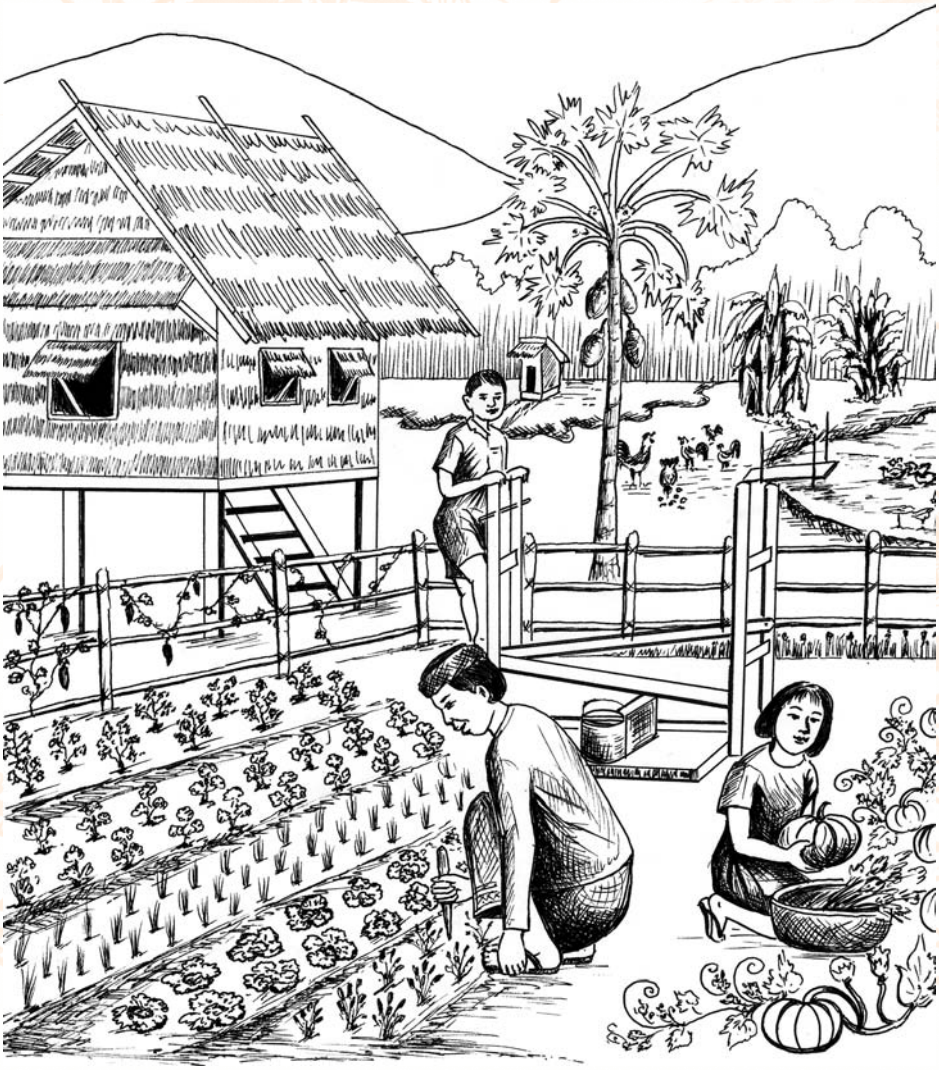
Handbook of

HOME GARDENING IN CAMBODIA

THE COMPLETE MANUAL FOR VEGETABLE AND FRUIT PRODUCTION



Helen Keller International
Cambodia

HANDBOOK FOR

HOME GARDENING IN CAMBODIA

THE COMPLETE MANUAL FOR VEGETABLE AND FRUIT PRODUCTION

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When referencing this publication, please follow the suggested reference below:

> Helen Keller International/Cambodia (2003). *Handbook for Home Gardening in Cambodia: The Complete Manual for Vegetable and Fruit Production*. Phnom Penh: Helen Keller Worldwide.

This publication was made possible through support by the Office of Health, Population and Nutrition, United States Agency for International Development (USAID)/Cambodia, under the terms of Award No. 442-G-00-95-00515-00 and by the Health and Nutrition Initiatives Fund in Cambodia under the Canadian International Development Agency (CIDA). The opinions expressed herein are those of the authors and do not necessarily reflect the views of USAID and CIDA.

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FOREWORD

Homestead food production is a long-term, food-based strategy for combating micronutrient deficiencies, particularly vitamin A deficiency. A large proportion of people affected by micronutrient deficiencies can be found among the poor and marginalized populations of the developing world. The high cost of most micronutrient-rich foods available in consumer markets can limit their consumption in such populations. More than a third of Cambodians are living below the poverty level and many households face chronic food insecurity. While homestead food production alone will not eliminate micronutrient deficiencies, the data generated over the years show that it can help reduce the risk of such deficiencies in a household by increasing the consumption of home-grown micronutrient-rich vegetables and fruits, increasing household income from the sale of garden produce that is used to purchase micronutrient-rich animal products, increasing the availability of animal foods (poultry, eggs, etc.), and increasing the household's ability to improve the health and nutrition of its members through the empowerment of women (1).

The Cambodia National Micronutrient Survey (2000) found that vitamin A deficiency is still a problem of public health significance in many parts of the country. Vitamin A intake was found to be very low, with less than 10% of women and children meeting their recommended daily intake. At the same time, it was found that vitamin A intake was higher among women and children of households that grew fruits and vegetables and/or kept poultry. The concept of homestead food production, as promoted by Helen Keller International (HKI), offers the poor and marginalized a low-cost way of producing their own foods rich in essential micronutrients such as vitamin A. Because homestead food production is a traditional practice in Cambodia, the concept is not new. The program builds upon local practices and is intended to assist farmers to improve/expand their gardening techniques. The HKI/Cambodia homestead food program was designed based on the more than 10 years of experience in operating such programs in Bangladesh. This handbook is based on the work of the Bangladesh program (2) but adapted to the Cambodian context. While animal food production is also an important part of homestead food production, this handbook only addresses vegetable and fruit production and was developed out of the expressed need of various agencies working with homestead food production in Cambodia. The handbook covers basic home gardening techniques and it provides staff of local and international non-governmental organizations, governmental organizations and United Nations' agencies with a reference document. It can be used as a basis for training extension agents in local and international NGOs, and farmers, and it can also be adapted for use by community-based farmers. We hope that the guidelines outlined in this handbook will be useful to those organizations and individuals implementing food-based programs.

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ACKNOWLEDGEMENTS

This handbook for home gardening in Cambodia has long been in the making and we would like to acknowledge the many individuals and organizations that contributed to realizing it.

The feedback and cooperation of the many household gardeners who are participating, or have participated in the past, in the joint Helen Keller International (HKI)-partners homestead food production program was essential for the development of this handbook. We extend our heartfelt and sincere thanks for their patience, enthusiasm and motivation.

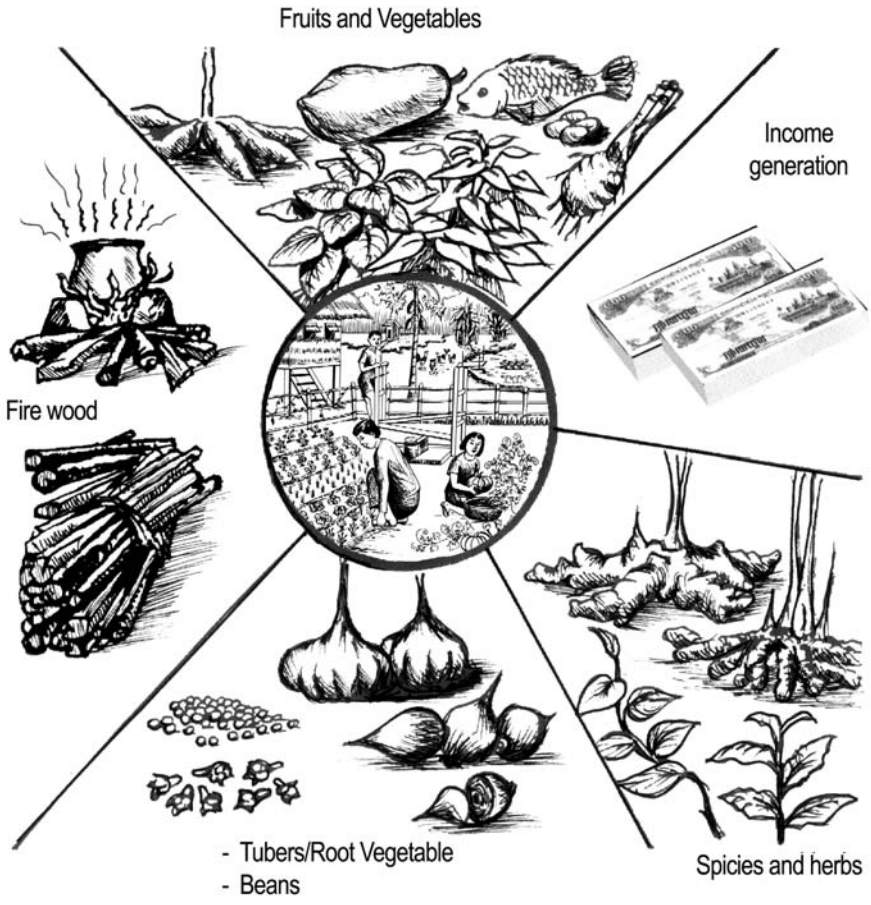
We would also like to thank the staff of HKI partner organizations – those from the Adventist Development and Relief Agency, Chamran Cheat Khmer, Partners for Development and Southeast Asian Outreach. The agriculture staff from these agencies provided significant input into the development of this handbook, particularly for the section on production practices. They were most helpful in reviewing the document and providing relevant feedback. Special thanks go to Dr. Yang Saing Koma, Director of the Centre d'Etude et de Développement Agricole Cambodgien (CEDAC) for his review of this handbook.

We would also like to acknowledge the important role of the Helen Keller International Asia-Pacific Regional Office, which was instrumental in the preparation of this document. Among the HKI/Asia-Pacific team who contributed their time and expertise to provide guidance and other assistance to this review were Dr. Saskia de Pee (Regional Scientific Advisor), Dr. Regina Moench-Pfanner (Regional Coordinator) and Dr. Martin W. Bloem (Senior Vice President, Chief Medical Officer, and Regional Director). We would like to acknowledge Mr. Hou Kroeun (Program Manager) of the HKI/Cambodia office for his contribution to this publication. We are also grateful to the HKI/Asia-Pacific Publications Unit for their assistance with the production of this document.

In particular, we would like to acknowledge the United States Agency for International Development (USAID) for overall program support to HKI under Grant No. 442-G-00-95-00515-00 and to the Health and Nutrition Initiatives Fund in Cambodia under the Canadian International Development Agency (CIDA) for funding the printing of this handbook. The production of this manual would not have been possible without this support.

1

BACKGROUND



BACKGROUND

WHY DO WE NEED A FOOD-BASED STRATEGY?

A large proportion of the world's population, particularly people who live in developing countries, do not have access to balanced diets. Many populations or subgroups of populations subsist on staple-based diets with very few animal foods that are often lacking in diversity, as well as in quantity in some places, which may result in micronutrient deficiencies, or malnutrition. Over eight hundred million people around the globe suffer from malnutrition. Asia and Africa have the highest prevalence of malnutrition. Malnutrition contributes to loss of productivity, diminished physical and mental abilities, disability and even death. Almost one third of children in developing countries are affected to some degree by vitamin A deficiency. Iron deficiency, which leads to anemia, is well-recognized as the most common dietary deficiency in the world. It is estimated that more than half of all pregnant women in the world and at least one third of preschoolers suffer from anemia.

Four strategies are commonly identified to improve micronutrient status, namely: capsule/tablet supplementation, fortification of commonly consumed foods, dietary diversification, and disease control. Dietary diversification is a sustainable and affordable strategy for the majority of the population, particularly the poor and most vulnerable groups. For instance, among poorer households in some countries in Asia, vegetables and fruits are often the only reliable source of vitamin A in the family diet. Home gardening has proven to be an effective approach to improved household food security. The production of vegetables and fruits in the home garden contributes significantly to increased consumption of these types of foods in many countries in Asia.

WHY DO WE NEED HOME GARDENS?

The annual per capita income in Cambodia is less than US$310, making it one of the least developed countries in Asia. Cambodia is predominantly an agrarian society. The agricultural sector provides more than 40% of the gross national product (GNP). Agriculture is the backbone of the economy; 80% of the total population are involved in agriculture.

Despite this, Cambodia does not produce enough vegetables to meet the needs of the population. It is estimated that, at present, local production meets only around 25% of total requirements. Therefore, vegetable production falls far short of meeting optimum nutritional needs. Based on the total vegetable production in Cambodia, the present daily per capita consumption is about 41g, which is much lower than the 200g per capita per day recommended by the United Nation's Food and Agriculture Organization (FAO).

There is a considerable amount of fallow land around homes and in the rice fields, which can be used for vegetable production. The production of fruits and vegetables provides the household with direct access to important nutrients that may not be readily available or within household economic reach. In addition, home gardening increases the diversity of foods available to households, which in turn leads to better overall utilization of nutrients, including calories. Vegetables and fruits often make other foods more palatable and can lead to an overall increased food intake. With the aim of improving the overall quality of the diet, home gardens address multiple micronutrient problems simultaneously. Equally important, home gardens have been shown to be a source of

additional income for households through the sale of a part of the garden produce. Studies suggest that this additional income is generally utilized to purchase additional food items, further increasing dietary diversification. Home gardening is especially important in overcoming seasonal unavailability of foods while promoting household self-sufficiency.

Monitoring conducted by Helen Keller International (HKI) in Bangladesh demonstrated an increase in the average weekly vegetable consumption per capita among target households. The Bangladesh National Vitamin A Survey of 1997 found that there was a lesser prevalence of night blindness and other problems associated with vitamin A deficiency among families with home gardens, compared to those without gardens (3).

In the long term, home gardening can play a vital role in the prevention of nutritional blindness in Cambodia.

WHAT IS THE EXTENT OF VITAMIN A DEFICIENCY IN CAMBODIA?

Results from the first National Micronutrient Survey of Cambodia, conducted by HKI in partnership with the Royal Government of Cambodia (RCG), show that night blindness – the first clinical sign of vitamin A deficiency – is a problem of public health significance among many rural Cambodian children (4). Night blindness was also found to be a problem among pregnant and lactating women. Vitamin A deficiency is a serious public health problem. It is associated with increased morbidity and mortality among preschool children and mothers. There are many factors associated with vitamin A deficiency. One of them is poor consumption of vitamin A-rich foods. In Cambodia, vitamin A intake among mothers and children is well below the recommended dietary allowance.

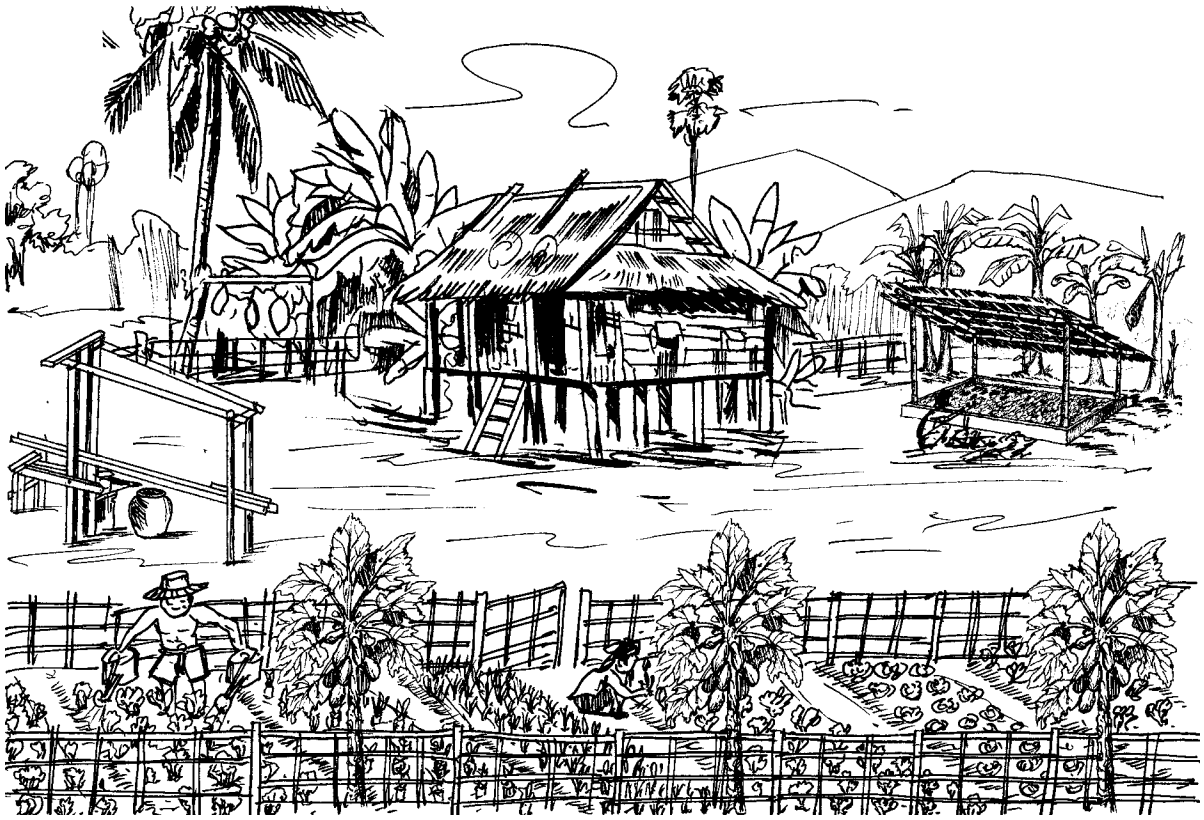
WHAT IS THE PRESENT STATUS OF VEGETABLE PRODUCTION IN CAMBODIA?

The agricultural production system in Cambodia is cereal based (mainly rice). Very limited work has been done on vegetable production and research in Cambodia. Next to rice, vegetables are the second largest crops produced in Cambodia. The total annual production is 195,894 tonnes and the total land area used for vegetable production is 33,755 ha (5). Most of the vegetables available are produced in five provinces: Kandal, Kampot, Takeo, Siem Reap and Kompong Chhang.

A number of governmental organizations (such as the Department of Agriculture and Kbal Koh Research Station) and non-governmental organizations (NGOs) are already working to promote vegetable production and home gardening in some parts of the country. However, the coverage of these promotional activities in high-risk areas is low and patchy. Around 40 organizations are presently involved in some way in vegetable production or home gardening activities with very limited targets. Ten of these organizations are working on different aspects of home gardening management. Some of them provide training in home gardening and nutrition/health education, and promote organic practices.

2

TARGET GROUPS



TARGET GROUPS

WHO ARE THE TARGET GROUPS OF HOME GARDENING PROGRAMS?

Recent studies and reports based on the 1993-94 and 1996 national and economic surveys indicate that nearly four out of ten Cambodians live in absolute poverty, lacking an adequate income to afford 2,100 calories of energy per capita per day. Food insecurity mostly exists among small and marginal/landless farmers in Cambodia as only a few of them can produce enough food for the whole year. This situation can be improved by promoting home gardening. In general, the situation in Cambodia seems to be worse for lower income groups.

To meet the vegetable and fruit requirements of poorer populations, it is necessary to organize them at the commune and village level for vegetable and fruit production in the homestead and near the rice fields. These groups must be taught, through demonstration and training, how to locally meet family requirements for nutritious food through home gardening. Those who are particularly vulnerable to vitamin A and iron deficiency – such as pregnant and lactating women, infants and children – should be the primary targets of the home gardening program.

WHO WILL WORK IN THE HOME GARDEN?

In Cambodia, more than 65% of the farming population are women (6). One author described the cultivation of small gardens as activities that were primarily the responsibility of women. However, another author described gardening as an activity for both sexes. Men, women and children are involved in vegetable cultivation on the riverbanks.

Gardening is work for all family members. Limited management is required to maintain a good household garden, making it possible to combine maintenance of the garden with other household tasks. A study conducted in Bangladesh on time allocation indicates that most gardening activities are done in the late afternoon, which does not seem to conflict with other important daytime activities of the mother (7). Evidence from a separate study on female time allocation among target households shows that an average of one hour per day is spent on gardening.

WHAT IS THE ROLE OF WOMEN IN HOME GARDENING?

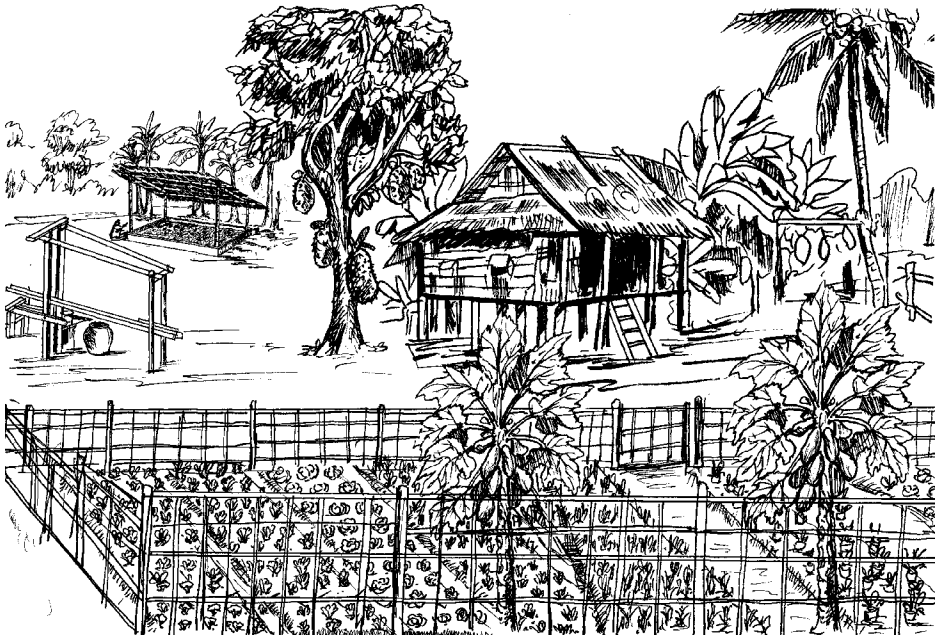
Home gardening in rural Cambodia has traditionally been undertaken by women. Women play an important role in the provision of food security at both the household and national levels. Women are generally the nutrition gatekeepers, the principal decision makers in procuring and preparing food for their children. Therefore, if women are targeted in home gardening programs, there is a greater likelihood that the vegetables produced will be utilized for household consumption.

Home garden management involves many different activities, which include land preparation, material procurement, sowing, fertilizing, weeding, thinning, irrigation, harvesting and seed processing. Apart from land preparation and material procurement, all these tasks can easily be done by women. Women can maintain gardens and this should not hamper their other daily household activities.

The involvement of women in home gardening provides an opportunity for them to earn additional income. Involving them in the production of vegetables and fruits in the homestead and in the rice field is a good way for them to make use of their time and skills. Women can supplement the family income by selling surplus produce in the local market. Experience from other home gardening projects has shown that gardeners mostly use their income from selling garden produce to buy items such as food, seeds, fencing, and chickens. Income from home gardens can thus improve the welfare and nutritional status of the family as well as contribute to the empowerment of women.

3

INTRODUCTION TO HOME GARDENING



INTRODUCTION TO HOME GARDENING

WHAT IS A HOME GARDEN?

A home garden is an area around the home where vegetables, annual and perennial plants, spices, herbs, shrubs and fruits are grown seasonally or throughout the year to meet family requirements.

Home gardening is one of the most ancient food production practices and is commonly practiced throughout the world. Different names for this include home garden, nutrition garden, show garden, kitchen garden, family garden, door yard garden and back yard garden. The basic function of all these gardens is the same. Marsh and others have grouped home gardening activities into two categories, traditional and promoted (8). In Asia, the home gardening system is common in many countries.

The important characteristics of a home garden include the following:

- It is near the house.
- It is close to a water source and other resources.
- It is on scattered or fixed plots, large or small.
- It can be utilized for year-round production.
- It can provide a combination of various crops with economic importance.
- It can sustain diversified vegetable crop production.
- It uses low-cost inputs.
- Production is primarily for household consumption.
- It uses mainly indigenous crop varieties, reducing dependence on hybrid seeds.
- It is managed by family members.

If home gardening is to succeed, it is important to consider the socioeconomic and cultural norms of the targeted communities, in addition to the technical aspects. To ensure sustainability, it is important to incorporate local practices and methods.

WHAT ARE THE DIFFERENT TYPES OF HOME GARDENS IN CAMBODIA?

Growing vegetables around the house is not a new concept for Cambodian people. Most households in rural areas grow some vegetables near the home. Some families grow a few gourd-type (*cucurbitaceae*) vegetables in a particular season, without proper management, while some grow multiple varieties with proper management. Some families also grow vegetables for commercial purposes, but this is often seasonal. It is important to know the different types of gardens.

There are four types of gardens in Cambodia: commercial, traditional, mixed and year-round garden. Based on the existing gardening practices in Cambodia, the following represent some of the characteristics of these four types of gardens.

Traditional Garden
- Seasonal cultivation
- Scattered plots
- Cultivation of limited number (2-3) of traditional varieties (such as pumpkin, cucumber, wax gourd)

Mixed or Medium Garden
- Vegetables usually grown for commercial purposes
- Produce for both consumption and sale
- Not year-round production (only six months of the year)
- Soil is not developed
- Cultivation of 4-5 varieties
- Not properly fenced
- Use of high cost inputs such as chemical fertilizers and pesticides
- Mostly on fixed land

Year-Round or Developed Garden
- Primarily for consumption and secondarily for income
- Production throughout the year
- Cultivation of more varieties (10-12 varieties for most of the year)
- Cultivation of vegetables, fruits, herbs, spices, multi-purpose trees (MPT) and ornamental plants
- Cultivation of micronutrient-rich vegetables
- Access to water for gardening
- Production of some varieties of seed
- Continuous activities for soil improvement (crop rotation, mulching)
- Mainly uses non-chemical methods of pest and disease control
- Properly fenced

Commercial Garden
- Seasonal production
- Crop varieties selected based on commercial aspects
- Mostly one or two varieties of crop
- Use of chemical inputs
- Primarily for economic purposes

Most homes in rural Cambodia are typically constructed above the surface of the ground/ soil and have some space around the house. The 2000 Cambodian National Micronutrient Survey found that the median size of homestead gardens is 30 m^2. The spaces located around the houses can be either fixed and scattered. Different areas around the home can have different characteristics, such as shady areas, wet low land, areas close to a pond or a well, and high ground with good sunlight. These different environments can be used to grow different types of vegetables.

Some vegetables – such as lemon grass, taro, mint, galangal, great galangal and kangkong – can be grown near wells. Vegetables that are shade-tolerant – such as sweet potato, kangkong, amaranth, ginger, all types of yam, and arrow root – can be grown in shady areas or under the shade of other plants. Certain fruit vegetables, such as tomato and eggplant, require full sunlight and should thus be grown in areas that are well-exposed

to sunlight. Vegetables such as lemon grass, *sesbania grandiflora*, and *acasia pennata* can be grown near ponds. Vegetables such as kangkong, taro, swamp leaf, and local sweet pepper can be grown in low-lying areas or ditches.

WHO CAN HAVE A HOME GARDEN?

Many people think that large fixed land is required for home gardening. However, this is not always necessary. Any household interested in home gardening for household consumption can easily set up a good garden, even on a very small amount of land or in scattered plots around the house.

In Cambodia, almost all households have some space in the homestead, such as a backyard and land near the road, under the house, near the cow shed and in front of the house. If all the space around the home is properly utilized and well managed, it is possible to have a prospering garden for most of the year, with a variety of vegetables and fruits. A wide range of vegetable varieties, including spices, herbs and indigenous plants and fruits, are grown in Cambodia. In this way, any household that has interest and minimum land around the house can establish a good garden.

WHAT INPUTS ARE REQUIRED FOR HOME GARDENING?

There are some essential inputs (such as seeds, seedlings, fencing materials, fertilizers and pesticide) required for vegetable production in the homestead. It is difficult for landless, marginal and small farmers to afford high-cost inputs. However, a good garden can be maintained without using high-cost inputs. There are some low-cost inputs and technology – such as compost, live fencing with locally-available materials, and non/chemical (cultural/mechanical/biological) methods of pest and disease control. Many local varieties of vegetable seeds are produced locally and can be purchased at low cost.

It is possible to produce a large number of nutritious, local varieties of vegetables – such as amaranth, kangkong, wax gourd, pumpkin, bean, *sauropus androgynus*, sweet potato, lemon grass, coleus, and mint leaves – without significant amounts of money, time and land.

WHY ARE LOW-COST AND SUSTAINABLE METHODS IMPORTANT IN HOME GARDENING?

Although approximately 80% of rural households grow some vegetables in the homestead, the practice of cultivating a home garden is not new in rural Cambodia. A baseline survey conducted by HKI in May-June 1999 found that 65% of households grow fruits and vegetables in the homestead (9). However, most of them are seasonal or occasional, and the varieties produced are limited to mainly gourd vegetables.

The main reasons for why home gardening is not more widely practiced are related to inputs such as seeds, fertilizer and water, import dependency, and lack of awareness and technical know-how among the rural population. Some of these problems can be solved with locally-adaptable, suitable, low-cost and sustainable technologies.

This handbook provides information on sustainable, low-cost methods of gardening practices such as composting, mulching, crop management, improving soil quality by using locally-available resources, small-scale seed production, and using non-chemicals methods of pest and disease control. If rural households can adapt low-cost and sustainable methods to meet their own needs, they will be more interested in doing year-round gardening.

WHAT ARE THE MAIN FACTORS IN CROP SELECTION FOR THE HOME GARDEN?

A wide range of vegetables, including herbs and spices, are grown in Cambodia. The following points need to be considered when planning for the promotion of home gardens:

Household Choice

The choice of vegetables and fruits for consumption differs from area to area, commune to commune and even household to household. Individual tastes, local culture, availability and other factors influence choice.

Availability of Resources

The choice of vegetables and fruits for production depends mainly on local practices, climate and type of land/soil. Certain vegetables grow easily in some areas but not in others. The selection of vegetable crops should be made on the basis of economic value, garden size, family choice, type of land/soil and technical ability in gardening.

It is important for those who promote home gardening to remember the following points when selecting crops for vegetable gardens:

- Select crops that require minimal investment, are low-risk and enable maximum returns, such as amaranth, ivy gourd, sweet potato, kangkong and bitter gourd.
- Give sufficient importance to indigenous varieties (such as *sesbania grandiflora*, *sauropus androgynus,*and drumstick) as they are technically feasible and culturally accepted.
- Choose many different varieties for cultivation to reduce the risk of crop loss in different seasons and to increase the frequency of consumption.
- Select vegetables and fruits that provide different micronutrients such as amaranth and pumpkin.

WHAT KINDS OF CROPS CAN BE GROWN IN A HOME GARDEN?

Vegetables and fruits for the home garden should be easy to grow and manage, and have many usable parts. They should have a relatively long harvesting period, require little water and chemical fertilizers, and be pest- and disease-resistant. The choice of crops should also be based on the local availability of seeds. An awareness of what types of crops can be grown in different seasons and in what types of plots is important for maintaining crop rotation.

WHAT ARE THE DIFFERENT TYPES OF VEGETABLES?

Sixty-nine types of vegetables and spices are currently cultivated or used to be cultivated in Cambodia (10). It is important for home gardeners and promoters to be familiar with the different categories of vegetables. There are various methods of classification – such as botanical, which is based on scientific characteristics. The classification adopted in this handbook is based on the use of the vegetables, which is familiar and easily understandable to all, including gardeners, promoters, commune leaders, extensionists and agriculturists. This also facilitates the discussion of production practices related to the different categories of vegetables. These categories are listed below.

- Leafy type
  kangkong, amaranth, ivy gourd, iceberg lettuce, Indian spinach, lettuce, arum leaf, jute leaf, Ceylon spinach
- Cabbage type
  mustard green, swanton mustard, white petiole, Chinese cabbage, petsal (green petiole), common cabbage, cauliflower, Chinese kale, broccoli
- Fruit/Tomato type
  green pepper, tomato, eggplant, pimento pepper, chili pepper, tabasco pepper, green papaya, bitter eggplant, okra
- Cucumber/Gourd/Trellis type
  wax gourd, pumpkin, cucumber, angled loofah, bitter gourd, sponge gourd, bottle gourd, snake gourd, watermelon
- Legumes/Bean type
  yard long bean, winged bean, hyacinth bean, mung bean, cowpea, snap bean, peanut, soybean
- Onion type
  chinese chives/onion stock, bunching onion, shallot, onion, garlic leek
- Root type
  arrow root, taro root, cassava, sweet potato, radish, turnip, beet, Chinese radish, winged yam (white), winged yam (purple), potato yam, tiger paw yam
- Edible Leaves/Flowers of trees
  sesbania javanica, *sesbania grandiflora*, epil epil, neem, drumsticks, *sauropus androgynus*
- Spices and Herbs
  coleus, basil, coriander, ginger, turmeric, swarm leaf, lemon grass, japanese pepper mint, mint leave, lemon grass
- Yam type
  winged yam, potato yam, tiger paw yam

For details see also
Appendix I: Crop Calendar for Different Vegetables and Fruits
Appendix II: Production Practices of Relating Different Vegetables
Appendix III: Practices of Relating Different Fruits and Trees

WHAT ARE COMMON PROBLEMS HOUSEHOLDS MAY FACE WHILE MANAGING A HOME GARDEN?

Small and marginal households in rural areas may face problems in establishing and maintaining home gardens other than those of a technical nature. These may include social and natural problems. Social problems include damage to home gardens by poultry and other farm animals, such as pigs. Also, at harvest time, fruits and vegetables may be stolen from the garden. Natural problems include floods and droughts, both of which are very common throughout Cambodia. Besides such problems, there are other common technical constraints, such as unavailability of inputs.

Floods

Cambodia is a flood-prone country. Floods in some parts of the country are due to low topograpy. Besides this, every year, heavy rains can seriously damage homestead vegetable cultivation. Floods can not be controlled, but one can take steps to minimize the damage caused. Farmers can prepare one or two shelter beds by using locally available resources such as timber and bamboo. At least one or two fast-growing vegetables and seedlings can be grown in this hanging bed. These seedlings can be transplanted immediately after the water recedes. Some other simple suggestions are to grow flood-resistant crops (such as kangkong), to establish better drainage systems, and to use a system of raised beds/small plots in the garden.

Irrigation/Drought

Year-round irrigation for vegetable cultivation is a common problem for many households in rural Cambodia. Lack of water for home gardens in the dry season makes it very difficult for households to maintain a garden. There are a limited number of tube wells in rural areas and those are usually a considerable distance from the homestead. Ring wells are a source of water for many households in rural areas; some households also have small ponds in the homestead. However, during the months of February to April, which is the hottest and driest time of the year, water can be scarce. The underground water level goes down and most of the ring wells and ponds dry up. A number of measures can be taken to overcome this problem.

Households situated close to a river or lake can bring water from these water sources during this period. Sometimes, household waste water can be used for gardening. As far as irrigation is concerned, efforts should be made to grow vegetables that require less irrigation and are drought-resistant, such as kangkong, sweet potato, and *sauropus androgynus*. The most important stages of water requirement for crop growth should also be identified. There are many locally-available mulching materials, such as rice straw, dry tree leaves and water hyacinth. These can be used to cover the beds or plots during the dry season. In addition, measures directed at maintaining soil moisture can be taken, including the use of more organic matter in the soil.

Scattered Plots and Less Space

There are some households in rural areas that do not have a fixed plot in their homestead for gardening. Vegetable production for family consumption does not require either a

large or a fixed area of land. Even a small amount of land in scattered plots (i.e. in different parts of the homestead) around the house can be utilized for home gardening. If scattered plots are properly used for growing different type of vegetables, it is possible to have a productive garden throughout the year. In Bangladesh, HKI found that it is possible to grow at least six varieties of vegetables in scattered plots throughout the year.

Poultry and Farm Animal Damage

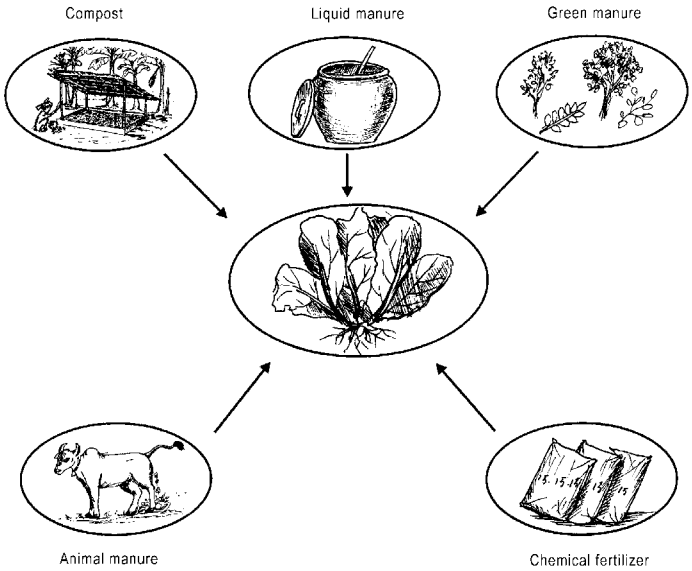
It is common for rural households to own chickens and pigs, mainly to earn additional income. Many home gardens have no fencing, which creates problems for the cultivation of vegetables. Pigs and chickens very often destroy the garden and beds at different stages after the seeds have been sown. To avoid these problems, the garden should be fenced.

There are various materials available for fencing such as bamboo, net and wire. However, most households cannot afford these conventional fencing materials. Live fencing is the simplest and most-affordable locally available option that can be used for a home garden. Certain locally available plants – such as epil epil, *sesbania grandiflora*, red gram, and hedge plant – can make good fences. It is always better to use a mix of different varieties for more protection.

Another way to solve the problem is to limit the space for chickens and pigs to roam around by making a shed for pigs and a house for poultry. It is also important to motivate neighbors, through group discussion, to control their pigs and chickens, especially after seeds have been sown.

4

FERTILIZER MANAGEMENT



FERTILIZER MANAGEMENT

WHAT IS THE STATUS OF SOIL IN CAMBODIA?

Soil in Cambodia, especially in the rain-fed lowlands, is considered poor. In the rain-fed lowland rice ecosystem, 56% of the soil is classified as low-potential soil, and 21% is classified as medium-potential soil (11). Low-potential soil is sandy, has low organic matter content and low cation exchange capacities or iron toxicity problems. The organic matter content in the soil in Cambodia is less than 1% on average throughout the country (12).

WHAT IS THE IMPORTANCE OF FERTILIZER IN THE HOME GARDEN?

Plants need certain nutrients from the soil in order to grow. Sixteen elements are known to be essential for the growth and development of plants. Three of these elements come from the air and water and the rest come from the soil.

Different vegetables have different requirements in relation to these elements: Generally, leafy vegetables need more nitrogen (N), flower and fruit vegetables need more phosphorus (P), and root vegetables need more potassium (K). The most widely available and used chemical fertilizers in Cambodia are 15-15-15, 16-20-0, and 18-46-0 applied with cow dung as basal. Urea is used for top or side dressing.

WHAT ARE THE DEFICIENCY SYMPTOMS OF THE MAIN NUTRIENTS?

For homestead and commercial vegetable production, it is important to know the deficiency symptoms of the major nutrients, as identified in the above paragraph, namely nitrogen, phosphorus and potassium (N, P, K). The symptoms of a deficiency of these nutrients in crops are listed below.

Deficiency Symptoms of Nitrogen
- Leaves become pale green and then turn yellow
- There is poor growth and development of leaves, stalks and branches, resulting in stunting
- Roots, shoots and fruits are smaller

Deficiency Symptoms of Phosphorus
- Growth of shoots and roots is stunted
- There is poor formation of lateral shoots and buds
- Flowering is reduced and bud and leaf opening is delayed
- Resistance to disease decreases
- A bluish-green color is visible on the leaf surface

Deficiency Symptoms of Potassium
- Leaves curl and upper surface of leaf becomes wrinkled
- Slight scorching occurs starting with the older leaves
- Growth is reduced and stunted, with short internodes and bending of main stem toward the ground
- The fruit often ripens unevenly

WHAT ARE THE DIFFERENT TYPES OF FERTILIZERs?

Fertilizers provide a combination of food elements to help with plant growth and development. There are two basic types of fertilizer – organic and inorganic.

I. Organic Fertilizers

1. *Compost and Liquid Compost*
2. *Farmyard Manure and Dung Fertilizer*
3. *Green Manure*

II. Inorganic Fertilizers

Inorganic or chemical fertilizers are always manufactured by industry. Chemical fertilizers supply nutrients but do not improve the soil structure. Chemical fertilizers are always expensive.

1. Simple Fertilizer

A simple fertilizer, such as urea, supplies only one nutrient, which is nitrogen. This is widely available and used as top and side dressing in Cambodia.

2. Mixed Fertilizer

Mixed fertilizer contains more than one but not all of the nutrients that plants need, such as 16-20-0. This is widely available and used in Cambodia.

3. Complete Fertilizer

Complete fertilizer, such as 16-20-16, supplies all the basic nutrients needed by plants. This is widely available and used in Cambodia.

WHAT ARE ORGANIC FERTILIZERS?

Organic fertilizers contain all the nutrients needed by plants. The materials required for making organic fertilizers come from plant and animal sources. Organic fertilizers are used to maintain soil fertility and increase production. The most common sources of organic fertilizers are animal manure and urine, crop by-products and the remains of dead plants.

It is inexpensive and can be prepared or procured at any time. The materials required for organic fertilizers are always available locally. They are not harmful or toxic to soil, even if used in large quantities.

WHAT ARE THE BENEFITS OF USINGS ORGANIC FERTILIZERS?

The benefits of organic fertilizers are as follows:

- they increase soil fertility
- they supply nitrogen, phosphorus, potassium and other nutrients
- they increase the water-holding capacity of the soil, which is very important in low-potential soils and where rainfall is minimum

- they increase the population and activities of soil microorganisms, which help to improve nitrogen fertility status
- they improve the Cation Exchange Capacity (CEC) of the soil, which becomes a storehouse of plant nutrients
- they prevent compactness, reduce soil erosion and supply more oxygen to the root
- they improve the physical condition of the soil, making it easier to cultivate
- they help in the effective use of chemical fertilizers; they can also help to reduce the amount of chemical fertilizer required
- they reduce the toxicity of the soil caused by the use of chemical fertilizers and insecticides

WHAT IS COMPOST?

Compost is a low-cost or cost-free organic fertilizer produced from materials such as house waste/kitchen scraps, straw, dead plant materials, animal manure and urine, water hyacinth, crop residue, plant stalks, fruit skin, poultry litter and fish waste. Two weeks to three months is required to make compost depending on the materials used. The materials become compost when they have completely rotted. There are different methods of preparing compost, such as the 'pit' and 'heap' methods.

HOW IS COMPOST PREPARED?

I. Conventional method

The steps in preparing compost using the conventional method are:

1. Choose a site in the homestead that is protected from rain; if this is not possible, the whole compost heap should be covered by a roof, which can be made with thatch or straw.
2. Collect all crop residues, animal manure, ash and other scraps and gather them near the compost heap.
3. The length of the heap may vary depending on use; the width should be 4 feet; the height should be 4-5 feet, and there should be more than one chamber.
4. For the first layer, fill the heap with crop and other plant residue, and straw.
5. The next layer should be one foot of animal manure and poultry litter.
6. Repeat steps 4 and 5 in the same sequence.
7. Top up the heap with a layer consisting of a mixture of good soil and animal manure; this layer should be half a foot high.
8. After a few days, the heap will become very hot at the center, which means that the materials are decomposing.
9. Watch the heap every 2-3 days; ensure that it is neither too dry nor too wet. Add some water if it is too dry.
10. Turn over or mix the pile with a spading fork every week until the materials have completely rotted.
11. The compost will be ready in 4-6 weeks and have a rich, black color.
12. Apply the compost to the plot during land preparation.

II. The 14-day method of composting

It is possible to make compost in 14 days. The steps for this are as follows:

1. Chop up the vegetative material and plant residue.
2. Mix these thoroughly with an equal amount of fresh manure.
3. Pile the mixture into a heap approximately 1 cubic meter in size.
4. Cover the heap with banana leaves or old sacks/jute bags.
5. After 3-4 days, the heap should become hot inside. Mix in some additional manure if it is not hot after that period.
6. After another 3-4 days, turn the heap inside out so that the materials from the center are on the outside and vice versa.
7. Turn the heap every two days in the same way.
8. After 14 days, the compost should be ready for use.

WHAT IS LIQUID FERTILIZER OR MANURE?

Liquid fertilizer/manure is a fermentation of water and fresh animal manure or the leaves of leguminous plants. Immersing a bag of fresh animal manure into a drum of water and allowing it to ferment makes liquid compost. Nutrients from the soil are easily absorbed when tea manure is applied. Depending on the availability of materials, animal manure can be substituted with the leaves of nitrogen-fixing trees, such as epil epil or gliricidia. The following are the steps for preparing liquid compost.

HOW IS LIQUID COMPOST FERTILIZER PREPARED?

1. Take an empty jute bag and fill with fresh leaves or manure up to ¾ of the bag.
2. Bind the open end and then place the bag in an empty drum.
3. Place a large stone on the bag to hold the bag at the bottom.
4. Fill the drum with water and then cover.
5. After three weeks, remove the bag from the drum.
6. Mix one part liquid fertilizer with four parts water. It is then ready for use in the field.
7. Apply the liquid fertilizer around the base of the plant (avoid any contact with the plant). Use it on the plot after plant germination or after transplanting.

WHAT LOCALLY AVAILABLE MATERIALS CAN BE USED?

Green Manuring

Green manuring is produced by the decomposition of cultivated crops and plowed soil. There are many green manuring and leguminous crops available in Cambodia which supply plant nutrients (especially nitrogen) to the soil such as gliricidia, *sesbania grandiflora*, sun hemp, pulses, soy bean and beans.

It has been found that there are many locally available materials from plant and animal sources that can be used as organic fertilizers in the home garden. Some vegetables do not require chemical fertilizers to grow in the home garden if adequate organic fertilizers are used. It is possible to obtain a good yield from many vegetables using only organic fertilizers.

The following table shows the nitrogen, phosphorus and potassium content of different organic materials that are available in rural areas.

Percentage of Nitrogen, Phosphorous and Potassium (NPK) in Different Types of Manure

Manure	Nitrogen (%)	Phosphorus (%)	Potassium (%)
Cow (old dung)	2.41	0.75	0.88
Buffalo	1.09	0.82	0.7
Broiler	3.17	3.29	2.41
Layer	2.85	4.21	2.0
Goat	1.5	1.5	2.0
Pig	0.5	0.3	0.5

Percentage of NPK in Different Organic Materials

Manure	Nitrogen (%)	Phosphorus (%)	Potassium (%)
Water Hyacinth compost	3.00	2.00	2.00
Compost (general)	0.60	0.48	0.85
Town Compost	0.60	1.00	1.40
Sun Hemp	0.75	0.12	0.51
Sesbania Grandiflora	0.62	NA	NA
Gliricidia	NA	NA	NA
Cowpea	0.71	0.15	0.58
Mustard cake	5.20	1.80	1.20
Sesame	6.20	2.00	1.20
Tishi cake	5.50	1.40	1.30
Peanut cake	7.10	1.50	1.50
Coconut cake	3.00	1.90	1.50
Neem cake	5.30	1.10	1.40
Leaves (rotten)	0.75	0.50	1.26
Bone meal	3.00	28.00	–
Fish meal	7.00	6.00	1.00
Blood dust	11.00	1.50	0.60
Ash	–	2.00	5.00
Rice Straw	0.52	0.52	1.61

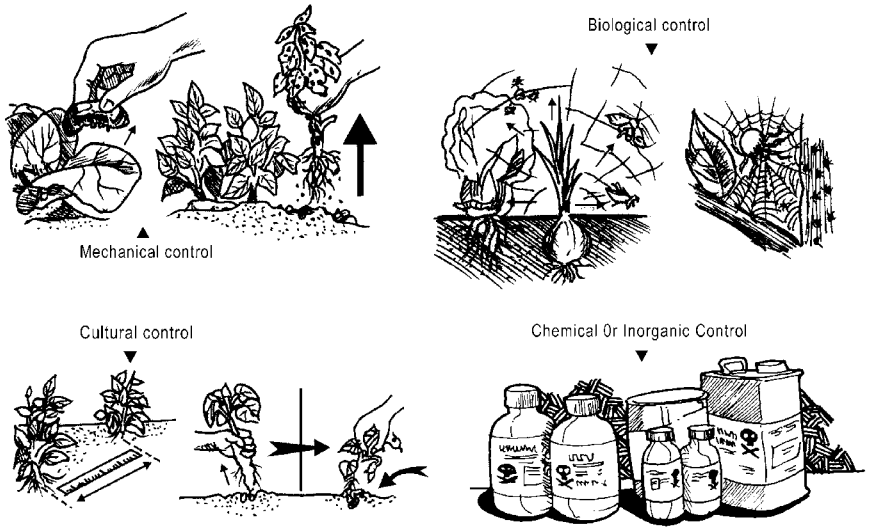
Assessment of locally available materials as sources of NPK

Material	Nitrogen (%)	Phosphorus (%)	Potassium (%)
Rice Bran	2	1	1
Peanut Shells	1	1	1
Eggshells	1	1	1
Sugar by product	1	3	1
Feathers	3	1	1
Banana Stalks	1	2	3
Banana Leaves	1	2	3
Banana Skins	1	2	3
Corn Cobs	1	1	3
Corn Silage	1	1	1
Corn Stalks	1	1	1

1= Poor Source, 2= Fair Source, 3= Good Source

5

PEST AND DISEASE CONTROL AND MANAGEMENT



PEST AND DISEASE CONTROL AND MANAGEMENT

WHAT ARE THE PROBLEMS WITH PESTS AND DISEASES OF VEGETABLES IN CAMBODIA?

Pests and diseases are major problems for vegetable cultivation in Cambodia. The Kbal Koh Vegetable Research Station has compiled a partial list of insect pests that are known to affect vegetable gardens in Cambodia. An early survey on plant diseases in Cambodia was carried out by Litzeneberger, Farr and Ho (13); 95 diseases that affect vegetables and spices were identified. Pests and diseases can damage vegetable crops, reducing yield, impairing quality and reducing its market price. However, the extent of crop damage due to various pests and diseases in Cambodia is not known. Crops can be partially damaged or completely destroyed. Adopting appropriate methods to control pests and diseases can improve vegetable production and quality, and thus increase its market value.

WHAT ARE THE MAIN METHODS OF PEST AND DISEASE CONTROL?

There are four main methods of pest and disease control:

I. Cultural Method

Cultural control involves the improvement of cultivation practices (such as the maintenance of proper cultural practices, use of pest and disease resistant varieties, appropriate seed selection, and crop rotation). The following are the different cultural methods:

1. Seed/Bulb/Seedling Selection

Diseases are usually carried by planting materials such as seeds, seedlings, and bulbs. The chance of disease attack can be reduced by proper selection of propagation materials from good sources.

2. Seed Treatment

Seeds can be treated by exposing them to sunlight for a couple of hours before sowing/planting. Some of the farmers in rural Cambodia treat their seeds with cattle urine/liquid manure before sowing.

3. Timely Planting

By maintaining proper sowing/planting schedules, the chance of pest and disease attack can be reduced. Selection of proper varieties for a particular season is also important for pest and disease control.

4. Crop Rotation and Combination

Crops of similar varieties or species usually should not grow in the same plots. Attacks by various pests and diseases can be avoided through crop rotation in the garden.

II. Mechanical Method

Mechanical control of pests and diseases can be carried out by hand, using sweeping nets and light traps, and nylon nets. These can often help decrease the population of pests such as rats and birds. Some insects can be picked off by hand and crushed. Uprooting part or all of a diseased plant and removing it from the garden can control some diseases.

III. Biological Method

The control of harmful insects through the use of beneficial insects and parasites, animals or plants is known as biological control. For example, harmful insects may be eaten by other insects, spiders, toads or birds. Biological control also includes growing insect-repelling plants in the garden. Plants that emit a strong scent from their leaves/stems/flowers/roots/tubers are used as insect repellents. Mint, basil, lemongrass, marigold, onion, ginger or galangal can be planted in the bed or borders, or in-between plants, to keep pests away.

IV. Chemical or Inorganic Method

The control of pests and diseases by applying chemical pesticide is known as the chemical method. This method is very common and effective, but expensive as well as harmful to human health and the environment. The pesticides available in the local market for controlling pests and diseases have different uses, methods of application and modes of action. There are four categories of pesticides, based on their mode of action. Some pesticides are effective in more than one mode. All pesticides kill pests by using a particular mode of action. It is important to know the different categories of pesticides available in the market.

1. Contact Pesticide

Contact pesticides kill insects on contact. The pesticide is sprayed onto the soil or directly onto plants. It is very effective against sucking and soil-based insects. Contact pesticides enter the insect's body through the dermal or cuticular route. Contact pesticides available in Cambodia are Folidol, Mevinphos, and Chlorfenvinphos.

2. Stomach Pesticide

Stomach pesticides kill pests by creating toxicity in the stomach of the insect. Insects are killed when they bite and chew the plant. The route of entry is ingestion through mouth. Stomach pesticides available in Cambodia are Abamectin, Deltamethrine, and Carbofuram.

3. Systemic Pesticide

When systemic pesticide is sprayed on any part of a plant or nearby soil the entire plant becomes poisonous. Insects die when they suck, bite or chew any part of the plant. The poison kills by moving to different parts of the insect's body. Systemic pesticides available in Cambodia are Azodrin, Furadan, and Dichlorphos.

4. Fumigant Pesticide

Fumigant pesticides turn into poisonous gas when it comes into contact with air. This gas obstructs the respiration of grain insects and rats, which subsequently die. A fumigant pesticide available in Cambodia is Zinc Phosphite.

WHAT IS INTEGRATED PEST MANAGEMENT (IPM)?

Integrated pest management is a comprehensive strategy that utilizes farmers' knowledge in managing crops to optimize crop health. This takes into consideration pest populations, agronomic factors, monitoring, action criteria, materials and methods, together with natural mortality factors (beneficial insects).

The National Integrated Pest Management (IPM) program of the Ministry of Agriculture, Forestry and Fisheries (MAFF) has commenced pilot activities in vegetable IPM in Cambodia, with the aim of enabling farmers to better manage their crops and more thoroughly understand the implications of their decisions in the use of pesticides, particularly insecticides.

WHAT ARE THE ACTIVITIES OF IPM IN CAMBODIA?

In Cambodia, Integrated Pest Management (IPM) started in 1993, in collaboration with several international organizations. Originally, IPM operated in five provinces. Since 1997, it has been extended to 14 provinces. IPM focuses mainly on rice production. A preliminary assessment found that farmers' attitudes toward pesticides have changed; IPM farmers tend to reduce the use of pesticides.

In the dry season of 1997, the IPM program targeted commercial vegetable production. Under this program, some field trials were conducted in one district on pesticide use in cabbage production. The results showed that with decreased pesticide application, there is no significant decrease in yield. Through the program, farmers gain a better understanding about use of pesticides and can also differentiate harmful from beneficial insects.

WHAT ARE THE TRENDS IN PESTICIDE USE IN CAMBODIA?

There are 241 different pesticides available in Cambodia (14). These are mainly imported from Thailand and Vietnam, while some are from other countries. About 72% of all pesticides available on the market are insecticides, 9% are herbicides, 6% are fungicides and rodenticides, and 3% are bactericides and fumigants.

Pesticides are imported by business people and by farmer-to-farmer exchanges, particularly when farmers live along the Cambodia/Vietnam border. Based on the World Health Organization's classification, 76% of all pesticides available in Cambodia are cIass I (extremely hazardous), 16% are class Ib (very hazardous), and the rest are class II (hazardous). Because of the lack of regulations, laws and controlling institutions, these pesticides are distributed throughout the country without any restrictions.

Farmers usually only choose chemical control measures against insects. Most pesticides available on the market are highly toxic. People are not aware of the dangers and hazards

of pesticides. Farmers generally disregard safety precautions when applying pesticides. Misuse of pesticides is very common and improper use of pesticides increases the cost of production.

HOW CAN ORGANIC METHODS OF PEST CONTROL BE APPLIED IN THE HOME GARDEN?

It is necessary to think carefully about the method of pest/disease control used in a home garden, since it is small and adjacent to the home.

To reduce attacks from pests and diseases in the vegetable garden, it is a good idea to grow different kinds of vegetables. Crop rotation then becomes important: after one kind of vegetable has been harvested, a different kind should be planted. As mentioned previously, insect-repellent plants can also be planted.

Wood ash can also be used to control insects. It can be applied directly onto the plant or onto the soil. A layer of wood ash on the soil will help to control cutworms, beetles, tomato fly ants and other crawling insects.

HOW ARE BOTANICAL PESTICIDES PREPARED?

There are several ways to prepare botanical pesticides by using different plant materials. To control chewing insects, home gardeners can apply locally-made botanical insecticides. These can be made from materials such as neem leaves, chili, garlic, tobacco, mint, onion and marigolds. For example, boil a mixture of tobacco, chili, mint or marigold leaves, and garlic, add water in the proportion of 1:10 and apply to the affected plant. A small amount of kerosene (1 or 2 teaspoons) and some soap water (one cup) can be added to the mixture to increase its effectiveness. Neem leaves are, on their own, also extremely effective against any kind of pest.

WHAT ARE THE CORRECT USES OF PESTICIDES FOR PEST AND DISEASE CONTROL?

Insecticides are harmful to humankind, the environment and beneficial insects. They are also expensive. Most insects that are harmful to vegetables in the home garden can be controlled without the need of insecticides. This can be done by biological and mechanical methods. When trying to control pests and diseases in the home garden one should first exhaust all possibilities using organic methods.

If it is really necessary to use an inorganic pesticide, it must be selected and applied very carefully. Pesticides should be used when pests are liable to cause considerable damage to the standing vegetable crop, and then only when all other methods have failed. It should not be used to control an insignificant number of harmful insects.

All pesticides are poisonous. They pose a serious danger to gardeners and consumers of the vegetables/fruits produced if they are not used properly. One can be affected by these in a number of ways, such as through skin contact or by breathing in either the chemical or something contaminated by it. Some pesticides cause nausea, dizziness and general weakness. Less obvious but equally serious are chronic effects which result

from months or years of exposure. These can include various kinds of skin diseases and other ailments that are often hard to cure, such as sterility, birth defects, nervous disorders and cancers of the liver, lung or stomach. Fish, snails and other food sources in ponds, rivers and canals can become poisoned if they border areas where pesticides are used.

HOW CAN PESTICIDES BE USED SAFELY?

Directions should be strictly followed whenever pesticides are used. This will improve effectiveness and reduced health risks.

When pesticides are used, the following precautions should be taken:

- Use the correct pesticide for your particular problem. Never buy banned pesticides such as DDT or Endosulphan (Thiodan).
- Keep pesticides away from food, animal feed and all water sources, and out of reach of children.
- Read labels carefully before use and follow directions.
- Never smell pesticides to identify them.
- Make sure you know how to operate the sprayer before using it.
- Gloves for hands and a mask to cover the mouth and nose should be worn when mixing and using pesticides. Do this outside the home in a well-ventilated area.
- Never use household utensils to measure and mix pesticides. Never stir nor mix pesticide solutions with your hand.
- Mix and apply the recommended amount of pesticide. More than this amount is wasteful and less will not control the pest.
- To maximize effectiveness, mix the pesticide properly. For powdered pesticides, first pour the water into the sprayer and then mix the powder with a little water in a separate container. Pour this solution into the sprayer, then add the exact amount of pesticide required and stir the mixture.
- Do not use leaky or defective sprayers – the solution may come into contact with your body.
- Wear clothes that cover the whole body, and a mask over the mouth and nose when spraying.
- Do not blow the nozzle to clear it.
- Never smoke, eat or drink while mixing or applying pesticide.
- Do not spray against the wind, it may contaminate the surrounding area.
- To reduce loss by evaporation and to avoid burning the plants, do not spray on very hot days.
- Do not spray too often; it may increase pest/disease resistance to the pesticide.
- Stop spraying pesticides on vegetables at least two weeks before harvesting. The residual effect of the pesticide on the crop is harmful to the consumer.
- Do not wash the sprayer or dispose of excess pesticide in a pond or river.
- Bottles or containers that have been used for pesticides should never be used for domestic purposes.
- After spraying, wash yourself completely with soap and water and change into clean clothes.
- Itchy skin, dizziness, stomach cramps and nausea are symptoms of mild poisoning. Stop spraying if you have any of these symptoms. Wash thoroughly and apply first aid where necessary. If symptoms persist, consult a doctor or other health provider.

WHAT ARE THE DISADVANTAGES OF CHEMICAL PESTICIDES?

- High cost
- Residual effect on vegetables, which may cause health problems
- Residual effect on soil, resulting in degradation of quality
- Pollution of the environment
- Danger in the home
- Destruction of beneficial insects

WHAT ARE THE MAIN PROBLEMS OF INSECTS AND THEIR METHOD OF CONTROL?

Insect	Vegetable(s) attacked	Method of Control
1. Leaf worm	Collard Green, Mustard Green, Chinese Cabbage, Chinese Kale, Cabbage	Mechanical control.
2. Brown fly	Mustard Green, Chinese Cabbage, Lettuce and most leafy vegetables	Mixed cropping and crop rotation are the best ways to prevent this pest from becoming a problem.
3. Fruit fly	Tomato, Cucumber, Wax Gourd, Sponge Gourd, Pepper and Bean	Pick the affected plant/fruit and put them under the soil or burn them. Control the insects with poison bait (food with poison).
4. Cutworm	Cauliflower, Eggplant, Cabbage and Tomato	Search for cutworms near the attacked plant (observing stem and shoot cuttings) and destroy them. Control cutworms with an ash and kerosene mixture around young plants.
5. Tuber worm	Sweet Potato, Cassava, Yam, Bean	Search for tuber worms near the attacked plant and destroy them.
6. Beetle	All gourd type vegetables and cucumber	Beetles can be controlled by hand and by spraying a mixture of wood ash and kerosene. In case of serious attacks, use an insecticide.
7. Aphid	Tomato, Yard long bean, Radish and Cabbage-type vegetables	Crush the aphids by hand. If this is not effective, they should be controlled with a prescribed pesticide, being careful not to destroy bees and propagating insects for seed production.
8. Stem borer	Cabbage, Eggplant, Chinese Cabbage and Cauliflower	Collect the affected stem and destroy away from the plant. Destroy eggs collected from leaves and shoots. Use ash on the plant.
9. Shoot and Fruit borer	Eggplant, Tomato, Bean	Collect affected shoots and fruits and destroy away from the plant. Destroy eggs collected from leaves and shoots. Use ash on the plant.

WHAT ARE THE MAIN PROBLEMS OF DISEASES AND THEIR METHOD OF CONTROL?

Disease	Vegetable attacked	Method of Control
1. Black leaf spot	Cabbage	Uproot the affected plant parts or whole plant.
2. Black rot	Cauliflower	Uproot the affected plant parts or whole plant.
3. Leaf curl disease	Pumpkin	Pull up the attached plants immediately and remove weeds. Control the insects carrying this disease.
4. Damping off	Collard green, Mustard green, Cauliflower, Cabbage, Tomato, Eggplant	Use disease-free seed and provide proper drainage facilities. Apply fungicide.
5. Fusarium wilt	Bean, Cucumber, Eggplant, Tomato, Cabbage	Use disease-resistant seeds, rotate crops, uproot diseased plants and use a mixture of Bordo.
6. Stem fungus	Cabbage type vegetables	Uproot the affected plant parts or whole plant and destroy.
7. Powdery mildew	Tomato, Eggplant, Pumpkin, Bottle gourd, Bean, Cucumber	Weed control. Spray Bordo mixture or Diathane M-45 on the affected plant.
8. Mosaic virus	Pumpkin, Tomato, Papaya, Cucumber, Cabbage	Uproot the affected plants and burn them to destroy the aphids, leaf-hopper and any other vectors.

Note: *The chemical methods suggested above should be used only if all organic methods have failed.*

6

VEGETABLE SEED AND SEEDLING PRODUCTION AND MANAGEMENT

VEGETABLE SEED AND SEEDLING PRODUCTION AND MANAGEMENT

WHAT IS A SEED?

A seed can be defined as any part of a plant that is used for propagation, such as the roots of potatoes, the stem of sweet potatoes and kangkong, the sucker of bananas, and the stalk of pineapples. In the botanical definition, a seed is an undeveloped and dormant plant, usually with reserve food supplies and protected by a seed coat. True seeds have three basic parts: an embryo, food storage tissues or an endosperm, and a seed coat.

WHAT IS THE PRESENT AVAILABILITY OF VEGETABLE SEEDS IN CAMBODIA?

Seeds are an important input for vegetable cultivation. In Cambodia, there is no organized system for supplying seeds. There is only one reliable and good-quality source of vegetable seeds. This is the Kbal Koh Vegetable Research Station. One of the objectives of this research station is to produce and multiply basic seeds for selected vegetable varieties. The capacity of the research station is limited due to a lack of resources and skilled manpower. As a result, the amount of seeds and seed varieties produced at the Kbal Koh station are not enough to meet the country's requirements.

Seeds of improved varieties of many vegetable crops, such as the *solanaceae* and *cucurbitaceae* families, are not available and, consequently, farmers produce their own without maintaining quality. These seeds are of low quality in their performance and yield low results. Many imported seeds sold in the market are not subject to good quality control and are expensive; also, these are not always available at the village level or in small markets. These imported seeds are often very inconsistent in their performance and it is difficult for farmers to understand the varieties, sowing times and cultivation methods. Vegetable seeds for home gardens currently come from different sources; 78% of farmers use seeds they have produced themselves (15).

WHY DO WE NEED TO PRODUCE SEEDS IN THE VILLAGE MODEL GARDEN OR HOME GARDEN?

Low quality of inputs is a serious constraint for vegetable production. An important input in vegetable cultivation is seeds. The use of good-quality seeds is an essential prerequisite for optimal production. The majority of farmers in Cambodia use vegetable seeds which they produce themselves. However, the variety is very limited and of poor quality. It was found from one study in Pursat that 18% of farmers take out a seed loan from other farmers, and 37% buy seeds from the market (16).

Seeds from diverse sources and of varying quality are available in the market. Many of the commercial varieties that have been introduced in the country by the private sector, have never been tested. Cambodian farmers have to get access to the best quality seeds in the most effective manner. Therefore, it is important to produce varieties of good-quality seeds in the promotional or demonstration gardens at the village or commune level. The main advantages of producing vegetable seeds at the local level are as follows:

- Seeds are available at the local level
- Gardeners and other community members can be independent
- Quality is assured
- There is no difficulty with procuring small amounts of seeds
- Ensures timely procurement and sowing
- Cost of seeds is low
- Valuable traditional or indigenous seed varieties can be preserved
- Income can be generated from selling the seeds at the commune level

HOW DOES VEGETABLE SEED PRODUCTION HELP TO ACHIEVE SUSTAINABILITY IN HOME GARDENING?

The success of a home garden is determined by the production of vegetables throughout the year. Home gardeners in rural areas do not generally know where to get good seeds and, even if they do, it is difficult to procure seeds in small quantities. The seeds available in the local market are not always of good quality. The production and availability of good quality seeds at the village level makes it possible to grow vegetables successfully throughout the year. This, in turn, leads to the sustainability of home gardening.

HOW ARE SEEDS PRODUCED TO ENSURE GOOD QUALITY?

Both self- and cross-pollinated seeds can be produced by home gardeners at the village level. Open-pollinated (OP) seeds, however, are not satisfactory for the purpose of seed production. It is relatively easy for home gardeners to maintain the quality of seeds for self-pollinated vegetables. This is more of a challenge with cross-pollinated vegetables, which tend to become modified and diversified. Hybrid seeds (F1) are difficult to produce, and need improved technology and significant inputs to produce a superior yield. Therefore, all hybrid seeds are imported and more expensive.

Home gardeners can be taught easy and safe techniques for producing good-quality seeds for their own use. If the original seeds are of good quality and the prescribed techniques are followed, then seeds can be kept for generations. Gardeners must also be aware of the characteristics that they should look for when selecting the best specimens to keep for seeds. Improper selection will alter the characteristics of the original variety. Different steps for ensuring good-quality seed production are described below.

I. Pollination

For successful good-quality seed production, it is important to understand the pollinating behavior of each vegetable. Vegetables are pollinated in one of three ways: Self-Pollination, Cross-Pollination or Partial Cross-Pollination. The pollination methods of most common vegetables in Cambodia are as follow:

Self-Pollination: The flowers of self-pollinated vegetables (such as beans, tomoates and lettuce) are complete – that is, they contain both male and female parts. Self-pollination occurs when the pollen of one flower fertilizes the same flower on the same plant.

Cross-Pollination: This occurs when an insect or the wind transfers pollen from the flower of one plant to the flower of another (e.g. pumpkin and radish).

Partial Cross-Pollination: Sometimes mixed pollination occurs. A single plant may either self-pollinate or cross-pollinate, depending on environmental conditions. Examples of mixed-pollinated plants are eggplant, okra and pigeon pea.

Pollination behavior of some vegetables in Cambodia

Vegetable/Fruit	Mode of Pollination	Pollination Medium
Red/Green Amaranth	Cross	Wind
Radish, Carrot, Chinese Radish	Cross	Insect
Cabbage, Cauliflower, Broccoli Mustard Green, Ptsai, Pestal, Chinese Kale, Pumpkin,	Cross	Insect
Wax Gourd, Bottle Gourd, Snake Gourd, Bitter Gourd, Sponge Gourd, Angled Loofah, Cucumber, Watermelon, Tomato	Cross	Insect
Chili, Green Pepper Pimento, Pepper, Capsicum Okra,	Self	Insect
Eggplant, Bitter Eggplant	Partial Cross	Insect
Kangkong	Cross	Insect
Papaya	Cross	Insect/Wind
Indian Spinach	Cross	Wind
Bean, Winged Bean, Hyacinth Bean, Yard Long Bean, Soybean	Self	Insect

II. Sources of Seeds

The source or derivation of the seeds must be known. Seeds should be either produced by the gardener or acquired from a reliable source for seed production.

III. Plot or Land Selection

The plot or land should not have been cultivated with the same crop during the preceding season or year. For health reasons, the land should also be free of major weeds and seed-borne diseases.

IV. Isolation Distance

Isolation distance means maintaining a distance to avoid cross-fertilization between two different varieties of the same crop. To prevent cross-fertilization of different varieties of the same vegetable, it is important to know and maintain correct isolation distances. Isolation distances vary with different categories of seeds, such as foundation or certified seeds.

A reasonable isolation distance should be maintained between the seed crop and any other variety, species or compatible wild species. Isolation distances have been officially quantified to enable certification. The table below gives the FAO standards for a "quality declared seed" – these are the minimum distances required for safe production. For superior categories of seeds (foundation seeds 1 and 2), even larger isolation distances are necessary.

Sometimes it is very difficult to maintain isolation distances between common vegetables with many varieties in the same village. In such cases, contamination from fields of the same crop that are too close in proximity can be prevented by providing the neighbor with the same varieties of seeds or by choosing a protected plot surrounded by trees or high fencing.

Recommended Isolation Distances for Seed Production of Different Varieties of Vegetables

Vegetable	Isolation Distance (m) (Certified Seed)
Amaranth	200
Mustard green, Petsal, Cauliflower, Cabbage, Common cabbage, Chinese Common Kale	1000
Yard long bean, Hyacinth bean, Winged bean, Snap bean, Mung bean, Soybean	10
Radish, Chinese Radish	1000
Beet	800
Indian Spinach	500-1000
Tomato*	10
Eggplant	200
Chili, Green pepper, Capsicum	200
Okra	200
Kangkong	200
Pumpkin, Bottle Gourd, Wax Gourd, Snake Gourd, Bitter Gourd, Angled Loofah, Cucumber, Watermelon, Sponge Gourd	500
Lettuce*	10

* Adequate distance to prevent mechanical mixture
Source: *FAO Technical Guidelines for Standards and Procedures for the Production of Quality Declared Seed (Rome, 1992)*

V. Healthy Crop Means Healthy Seeds

Diseased plants should be removed from the field and destroyed. This not only prevents the contamination of other plants but also of the next generation through seed-borne diseases.

VI. Roguing

Roguing is the action by which off-types are removed and destroyed. All plants found in the field which do not conform to the desired varietal characteristics, are called "off-types." The varietal characteristics (which are highly heritable) are those by which one variety can be distinguished from another. The amount of rouging to be performed depends on the crop condition.

VII. Plant Selection

The time for maintenance and selection of a variety needs to be carefully identified. This is a highly specialized job, which requires a thorough knowledge of varieties and breeding techniques.

Home gardeners have to decide which are the most suitable plants to bear seeds from among many plants in the garden. Farmers can maintain a variety at an acceptable level of quality by adhering to the principles set out above, and by carefully selecting at the appropriate growing stage, the best plants. These should be both true to type and have the highest yield.

To prevent household members from harvesting the plants/fruits that you wish to keep for seeds, mark the selected plants so that everyone can see that these plants or fruits are for seed saving.

VIII. Seed Collection and Extraction

Seed collection and extraction depends on the type of vegetables that will be harvested. Different types of vegetables have different methods of seed collection, as follows.

Wet seed from fleshy fruit

The fruit and seeds are wet such as in tomato, eggplant, cucumber and bitter gourd. Usually the flesh is attached firmly to the seeds. Seeds are extracted by using a knife or hand. Fermentation process is sometimes done to remove the seeds. After cutting, soak the fruit in water for 12-24 hours. After soaking, separate the seeds from the flesh and throw away flesh together with the seeds that float in water. The rest, good seed (sunken), are then washed and dried.

Dry seeds

These are obtained or extracted from a dried pod or fruit. Seeds are extracted by hand or beaten collectively inside a bag. Beating the seed inside the bag is necessary to prevent them from scattering. Seeds from vegetables such as petsal, bean, cauliflower, cabbage and mung bean are obtained in this way.

Dry seed from fresh fruit

The ripe fruit is dried before the seeds are extracted. Examples are chili and okra.

The following guidelines should help gardeners achieve better seed collection:

- Harvest the selected plant at the proper stage of maturity depending on the type.
- Extract the seed from the fruit/pod using the appropriate technique: wet seed extraction by fermentation for seeds contained in fleshy fruits; and threshing after drying for seeds contained in pods or cobs.
- Collect seeds in the dry season, rather than the wet season. This helps to prevent potential problems with diseases.
- Collect seeds on a dry, sunny day if possible.
- Extract seeds in a clean and empty area to avoid the accidental inclusion of non-selected plants.
- Separate seeds that have been collected for seed production from those that have been collected for vegetable production.

IX. Cleaning and grading of seeds

Cleaning is an important part of maintaining seed quality. The cleaning and grading process is one by which undesirable materials are physically separated from desired ones. The undesirable materials are mainly:

- Insert matter
- Weed seeds
- Other crop seeds
- Lightly-damaged or deteriorated seeds

The cleaning process usually removes 5-10% of the undesirable materials. Home gardeners perform this process mainly by winnowing and by gravity separation using locally available materials, bamboo baskets and wind blowing.

X. Seed Drying

It is necessary to dry seeds properly before processing and storing. Seeds with high moisture content are easily attacked by pests and diseases and get damaged during processing. Seed drying is important as it increases the longevity and viability of the seed, and facilitates storage. Drying removes the excess moisture that causes excessive respiration, heating and fungal invasion. Seeds should be dried in the sun on a clean, uniform surface. Seeds should not be dried on the ground. The amount of drying required depends on the air temperature, relative humidity and wind velocity. Various locally available materials can be used for drying seeds such as plastic sheets and jute mats. If it starts to rain the seeds can quickly be covered with these materials.

The following points should be kept in mind when drying seeds:

1. Choose a spot that is always exposed to the sun during the day.
2. Spread the seeds thinly over the drying mat.
3. Seeds should be turned over gently four or five times a day to ensure that they dry evenly.
4. Do not dry seeds in the sun when the sun's heat is too intense (i.e. between 11am and 1pm during the dry season) because this can damage the germination capacity of the seeds.

5. In the evening, bring the seeds indoors.
6. Continue this process until the seeds are properly dried.

XI. How to Determine if Seeds are Sufficiently Dried

There are several local methods that home gardeners use to determine whether seeds have been dried enough for storage. All vegetable seeds are divided into three categories (depending on their size) for the purpose of the tests, as follows:

1. Large, thin seeds will break with a snapping sound when twisted between the fingers. This method works with seeds from pumpkins, bottle gourd and wax gourd.
2. Large, thick seeds, which cannot be broken between the fingers, must be tested in a different way. The seed will break with a cracking sound when bitten between the front teeth. This method works with seeds from beans, soybean and maize.
3. Small seeds will break with a cracking sound when squeezed between the fingernails. This method works for amaranth, radish, mustard green and petsal seeds.

XII. Storage of Seed

After cleaning and drying, seeds should be stored carefully so that they remain dry and safe from insect attacks. Seeds should be stored with the following principles in mind:

1. Bottles, tins and glass jars with tightly-fitting lids or stoppers can be used.
2. Make sure that the container is dry before putting seeds into it.
3. Do not use paper, leaves or grass to plug a bottle, as these will allow moisture to enter the bottle.
4. Use rat and mouse-proof containers.
5. Different varieties of seeds can be put into separate plastic bags and then into large tins or glass jars.
6. Toasted rice or ash can be kept inside the container to draw moisture out of the air and keep the seeds dry.
7. Do not put a small amount of seeds in a large container.
8. Remember that heat kills seeds, so store your seeds in a cool, shady and dry place.
9. Do not place the seeds directly over the fire (cooking place) or in direct sunlight.

XIII. How to Test the Quality of Seeds

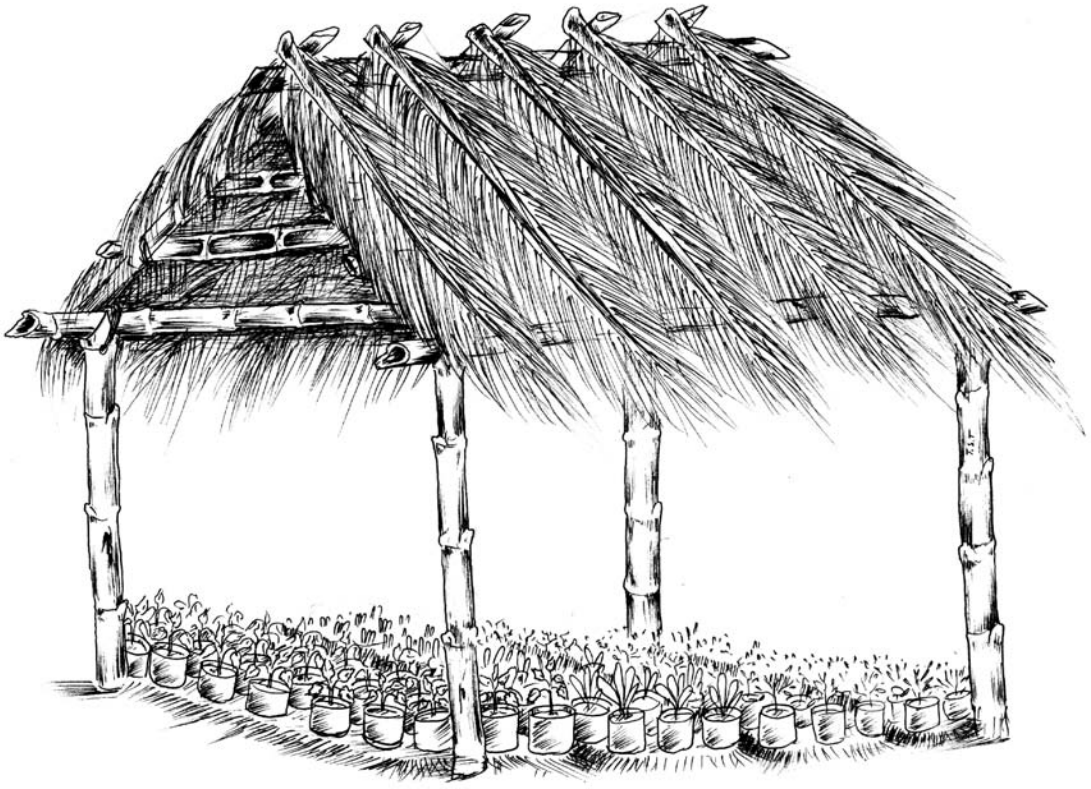
If all the steps described above have been carefully followed, the home gardener should have good healthy seeds. The seeds the garden has produced will usually be stored for 6-8 months before being used. Controlling storage in Cambodia, especially during the late dry and late rainy season, is very difficult. It is therefore advisable to carry out a simple germination test before using the seeds, or selling or giving them to others.

- Take an earthen or wooden pot, fill it with river sand and wet it.
- Sow 100 seeds and wait for about one week, maintaining a high level of moisture.
- After one week, count the seedlings that have come up. There should be at least 50 to 80 (depending on the type of vegetable).

Experience has shown that home gardeners quickly understand the purpose of the germination test. They learn not to waste their resources by sowing bad seeds and are therefore careful to germinate any new seeds they intend to sow.

7

SEED SOWING, SEEDLING PRODUCTION AND TRANSPLANTING



SEED SOWING, SEEDLING PRODUCTION AND TRANSPLANTING

HOW ARE SEEDS OF DIFFERENT VEGETABLES SOWN?

Seeds are sown to grow vegetables and to raise seedlings. There are some vegetables which cannot grow directly by sowing the seed in the plot. For example, for vegetables such as tomato, eggplant, mustard green, petsal, cabbage and cauliflower, seedlings first need to be raised and then transplanted in the plot.

Generally, the seeds are covered with a layer of soil after sowing. If the seeds are sown too deep, they will have difficulty emerging from the ground and may rot. If the seeds are sown too close to the surface the risk is greater that they will be dried out by the sun or eaten by birds or rodents. There are several different types of vegetable seeds based on their size, and it is important to maintain the correct distances between plants (plant-to-plant) and between rows (line-to-line).

WHAT ARE THE DIFFERENT METHODS OF SEED SOWING?

Depending on the type of vegetables, there are several methods of sowing seeds, as follows:

1. Broadcast Sowing

In the broadcast method, the seed is directly sown in the plot without maintaining any space between the plants and rows or lines. Traditionally, small seeds are sown in this manner. Small seeds are sometimes mixed with soil and then sowed by hand across the entire surface of the plot. Broadcast sowing creates irregular plant spacing. In some places, the plants may be too close to each other, while in other areas there may be empty spaces. Hoeing is impossible and weeding can hardly be done by hand.

2. Drilling or Row Seeding

Seeds are kept on drilling materials with a pointed stick or with a hoe. After sowing, the edges of the drill are turned over with a rake so the seeds are covered. To make straight drills, use a string stretched between two stakes as a guideline. By using a maker, we can quickly make several parallel drills at once. On sloping ground, the drill should be made across the slope to prevent seeds from being washed away by rain. Row seeding ensures that each plant has the same surface area available and makes weeding easier. Watering is also easier if ditches are made between the rows of plants.

3. Pocket Drilling or Sowing in Seed Holes

This method is used for vegetables that have larger seed and plant sizes (such as okra, legumes and maize). Pits or holes are prepared and 2-4 seeds are dropped in each pit. A spacing wheel makes it easy to make rows of holes. The spacing and the size of the pit must be adapted for each crop. Thinning /transplanting can be performed if necessary.

WHAT IS A VEGETABLE SEEDLING?

Some vegetables cannot be grown directly after seed sowing, such as tomato, eggplant, pepper and cabbage. One must first raise seedlings on a seedbed and then transplant the seedlings on the main plot. To raise seedlings, the seedbed must be on high, fertile ground that is rich in humus. In addition, the land should drain well and be well-exposed to sunlight.

HOW ARE SEEDBEDS PREPARED AND SEEDLINGS RAISED?

For seedling production, the seedbed will need to be located on high ground in the homestead and should be carefully tilled and enriched with fine manure or compost. Roots and stones should be removed and clods should be crumbled. Based on the size of the seeds, sowing should be done by broadcasting or in rows. The seeds should be covered with good light soil. The bed should be regularly watered when dry, preferably in the morning, but never in the sun, and it should be kept free of weeds. The seedlings should be protected from direct sunlight, heavy rain and strong winds by using locally available materials such as polythene, thatch, banana stalk and/or large leaves.

HOW ARE SEEDLINGS TRANSPLANTED?

Seedlings should be transplanted within 2-4 weeks of sowing, when plants should have around 4-6 leaves. The age of the seedling will depend on the type of vegetable. Watering should be performed immediately after transplanting. For better growth, sprinkle a mixture of water and manure on the seedlings after a few days. If necessary, the newly transplanted plant can be shaded from direct sunlight by using folded banana leaves or stalks. There are several steps in transplanting, as follows:

1. Digging up the seedlings

To start, soften the soil by watering the seedbed a few hours before transplanting. Seedlings can be pulled out with bare roots or dug out with a ball of earth. While digging out the plant, lightly press the root ball so it does not crumble. Digging up a plant with a ball of earth around the roots causes less injury to the young plants but takes a longer time.

2. Keeping the seedlings in a trench

The seedlings can be kept for a while by putting them in a small trench in the shade and covering with moist soil. However, always transplant them immediately after digging them up.

3. Trimming

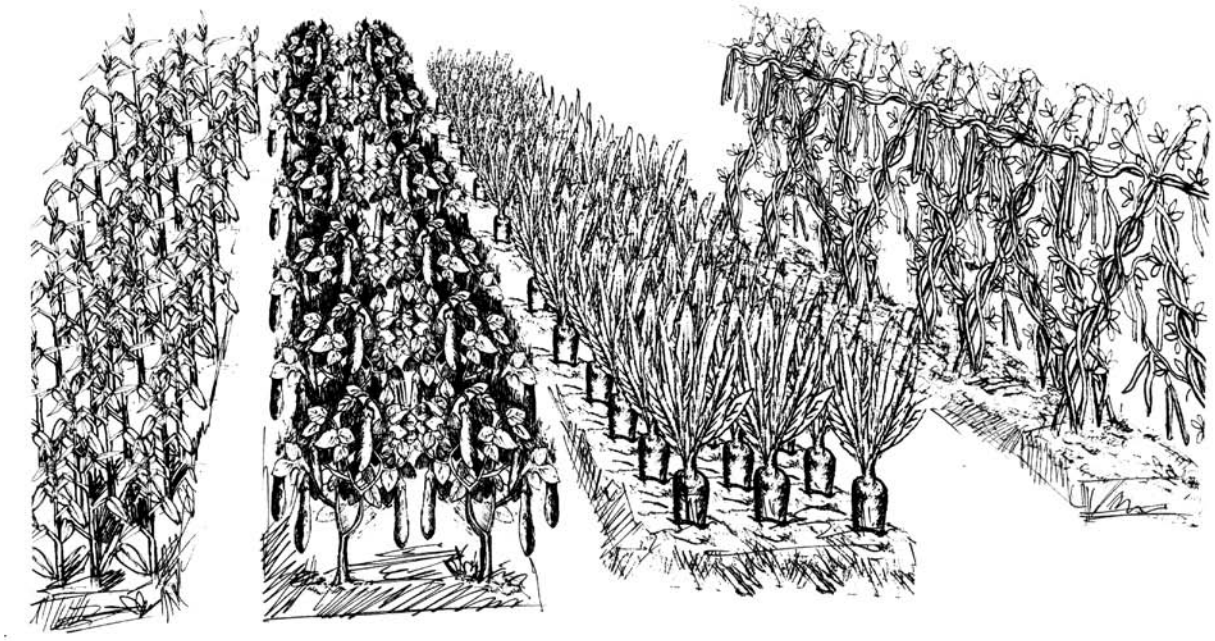
About one third of the roots and leaves can be cut in order to stimulate rooting and reduce drying out of the plants. Fleshy roots should not be trimmed, as they will rot. Trimming is not always necessary.

4. Planting

Transplanting should be performed with great care. Make a hole that is large enough to contain the roots with forcing them upwards. Generally, the seedlings should be transplanted at the same depth as they were planted in the seedbed. However, when the soil is light and the climate is dry, some vegetables, such as leek, onion and tomato, can be planted deeper to encourage root growth. The soil around the roots should be pressed firmly to prevent the roots from drying. Press firmly, but not too hard, with the fingers.

8

INTERCULTURAL OPERATIONS FOR BETTER MANAGEMENT OF THE HOME GARDEN



INTERCULTURAL OPERATIONS FOR BETTER MANAGEMENT OF THE HOME GARDEN

WHAT IS CROP ROTATION?

Crop rotation is the practice of growing different types of vegetable crops in the same plot or same bed in different seasons. There are different types of vegetables, such as leafy, fruit, root and tuber vegetables. If the same type of vegetable is grown in the same plot continuously, there will be a decrease in soil quality and a reduction in crop yield, as well increased chances of pest and disease attacks. Therefore, it is important to grow different types of vegetables in different seasons in the same plot.

Advantages of crop rotation

- Improves soil fertility
- Reduces the chances of pest attacks
- Controls soil diseases
- Improves plant growth due to the different root depths of different plants

WHAT IS MULCHING?

Mulching is the practice of adding different organic substance to the soil around the plant, by covering the soil with different locally available materials, in order to hold the moisture in the soil. Various mulching materials are available in the rural areas in Cambodia, such as water hyacinth, straw and plant leaves. In the dry season, it is very important to maintain soil moisture for vegetable production.

Advantages of mulching

- Holds the moisture in the soil
- Adds organic matter to the soil

WHAT IS CROP DIVERSIFICATION?

Crop diversification refers to growing different kinds of vegetables in one area or plot at the same time. It is always important to cultivate a wide range of varieties instead of growing only one or smaller variety of vegetables in the whole garden area or plot. By growing a wide variety of vegetables, all the different spaces in the homestead can be utilized.

Advantages of diversification

- Increases the frequency of vegetable consumption by household members.
- Reduces the risk of crop loss.
- Ensures the availability of different types of vegetables in the same season.
- Reduces the chances of pest and disease attacks.

WHAT IS INTENSIVE PLANTING?

For small spaces of land in the homestead, it is important to practice intensive planting. Close spacing is recommended to prevent the growth of weeds and reduce direct exposure of the soil to sunlight, which also reduces the moisture evaporation from the soil. Plants are correctly spaced when the leaves of the fully-grown plants slightly overlap with the nearest plant. This achieves maximum use of space and high yield.

HOW ARE VEGETABLES GROWN DURING THE DRY SEASON?

It is very difficult to grow vegetables in the dry season where there is no irrigation. Through some techniques, it is possible to grow some vegetables during the dry season. Plants mostly absorb water through their roots. It is therefore important that the soil is able to hold moisture to promote plant growth. Practices a gardener can use to increase the water holding capacity in the soil are as follows:

- Regular application of organic matter will improve the ability of the soil to hold water and supply to it to plant roots.
- Use a windbreak to protect the planting area. This will help to keep soil moisture from running out.
- Select plants that will grow well in dry conditions, such as kangkong, *Sauropus androgynus* and *Sesbania Grandiflora*.
- Grow some vegetables near wet and moist areas, such as near washing or cleaning areas or ring wells.
- Grow some vegetables in a shady place. Sweet potato can grow well in a shaded area.
- Cover the soil around the plant with organic substances.
- Select drought resistant varieties during the dry season, such as amaranth and string bean.

9

FOOD PREPARATION AND STORAGE

FOOD PREPARATION AND STORAGE

WHAT IS THE IMPORTANCE OF FOOD PREPARATION?

Vegetables and fruits contain different micronutrients in varying amounts. Different parts of the vegetable plant are consumed. The cooking process varies from area to area depending on local culture and habits. Some places also have food restrictions. Not all foods that are palatable are necessarily nutritious. The nutritional value of any meal depends on the individual food items used and how they are prepared and cooked. Therefore, it is important to know effective ways of cooking and preparing foods so that they still contain their respective nutrients. A variety of foods are available in Cambodia. These foods are prepared, stored or cooked in many different ways.

WHAT VEGETABLES AND FRUITS ARE RICH IN MICRONUTRIENTS?

There are many vegetables, including indigenous varieties, that contain different micronutrients. Vegetables that are rich in vitamin A include kangkong, amaranth, ivy gourd, Indian spinach, arum leaves, jute leaves, ceylon spinach, mustard green, swaton mustard, garlic leaves, pimento pepper, chili pepper, tabasco pepper, pumpkin and leaves, bitter gourd leaves, orange sweet potato, carrot, skoun, *sesbania javanica, sesbania grandiflora,* epil epil, neem, drumstick and leaves, water mimosa, *sauropus androgynus,* slek raing, slek roneang, slek prech, tamarind leaves, star gooseberry leaves, sweet potato leaves, Japanese pepper mint, basil, coriander leaves and papaya leaves.

Vegetables that are rich in iron include carrot leaf, coriander leaf and seed, soybean, black gram, spinach, coloesia (black arum leaf), mint, mango, pineapple and lemon.

Among the fruits available in Cambodia, ripe papaya, ripe mango and ripe jackfruit are rich in vitamin A.

WHICH PARTS OR TYPES OF VEGETABLES ARE RICH IN MICRONUTRIENTS?

The leaves of green leafy vegetables contain more vitamins and minerals than the stem. For example, kangkong leaves are richer in vitamin A and iron than their stems. However, in Cambodia, people prefer to eat the stems rather than the leaves. They should therefore be educated about this nutritional issue so that they do not throw the leaves away but instead use them more in cooking.

Ripe papaya is rich in vitamin A, but green papaya is not so rich in this micronutrient. In Cambodia, people like to eat green papaya as a vegetable. They should be encouraged to keep the papaya fruits until they are ripe and consume it as a fruit rather than as a vegetable.

Orange sweet potato is richer in vitamin A than the white variety. People should be educated on this and encouraged to grow orange sweet potato, instead of the white ones. Leaves of the sweet potato are rich in vitamin A and iron. People should be encouraged to use sweet potato leaves in cooking, especially during the dry season when vegetables are less available.

HOW SHOULD FOOD BE PROCESSED FOR OPTIMAL NUTRITION?

Food preparation includes washing, soaking, peeling, and cutting. The process affects the nutrients in foods such as rice, tubers, fruits, vegetables, and legumes.

Some nutrients will be lost during washing, soaking, peeling, and cutting, especially those vitamins that dissolve in water (e.g. vitamin B and C). However, the extent of the loss will depend on the number of washings, the amount of water used, and the length of time a food is soaked.

Vegetables should be washed before peeling or cutting. This is important for avoiding contamination with germs or worms. Washing vegetables and fruits after cutting will increase the loss of nutrients, especially vitamins that dissolve in water.

Vegetables and fruits that do not need to be peeled should not be peeled. Many nutrients are in the skin; peeling will take away those nutrients. If it is necessary to peel, only a thin layer should be peeled off. It is especially important to wash fruits and vegetables if they are not going to be peeled.

To preserve vitamins, rice should be washed in a small amount of water and should not be soaked for a long time. Rice should be washed in cool water as quickly as possible and only washed once.

HOW SHOULD FOOD BE COOKED TO PRESERVE MICRONUTRIENTS AND MINERALS?

Rice is often cooked alone. Other foods may be cooked in combination to prepare a variety of dishes, such as soups and fried dishes. Some foods are eaten raw. Some basic cooking methods are: fast or slow boiling, steaming, frying, grilling, roasting, and baking. These different cooking methods affect the nutrients in foods to a different extent.

The effect of cooking on a food's nutrient value depends on a number of factors. These include the amount of fat or water used, the cooking temperature, and the length of time the food is cooked. The following guidelines will help reduce nutrient loss during cooking:

- Cook rice with the lid on. Use just enough water so that it is all absorbed and extra water need not be poured out.
- Cook green leafy vegetables in fat or oil (fried dishes) for a short time – fat or oil helps the body absorb vitamin A better.
- Cook green leaves and vegetables in a small amount of water for a short time.
- Do not use high temperatures when cooking vegetables.
- Do not overcook vegetables.
- Eat fresh (raw) fruits as much as possible. Make sure fruits are cleaned properly. Avoid cooking fruits.

WHAT IS FOOD STORAGE?

To keep food safe we should:

- Keep storage areas and cupboards clean, cool and dry
- Do not store food in containers that have previously been used for chemicals
- Keep food covered while it is stored, and keep it away from chemicals such as insecticides and household cleaners
- Keep insects, pests, animals, birds and dust away from food

Fish, meat and poultry require special care as they always have germs (bacteria) on their surface. They can go bad very quickly in warm climates. Fresh fish, meat and poultry should be:

- Gutted as soon as possible (for fresh fish)
- Kept away from direct sunlight and dry wind
- Kept as cold as possible
- Kept separately from cooked food or food that is to be eaten raw
- Salted and dried if they are to be kept for a long time at room temperature
- Prepared (cooked/fried) as soon as possible

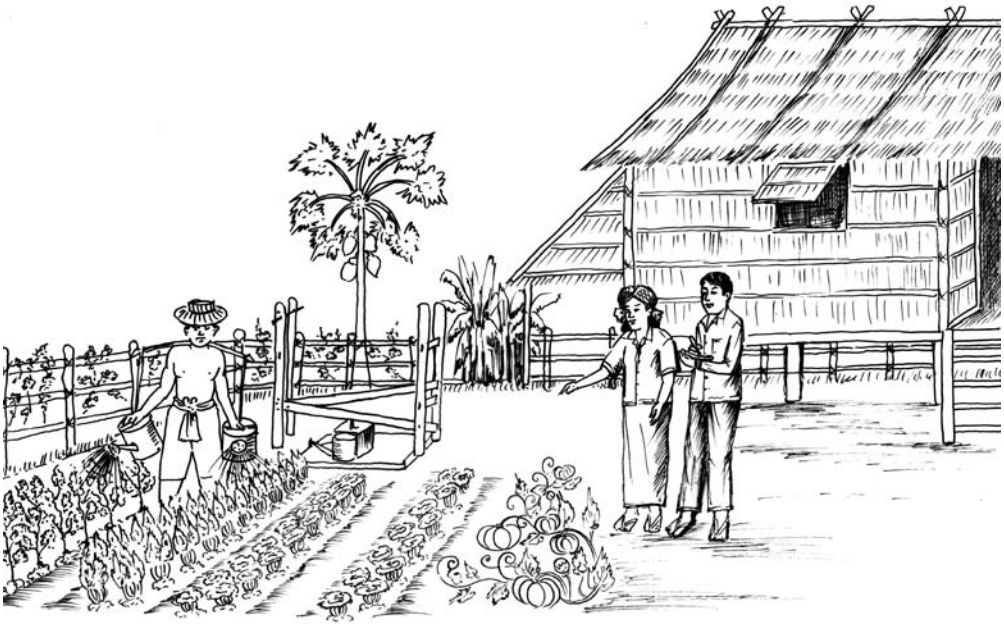
WHAT IS FOOD HYGIENE?

Fresh and clean foods are important for good nutrition. Contaminated foods can reduce both the food's nutrient value and cause disease. Diseases that are caused by contaminated foods and water include diarrhea, typhoid, cholera and hepatitis. The following practices will prevent food-related illnesses and reduce the wastage of food:

- Throw away any food that smells bad, looks bad, or is spoiled
- Wash your hands and your children's hands before handling food
- Cook and eat without delay
- Avoid coughing or sneezing near food or on food. Avoid touching hair, mouth, nose or anything likely to be dirty while preparing food
- Food must be covered to protect it from flies, insects and dust
- Do not eat foods from badly dented or very old cans. Cans with bumps on top are especially bad as the cans may rust. Once the can is opened, the food should be eaten straight away or put in a clean covered container and stored in cold place. Food should not be left in the can once the can is opened
- Cooked food should be kept separately from raw food
- Fruits and vegetables that are eaten raw should be washed properly with clean water. Fruits and vegetables that are eaten raw should be washed before others that need to be cooked
- Make sure that the water used for cooking and washing is fresh and from a safe source (hand pump, covered well, boiled, etc.)
- Meat and fish should be cooked thoroughly. Do not eat raw meat or fish. Fermented or preserved fish should be cooked to prevent worms
- Re-cook all foods that have been left in the open for more than 2 hours
- Wash your hands with soap and water before cooking
- Cooking utensils should be washed and kept covered
- The kitchen should be kept clean to avoid insects and flies

10

MONITORING OF HOME GARDENING PROGRAMS



MONITORING OF HOME GARDENING PROGRAMS

WHAT IS HOME GARDEN MONITORING?

Home gardening is a complex production process characterized by a diversity of inputs, practices and products. It includes a wide range of activities. The availability of resources in the community is also an important factor. Constraints in any of these areas can lead to the failure of the program.

Monitoring is an important part of any home gardening program. Monitoring involves the continuous gathering of information on different activities in the garden. On the basis of the information collected, necessary modifications can be made to the program. The main importance of monitoring a home gardening program is to improve program activities, to design local techniques, and to strengthen the capacity of local organizations. All participants of the program, including local communities, will use the results of the monitoring.

Evaluation is different from monitoring. Evaluation involves conducting surveys or studies after the program has been running for a certain length of time or at the end of the program and comparing them to data collected before the start of the program or to data gathered among people not involved in the program in order to determine how far goals and objectives have been achieved. The results of the evaluation are useful for future planning and decision making.

WHAT ARE THE CHARACTERISTICS OF A MONITORING SYSTEM?

The following are the main characteristics of an effective monitoring system:

- It should be simple and easily understandable.
- It should operate regularly (every 3-4 months).
- Program team members and members of the community should participate.
- It should deal with qualitative and quantitative aspects.
- It should focus on the most important parts of the program.
- Results should be shared immediately.

WHY DO WE NEED MONITORING?

Home gardening programs have two important components, promotion of vegetable production and consumption. One needs to address all important issues related to vegetable production and consumption. Monitoring forms part of all home gardening programs. The main purpose of monitoring is not to measure the success or failure of a program but to improve program activities, design strategies and local techniques, as well as to strengthen the local organization. The results of monitoring and evaluation should be used by people inside and outside the program.

As far as intervention activities are concerned, monitoring is important for program sustainability. Any successful program depends on the participants' ability to solve problems, accountability at all levels and the performance of local institutions. All these elements can be ensured through a monitoring system. A program will be sustainable only if the local community participates in monitoring activities. Hence, the need for community-based monitoring.

WHAT IS COMMUNITY-BASED MONITORING?

Community-based monitoring involves the monitoring of different activities in the home garden by promoters through the active participation of community members. This monitoring system helps community members identify problems and find possible solutions. Local communities should take part in designing and carrying out the evaluation of garden interventions. The following are the main characteristics of community-based monitoring:

- Participation of members of the community is ensured.
- Conducted by promoters and community members.
- Identification of problems and possible solutions based on the particular commune/ village situation.
- The community takes part in designing and implementing the program.

WHAT ARE THE OBJECTIVES OF COMMUNITY-BASED MONITORING?

The main objectives of community-based monitoring are:

- To fine-tune the program.
- To identify problems and intervene accordingly through community participation.
- To establish an integrated method of education and evaluation within the program.
- To reinforce or follow up on any training components of the program.

WHAT INDICATORS SHOULD BE USED FOR MONITORING GARDENING PROGRAMS?

Home gardening programs have two principal components: vegetable production and nutrition education to promote vegetable consumption. Gardening activities may be promoted through various approaches, such as through providing inputs to individual households, establishing demonstration gardens, etc. In Cambodia, the most common approach for the promotion of home gardens is the demonstration approach. Most organizations promote home gardens by establishing demonstration gardens at the village level. The name of the demonstration garden is different from area to area. In some places, they are called promoters' garden and in others, show gardens, demonstration gardens and village model gardens. The main objective of a demonstration garden is to provide technical and input support to other households for gardening. Therefore, monitoring activities need to monitor both the demonstration garden and the household gardens. Furthermore, monitoring results for both demonstration and household gardens can show how well the linkage is established between both sides.

Nutrition education promotes appropriate processing, storage and cooking techniques to preserve the pro-vitamin A content of food. There are many factors that contribute to successful home gardening. These need to be identified and related to the production and consumption components.

Many indicators can be used for monitoring both the production and nutrition aspects of home gardening, depending on the nature of program activities. A set of simple indicators, which can be adopted to assess vegetable production in a home garden, is described

below. Village-level workers and home gardeners can use these indicators to assess the status of gardening activities by themselves. These indicators may not follow standard scientific assessment procedures, but they provide a simple way of finding out whether vegetable production is progressing well and, if not, what the problem is. Home gardeners then have an opportunity to take appropriate action to solve the problem.

The suggested indicators are described below:

Demonstration Gardens

Size of demonstration garden
The size of the garden is important for demonstration. This indicator is related to the potential effectiveness of the demonstration and ensures that different types of vegetable production can be shown.

Number of varieties of vegetables, seeds and seedlings
The next step is the production of different varieties of vegetables, seeds and seedlings. For demonstration purposes, it is important to demonstrate a number of vegetables, seeds and seedlings. This shows the difference between the household garden and the demonstration garden.

Presence of different aspects of gardening
It is important to show the different aspects and practices of gardening in the demonstration garden. For example, year-round production, diversification, low-cost technology, crop rotation, and utilization of different spaces in the land, bed system, composting and fencing. This indicator shows the status of gardening and practices.

Amount produced and marketing
Amount of vegetables, seeds and seedlings produced in the demonstration garden, and how and where the produce is sold. By observing this, one can measure the status of support from the demonstration garden to other households.

Income from the demonstration garden
This shows the productivity of the demonstration garden, which is very important for the owner of the demonstration garden for continuing the garden.

Household Gardens

Number of varieties
This is the first step of gardening. This indicator will reveal the status of gardening, which reflects production and consumption.

Amount of vegetable produced, consumed and sold
This indicator shows the status of gardening, availability of vegetables for household consumption and percentage consumed and sold. It is an indication of the use of garden produce.

Inputs used
The inputs used for gardening gives an indication of the source of these inputs, the availability of inputs and linkages with the demonstration garden.

Income from the household garden and its use
This indicator shows the status of production, income and utilization of income from the sale of garden produce. It is also an indication of the productivity of the garden.

Nutrition Education for Consumption

Number of vitamin A/micronutrient-rich vegetables
This shows the availability of nutritious vegetables in the garden. By observing this, more planting of vitamin A/micronutrient-rich vegetables can be encouraged in the garden, as necessary.

Frequency of vegetable consumption
This presents the number of days over which vegetables are consumed by the mother and children under 6 years of age. This is an important indicator for the promotion of vegetable consumption and helps in the consideration of necessary interventions.

APPENDIX I

CROP CALENDAR

CROP CALENDAR FOR VEGETABLES AND FRUITS IN CAMBODIA

A wide range of varieties of vegetables and fruits can be grown throughout the year in the home garden. Some vegetables, such as tomato, cabbage and cauliflower, are mostly grown in the early and late dry season. Others, such as pumpkin, bottle and wax gourd can be harvested over a long period. Another group of vegetables, including amaranth, kangkong and basil, can be grown throughout the year. For every vegetable, there is an optimum time for sowing/planting and growing; but with proper management, some vegetables can be grown for a longer time to give a better yield.

In Cambodia, the number of available vegetables fluctuates throughout the year. In the early and late rainy season, the number of varieties are less than in the dry season. Home gardeners should, however, be able to grow and harvest at least 8-10 different varieties of vegetables and fruits throughout the year.

The following table lists the vegetables and fruits that can be sowed/planted and harvested each month.

JANUARY
MEAKASEI

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
Kangkong (trokoun)	Papaya (lahong)	Common Cabbage(spey kdop)	Papaya (lahong)
Amaranth (pti doung)	Jackfruit (knor)	Kangkong (trokoun)	Jackfruit (knor)
Iceberg Lettuce (salad)	Coconut (dong)	Amaranth (pti doung)	Star Gooseberry (kontout)
Lettuce (salad)	Wood Apple(krasang)	Iceberg Lettuce (salad)	Lemon (krouch sma)
Ceylon Spinach(chrolong)	Tamarind (ampil)	Indian Spinach (chrolong)	Coconut (doung)
Mustard Green (speychonkes)		Lettuce (salad)	Pomelo (krouch klong)
Cauliflower (khana phka)		Ceylon Spinach (chrolong)	Tamarind (ampil)
Chinese Kale (khana slek)		Mustard Green (spey chonkes)	Wood Apple (krasang)
Tomato (peng pos)		White Cabbage (spey krangang)	Jujube (putrea)
Green Pepper (mtas plok)		Chinese Cabbage (spey kheiv)	Tkov (tkov)
Eggplant (trop veng)		Chinese Kale (khana slek)	Cauliflower (khana phka)
Chili Pepper (mtas hil)		Wax Gourd (trolach)	Yard Long Bean (sandek kour)
Tobasco Pepper (mtas ach sat)		Chinese Chive (kouy chay)	Cucumber (trosak)
Bitter Eggplant (troponong)		Onion (ktem barang)	
Yard Long Bean (sandek kour)		Garlic Leek (ktem sar)	
Onion Stock (kouchay)		Taro Root (moeum trov)	
Onion (ktem barang)		Cassava (damlong mi)	
Watermelon (ov lek)		Chinese Radish (chia tav)	
		Neem (sdoa)	
		Coleus (chi slek trocheak chrok)	
		Coriander (chivansuy)	
		Lemon Grass (slek krey)	
		Mint Leaf (chi angkam)	
		Green Pepper (mtas plok)	
		Chili Pepper (mtas hil)	
		Bitter Eggplant (trop pongong)	

FEBRUARY
BOSH

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
Kangkong (trokoun)	Papaya (lahong)	Kangkong (trokoun)	Papaya (lohang)
Amaranth (pti doung)	Jackfruit (knor)	Amaranth (pti doung)	Jackfruit (knor)
Japanese Pepper Mint (chi angkam)	Tamarind (ampil)	Iceberg Lettuce (salad)	Coconut (dong)
Coleus (chi slek trocheak chrouk)	Wood Apple (krasang)	Mustard Green(spey chonkes)	Logan (mean)
Basil (chi neang vorng)	Jujube (Potrea)	Swantow Mustard (spey choeung tea)	Tamarind (ampil)
Ginger (kngey)	Tkov (tkov)	White Petiole (spey sor)	Wood Apple (krasang)
Iceberg Lettuce (salad)	Coconut (dong)	Chinese Cabbage (spey keiv)	Milk Fruit (tekdos)
Wax gourd (trolach)		Petsal (spey keiv)	Jujube (potrea)
Common Cabbage (spey kdoup)		Cauliflower (kana phka)	Tkov (tkov)
		Chinese Kale (kana slek)	
		Mungbean (sandek kheiv)	
		Cowpea (sandek angkuy)	
		Yard Long Bean (sandek kour)	
		Peanut (sandek dey)	
		Hyacinth Bean (popeay sbek)	
		Garlic Leek (ktem sor)	
		Chinese Radish (chai tav)	
		Basil (chi neang vorng)	
		Coleus (chi slek trocheak Chrouk)	
		Coriander (chi van suy)	
		Sponge Gourd (nonong moul)	
		Bottle Gourd (klouk)	
		Angled Loofah (nonong chroung)	
		Wax Gourd (Trolach)	

MARCH
MEAK

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
Kangkong (trokoun)	Jackfruit (knor)	Kangkong (trokoun)	Jackfruit (knor)
Amaranth (pti doung)	Mango (svay)	Amaranth (pti doung)	Mango (svay)
Cucumber (trosak)	Coconut (doung)	Iceberg Lettuce (salad)	Coconut (dong)
Pumpkin (lpov)	Logan (mean)	Cucumber (trosak)	Papaya (lohang)
Hyacinth Bean (sandek yak)	Sapodilla (lmout)	Tomato (peng pos)	Logan (mean)
Japanese Pepper Mint (chi angkam)	Mokak (mokak)	Eggplant (trop veng)	Sapodilla (lmout)
Iceberg Lettuce (salad)	Tamarind (ampil)	Cucumber (trosak)	Mokak (mokak)
Coriander (chi van suy)	Guava (trobek)	Pumpkin (lpove)	Tamarind (ampil)
Basil (chi neang vong)		Wax Gourd (trolach)	
Holy Basil (mras prov)		Bitter Gourd (mrass)	
Coleus (chi slek trocheak chrouk)		Sponge Gourd (nonoung moul)	
Yard Long Bean (sandek kour)		Bottle Gourd (klok)	
Sweet Pepper (mtas plok)		Watermelon (ov lek)	
Chili Pepper (mtas hil)		Mungbean (sandek bay)	
Mint (chi angkam)		Cowpea (sandek angkuy)	
Yard Long Bean (sandek kour)		Winged Bean (popeay chroung)	

APRIL
PHALKUN

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
Kangkong (trokoun)	Mango (svay)	Kangkong (trokoun)	Jackfruit (knor)
Amaranth (pti dong)	Jackfruit (knor)	Amaranth (pti doung)	Papaya (lohong)
Cucumber (trosak)	Coconut (doung)	Watermelon (ov lek)	Pring (pring)
Pumpkin (lpove)	Logan (mean)	Bitter Gourd (mrass)	Coconut (doung)
Wax Gourd (tralach)	Sapodilla (lmout)	Yard Long Bean (sandek kour)	Mango (svay)
Bitter Gourd (mrass)	Mokak (mokak)	Basil (chi neang vorng)	Logan (mean)
Angled Loofah (nonong chrong)	Tamarind (ampil)	Holy Basil (mras prov)	Sapodilla (lmout)
Sponge Gourd (nonong moul)		Mint (chi angkam)	Mokak (mokak)
Bottle Gourd (klok)		Coleus (chi slek trocheak chrouk)	Tamarind (ampil)
Japanese Pepper Mint (chi angkam)		Coriander (chi vansuy)	
Coleus (chi slek trocheak chrouk)			
Basil (chi neang vorng)			
Coriander (chi van suy)			
Holy Basil (mrass prov)			
Chili Pepper (mtas hil)			
Yard Long Bean (sandek kour)			

MAY
CHET

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
Amaranth (pti doung)	Mango (svay)	Kangkong (trokoun)	Pomegranate (totem)
Kangkong (trokoun)	Jackfruit (knor)	Amaranth (pti doung)	Jackfruit (knor)
Pumpkin (lpove)	Milk Fruit (tek dos)	Bitter Eggplant (tropongong)	Papaya (lohong)
Eggplant (trop veng)	Coconut (doung)	Drumstick (mrum)	Star Gooseberry (kontout)
Bitter Gourd (mrass)	Papaya (lohong)	Ivy Gourd (slek bas)	Eggfruit (sada)
Bitter Eggplant (trop pongong)	Carambola (speu)	*Sauropus Androgynus (ngop)*	Pring (pring)
Wax Gourd (trolach)	Star Gooseberry (kontout)	Radish (chai tav)	Coconut (doung)
Chili (mtes hil)	Eggfruit (sada)		Carambola (speu)
Sponge Gourd (nonong moul)			
Ivy Gourd (slek bas)			
Yard Long Bean (sandek kour)			
Winged Bean (popeay chroung)			
Mungbean (sandek bay)			
Hyacinth Bean (popeay sbek)			
Cassava (damlong mi)			
Cucumber (trosak)			
Watermelon (ov lek)			

JUNE
PEASAK

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
Taro (trav)	Mango (svay)	Kangkong (trokoun)	Pring (pring)
Kangkong (trokoun)	Jackfruit (knor)	Amaranth (pti doung)	Coconut (dong)
Amaranth (pti doung)	Milk Fruit (tekdos)	Bitter Eggplant (trop pongong)	Star Gooseberry(kontout)
Indian Spinach (chrolong)	Coconut (dong)	Ivy Gourd (slek bas)	Carambola (spue)
Ceylon Spinach (chrolong)	Papaya (lohong)	*Sauropus androgynus* (ngop)	Papaya (lohong)
Chili Pepper (mtes hil)	Carambola (spue)	Yard Long Bean (sandek kour)	Jackfruit (knor)
Iceberg Lettuce (salad)	Eggfruit (sada)		
Ivy Gourd (slek bas)	Star Gooseberry (kontout)		
Lettuce (salad)	Pomegranate (totem)		
Jute Leaf (krochoa slek)	Cashew (svay chanti)		
Mustard Green (spey chonkes)	Tamarind (ampil)		
Chinese Cabbage (spey keiv)	Guava (trobek)		
Yard Long Bean (sandek kour)			
Winged Bean (popeay chroung)			
Hyacinth Bean (popeay sbek)			
Mungbean (sandek bay)			
Cowpea (sandek angkuy)			
Snap Bean (sandek barang)			
Soybean (sandek seang)			
Taro Root (mouem trov)			
Cassava (domlong mi)			
Sweet Potato (damlong chvea)			
Wax Gourd (trolach)			
Pumpkin (lpove)			
Cucumber (trosak)			
Angled Loofah (nonong chrong)			
Bitter Gourd (mrass)			
Sponge Gourd (nonong moul)			
Snake Gourd (nonong pos)			
Chinese Chive (kuy chay)			
Bunching Onion (ktem slek)			
Sesbania Grandiflora (angkea dey)			
Coleus (chi slek trocheak chrouk)			
Basil (chi neang vong)			
Coriander (chi van suy)			
Ginger (khgney)			
Turmeric (romeat)			
Swamp Leaf (ma am)			
Lemon Grass (slek krey)			
Mint (chi angkam)			
All Yam Types (domlong kroup mouk)			

JULY
CHHASH

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
Taro (trav)	Mango (svay)	Amaranth (pti dong)	Papaya(lohong)
Kangkong (troukoun)	Jackfruit (knor)	Kangkong (trokoun)	Coconut (dong)
Indian Spinach (chrolong)	Coconut (doung)	Pumpkin (lpove)	Eggfruit (sada)
Amaranth (pti doung)	Papaya (lohong)	Eggplant (trop veng)	Star Gooseberry (kontout)
Ceylong Spinach	Carambola (spue)	Bitter Eggplant (trop pongng)	Carambola (spue)
Ivy Gourd (slek bas)	Eggfruit (sada)	Bitter Gourd (mrass)	
Jute Leaf (krochov slek)	Star Gooseberry (kontout)	Chili (mtas hil)	
Yard Long Bean (sandek kour)	Pomegranate (totem)	Ivy Gourd (slek bas)	
Chinese Chive (kuy chay)	Cashew (svay chanti)	Yard Long Bean (sandek kour)	
Bunching Onion (ktem slek)	Tamarind (ampil)	Winged Bean (popeay chrong)	
Sesbania Grandiflora (angkea dey)	Guava (trobek)	Mungbean (sandek bay)	
Turmeric (romeat)		Chinese Chive (kuychay)	
Coleus (chi slek trocheak chrouk)		Bunching Onion (ktem slek)	
Basil (chi neang vorng)		*Sauropus androqynus* (slek ngoup)	
Swamp Leaf (ma am)		Onion (Ktem barang)	
Ginger (kngey)		*Sesbania Grandiflora* (angkea dey)	
Lemon Grass (slek krey)		Coleus (chi slek trocheak chrouk)	
Mint (chi angkam)		Basil (chi neang vong)	
Great Galangal (mdang)		Coriander (chi van suy)	
Bitter Eggplant (trop pongong)		Ginger (kngey)	
		Lemon Grass (slekrey)	
		Mint (chi angkam)	

AUGUST
ASATT

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
Kangkong (trokoun)	Mango (svay)	Kangkong (trokoun)	Coconut (dong)
Amaranth (pti dong)	Jackfruit (knor)	Amaranth (pti doung)	Papaya (lohong)
Yard Long Bean (sandek kour)	Pomegranate (totem)	Yard Long Bean (sandek kour)	Banana (chek)
Indian Spinach (chrolong)	Eggfruit (sada)	Indian Spinach (chrolong)	Pineapple (mnoss)
Ceylon Spinach (chrolong)	Guava (trobek)	Ceylon Spinach (chrolong)	Star Gooseberry (kontout)
Ivy Gourd (slek bas)	Custard Apple(teab bay)	Ivy Gourd (slek bas)	
Bitter Eggplant (trop pongong)		Chili (mtes hil)	
Bitter Gourd (mrass)		Jute Leaf (krochov slek)	
Chinese Chive (kuy chay)		Taro Stem (teang trov)	
Bunching Onion (ktem slek)		Yam (domlong)	
Garlic leek (ktem krahom)		Sweet Potato (dom long chvea)	
Taro (trav)		Bunching Onion (ktem slek)	
Coleus (chi slek trocheak chrouk)		Mint (chi angkam)	
Basil (chi neang vorng)		Ginger (kngey)	
Ginger (kngey)		Great Galangal (rom dang)	
Turmeric (romeat)		Swamp Leaf (ma am)	
Swamp Leaf (ma am)		Coleus (chi slek trocheak chrouk)	
Lemon Grass (slekrey)		Coriander (chi van suy)	
Mint (chi angkam)			

SEPTEMBER
SRAP

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
Kangkong (trokoun)	Jackfruit (knor)	Kangkong (trokoun)	Jackfruit (knor)
Iceberg Lettuce (salad)	Mokak (mokak)	Amaranth (pti dong)	Mokak (mokak)
Tomato (peng pos)	Coconut (dong)	Ivy Gourd (slek bas)	Coconut (dong)
Eggplant (trop veng)	Papaya (lohong)	Iceberg Lettuce (salad)	Papaya (lohong)
Green Pepper (mtas plok)	Banana (chek)	Tomato (peng pos)	Banana (chek)
Pimento Pepper (mates havay)		Eggplant (trop veng)	Guava (trobek)
Chili Pepper (mtes hil)		Cucumber (trosak)	
Tabasco Pepper (mtas ach sat)		Pumpkin (lpove)	
Cucumber (trosak)		Wax Gourd (tro lach)	
Pumpkin (lpove)		Bitter Gourd (mras)	
Wax Gourd (trolach)		Sponge Gourd (nonong moul)	
Bitter Gourd (mras)		Winged Bean (popeay chroung)	
Sponge Gourd (nonong moul)		Hyacinth Bean (popeay sbek)	
Bottle Gourd (klok)		Garlic Leek (ktem sor)	
Watermelon (ov lek)		Shallot (ktem kraham)	
Winged Bean (popeay chrong)		Onion (ktem barang)	
Hyacinth Bean (popeay sbek)		Chinese Chives (kuy chay)	
Garlic Leek (ktem kraham)		Sweet potato (damlong chvea)	
Sweet Potato (dam long doung)		Cassava (damlong mi)	
Cassava (damlong mi)		Taro (trov)	
Winged Yam (white) (dam long pos)		Arrow Root (sakou)	
Winged Yam (purple) (dam long cheam man)		Coleus (chi slek trocheak chrouk)	
Coleus (chi slek trocheak chrouk)		Basil (chi neang vong)	
Japanese Pepper Mint (chi angkam)		Coriander (chi vang suy)	
Basil (chi neang vong)		Ginger (khngey)	
Coriander (chi van suy)		Turmeric (romeat)	
Ginger (khngey)		Lemon Grass (slekrey)	
Lemon Grass (slekrey)			
Papaya (lohong)			

OCTOBER
PHATRABOT

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
Kangkong (trokoun)	Jackfruit (knor)	Kangkong (trokoun)	Jackfruit (knor)
Amaranth (pti doung)	Mokak (makak)	Amaranth (pti doung)	Coconut (dong)
Ivy Gourd (slek bas)	Coconut (dong)	Iceberg Lettuce (salad)	Papaya (lohong)
Iceberg Lettuce (salad)	Papaya (lohong)	Tomato (peng pos)	Banana (chek)
Tomato (pengpos)	Banana (chek)	Tabasco Pepper (mtes ach sat)	Guava (trobek)
Eggplant (trop veng)	Coconut (dong)	Chili Pepper (mtes hil)	Pomelo (krouch klong)
Green Pepper (mtes plok)	Kroping Reach (kropingreach)	Pimento Pepper (mtes havay)	KropingReach (kropingreach)
Pimento Pepper (mtes havay)	Guava (trobek)	Green Pepper (mtes plok)	
Chili Pepper (mtes hil)		Cucumber (trosak)	
Tabasco Pepper (mtes ach sat)		Pumpkin (lpov)	
Cucumber (trosak)		Garlic Leek (ktem sor)	
Pumpkin (lpove)		Shallot (ktem kroham)	
Wax Gourd (trolach)		Onion (ktem barang)	
Bitter Gourd (mrass)		Chinese Chives (kuy chay)	
Winged Bean (popeay chroung)		Sweet Potatos (damlong chvea)	
Sponge Gourd (nonong moul)		Cassava (Damlong mi)	
Bottle Gourd (klok)		Taro (trov)	
Watermelon (ov lek)		Arrow Root (sakou)	
Hyacinth Bean (popeay sbek)		Coleus (chi trocheak chrouk)	
Garlic Leek (ktem sor)		Basil (chi neang vorng)	
Bunching Onion (ktem slek)		Coriander (chi van suy)	
Chinese Chive (kuychay)		Ginger (kngey)	
Sweet Potato (damlong chvea)		Turmeric (romeat)	
Cassava (damlongchvea)		Japanese Pepper Mint (chi angkam)	
Winged Yam (white) (damlong pos)		Lemon Grass (slekrey)	
Winged Yam (purple) (damlong doung)			
Coleus (chislek trocheak chrouk)			
Japanese pepper mint (chi angkam)			
Basil (chi chroktrey)			
Coriander (chi van suy)			
Ginger (kngey)			
Lemon grass (slekrey)			
Ceylon spinach (chrolong)			

NOVEMBER
ASOUCH

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
Kangkong (tokoun)	Papaya (lohong)	Kangkong (trokoun)	Papaya (lohong)
Amaranth (pti doung)	Coconut (dong)	Amaranth (pti doung)	Logan (mean)
Iceberg Lettuce (salad)	Carambola (spue)	Cassava (damlong mi)	Carambola (spue)
Lettuce (salad)	Jackfruit (knor)	Indian Spinach (chrolong)	Jackfruit (knor)
Ceylon Spinach (chrolong)		Bitter Eggplant (tropongong)	Wood Apple (krasang)
Indian Spinach (chrolong)		Taro Root (moeum trov)	Tamarind (ampil)
Mustard Green (spey chonkes)		Mint (chi angkam)	Coconut (dong)
Swatow Mustard (spey kmov)		Coleus (chi trocheak chrouk)	Sapodilla (lmout)
White Petiole (spey krongang)		Bunching Onion (ktem slek)	
Chinese Cabbage (spey kheiv)		Ginger (kngey)	
Common Cabbage (spey kdop)		Turmeric (romeat)	
Cauliflower (kana phka)		Ivy Gourd (slek bas)	
Chinese Kale (kana slek)		*Sauropus androgynus* (slek ngop)	
Green Pepper (mtes plok)		Great Galangal (Rom dang)	
Tomato (peng pos)			
Eggplant (trop veng)			
Pimento Pepper (mtes havay)			
Chili Pepper (mtes hel)			
Tabasco Pepper (mtes ach sat)			
Bitter Gourd (mras)			
Wax Gourd (trolach)			
Pumpkin (lpove)			
Cucumber (trosak)			
Angled Loofah (nonong chrong)			
Snake Gourd (nonong pos)			
Watermelon (ov lek)			
Peanut (sandek dey)			
Yard Long Bean (sandel kour)			
Chinese Chive (kuy chay)			
Bunching Onion (ktem slek)			
Garlic Leek (ktem sor)			
Sweet Potato (dam long chvea)			
Coleus (chi tro cheak chrouk)			
Basil (chi neang vong)			
Mint (chi angkam)			

DECEMBER
KADEK

Sowing/Planting		Harvesting	
Vegetable	***Fruit***	***Vegetable***	***Fruit***
KangKong (trokoun)	Banana (chek)	KangKong (trokoun)	Logan (mean)
Amaranth (pti doung)	Jackfruit (knor)	Amaranth (pti dong)	Papaya (lohong)
Ivy Gourd (slek bas)	Papaya (lohong)	Ivy Gourd (slek bas)	Coconut (dong)
Iceberg Lettuce (salad)	Wood Apple (krasang)	Iceberg Lettuce (salad)	Pomelo (krouch klong)
Indian Spinach (chrolong)	Logan (mean)	Indian spinach (chrolong)	Wood Apple (krosang)
Lettuce (salad)	Tamarind (ampil)	Lettuce (salad)	Eggfruit (sada)
Jute Leaf (krochov slek)		Jute Leaf (krochov slek)	
Ceylon Spinach (chrolong)		Ceylon Spinach (chrolong)	
Mustard Green (spey chonkes)		Mustard Green (spey chonkes)	
Swatow Mustard (spey cheoung tea)		Swatow Mustard (spey cheoung tea)	
White Petiole (spey sor)		White Petiole (spey sor)	
Chines Cabbage (spey kheiv)		Chines Cabbage (spey kheiv)	
Common Cabbage (spey kdop)		Cauliflower (khana phka)	
Cauliflower (kana phka)		Common Cabbage (spey kdop)	
Chinese Kale (khana slek)		Green Pepper (mtes plok)	
Green Pepper (mtes plok)		Pimento Pepper (mtes havay)	
Tomato (pengpos)		Chili Pepper (mtes hil)	
Chili Pepper (mtes hel)		Tomato (peng pos)	
Eggplant (trop veng)		Eggplant (trop veng)	
Wax Gourd (trolach)		Wax Gourd (trolach)	
Green Papaya (lohong kchey)		Pumpkin (lpove)	
Mungbean (sandek bay)		Angled Loofah (nonong chrong)	
Cowpea (sandek angkuy)		Bitter Gourd (mrass)	
Chinese Chive (kuy chay)		Sponge Gourd (nonong moul)	
Bunching Onion (ktem slek)			
Garlic Leek (ktem sor)			
Coleus (chi slek trocheak chrouk)			
Basil (chi neang vorng)			
Coriander (chi van suy)			
Ginger (kngey)			
Turmeric (romeat)			
Lemon Grass (slek krey)			
Japanese Pepper Mint (chi angkam)			
Mint Leaf (chi angkam)			

APPENDIX II

PRODUCTION PRACTICES: How to grow vegetables

PRODUCTION PRACTICES RELATING TO DIFFERENT VEGETABLES

Different vegetables can be grown in the home garden throughout the year. The practices described below should be followed to achieve successful production and optimum yield.

Soil

Soil is an important factor for growing vegetables. Different vegetables need different types of soil. Loamy and sandy loam soil is suitable for most vegetables. Sandy and clay soil will have to be treated with large amounts of organic fertilizers if it is to be used for growing vegetables.

Land Preparation

Depending on the total area, land can be divided into several plots where small beds can be prepared. One bed should be kept for raising seedlings. Land must be plowed in a way that is most appropriate for the type of vegetable and size of seed. For smaller seeds, like those of amaranth, ptsai or mustard green, the land should be well pulverized. For gourd-type vegetables, such as pumpkin and wax gourd, it is better to prepare pits.

Sowing/Planting Time

To obtain the expected yield, sowing and planting must done at the proper time. It is particularly important for vegetables such as cabbage, collard green, mustard green, cauliflower and tomato that seedlings be planted in time to obtain the maximum yield.

Spacing

For some vegetables such as amaranth and kangkong, both broadcast and line sowing methods can be used. Ideally, however, all vegetable seeds should be sowed in lines maintaining proper distances. When transplanting seedlings, it is essential that distances between lines and between plants be maintained.

Seed Rate

To obtain the expected yield, the use of good quality seeds is essential. The seed rate depends principally on the quality of the seed. For seeds that are sowed directly, a 10-15% higher rate should be used. Thinning should be carried out after germination to obtain better growth.

Germination

The number of days required to germinate seeds depends mainly on the soil moisture and the depth at which seeds have been sowed. Soil should be kept moist until the seeds have germinated. Hard-coated seeds such as Indian spinach, bottle gourd and kangkong must be soaked in water for 12 to 24 hours before sowing.

Variety

A good variety will give a good yield. Some vegetables such as cauliflower and cabbage have many varieties. Varieties should be selected carefully depending on the desired time of cultivation.

Fertilizer

Large quantities of organic fertilizers should be used when growing vegetables in the home garden. This not only provides nutrients for the soil, but also increases the soil's water-holding capacity. It is easy to prepare compost using locally available animal and plant materials. In case of very poor soil, additional organic fertilizers plus a small amount of chemical fertilizers should be used.

Intercultural Operations

Intercultural operations such as irrigation, mulching, weeding, thinning, earthing up, and stacking, and pest and disease control should be carried out at the proper time.

Crop Duration/Harvest

Crop duration is measured from the time of sowing to the end of harvesting. It depends on the season and the duration of the harvest. Vegetables are generally harvested when they have matured, although some are harvested at an earlier stage. In the case of most vegetable varieties, harvesting may last from 15-45 days or even longer since they are not all harvested at the same time.

Yield

Crop yields depend on some of the factors mentioned above, together with other factors such as the use of inputs, cultural management and time of harvesting.

CDCOM	Cow Dung Compost
TD	Top Dress
DS	Diamonium Sulphur
DP	Diamonium Phosphate
Are	Are (1 Are = 100m^2)
DAS	Days After Sowing
DAP	Days After Planting

Detailed production practices for a wide range of vegetables are given in the following pages.

Leafy Type Vegetables

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Kangkong	Kangkong can grow any time of the year. Best time for sowing is March to August	200-250 g It can be grown both from seed and stem cutting	1.5 - 2.5 cm	5-8 days	Line to line: 30 Plant to plant: 15	Pert Phan, Kbal Koh, Tra Kourn pray, Tra Kourn Chin
Amaranth	Any time of the year except late rainy season (September-October)	60 g	1 cm	4-5 days	Both broadcast and line sowing can be done. For line sowing Line to line: 20	Phti dong, Phti sa, Pti Kraham
Ivy Gourd	June - July	60-70 g	1.5 cm	6-8 days	Line to line: 100 Plant to plant:100	Bas
Iceberge Lettuce	November-December	100 g	1-1.5 cm	3-4 days	Broadcast and line sowing method can be done. For line sowing or transplanting: from Line to line: 15 cm Plant to plant:15 cm	Salad
Indian Spinach	June -July	120 grams	2 cm	5-6 days	Line to line: 35 cm Pit to pit: 20 cm	Chrolong Slek
Lettuce	Can be grown any time in the year, but the best time to grow is November-December	80-100 grams	0.5-1 cm	3-4 days	Transplanting method: Line to line: 15 cm Line to line: 15 cm	*Latuca sativa*
Arum Leaf	Any time it grows in the moist place					It is a volunteer plant
Jute Leaf	June-July	70-90 gram	1 cm	3-5 days	Only broadcast method is done for Jute leave. Plant to plant whould be 20 cm.	Kro Chov slek
Ceylon Spinach	June -July	100 grams	1.50 cm	4-5 days	Line to line: 30 cm Plant to plant: 20cm	Chrolong slek

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
During land prep: COM - 100 kg Basal DAP: 2 kg 1st TD at 30 DAS: Urea - 1.5 kg 2nd TD at 50 DAS: Urea - 1.5 kg	Weeding needs to be done after sowing 1-2 times.	50 - 60 DAS. Harvesting can start after 40 DAS after sowing and continue for long time	300 - 400	Seeds must be soaked for 24 hours before sowing. Water requirement is low. It can tolerate both drought and water logged condition
During land prep: COM - 75 kg Basal DAP: 2 kg 1st TD at 30 DAS: Urea - 1.5 kg	Soil should be kept moist until the seeds have germinated.	40-50 days. Harvesting can continue for a long time	100 - 150	Water requirement is low and it can tolerate water logged condition
During land prep: COM – 100 kg	Soil should be kept moist until the seeds have germinated.	45 - 60 DAS	60 - 80	Mostly, Ivy gourd is grown naturally in the bush, along the fences and in the forest as volunteer plant
Basal: Compost 150 kg Top dress: Urea 1kg Side dress: Urea 0.50 kg	Soil should be kept moist until seeds have germinated Weeding should be done regularly at the initial stages	35-45 days	50-60	Water requirement is high. It is not a drought tolerant vegetable
Basal: Compost: 150 kg Side dress: Urea 1.5 kg DAP 0.5 kg Com: 50 kg	Enough water should be provided until the seeds are germinated	50-70 days	50-70	The seeds must be soaked in water for 12 hours before sowing. The Indian spinach is rich in vitamin A, but is not popular vegetable for most Cambodian farmers
Basal: Compost: 100 kg DAP: 1.5 kg Side dress: Urea : 1.5 kg Comp: 50 kg Top dress: Urea: 1 kg	Sufficient water should be provided until the seeds have germinated	45-60 days	50-60	Water requirement is high. If sufficient water is not provided to lettuce, the taste becomes bitter. Lettuce is very popular in Phnom Penh city
During land preparation Compost: 150 kg	Thinning should be done if plants are too dense after 1-2 weeks sowing	45-60 days	80-100 kg	It is a water-logged tolerant plant.
During land preparation Compost: 150 kg DAP 2 kg	Sufficient water should be provided to ensure good germination	Continuously harvested from 45-75 days	70-100 kg	Water requirement is medium.

Cabbage Type Vegetables

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Mustard Green	Can be grown any time in the year, but the best time to grow is in December	100-150 grams	1cm	3-4 days	Line to line: 30cm Plant to plant: 20cm	Spey Chongkes
Swatow Mustard	Can be grown any time in the year, but the best time is December-January	100-150 grams	1cm	3-4	Line to line 30cm Plant to plant: 20cm	Spey Choueng tea
White Petiole	December-January	100-150 grams	1cm	3-4	Line to line: 25cm Plant to plant: 15cm	Spey Krangang
Chinese Cabbage	December-January	100 -150 grams	1cm	3-4	Line to line: 20cm Plant to plant: 15cm	Spey kmoa
Petsal (green petiole)	Best time is November-January	100-150 grams	1cm	3-4	Line to line: 25cm Plant to plant: 15cm	Improved variety
Common Cabbage	Best time is November-December	100-150 grams	1.5cm	3-4	Line to line: 35cm Plant to plant: 25cm	Speykdop
Chinese Kale	Best time is December -January	100-150 grams	1.5cm	3-4	Line to line: 25cm Plant to plant: 15cm	Khana slek
Cauliflower	Best time is December-January	100-150 grams	1cm	3-4	Line to line: 30cm Plant to plan: 20cm	Khana Pka Brassican rapa

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 100 kg DAP: 2 kg Side dress: Compost: 50 kg Urea: 1.5 kg Top dress: Urea: 1 kg	Regularl weeding is necessary after 2 weeks transplanting. Soil should be loosen finely.	45-50 days	50-60 kg	The seeds should be soaked overnight before sowing
Basal: Compost: 100 kg DAP: 2 kg Side dress: Compost: 50 kg Urea: 1.5 kg DAP: 0.5 kg Top dress: Urea: 1 kg	Soil should be well loosed when applying the fertilizer for the side dress. Mulching should be done to protect water evaporation specially in the dry season	45-55 days	100-120 kg	Seeds should be soaked in water for 12 hours before sowing
Basal: Compost: 100 kg DAP: 2 kg Side dress: Compost: 100 kg Urea: 1 kg DAP: 0.5 kg	Soil should be kept moist until the seeds have germinated	55-65 days	120-150 kg	Seeds should be soaked in water overnight before sowing
Basal: Compost: 100 kg DAP: 2 kg Side dress: Urea: 1.5 kg Compost: 50 kg	Soil should be kept until the seeds are well germinated.	50-55 days	130-160 kg	Transplanting should be done when seedling has 4--6 leaves
Basal: Compost: 150 kg DAP: 2 kg Side dress: Compost: 50 kg Urea: 1 kg	Weeding should be done regularly. Mulching should be done in the dry season to ensure the bed moisture.	55-65 days	120-150 kg	Seeds should be soaked for 12 hours before sowing
Basal: Compost: 100 kg DAP: 2 kg Side dress: Compost: 50 kg Urea: 1 kg PS: 2 kg	Soil should be kept moist until the seeds have germinated	75-80 days	150-200 kg	Seeds should be soaked in water overnight before sowing
Basal: Compost: 100 kg DAP: 2 kg Side dress: Compost: 50 kg Urea: 1 kg DAP: 2 kg	Mulching should be done to ensure the bed from drying out, specially in the dry season. Soil should be kept moist until the seeds have germinated	It takes 90 days from sowing to harvest.	120-150 kg	Seeds should be soaked in water overnight before sowing
Basal: Compost: 100 kg DAP: 2 kg Side dress: Compost: 50 kg Urea: 1 kg PS: 2 kg	Soil should be kept moist until the seeds have germinated	80-90 days	150-200 kg	Seeds should be soaked in water overnight before sowing

Fruit/Tomato Type Vegetables

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Green Pepper	September-December	100 grams	1.5cm	4-6	Line to line: 40cm Plant to plant 25cm	Improved variety
Tomato	December-January	90-100 grams	1cm	4-5	Line to line: 50cm Plant to plant: 40cm	Pang pos havay
Eggplant	December-January	90-100 grams	1cm	4-6	Line to line: 50cm Plant to plant: 40cm	Trop veng Trop Pong Ko
Pimento Pepper	December-January	90-100 grams	1cm	4-6	Line to line: 45cm Plant to plant: 30cm	Improved variety
Chili Pepper	June-July November-January	90-100 grams	1cm	4-6	Line to line:45cm Plant to plant: 30cm	Improved variety
Tabasco Pepper	June-July	90-100 grams	1cm	4-5	Line to line: 45cm Plant to plant: 30cm	Improved variety

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 100 kg DAP: 2 kg Side dress: Compost: 50 kg Urea: 1 kg DAP: 3 kg	Mulching should be done to ensure the bed from drying out, specially in the dry season. Soil should be kept moist until the seeds have germinated	50-90 days	120-150 kg	Transplanting should be done when the seedling has 4-6 leaves
Basal: Compost: 100 kg DAP: 1 kg Side dress: Compost: 50 kg Super P: 2 kg PS: 3 kg	Mulching should be done to ensure the bed from drying out, specially in the dry season. Soil should be kept moist until the seeds have germinated	50-90 days	100-150 kg	Transplanting should be done when the seedling has 4-6 leaves
Basal: Compost: 100 kg DAP: 2 kg Side dress: Compost: 50 kg Urea: 1 kg DAP: 3 kg	Mulching should be done to ensure the bed from drying out, specially in the dry season. Soil should be kept moist until the seeds have germinated	50-90 days	120-150 kg	Transplanting should be done when the seedling has 4-6 leaves
Basal: Compost: 100 kg DAP: 1 kg Side dress: Compost: 50 kg Super P: 2 kg PS: 3 kg	Mulching should be done to ensure the bed from drying out, specially in the dry season. Soil should be kept moist until the seeds have germinated	50-90 days	120-150 kg	Transplanting should be done when the seedling has 4-6 leaves
Basal: Compost: 100 kg DAP: 1 kg Side dress: Compost: 50 kg Super P: 2 kg PS: 3 kg	Mulching should be done to ensure the bed from drying out, specially in the dry season. Soil should be kept moist until the seeds have germinated	50-90 days	120-150 kg	Transplanting should be done when the seedling has 4-6 leaves
Basal: Compost: 100 kg DAP: 1 kg Side dress: Compost: 50 kg Phosphate: 2 kg PS: 3 kg	Mulching should be done to ensure the bed from drying out, specially in the dry season. Soil should be kept moist until the seeds have germinated	50-90 days	120-150 kg	Transplanting should be done when the seedling has 4-6 leaves

Fruit/Tomato Type Vegetables (cont'd)

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Papaya	June -July	80 grams	2.5cm	6-7	Line to line: 2.50m Plant to plant: 2m	Lohong Lak
Bitter Eggplant	June-July	60grams	1cm	4-6	Line to line: 1m Plant to plant: 1m	Tropongong
Okra	June-July	100 grams	2cm	4-5	Line to line: 50cm Plant to plant: 40cm	Improved variety

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 300 kg	Mulching should be done to ensure the bed from drying out, specially in the dry season. Soil should be kept moist until the seeds have germinated	170 days	300 kg	Transplanting should be done when the seedling has 4-6 leaves
Basal: Compost: 150 kg DAP: 3 kg	The soil should be kept moist until the seeds have germinated Weeding should be done regularly	360-600 days	150 kg	It is a shade and drought tolerant plant.
Basal: Compost: 150 kg DAP: 3 kg Side dress: Compost: 50 kg 16.20.0 2 kg	The soil should be kept moist until the seeds have germinated Weeding should be done regularly	75 days	200 kg	Water requirement is medium.

Cucumber/Gourd/Trellis Type of Vegetables

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Wax Gourd	May-June	100 grams	2cm	4-5 days	Line to line: 2m Plant to plant: 2m	Tralach Srov Tralach plouk Tralacht noeun
Pumpkin	May-June December	2-3 seeds per pit	2cm	4-5 days	Line to line: 2.5m Plant to plant: 2m	Lpov Kdam Lpov Thom
Cucumber	May-June November-December	3-4 seeds per pit	2cm	4-5 days	Line to line: 1.50m Plant to plant: 1m	Trosak Phar Trosak Srov
Angled Loofh	May-June November-December	3-4 seeds per pit	2cm	4-5 days	Line to line: 1.5m Plant to plant: 1.5m	Son Dai
Bitter Gourd	June-July November-January	3-4 seeds per pit	3-4cm	5-7 days	Line to line: 1m Plant to plant: 60cm	Marash Khmer Marash youn
Sponge Gourd	May-June November-December	3-4 seeds per pit	4cm	4-5 days	Line to line: 1.5cm Plant to plant: 1.5cm	Ro Nong Veng Ro Nong Sral

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 150 kg 16.20.0: 3 kg	The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	75 days and some varieties 5 months	200 kg	Water requirement is medium
Basal: Compost: 150 kg 16.20.0 1 kg Side dress: Compost: 50 kg 15.15.15 2 kg 16.20.0 1 kg Urea 1 kg	The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	80-90 days	250 kg	Water requirement is medium
Basal: Compost: 150 kg 16.20.0 1 kg Side dress: Compost: 50 kg 15.15.15 2 kg 16.21.0 1 kg Urea 1 kg	The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	55-75 days and	150 kg	Water requirement is medium.
Basal: Compost: 150 kg 16.20.0 1 kg Side dress: Compost: 50 kg 15.15.15 2 kg 16.22.0 1 kg Urea 1 kg	Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	75-90 days and	200 kg	Water requirement is medium.
Basal: Compost: 150 kg 16.20.0 1 kg Side dress: Compost: 50 kg 15.15.15 2 kg 16.23.0 1 kg Urea 1 kg Side dress is done after 30 days from seed sowing.	Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	75-90 days and	200 kg	Water requirement is medium.
Basal: Compost: 150 kg 15.15.15 3 kg	Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. 10-15 days after sowing seeds, stakes should be installed	80-90 days and	200 kg	Water requirement is medium.

Cucumber/Gourd/Trellis Type of Vegetables (cont'd)

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Bottle Gourd	Any time of the year, but the best time is December-January	3-4 seeds per pit	4-5cm	4-5 days	Line to line: 4m Pit to pit: 2m	Klok veng Klok Tanap
Snake Gourd	December-January June-July	3-4 seeds per pit	3-4cm	4-5 days	Line to line: 2m Pit to pit: 2m	Improved variety
Watermelon	November-January	3-4 seeds per pit	3-4cm	4-6 days	Line to line: 1.5m Plant to plant: 1m	Sugar baby F1 water melon

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 150 kg 16.20.0 1 kg Side dress: Compost: 50 kg 15.15.15 2 kg 16.24.0 1 kg Urea 1 kg Side dress is done after 30 days from seed sowing.	Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	90-95 days	300 kg	Water requirement is medium.
Basal: Compost: 150 kg 16.20.0 1 kg Side dress: Compost: 50 kg 15.15.15 2 kg 16.24.0 1 kg Urea 1 kg Side dress is done after 30 days from seed sowing.	Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	75 days	150 kg	Water requirement is medium.
Basal: Compost: 150 kg 16.20.0 1 kg Side dress: Compost: 50 kg 15.15.15 2 kg 16.24.0 1 kg Urea 1 kg Side dress is done after 15 weeks and again after 35 days from seed sowing.	Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	75-90 days	150 kg	Water requirement is less. And also the mulching technique is required after transplantation in order to keep soil moist and prevent weed.

Legumes/Bean Type Vegetables

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Yard Long Bean	November-January	3-4 seeds per pit	3cm	2-3 days	Line to line: 60cm Plant to plant: 50cm	Sandigan KD2 Green pod Koahsing
Winged Bean	May-June	3-4 seeds per pit	4cm	3-6 days	Line to line: 1m Plant to plant: 1m	Popeay chrong
Hyacinth Bean	November-January May-July	3-4 seeds per pit	4-5cm	6-8 days	Line to line: 1m Plan to plant: 1m	Popeay Sbek
Mungbean	June	150 grams	2-3cm	4-6 days	Line to line: 30cm Plant to plant: 20cm	Improved variety

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: After 2 weeks old Compost: 50 kg 16.20.0: 1 kg 15.15.15: 1 kg 2nd Side dress: Before flowering 15.15.15 1 kg Compost: 30 kg	After 1 week, stakes should be installed. Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	55-70 days	150 - 200 kg	The seeds should be soaked for 12 hours before sowing. Water requirement is high in dry season.
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: After 2 weeks old Compost: 50 kg 16.20.0: 1 kg 15.15.15: 1 kg 2nd Side dress: Before flowering 15.15.15 1 kg Compost: 30 kg	After 1 week, stakes should be installed. Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	70-90 days	90 kg	The seeds should be soaked for 12 hours before sowing. It is a drought tolerant vegetable
Basal: Compost: 150 kg 16.16.0 2 kg	After 1 week, stakes should be installed. Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	55-70 days	150 kg	The seeds should be soaked for 12 hours before sowing. It is a drought tolerant vegetable
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: After 2 weeks old Compost: 50 kg 16.20.0: 1 kg 15.15.15: 1 kg 2nd Side dress: Before flowering 15.15.15 1 kg Compost: 30 kg	Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	60 - 80 days	60-70 kg	The seeds should be soaked for 12 hours before sowing. Water requirement is medium.

Legumes/Bean Type Vegetables (cont'd)

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Cowpea	May-June November-December	150 grams	2-3cm	3-5 days	Line to line: 30cm Plant to plant: 20cm	Improved variety
Snap Bean	June -July	120 grams	3-6cm	4-6 days	Line to line: 60cm Plant to plant: 40cm	Improved variety
Peanut	November-December	3-4 nuts per pit	3-4cm	4-5 days	Line to line: 40cm Plant to plant: 30cm	Improved variety
Soybean	June-July November-December	3-4 seeds per pit	3-4cm	3-4 days	Line to line: 40cm Plant to plant: 20cm	Improved variety

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: After 2 weeks old Compost: 50 kg 16.20.0: 1 kg 15.15.15: 1 kg 2nd Side dress: Before flowering 15.15.15 1 kg Compost: 30 kg	Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	55-70 days	50-60 kg	The seeds should be soaked for 12 hours before sowing. Water requirement is medium.
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: After 2 weeks old Compost: 50 kg 16.20.0: 1 kg 15.15.15: 1 kg 2nd Side dress: Before flowering 15.15.15 1 kg Compost: 30 kg	Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	65 days	40-50 kg	The seeds should be soaked for 12 hours before sowing. Water requirement is medium.
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: After 2 weeks old Compost: 50 kg 16.20.0: 1 kg 15.15.15: 1 kg 2nd Side dress: Before flowering 15.15.15 1 kg Compost: 30 kg	Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	65 days	40-60 kg	Water requirement is medium.
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: After 2 weeks old Compost: 50 kg 16.20.0: 1 kg 15.15.15: 1 kg 2nd Side dress: Before flowering 15.15.15 1 kg Compost: 30 kg	Thinning should be done after 1-2 weeks to make the plants not too dense. The soil should be kept moist until the seeds have germinated. Weeding should be done regularly	65 days	40-70 kg	Water requirement is medium.

Onion Type Vegetables

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Chinese Chives/Onion Stock	Can grow most of the year, but the best time is June -July and December	3-4 stems per pit	3-6cm	3days	Line to line : 13cm Plant to plant: 13cm	Improved
Bunching Onion	June -July November-December	3-4 stems per pit	3-6cm	3 days	Line to line: 13cm Plant to plant: 13cm	Improved
Shallot	November-December June-July	150 grams	6-8cm	4-5 days	Plant to plant: 13cm Line to line: 13cm	Improved
Onion	June-July	3-4 stems per pit	5cm	3 days	Line to line: 13cm Plant to plant: 13cm	Improved
Garlic Leak	December-January	3-4 bulks per pit	4-5cm	4-8 days	Line to line: 13cm Plant to plant: 13cm	Improved

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: after 2 weeks old Compost: 50 kg Urea: 1 kg 15.15.15: 1 kg 2nd Side dress:15 days before Harvest Urea 1 kg Compost: 30 kg	Mulching with rice straw should be done to keep the soil moist especially in the dry season. Weeding should be done regularly	45-50 days	150 kg	Water requirement is high in the dry season
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: after 2 weeks old Compost: 50 kg Urea: 1 kg 15.15.15: 1 kg 2nd Side dress:15 days before Harvest Urea 1 kg Compost: 30 kg	Mulching with rice straw should be done to keep the soil moist especially in the dry season. Weeding should be done regularly	45 days	150 kg	Water requirement is high in the dry season
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: after 2 weeks old Compost: 50 kg Urea: 1 kg 15.15.15: 1 kg 2nd Side dress:15 days before Harvest Urea 1 kg Compost: 30 kg	Mulching with rice straw should be done to keep the soil moist especially in the dry season. Weeding should be done regularly	75 days	70-80 kg	Water requirement is high in the dry season
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: after 2 weeks old Compost: 50 kg Urea: 1 kg 15.15.15: 1 kg 2nd Side dress:15 days before Harvest Urea 1 kg Compost: 30 kg	Mulching with rice straw should be done to keep the soil moist especially in the dry season. Weeding should be done regularly	45 days	150 kg	Water requirement is high in the dry season
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: after 2 weeks old Compost: 50 kg Urea: 1 kg 15.15.15: 1 kg 2nd Side dress:15 days before Harvest Urea 1 kg Compost: 30 kg	Mulching with rice straw should be done to keep the soil moist especially in the dry season. Weeding should be done regularly	65 days	150 kg	Water requirement is high in the dry season

Root Type Vegetables

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Arrow Root	June-July	3-4 plants per pit	8-10 cm	5-7 days	Line to line: 50cm Pit to pit: 40cm	Sakou sar
Taro Root	June-July	1-2 seedlings per pit	8-10 cm	grows right away	Line to line: 50cm Pit to pit: 40cm	Trav Sla Trav Tek
Cassava	June-July	2 cuttings per pit	10 cm	7-10 days	Line to line: 60cm Pit to pit: 50cm	Dam long Kraham
Sweet Potato	November-December May-June	2 cuttings per pit	5-8 cm	3-5d ays	Line to line: 10cm Plant to plant: 10cm	Damlong Chvea Damlong sar
Carrot	November-December	100 grams	1.5 cm	3-5 days	Line to line: 15cm Plant to plant: 15cm	Improved
Radish	November-December	150 grams	1-2 cm	3-5 days	Line to line: 10cm Plant to plant: 8cm	Improved
Chinese Radish	November-December	150 grams	1-2 cm	3-5 days	Line to line: 10cm Plant to plant: 8cm	Improved

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 150 kg 15.15.15: 3 kg	Weeding should be done regularly	120-150 days	150 kg	Water requirement is medium to low.
Basal: Compost: 150 kg 15.15.15: 3 kg	Weeding should be done regularly	120-150 days	150 kg	Water requirement is medium to low.
Basal: Compost: 150 kg 15.15.15: 3 kg	Weeding should be done regularly	130-150 days	160 kg	Water requirement is medium to low.
Basal: Compost: 150 kg 15.15.15: 3 kg	Weeding should be done regularly	75-90 days	160 - 200 kg	Water requirement is medium to low.
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: after 2 weeks old Compost: 50 kg Urea: 1 kg 15.15.15: 1 kg 2nd Side dress: 25 days before Harvest 15.15.15 1 kg Compost: 30 kg	Mulching with rice straw should be done to keep the soil moiste specially in the dry season. Weeding should be done regularly. Make the bed higher in rainy season	75 days	150 kg	Water requirement is medium to low.
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: after 2 weeks old Compost: 50 kg Urea: 1 kg 15.15.15: 1 kg 2nd Side dress: 25 days before Harvest 15.15.15 1 kg Compost: 30 kg	Mulching with rice straw should be done to keep the soil moist especially in the dry season. Weeding should be done regularly. Make the bed higher in rainy season	65 days	150 kg	Water requirement is medium to low.
Basal: Compost: 150 kg 16.16.0 2 kg 1st Side dress: after 2 weeks old Compost: 50 kg Urea: 1 kg 15.15.15: 1 kg 2nd Side dress: 25 days before Harvest 15.15.15 1 kg	Mulching with rice straw should be done to keep the soil moist especially in the dry season. Weeding should be done regularly. Make the bed higher in rainy season	75 days	150 kg	Water requirement is medium to low.

Edible Leaves / Flowers

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Sesbania Javanica	June-July Direct sowing	70 grams	2-3 cm	4-8 days	Line to line: 60cm Plant to plant: 40cm	Snor
Sesbania Grandiflora	June -July Direct sowing	70 grams	2-3 cm	4-8d ays	Line to line: 60cm Plant to plant: 40cm	Improved
Ipil Ipil *Leuceana*	June-July Direct sowing	150 grams	2-3 cm	4-5 days	Plant to plant: 40cm Line to line: 40cm	Improved
Neem	June-July	200 grams	4-5 cm	4-6 days	Line to line: 60cm Pit to pit: 40cm	Improved
Drumstick	June-July	200 grams	4-5 cm	4-6 days	Plant to plant: 60cm Line to line: 40cm	Improved
Sauropus Anddrogynus	June-July	150 grams	4-5 cm	4-5 days	Plant to plant: 40cm Line to line: 30cm	Improved

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 100 kg	Soil should be kept moist until the seeds are germinated. Pruning should be done every 3-4 months	2-5 years		Water requirement is less
Basal: Compost: 100 kg	Soil should be kept moist until the seeds are germinated. Pruning should be done regularly	2-5 years		Water requirement is less
Basal: Compost: 100 kg	Soil should be kept moist until the seeds are germinated. Pruning should be done regularly	1-5 years		Water requirement is less
Basal: Compost: 100 kg	Soil should be kept moist until the seeds are germinated. Pruning should be done regularly	1-5 years		Drought tolerance Water requirement is less
Basal: Compost: 100 kg	Soil should be kept moist until the seeds are germinated. Pruning should be done regularly	1-3 years		Drought tolerance, but not water logged tree. Water requirement is less
Basal: Compost: 100 kg	Soil should be kept moist until the seeds are germinated. Pruning should be done regularly	1-3 years		Drought tolerance, but not water logged tree. Water requirement is less

Spices and Herbs

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Coleus	Year-round	2 cuttings per pit	4-5 cm	3-4 days	Line to line: 5cm Pit to pit: 5cm	Improved
Basil	Round the year	2 cuttings per pit	4-5 cm	3-4 days	Line to line: 10cm Plant to plant: 10cm	Chi neang vorng
Coriander	Round the year	80 grams	1-2cm	3-4 days	Line to line: 8cm Plant to plant: 8cm	Improved
Ginger	June-July	2-3 plants per pit	8 cm	7-10 days	Plant to plant: 70cm Line to line: 60cm	Improved
Turmeric	June-July	2-3 plants per pit	8 cm	7-10 days	Line to line: 50cm Plant to plant: 35cm	Improved
Swamp Leaf	July-August	3-4 plants per pit	5 cm	3 days	Plant to plant: 30cm Line to line : 30cm	Volunteer Plant
Lemon Grass	June-July	3-4 plants per pit	6 cm	7-10 days	Line to line: 30cm Plant to plant: 30cm	Improved
Japanese Pepper Mint	Round the year	3-4 cutings per pit	5 cm	5 days	Line to line: 5cm Plant to plant: 5cm	Improved
Mint Leaf	Round the year	3-4 cutings per pit	5 cm	5 days	Line to line: 5cm Plant to plant: 5cm	Improved

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 100 kg 15.15.15 2 kg	Soil should be kept moist until the seeds are germinated. Pruning should be done regularly	45 days	30-40 kg	Water requirement is high in the dry season
Basal: Compost: 100 kg 15.15.15 2 kg	Soil should be kept moisture until the seeds are germinated. Pruning should be done regularly	45 days	30-40 kg	Water requirement is high in the dry season
Basal: Compost: 100 kg 15.15.15 2 kg	Soil should be kept moisture until the seeds are germinated. Pruning should be done regularly	45 days	40-50 kg	Water requirement is high in the dry season
Basal: Compost: 100 kg 15.15.15 3 kg	Weeding should be done regularly	6-7 months	120 kg	Water requirement is medium to low.
Basal: Compost: 150 kg 15.15.15 3 kg	Weeding should be done regularly	6-7 months	120 kg	Water requirement is medium to low.
Basal: Compost: 150 kg 15.15.15 1.5 kg	Weeding should be done regularly	36 days	120 kg	Water requirement is very high
Basal: Compost: 150 kg 15.15.15 3 kg	Weeding should be done regularly	55-90 months	120 kg	Water requirement is medium to low.
Basal: Compost: 150 kg 15.15.15 1.5 kg	Weeding should be done regularly	36 days	120 kg	Water requirement is very high
Basal: Compost: 150 kg 15.15.15 1.5 kg	Weeding should be done regularly	36 days	120 kg	Water requirement is very high

Yam Type Vegetables

Name of Vegetable	Sowing/ Planting Time	Seed Rate /Are or 100 sq.m	Depth to Sow Seed	Days needed to Germinate	Spacing in cm	Variety
Winged Yam (white)	June-July	1-2 tubers per pit	8-10 cm	5-10 days	Pit to pit: 1m Line to line: 1m	Damlong pos
Winged Yam (purple)	June-July	1-2 tubers per pit	8-10 cm	5-10 days	Pit to pit: 1m Line to line: 1m	Damlong cheaman
Potato Yam	Jun-July	1-2 tubers per pit	8-10 cm	5-10 days	Line to line: 8cm Plant to plant: 8cm	Local
Tiger Paw Yam	June-July	1-2 tubers per pit	8-10 cm	5-10 days	Line to line: 8cm Plant to plant: 8cm	Damlong Diakla

Amount of fertilizer per are with time of application	Intercultural Operation	Crop Duration Harvest	Production/ Are in kg	Remarks
Basal: Compost: 150 kg Side dress: 15.15.15 1.5 kg	Weeding should be done regularly	90-120 months	120 kg	Water requirement is very high
Basal: Compost: 150 kg Side dress: 15.15.15 1.5 kg	Weeding should be done regularly	90-120 months	120 kg	Water requirement is very high
Basal: Compost: 150 kg Side dress: 15.15.15 1.5 kg	Weeding should be done regularly	90-120 months	120 kg	Water requirement is medium
Basal: Compost: 150 kg Side dress: 15.15.15 1.5 kg	Weeding should be done regularly	90-120 months	120 kg	Water requirement is medium

APPENDIX III

PRODUCTION PRACTICES: How to grow fruits and trees

PRODUCTION PRACTICES RELATING TO DIFFERENT FRUITS AND TREES

There are many fruits that can be grown in the home garden. Some are of short duration and start fruiting within one to two years after transplanting the sapling. Some fruit trees needs more time for fruiting. In the home garden, both short- and long- duration fruit trees should be planted. Different spaces in the homestead can be used for planting fruit trees. Most of the fruits are seasonal in Cambodia, but there are also some fruits like papaya that can be harvested throughout the year. Emphasis should be on varieties of fruits that are rich in micronutrients and that can easily be grown.

Different fruits can be grown in the home garden throughout the year. The practices described in Appendix III should be followed to achieve successful production and optimum yield.

Tree Sapling Production

Fruits

Name of fruit	Time for seed collection	Time for sowing in polybag/ bed	Remarks
Papaya	November - January	November – January	Propagation can only be done through seed. It is better to sow the seed within one month after collection. Seed should be soaked for 24 hours with water before sowing. It cannot tolerate water logged condition water before sowing.
Mango	April - May	May - June 5-6 days after collection of seed	Propagation can be done through both seed and grafting. For better quality, grafting should be done. At the VMG, grafting should be done for promotion of good vareties.
Jackfruit	May - June	May - June	Propagation can be done only through seed. Germination capability lasts a very short time. Sowing should be done within 7 days after seed collection.
Guava	September - October	September - October	Propagation can be done through both seed & grafting. For better quality, grafting should be done.
Star Gooseberry	Any time but best is in November - December	Any time but best is in November - December	Propagation can be only done through seed. It is better to sow the seed within one week after collection.
Eggfruit	May - June	May - June	Propagation can only be done through seed. It is better to sow the seed within one week after collection.
Lemon	Only grafting	Best time for grafting is May - June	Propagation can be done through both from seed and grafting. For better quality grafting can be done
Coconut	May - June	May - June	Propagation can be done only through seed/fruit.
Olive	November - December	November - December	Propagation can be done only through seed.
Pomelo	*May - June*	*May - June*	*Propagation can be done both from seed and grafting. However, for a better quality, grafting can be done.*

Name of fruit	Time for seed collection	Time for sowing in polybag/ bed	Remarks
Logan	Mach - April	May - June	Propagation can be done both from seed and grafting but grafting is preferred for farmers .
Pineapple	May - June	May - June	Propagation can bring only through bulking.
Pomegranate	July - August	June - July	Propagation can be done both from seed and grafting. But, seed propagation is recommended.
Cashew	March - April	June - July	Propagation can be done only from seed.
Custard Apple	June - July	June - July	Propagation can be done only from seed.
Tamarind	January - February	January - February	Propagation mostly is done by seed in Cambodia. The seed should be soaked in water overnight.
Wood Apple	January - February	January - February	Propagation can be done both from seed and grafting.
Rose Apple	May - June	June - July	Propagation is done only from grafting.
Milk Fruit	February - March	May - June	Propagation can be done from seed only.
Pring	May-June	May-June	Propagation can be done only from seed.
Jujube	December-January	December - January (sowing seed) grafting June-July	Propagation can be done from both seed and grafting.
Tkov	January-	June-July	It is voluntear from tree.
Kom Ping Reach	August - June	August - June	Grafting is best for Cambodia.
Carambola	June - July	June - July	Grafting is the best for Cambodia.
Mokak	August - June	August - June	Propagation can be done from seed and grafting.

Tree Sapling Production

Trees

Name of tress	Time for seed collection	Time for sowing in polybag/ bed	Remarks
Neem	March - April	April - May (Immediate after seed collection preferably within month)	It is better to sow the seed immediately after collection. Seed should be soaked for 24 hours with water before sowing. 10 - 15 days is required for germination.
Leuceana/Ipil Ipil	November - December	November - December	After collecting the seeds from the fruit they should dry in the sun. Seeds should be soaked for 24 hours with water before sowing. 8 - 10 days is required for germination.
Tamarind	September - November	September - November	It is better to sow the seed immediately after collection. Seed should be soaked for 24 hours with water before sowing. 10 - 15 days required for germination.
Acacia	December - January	December - January	Seeds should be soaked for 24 hours with water before sowing. It needs about 10 days to germinate.
Raintree	December - January	December- January	It is better to sow the seeds immediately after collection. Seeds should be soaked in water for 12 - 24 hours before sowing.
Acacia Pennata	January - February	January - February	It is better to sow the seed immediately after collection. Seeds should be soaked in water for 12 - 24 hours before sowing.
Sauropus androgynus	January - February	January - February	The seeds should be seek of 24 hours before sowing.
Sesbenia grandiflora	March - April	March - April	The seeds should be soaked for 12 hours before sowing.
Erythrina Indica	March-April	May-June	The seed should be soak edof 12 hours before sowing.

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