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F.A.I.T.H. Gardening
(Food Always In The Home)

Manual

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Adapted from the original **MBRLC "HOW TO" SERIES NO. 2**
A MANUAL ON HOW TO MAKE FAITH (Food Always In The Home) GARDEN
ASIAN RURAL LIFE DEVELOPMENT FOUNDATION, INTERNATIONAL

To our valued reader:

The illustrated manual, how to make a FAITH (*Food Always In The Home*) garden, is written especially for you. This manual is a guide for growing various garden vegetables. It will also teach you how to produce fresh vegetables throughout the year-thus food always in the home.

The Food Always In The Home (FAITH) Garden technology described in this handbook has been tried and verified by us for several years now. We find the technology very workable at our multiple training centers as well as in several village-level projects throughout Asia. Also, we are finding this technology to be popular with rural and city dwellers alike.

We are happy to share with you this technology. You are very much welcome to try and follow or improve it. Happy FAITH gardening!

Sincerely yours,

J. Jeff Palmer, Director
Asian Rural Life Development Foundation, International

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Introduction to the Fourth Edition of the FAITH (Food Always In The Home) Garden manual

The "FAITH" Garden Technology

In 1974, to promote home gardening, the Mindanao Baptist Rural Life Center in the Philippines, commenced the development and practice on its farm the simple but effective vegetable growing system called "FAITH" or Food Always in The Home.

Fresh Vegetables Every Day

As its name suggests, the **FAITH Garden** system is a system by which farmers can produce a continuous and sufficient supply of fresh vegetables for their families on minimal space, and by using some simple agricultural techniques, produce them all year round. It is not felt however, that FAITH gardening is the final word in family gardening. This is only an attempt to develop a home garden that can provide adequate nutritious food with minimal cost, labor, and land utilization. It is meant to be used as a guide and we welcome any improvements you might suggest.

Can I Plant a FAITH Garden?

As in most agricultural systems, the primary limiting factor for the FAITH Garden is water. The system outlined in this manual is best suited for climates which have either regular rainfall, or resources to provide ample irrigation. It also works best in the tropics where temperatures allow year-round crop growth and production. However, the techniques outlined in this manual are easily adapted and incorporated into temperate garden systems, even though cold temperatures may prevent year-round production.

If you are farming in a monsoon, semi-arid or desert region, you must select crops and techniques appropriate to drier areas. Instead of planting on raised beds, for example you would dig down and plant in holes or depressions in the earth in order to conserve moisture. You would also place an emphasis on the use of windbreaks, mulches, water catchments and drip irrigation systems.

Regardless of whether you live in the mountains or in the lowlands, where it is rainy or dry, you can produce food to feed your family, and the FAITH Garden system is a tool you can use to produce nutritious fruits and vegetables in most climatic and geographic areas of the world.

Importance Of Vegetables

Vegetables are essential to our daily diet. Rich in vitamins, minerals, protein and fiber, these plants contribute enormously to the nutrient requirements of the human body.

Many People Do Not Eat Vegetables Every Day

While vegetables can easily be grown in most parts of the world, many people surprisingly do not grow or consume enough of them. For instance, in the Philippines, Generosa T. Medrena, senior science research specialist of *The PCARRD Monitor* says, "The average per capita consumption of 12.4 kilograms of green and yellow vegetables is far short of the recommended allowance of 32.4 kilograms per year."

Reason For Low Vegetables Consumption

Scientists believe that the low vegetable consumption can be traced to the lack of knowledge of health benefits. Many people do not know that vegetables are inexpensive

sources of natural vitamins, minerals and proteins. In addition, many fail to maintain vegetable gardens in their home yards because there is a general lack of know-how about simple, practical home-gardening methods.

Home Gardening Can Reduce A Family's Daily Food Expense

"Home gardening," says Enriqueta B. Torres in Research at the University of the Philippines, Los Baños, "can reduce by about 20 percent a family's total daily food expenditures. Considering the high cost of vegetables and the rate of malnutrition in the many countries today, home gardening should be taken seriously by families with low income, and whose members are nutritionally at risk."

A Rewarding Hobby

Home gardening can be a rewarding hobby, even for urban dwellers. "We find it very productive, gratifying way of spending our leisure hours before and after office works," says one bank teller.

A Closer Knit Family

Home gardening can bring a family closer together. Remarks one school teacher," Working in the garden together helps strengthen family ties."

Vegetables From The Home Garden Are Of Superior Quality

Fresh vegetables from home gardens are generally superior to those sold in the markets, which are often polluted by exposure to dust, insects, dirty water and handling. Moreover, growing your own vegetables, you can know for sure whether or not chemicals have been applied.

Additional Income From Home Gardening

Sometimes, home gardens produce more vegetables than a family can consume. The surplus may be shared with neighbors and friends or sold in the market to add to the family's income.

Other Benefits From Home Gardening

Home gardening is an invigorating form of exercise that strengthens soft, flabby muscles. It can improve the appearance of your home. A home with lush-growing vegetables is very pleasant to look at.

Additions to the Latest Editions of the FAITH Garden Manual

In the latest editions, Larry Yarger, agricultural consultant and writer for ECHO (Educational Concerns for Hunger Organization), located in southwest Florida, USA, has added several new sections to the FAITH Garden manual. These include four appendices (Vermiculture Basics, Home Garden Pesticides, Companion Plants, and Weights/Measures Charts) and a section on Integrated Pest Management (IPM). In addition to editing the entire manual, he has also augmented several existing sections, including "Cultural Practices" and Appendix number 1, the "List of Home Garden Vegetables." The manual itself has been edited to be more universal in scope, thereby making it more applicable and useful in communities around the globe.

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10 Steps

to the

F.A.I.T.H.

[Food Always In The Home]

Garden

Step 1: Locate The Best Site For The Garden

Criteria For Site Selection

There are ten (10) steps in making the **FAITH Garden**. The first step is to locate the best site for your garden. The criteria for good site selection are good water supply, good soil drainage and fertility, sunlight availability, and good air circulation.

Good Water Supply

Water is an important factor in plant growth. In the dry season, it is a vital requirement of the vegetable grower. You should plant your vegetables in a site where you can easily obtain water for the plants.

Good Soil Drainage

Establish your garden on a light slope to provide drainage, especially during rainy season. If your land is flat, dig drainage channels or ditches around the planting site.

Good Soil Fertility (for Good Plant Nutrition)

Soil, the natural medium for plant growth is the primary resource of agriculture. The soil in your garden should be fertile enough to make plants grow. It should contain humus, a form of organic plant food or organic matter, hold moisture and be well-drained.

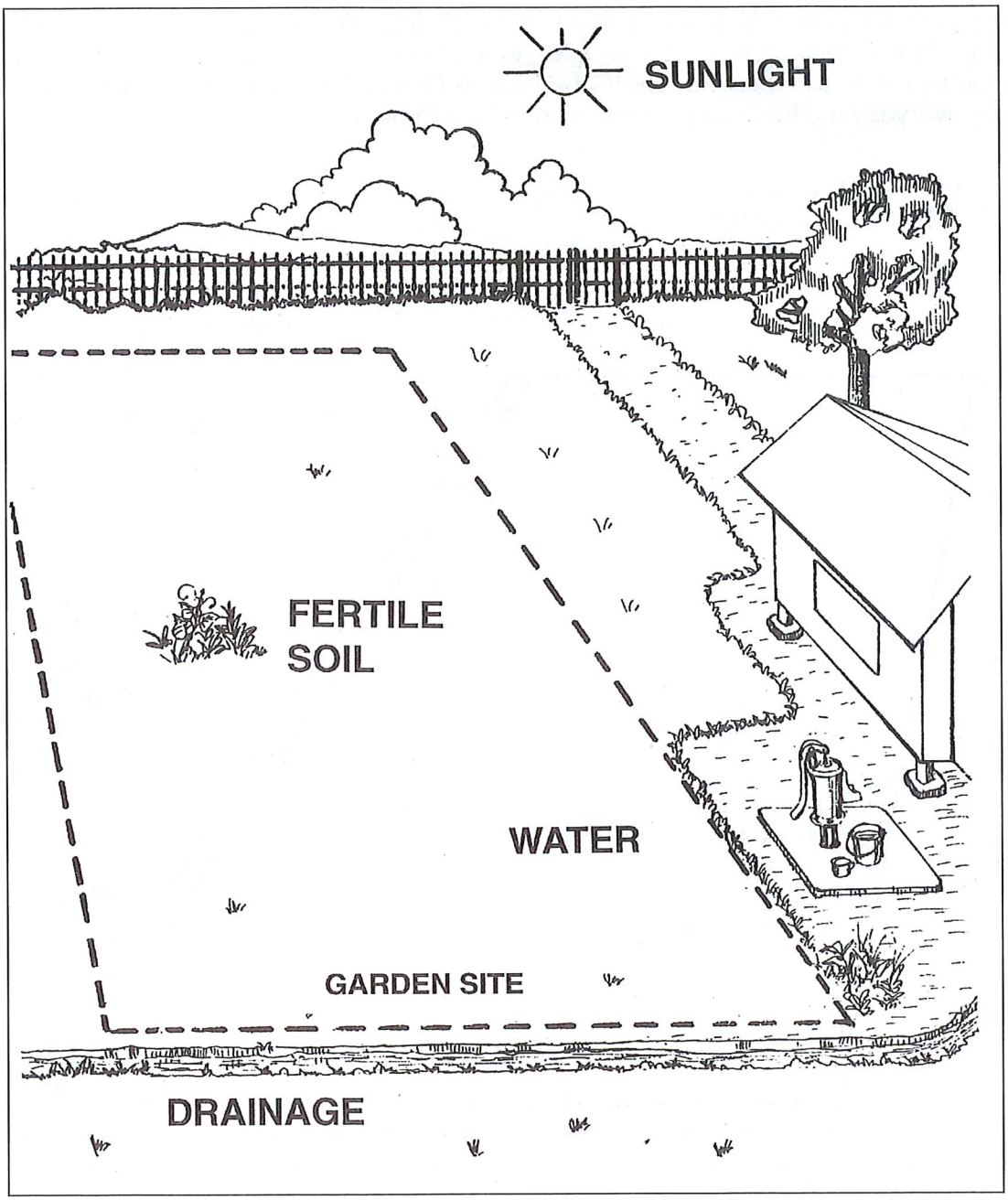
The primary types of soils needed for vegetables gardening are: (1) **loam** (23 to 52 percent sand, 20 to 50 percent silt, and 5 to 27 percent of clay); or (2) **silt-loam** (20 to 50 percent sand, 50 to 88 percent silt and 0 to 27 percent clay); (3) **clay-loam** (20 to 42 percent sand, 18 to 52 percent silt, and 27 to 40 percent clay). Other soils will produce, but these are the best.

Sunlight Availability

Your garden site should receive sunshine throughout the day. Growing plants need sunshine to produce food. The process by which they produce food is called "photosynthesis."

Good Air Circulation

Air circulation refers to the intensity of wind passing through your garden site. Strong winds are not good for young plants. They also dry the soil out. Your site should have natural windbreaks around it, including hills, trees, and buildings. Air circulation is important to help control fungal or mold growth in your garden.

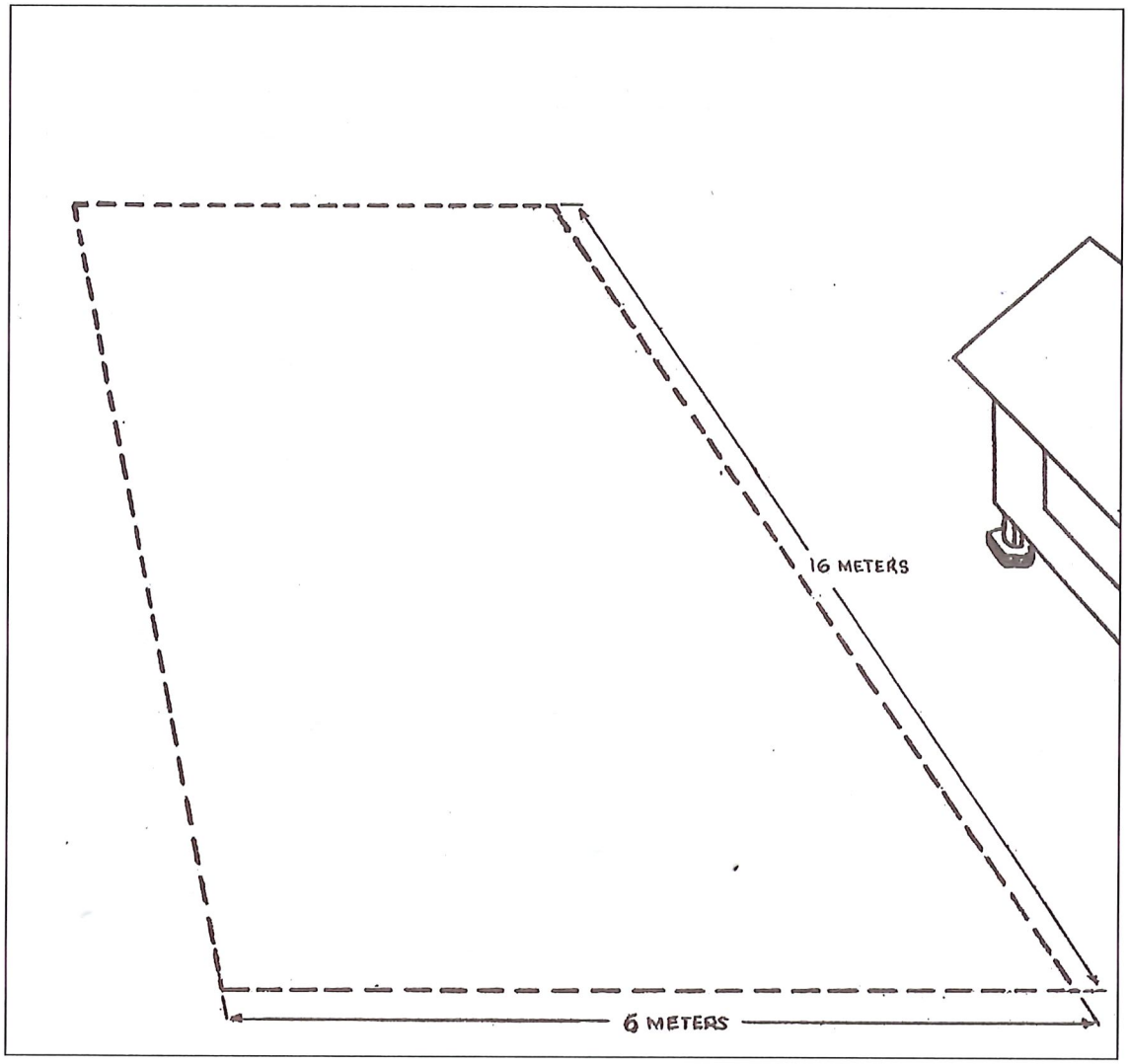


A good garden site includes fertile soil, a good source of water, good soil drainage, sunlight for most of the day, and good air circulation.

STEP 2: PROVIDE ENOUGH SPACE

ADEQUATE GARDEN SIZE FOR THE FAMILY

Home gardens ordinarily have an area of about fifty (50) square meters. The ideal garden size, however, is ninety-six (96) to one hundred (100) square meters and commonly has a dimension of six (6) by sixteen (16) meters. This size is adequate to supply everyday the fresh vegetables needed for a family of six.



Adequate garden size for a family of 6 is 96 to 100 square meters.

Step 3: Prepare The Soil

Soil Preparation

Successful vegetable cultivation depends largely on how you prepare the soil before planting. Vegetables grow and yield better in well-prepared soil. There are however, no hard-and-fast rules in preparing soil for vegetable planting. Much depends on the terrain, the soil type, the size of your garden, the vegetables you want to plant, and the season.

How To Prepare The Soil

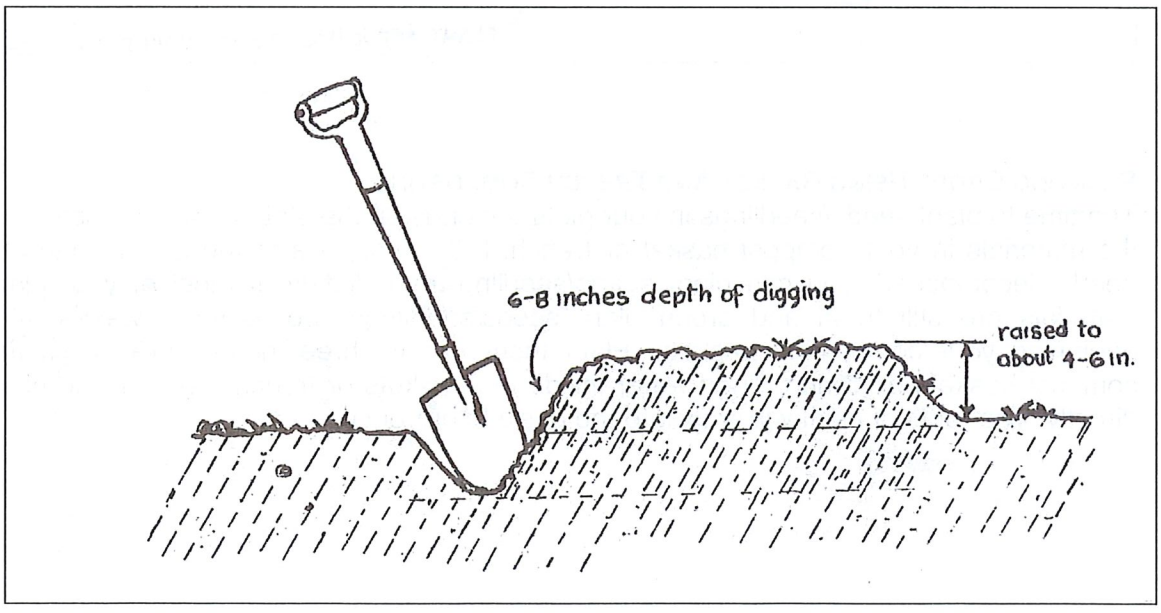
Loosen the soil manually with a hoe, shovel or garden fork. Do not work the soil when it is very wet so as not to destroy its structure. Clear the garden site and save cut grasses and weeds for composting. In heavy (clayey) soils, dig the land 2 times to a depth of 15 to 20 cm (6 to 8 in). Rake the soil and break up the clods between diggings.

Amend The Soil

As you work the soil, it is good to work in organic material such as compost or rotted animal manure. This will add nutrients to the soil, and at the same time improve the structure of the soil so it will be loose, better hold moisture and be better drained. Organic matter also helps protect the soil from erosion and pollution that may come from excessive amounts of agrichemicals such as chemical fertilizers and pesticides.

Provide Drainage

To provide good soil drainage in regions of high rainfall, make raised beds 15 to 25 centimeters (6 to 10 inches) above ground level. Raising beds this way facilitates drainage and also provides paths through the garden. The beds should be about one meter wide with about fifty centimeters between beds. In monsoon or semi-arid regions, it is not necessary to raise the beds. In dry areas raised beds are not necessary.



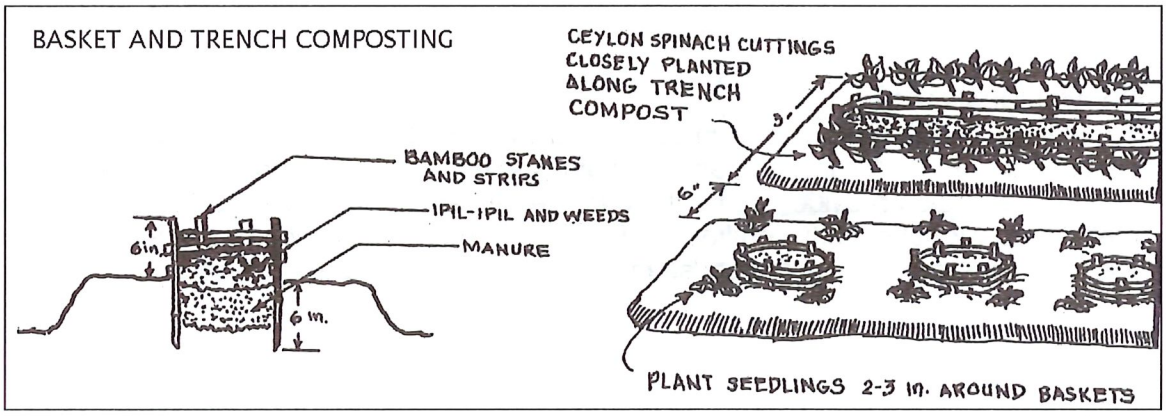
Step 4: Fertilize With Compost

Basket And Trench Composting

Make compost baskets of wire or shape flexible bamboo strips around stakes to make round forms at least one foot high. Make holes in you garden plot 6 inches deep and large enough to accommodate the baskets, spacing the holes one meter apart. Then place the baskets in the holes. If you prepare trench composting, dig a trench 6 inches deep and place bamboo stakes along the side of the trench. Then weave bamboo strips around the stakes to form a "fence" about 6 inches high along the side of the trench.

Process Of Basket And Trench Composting

Put organic material and manure (goat manure, chicken dung, etc.) in the baskets or trench first, then grasses, weeds, ipil-ipil (*Leucaena leucocephala*) or gliricidia (*Gliricidia sepium*) leaves. There is no need to turn the composting materials. Just keep on adding new materials. After the harvest, remove the contents of the baskets or trench and work the compost into the soil around the baskets or trench to make the soil more fertile and to improve its structure. Then place new compost materials in the baskets or trench for the next crop.



Planting Crops Using Basket And Trench Composting

The time to plant seeds/seedlings in your plots depends on the state of decomposition of the materials in your compost basket or trench. If the materials at the bottom part are nearly decomposed, you can plant seeds/seedling immediately. If most of your plant materials are still fresh and green plant seeds/seedlings two to three weeks after beginning your composting baskets. Plant them two to three inches away from the compost baskets or trench. Then water inside the baskets or trench – not on the plant directly. The roots of plant will grow into the baskets or trench.

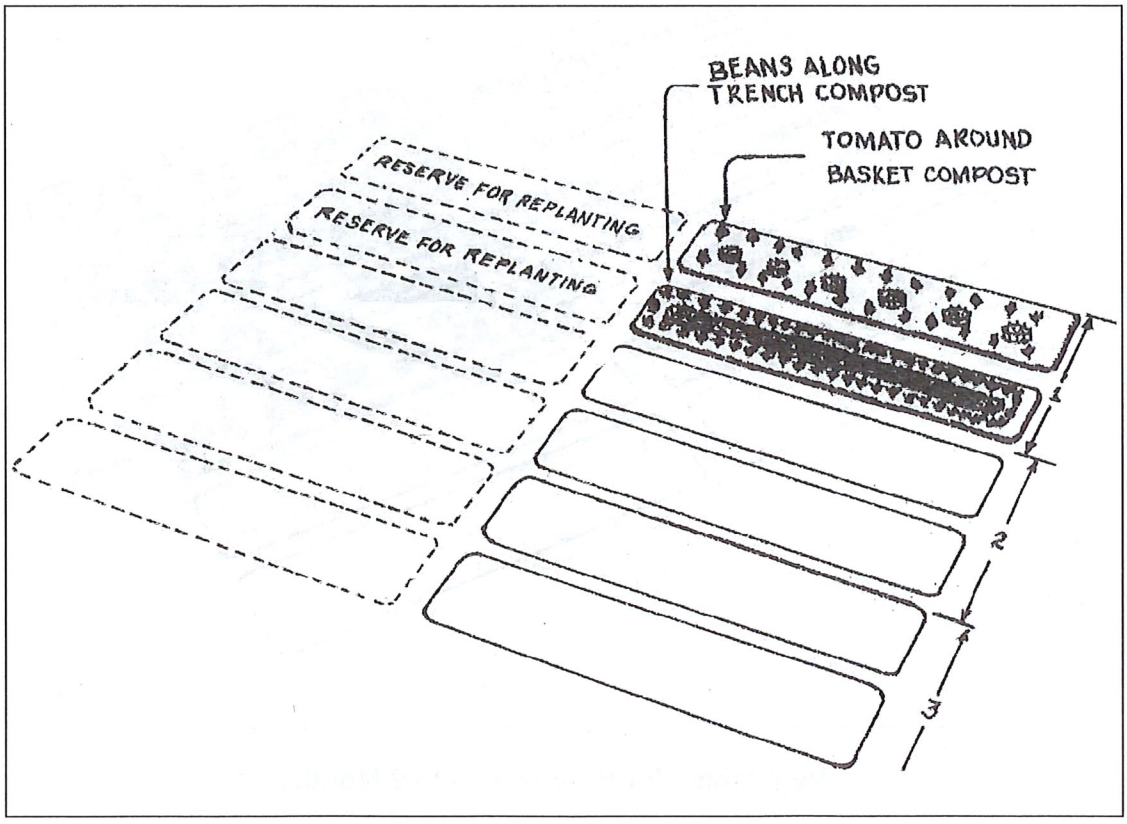
STEP 5: PLANT ONE –THIRD TO EARLY-MATURING VEGETABLES

PLANT EARLY-MATURING VEGETABLES

Divide your garden into three main sections. Set aside the first section for vegetables that you can harvest in two to four months.

This might include crops such as vegetable soybeans (*Glycine max*), tomatoes (*Lycopersicon esculentum*), cucumber *(Cucumis sativus)*, pak choi (*Brassica rapa 'pekinensis'*), yard-long bean (*Vigna unguiculata 'sesquipedalis'*), radish (*Raphanus sativus*), mustard (*Brassica juncea*), cowpeas (*Vigna unguiculata 'unguiculata'*), sweet corn (*Zea mays*), sweet pepper (*Capsicum annuum*), mung beans (*Vigna radiata*), carrots (*Daucus carota*), etc.

Do not plant the whole section; reserve one-half of the section for **relay planting**. Relay planting is when you plant one bed and allow it to grow, leaving a second bed unplanted. When the first bed begins to produce, you then seed up the second bed. In this way, you can manage production all year round. (See pg. 16, Step 9.)



Vegetables for Harvest in 2 to 4 Months

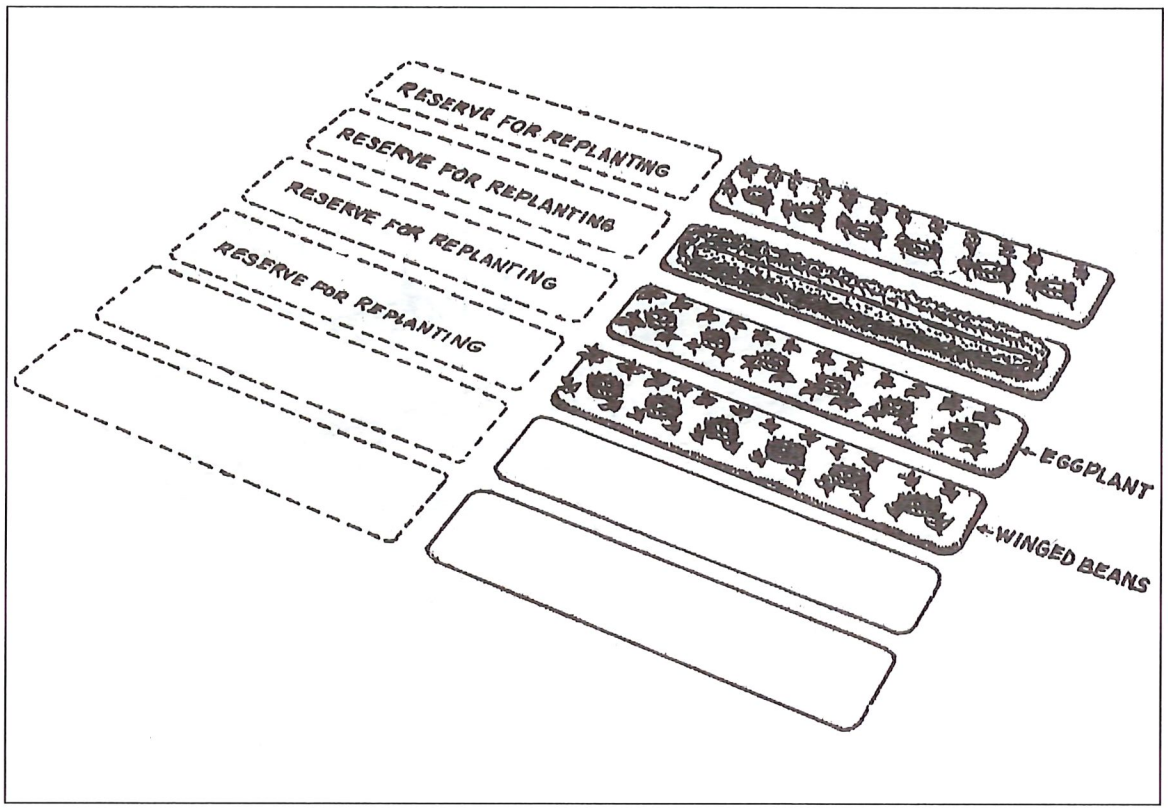
STEP 6: PLANT ANOTHER ONE-THIRD TO SEMI-ANNUAL VEGETABLES

PLANT SEMI-ANNUAL VEGETABLES

Set aside the second section for vegetables that are harvestable in six to nine months.

These include winged bean (*Psophocarpus tetragonolobus*), bitter gourd (*Momordica charantia*), eggplant, (*Solanum melongena*), okra (Abelmoschus esculentus), squash (*Cucurbita spp.)*, garlic (*Allium sativa)*, onion *(Allium cepa)*, chayote *(Sechium edule)*, bottle gourd (*Lagenaria siceraria*), vegetable gourd (*Luffa acutangula)*, wax gourd (*Benincasa hispida),* ginger (*Zingiber officinalis*) and others.

As in the first section, plant one-half of this section and reserve the remaining half-portion for relay planting.



Vegetables for Harvest in 6 to 9 Months

STEP 7: PLANT THE REMAINING ONE-THIRD TO ANNUAL VEGETABLES

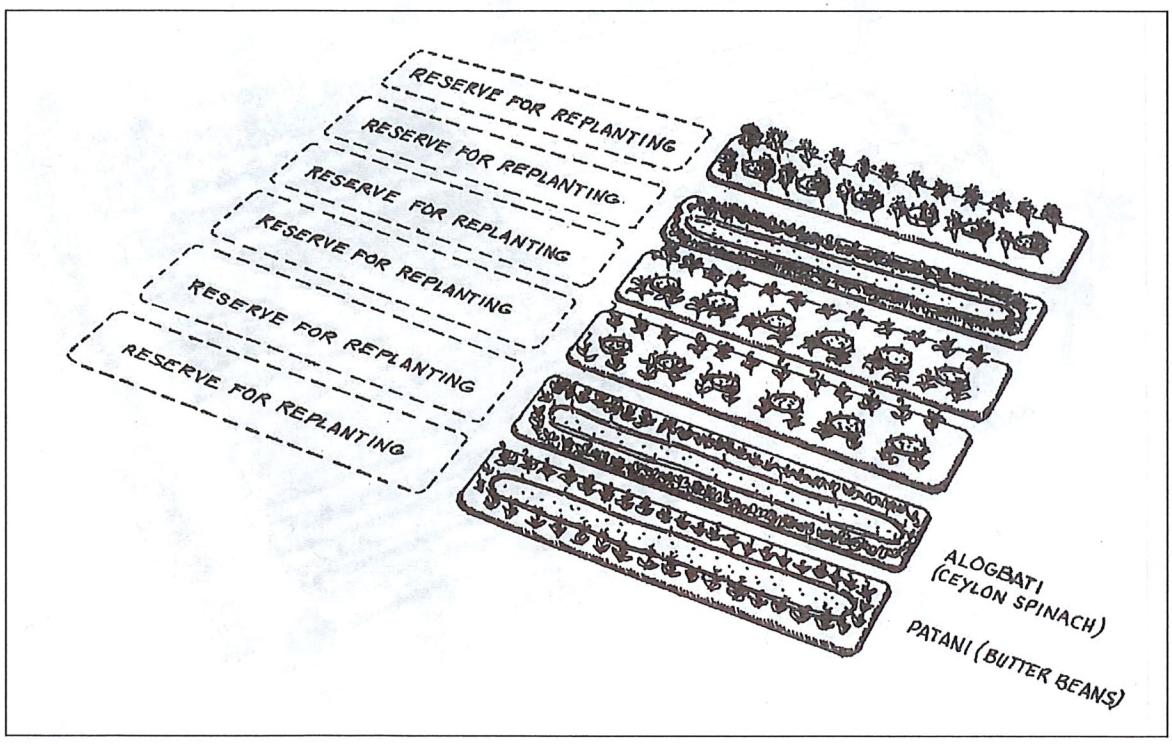
PLANT ANNUAL VEGETABLES

Set aside the last section for planting year round vegetables. These are vegetables that will take most of the year to grow, mature and be harvested.

This group includes crops such as lima beans (*Phaseolus lunatus*), upland kangkong (*Ipomoea aquatica*), Malabar spinach (*Basella alba*), sweet potato (*Ipomoea batatas*), taro (*Colocasia esculenta*), cassava (*Manihot esculenta*), yam beans or jicama (*Pachyrhizus erosus*) and pigeon pea (*Cajanus cajan*).

As in the first and second sections, plant only one-half of this section and reserve the remaining one-half for relay planting.

Be sure to allow for enough space to grow large plants such as cassava and pigeon pea, and plan appropriate trellises for vining plants such as lima beans and Malabar spinach.



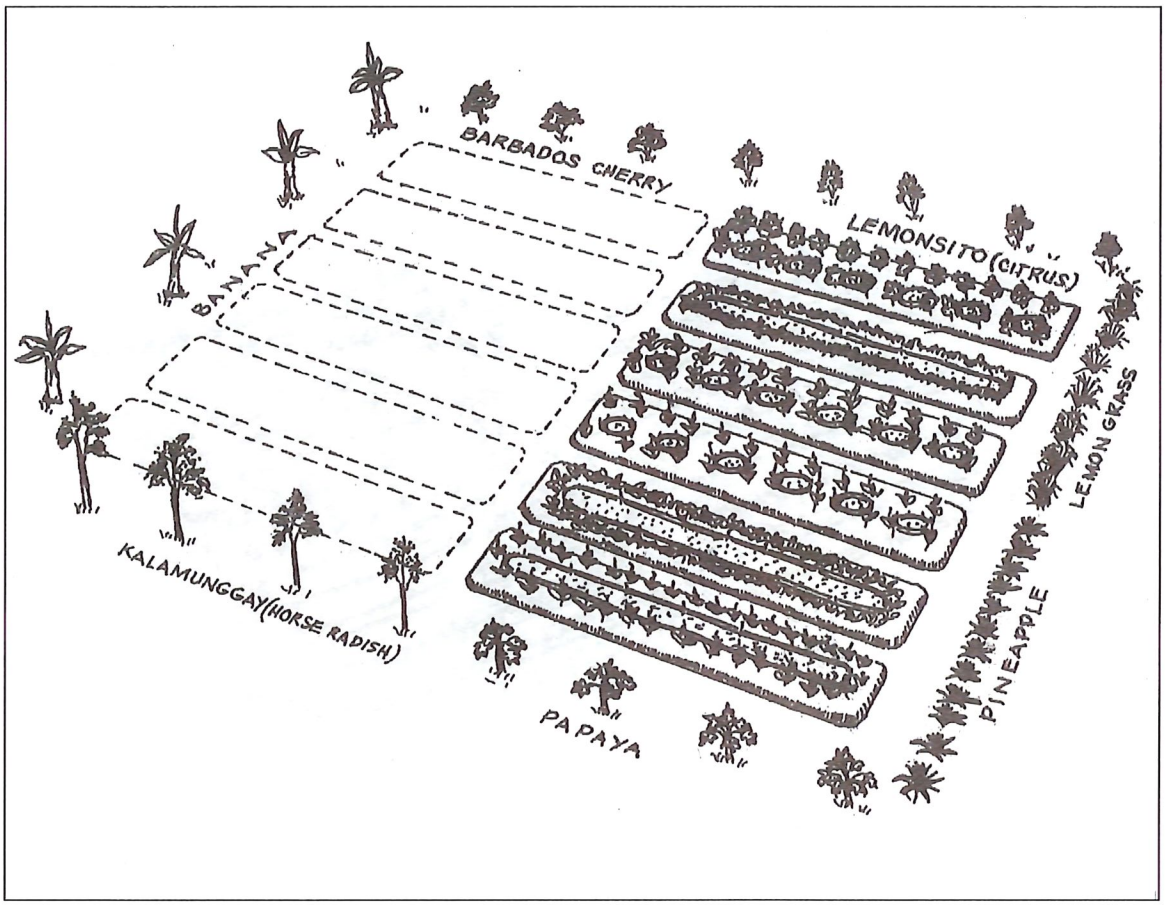
Your FAITH Garden is now planted to short, medium and long term crops, all of which will mature within a year or more.

Step 8: Plant Border Area Of The Garden To Permanent Crops

Plant Borders And Surrounding Area To Permanent Crops

Plant the surrounding area of your garden to permanent or semi-permanent plants.

This may include plants like papaya (*Carica papaya*), pineapple (*Ananas comosus*), sugarcane (*Saccharum officinarum*), moringa (*Moringa oleifera*), katuk (*Sauropus androgynus*), banana (*Musa acuminata*), citrus (*Citrus spp.*), short fruit trees such as Barbados cherry (*Malpighia glabra*) and *Annona* spp., and small perennial herbs such as lemon grass (*Cymbopogon citratus*).



Plant the Borders of Your FAITH Garden

STEP 9: PLANT RESERVED PORTION ON TIME

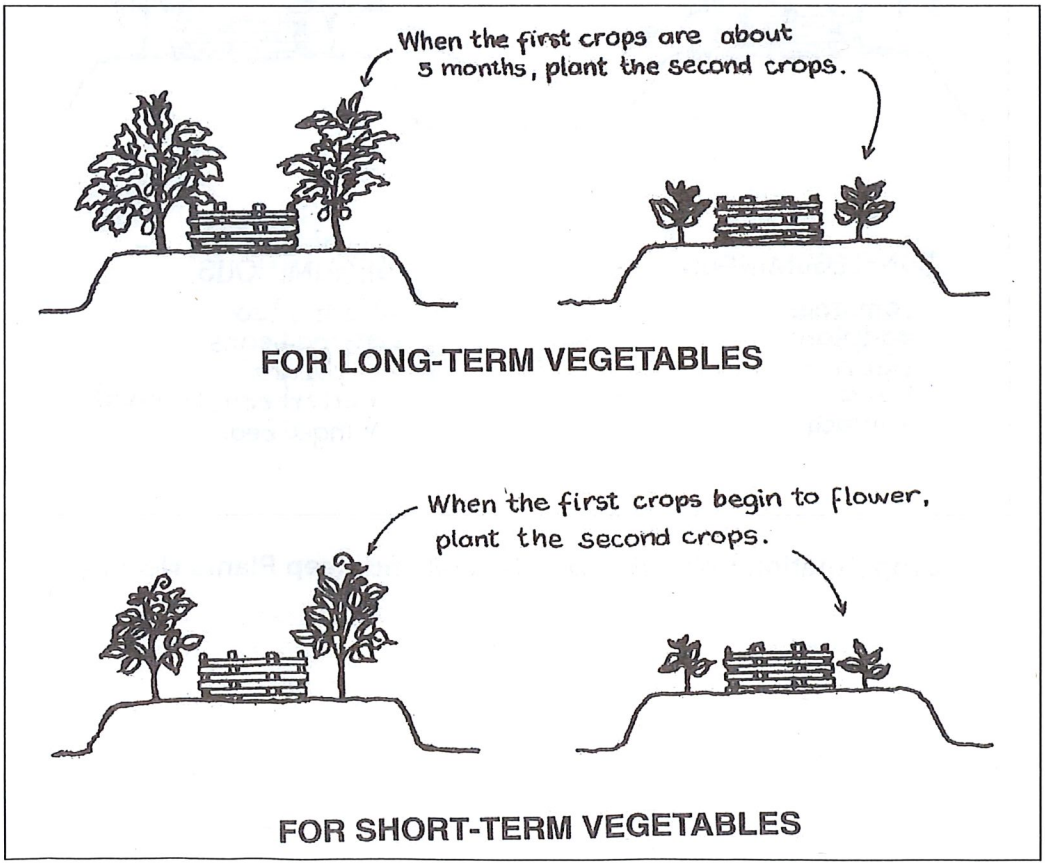
RELAY PLANTING

Relay planting is a technique used to maximize crop production by replanting the same crop before the first planting has been harvested. In most cases, a portion of the garden or field is planted to one crop, and at about the time of flowering, the same crop is replanted. Some crops are replanted into the same beds, but for the FAITH Garden and purposes of crop protection and pest control we will plant them into a different bed.

Replant promptly the reserved portions of your FAITH garden. This is done before the first plantings have matured, and will further help ensure continuous and adequate supply of fresh vegetables in your home.

In the third section (year-round vegetables) of your garden, plant the reserved half-portion when the crops in the first half are about five months old. In the second section (mid-term vegetables), plant the reserved portion when the crops in the first half are about four months old. In the first section (the early-maturing vegetables), plant the reserved portion when the crops in the first half start to flower.

Repeat this step for each bed and section at the appropriate time.



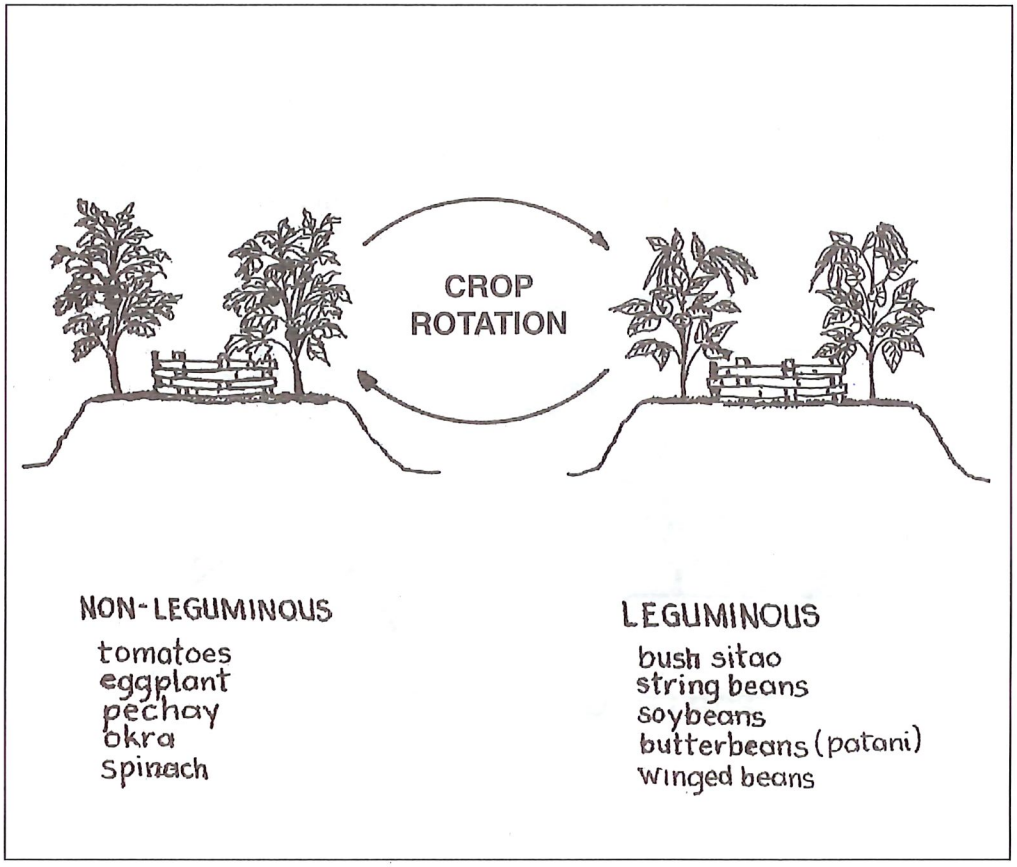
Use Relay or Succession Planting to Maintain Year-Round Vegetable Production

STEP 10: PRACTICE CROP ROTATION

ROTATE YOUR VEGETABLES

When replanting, practice crop rotation. This means that you plant leguminous vegetables (like soybeans, long beans, snap beans, etc.) to garden plots where non-leguminous vegetables (such as tomatoes, eggplants, okra, kangkong (water spinach), etc.) were previously planted, and vice versa.

Crop rotation helps prevent the spread of pest and diseases and also improves the fertility of the soil in your garden. If possible, don't plant the same crop again into the same bed it grew in the previous season.



Crop Rotation Helps Restore the Soil and Keep Plants Healthy

CULTURAL PRACTICES

IN THE

F.A.I.T.H.

[FOOD ALWAYS IN THE HOME]

GARDEN

Cultural Practices In The Garden

Besides following the TEN BASIC Steps of FAITH gardening, remember to observe other needed vegetable gardening practices such as:

Seed Treatment

Seeds may be treated with any of both following chemicals: Orthocide (Captan), Sevin 85S or Brassicol (PNCB). Treating seeds with chemicals will protect germinating seeds from pre- and post- emergence damping-off disease. Seeds from reliable sources are usually treated with fungicides and insecticides prior to storage.

Any seed with color added has been treated. Do not eat these seeds! They are for planting only!

Inoculation Of Legumes

Snap bean, cowpea, lima bean, garden pea, and other legumes can be inoculated before planting. When we inoculate, we add a particular micro-organism to the seed and to the soil. This micro-organism is a soil bacterium called *Rhizobium* and it interacts with the roots of leguminous plants to produce nitrogen which will naturally fertilize the plant and build soil fertility. These bacteria are often present naturally in the soil, but we can assure their presence by inoculation of the seed. Once the inoculant is in the soil it will stay there and continue to interact with leguminous crops.

To inoculate, put the seeds in a container and moisten them with water. Mix the inoculant (available in agricultural supply stores) thoroughly until all the seeds are well-coated. Legumes have their own matching inoculants. Be sure to use the right inoculant for the legume you are using. Many benefits can be derived from effective inoculation. It prevents the early nitrogen starvation of plants, thus reducing the demand for soil nitrogen.

If you can't find inoculant, you can still plant leguminous crops without inoculating the seeds. You will have to make up for the lack of natural nitrogen by adding a bit more in soil preparation, either in the form of animal manure or chemicals from the market.

Hardening Seedlings And Young Plants

Before transplanting seedlings into the garden plots, "harden" them first for several days. This is done by exposing them gradually to strong sunlight in the field if they have been shaded. You also harden them off by gradually withholding water. Withhold more and more water as transplanting time draws near. This method slows down the plant growth. Their tissues become thicker, less succulent and harder, hence the term "hardening."

Hardening plants helps them recover rapidly from the stress of transplant. A succulent plant needs much water and nutrients for rapid growth. It cannot tolerate dry field conditions. A hardened plant will grow slower after transplanting but will resume normal growth much sooner than a non-hardened plant.

Transplanting

A day before transplanting, water the seed box or seedbed thoroughly. This will facilitate the pulling of seedlings and minimize root injury. Transplant the seedlings to the prepared garden plots. The best time of day is either early morning or late afternoon

when the sun is not as bright. After transplanting, firm the soil slightly around the base of the plants and water them in. If the weather is hot, cover the seedlings with coconut leaves or banana flower bracts or leaves.

Use a starter solution of fertilizer to water in the plants. If available, this can be a soluble fertilizer from the market. Most soluble fertilizers are either green or blue and are mixed with water at the rate of about 1 tablespoon (15 g) of fertilizer per four (4) liters or one (1) gallon. Cut this in half for new transplants. For less money, you can make manure tea by placing animal manure into a woven bag and soaking it in a bucket of water. When the water turns brown, the tea is ready to serve!

FERTILIZERS

Just like people and animals, plants need good food to eat or good nutrition. They produce the basic foods through photosynthesis, but need to get important minerals from the soil. Fertilizers help to build the soil nutrition level to give us healthy plants. There are many types of fertilizers, some of which we can buy in the market, others we have at home, but we must be diligent to provide the right fertilizer for our crops.

Healthy soil produces healthy crops; poor soil produces poor crops!

The most important fertilizers for plants are nitrogen (N), phosphate (P) and potassium (K). You find 'NPK' on all bags of fertilizers, and they are accompanied by numbers such as 8-2-8, 46-0-0 or 10-10-10. This shows the percentage of each of these nutrients in the fertilizer. A soil test will tell you how much of N, P and K your plants will need.

Natural fertilizers such as **compost** made from plant and animal waste (e.g. rotted leaves, grass, straw, kitchen scraps, worm castings and animal manures) provide the soil with natural chemicals that make plants resistant to pests and diseases. It also adds **organic matter**, important in the soil for water management and soil structure. We apply natural fertilizers when we till under green manure crops and animal manures, when we make basket compost and when we **mulch** the ground around the plants.

The best **animal manures** for your crops are goat and rabbit manure, and **worm castings**. [*See Appendix 2 on Worm Culture.*] They are balanced and can be applied directly to the crop or mixed into the hole when planting. Cow, buffalo, horse and poultry manures should be composted or well-rotted before applying. Horse manure is generally high in salts. Chicken manure is high in nitrogen, so it is too "hot" to put directly on crops, as they will burn. It must be decomposed or made into compost first.

Green manure crops also know as green manure/cover crops (**GMCC's**) are any plant grown to a lush, green state and either cut and left on the soil surface as mulch or tilled into the soil. This adds nitrogen and organic matter to the soil, along with other minerals, depending on the GMCC used. Leguminous plants, because of their nitrogen-fixing capability are the best GMCC's. The best time to cut and/or till under a GMCC is just as it begins to flower, as this is the stage when the nutrient level is highest in the plant.

Water-soluble or foliar fertilizers can be bought in the market and are usually green or blue in color and provide fast nutrition for the plant. They can be applied to the soil or sprayed directly on the foliage (leaves) of the plant. Usually 1 Tbsp or 15 g per 4 liters of water is the mix for this fertilizer.

Manure tea or **compost tea** can be made by placing compost or animal manures into a woven bag and sinking the bag into a large container of water. When the water turns brown it is ready to apply to the plants. Bury the contents of the bag in the ground to help enrich the soil. Do the same with dead fish remains.

Used tea leaves or coffee grounds make good fertilizer. Old banana stalks (after harvesting) make good fertilizer by providing potassium and organic matter. Coffee and cacao hulls when composted with manure make an excellent organic fertilizer and mulch. Epsom salts (magnesium sulfate) can be purchased in a pharmacy, and are good to add magnesium to the soil. Blood meal, bone meal and lime are also good natural fertilizers.

Since plants remove certain minerals for growth, you can return these minerals to the soil by fertilizing with the very same plants. For example, bananas are good sources of potassium (K). They need K to grow and it comes from the soil and fertilizers, so it is good to chop up old banana stalks (which are rich in K) and return them to the soil to nourish the new banana shoots.

Water Supply And Irrigation

Without water, fertilizers cannot be effectively absorbed by the roots, and soil nutrients cannot be transported to the leaves. Photosynthesis will not take place.

Make sure you have a good irrigation source. This may be an irrigation ditch, a well, large stone jars, steel drums, a fish pond or the rainy season. Your garden should receive an average of 2.5 to 5.0 cm (1-2 in) of water every week. If you have sandy soil, you will have to irrigate even more. Mulching will help maintain the moisture in the soil.

Check to see if the soil is moist enough by removing about 2-5 cm of soil near the root zone. If it is moist, then there is enough water in the soil for your crops. If not, plan on irrigating that day. The best watering times are in the early morning and in the evening.

Cultivation

Cultivate or loosen the soil around the plants to enable their roots to expand and develop fully. Plants with fine roots spreading out near the surface should not be cultivated too deeply. Deep cultivation is needed only for deep-rooted plants like radish, beet, and carrot. This also helps to keep weeds down. Cultivate only when there is enough soil moisture. Do this late in the afternoon or early morning. Cultivation may be done with a hoe, or other suitable hand tool.

Mulching the soil around the plants actually eliminates the need for cultivation! A good organic mulch around the crop plants helps to maintain soil moisture and the activity of worms and other soil organisms which work the soil for you! This way you can add nourishment to the soil, cut back on hoeing which can damage roots of crop plants, and if maintained can facilitate no-till planting in your FAITH garden.

Ratoon Some Of Your Plants

When you observe that your vegetables crops are no longer productive. You can rejuvenate plants like okra, lima beans, winged beans, eggplants, sweet pepper, moringa, broccoli and pigeon peas by cutting them at a height of 15-30 cm (6-12 in) above the ground allowing them to resprout or 'ratoon'. This gives additional production

for many crops. For sweet potato, kangkong, and Malabar spinach, trim them about one inch above the ground. You may do this two times before needing to replant.

TRELLISES

Plants needing support or trellises include cucumber, bitter gourd, chayote, bottle gourd, luffa, winged bean, pole bean, lima bean, and yard-long bean. Poles 2.0 to 2.5 meters in length can be set into the ground to a sufficient depth in a tepee-like arrangement.

STAKING

Vegetables that need stakes include tomato, okra, some eggplant, and some sweet pepper. Stakes are usually set during the rainy season to support the plants, prevent lodging (falling over) and keep the fruit off the ground. Good staking materials are ipil-ipil, gliricidia, and bamboo.

MULCHING

Good organic mulch can be made from any of the following: rice straw, rice hulls, cut grass, compost, sugarcane bagasse, sawdust, wood chips and paper. Spread the mulch on the surface of the ground, around the plants or between the rows of plants. Mulching controls weeds by preventing sunlight from reaching the ground.

Plant materials such as grass, straw, leaves and weeds used as mulch will decompose and become organic matter, an important part of fertile topsoil. A note of caution: "woody" or very fibrous mulches such as undecomposed rice hulls or sawdust may draw nitrogen from the soil in the decomposition process, giving the appearance that the soil is "used up." In such a case be sure to replenish needed nutrients with compost or animal manure.

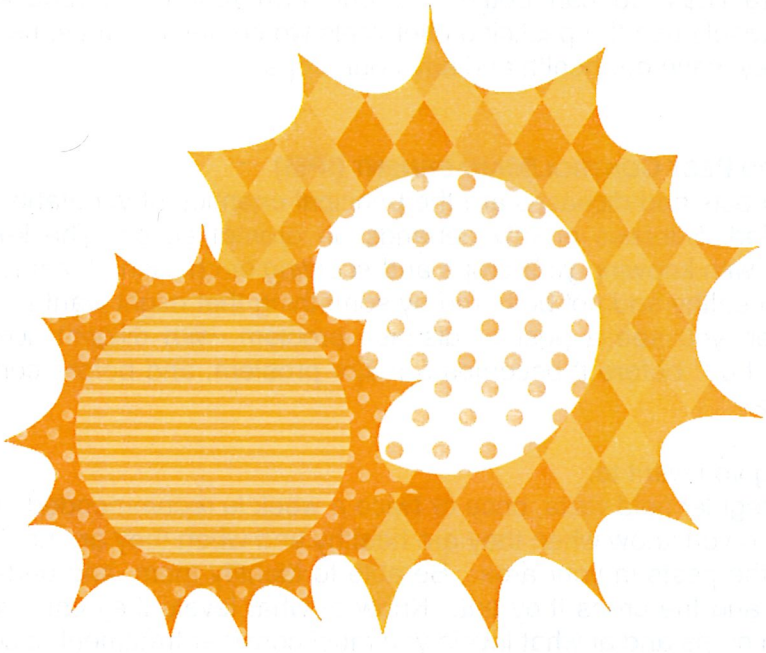
If you are in a very dry climate, even sand and small stones can help hold moisture in the ground. You may also mulch with plastic sheeting, but first must make sure you have a way of getting water and fertilizer to the plants under the plastic!

Organic mulch is important during the dry season in any climate, as it reduces moisture loss and saves irrigation water. Straw or vetiver grass mulch keeps the soil moist even on the warmest days. During heavy rains, mulch reduces the impact of raindrops on the soil surface and prevents fertile topsoil from eroding or being washed away.

CROP PROTECTION

For good production, it is important that you protect your garden from damaging pests and diseases. This means that you will need to know how to keep the plants strong and healthy, and recognize when a plant is "sick." You may need to protect your crops using a number of physical, biological or chemical means, so you'll want to make the right choices to keep your plants healthy, and you and your family safe. [*See sections on IPM (Integrated Pest Management) and Home Garden Pesticides.*]

IPM



INTEGRATED PEST MANAGEMENT

IPM (Integrated Pest Management)

Practices For Crop Protection

IPM is a crop protection system by which we control the pests and pest damage in the FAITH Garden. We can do this by using a combination of simple cultural, biological and chemical methods. It's important to understand that with IPM we are not eradicating pests, but managing them so our crops will produce and be healthy plants.

Using IPM practices we can better use our farm resources, reduce environmental pollution and wisely use the pesticide chemicals we sometimes must use. IPM helps us save our money, save our health and save our crops.

Steps to Good Pest Control/Management (IPM)

Scouting. Insects and diseases are the principal enemies of vegetables, but these can all be controlled. Success greatly depends on prompt action. The key to good pest control begins with knowing your crops and *scouting* or checking them regularly to make sure they are healthy and not bothered by something that might want to eat them before you do! When you see a pest or disease problem, with diligent scouting it can be "nipped in the bud" before it becomes a major problem, and before control becomes a major expense.

When scouting you want to:

1) Make regular field visits, once or twice a week is recommended. Get to know the crops so you know when they are healthy and when they are not healthy.
2) Know the pests in your area. Be able to identify them, and understand their life cycles and the crops they eat. Know at what levels they can co-exist with your garden crops and at what levels you must consider treatment to control them.
3) Know the difference between pest damage and problems resulting from mechanical damage, fertilizer deficiency, moisture stress and herbicide damage.
4) Know how to collect samples of pests to identify.
5) Understand the severity of pests and crop conditions.
6) Know the different options for treatment.

Options for Treatment

Cultural Controls refer to the control of pests by the way a crop is produced or managed, such as cultivation techniques, timing of planting, crop diversification, and mixed farming systems, such as crop rotation, relay planting and intercropping. Almost everything that is done to raise a crop effects its health and pest management.

Healthy crops

The best pest control measure is **prevention**. This happens with a good scouting program and maintaining strong, healthy plants with the right irrigation, light, fertilizer and soil organic matter content. If a plant is strong and healthy, any damage pests do to it will affect the plant less.

Healthy soil will produce healthy plants. Use animal manures, compost, gmcc's (green manure/cover crops and organic mulches to help build up soil organic matter. This will

provide a good environment not only for the plants, but also for other important organisms such as earthworms. Organic matter helps maintain good soil moisture and root aeration for the plants. The more organic matter, the happier the soil!

Planting techniques

Tilling the soil (with either plow or hoe) helps to control pests by burying pests too deep to survive and by exposing them to the sun and predators. **No-till systems** and **mulch systems** can keep pests from maturing and weed pests from germinating.

Crop Rotation takes away food for pests and replenishes soil nutrients taken out by other crops. It can also interrupt the life cycles of certain pests.

Optimal Planting Times can protect crops at vulnerable stages, as well as interrupt the life cycles of pests.

Companion Planting and **Intercropping** makes use of special characteristics of plants to guard against pests and shares them with other more vulnerable plants. [*See Appendix 4 on Companion Planting.*] Some plants have natural chemicals to restrict the growth of weeds, fungi and bacteria. We can also plant multilines - multiple varieties of the same crop, some of which may have resistance to a pest or disease to protect those varieties that do not have that resistance.

Trap Crops (plants preferred by the pest) planted as a guard row may be used to trap pests and keep them from attacking the crop plants.

Field Hygiene

Keeping fields and nurseries clean helps reduce debris where insects and disease organisms might live and breed. It is especially important to keep weeds and grass either cut or removed to keep insects down. Rogue out (remove) dead or diseased crop plants immediately and either bury or burn them. Even when dead, they can still transmit the disease that killed them! Collect fallen fruit and dispose of it, eat it or feed it.

Collect rotting, infested or mummified fruit that has fallen prematurely and bury deep, burn or immerse in water 2-3 weeks to kill the pests. After harvest, remove all fruit that cannot be eaten or sold and destroy it (bury or burn) or feed it to the animals. Don't compost diseased or insect infested fruit.

Disinfect your cutting tools (pruners, machete, bolo or cutlass) with 20% bleach solution or undiluted alcohol to prevent the spread of disease. A light spray covering all cutting edges will take care of this. Disinfect them before pruning each new plant or tree when you are pruning diseased plants or trees. Clean and oil your tools before putting them away.

Raise chickens under fruit trees to help kill insect pests. After harvesting a portion of your garden or field, put up a temporary fence and allow the chickens to range in the fenced in area. They will eat insects and weed seeds, till the soil and fertilize it!

Mechanical pest control

When there are only a few pests in the garden or field, we can mechanically remove them simply by picking them off the plants and feeding them to the chickens or killing

them. Generally the best way to eliminate caterpillars, beetles, and insect eggs is to pick them off the plants by hand.

Weeding is a mechanical method of removing plant pests and **rogueing** is a mechanical way to remove dead or diseased crop plants. It is quite common to see fruit growing in the trees with plastic bags covering them. This is a mechanical control to keep insects and birds from eating the developing fruit.

Traps & Baits

The use of Traps and Baits is another way to mechanically remove pests from the field, orchard or garden. **Pheromones** (insect hormones that when discharged affect others of the same species in some way) are used in insect traps to draw them away from the crops and into a trap. **Sticky cards**, spheres, or anything that uses a sticky substance to trap insects or rodents are easy to make and use. Cover yellow cards with oil, glue, grease or other sticky substance to trap a number of insects in the garden. Spheres the color of the ripe fruit in the fruit trees covered with sticky substance will trap the insects that might otherwise eat your fruit!

Ants and cockroaches may be caught in and poisoned in traps baited with sugar or sweetened condensed milk combined with either borax or boric acid. You can make baits by mixing sweetened condensed milk with either boric acid or borax into a thick substance, and then daubing it onto paper or aluminum foil to dry. These baits may then be placed wherever ant or cockroach traffic is heavy.

If you have problems with snails or slugs, bury a small dish or tin of water in the ground with beer or honey mixed in. This will provide a nice trap. If this is not available, place boards in the paths along side of your crops. At night, the slugs and snails will rest on the underside of the boards and you can remove and kill them or feed them to the chickens in the morning.

If you have problems with rats and/or mice, try setting up a 20-liter (5-gallon) bucket 1/3 full of water. Float a few unsalted, unshelled peanuts on the water and let stand until morning where the rodent traffic is greatest. Check to see how many rats have drowned in your home-made trap trying to get the peanuts!

BIOLOGICAL CONTROLS include the utilization of naturally existing **predators**, **climatic conditions**, and **beneficial organisms** raised specifically to help control pests on the farm. These might include snakes, birds, predatory insects and the change of seasons. Predators include: ladybugs, hover flies, robber flies, preying mantis, assassin bug, ground beetles, lacewings, damselflies, dragonflies, ant lion (doodlebug), spiders and predatory mites.

Parasites are a type of predator that will feed on another organism and weaken it, though it may or may not kill it. These include a wide rage of flies and wasps, including the trichogramma, aphidius and braconid wasps and the tachinid fly. These species lay their eggs on another insect and the young feed on the insect when they hatch. Other organisms that help control pests biologically include predatory fungi, predatory nematodes and bacteria which feed on insects.

Some commonly used **biological pesticides** are bacteria in the *Bacillus* genus. *Bacillus popilliae* var. *popilliae* is the milky spore bacterium used to kill the larvae of Japanese beetles, and *Bacillus thuringiensis* var. *kurstaki* (Bt, Btk) [sold as Bt, Dipel, Thuricide, Biobit, Condor, MVP (all registered trademarks)] is the bacterium used to kill loopers and other leaf-eating caterpillars. *Bacillus thuringiensis* var. *israelensis* (Bti) [sold as Vectobac, Bactimos, Gnatrol, Teknar, Skeetal (all registered trademarks)] kills fungus gnat larvae and mosquito larvae, and *Bacillus thuringiensis* var. *san diego* [sold as M-Trak, Foil, Novodor (all registered trademarks)] and *Bacillus thuringiensis* var. *tenebrionis* are used to kill beetle larvae. *Bacillus thuringiensis* var. *aizawai* [sold as Certan, Agree, Xentari (all registered trademarks)] is also used to kill certain caterpillars, such as the larvae of wax moths that destroy honey production.

Bt formulations are available as liquid concentrate, wettable powder, dust, granules and briquettes.

CHEMICAL CONTROLS are any and all chemical substances used to control pests in the garden, orchard or field. Some are commercially produced; others are made from household cleaners and food items; others are made from plant residues. Regardless, they are all chemical substances and should be treated with respect and caution when used to control pest populations on the farm.

TYPE OF PESTICIDE	WHAT IT KILLS
Insecticide	Insects
Acaricide / Miticide	Mites, Ticks
Fungicide	Fungi such as molds, mildew and rusts
Bactericide / Antibiotic	Bacteria
Herbicide	Weeds / Plants
Avicide	Birds
Rodenticide	Rodents such as rats and mice

- There are many types of pesticides -

Naturally-Occurring Chemicals
The following are plants with naturally-occurring pesticide chemicals. (See Appendix 3 **Home Garden Pesticides** for uses.)

ENGLISH NAME	SCIENTIFIC NAME	ACTIVE CHEMICAL	PLANT PARTS USED
Amaranth	*Amaranthus spp.*		Stems, flowers, leaves
Annatto	*Bixa orellana*		Fruit, roots
Annona	*Annona spp.*	Acetogenin	Roots, leaves, seeds, unripe fruit, bark
Basil	*Ocimum basilicum*		Leaves, oils
Bougainvillea	*Bougainvillea glabra*		Leaves, flowers
Cashew	*Anacardium occidentale*		Leaves, seeds, seed oil
Cassava	*Manihot esculenta*		Starch water from root
Castor Bean	*Ricinus communis*	Ricin ☠	Leaves, seeds
Chili peppers	*Capsicum spp.*	Capsaicin	Fruits, leaves
Crotalaria	*Crotalaria spp.*		Whole plant, seeds
Derris	*Derris spp.*	Rotenone ☠	Roots
Eucalyptus	*Eucalyptus spp*		Leaves
Finger millet	*Eleusine coracana*		Leaves, stem
Garlic	*Allium sativum*		Bulb, leaves
Gliricidia	*Gliricidia sepium*	Coumarin, Rotenone	Leaves, bark, fruit
Goat Weed	*Ageratum conyzoides*		All parts of plant
Jimson weed	*Datura stramonium*		Whole plant, leaves
Lantana	*Lantana camara*	Lantadine, Lantamine	Leaves, leaf ash
Marigold	*Tagetes spp.*	Thiopene	Whole plant
Moringa	*Moringa spp.*		Seeds, leaves
Muña	*Minthostachys spp.*		Whole plant
Neem	*Azadirachta indica*	Azadirachtin	Seeds, leaves
Oleander	*Nerium oleander*		All parts of plant
Onion	*Allium cepa*		Bulb, leaves
Papaya	*Carica papaya*		Leaves
Pencil Tree	*Euphorbia tirucalli*		Leaves, branches, sap
Periwinkle	*Catharanthus roseus*		Roots, leaves, flowers
Persian lilac, Chinaberry	*Melia azedarach*	Rotenone ☠	Seeds, leaves, roots
Physic Nut, Jatropha	*Jatropha curcas*		Whole plant, seeds
Purslane	*Portulaca oleracea*		Leaves
Pyrethrum	*Chrysanthemum cinerariaefolium*	Pyrethrum	Flowers
Soybean, Soya	*Glycine max*		Stems
Sweet Potato	*Ipomoea batatas*		Leaves, starch water
Tamarind	*Tamarindus indica*		Leaves, fruit
Tephrosia, fish bean	*Tephrosia spp*	Rotenone ☠	Whole plant, leaves, twigs, roots
Tobacco	*Nicotiana tabacum*	Nicotine ☠	Leaves, stems
Tomato	*Lycopersicon esculentum*	Solanine	Leaves, stems
Yam bean, Jicama	*Pachyrhizus erosus*	Rotenone ☠	Seeds

Household Chemicals
Many household chemicals can be used in chemical formulations for pesticides. Many might even be considered naturally occurring. Examples include: wood ashes, cinnamon powder, kerosene, vegetable and mineral oils, alcohol, milk, buttermilk, liquid soap, baking powder, baking soda, flour, cornmeal, agricultural lime, animal urine, boric acid, borax, vinegar, epsom salts, powdered sulfur and ammonia.

Synthesized Chemicals
These are chemicals that have been produced specifically to control pests and in general are considered the most dangerous to both the environment and to human lives. These are found primarily in the following groups. Organophosphates, Carbamates, Chlorinated Hydrocarbons (Organochlorines), Synthetic Pyrethroids and Juvenating Hormones/Growth Regulators are all chemicals that have been synthesized or made from oil and oil by-products.

DANGERS/PRECAUTIONS
Safety First!!! Whether naturally occurring or synthesized, pesticides are chemicals and are poisonous to the target pests. Sometimes they are also poisonous to us and to our children. Therefore, if you have to use dangerous chemicals, take appropriate precautions when using them, so not to endanger others, the environment or ourselves. Here's how.

Read the Label. Know the chemical you are using. Understand what it will kill and what the dangers are to you and your family. Especially if it is a commercially prepared chemical, **read the label** before doing anything! Note the precautions and medical treatments as well as the instructions for use. If you don't have one, or cannot read the label in your language, you can go on line and call up an MSDS, or Material Safety Data Sheet on the chemical you intend to use. Consider all of the safety precautions listed.

Apply the Pesticide Safely. Whether mixing, transporting or applying (spraying or dusting) pesticides, **wear proper clothing**. Wear clothing with long sleeves and that covers your legs. Wear boots or shoes that cover your feet completely. Wear a mask over your face so you do not inhale the chemicals, and a hat. Wear rubber gloves. Many chemicals, even home-grown chemicals will enter your body through your skin, so take precautions!

- ✓ **Do NOT let children play near where you are spraying or preparing the spray.** Do not allow anyone to enter the field or garden until after the REI or re-entry interval.
- ✓ Spraying should be done in the morning or late evening when the sun is not intense and when the wind is not blowing. **If there is any wind, do NOT spray.**
- ✓ Insects lay eggs on the underside of the leaves. It is therefore important to spray the undersides of the leaves, as well as the tops.

- ✓ After spraying, clean all your equipment, dispose properly of empty pesticide containers, remove all spraying clothes and launder them before wearing again, and bathe your whole body to get rid of any pesticide residue.

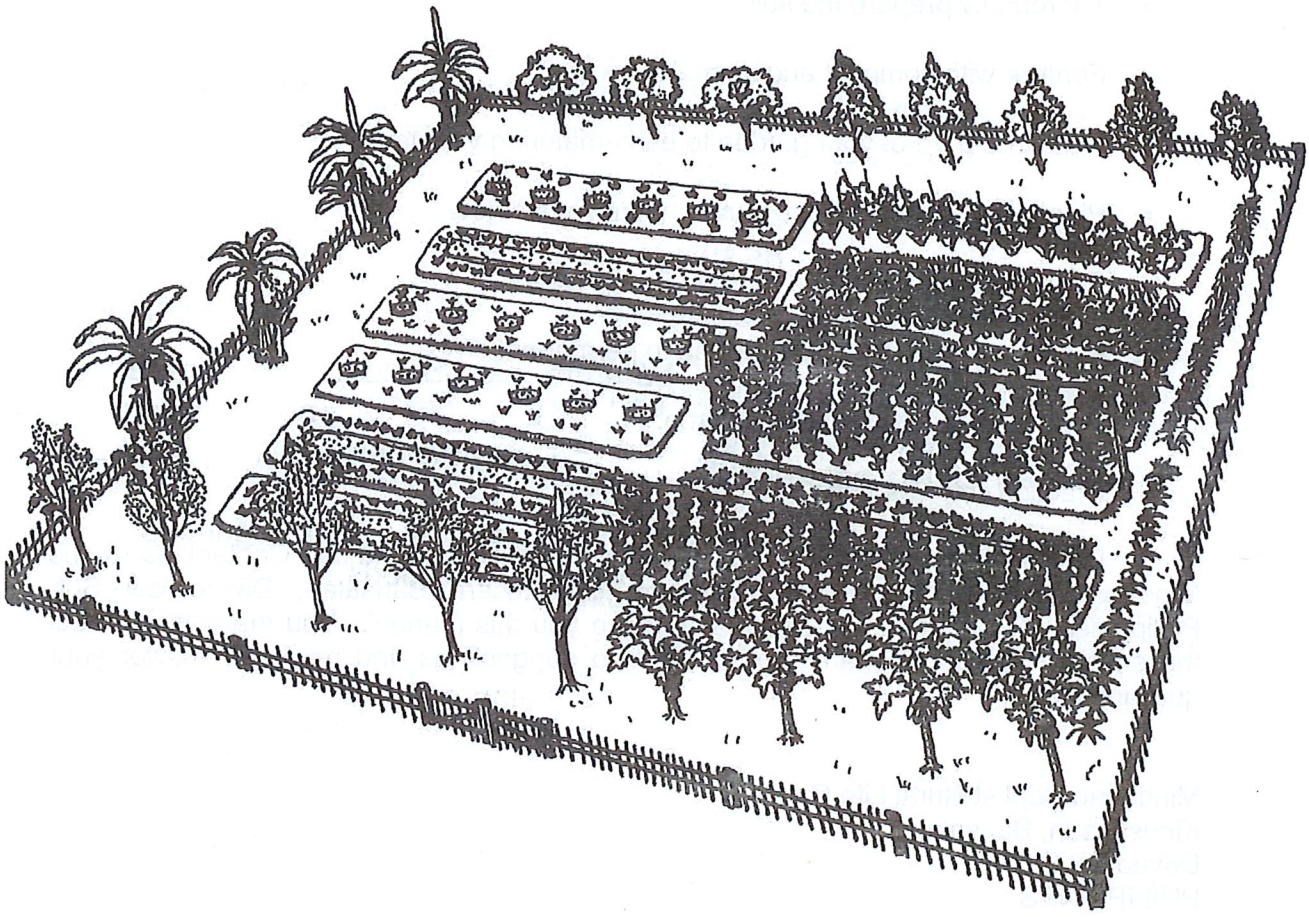
- ✓ Do **NOT** eat, play with your children or even shake hands with anyone until you have washed completely after spraying.

Re-entry interval (REI). This is the time required before workers may re-enter the field after spraying. On commercial pesticides follow the recommendation on the label. For home-made pesticides, to make sure of safety, it would be good to wait until the next day before going back into the field.

- ✓ ***Do NOT allow anyone to enter the field or garden until the REI time is up!***

IPM is important in agriculture as it provides local farmers with a more affordable way of controlling pests, while making better use of available resources. Overall, it helps us to be better stewards of the world God has given us.

THIS IS HOW YOUR FAITH GARDEN WILL LOOK



REMEMBER THE TEN STEPS OF "F.A.I.T.H." GARDENING

As per our experience, the FAITH garden will faithfully give you vegetables throughout the year, if you faithfully follow the ten steps. In summary, then ten steps are:

- Locate the best place for your garden.
- Provide enough space.
- Thoroughly prepare the soil.
- Fertilize with compost and animal manures.
- Plant one-third of your garden to early-maturing vegetables.
- Plant another one-third to semi-annual vegetables.
- Plant the remaining third to annual vegetables.
- Plant the periphery of the garden to permanent crops.
- Plant the reserved portion on time.
- Practice crop rotation.

Do you have some inquires or suggestions? Let us know. Contact us at the Mindanao Baptist Rural Life Center in Kinuskusan, Bansalan, Davao del Sur, Philippines. Or, contact the person who gave you this manual. You may also contact the staff at ECHO. We are always open to suggestions and ready to answer your questions!

Mindanao Baptist Rural Life Center
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APPENDICES

FOR THE

F.A.I.T.H.

[FOOD ALWAYS IN THE HOME]

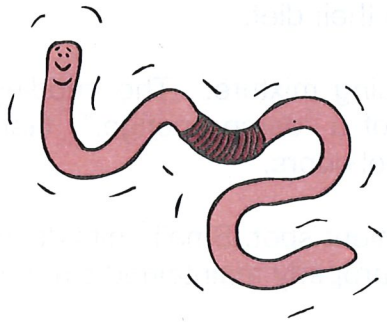
GARDEN MANUAL

APPENDIX 1: LISTING OF SOME POPULAR VEGETABLES

COMMON ENGLISH NAME	SCIENTIFIC NAME
Amaranth (Vegetable or Green)	*Amaranthus tricolor*
Bean (Snap, Common or String)	*Phaseolus vulgaris*
Bitter Melon or Bitter Gourd	*Momordica charantia*
Bottle Gourd	*Lagenaria siceraria*
Broccoli	*Brassica oleracea var. italica*
Cabbage	*Brassica oleracea var. capitata*
Carrot	*Daucus carota subsp. sativus*
Cauliflower	*Brassica oleracea var. botrytis*
Celery	*Apium graveolens var. dulce*
Celery, Chinese	*Apium graveolens var. secalinum*
Chaya or Tree Spinach	*Cnidoscolus aconitifolius*
Chayote	*Sechium edule*
Chinese Cabbage	*Brassica rapa subsp. pekinensis*
Chinese Kale	*Brassica oleracea var. alboglabra*
Coriander or Cilantro	*Coriandrum sativum*
Cucumber (Pickling or Slicing)	*Cucumis sativus var. sativus*
Eggplant	*Solanum melongena*
Ethiopian Mustard or Ethiopian Kale	*Brassica carinata*
Garlic	*Allium sativum*
Hyacinth or Lablab Bean	*Lablab purpureus*
Kangkong	*Ipomoea aquatica*
Katuk	*Sauropus androgynous*
Lagos Spinach or Quail Grass	*Celosia argentea*
Lima Bean or Butter Bean	*Phaseolus lunatus*
Loofah, Angled	*Luffa acutangula*
Loofah, Smooth	*Luffa aegyptiaca*
Maize or Sweet Corn	*Zea mays*
Melon, Cantaloup or Muskmelon	*Cucumis melo*
Moringa or Drumstick	*Moringa oleifera*
Mung Bean or Green Gram	*Vigna radiata*
Mustard	*Brassica juncea var. juncea*
Okra	*Abelmoschus esculentus*
Onion	*Allium cepa*
Pak Choi	*Brassica rapa subsp. chinensis*
Pea	*Pisum sativum*
Pepper (Sweet or Bell)	*Capsicum annuum*
Pepper (Chili)	*Capsicum frutescens*
Pigeon Pea	*Cajanus cajan*
Potato (White or Irish)	*Solanum tuberosum*
Radish (Daikon, Cherry)	*Raphanus sativus var. sativus*
Soy Bean (Edamame or Vegetable Soy)	*Glycine max*
Spinach	*Spinacia oleracea*
Spinach (Malabar or Ceylon)	*Basella alba*
Spinach (New Zealand)	*Tetragonia tetragonioides*
Squash or Pumpkin	*Cucurbita moschata, C. pepo, C. maxima*
Sweet Potato	*Ipomoea batatas*
Tomato	*Lycopersicon esculentum*
Watermelon	*Citrullus lanatus*
Winged Bean	*Psophocarpus tetragonolobus*
Yard-Long or Asparagus Bean	*Vigna unguiculata subsp. sesquipedalis*

APPENDIX 2

VERMICULTURE BASICS & WORM COMPOSTING



APPENDIX 2: VERMICULTURE BASICS AND WORM COMPOSTING

Worm culture is useful in recycling kitchen and animal wastes to produce a rich organic fertilizer, a high-protein feed for poultry and a potentially lucrative business selling worms and worm castings. The worms are also invaluable partners in building the soil in your **FAITH Garden**.

ITEMS NEEDED INCLUDE:

- A container or bin
- Worms
- Bedding
- Food (kitchen scraps, leaves, plants, feed and animal wastes)

1) CHOOSE A BIN

A standard worm bin is a shallow box made from concrete, metal, plastic or wood. You can use an old dresser drawer, barrel, or custom-made bin for your worms.

The container should be 20–30 cm (8–12 inches) deep, and provide one square foot (0.1 m^2) of surface area for every 500 g (1 pound) of food waste fed per week. A bin with the surface area of 1 square meter requires about 5 kg of waste per week to feed the worms.

Make sure there is good drainage in the container so the worms don't drown. If possible, design a way to capture the liquid runoff which can be used as liquid plant fertilizer. Cover the bin to conserve moisture, provide darkness for the worms and protect them from predators and rain.

2) PREPARE THE BEDDING

Shredded newspaper, chopped tree leaves, chopped straw or dry grass, coconut coir, seaweed, sawdust, compost and aged manure make nice bedding materials. A variety provides more nutrients for the worms and produces richer compost. Sand and soil should be added to the bedding to provide the worms with the necessary "grit" in their diet.

Fill the bin with the bedding mixture. The bedding should be damp with an overall moisture content of a "damp sponge." Gently lift the bedding to help provide aeration and control odors.

Locate the bin in a convenient spot. Small units do well in the kitchen, and there is no odor produced by a properly maintained bin. Larger units do well under the shade of trees.

Shredded newspaper, chopped leaves, dry grass or straw, coconut coir, seaweed, sawdust, compost and aged manure make nice bedding materials.

3) Add The Worms

Eisenia Foetida, the **red wiggler or manure worm** is the preferred worm species for composting because they thrive on organic materials such as food scraps and manure. Other species will also work, although the red wiggler has been shown to be the best. You can find them in a friend's worm bin, or in a farmer's manure pile. Other worms can be found under rocks and logs, piles of leaves and compost. Be careful, though. In the dry season, they will migrate deep into the earth and be hard to find. You can "call" them by moistening the ground and covering it with leaves or straw, giving them a cool, moist refuge to visit.

For 1 kilogram of waste you will need about 2 kilos of worms (approximately 4000) to consume and convert it. If you don't have that many worms to start, don't worry. It may just take a bit longer to consume the waste. ***Meanwhile, the worms will multiply, doubling their numbers in just 2-3 months.***

4) Add Food And Animal Wastes

Your worms will eat food scraps such as fruit and vegetable peels, pulverized egg shells, tea leaves and coffee grounds. They will eat fresh and dry leaves. They will also eat meat and dairy products, but if you have rat problems, it is recommended not to feed these. Bury the food scraps under the bedding making sure no food waste is exposed. This will help control odors. Rotate spots in the bin when burying the food waste.

On a larger scale, make a slurry of animal manure (fresh manure with a little water so it can be poured) and pour into the empty half of the worm bin. The worms and bedding remain on the other half giving them a refuge while they feast on the decomposing manure.

5) Harvest The Worm Castings

After approximately **2-3 months** the contents of the bin will begin to look like rich black soil rather than the bedding that it started as. Move the entire contents of the bin to one side, sifting out the worm castings; fill the empty side with new bedding and begin to bury your food waste in the new bedding. Within a short time the worms will migrate to the new food source, and you will be able to remove the worm castings from the other side of the bin. Over time, you will be able to skim the castings off the top of the bedding without disturbing the worms.

If you want to harvest all the compost at once, dump the entire contents onto a large tarp or sheet and separate the worms out manually. Or, put the whole lot into the garden. Watch out that you don't damage or lose the tiny, lemon-shaped worm cocoons which contain up to 20 baby worms. Add these with a little of the finished compost into the bedding of the next bin.

You can trap the worms and remove them from the finished castings by starving them for several days. Then strategically place some manure or food waste in one corner of the bin. The worms within 2-3 days will have migrated to the food

source, and you will be able to safely remove them in preparation to harvest the worm castings.

For poultry feed, empty the portion of castings and worms onto a large tray and allow the birds to feed. When the worms have been eaten, you may remove the compost for use elsewhere. Use the finished compost as soil conditioner for the garden, as potting soil or as a commodity to sell in the market!

6) Some Useful Vermiculture Resources

Worms Eat My Garbage, by Mary Appelhof. 1997. Flower Press, Flowerfield Enterprises, LLC. Kalamazoo, Michigan, USA. 163 pp.

Earthworm Breeding for Profit, by David Lambert. 1983. Weston and Co., Kiama, Australia. 33 pp.

The Worm Book, by Loren Nancarrow and Janet Hogan Taylor. 1998. Ten Speed Press, Berkley, California, USA. 150 pp.

Various Internet Websites

APPENDIX 3

HOME GARDEN PESTICIDES

FOR

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PLANT PROTECTION IN THE F.A.I.T.H. GARDEN

APPENDIX 3: HOME GARDEN PESTICIDES

INSECTICIDES

Alcohol

Dab alcohol (isopropanol or ethanol) on with cotton swabs or small paint brush to spot clean plants. Alcohol may also be used in a small hand sprayer for larger operations.

Indications: aphids, mealy bugs, scale insects, thrips, spider mite

Ammonia

To one (1) liter of water, add:

- 150 ml household ammonia
- 1 squirt liquid soap

Indications: aphids, flea beetles, scales, thrips, white fly, mealy bugs

Boric Acid (Borax) Bait

- Mix sweetened condensed milk with boric acid or borax powder enough to make a thick, viscous mass
- Glob portions of this mass onto small pieces of aluminum, paper, cardboard or plastic and let dry
- Place in clothes drawers, bookshelves, cupboards, around plants, etc. as baits

Indications: cockroaches, fire brats, silver fish, ants

Boric Acid Ant Bait

In 750 ml water dissolve:

- 4 tsp borax or boric acid
- 250 ml (~1 cup) sugar

- Loosely pack several small containers half-way with cotton balls or cotton wool
- Moisten the cotton in the containers with the bait solution
- Make 2-3 holes in the lids of each container large enough for ants to enter
- Cover the containers and seal with adhesive tape

- Place several containers near the ant mound –or–
- Place in strategic places to divert ants' attention from your plants

- Keep the bait moist
- Experiment with the strength of the solution. With a large number of dead ants near the bait, it is too strong. If the ants keep coming back for a week or more, it is too weak. You want the bait at a concentration so the workers take it back into the colony to reduce the ant population at the source.

Citrus Peel

- Mix together the grated peel of a lemon, an orange and a lime and boil for a few minutes
- Let stand for 24 hours
- Filter
- Do not dilute

Indications: Useful as a repellent against potato beetles, caterpillars and other insects.

Clay

- Make a suspension of fine clay in water
- Spray onto plants

Indications: useful against aphids

Cornmeal

- Dust the ground around tomato and pepper transplants for cutworm control
- Reapply as needed, when you can no longer see the cornmeal on the soil

Diatomaceous Earth

Diatomaceous earth is a non-toxic, inert material made from the mineral remains of shells of diatoms, single-celled aquatic plants found in the ocean. Processed diatomaceous earth is a fine talc-like powder made up of these shells which are sharp and needle-like. These 'needles' penetrate the pest's body, killing it through dehydration.

Application

- Dust onto soil to control crawling pests
- Dust on foliage (leaves) to control chewing and sucking pests
- Mix with soapy water and sprinkle on the plant or soil
- Apply around the base of seedlings to control cutworms and grubs
- Apply early in the morning when plants are wet with dew to help it adhere

Indications: ants, aphids, bedbugs, beetles, caterpillars, flea beetles, leafhoppers, grubs, fleas, lice, mites, maggots, thrips, slugs & snails, storage pests, borers, internal parasites of livestock

Reminders

- Protect your face when applying. It can irritate the mucous membranes of the eyes, mouth and nose.
- Diatomaceous earth is non-selective; it also kills beneficial insects
- Reapply after heavy rain

Cornmeal

- Dust the ground around tomatoes with cornmeal for cutworm control.
- Reapply as needed, when you can no longer see the cornmeal on the soil.

Indications: cutworm control

Diatomaceous Earth

Diatomaceous Earth is a non-toxic, inert material made from the mineral remains or shells of diatoms, single-celled aquatic plants found in the ocean. Processed Diatomaceous Earth is a fine talc-like powder made up of these shells which are sharp and needle-like. These 'needles' penetrate the pest's body, killing it through dehydration.

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- Reapply after a heavy rain.

Flour Spray I

To 5-10 liters water, stir in

- 2 cups (500 ml) fine, white flour
- 1Tbsp liquid soap

Indications: mites and aphids

Flour Spray II

To 50 liters of water add:

- 250 ml (1 cup) sour milk or buttermilk
- 8 cups (2 liters) fine white flour
- add liquid soap as surfactant
- spray infested crops, including the undersides of the leaves

Indications: kills adults, eggs and larvae of aphids, mites, thrips, white fly

NOTE: apply flour sprays in the early morning. As the sun dries out the mixture, the insects will be encrusted and killed in the mix.

Garlic Spray

In four (4) liters water blend:

- 5 ml (1 tsp) garlic juice
- 5 ml (1 tsp) rubbing alcohol (ethanol, methanol or isopropanol)

May be used immediately

Garlic Spray II

To one (1) liter of water, steep

- 2 mashed or macerated garlic cloves for 24 hours.
- Filter.
- Do not dilute. Spray on plants, no more than twice a week

Indications: control of aphids, spider mites, scale

Garlic Spray III

- Steep 20 cloves of finely chopped garlic for 24 hours in olive oil to cover.
- Strain and save the oil.
- Add 2 tsp of this mixture to 2 cups of water (500 ml) with a few drops of liquid dish soap.
- Shake and strain again.
- Dilute this mixture, using 2 tsp per 2 cups of water.
- Spray on plants.

Indications: Useful against larger insect pests: leafhoppers, slugs, plant bugs, whitefly.

Garlic and Oil Spray

- Mash or macerate 2 large garlic bulbs (more if they are small).
- Soak in 2-3 tablespoons of mineral or cooking oil for two days.
- Add this mixture to one (1) liter of water
- Filter and add 1 Tbsp liquid soap.

- Spray plants with a mixture of 2 Tbsp per 1 liter of water. Spray all plant surfaces, but it is good to test this first by spraying a few leaves to check for sensitivity.

Indications:

Garlic, Oil & Pepper Spray

- Steep 20 g of chopped garlic in 20 ml of vegetable oil for 24 hours.
- Add 1 liter of water and 10 ml of liquid dish soap.
- Strain.

- Boil 5 hot peppers in 2 liters of water until the water is reduced by half.
- Add to the first mixture.

Spray on plants every 4 or 5 days.

Gliricidia Spray

In four (4) liters (1 gallon) of water add:
- 1 kg (6-8 liters dry volume) chopped fresh gliricidia leaves

Allow to soak 2 days, then
- filter out leaves
- add 1Tbsp liquid soap to the liquid
- mix and spray

Indications: aphids, cabbage loopers, mosquitoes

Home Insect Spray

To two (2) liters warm water, add:
- 1 whole head of garlic, mashed
  1 tablespoon fresh crushed cayenne pepper
  1/4 onion, mashed

- Allow to steep for two to three days.
- Filter mixture into a pump spray bottle.

To this mixture add:
- 1-2 drops liquid soap

Indications: flea beetles, other insects.

Kerosene Spray

To (4) liters or (1) gallon water, add:
- 3 Tbsp (45 ml) kerosene
- ½ tsp (2.5 ml) liquid dish soap
- Mix well and stir or shake constantly while in process of application

Indications: to control powdery mildew, various insects

Neem (aqueous leaf extract)

In five (5) liters of water soak

- 1 kilogram of neem leaves
- soak overnight
- grind the soaking leaves and filter the extract
- add 1 tsp or 1 squirt of liquid soap
- mix well and spray or sprinkle on plants

There is no need to boil the extract. This reduces the Azadirachtin content. Some prefer to soak the leaves longer, but the longer they soak they develop a foul smell. To treat 1 hectare of land, nearly 80 kg of leaves are needed, so this amount is recommended for the home garden.

Neem (easy leaf extract spray)

In any container (such as a 20-liter/5-gallon bucket)

- fill half full of fresh neem leaves
- chop the leaves a bit, if desired
- fill the container full of water
- let set overnight
- spray undiluted in the morning

NOTE: the active ingredient in neem, azadirachtin breaks down in sunlight and water over time, so it is best to use the spray soon after making it.

Neem (aqueous seed extract)

- Crush 500 g (3 double handfuls) neem seed in a mortar & pestle into a paste
- Mix paste thoroughly in 10 liters of water
- Leave to soak overnight
- Filter through layered cotton cloths
- Spray or sprinkle over plants

Repeat every 10-15 days if bad infestation

Indications: control of diamond back moth, cabbage worm, aphids, cutworms, locusts, lace bug, armyworm, flea beetle, green rice leaf hopper, jassids, leaf miners, Mexican bean beetle, mites, root-knot nematodes, rice stem borers, spotted stalk borer, white-backed rice plant hopper, tomato leaf spot fungus.

Neem (oil spray)

To one (1) liter of water add:

- 30 ml (1 fl oz) neem oil
- 1 tsp (5 ml) liquid soap (emulsifier)

Mix well and use immediately. A knapsack sprayer is recommended over a hand sprayer.

Pepper Spray I

To one (1) liter of water mix:

- 1 tsp of liquid dish soap
- a pinch of dried, ground cayenne or other hot chili pepper

Do not dilute before spraying on plants

Indications: Useful against aphids and scale insects

Pepper Spray II

Chop up mash or macerate together the following:

- 3 hot peppers, half an onion and 1garlic clove

- Mix these in 1 liter of water and let steep for 24 hours.
- Filter
- Add 1 tsp or 1 squirt liquid soap
- Spray directly on insects

Petunia or Marigold Tea

- Pour 1 liter of boiling water over 2 cups of chopped petunia or marigold leaves.
- Let steep for 24 hours.
- Strain.
- Do not dilute before spraying on plants.

Indications: for control of aphids and caterpillars

Soap Sprays

Recipe A. In four (4) liters of water:

- Dissolve 25 ml (5 tsp) of liquid dish soap or 50 g of bar soap.

Recipe B. In five (5) liters of water

- Dissolve 30 ml (6 tsp) of liquid soap; spray

Recipe C. In one (1) liter of water dissolve

- ½ Tbsp or 10 ml liquid soap

Recipe D. In one (1) liter of water dissolve

- One (1) Tbsp soap powder or 7 g of bar soap
- Add kerosene to increase effectiveness

Indications: Spray on aphids, thrips, caterpillars, whiteflies, mites, slugs, leaf miner, small beetles. Use stronger solutions for stronger insects.

NOTE: It is recommended not to use laundry detergent (powdered or liquid) as it may be too strong on the plants. However, some cultures may not have liquid soap and use the same powdered soap for both laundry and dishes. In this case, use the powdered soap as you would the liquid soap, but **always test them first**.

Tobacco I

- Boil 250 g tobacco leaves, stems or dust in 4 liters water for 20 minutes
- Allow to cool; filter through layered cotton cloth
- Add this solution to 4 more liters of water
- Add 50 g bar soap or 3-5 Tbsp liquid soap as surfactant (Don't use laundry soaps such as Omo, Breeze, Tide or Ajax.)

Indications:

- pour into sorghum and maize funnels (whorls) to kill stalk borer
- apply as soil drench around plants to kill cutworms
- spray beans to prevent rust disease
- spray also to control aphids, beetles, cabbage worms, caterpillars, grain weevils, leaf miners, mites, stem borers and thrips
- especially effective against biting or sucking insects
- applied weekly with a brush, is effective against ticks and fleas in cattle

Tobacco II

In 15 liters (4 gallons) of water, soak

- 1 kg crushed or bruised tobacco stalks and leaves for 24 hours
- Filter
- Add handful of soap flakes or 3-5 Tbsp liquid soap
- Spray immediately on plants

Tobacco Leaf Mulch

Mulch around plants with Tobacco leaves to kill or repel aphids, flea beetles, slugs, cutworms, snails and thrips

WARNING: Tobacco has a VERY high toxicity ☠. Do not let people or animals drink the solution, and when spraying, wear protective clothing – especially a mask, or apply solutions with a watering can only. Do not eat vegetables within 4 days of application and wash them carefully when you do.

Spray Tobacco sprays in the evening to allow them to work in the night. And in general, do not spray potatoes, peppers, tomatoes, tomatillos, eggplant, tamarillo, naranjilla or any plant that is in the Solanaceae family to prevent the spread of viruses.

Tomato Leaf Tea I

In one (1) liter of water steep

- Tomato stems and leaves (around 2 cups) for 24 hours.
- Strain.
- Add and additional ½ liter of water
- Add 1 tsp or 1 squirt liquid soap
- Use as an insecticide.
- Spray copiously on plants.

Indications: Useful against cabbage worms and aphids

Tomato Leaf Tea II

To two (2) liters of water add:

- 1 kg chopped tomato stems and leaves
- bring to a boil
- allow to cool
- filter

Indications: spray to deter caterpillars, black or green flies; apply every 2 days when cabbage butterflies are present

Tomato solutions are effective at repelling aphids, ants, cabbage worms, caterpillars, cockroaches, diamondback moth, flies, grasshoppers, grubs, insect larvae, nematodes, red spider mites, tomato hornworm, whitefly, fungi and bacterial wilt.

Vegetable Oil Spray I

To 15 liters of water, thoroughly mix

- 1 liter vegetable oil
- 100 g hard soap (dissolved) or 100 ml liquid soap
- Stir until a cloudy emulsion is obtained
- Spray

Vegetable Oil Spray II

In 500 ml (1/2 liter) of oil, thoroughly mix

- 2 Tbsp liquid dish soap

Dilute this mixture at the rate of 100 ml oil/soap mix to 1 liter water

Indications: spray vegetable oil every 10 days to protect eggplants, carrots, lettuce, celery, watermelon, peppers and cucumbers from insects such as aphids, caterpillars, fleas, flies, red spider mites, scale, thrips and white fly.

NOTE: Test the solution first on the plants to make sure the plant will not suffer damage. (Leaves of squash, cauliflower and red cabbage can burn.) Avoid spraying on hot days. Spray fruit trees only during dormant periods. Do not use coconut or palm oils as they may gel. Use infrequently as these solutions are very effective. [See ***horticultural oil*** in the insecticide section of this appendix for oil options.]

Vinegar Spray

In 10 liters of water, mix:

- 3 Tbsp vinegar (white vinegar if possible)
- 3 Tbsp liquid soap
- 2 Tbsp liquid manure (manure tea)

Indications: spray to control aphids

FUNGICIDES

Baking Soda (Sodium Bicarbonate) Spray I

In one (1) liter of water, mix:

- 1 Tbsp of baking soda -or- baking powder
- 1 squirt of liquid dish soap

Mix well. For some sprayers, you may need to filter out larger particles so they don't clog the sprayer. For this, use several layers of cotton cloth.

Baking Soda Spray II

In one (1) liter of water dissolve:

- 100 g (approximately 7 Tbsp) baking soda -or- baking powder.
- 1 Tbsp liquid soap
- Filter and dilute by adding 9 more liters clean water.

Baking Soda Spray III (also see Cornell Spray)

In four (4) liters or one (1) gallon of water, mix:

- 1 Tbsp baking soda or baking powder
- 1-3 Tbsp (15-45 ml) vegetable oil
- mix well, then add 1 tsp liquid soap
- mix again

Apply soon as symptoms appear. Spray on plant foliage and stems, covering all surfaces. Shake or stir occasionally to keep the soda in suspension. You may need stronger solutions for some diseases. Test the plants first to make sure there is no damage.

Indications: powdery mildew, downy mildew, black spot on strawberries, peppers, strawberries and eggplant; blue rot on citrus in storage and fungal diseases in general

Bleach Drench

To one (1) liter of water, mix

- 2-3 tsp bleach

Indications: drench seed bed to prevent damping off disease

Copper (Bordeaux Mix)

To four (4) liters or one (1) gallon of water add:

- 3.5 Tbsp powdered copper sulfate
- 10 Tbsp hydrated or slaked lime
- Mix well in a plastic container, stirring with a wooden spoon, stick or paddle
- Spray in the early morning of a sunny day so solution will dry on the leaves
- Constantly shake sprayer to prevent clogging of sprayer

Indications: anthracnose, bacterial blight, bacterial wilt, black spot, downy mildew, late blight [on solanaceous crops], powdery mildew, rust, and many other disease causing pathogens; flea beetles [on potatoes and tomatoes]

Cornmeal

- Work 1 kg cornmeal into the soil for every 10 square meters (2 lbs per 100 square feet). Water well to activate the fungicidal properties. One application per season is usually sufficient, but repeat applications won't hurt anything.
- Dust the ground around tomatoes with cornmeal for cutworm control. Reapply as needed, when you can no longer see the cornmeal on the soil.
- Dust the ground around roses with cornmeal, and water in. This helps to eliminate black spot spores that attack roses, and also helps to eliminate the spores in the soil around the roses.

In four (4) liters (one gallon) water:
- Soak 250 g (1 cup) cornmeal overnight
- Strain the liquid and spray undiluted on susceptible plants the next day

Indications: fungal diseases

NOTE: Any type of cornmeal can be used as a fungicide

- **Food grade cornmeal**, found in dry goods and grocery stores, will work but is more expensive and comes in smaller quantities than horticultural cornmeal.
- **Horticultural cornmeal** has not been stored under the stricter guidelines required for food grade cornmeal. "Hort" cornmeal is generally used for livestock feed. It too will work as a fungicide and comes in less expensive bulk quantities.

Cornell Spray and Modifications of the Cornell Spray

Cornell Spray (variations)
In four (4) liters (one gallon) of water mix:
- 2 Tbsp horticultural oil *
- 1 heaping Tbsp of baking soda (bicarbonate of soda)
- 1 Tbsp of liquid dishwashing soap

In four (4) liters (one gallon) of water mix:
- 1 Tbsp horticultural oil *
- 1 Tbsp baking soda
- ½ tsp liquid dish soap

In four (4) liters (one gallon) of water mix:
- 2 Tbsp horticultural oil *
- 4 tsp baking soda
- 1 Tbsp liquid dish soap

Modified Cornell Spray
Add to any of the above mixtures:
- 1 Tbsp fish oil and/or seaweed emulsion (as fertilizer)

ECHO modification A: In four (4) liters (one gallon) of water mix:

- 5 Tbsp commercial horticultural oil *
- 4 Tbsp Safer Insecticidal Soap®
- 1 Tbsp baking soda

ECHO modification B: In four (4) liters (one gallon) of water mix:

- 5 Tbsp horticultural oil *
- 2 tsp liquid dish soap
- 1 Tbsp baking soda

ECHO modification C: Either A or B without the baking soda

Mix well and spray with a pump sprayer late in the evening after first watering thoroughly. Shake well before and during use.

Indications: black spot in roses, powdery mildew, urocladium leaf spot in cucumber, alternaria leaf blight in muskmelon, gummy stem blight in melon, anthracnose in cucurbits, rust, dollar spot and pythium blight in turf, late blight in potato, wheat rust, fungal diseases in banana, peanuts, alfalfa; spider mites and aphids

For black spot control, it is important to spray all plant surfaces – stems as well as the foliage. It has been found that the black spot spores reside in lesions in rough stems and that they can attack, not only the foliage, but stems and branches, as well.

Some sources recommend that the plants be well-watered before spraying, often to irrigate 2-3 days in advance.

NOTE: Don't add vinegar. This will react with the baking soda. Some recommend not using fish oil or seaweed products containing sulfur with horticultural oil spray. Some also recommend not mixing fungicide with horticultural oil sprays, as you may get foliar damage. Test it out first.

* Editor's Note: Commercial oils used include Sunspray® and Volck®, which are not always available. However, you may also use cooking (vegetable) oil or mineral oil or a number of other oils with satisfactory results. [See ***horticultural oil*** in the insecticide section of this appendix for options.]

Kerosene Spray

To four (4) liters or one (1) gallon of water add:

- 3 Tbsp kerosene
- ½ tsp liquid detergent soap
- mix well and stir/shake constantly while spraying

Indications: powdery mildew, various insects

NOTE: Other horticultural oils may be substituted for kerosene in this recipe. See ***horticultural oil*** in the insecticide section of this appendix for options.

Milk Spray

Mix equal parts milk and water, 50:50
- spray on roses to prevent Powdery Mildew and Black Spot.

To (4) four liters or (1) one gallon water, mix
- 2 cups or 500 ml milk
- spray on cucumbers, squash, and pumpkins, lettuce, and tomatoes

Indications: powdery mildew, downy mildew, black spot

Sulfur Dust

- Sprinkle sulfur dust on plants to kill spider mites, scale, various fungi, especially powdery mildew, bean rust and gray mold of fruit.

- Apply dust on the plant parts which are infected; do not apply to tender leaves, cucurbits or other sensitive plants, as sulfur can burn them.

Molasses (Treacle or Jaggery)

Mix into four (4) liters (1 gallon) of water:
- 2 tablespoons of molasses
- 1 squirt liquid dish soap

Water or apply as a foliar spray.

Indications: fungal diseases on tomatoes

HERBICIDES

Vinegar

- Spray weeds with full-strength white vinegar

Boiling Water

- Pour boiling water over the weeds. It might take a couple of applications, but they will die.

MISCELLANEOUS

Slug Spray

- Mix one part ammonia with two parts water and spray infested areas.
- Apply on a day below 27° C (80° F).

Insect Barrier

Water bottles with both ends cut off, made into 8-10 cm (3-4 in) "tubes", with a band of sticky or greasy material such as grease or petroleum jelly (Vaseline®) applied to the outside, placed in the soil around the plant stem will serve as a physical barrier to many pests.

Ant Barrier

Tie a jute cord around the tree and apply petroleum jelly (Vaseline®), grease or sticky trap material to the cord to prevent leaf-cutter ants from climbing into fruit trees.

Some say a cord of sheep's wool tied around the tree will keep the ants out.

For Leaf-Cutter Ants

Plant ***Canavalia spp.*** around areas where there are colonies of leaf cutter ants (mochomos, zompopos, etc.) The ants don't eat the leaves they cut; they use them to grow a fungus which the ants eat. Canavalia leaves keep the fungus from growing and starve the ants.

Spring Tonic (fertilizer) for the Garden

Here is a little organic pick-me-up for the plants in your garden

To eight (8) liters (2 gallons) warm water, dissolve:
3 tablespoons of liquid seaweed or sea kelp
3 tablespoons of Epsom salts (Magnesium Sulfate crystals)
3 tablespoons of fish emulsion (not fish sauce!)
1 packet or 1 tsp of dry baking yeast
1 tablespoon of baking soda
3 tablespoons of blood meal powder
3 tablespoons of bone meal, finely crushed
1/4 cup of molasses or 1 can of regular cola

Use this as a soil drench around the base of the plant.

Aquarium Water Fertilizer

When you remove water from your freshwater aquarium, don't pitch it down the drain! Use it to fertilize potted plants.

Epsom Salt Bloom Booster

To four (4) liters (1 gallon) water dissolve:

- 1 - 2 tablespoons Epsom salts (Magnesium Sulfate)

Apply as a foliar spray to plants at bloom time, and again 10 days later to encourage better fruit and flower production, especially with peppers and tomatoes. It provides magnesium and sulfur, and is better taken in by the plant as a foliar spray than when added to the soil.

Compost Accelerator I

To twenty (20) liters (5 gallons) water, add

- 250 ml (8 ounces or 1 cup) of molasses (treacle)
- 125 ml (4 ounces 1/2 cup) of kelp or seaweed.

Sprinkle over your existing compost pile, or incorporate into a new pile.

Compost Accelerator II

To one (1) liter of warm water, mix

- 500 g (1 lb) sugar
- 100 g yeast (either baker's or brewer's yeast)
- Allow the yeast to grow.
- When bubbles begin to form, add this mixture to twenty (20) liters of water
- Add another 500 g sugar and sprinkle on your compost pile, either as you build it, or incorporated into the existing pile

Honey Water Rooting Solution

- 1/4 cup honey
- 3/4 cup boiling water

Combine and cool. Place cuttings in this solution for a couple of days to help them root.

Rat Poison

You will need:

Gliricidia branches [young, 1.5-1.8 m x 2-5 cm (5-6 ft x 1-2 in)]
12 liters (3 gal) shelled maize, with water to cover (barely)
Large metal cooking pot or bucket (~20-25 liters/5-6 gallons)
20 liter (5 gallon) pail or similar container

- Remove the bark from a branch of gliricidia about 1.5 to 1.8 m long and about 2-5 cm in diameter (it's usually a new shoot less than a year old); cut the bark into small pieces (about 2-5 cm^2 in size).
- Mix bark pieces with shelled maize in a large cooking pot. Add water to cover the maize, no more; a little less is better.
- Bring to boil; boil ~10-15 minutes.
- Turn off heat; cool overnight.
- Pour mixture into large pail and mix.
- Ferment 3 days. [In temperatures less than 25-30° let ferment longer.]
- Place maize grains wherever rats may frequent. [Experiment with other grains if maize is not available.]
- Dry unused portion for storage and later use.

REMEMBER:

- All homemade pesticides contain chemicals that are potentially dangerous to you, your family, your animals and your crops
- Protect yourself and your family when using them
- Test the mixture on a small area before spraying a whole field to make sure it will not damage the crop
- Label your mixtures
- Keep them in an area far away from children and food
- Keep them in an area far away from livestock feeds and supplies

APPENDIX 4

GUIDE TO

COMPANION PLANTING

IN THE

F.A.I.T.H. GARDEN

APPENDIX 4: COMPANION PLANTING

CROP PLANT	COMPANION	RELATIONSHIP OF COMPANION TO CROP PLANT
anise	coriander	coriander seed sewn with anise improves anise germination; anise seed formation is strengthened by the presence of coriander
apple	chives	prevent apple scab
bean	carrots cauliflower beets	benefit bean growth
	basil	repels tomato hornworm
	marigold	repels Mexican bean beetle
	strawberry	mutually beneficial
	onion *garlic* *shallots* *chives* *fennel*	*inhibit bean growth*
	savory	repels bean beetles; improves growth, flavor
		Repels Colorado potato beetle in potatoes and eggplant
pole beans	*beets* *kohlrabi* *sunflower*	*inhibit pole beans*
	radish	mutually beneficial
bees		attracted to acacias, alfalfa, banana, basil, bergamot, borage, brassicas, buckwheat, catnip, chinaberry, cleome, citrus, clovers, coffee, coriander, dahlia, guava, hyssop, lemon balm, loquat, lupines, maize, marjoram, mesquite, morning glory, mints, neem, okra, palms, pumpkin, savory, squash, thyme, watermelon
beet	bush beans onion kohlrabi	benefit beets
	pole bean *charlock* *mustard*	*inhibit beets*
borage		returns potassium, calcium to the soil; good border for strawberry beds; honey plant
broccoli	beans	benefit broccoli growth

	dill celery sage peppermint	
buckwheat		adds calcium to the soil as GMCC
buttercup or ranunculaceae family		root secretions kill nitrogen-fixing bacteria, therefore leguminous pastures as well
cabbage family	hyssop thyme artemisia (wormwood) southernwood tomatoes sage rosemary mint	repel white cabbage butterfly when planted nearby
	aromatic herbs	benefit cabbage family
	strawberry *pole bean* *tomato*	*inhibit cabbage family growth*
		heavy feeders; like mulch and manures; rotate cabbage family each growing season
cabbage		repels soil pests
	beans dill celery sage peppermint	benefit cabbage growth; peppermint repels the white cabbage butterfly
	hyssop	trap crop to lure away the cabbage butterfly
carrot		needs lime, humus, potash
	onion leek artemisia sage rosemary black salsify	repel carrot fly (*Psila rosae*)
	tomatoes	mutually beneficial
	leaf lettuce chives radishes	benefit carrot growth
	dill	*inhibits carrot growth*
cauliflower	celery	repels white cabbage butterfly (*Pieris rapae)*
	tomatoes *strawberries*	*inhibit cauliflower*
celery	bush bean	benefit celery when grown nearby

	leek tomato	
chamomile		repels cabbage moths
chili pepper		
Chinese cabbage	*corn or maize*	*don't plant together; corn root and ear worms will eat the cabbage*
citrus		protected by rubber trees, live oak and guava
calendula		repels nematodes
collards	tomato	tomato decreases flea beetle populace
coriander		repels aphids, attracts bees
	anise	coriander seed helps anise seed to germinate; coriander improves the growth and seed production of anise
corn *(also maize)*	beans potatoes peas cucumbers pumpkin squash	mutually beneficial; cucurbits such as squash and pumpkin like the light shade provided by the corn; pole beans use the stalks to climb on; legumes help fertilize the maize/corn
	cucumber	deters raccoons who might feed on corn
	tomato	*corn earworm and tomato fruitworm are the same and will eat both*
		cucumber beetles and corn rootworm are the same insect at different stages
	marigold	inhibits Japanese beetle that eats corn silks
	sunflower	mutually beneficial; row strip crop; sunflower reduces fall armyworm on corn; corn reduces carpophilus beetles on sunflower
cucumbers	beans peas radish sunflower	mutually beneficial; radishes planted with cuke seed protect against cucumber beetles
	chayote	protective of cukes
	potatoes *aromatic herbs*	*inhibit cucumbers*
dill		honey plant
eggplant	redroot pigweed (Amaranthus retroflexus)	makes eggplant more resistant to insect attack
	beans	protect eggplant from Colorado potato beetle
fennel		*most plants inhibited by fennel*
	coriander *artemisia (wormwood)*	*inhibit fennel growth*
	beans	*beans and fennel don't like each other*

flax		repels Colorado potato beetle
flowering plants	chamomile carrot celery clover coriander daisy dill canna citrus mint nasturtium parsley parsnip rosemary rue thyme yarrow	attract beneficial insects
strong-smelling plants	aloe vera artemisia basil calendula chamomile catnip chili pepper chives citronella garlic ginger horehound lantana lavender leek lemon grass marigold mint onion tansy thyme tobacco	deter pests by "putting them off the scent"
garlic		kills some soil fungi; inhibits growth of peas and beans
grape	hyssop	increases grape yield when planted nearby
guava		protects nearby citrus trees
hedges		protect the garden from winds that dry out and erode soil; chaya, moringa and other

		perennials make good hedges
hyssop		tea made from hyssop may be used on bacterial diseases
		a bee plant
		as a trap crop, hyssop attracts the cabbage butterfly
jimsonweed (*Datura stromonium*)		protects nearby plants from Japanese beetles
kohlrabi	onions beets aromatic herbs cucumbers	mutually beneficial
	strawberry *tomato* *pole beans* *fennel*	*inhibit kohlrabi growth*
		likes water & drainage, humus, filtered sunlight
lavender		deters slugs
leek	carrots celery onions	mutually beneficial
		heavy feeders; like rich soil & lots of humus
lettuce	onions strawberries cucumbers carrots radishes	mutually beneficial
lupine		adds calcium and nitrogen to the soil
maize *(see also "corn")*	beans	beans in general help fertilize maize; fava beans and maize are a good combination
marigold		repels nematodes and various insects
mints		Repel cabbage moths
nasturtium		repels aphids and whiteflies
onion family	cabbage family	mutually beneficial
onions	beets strawberries tomatoes lettuce savory	benefit onions
	peas *beans*	*inhibit onions*
		A "wall" of onions as a border will keep rabbits out of the garden

peas	carrots turnips radishes cucumbers corn beans potatoes	mutually beneficial
	onion *garlic*	*inhibit peas*
pennyroyal		repels ants
peppermint		protects cabbage from the white cabbage butterfly
petunia		protects beans against beetles
potato	*tomato*	*tomatoes render potatoes more susceptible to blight*
	green beans flax	planted in alternate rows with potatoes repel the Colorado potato beetle
radish	cucumber squash melon	radish repels striped and spotted cucumber beetles
	nasturtium	improves both growth and flavor of radish
	tomato	radish repels 2-spotted spider mite in tomato
	kohl rabi bush bean pole bean	mutually beneficial
	leaf lettuce	lettuce makes radishes more tender
	hyssop	*Inhibits radish growth*
rue		repels house and stable flies
	sweet basil	*rue and sweet basil dislike each other*
sesame	*sorghum*	*root secretions from sorghum prevent sesame from ripening*
shallot	*peas* *beans*	*inhibit shallot growth*
spearmint		repels various rodents, ants and possibly aphids (due to their relation to ants)
spinach	strawberries	mutually beneficial
squash	radish	plant together; radish will keep insects down
	nasturtium	repels squash bugs
strawberries	beans	mutually beneficial
	borage	grown as border along strawberries; benefits strawberries
sweet basil		mutually harmful to rue
tansy		repels ants, flies, moths; rub on dog's fur to repel flies
thyme		repels cabbage worm; enlivens plants

		growing nearby
tomato	basil (sweet)	benefits tomatoes by improving resistance to insects & disease, growth and flavor; repels mosquitoes, flies and tomato horn worm
	bee balm	improves growth and flavor of tomato
	asparagus	tomato protects asparagus from asparagus beetles; asparagus protects tomatoes from nematodes
	carrots	benefit tomatoes
	radish	radish repels 2-spotted spider mite
	garlic	garlic repels red spider mite
	cabbage family	*mutually inhibit growth*
	potatoes *fennel*	*inhibit tomato growth; tomatoes render potatoes more susceptible to blight*
		heavy feeders; tomatoes like compost, humus, manure, mulches
yarrow		Increases the aromatic quality of herbs

***NOTE:** Many of these plant associations are suggested due to observations made by home gardeners, farmers and development workers. Should you or anyone conduct controlled scientific investigations on companion cropping and such plant associations, ECHO and MBRLC would be thankful to know of the results and conclusions of your work.

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APPENDIX 5

WEIGHTS MEASURES & SOME CONVERSION CHARTS

APPENDIX 5: WEIGHTS, MEASURES & SOME CONVERSION CHARTS

All measurements are derived from seven basic units and are described internationally as the Systéme International d'Unités (SI) or **SI-Metric**. These basic units are as follows:

Ampere	A	Electric Current
Candela	cd	Light Intensity
Kelvin	K	Temperature
Kilogram	kg	Weight (mass)
Meter	m	Length
Mole	mol	Molecular Substance
Second	s	Time

UNITS OF LENGTH

Centimeters & Inches	cm x .394 = in	in x 2.54 = cm
Centimeters & Millimeters	cm x 10 = mm	mm x .1 =cm
Centimeters & Picas	cm x 2.371 = picas	picas x .4233 = cm
Centimeters & Points	cm x 28.4528 = points	points x .0351 = cm
Millimeters & Inches	mm x .0394 = in	in x 25.4 = mm
Millimeters & Micrometers (Microns)	mm x 1000 = µm (µ)	µm (µ) x .001 = mm
Meters & Chains (G*)	m x .04971 = ch	ch x 20.117 = m
Meters & Fathoms	m x .547 = fm	fm x 1.83 = m
Meters & Feet	m x 3.281 = ft	ft x .305 = m
Meters & Yards	m x 1.094 = yd	yd x .914 =m
Meters & Furlongs	m x .005 = fur	fur x 201.17 = m
Chains (G*) & Feet	ch x 66 = ft	ft x .015 =ch
Chains (G*) & Rods	ch x 4 = rd	rd x .25 = ch
Chains (G*) & Yards	ch x 22 = yd	yd x .455 = ch
Fathoms & Feet	fm x 6 = ft	ft x .167 = fa
Kilometers & Feet	km x 3280.84 = ft	ft x (3.048×10^{-4}) = km
Kilometers & Yards	km x 1093.6 = yd	yd x .00091 = km
Kilometers & Statute Miles	km x .621 = mi	mi x 1.609 = km
Kilometers & Nautical Miles	km x .540 = n mi	nmi x 1.852 = km
Nautical Miles & Statute Miles	nmi x 1.15 = mi	mi x .869 = n mi

* G = Gunter's or Surveyor's chain

Unit	Abbreviation	SI/Metric	US
Angstrom	Å	.0001µ (10^{-10}) m	.000,000,004 in
Cable	cb	219.456 m	120 fm / 720 ft
Centimeter	cm	.01 m	.3937 in
Chain (Gunter's/Surveyor's)	chG	20.117 m	66 ft / 4 rd
Chain (Ramden's/Engineer's)	chR	30.48 m	100 ft
Decimeter	dm	.1 m, 10 cm, 100 mm	3.973 in
Dekameter	dam	10 m	32.8 ft
Fathom	fm, fath, fth	1.829 m	6 ft
Foot	ft	.305 m	12 in
Furlong	fur	201.168 m	1/8 mi, 220 yd
Hand (horse height)	-	10.16 cm	4 in
Inch	in	2.54 cm	-
Kilometer	km	1000 m	.621 mi
League	-	4.8	3 mi
Link (Gunter's)	-	.201 m	7.92 in

Link (Ramden's)	-	.305 m	12 in
Meter	m	10 dm, 100 cm, 1000 mm	39.37 in, 3.28 ft
Micrometer (Micron)	µm (µ)	.001 mm	3.937 x 10^{-5} in
Mile (statute/land)	mi	1.609 km	5280 ft, 1760 yd
Mile (nautical/sea)	nmi	1.85 km	6076.11549 ft
Millimeter	mm	.001 m, .01 dm, 1 cm	.03937 in
Mil	mil	.0254 mm	.001 in
Point (type size)	-	.353 mm	.0138 in
Pica (type size)	-	4 mm	12 points, .1668 in
Rod	rd	5.029 m	16.5 ft
Yard	yd	.914 m, 914.4 mm	3 ft, 36 in

UNITS OF AREA

Square Centimeters & Square Inches	cm^2 x .155 = in^2	in^2 x 6.452 = cm^2
Square Meters & Square Chains (G*)	m^2 x .0025 = ch^2	ch^2 x 404.686 =m^2
Square Rods & Square Chains (G*)	rd^2 x 625 = ch^2 (G*)	ch^2 x 16 = rd^2
Square Chains (G*) & Acres	ch^2 (G*) x .1 = A	A x 10 = ch^2 (G*)
Square Chains (G*) & Square Feet	ch^2 (G*) x 4356 = ft^2	ft^2 x .00023 = ch^2 (G*)
Hectares & Square Miles	ha x .0039 = mi^2	mi^2 x 258.999 = ha
Hectares & Acres	ha x 2.471 = A	A x .405 = ha
Acres & Square Miles	A x .00156 = mi^2	mi^2 x 640 = A
Square Kilometers & Square Miles	km^2 x .386 = mi^2	mi^2 x 2.59 = km^2
Square Meters & Acres	m^2 x .000247 = A	A x 4046.856 = m^2
Square Meters & Hectares	m^2 x .0001 = ha	ha x 10,000 = m^2
Square Meters & Square Feet	m^2 x 10.764 = ft^2	ft^2 x .093 = m^2
Square Meters & Square Yards	m^2 x 1.196 = yd^2	yd^2 x .836 = m^2
Square Meters & Square Rods	m^2 x .03954 = rd^2	rd^2 x 25.293 = m^2
Square Yards & Square Feet	yd^2 x 9 = ft^2	ft^2 x .1111 = yd^2

* G = Gunter's or Surveyor's chain

Unit	Abbreviation	SI/Metric	US
Acre	A	4047 m^2	43,560 ft^2
Are	a	100 m^2	1076.39 ft^2
Hectare	ha	10,000 m^2	2.471 A
Manzana (originally)		10,000 square varas	~ 2.0 A
Manzana (Argentina)		1 ha	2.47 A
Manzana (Belize)		8,353 m^2	2.064 A
Manzana (Costa Rica)		6,988.96 m^2	1.727 A
Manzana (El Salvador)		7025.79 m^2	1.736 A
Manzana (Guatemala)		7056 m^2	1.74 A
Manzana (Honduras)		6972.25 m^2	1.72 A
Manzana (Nicaragua)		7000 m^2	1.7 A
Phần (Viet Nam)		.24 m^2	
Rai (Thailand)		1600 m^2	.4 A, 1914 yd^2, 1 sen^2
Sào (Viet Nam)		360 m^2	
Square Centimeter	cm^2	100 mm^2	.155 in^2
Square Foot	ft^2	.0929 m^2	144 in^2
Square Inch	in^2	6.4516 cm^2	-
Square Kilometer	km^2	1,000,000 m^2	.386 mi^2
Square Meter	m^2	10,000 cm^2	10.764 ft^2
Square Mile	mi^2	2.59 km^2	640 A
Square Millimeter	mm^2	-	.00155 in^2
Square Rod	rd^2	25.293 m^2	272.25 ft^2

Square Yard	yd^2	.836 m^2	9 ft

Units of Liquid Volume

UK & US Gallons	UK gal x 1.201 = US gal	US gal x .833 = UK gal
UK & US Quarts	UK qt x 1.202 = US qt	US qt x .833 = UK qt
UK & US Pints	UK pt x 1.201 = US pt	US pt x .833 = UK pt
UK & US Ounces	UK oz x .961 = US oz	US oz x 1.041 = UK oz
UK Gallons & Liters	UK gal x 4.546 = L	L x .220 = UK gal
UK Pints & Liters	UK pt x .568 = L	L x 1.76 = UK pt
UK Ounces & Milliliters	UK oz x 28.413 = ml	ml x .035 = UK oz
US Gallons & Liters	US gal x 3.785 = L	L x .264 = US gal
US Quarts & Liters	US qt x .947 = L	L x 1.056 = US qt
US Pints & Liters	US pt x .473 = L	L x 2.113 = US pt
US Ounces & Liters	US oz x .03 = L	L x 33.8 = US oz
US Ounces & Milliliters	US oz x 29.572 = ml	ml x .034 = US oz
Gills (US) & Ounces (US)	gi x 4 = oz	oz x .25 = gi
Gills (US) & Milliliters (Cubic Centimeters)	gi x 118.29 ml (cc)	ml (cc) x .00845 = gi
Gills (UK) & Milliliters (Cubic Centimeters)	gi x 142.065 = ml (cc)	ml (cc) x .00704 = gi
**Units used in the UK are often called "Imperial" units – Imperial gallon, etc.*		

Unit	Abbreviation	SI/Metric	US
Barrel, fluid (US)	bbl	26.2 gal (UK)	31.5 gal*
Dram (US)	dr	3.697 ml	.125 oz
Gill (1/4 UK Pint)	gi	.142 L	4.8038 oz
Imperial Gallon (UK)	gal	4.546 L	1.201 gal
Gallon (US)	gal	3.785 L	4 qt, 8 pt, 16 c
Liter	L, l	1000 ml, .001 m^3	1.057 qt
Ounce, fluid (UK)	oz	.028 L	.96 oz
Ounce, fluid (US)	oz	.02957 L	2 Tbsp
Pint (UK)	pt	1.2 pt (US), .568 L	19.2 oz
Pint (US)	pt	.833 pt (UK), .473 L	16 oz
Cup (US)	c		8 oz
Quart	qt	.946 L	2 pt
Thang (Thailand)		20 L	5 gal
Thùng (Viet Nam, Cambodia)		20 L	5 gal

Units of Dry Volume

Cubic Centimeters & Cubic Inches	cm^3 x .061 = in^3	in^3 x 16.387 = cm^3
Cubic Inches & Cubic Feet	in^3 x .000579 = ft^3	ft^3 x 1728 = in^3
Cubic Feet & Cubic Yards	ft^3 x .037 = yd^3	yd^3 x 27 = ft^3
Cubic Meters & Cubic Yards	m^3 x 1.308 = yd^3	yd^3 x .765 = m^3
Pints & Quarts	pt x .5 = qt	qt x 2 = pt
Quarts & Pecks	qt x .125 = pk	pk x 8 = qt, 2 gal, 16 pt
Pecks (US) & Bushels (US)	pk x .25 = bu	bu x 4 = pk, 8 gal, 32 qt
Bushels (US) & Barrels (US)*	bu x .0305 = bbl	bbl x 3.281 = bu
Bushels (UK) & Bushels (US)	bu (US) x .969 = bu (UK)	bu (UK) x 1.032 = bu (US)
* A barrel is not the same as a steel *drum*, which holds 55 gals (US). There are different kinds and sizes of barrels depending on their contents.		

Unit	Abbreviation	SI/Metric	US
Cubic Centimeter	cm^3 (cc)	1000 mm^3	.061 in^3
Cubic Foot	ft^3	.02832 m^3	1728 in^3

Cubic Inch	in^3	16.387 cm^3	-
Stere (Cubic Meter)	ST	1 m^3	1.3 yd^3
Cubic Yard	yd^3	.7646 m^3	27 ft^3
Dry Pint (US)	pt	.551 L	½ qt (US Dry), 1/8 dry gal
Dry Quart (US)	qt	1.1 L	¼ gal (US Dry)
US Dry Gallon, Half Peck	gal	4.4 L	4 qt (US Dry), 1/8 bu (US)
Imperial Gallon (UK)	gal	4.546 L or dm^3	1.03 gal (US Dry)
Peck (US)	pk	8.81 L	8 qt (US Dry), ¼ bu (US)
Bushel (US)	bu	35.24 L	8 US Dry gal
Bushel (UK) (obsolete)	bu	36.369 L or dm^3	1.03 bu (US), 8 imperial gallons

Kitchen/Cooking Measures

Liquid Measures (US/SI)							
1 gal	4 qt	8 pt	16 c	128 fl oz	3.79 L		
½ gal	2 qt	4 pt	8 c	64 fl oz	1.89 L		
¼ gal	1 qt	2 pt	4 c	32 fl oz	.95 L		
	½ qt	1 pt	2 c	16 fl oz	.47 L		
	¼ qt	½ pt	1 c	8 fl oz	237 ml		
			½ c	4 fl oz	118 ml	8 tbs	24 tsp
				2 fl oz	59 ml	4 tbs	12 tsp
				1 fl oz	30 ml	2 tbs	6 tsp
				½ fl oz	15 ml	1 tbs	3 tsp
Teaspoon (tsp), Tablespoon (tb, tbs, tbsp), Fluid Ounce (fl oz), Cup (c)							
Dry Measures (US/SI)							
			1 c	8 fl oz	237 ml	16 tbs	48 tsp
			¾ c	6 fl oz	177 ml	12 tbs	36 tsp
			2/3 c	5 1/3 fl oz	158 ml	10 2/3 tbs	32 tsp
			½ c	4 fl oz	118 ml	8 tbs	24 tsp
			1/3 c	2 2/3 fl oz	79 ml	5 1/3 tbs	16 tsp
			¼ c	2 fl oz	59 ml	4 tbs	12 tsp
			1/8 c	1 fl oz	30 ml	2 tbs	6 tsp
			1/16 c	½ fl oz	15 ml	1 tbs	3 tsp
			1/48 c	1/6 fl oz	5 ml	1/3 tbs	1 tsp

Units of Weight and Mass

Grains (gr) & Grams (g)	gr x.065 = g	g x 15.432 = gr
Drams (avdp) & Ounces (avdp)	dr x .062 = oz	oz x 16 = dr
Pennyweight & Grams	dwt x 1.5552 = g	g x .643 = dwt
Grams & Ounces (avdp)	g x .035 = oz	oz x 28.349 = g
Ounces (troy) & Grains	oz tr x 480 = gr	gr x .00208 = oz tr
Ounces (troy) & Grams	oz tr x 31.103 = g	g x .032 = oz tr
Ounces (troy) & Ounces (avdp)	oz tr x 1.097 = oz	oz x .911 = oz tr
Ounces (avdp) & Pounds (avdp)	oz x.0625 = lb	lb x 16 = oz
Milligrams & Grains	mg x .015 = gr	gr x 64.799 = mg
Grains & Carats (metric)	gr x .32399 = c	c x 3.0865 = gr
Milligrams & Carats (metric)	mg x .005 = c	c x 200 = mg
Pounds & Kilograms	lb x .454 = kg	kg x 2.205 = lb
Tons (long) & Pounds (avdp)	lt x 2240 = lb avdp	lb x .0004460 = lt
Tons (short) & Pounds (avdp)	sht x 2000 = lb avdp	lb x .0005 = sht
Tonnes (metric) & Pounds (avdp)	t x 2204.62 = lb	lb x.0004536 = t

**avdp = avoirdupois, French word meaning "goods of weight", standard 16 dr = 1 oz, 16 oz =1 lb*

Unit	Abbreviation	SI/Metric	US/Avoirdupois
Grain (avdp)	gr	.0648 g, 64.8 mg	.037 dr, .002286 oz
Dram (avdp)	dr, dr avdp	1.772 g	1/16 oz, 27.344 gr
Ounce (avdp)	oz, oz avdp	.028 kg, 28.35 g	16 dr, 1/16 lb, 437.5 gr
Pound (avdp)	lb, lb avdp, #	.454 kg, 454 g	16 oz, 7000 gr
Hundredweight, short hundredweight	cwt	45.359 kg	100 lb
Ton (short ton)	t, sht	.907 mt	20 sh cwt, 2000 lb
Microgram	µg	.000001 g	.000015 gr
Milligram	mg	.001 g	.00003527 oz, .015 gr
Centigram	cg	.01 g	.0003527 oz, .154 gr
Gram	g	1000 mg, 100 cg	.03527 oz
Hectogram	hg	100 g	3.527 oz
Kilogram, Kilo	kg	1000 g	35.27 oz, 2.2 lb
Tonne, Metric Ton	t, mt	1000 kg	2204.6 lb, 1.102 sh t
Pennyweight	dwt, pwt	1.555 g	.05486 oz,
Troy Ounce	oz tr	.03 kg, 30 g	480 gr, 1.0971 oz
Stone	st	6.35 kg	14 lb
Hundredweight, long hundredweight	cwt	50.802 kg	112 lb
Ton, Long Ton, British Ton	lt	1.016 mt, 1016 kg	2240 lb

UNITS OF TEMPERATURE [Temperature Conversion]

From:	To Fahrenheit	To Celsius	To Kelvin
Fahrenheit (°F)	°F	(°F - 32) x 5/9 (°F – 32) / 1.8	(°F - 32) x 5/9 + 273.15
Celsius (°C)	(°C x 9/5) + 32 °C x 1.8 + 32	°C	°C + 273.15
Kelvin (°K)	(°K - 273.15) x 9/5 + 32	°K - 273.15	°K

°F	°C	°F	°C	°F	°C	°F	°C	°F	°C
0	-17.8	21	- 6.1	42	5.5	63	17.2	84	28.9
1	-17.2	22	- 5.5	43	6.1	64	17.8	85	29.4
2	-16.7	23	- 5.0	44	6.7	65	18.3	86	30.0
3	-16.1	24	- 4.4	45	7.2	66	18.9	87	30.5
4	-15.5	25	- 3.9	46	7.8	67	19.4	88	31.1
5	-15.0	26	- 3.3	47	8.3	68	20.0	89	31.7
6	-14.4	27	- 2.8	48	8.9	69	20.5	90	32.2
7	-13.9	28	- 2.2	49	9.4	70	21.1	91	32.8
8	-13.3	29	- 1.7	50	10.0	71	21.7	92	33.3
9	-12.8	30	- 1.1	51	10.5	72	22.2	93	33.9
10	-12.2	31	- 0.5	52	11.1	73	22.8	94	34.4
11	-11.6	**32**	**0.0**	53	11.7	74	23.3	95	35.0
12	-11.1	33	0.5	54	12.2	75	23.9	96	35.5
13	-10.5	34	1.1	55	12.8	76	24.4	97	36.1
14	-10.0	35	1.7	56	13.3	77	25.0	98	36.7
15	-19.4	36	2.2	57	13.9	78	25.5	99	37.2
16	- 8.9	37	2.8	58	14.4	79	26.1	100	37.8
17	- 8.3	38	3.3	59	15.0	80	26.7	101	38.3
18	- 7.8	39	3.9	60	15.5	81	27.2	102	38.9
19	- 7.2	40	4.4	61	16.1	82	27.8	103	39.4
20	- 6.7	41	5.0	62	16.7	83	28.3	104	40.0

°F	°C	°F	°C	°F	°C	°F	°C	°F	°C
- 4.0	-20	**32.0**	**0**	68.0	20	104.0	40	140.0	60
- 2.2	-19	33.8	1	69.8	21	105.8	41	141.8	61
- 0.4	-18	35.6	2	71.6	22	107.6	42	143.6	62
1.4	-17	37.4	3	73.4	23	109.4	43	145.4	63
3.2	-16	39.2	4	75.2	24	111.2	44	147.2	64
5.0	-15	41.0	5	77.0	25	113.0	45	149.0	65
6.8	-14	42.8	6	78.8	26	114.8	46	150.8	66
8.6	-13	44.6	7	80.6	27	116.6	47	152.6	67
10.4	-12	46.4	8	82.4	28	118.4	48	154.4	68
12.2	-11	48.2	9	84.2	29	120.2	49	156.2	69
14.0	-10	50.0	10	86.0	30	122.0	50	158.0	70
15.8	- 9	51.8	11	87.8	31	123.8	51	159.8	71
17.6	- 8	53.6	12	89.6	32	125.6	52	161.6	72
19.4	- 7	55.4	13	91.4	33	127.4	53	163.4	73
21.2	-6	57.2	14	93.2	34	129.2	54	165.2	74
23.0	-5	59.0	15	95.0	35	131.0	55	167.0	75
24.8	-4	60.8	16	96.8	36	132.8	56	168.8	76
26.6	-3	62.6	17	**98.6**	**37**	134.6	57	170.6	77
28.4	-2	64.4	18	100.4	38	136.4	58	172.4	78
30.2	-1	66.2	19	102.2	39	138.2	59	174.2	79

Sources & Additional Resources for Units of Measure

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