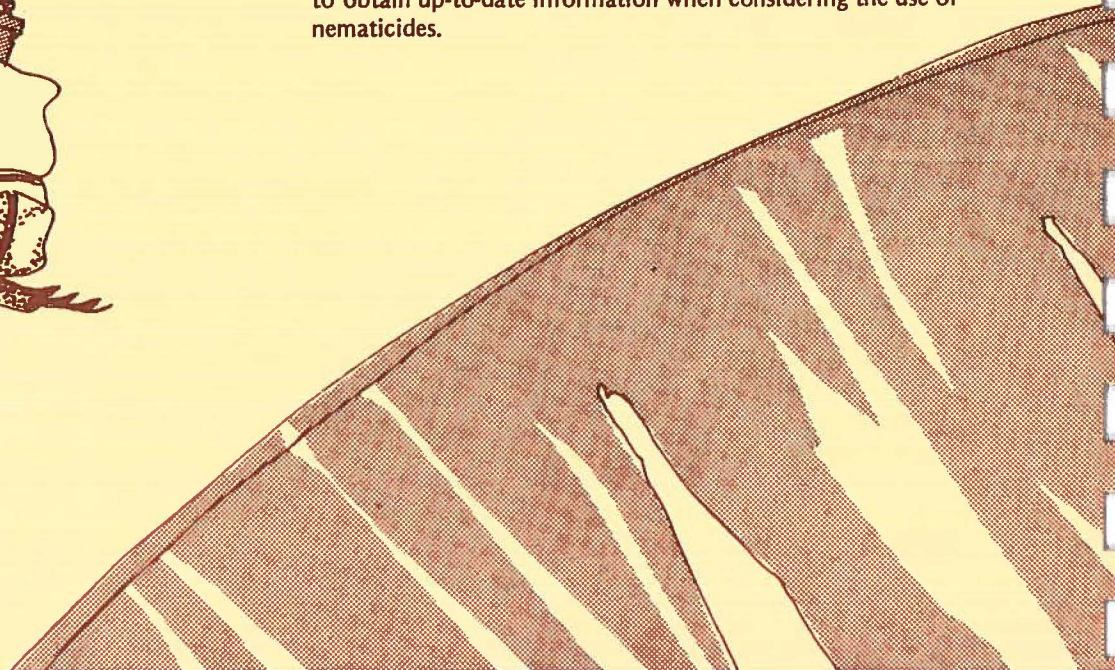
Burrowing Nematode

(*Radopholus similis*)

This microscopic worm attacks the corm of the banana plant causing a reddened tissue around the feeding sites. Severe infestations result in weak plants, poor growth, depressed yields and the plants being more susceptible to Panama wilt. Because this pest is found both in the soil and in plant roots it is important to insure that planting materials and planting site are pest-free. By trimming the corm, gouging out discolored spots and dipping the corms in hot water or a chemical solution, the nematodes can be eliminated from the planting material.

Virgin or fallowed lands may be relatively free of plant parasitic nematodes and make good planting sites. When fallowing a field no bananas should be grown on it for two years. Flood fallowing requires six months.

Chemical nematicides, such as Nematicur, are efficient tools in treating an infected field. Government restrictions on their use are constantly changing. Growers are advised to obtain up-to-date information when considering the use of nematicides.



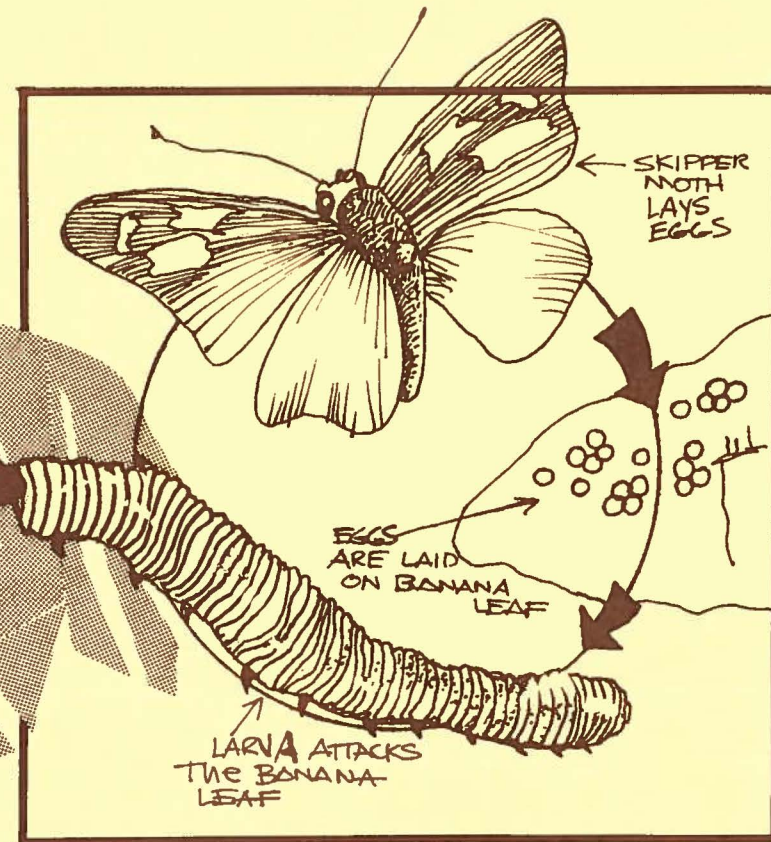
Moko Disease

(*Pseudomonas solanacearum*)

Moko disease is a bacterial disorder which is most prevalent on younger plants, but may also cause problems with older plants. The disease attacks the younger leaves which become yellowish-green and then collapse. The older leaves are subsequently infected and collapse, resulting in a leafless plant that soon dies. At present this disease is a minor problem on Guam but could become more serious. Basic plantation sanitation and weed suppression will help restrain this disease. If an infection overtakes the crop a minimum two-year fallow period may be an effective method of control.



Banana Leaf Roller
(*Erionata thrax*)



This brown moth (or skipper) with yellow spots on its forewings lays batches of eggs on the leaves. The eggs hatch into larvae or caterpillars which cut a strip of leaf and roll it into a distinctive leaf roll. The larva, covered in a whitish powder, will evolve into a pupa or cocoon inside the roll.

On Guam there are two natural parasites of this leaf roller. One attacks the eggs and the other feeds on the larva. It is more economical to let these parasites control the pest than to spray insecticides. Only in severe cases should a grower consider applying insecticide.

For smaller plantings the leaf rolls can simply be squeezed by hand to crush the larvae.

Pest Control Guide For Bananas

DISEASE	TYPE	THREAT		PEST	TYPE	THREAT	
Bunchy Top	Virus	Major	<ol style="list-style-type: none"> 1. Use disease-free planting material. 2. Control aphid vectors by spraying malathion or diazinon insecticides 3. Remove and destroy infected mats. 	Burrowing Nematode	Eelworm	Minor	<ol style="list-style-type: none"> 1. Trim & disinfect planting material. 2. For infected fields use a nematicide prior to planting. 3. Avoid soil movement.
Panama Wilt	Fungus	Major	<ol style="list-style-type: none"> 1. Remove & destroy infected mats. 2. Plant resistant varieties. 3. Avoid soil movement. 4. Disinfect tools. 	Aphids	Insect	Major	<ol style="list-style-type: none"> 1. Spray throats and base of plants with malathion or diazinon insecticides when aphids appear.
Black Leaf Streak	Fungus	Minor	<ol style="list-style-type: none"> 1. Prune & burn or bury diseased leaves. 2. Apply oil sprays & fungicides. 	Corn Weevil	Insect	Major	<ol style="list-style-type: none"> 1. Trim & disinfect planting material. 2. Apply insecticides in infested areas.
Sigatoka	Fungus	Minor	<ol style="list-style-type: none"> 1. Prune & burn or bury diseased leaves. 2. Apply oil sprays & fungicides. 	Chinese Rose Beetle	Insect	Minor	<ol style="list-style-type: none"> 1. Spray sevin insecticide in the evening when infestation is serious. 2. Maintain weed-free access road around planting.
Moko	Bacteria	Minor	<ol style="list-style-type: none"> 1. Allow at least two -year fallow period before replanting. 2. Use disease-free planting material. 3. Avoid soil movement. 	Banana Leaf Roller	Insect	Minor	<ol style="list-style-type: none"> 1. Natural parasites generally keep populations controlled. 2. Squeeze leaf rolls to kill larvae.

Chemical Control Guide For Bananas

INSECT	INSECTICIDE	FORMULATION	Rate per Gallon of Water	Waiting Period: Days*	COMMENTS
BANANA APHID	MALATHION	57% E.C.	2 tsp.	3	Spray the throat and the base of the young leaves as this is where aphids form colonies.
	DIAZINON	AG 500 50% W.P.	1 tsp. 1 tsp.	7 7	
CORM WEEVIL	SEVIN	50% W.P.	2 tsp.	3	Spray base of mat and surrounding leaf litter.
	DIAZINON	14% Granules	¼-½ lb. per mat	7	Scatter granules around base of mat.
CHINESE ROSE BEETLE	SEVIN	50% W.P.	2 tsp.	3	Spray foliage and leaf litter at base of mat in the evening. Difficult to control chemically.
	DIBROM	58% E.C.	1 tsp.	4	
LEAF ROLLER	THURICIDE	<i>Bacillus thuringiensis</i>	1 tsp.	0	Spray leaves thoroughly. Difficult to control chemically.
	SEVIN	50% W.P.	2 tsp.	3	

*TILL HARVEST

Harvesting and Handling

Bananas intended for fresh market should be harvested when the fingers are plump, but still a light green. The corners of the fingers should be rounded rather than angular. The fruit will ripen, with no loss of quality, while in transit. The harvesting of bunches with yellow fingers, even if it is only the top fingers, is not recommended. The bunch will ripen with unexpected speed. The fingers will quickly blacken, split, fall off and attract insects. This results in many wasted fruit.

Harvesting bananas generally requires two men. The first stands beneath the bunch; the second, using a machete, makes two cuts in the shape of a "V" on the top half of the pseudostem or trunk. This allows the bunch to slowly descend on the first man's shoulders. The bunch is then cut free. It is best to leave an 18" stalk on the bunch. Place the bunch on a layer of banana leaves or foam rubber. Also, cover it with banana leaves for transporting.

A banana pseudostem produces fruit only once. Cut it back to the point where it buckled and cut the leaves into pieces where they will serve as mulch. The pseudostem is then left to deteriorate in place.

If the bunches are temporarily stored on the farm they should be hung or set in a cool, shaded area. After harvesting, the bunches are usually cut into individual hands and washed. Damaged hands are discarded. When possible the hands should be carefully packed in crates or boxes. In order to obtain a good price, it is important that the fruit be presented in an attractive manner at the market.

The greatest challenge in banana growing is delivering unbruised fruit to the market. Every effort should be made to avoid these profit-reducing blemishes. The use of plastic sleeves, padding and handling as little as possible will aid in avoiding bruising.

APPENDIX 1

Activities Schedule For A Banana Planting

Preplant activities

- 1) Select the site
- 2) Clear the Land (Dry Season)
- 3) Build roads if needed (Dry Season)
- 4) Rip the soil if needed (Dry Season)
- 5) Plant shelter belts if needed
- 6) Build fences, sheds, etc.
- 7) Install water pipes, irrigation system and electricity if desired

Items 1 - 7 should be done 3-5 months prior to the time of planting. Some activities are best done in the dry season, these have been indicated.

- 8) Disc and harrow field, and control nematodes if necessary, 4 - 6 weeks before planting
- 9) Mark planting holes: 3 - 4 weeks before planting
- 10) Dig planting holes: 2 - 4 weeks before planting
- 11) Collect manure for planting: 3 weeks before planting
- 12) Spray for weed control: 4 - 8 days before planting

Post planting

- 1) Plant the field: Day 1
- 2) Irrigate if needed: Day 2 and Week 2
- 3) Prune away extra plants: Weeks 4 and 6
- 4) Irrigate if necessary: Week 5
- 5) Replant those corms not germinated: Weeks 6 and 7
- 6) Inspect crop for diseases and pests: weekly
- 7) Irrigate as necessary
- 8) Control weeds: Every two weeks
- 9) Fertilizer: Week 14
- 10) Prune unwanted suckers: Month 5
- 11) Allow 1 sucker at: Month 5 and Month 10
- 12) Fertilizer: Month 7
- 13) Remove dead leaves: as necessary for disease control
- 14) Remove male flowers and unwanted female flowers: After fruit set
- 15) Bag bunches: After fruit set
- 16) Prop bunches: After fruit set
- 17) Arrange handling and harvest activities before harvest
- 18) Fertilizer: Month 11

APPENDIX 2

Comparison of Irrigation Systems

ADVANTAGES

- 1) Drip or trickle system
 - a. Conserves water
 - b. Low labor
 - c. Uses poor quality water
 - d. Confines irrigation to crop only

- 2) Drag lines
 - a. Portable
 - b. Easy to build and repair
 - c. Inexpensive

- 3) Traveling Sprinklers
 - a. Simple
 - b. Inexpensive
 - c. Portable

- 4) Basin Irrigation
 - a. Waters crop thoroughly
 - b. Watering confined to crop only

- 5) Furrow irrigation
 - a. Similar to basin irrigation

DISADVANTAGES

- 1)
 - a. Initially expensive
 - b. Fairly sophisticated filtering system
 - c. Difficult to repair

- 2)
 - a. Labor intensive
 - b. Can use large quantities of water
 - c. Sprinkles water in un-needed areas

- 3)
 - a. Can use large quantities of water
 - b. Sprinklers water unnecessary areas
 - c. Travelers sprinkling overhead may increase disease problems

- 4)
 - a. Uses amounts of water
 - b. Dikes must be tended regularly
 - c. Suitable only on flatland

APPENDIX 3

Bananas on Guam

Chamorro Name	English Name	Eating (E) or Cooking (C)
Manila.		E
Lakatan.	Cavendish Group	E
Makao.		E
Guahu.	Dwarf Cavendish	E
	Williams Hybrid (Giant Cavendish)	E
Taiwan.	Cavendish Group	E
Dama.		E
Palau.		C
Long.		C
Tanduki.		C
Galayan.		C
Paladang.		C
Pahong.		C
Halom tano.	A wild plant with seeds	C
Bunita.	an ornamental with purple fruit	

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