

Growing Bell Pepper In Guam

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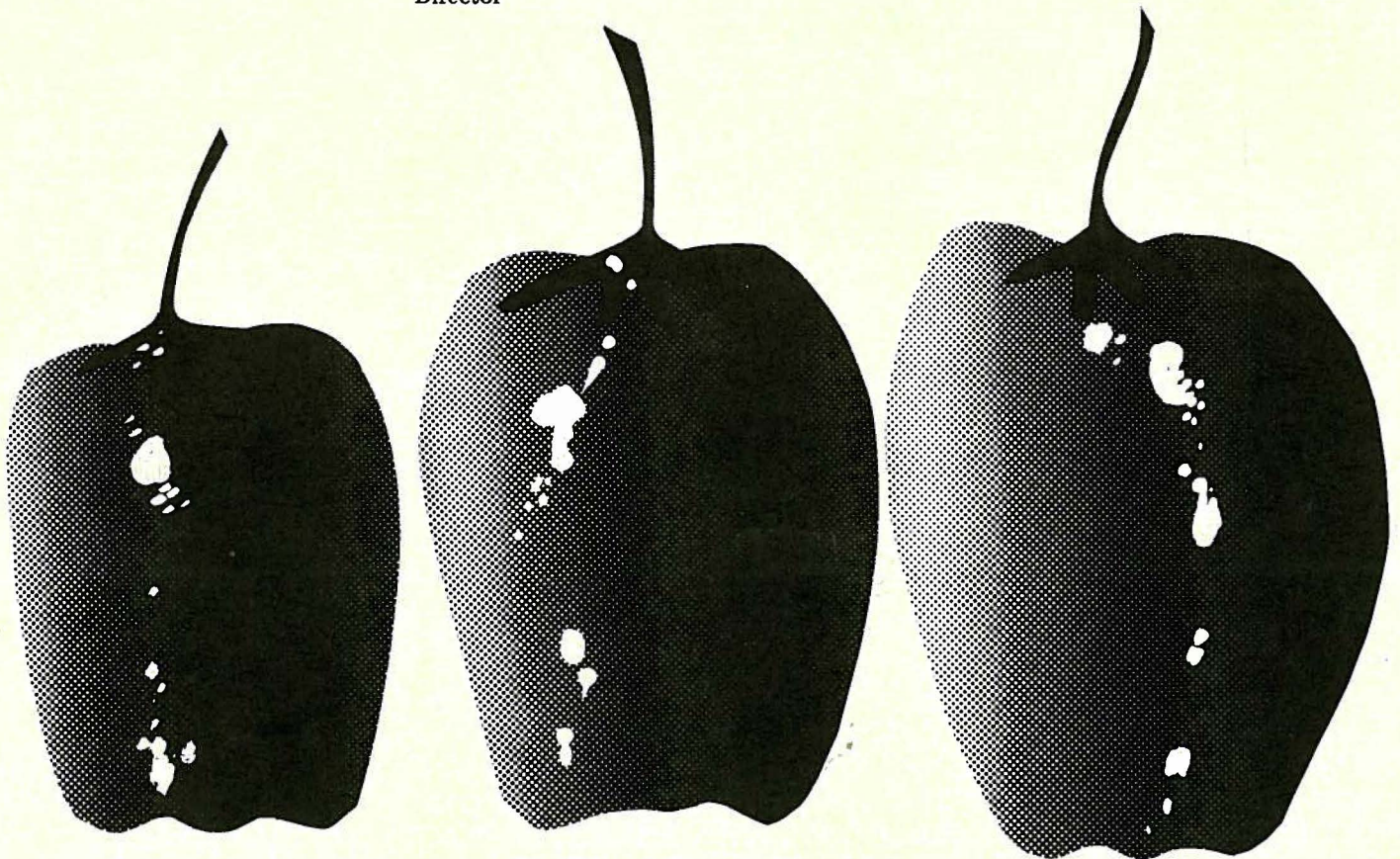


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Introduction

Sweet or bell pepper (*Capsicum annum L.*) is one of the most popular and important crops grown in Guam. It belongs to the Solanaceae or Nightshade family. The plant is slightly woody and grows upright from 2 to 4 feet (60 to 120 centimeters tall). The fruit is large, blocky, and frequently is three or four-celled. Usually, the kidney-shaped, and numerous, are inserted on the swelling at the base of the fruit. The fruit is rich in Vitamin A and to a lesser degree Vitamin B2, Vitamin C, and Vitamin E.

The cultivated bell pepper is thought to be of tropical American origin, where it has been very popular. After the discovery of America, bell pepper was rapidly spread over Europe. The bell pepper is unrelated to the vine that produces black pepper (*Piper nigrum*).

Climatic and Soil Requirements

Bell pepper thrives best in relatively warm climate where the growing season is long. Although it can be planted any time of the year in Guam is due to the tropical climate conditions, higher yield is usually obtained during the dry season than during the rainy season. Climatic conditions at the time of blossom development and fruit setting have a marked effect on yield. Unfavorable temperature and inadequate water supply are basic factors that inhibit the proper development of buds, blossoms, and fruits causing them to drop. Low humidity and high temperature result in excessive transpiration and a water deficit in the plant. Under such conditions, abscission of buds and blossoms and the production of small fruits usually take place. A water deficit might develop even when the soil is well supplied with water due to the excessive transpiration under conditions of high temperature.

Bell pepper is grown in many classes of soils ranging from light sands to clays. But a sandy loam which holds moisture fairly well, well-drained and free from root-knot nematodes and bacterial wilt organisms is the ideal soil for the growing of bell pepper. If the soil is not naturally fertile, a combination of manure and commercial fertilizer may be applied. A soil or organic matter content of at least 1.5 percent is considered most ideal. If the manure is not available, soil improving crops (such as mungo bean) may be grown and plowed under to supply the organic matter. The bell pepper is not especially sensitive to soil acidity, having optimum pH range between 5.5 to 6.8. But strong acid or alkaline soils should be corrected to bring the pH within this range.



Fig. 1.



Fig. 2.

Starting Seedlings

The seedlings are usually started in seedflats, seedbeds or commercial peat pellets.

(I) Seedflat or Seedbed Method:

Seedflats offer the better way of starting seedlings because it is easier to treat the soil for nematodes and disease organisms than it is in seedbeds. The best medium for starting seedlings is a mixture of one part compost, one part sand, and one part garden soil. The organic matter of the compost provides nutrients and, at the same time, improves soil texture. Garden soil retains moisture, while sand provides good drainage and aeration. The seeds should be sown thinly on shallow furrows in seedflats or seedbeds. After sowing, the surface is levelled, pressed firmly, and watered moderately to prevent seed exposure.

(II) Commercial Peat Pellet Method:

Commercial peat pellets are becoming increasingly popular. They consist of peat moss and a small amount of fertilizer with a plastic netting. The commercial peat pellet is hard and dry, about $\frac{1}{4}$ inch in height and $1\frac{3}{4}$ inches in diameter. After sprinkling with water for a few minutes, it becomes soft and moist and expands to approximately seven times its original size. The seeds can then be sown in the peat pellet. The peat pellet is a sterile and disease-free medium, which is a tremendous advantage in helping the young seedling to become established. When the seedlings are about 2 inches (5 centimeters) in height (about 2 weeks old), they should be watered twice a week with a starter solution consisting of 2 tablespoons (30 grams) of complete fertilizer (such as 15-15-15) per gallon (3.78 liters) of water. This treatment will give the seedlings a good, healthy start at transplanting time.

The seedlings from either seedflats, seedbeds, or peat pellets should be sprayed with a combination of insecticide and fungicide (such as Malathion and Dithane) once a week up to transplanting.

Care of Seedlings

Daily care of seedflats, seedbeds, or peat pellets is very important for satisfactory growth. They should be watered moderately daily, or twice a day, so as to provide just sufficient moisture to let seeds germinate after 6 days from the date of sowing. Overwatering after germination makes seedlings soft and very susceptible to damping-off. Watering should be done in the morning to allow the leaves and medium surface to dry before night to avoid the incidence of fungal and bacterial diseases.

The treatment of hardening, which makes plant tissues tough and firm, is desirable before transplanting to enable the seedlings to better withstand the unfavorable effects of its new environment. Hardening is accomplished by exposing the seedling to less favorable environmental conditions in order to check rapid growth. The best and most practical method under tropical conditions is by direct exposure to sunlight and a gradual reduction in watering, both in amount and frequency.

A day before transplanting, the seedflats or seedbeds should be watered thoroughly to facilitate pulling of seedlings, thus minimizing root injury.

Land Preparation

The field should be thoroughly prepared by 2 to 3 plowings to a depth of 8 inches (20 centimeters) with alternate harrowing to provide conditions for optimum moisture penetration and air movement, and to eliminate surface unevenness in the field.

Transplanting and Distance of Planting

When seedlings are 4 to 5 weeks old, they are ready for transplanting. Late in the afternoon is the best time of the day to transplant them, especially during the dry season. If the seedlings become too old and tall due to postponement of transplanting during inclement weather, it is advisable to set them deeper into the soil than is ordinarily done to reduce whipping by the wind.

The plants usually are set 4 feet (122 centimeters) apart between the rows and 2 feet (61 centimeters) within the rows. The wider the row spacing will be convenient for tractor cultivation, spraying pesticides, and harvesting. Plants tend to grow taller at a closer spacing, thus preventing the fruit from touching the soil surface and being shaded from direct sunlight.



Fig. 3.



Fig. 4.

Fertilizer Application

Soil nutrient condition is one of the factors that affect crop productivity. To produce high yield of bell pepper on soils low in fertility, manure and commercial fertilizer should be applied. The quantity and analysis of commercial fertilizer to be used will depend on the soil type, crop rotation, nutrient present in the soil, previous cropping practices, and organic matter content of the soil. If manure is available on the farm, or if it can be purchased at a reasonable price, its use is recommended. In general, chicken manure may be applied at the rate of about 2 tons per acre (4.48 metric tons per hectare) supplemented with 500 pounds per acre (560 kilograms per hectare) of complete fertilizer, such as 10-20-20 or 10-20-10. Where no manure is used, 800 pounds per acre (896 kilograms per hectare) of complete fertilizer, such as 10-20-20 or 10-20-10 should be applied to the soil.

The fertilizer should be applied in split application; one-half at planting time and one-half at 4 weeks after transplanting. The split application of fertilizer will reduce the loss of nitrogen from leaching. Since bell pepper occupies the land for a long period, it may be desirable to apply additional nitrogen once or twice after first harvest. A side dressing of 140 pounds per acre (156.8 kilograms per hectare) of 21-0-0 fertilizer or 35 pounds per acre (39.2 kilograms per hectare) of actual nitrogen is required at each application.

Irrigation

The amount and frequency of irrigation are determined by soil type and climate. The critical stage that irrigation should be applied is during the early vegetative growing stage, at flowering, and when the fruits have already developed. A long dry period may cause shedding of flowers and young fruits. When it becomes necessary to irrigate, the soil should be thoroughly soaked to wet the entire root zone.

Cultivation and Weed Control

Shallow cultivation to a depth of about 3 inches (7.5 centimeters) is required to control the weeds and keep soils loose and mellow.

Frequent and deep cultivation should be avoided since the soil may in fact speed up water loss by exposing fresh amount of moist soil to the atmosphere, and fine roots and root hairs may be destroyed.

Weeds not only rob moisture and plant nutrients, but some weeds harbor insects and diseases. Hand hoeing or pulling is usually necessary to destroy weeds growing between the plant in the rows.

Applying herbicides (chemical weed control) is another method of weed control. Chemical weed control is the most sophisticated and probably the cheapest control method. Application of this method, however, requires appropriate knowledge and skill in order to obtain safe and best results.

The last and probably the best weed control technique is mulching. Good mulching will suppress weeds, help conserve soil moisture and, to a certain degree, reduce the effect of excessive rain during the wet season.

Staking

The practice prevents fruits from touching the soil surface and minimizes damage of plant from the wind. The stems of bell pepper are tied to the poles, such as bamboo or tangantangan, as they grow upward.

Varieties (Cultivars)

A number of desirable varieties of bell pepper can be grown in Guam. Based on the fruit type, appearance, texture, and yield; Keystone Giant, Twilley's Big Pack, Florida Giant, Big Star, New Star, Ruby King, and Yan Kwang are the promising varieties of the large fruited sorts. The fruit of large fruited varieties averages about 3 to 4 ounces (85 to 113 grams). World Beater and Express Bell are the promising varieties of the smaller fruited sorts with fruit weighing about 2.5 ounces (70 grams).

Insects and Their Control

APHIDS

(*Aphis gossipii*)

They are relatively small, measuring about 1/16 inch (1.6 millimeters) long. Their color usually is yellowish-green or olive-green, and they are often present in great numbers on the leaves and inflorescences. Damage is caused by sucking plant juice from the underside of leaves, thus causing the leaves to curl downward. This stunts and/or kills the plant.

SPIDER MITES

(*Tarsonemus translucens*):

They are tiny insects that are difficult to see with the naked eye. Damage is caused by sucking the plant juice with the injured leaves showing pale mottling or stippling on the upper surface.

LEAFHOPPERS

(*Empoasca flavescens*):

They are yellow-green insects, measuring about 1/10 inch (2.5 millimeters) in length. Damage is caused by feeding on the under surfaces of the leaves near the edges, thus causing yellowing, wilting and drying.

FLY BEETLES

(*Psylliodes balyi*):

It is a shiny, black beetle, measuring about 1/16 inch (1.6 millimeters) in length. It jumps and walks between plants. Damage is caused by feeding on the upper surface of the leaf.

Suggested chemical control methods for insects are listed in Table 1.

Diseases and Their Control

BACTERIAL WILT

The casual bacterium is *Pseudomonas solanaceum*. The wilting of the young leaves is the first symptom of the disease. The xylem of the lower part of the stem turns brown and the roots develop a water-soaked appearance the stem browning and root decomposition progress, the leaf wilting increases and the plant eventually dies. When recently affected stems or roots are cut crosswise and allowed to stand a short time, a dingy gray to yellowish ooze may appear from the darkened circle.

CERCOSPORA LEAFSPOT

The casual fungus is *Cercospora capsici*. The fungus produces large oval or oblong spots with light gray centers on leaves. Unless controlled, it causes severe defoliation.

ANTHRACNOSE

The casual fungus is *Gloeosporium piperatum*. Disease areas develop as dark, round, sunken spots which often reach an inch (2.5 centimeters) in diameter. Dark, raised specks are produced in the spots. The spores in the specks are washed or splashed by rain to other pepper fruit to cause new infections.

MOSAIC

The disease is caused by a virus. The symptoms of infection are distinct mottling and distortion of the leaves. Affected plants appear stunted and take on a bushy shape. Leaves are somewhat wrinkled and often pale green. It is highly contagious and easily spread by direct contact with infected plants and/or by persons who may have handled mosaic infected plants. It is also transmitted by insects.

SOUTHERN BLIGHT

It is caused by the fungus *Sclerotium rolfsii*. The fungus attacks the stem of the plant near the soil surface and forms a white mold on the stem base. Later in the season, small brown bodies appear in the mold. Infected plants wilt and die.

Suggested chemical control methods for diseases are listed in Table 2.

(See photos on the following pages.)

Harvesting

The time to harvest bell pepper should be determined largely by the size of the fruit and its stage or maturity. For market, they are picked as soon as they reach approximately full size and become firm, but before they begin to turn red or yellow, depending on variety. In general, harvesting can be done 80 to 100 days after transplanting. Fruits are harvested by cutting with a clipper or picked by breaking the stems loose by an upward twist. A weekly interval for harvesting is usually practiced.

Handling and Storage

Bell pepper fruit is perishable and delicate, and should be sold soon after harvesting. But if great quantities are produced, selling is sometimes a problem. To maintain good quality, proper handling and storage are very important. They can be stored at 46.4 - 60°F (8 - 10°C) and at 85 - 90% RH for 8 - 10 days. The fruits are subject to chilling injury if held at temperature below 45°F (7.2°C), which leads to development of rots.

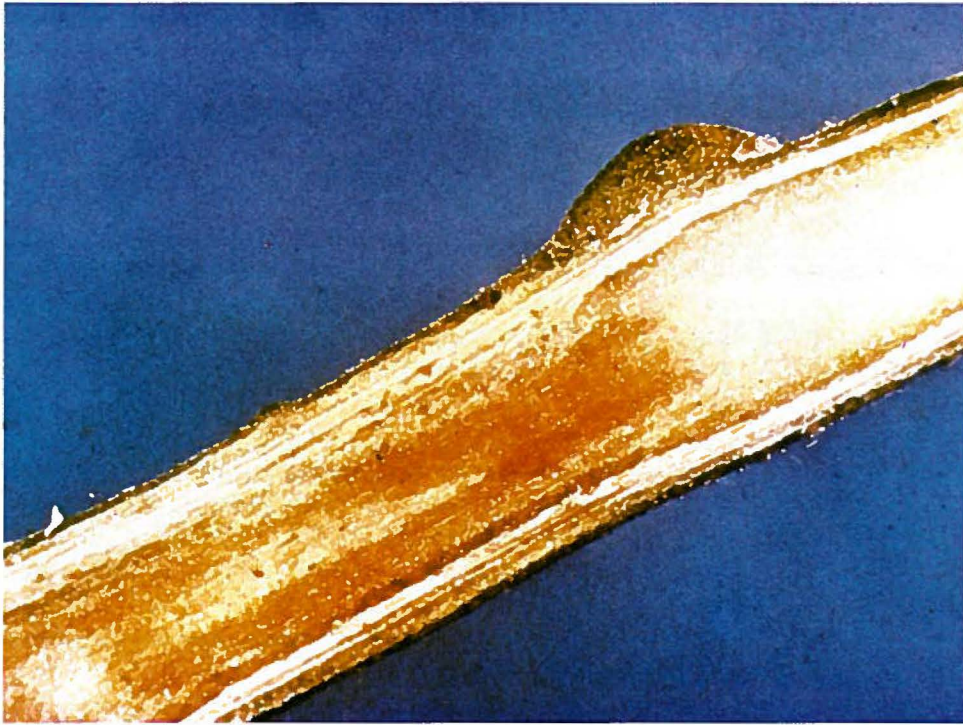


Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.

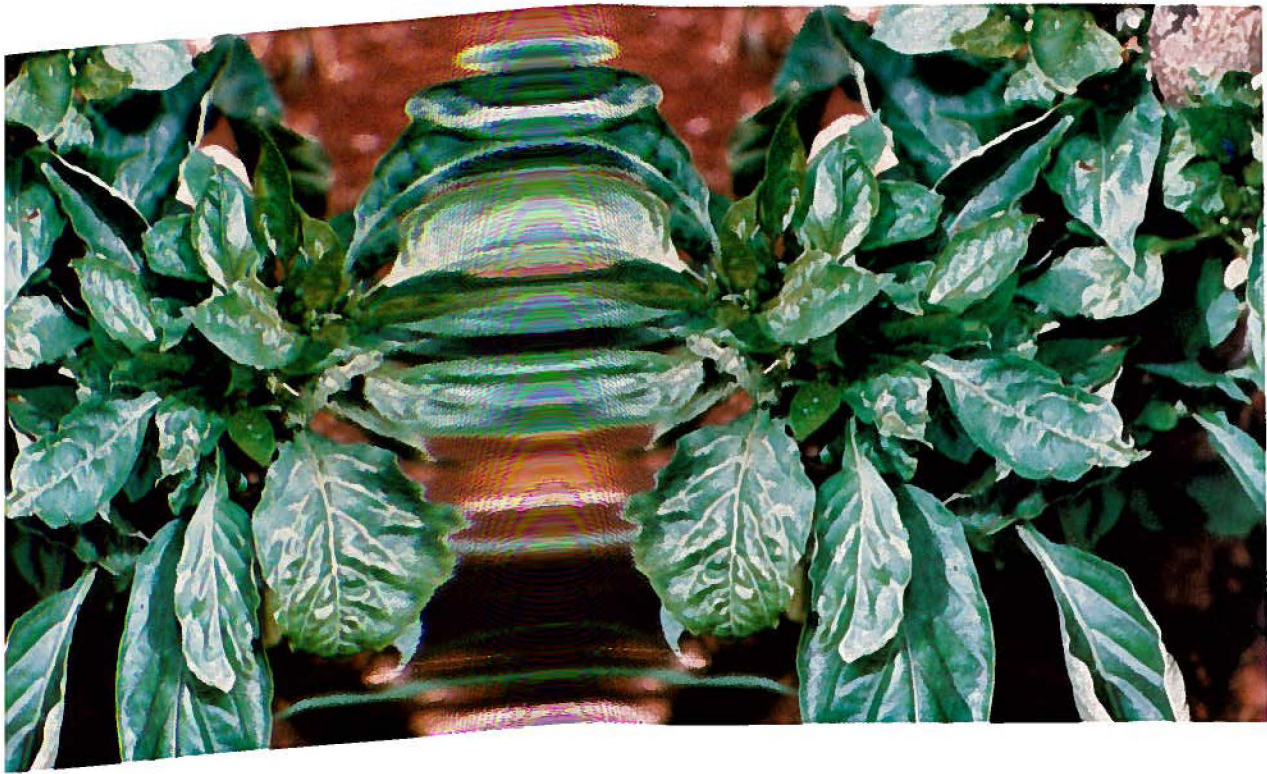


TABLE 1
Suggested chemical control methods for insect pests.

Insect	Pesticide	Dosage	Minimum days before harvest
Aphids	Malathion 50% EC	2 teaspoons/gal.	3
Spider Mites	Ethion 25% WP or Kelthane	2 teaspoon/gal. 2 teaspoon/gal.	1 1
Leafhoppers	Diazinon Ag 500, 4 EC	2 teaspoon/gal.	1
Flea Beetles	Diazinon Ag 500, 4 EC or Sevin 50% WP	2 teaspoon/gal. 1 tablespoon/gal.	1 1

TABLE 2
Suggested chemical control methods for diseases.

Disease	Pesticide	Dosage	Minimum days before harvest
Bacterial Wilt	Not available	-----	-----
Bacterial Leafspot	Dithane M-22 or M-45 plus copper sulfate	1 tablespoon/gal. 2 tablespoon/gal.	1
Cercospora Leafspot	Dithane M-22 or M-45	1 tablespoon/gal.	1
Anthraco nose	Dithane M-22 or M-45	1 tablespoon/gal.	1
Southern Blight	Terrachlor 75% WP plus Captan 50% WP on soil surface around the plant	5 tablespoon/gal. 5 tablespoon/gal.	1 1



Fig. 9.



Fig. 10.

Trade names of products are used to simplify the information.
No endorsement of named products is intended.

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