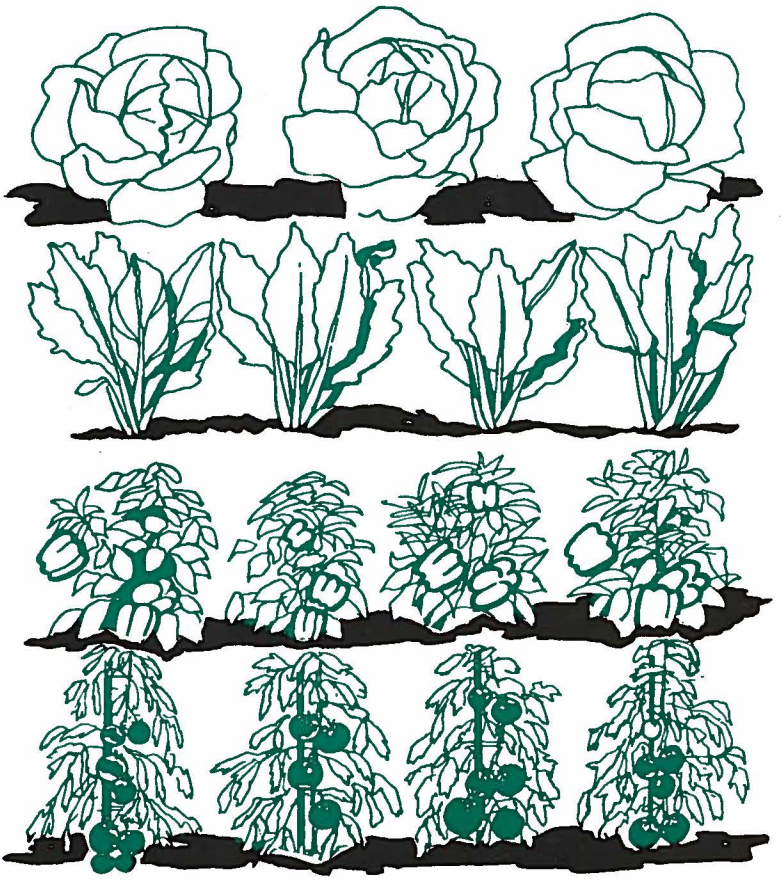
Home Gardening on Guam



Guam Cooperative Extension
College of Agriculture and Life Sciences
University of Guam

We are pleased to bring you this information!

This publication is intended as a general guide for gardeners and would-be gardeners. As a gardener on Guam, you will find the material helpful in providing practical "how-to" information that makes growing vegetables and fruits easier and more enjoyable

For more information, or assistance in setting up your gardens, please contact any of our Extension Agents at 734-2575, 734-2579, 734-2518 or 734-4753.

The Guam Cooperative Extension, as part of the University of Guam, conducts educational programs in agriculture and natural resources, community resource development, consumer and family sciences and 4-H Youth Development.

Extension information and programs are available to all citizens throughout the island regardless of age, race, color, national origin, religion, sex or disability.

Contents

What To Grow In Your Garden

Do you dream of having garden-fresh vegetables and fruit on your table? If your answer is **yes**, then why not grow your own?

Begin by deciding what you want to grow. You should consider what vegetables and fruit your family likes as well as those that will supply the most nutrients for your family's diet.

Here are some savory suggestions

Petsai is a dark-green variety of Chinese cabbage which grows quite easily, is a fair source of vitamins A and C, and contributes some iron. Petsai can be used as a substitute for lettuce in salads, or can be part of cooked mixed vegetable dishes.

Head Cabbage supplies vitamin C to the diet. It can be used in salads, including coleslaw, or in meat and vegetable dishes.

Bell Peppers supply both vitamins A and C to the diet. They add a fresh taste to salads and can also be used in cooked meat and vegetable dishes.

Beans help to supply protein to the diet. K.W. beans or long beans can be cooked by themselves or with meat. Winged beans are particularly high in protein and can be cooked or pickled.

Tomatoes are an all-time garden favorite. They are a fair source of vitamin C and also supply vitamin A to the diet. Tomatoes can be served in tossed salads, as a dish by themselves, cooked in stew and soups, or made into tomato sauce or catsup.

Cucumbers, though not high in nutrients, maintain their status as a local favorite. They can be sliced and served fresh in a soy sauce and vinegar dressing. They are also a popular addition to tossed salads, and can be made into dill, sweet, or sour pickles.

Eggplant contributes small amounts of several vitamins and minerals. It can be dipped in butter and fried, or can be part of mixed vegetable and meat dishes, but is most often cooked on a grill and served soaked in coconut milk.

Radish and Green Onions grow well and can be used as a garnish in salads. Green onions can also be used for flavoring in many meat dishes, and are an indispensable ingredient to *fina'dene* and fried rice.

Papaya and cantaloupe provide vitamin A to the diet, and cantaloupe also provides vitamin C. Both fruits grow quite easily on Guam. Cantaloupe can be served, sliced, cubed, or sphered, in fruit and tossed salads. Cut in half, cantaloupe can be served as an edible dish and refreshing complement to a scoop of ice cream. Papaya is a versatile fruit which can be served ripe in slices or spheres, or just before it ripens, slivered and served as a salad, sliced and pickled, or candied.

Sweet Potato (the light yellow variety) is commonly grown on Guam. This variety has small amounts of many vitamins and minerals but primarily contributes starch to the diet.

Choosing a variety of vegetables and fruits from this list will help to insure that your family's diet will be nutritious and low in calories. If you have a difficult time getting your children to eat vegetables, let them help you plant and care for the vegetables in your garden. They are more likely to try vegetables if they have helped to care for them and have watched them grow.

Most of these vegetables and fruit can be preserved by either freezing or pickling. If you grow more than your family can eat fresh, you can preserve them for later use.

Now that you've decided what to grow, the next step is to select the proper garden site for your crop(s).

Choosing Your Garden Site, and Preparing Your Tools and Supplies

Preplanting activities are separated into two categories — site selection and preparation of tools and supplies. The site of your garden is determined by factors such as size, availability of sunlight, water supply, soil condition, and the number of hours you have available to work on your garden.

Select your garden site with the following in mind:

1. Cultivate an area large enough to supply your family's produce needs. A 15' x 20' garden will be more than adequate for a family of four.

2. Vegetable crops do best when exposed to a full day of sunlight. The best sunlight exposure for most crops is from the afternoon sun. Leafy crops such as leaf lettuce, and head cabbage tolerate the least sunlight exposure. Root crops like radish do best with a full day of sunlight. Avoid placing the garden adjacent to buildings and tall trees.

3. Be sure that a water source is nearby and water is readily available. A 15' x 20' garden will require 20 to 40 gallons of water daily (rainfall included).

4. While today's technology allows the growing of plants in just about any soil condition, try to avoid gardening in very rocky areas, especially when growing root crops. But if this condition is unavoidable it can be compensated for to some degree by removing large rocks and incorporating livestock manure and/or plant humus.

5. Avoid beginning a large garden only to abandon it because you don't have enough time to tend to it. A 15' x 20' garden will require at least six to eight hours each weekend. You will need to spend two weekends just to prepare the field before planting. In addition, an hour or more may be spent every other day for other gardening activities such as watering, weeding, spraying, and harvesting.

6. Be sure to protect the garden from damage by pets and stray animals, such as chickens. An inexpensive fence made of chicken wire and *tangantangan* (a type of wood) posts should help out.

After you have chosen a garden site, make a sketch of the garden. Plot out where you will grow the crops in terms of rows and in relation to the height of the crops. Place the same crop in a row and situate taller crops (corn, trellised beans, cucumbers, tomatoes, and eggplant) farthest from the direction the sun sets. Place shorter crops (red radish and green bunching onions) nearest the direction where the sun sets. This means your crop rows should run north to south, with the tallest crops facing east and the shortest crops facing west. If late afternoon shading from nearby trees or buildings cannot be avoided, then run crop rows east to west, with the tallest crops facing north and the shortest crops facing south. The latter crop row arrangement allows for maximum use of midday sunlight. Note that you can have a combination of crops in one row but be sure that the crops are somewhat comparable in height. For example, you can plant green onions and radishes in one row.

Be prepared to tackle gardening work with the proper supplies and tools. While you can easily go to a store and buy seeds, pesticides, or hand tools at almost any time, it pays to identify the location(s) where you can get the right supplies and tools. The use of proper supplies and tools can make a difference in the outcome of the garden.

If a power tiller is not available for use in preparing the soil, then the use of a pick, shovel, rake and hoe should be adequate for land preparation. After planting, a garden hose, hoe and spade will be the tools regularly used for watering and weeding. A small manually-operated sprayer (one to three gallons capacity) is recommended to be available for pesticide applications and a small plastic pail for fertilizer application.

Finally, familiarize yourself with sources that have available seeds, pesticides, fertilizers and other materials such as nets or stakes used for trellising climbing crops. Select seed or seedling varieties that do well in Guam's tropical environment. Varieties that do

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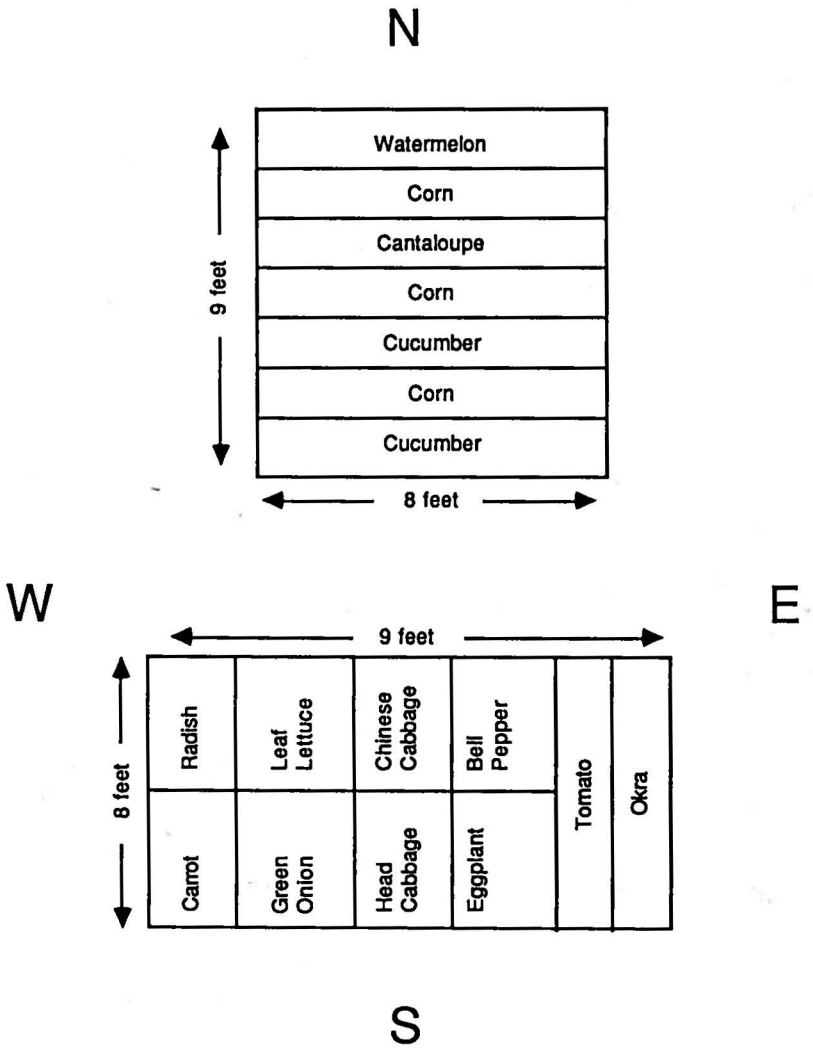


well in cool climates do rather poorly on island in terms of production. Also, select varieties that are resistant or tolerant to significant tropical insects and diseases.

Cultural Practices for the Home Garden

Cultural practices deal with the methods of planting, seeding, overall caring/maintenance and harvesting of crops. Practices vary depending on the type of vegetables to be planted. The garden should be measured and arranged according to plans. The rows should be marked and the distance between rows measured. Also, survey the number of plants or hills in the row to see if the projected harvest will meet your family's needs. Recommended spacing for the different vegetables can be found on *Table A.* The distance between rows depends on the size of plants when they are full-grown. Serious consideration should be given to size because there is a tendency to overcrowd a garden, which limits the production capability of the planted vegetables. *Table A* provides recommendations to help you with your garden arrangements and plans.

Different vegetables can be grown in the garden. The seeds may be directly planted (also called direct-seeding) or transplanted. Transplants are seedlings that are grown in a nursery condition at an earlier time, then are transplanted in the garden. Transplants will be ready for harvest earlier than if you had to direct-seed in the garden. A general rule for planting seeds or direct-seeding is to plant at a depth of four times the average diameter of the seed. Another rule of thumb is to plant small seeds about a half inch deep and larger seeds one- to one-and-one-half inches deep. In transplanting, plant the seedlings to the depth at which the roots were growing in their seedling container. Make planting holes large enough so that the roots will not be crowded. Be sure to pat down the soil around the main stem. *Table A* also indicates which crops are best for direct-seeding or transplanting.

Buy seeds or seedlings for transplant from a reliable source. Also, when buying seeds, be sure the seed is viable. Most garden seeds

Table A. Recommended Crops for the Home Garden

Crop	Est. Plantings for Family of Four	Distance Between Rows	Distance Between Plants	Direct Seeding (D) Transplant (T)	No. of Seeds per Hill	Days to Harvest
Beans (K.W., Yardlong, Winged Bean(	15-20 ft. row	36"	24"	D	2	50-60
Beans-Long	15-20 ft. row	36"	24"	D	2	60-70
Cabbage (Chinese)	10-15 plants	30"	12"	D	—	45-70
Cabbae (Head)	10-15 plants	36"	24"	T	–	75-85
Cantaloupe and other similar melons	5-10 hills 4 plants/hill	72"	48"	D	4	70-85
Chayote	1-2 plants	grow along fence	72"	D	2	50-65
Chives	1 clump	–	Need 4 sq. ft.	D	–	50-65
Corn (Field or Sweet)	20-30 plants in 4 rows	36"	12"	D	2	60-70
Cucumbers	5-10 hills 4 plants/hill	48"	24"	D	4	40-50
Eggplant	4-6 plants	24"	36"	T	–	55–65
Leek	10 ft. row	24"	2"	T	–	90-110
Mustard	10 ft. row	24"	8"	D	2	45-60
Okra	10-20 ft. row	36"	18"	D	2	40-50
Parsley	1 or 2 plants	24"	8"	D	–	35-45
Peppers	5-10 plants	36"	24"	T	–	60-75
Potatoes (Sweet)	50-100 ft. row	36"	12"	T	–	70-80
Radishes (Red, White)	4 ft row	18"	1"	D	2	30-60
Spinach	10-20 ft. row	18"	3"	D	2	45–60
Tomatoes	10-20 plants	5"	3"	T	–	60-70
Watermelon	6 plants	72"	60"	D	4	80-90

lose their viability after about a year. As a general rule, observe the date and germination percentages on the package and buy only the amount needed for one planting season. It is not recommended to use seeds that have been stored for two to three years. Also, select healthy seedlings which show a greater possibility of surviving when transplanted in the garden. Seedlings grown in shaded nursery conditions may need hardening before transplanting in the garden. To harden the seedlings, expose them two to three hours a day in direct sunlight in their containers. Do this for at least two days before transplanting.

Plants need to be watered so that the necessary nutrients are absorbed by the roots for growth and expected yields. Vegetable crops differ in the amount of water needed and the frequency of water application. It is recommended that the vegetable garden be watered about once a week or more frequently, as needed. Wet the soil to a depth of at least two feet at each watering. It is best to adjust watering to meet the needs of the shallow-rooted crops. If these are satisfied, the medium- and deep-rooted crops will automatically get enough water.

Weeds are one of the garden's biggest pests. Weeds compete with vegetable and fruit plants for water and plant foods. Weeds also shade plants, which slows down plant growth, and chokes out small plants. Weeds can be controlled through frequent cultivation between the rows and hand weeding around the plants.

Thinning of plants is required because overcrowded plants cannot grow rapidly to their normal size. Usually direct-seeded vegetables such as Chinese cabbage, radish, onions and mustard greens will require some thinning. The thinning of smaller plants can be used in tossed green salads.

A trellis supports plants that have vines such as beans (pole and yardlong), winged beans, cucumbers, and other climbing vegetables. A garden fence may also be used as a trellis. A trellis should be located to one side of the garden so that it will not block sunlight to the rest of the plants. A stake will provide adequate support for climbing varieties of tomatoes, pepper, eggplant, and other similar crops. Trellising and/or staking can also minimize

damage to the plant caused by heavy rains and winds, as well as provide support during the development of fruit.

Protection against insect pests, and diseases is recommended for most vegetable gardens on Guam. There are several insect pests that can damage the entire garden. Also, high temperatures and high humidity contribute to the potential damage from diseases.

Garden Soil Preparation

Soil preparation is an important factor in the success of a garden. The basic objective in preparing the soil is to get rid of unwanted weeds and to condition the soil to make plant nutrients more readily available, provide aeration for roots, increase the soil's moisture-holding capacity, and also improve yields. Land preparation can be done by using hand tools; using roto-tillers, which could make work more convenient; or using a garden-size tractor with a plowing implement for larger plots.

Access to a roto-tiller is helpful and more convenient in a small garden plot. Roto-tillers have many uses such as cultivating new ground, mixing organic matter and fertilizers, preparing seedbeds, and tilling under (working into the soil) crop residues. If you do not have access to a roto-tiller or garden-size tractor, hand tools such as a pick, shovel, hoe, and spade will be sufficient, but will require more time and energy.

A recommended plot for a garden requires well-drained soil with good moisture-holding capacity. Although fertile soils are always preferred, poor soil can be conditioned and made productive through the use of fertilizer. In addition, soil should have ample organic matter which is a good source of plant nutrients. If the soils are shallow, as in most areas around Guam, topsoil needs to be added to the site selected. A depth of six to eight inches of soil will be sufficient for the garden. Add to the topsoil animal manure, compost, or any similar material to increase the soil depth.

The soil should be thoroughly cultivated or worked over at least two times. The first cultivation should be done several weeks before planting, and the second time right before the day of planting. However, there is no limit to the number of times you till the soil. More frequent tilling will control the growth of weeds as well as condition the soil. Tilling will break up the big chunks of soil. If done by hand, you will need to level the site with a spading fork or rake to remove the big chunks and to pulverize the soil to a workable medium.

The addition of organic matter such as chicken or livestock manure, compost, grass clippings, and many other similar

materials, will improve the management and texture of the soil. Organic matter, when allowed to decompose, provides certain plant nutrients which are not otherwise readily available for plants. Also, it provides the aeration needed for plant growth and increases the moisture-holding capacity of the soil. Grass, brush clippings, kitchen waste, seaweed, and any similar material which can be decomposed by microorganisms could be piled in a compost heap. The decomposed material, called compost, is then added and mixed into the soil, thus providing the organic matter.

Plant Food - Fertilizers

Plants require food which is in the form of nutrients (elements). These nutrients are generally found in the soil and vary in content by soil types. Organic materials from decomposed plant and animal products are also a source of some plant nutrients. If any of these nutrients are lacking due to poor soil type, this can be corrected through the use of fertilizers to sustain productive plant growth. Fertilizers may be inorganic (chemical) or organic. These fertilizers, applied separately or in combination, can be used to correct poor soils. Organic fertilizer increases the water- and nutrient-holding capacity of the soil. Materials originating from plants and animals such as sludge, manure, bone meal, fish meal, and wood ashes are types of organic fertilizers.

Inorganic (chemical) fertilizers provide greater quantities of plant nutrients for plant use than organic fertilizers. Additionally, inorganic fertilizers provide nutrients in forms that are readily available to plants when they (nutrients) are most needed, thus increasing the plants' capacity for growth and yields. Inorganic fertilizers also have greater nutritive value compared to the same amount of plant food available from organic fertilizers.

There are 16 elements (nutrients) that are essential to plant growth. Three of the 16, carbon, hydrogen, and oxygen, are supplied by water and air. The remaining 13 elements are categorized into three groups. The first group, referred to as

Soil testing services are provided by the Agricultural Experiment Station at the College of Agriculture and Life Sciences. Based on the soil test results you will know what type of fertilizer to use and how much to apply. The steps to soil sampling are:

a) With a spade, make a deep hole in the soil.
b) Throw out a spadeful of soil.
c) Cut a half- to one-inch of soil from the back of the hole. Be sure the slice is at least five to seven inches deep and fairly even in width and thickness.
d) Place this sample slice in a plastic container.
e) Repeat the above procedure five or six times at different areas in your garden.
f) Thoroughly mix the five or six slices you have in the container.
g) After thoroughly mixing, take out about one pint of soil and place it in a clean plastic bag and bring the sample to the College of Agriculture and Life Science at Dorm I (near the UOG Fieldhouse) at the University of Guam in Mangilao.

When To Apply Fertilizers

Fertilizers should be applied to meet the needs of plants, and the amount and kind should be determined by a soil test. For the home garden, however, it is usually satisfactory to apply 2 to 2 1/2 pounds of fertilizer per hundred square feet of garden area at planting and the same amount again when the plants are three to four weeks old. Apply a complete fertilizer based upon the soil test results.

For plants that are to be transplanted, the use of a starter solution instead of tap water at planting will reduce the shock of

transplanting and produce larger, healthier plants. Use one pint of starter solution per plant. Starter solutions may be made by adding two ounces of dry fertilizer or two teaspoons of liquid fertilizer per gallon of water. Use complete fertilizers that are high in phosphorus.

How To Apply Fertilizers

Fertilizers can be broadcast or sidedressed. Broadcasting means spreading the fertilizer over the surface of the soil, then incorporating it into the topsoil by raking or tilling. Also, it may be placed in a band below or to the side of the seed or plant. It is recommended that a band application be placed below for small-seeded plants, and a band below and to the side of the seed for large-seeded plants. For small-seeded plants, and seeds on hills, fertilizer placement is two to three inches below the seed and two to three inches away from the seed. For transplanted seedlings, fertilizer should be placed four to five inches below the seedling. Sidedressing of fertilizer is done after the plants are well established. To sidedress, place the fertilizer in a shallow band four to six inches away from the plants. Cover the fertilizer with soil after application. Exercise care at all times so that the fertilizer does not come into contact with the leaves, stems, and roots, to prevent *burning* the plant.

How Much Fertilizer To Apply

Fertilizer recommendations are generally given in pounds per acre. Since most home gardens are not this large, information in Table B is designed for home garden plots.

Sidedress With Nitrogen

Vegetables vary in the amounts of nitrogen they need. Usually, vegetable crops require most of their nitrogen after they have made considerable growth or have begun to fruit. Too much nitrogen before this time will delay maturity and reduce flowering and yields.

When the plant is young it will receive enough nitrogen from the breakdown of organic matter and preplant fertilizer application. When the plant starts fruiting, or makes considerable growth, a nitrogen sidedressing is needed. Because vegetable crops vary in both the amount of nitrogen required and times of application, Table C is provided for a handy reference.

Table B. Fertilizer Recommendations for Home Garden Use

Recommended Rate (lbs./acre)	Broadcast (per 100 sq. ft.)	Banded (per 10 ft. Row Spaced:			Hill Placement Per Hill Sized:		
		1 ft.	2 ft.	3 ft.	5x5 '	2 1/4 x 2 1/4 ft.	2 x 1 1/2 ft.
100-110 l (lbs./acre)	1/2c (1/4 lb.)	3/4 tbs.	1 1/2 tbs.	2 1/2 tbs.	2 tbs.	1 1/2 tsp.	1/2 tsp.
200-225 lbs.	1c (1/2 lb.)	1 1/2 tbs.	3 1/2 tbs.	5 tbs.	4 tbs.	2 1/2 tsp.	1 tsp.
400-450 lbs.	1 pt. (1 lb.)	2 1/2 tbs.	5 tbs.	1/2c	6c	1 1/2 tbs.	2 1/2 tbs.
850-900 lbs.	2 pts. (2 lts.)	6 1/2 tbs.	3/4c	1 1/4 c	1c	3 1/4 tbs.	1 1/2 tbs.
1,300 lbs.	3 pts. (2 lbs.)	1/2c	1 1/4c	1-3/4c	1 1/2c	5 tbs.	2 1/2 tbs.

Table C. Recommended Nitrogen Sidedressing

Crop	Amount of Sidedressing (lbs. per 100' row*) Ammonium Sulfate	Time of Application Sprinkle the Nitrogen Fertilizer in the Middle of the Rows and Water if Rain is Not Likely
Tomato	1	1) One to two weeks before first tomato ripens. 2) Two weeks after picking first ripe tomato. 3) One month later.
Cucumber Cantaloupe Melon	1	1) One week after blossoming begins. 2) Three weeks later.
Sweet Corn	1	1) When plants are 8-10 inches tall. 2) One week after tassels appear.
Peas and Beans	1	After heavy bloom and set of pods.
Peppers and eggplants	1	After first fruit sets
Cabbage	1	3 weeks after field transplanting
Kale and mustard	1	When plants are about 1/3 grown
Sweet potatoes	none	Excessive amounts of nitrogen will reduce yields, or lower quality, or both. Sidedressing of nitrogen not needed.

*Urea may be used on an equivalent nitrogen basis.

Garden Pests

Garden pests are problems for the home gardener. Plants and vegetables take some time to grow and can be taken over by garden pests in a short time, making the garden unproductive and the gardener frustrated.

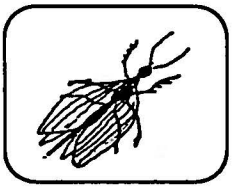
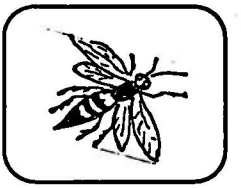
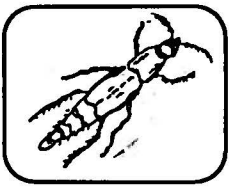
Garden pests are anything that compete with plants or crops for food, nutrients, water or space. They injure and spread diseases to crops and plants. Most pests affect the productive capacity of a plant and garden. Also, fruits and vegetables may be of lower quality relative to texture, taste, color, and shape. The control of garden pests is always a problem to the gardener.

For purposes of identification and control, pests are classified as:

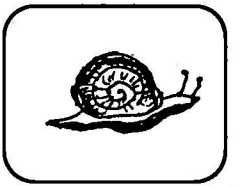
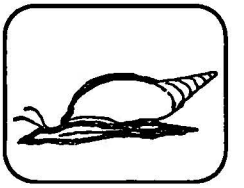
1) insects,
2) plant disease agents,
3) weeds,
4) mollusks, and
5) vertebrates.

Insects are found everywhere, in the soil, water, air, inside plants, and fruits. Insects have three pairs of jointed legs and three body regions--the head, thorax, and abdomen. Because not all insects are pests, they can be divided into two categories, beneficial and destructive. There are hardly enough of the beneficial insects such as preying mantis, tiny parasitic wasps, honey bees, and some beetles to control destructive insects. On the other hand, the destructive insects feed on, cause injury, or transmit diseases to plants, vegetables and fruits. Examples of these destructive insects are aphids, whiteflies, thrips, termites, leaf-miners, caterpillars, and many more. It is very important to identify the insect causing the damage because a beneficial insect can be easily mistaken for a pest.

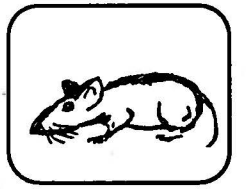
A plant disease is any harmful condition that makes a plant different from a normal plant in its appearance or function. Pathogens are the major cause of plant disease. Pathogens may be fungus, bacteria, viruses, and microscopic worms in the soil called nematodes. These pathogens infect the plants in three

Insects

Mollusks



Vertebrates

ways: (1) the over-development of plant tissues in the form of root galls, stem swelling, and leaf curls; (2) the underdevelopment of plant tissue as in stunting of plant, lack of chlorophyll or yellowing of leaves; and (3) the death of plant tissues as evidenced by wilting and appearance of blights, leafspots, and cankers. Guam's climate and tropical environment is ideal for plant diseases, which makes disease control an important concern for most gardeners. Most diseased plants may be easily recognized by comparison with a healthy plant.

Weeds are any plant that is growing out of place in the garden. For example, if cucumber is growing in a patch of Chinese cabbage, the cucumber is considered a weed. Weeds reduce the garden's capacity to produce, lower the quality of the fruit and vegetables, and increases the cost of maintaining the garden.

Weeds harm desirable plants by (1) competing for water, nutrients, light and space in the garden, (2) harboring insect pests and plant disease agents, and (3) releasing toxins in the soil which inhibit the growth of most plants. So, it is very important to remove all weeds and to maintain a clean garden.

Mollusks are a large group of land and water animals. The most common mollusk pest on Guam are snails. Snails and slugs feed on plants at night. They usually tear holes in the leaves, fruit and stem. These pests may also eat an entire seedling. The injuries by snails and slugs are easily noticed because of the chewing damage on most parts of the plants and fruit.

Finally, certain vertebrate animals which have jointed backbones may also be pests. They include rats, rodents, birds, and snakes. The damage is noticeable through the larger chewing damage on the plants. Also, fruits and vegetables usually disappear or are scattered in the garden.

There is a need to identify the garden pest before a pest control method is used. If the garden pest is not correctly identified, the cost may be expensive and the methods and type of pest control may be inappropriate.

Observe and examine the growth of plants, fruits, and vegetables. If anything out of the ordinary is occurring, then there is need to examine what is causing the changes in the garden.

Use of Pesticides in the Home Garden

Pesticides are chemicals used to destroy pests and control their activity or prevent them from causing damage. Some pesticides either attract or repel pests. Chemicals which regulate plant growth or remove foliage may also be classified as pesticides. Chemical control is generally the fastest way to control pests. In many cases, pesticides are the only weapon available for combatting pests.

Chemicals used to control insects and insect-like pests include insecticides, miticides and acaricides. Most chemicals used to combat insects act either as repellents or direct poisons. Repellents keep pests away from an area or specific host. Products designed to keep mosquitos off humans are an example. Direct poisons include chemicals that poison one or more life systems in the pest. Some will poison an insect if they are eaten (stomach poisons) while others require only contact with the insects (contact poisons).

Chemicals used to control plant disease pathogens include fungicides, bactericides and nematicides. Fungicides kill or inhibit growth of fungi and some, those with copper, are also toxic to bacteria. Nematicides kill nematodes by contact or systemic action.

A plan to control weeds in the home garden may include cultural control and chemical control. Cultural control may include mowing, hand-weeding, mulching and tilling. Chemicals used to control weeds are called herbicides. These chemicals kill weeds by contact or systemic action. Contact herbicides kill only the plant parts which the chemical touches. Systemic herbicides are absorbed by roots or foliage and carried throughout the plants.

Before purchasing a pesticide, be sure one is needed. An assessment of plant damage is essential before applying

chemical control. If a pesticide is to be used, identify the target pest and select the proper chemical for the job. By carefully observing the pest problem and applying chemicals when the pests are most vulnerable, one will be able to use a lower dose of pesticides and apply them less often.

All chemicals are potentially hazardous and should be used carefully. Follow the directions exactly, and pay close attention to precautions and limitations given on the container label. Store all chemicals in a safe place where children, pets, and livestock cannot reach them. Do not reuse pesticide containers. Avoid inhaling fumes and dust from pesticides. Avoid spilling chemicals. If they are accidentally spilled, immediately remove contaimated clothing and thoroughly wash the skin with soap and water. Follow all label precautions and directions, including requirements for protective equipment. Use a pesticide only against pests specified on the label. Apply pesticides at the rates specified on the label. Laws, regulations, and information concerning pesticides change frequently, so be sure the label you are using is up to date.

The success of many pesticide programs depends on the correct application of the needed pesticides. To achieve the most efficient pest control, choose the correct coverage, gallonage and type of equipment. Coverage is the distribution of a spray on or within the plant. The degree of coverage required differs with the target pest.

A thorough coverage application which distributes a wet film of spray on all plant parts is recommeded for the home garden. For example, scale insects, which are distributed throughout a plant and do not move around much, require a spray that reaches both exterior and interior parts of the plant. Therefore, scales are most often controlled with a thorough coverage application. Spray coverage to the top and underside of foliage and plant parts should be uniform and complete, but do not spray to the point of run-off.

Observe the Following Rules!

Wear goggles, an approved respirator, unlined rubber gloves, overalls or long-sleeved shirts, and long pants when mixing or applying pesticides.

Avoid drift from the application areas to adjacent areas occupied by human or livestock or to bodies of water.

Change clothing and bathe after the job is completed.

Know the insecticide, the symptoms of over exposure to it, and a physician who can be called quickly. In case symptoms appear, stop operations at once and contact a physician.

Harvest Tips

The ultimate goal of a home garden should be the harvest of quality fruit and vegetables for the family's eating enjoyment and nutritional benefit. The time and effort you spend on preparing and caring for the garden is just as important as the ability to determine when crops are best harvested.

To obtain quality produce that is rich in flavor and high in nutirtion, fruits and vegetables must be harvested at their proper maturity and peak condition. Harvesting depends on factors such as the type of crop, weather conditions, and the length of time involved before the fruit or vegetable is used. Certain crops can be harvested during their stages toward maturity, while some are best harvested when they reach their edible maturity. Crops that are harvested past their edible maturity either deteriorate immediately or increase in size considerably (causing poor quality of crop).

Guam's hot weather helps to decrease the quality of fruits and vegetables if they are not harvested promptly at their peak condition and maturity. It is best to harvest crops in the very early morning hours.

Harvesting fruit and vegetables during the coolest time of day (early morning hours) allows for additional shelf life. On the other hand, produce harvested during the hottest time of the day will require a cooling-down process prior to being stored in the refrigerator if an extended shelf life is expected of the produce.

While there is no hard and fast rule in the harvest of fruit and vegetables, the ability to perceive harvest-ready crops can be developed through knowledge and experience. Following are some ideas on harvesting popularly-grown crops.

Leafy vegetables such as leaf lettuce, mustard greens and Chinese cabbage can be harvested at almost any time during their development toward maturity. A leafy vegetable reaches

its maturity when vigorous growth of the leaves reaches maximum size typical of the variety it represents. Look for the bright green color (one representative of the variety), firm, yet tender structure, and crisp leaves. Symptoms of over-maturity include a dull green and yellowing color, wilting or withering, tough leaves accompanied by a bitter taste, and development of a seed stalk. Yellowing or a dull green color in the early stages of leaf development is usually a sign of nitrogen fertilizer deficiency.

Heading or cole crops such as head cabbage and heading Chinese cabbage varieties are best harvested when heads reach their maximum size which is generally indicated by firm and tightly-grouped leaves. If the head is left too long on the plant, bursting of the head may occur. One way to determine when the heads have reached their maturity is to keep a careful tab of the day the crop was planted and the recommended harvest period of the variety. Cauliflower is a more delicate crop and should be checked often to see when the curds (head) become firm, smooth and tightly grouped. This firmness of the curds does not stay long and any delay of harvest will quickly ruin the flavor and texture of the curd. The harvest indication for cauliflower can also be applied to broccoli. Kohlrabi is best harvested when its enlarged stem reaches two-and-a-half to three inches in size (diameter). If Kohlrabi is left in the field longer than necessary, the enlarged stem becomes woody and tough. Use a sharp knife to facilitate harvesting of heading crops.

Bulb crops most commonly grown on island are the green bunching onions. Bunching onions are harvested with both the leaves and bulbs. However, if only the leaves are desired, the leaves may be cut off the bulb at near ground level. The leaves are generally ready for harvest when it is about eight inches long. Both the leaves and bulbs are excellent ingredients in tossed salads or as a spice for recipes. Garlic can also be grown on island and their bulbs are harvested when the leaves begin to wilt and change in color. When harvesting garlic, be sure to leave the roots and leaves intact and place them on a dry, well ventilated ledge for several days as a curing process. After curing, remove the roots and tops.

Root crops — Quality root crops are generally associated with healthy tops (leaves). However, excessive application of nitrogen fertilizer may bring about over-healthy leaf growth which does not necessarily correspond to large or sufficient root crop formation, especially during the early stage of plant growth. Generally, radish are ready for harvest 19 to 21 days from the date of planting. Some varieties of radish take up to 60 days to harvest. Radish is best harvested when the enlarged portion of the root measures approximately one inch in diameter. Removal of the radish tops is generally done to enhance storage life and reduce weight loss of the roots. Sweet potatoes are harvested when the enlarged roots are mature. Since not all the roots on a given plant mature at the same time, you may wish to periodically harvest roots as they mature. However, one-time harvesting may be done when a majority of the roots reach maturity. Sweet potatoes become fibrous when harvested beyond their mature stage and often are attacked by the sweet potato weevil and root rot disease.

Tubers — Cassava (*mendioka*) and taro (*suni*) are the most commonly grown tubers around the house or garden. Cassava tubers (root) are harvested four to six months from the date of planting dependiing on the variety. Cassava can be left up to one year in the ground but a certain percentage (less than 30 percent) may become woody or fibrous. Dried cassava tubers are ground into flour called tapioca. The indication for harvest on taro crops is the yellowing of leaves, or when they are from six to seven months from planting.

Legume or bean crops such as pole or snap beans, bush beans, yardlong beans and winged beans can be harvested at early stages of bean pod development, depending on preference. Since most bean crops produce pods at intervals, daily inspection of the bean for pod development should be conducted. The important thing to remember about bean crops is that seeds development in the pods should not be allowed to be fully developed, otherwise the seeds become tough and the inner walls of the pod become very stringy. Large seeds protruding extensively on the pods should not be allowed to take place if tender beans are to be harvested.

Nightshade crops — Tomato fruits are harvested at various stages of development from immature green, mature green, half-ripe or pink, to ripe or red. At what stage you harvest tomatoes depends on what you plan to use it for. If you prefer ripe fruit, allow the fruits to reach the *turning stage* before harvesting.

The turning stage is when the fruit begins to change its shade of green. Bell peppers or sweet peppers are generally harvested before they begin to change color (red or yellow, depending on the variety). Observe the fruits and watch for maximum size or growth (again this depends on the variety). Once the fruit reaches its maximum size, the peppers should be harvested without delay. Eggplant is generally harvested before the fruit are fully mature. Harvesting of eggplant may begin once the fruit reaches 1/3 to 2/3 its usual size and are still glossy. Dull colored fruits are an indication of overripeness.

Vine crops — Cucumbers are generally ready for harvest on the 35th day after planting. Cucumbers for salad ingredients are best harvested when they are about six to ten inches long (though some hybrid varieties may have longer fruits). If you are not certain, do not allow the cucumber fruit to reach more than two inches in diameter. Watermelon are ready for harvest when the color of the rind of the fruit in contact with the ground changes from white to yellow. Cantaloupe fruits are ripe when they become noticeably yellow and the netting becomes prominent. Ripe cantaloupe fruits should be easily separated from the vine when slight thumb pressure is applied on the stem.

Grain crops — Sweet corn is best harvested at its milk stage. This is indicated by a thick, milky substance from the kernel as you break the kernel with thumb or fingernail pressure. The silk of the corn cob is generally brown but the husks are moist with a bright, healthy color.

Freezing Garden Produce

Freezing is one of the simplest and least time-consuming ways to preserve foods at home. You can keep a supply of your favorite vegetables on hand year-round, or prepare ahead for a fiesta. More of the natural color, fresh flavor, and nutritive values are retained by freezing vegetables than any other method of preservation. Frozen vegetables are also ready to serve quickly because most of the preparation they need for the table is done before freezing.

Fresh, tender vegetables right from the garden are best for freezing. Wash the vegetables thoroughly in cold water. Lift washed vegetables out of the water and drain well. Do not allow them to stand in the water as they lose quality and nutrients. Cut off and discard the tops or stems of the vegetables that are not eaten. Next, cut the vegetables into the size pieces you want for serving just as if you were preparing to serve at the table.

Heating or blanching before packaging is very important. All vegetables, except onions and green or red peppers, must be blanched. If vegetables are not heated, the ripening enzymes continue to be active during frozen storage, causing loss of flavor, color, and breakdown of texture. Heating also wilts or softens vegetables and makes them easy to pack. Blanching time will vary with the vegetables and size of the pieces. Consult your recipe for blanching time. Recipes may be obtained from the Home Economics office of the Guam Cooperative Extension at the College of Agriculture and Life Sciences, Dorm I, at the University of Guam.

To blanch vegetables, place them in boiling water for the specified time. For each pound of prepared vegetables use at least one gallon of rapidly boiling water. Lower the vegetables into the boiling water, making sure they are not packed tightly. There must be room for the water to circulate freely around the vegetables. Put the lid on the pot and start keeping track of the boiling time.

After the vegetables are heated, plunge them immediately into a large quantity of cold water. When cooled, remove the vegetables from the water and drain.

Place the cold vegetables into a moisture/vapor-proof container. Pack foods tightly to cut down on the amount of air in the package. For most vegetables, allow about a half-inch space at the top of the package because food expands as it freezes. Keep sealing edges free of moisture and food so that a good closure can be made. Label and date packages and place them in the coldest part of the freezer.

Follow these guidelines and soon you and your family will be eating garden-fresh vegetables. If you have more detailed questions, please consult with an Extension Agent by calling 734-2575, 734-2579, 734-2518 or 734-4753.

Pest Control Methods

Biological control
This involves the use of naturally occurring enemies such as parasites, predators and disease agents (pathogens). It also involves capturing, producing and releasing biological control agents to supplement natural control. This method is generally conducted by agricultural entities.

Chemical control
The use of pesticides (chemicals) to destroy pests. The type of chemical used on crops must be approved for use on the crop. Some pests are known to be resistant to pesticides. Chemical control is perhaps the most widely used method to control agricultural pests.

Cultural control
Planting, growing, harvesting and tillage practices can sometimes manipulate pest populations. Examples are growing plants on trellises, and keeping the garden free of weeds.

Host resistance
This method entails using crop varieties that are immune to certain disastrous pests.

Mechanical control
This involves the use of traps, screens, barriers, radiation, and electricity to prevent the spread of pests or reduce infestations.

Natural forces
Populations of pests may be controlled by such factors as climate, natural enemies, topography of land area, and availability or lack of food and water supply for the pest.

Sanitation
This involves the use of pest-free seeds or plants and decontaminating of equipment and other possible carriers before allowing them to enter the garden.

Conversion Table

1 tablespoon (T) = 3 teaspoons (tsp)
1 fluid ounce (oz.) = 2 tablespoons
1 cup (c) = 8 fluid ounces
1 pint = 2 cups or 16 fluid ounces
1 quart (qt.) = 2 pints or 32 fluid ounces
1 gallon (gal) = 4 quarts or 8 pints or 128 fluid ounces

1 pound (lb) = 16 ounces
1 hundred weight (cwt.) = 100 pounds
1 ton = 20 cwt. or 2,000 pounds
1 gram (g) = .035 ounce
1 kilogram (kg) = 2.2 pounds
1 metric ton = 100 kilograms or 2,205 pounds

1 hectare = 2.5 acres

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