UNIVERSITY OF GUAM
COOPERATIVE EXTENSION
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Starting a vegetable garden in Guam

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Agriculture & Natural Resources Program

Fact Sheet CEO-01-2024

Introduction

Vegetable gardens provide fresh and nutritious food that our bodies need. In fact, those who eat vegetables from their gardens can have longer and healthier lives. Gardening provides the benefits of exercise and fresh air as well as relaxation and stress reduction. This booklet is designed to help residents of Guam start a vegetable garden and maintain it year-round.

Steps to gardening in Guam

Site selection

Site selection is one of the most important steps when starting a garden. Some of the things to consider are the size of the area, amount of sun and wind, topography, location of a water source, and soil conditions. Ideally, the land should be flat or slightly sloped and have good drainage. Gardens should not be placed in low spots, where water puddles after it rains. Soggy soil can lead to root rot and can kill plants. The site should be near a water source and away from areas that pigs, chickens, deer, and other animals that may damage or eat the vegetables can access it.

Planning

When starting a vegetable garden, some factors to consider include:

1) the amount of space available
2) the type of vegetables the gardener and his or her family likes to eat
3) the type of garden
4) the time of year.

The amount of time one can devote to working in the garden must also be taken into account. It is best to start with a small garden that is manageable. Sometimes gardeners start out with a large garden and end up abandoning it because they do not have enough time to maintain it.

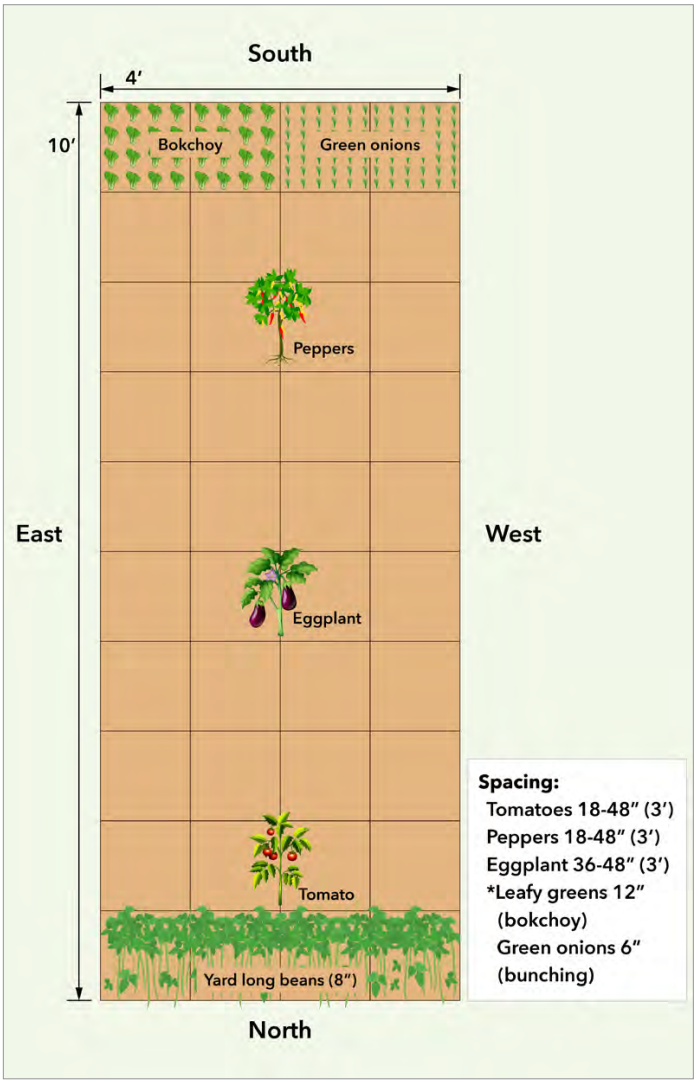

Figure 1. Garden orientation
Graphic by Conrad Calma

It is a good idea to make a sketch to scale. Indicate where the water source is located. Also map out the vegetables to be grown and the spacing between plants. Put the garden in a place where the vegetables will get plenty of sunshine. Most vegetables need at least 6-8 hours of full sun per day. Avoid placing the garden adjacent to buildings and tall trees that may shade the garden. Also, do not plant in an area with strong winds because plants can be damaged.

Ideally, rows should be oriented north to south to get the most sunlight per day (Fig. 1 on Page 1). The taller plants should be planted on the north side of the garden and the shorter ones on the south side so they are not shaded out. The width of the garden should be 3-4 feet so vegetables can be reached and harvested from both sides. However, in small yards with obstructions, vegetable plants should be planted in an area that receives the most sunlight. It is best for the plants to receive afternoon sun in these areas if possible.

Before planting an in-ground garden, it is recommended that gardeners take a soil sample to be analyzed (See procedures in "Soil Sampling for Healthy Plants and a Healthy Environment," 1998.) to see if the soil needs to be amended. The soil test can indicate the levels of phosphorus, potassium, magnesium, and calcium in the soil. It also specifies the pH (acidic or alkaline) and the percent of organic matter. Organic matter improves soil quality, drainage, yield, and reduces erosion.

Types of gardens

There are four main types of vegetables gardens:

1) in-ground garden (Fig. 2)
2) raised-bed garden (Fig. 3)
3) waist-high raised-bed garden (Fig. 4)
4) container garden (Fig. 5).

Figure 4. Waist-high raised-bed garden
Photo by Olympia Terral

Figure 2. In-ground garden
Photo by Phoebe Wall

Figure 3. Raised-bed garden
Photo by Phoebe Wall

Figure 5. Container garden
Photo by Phoebe Wall

Figure 6. Example of a trellis
Photo by Phoebe Wall

When choosing a type of garden, take into account the soil type. If the soil is rocky and shallow, consider growing vegetables in raised beds or containers. If using containers, make sure there are ample drainage holes so the pot does not get waterlogged, which can cause root rot.

Which vegetables a gardener wants to grow is a factor when growing vegetables in waist-high beds. For example, corn, tomatoes, and okra are not suitable for growing in this type of garden. Shorter vegetables, such as leafy greens, green onions, and certain herbs are appropriate for waist-high raised bed gardens.

Tools, materials, and supplies

Before preparing the garden, buy all the necessary items. Shovels, spades, hoes, rakes, trowels, a wheelbarrow, and garden hoses are standard items needed for growing vegetables in the ground. One can also use a drip irrigation system to save time watering and reduce the amount of water used. Raised bed and container gardens usually require a trowel, high-quality potting mix, a wheelbarrow, a hose, and a watering wand.

Table 1. Common vegetables grown in Guam gardens

Crop name	Days to harvest	Days during harvest	Recommended planting months
Beans, yardlong	55–60	4 weeks	Sept-Apr
Cabbage, Chinese	45–60	2 weeks	Oct-Apr
Corn, sweet	60–70	2 weeks	Sept-Apr
Cucumber	35–45	3 weeks	Sept-Apr
Eggplant, long	55–65	12 weeks	Year round
Leafy greens	30–50	once	Year round
Melon, bittermelon	60–80	8 weeks	Year round
Melon, watermelon	60–70	2 weeks	Oct-March
Okra	60–70	8 weeks	Year round
Onion, green	30–50	once	Year round
Peppers, hot	50–60	12 weeks	Year round
Potato, sweet	3–4 months	once	Year round
Taro, red	6–10 months	once	Year round
Tomato, cherry	60–70	5 weeks	Oct-May

There are also adaptive tools and materials, such as ergonomic upright handle garden tools for hand joint damage/arthritis, for those with physical disabilities. There are ergonomic shovels, spades, trowels, and other items as well.

When growing certain vegetables, like cucumbers and beans, a trellis is needed to support them (Fig. 6). Tomatoes need to be supported with stakes, trellises, or cages to keep them off the ground.

If there are chickens in the area, some type of barrier, such as chicken wire, may need to be installed to keep the chickens from damaging the garden. Barriers may also be needed for pets that dig.

What and when to plant

A wide selection of vegetables grow in Guam (Table 1). Warm season crops, such as tomatoes, cucumbers, eggplant, and yard long beans, grow well in Guam's tropical environment. Cool season vegetables, such as peas and brussels sprouts, do not produce vegetables on Guam. Some cool-season vegetables, such as lettuce, broccoli, and kale grow quite well in Guam if the right variety is used.

It is important to buy the variety of vegetable seeds and seedlings that will grow well in Guam's hot and humid

climate. Many seeds sold in Guam are not suited for our environment. For a list of crops and varieties, please see the "Guam Crop Charts" (https://www.uog.edu/_resources/files/extension/publications/Guam_Crop_Charts.pdf).

Preparing the garden

After deciding what to put in the garden, the area should be prepared for planting. One way to start a vegetable garden in the ground is using the no-till method. First, remove the weeds. Cardboard or shredded paper can then be laid on the ground of the garden to suppress weeds from emerging. Amend the soil around the plants with compost, manure, or fertilizer, and cover the garden with mulch. If drip irrigation is used for watering, place it under the mulch.

Figure 7. Mature tomato plants with mulch on the top of the soil
Photo by Phoebe Wall

Mulch (Fig. 7) suppresses weed growth, conserves water, improves nutrient availability, and keeps the soil open and loose for water penetration and air movement. It can also increase the growth and yield of vegetables and other plants. Two to three inches of mulch is laid on top of the soil after planting. It should be placed 2–3 inches away from the base of the plant. Organic mulches include ironwood needles, compost, shredded paper, leaves, and dried grass clippings. At present mulch and compost can be purchased in bulk at Pacific Topsoil and Compost.

Use a good-quality potting mix for containers. A lightweight mix should be used for waist-high beds. The different mixes are usually soilless and contain peat moss and perlite. They retain water, improve drainage, and provide aeration. The peat moss should not be allowed to dry out because it is difficult to rewet.

Starting plants

Vegetables can be planted by seed or seedlings. Some vegetables, such as green onions and turmeric (yellow ginger), are propagated by division. Seeds, such as corn, beans, radishes, and cucumber can be planted directly into the soil. Other vegetable plants, such as tomatoes, eggplants, and peppers, do much better when grown in small containers filled with potting mix and then transplanted when they are large enough. Two to three seeds should be planted per hole. Plant the seeds two or three times deeper than the width of the seeds.

Once the sprouts are 1–1.5 inches high, depending on the vegetable, keep the best seedling and gently remove the others leaving one per pot. When the seedlings get four to five true leaves, most plants can be transplanted into the garden (Fig. 8).

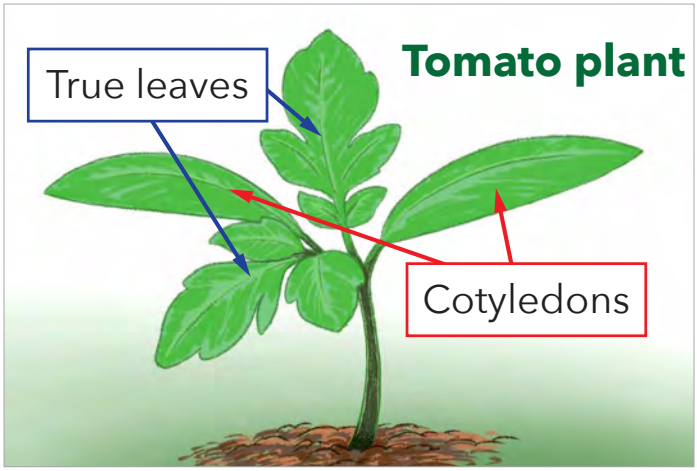

Figure 8. The first true leaves and the cotyledons (seed leaves).
Illustration by Conrad Calma

Planting

If seedlings are grown in a shady area, they need to be "hardened off" before planting them in the garden. During this process, seedlings need to gradually be exposed to more sunlight, increased temperature, and less water. It takes about 10–14 days until the seedlings are ready to be transplanted in the garden.

When transplanting a seedling into the ground, dig a hole large enough for the roots. The hole should be the same depth as the root ball and twice as wide. Hold the root ball gently, put the seedling in the hole, and fill the hole with soil. Put the seedling and soil into the hole so they are even with the soil surface. The plant should be able to stand up straight on its own. Gently tamp the soil and water the vegetable plants after planting.

It is best to plant in the late afternoon or on a cloudy or overcast day. The plants can face additional stress if they are planted in the middle of the day when the temperature and sunlight are highest.

Figure 9. Example of mulch
Photo by Phoebe Wall

Before planting, add mulch (Fig. 9) on top of the soil to save water, reduce weeding, help roots to grow, and keep the soil cooler. Commercial mulch, grass clippings, ironwood (gago) needles, shredded paper, and leaves can be used as mulch.

Watering

Make sure vegetable plants are watered when they need it. Temperature, wind, and the amount of sunlight plants receive, among other factors, determine the amount of water needed. An increase in the above will require an increase in the amount of water plants need.

Tips for when and how much to water:

In-ground garden

- Rocky or sandy soil needs to be watered more often than clay soil.
- Shallow soils, often found in northern and central Guam, need to be watered more often than deep soils, which are mainly found in the South.
- Mulched plants need less water.

Raised-bed garden

- Stick your finger approximately 2 inches into the soil to see if the plant needs to be watered. If it is moist, do not water.
- The amount of water needed is dependent on the size of the plant and the volume of the potting mixture and amendments of the raised bed.
- Mulched plants need less water.

Container garden

- Stick your finger approximately 2 inches into the potting mix to see if the plant needs to be watered.
- Plants dry out quickly, especially when it is sunny and windy. Some plants, such as tomatoes, may have to be watered one to two times per day depending on the size of the plant and container, as well as the weather.
- Water the potting mix slowly until water comes out the drainage holes.
- Plants on cement surfaces dry out quicker because of the heat and reflection off the cement.

Make sure to water slowly and thoroughly, which helps the soil not have to be watered as often and helps the roots grow deeper. Water the soil, not the leaves, because plant diseases can develop and spread. Mulch helps stop the water from splashing up to the leaves, which can cause some plant diseases.

Plant nutrients

Plants need macro, secondary, and micronutrients to grow and produce flowers and fruit. If any plant nutrient is deficient, plant growth will be compromised, even if the other nutrients are abundant (Liebig's Law of Minimum).

Macronutrients

Macronutrients are the nutrients needed most. They include:

- Nitrogen (N): Gives leaves their green color and improves the quantity of leaves. It also promotes rapid plant growth. If too much is applied, the vegetables will have lots of leaves and fewer fruits.
- Phosphorus (P): Stimulates early root formation and root development. It also speeds up the maturity of plants and stimulates seed germination, flowering, and fruiting. Add phosphorous to the soil if needed. In rocky soil, P gets tied up and makes it unavailable to plants.
- Potassium (K): Improves the quality of fruit and provides the formation and translocation of starches. It also aids in root development, flower initiation, and seed and fruit development. Potassium has been shown to reduce disease incidence in some plants as well.

Secondary nutrients

Secondary nutrients include calcium, magnesium, and sulfur. Micronutrients include iron, zinc, chlorine, boron, copper, molybdenum, and nickel. It is important to provide the right amount of these elements so they do not experience deficiency or nutrient excess symptoms.

Fertilizers

Vegetable plants usually need fertilizer to grow well. Fertilizer applications depend on the crop and the amount of nutrients already in the soil or potting mix.

Synthetic (man-made) fertilizers, such as 16-16-16 and 10-20-20, can be used for vegetables that produce fruit, such as tomatoes, eggplant, beans, and cucumber. Fertilizers higher in nitrogen can be used for leafy vegetables, such as Chinese cabbage, leafy greens, and green herbs, such as basil, mint, and rosemary.

Natural/organic fertilizers, such as bone meal, blood meal, manures, and compost are produced naturally. They are derived from plants and animals and seem to be becoming more popular in home gardens in Guam.

Figure 10. Fertilizer label indicating the percentage of nitrogen, phosphate, and potassium.

The fertilizer label should always be read before purchasing the product. Fertilizers have three numbers on the front of the container (Fig. 10). These numbers indicate the percentage of nitrogen, phosphate, and potassium in the fertilizer. Other plant nutrients will be listed on the container if they are present.

Three synthetic fertilizer formulations are readily available on the market: granular, water soluble, and slow release. Granular fertilizers, such 10-20-20, are usually used for in-ground and raised bed gardens. Slow-release and water-soluble fertilizers are usually best used for container gardening.

Figure 11. Aphids
Source: Wikimedia

Figure 12. Whiteflies
Source: Flickr Creative Commons

Figure 13. Mealybugs on eggplant
Photo by Phoebe Wall

Figure 14. Leafminers on eggplant
Source: Dara Renee Sailler

Figure 15. Chinese rose beetle
Source: iNaturalist

Figure 16. Corn earworm
Source: Ric Bessin

Organic fertilizers are also available in Guam. Bone meal and blood meal are the most common ones found on-island.

Pest management

Guam has many plant pests. Some include insects, mites, plant diseases, and weeds. Aphids (Fig. 11), whiteflies (Fig. 12), mealybugs (Fig. 13), leafminers (Fig. 14), beetles (Fig. 15), and caterpillars/loopers (Fig. 16) are some of the most common insects that attack vegetable plants. Pigs, chickens, deer, and dogs also attack gardens.

Plant diseases may be caused by microscopic organisms, such as bacteria, fungi, viruses, and nematodes. Dark or

yellow spots on the leaves or fruits, crinkled leaves and other symptoms that look unusual may indicate a plant disease.

The first step of pest management is monitoring the garden frequently to identify plant pests and beneficial insects. It is best to detect insects and diseases before their population gets too high. Common places to inspect for insects are the underside of leaves and new growth. Plant diseases can be found on any part of plants.

Proper identification of plant pests and their natural enemies, such as praying mantises and certain ladybeetles, is part of a strategy called Integrated Pest Management (IPM). The goal of IPM is to keep pest populations to an acceptable level.

The following are some IPM strategies:

- Use crop varieties that are resistant to specific diseases.
- Biological control: Use natural enemies (specific organisms that suppress pests).
- Cultural control: Modify the environment of plants to prevent pests.
- Crop rotation: Do not continuously grow the same vegetables in the same place, year after year. Rotate plants from different plant families, e.g., tomato family, bean family, melon family, etc.
- Spacing: Increase to improve air movement between plants and reduce plant diseases.
- Weed control: Weeds harbor pests and compete for sunlight and nutrients.
- Sanitation: Remove diseased shoots, leaves and fallen fruit, and plant debris to prevent the spread of pests.
- Mechanical control: Examples include barriers, traps, screens, and fences.
- Chemical control: Insecticides, fungicides, herbicides, etc.

Gardening can be very rewarding. There is always something to learn, and it is satisfying to reap the fruits of one's labor and eat fresh, nutritious vegetables.

Disclaimer: *UOG Cooperative Extension & Outreach does not endorse any of the products reflected in the examples shown in this fact sheet.*

REFERENCES

Artero, V. T., Barcinas, J. D., Carpenter, K. A., De Guzman, B. P., & Santos, V. M. (1988). *Home Gardening on Guam* (2nd ed.). Guam Cooperative Extension, University of Guam. https://www.uog.edu/_resources/files/extension/publications/Home_Gardening_on_Guam_1988.pdf

Brady, N. C. (1990). *The Nature and Properties of Soils* (10th ed.). Macmillan Publishing Co.

Kopsell, D. (2016). Garden Mulches. University of New Hampshire Cooperative Extension. Retrieved from https://extension.unh.edu/sites/default/files/migrated_unmanaged_files/Resource007193_Rep10385.pdf

Motavalli, P. (1998). *Soil Sampling for Healthy Plants and a Healthy Environment.* College of Agriculture & Life Sciences, University of Guam. https://www.uog.edu/_resources/files/extension/publications/Soil_Sampling_1998.pdf

Santos, L., & Wall, P. (2020). *Guam Enabled Gardening: Adaptive Gardening Series - Adaptive Tools* (No. FS006-20). University of Guam Cooperative Extension & Outreach. Retrieved from https://www.uog.edu/_resources/files/extension/06_Enabled_Gardening_Adaptive_Tools.pdf

Santos, L., & Wall, P. (2020). *Guam Enabled Gardening: Adaptive Gardening Series - Planning the Garden* (No. FS003-20). University of Guam Cooperative Extension & Outreach. Retrieved 2024, from https://www.uog.edu/_resources/files/extension/publications/03_Enabled_Gardening_Planning_Garden.pdf

Tuquero, J., Bamba, J., Marutani, M., & Wall, P. (2016). *Guam Crop Charts* (FPP-01). University of Guam College of Natural & Applied Sciences. Retrieved July 26, 2024, from https://www.uog.edu/_resources/files/extension/publications/Guam_Crop_Charts.pdf

Uchida, R. (2000). Essential Nutrients for Plant Growth: Nutrient Functions and Deficiency Symptoms. *In Plant Nutrient Management in Hawaii's Soils, Approaches for Tropical and Subtropical Agriculture.* College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa. https://www.ctahr.hawaii.edu/oc/freepubs/pdf/pnm3.pdf

Wall, P., & Santos, L. (2020). *Guam Enabled Gardening: Adaptive Gardening Series - Pest Management* (No. FS010-20). University of Guam Cooperative Extension & Outreach. Retrieved July 26, 2024, from https://www.uog.edu/_resources/files/extension/10_Enabled_Gardening_Pest_Management.pdf

Wall, P., & Santos, L. (2020). *Guam Enabled Gardening: Adaptive Gardening Series - Plant Fertilizers* (No. FS009-20). University of Guam Cooperative Extension & Outreach. Retrieved July 26, 2024, from https://www.uog.edu/_resources/files/extension/09_Enabled_Gardening_Plant_Fertilizers.pdf

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Published: September 2024

This publication, as supported by U.S. Department of Agriculture funds through the University of Guam College of Natural & Applied Sciences, is in the public domain.