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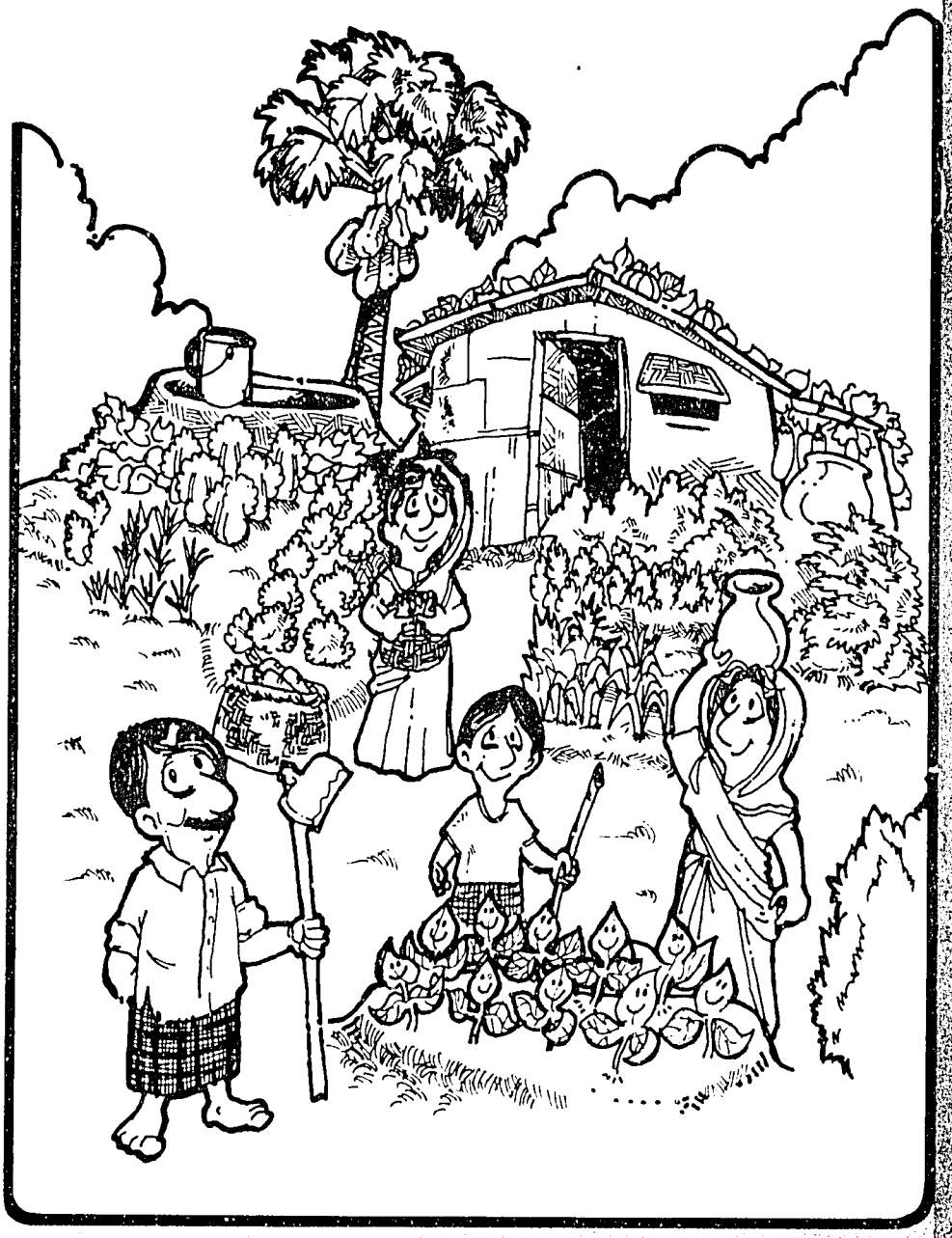
HOME GARDENING IN SOUTH ASIA

THE COMPLETE HANDBOOK



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LIST OF ACRONYMS

AVRDC	Asian Vegetable Research and Development Center
BADC	Bangladesh Agricultural Development Corporation
CEC	Cation Exchange Capacity
FAO	Food and Agriculture Organization of the United Nations
GO	Governmental Organization
MP	Murate of Potash
NGO	Non-Governmental Organization
NNBP	National Nutritional Blindness Prevalence Survey
NPK	Nitrogen, Phosphorus, Potassium
TSP	Triple Super Phosphate
UNICEF	United Nations Children's Fund
WHO	World Health Organization
NOVIB	Netherlands Organization for International Development Cooperation

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Our special thanks to Rachel Kabir for translating our technical jargon into easily understandable English and to Barbara Bochnovic (HKI/NY) for her inputs towards design and layout and for coming through with all the New York based formalities.

The Authors

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FOREWORD

In developing countries such as Bangladesh, India and Pakistan, the lack of vitamin A in the diet is a contributing factor to the continuing high levels of infant and child morbidity and mortality. Inadequate vitamin A intake not only causes night blindness, keratomalacia and permanent blindness, but has also been shown to increase the vulnerability of children to severe infections and premature death. In Bangladesh alone, it is estimated that more than a million children under six years of age suffer from some degree of xerophthalmia and more than 30,000 children are blinded each year due to severe vitamin A deficiency. Individuals, communities and nations suffer long-term social and economic consequences as a result of vitamin A deficiency.

There is an urgent need to identify and promote achievable and sustainable strategies to help alleviate vitamin A deficiency. The best method of improving vitamin A status is through food-based approaches; either food fortifications or changing the dietary patterns of the most vulnerable groups.

The Office of Nutrition of the United States Agency for International Development (USAID) supports the food-based approach to eradicate vitamin A deficiency, recognizing that truly sustainable programs often require more than the transfer of technology and resources. For instance, home gardening projects often require the provision of technical skills and resources to promote increased production of local micronutrient-rich foods, combined with messages that stimulate increased consumption of such foods. With a grant from USAID/Washington, Helen Keller International (HKI), Bangladesh has initiated a home gardening and nutrition promotion/social marketing project in several districts throughout Bangladesh.

This handbook, the first publication of the project reflects HKI/Bangladesh's experience working with local NGOs over the past several years and discusses the issues and technicalities involved in making a home gardening and social marketing/nutrition promotion program successful. The detailed illustrations and step-by-step instructions make it useful for field workers and program managers as well as farmers and other vegetable producers. We hope that the "lessons learned" presented in this handbook are helpful to others in their efforts to eradicate vitamin A deficiency.

Frances R. Davidson

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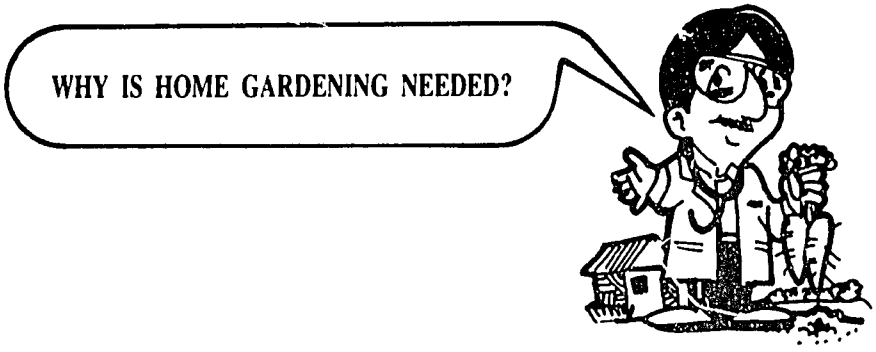
Development Center
Office of Nutrition, USAID

1 BACKGROUND



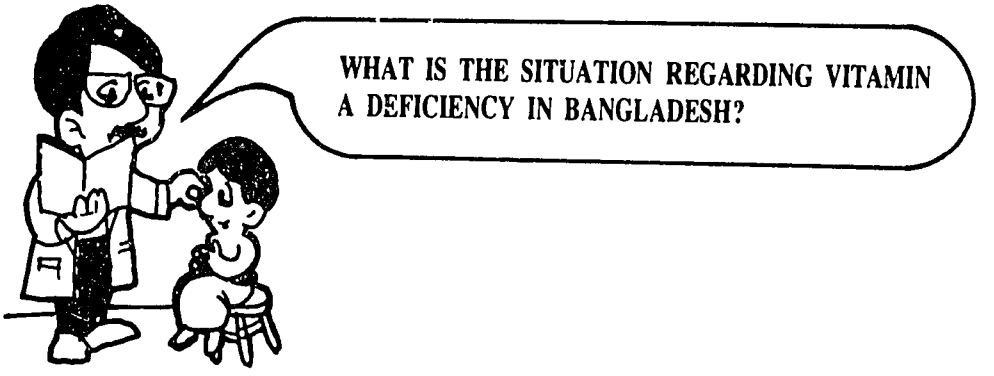
The National Nutrition Survey of 1981-82 revealed that in Bangladesh the average intake of vitamin A was only 38% of the recommended daily amount, and that 88% of families consumed even less than that. That survey also revealed that vegetables were the main source of vitamin A in the diet. The National Nutritional Blindness Prevalence Survey (NNBP) conducted in 1982-83 found that only 13% of children under 5 ate vegetables. The main responses for not eating vegetables was stated to be either non-availability or high cost. The reasons for the low consumption of vitamin A would therefore seem to be not only poor availability of vitamin A rich vegetables, but also the prohibitive cost of those vegetables which are available. In addition, a general lack of awareness about the importance of vitamin A in the diet adds further constraints to vegetable intake.

Bangladesh does not produce enough vegetables to meet the needs of the population: it is estimated that local production meets only 25% of total requirements. Therefore, it follows that vegetable production falls far short of meeting the optimum nutritional need. The present daily consumption is about 30 gm per person although the average adult requires at least 200 gm.

About 10% of the 14 million homes in Bangladesh have an average area of 810 square meters. There is considerable fallow land around the homes which can be used for vegetable production. By establishing a home garden, a marginal or poor family can grow enough vegetables for its consumption and also be left with a surplus to sell at the local market for generating additional family income. Experiments conducted in Thailand and Taiwan by the Asian Vegetable Research Development Center

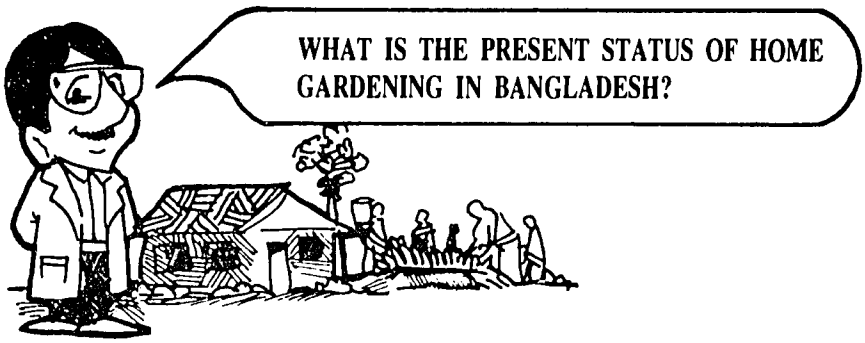
(AVRDC) have shown that it is possible for small gardens to produce enough foods rich in vitamin A (among other nutrients) to meet the family's requirements. The NNBP found that familes with home gardens were less at risk of xerophthalmia and other problems associated with vitamin A deficiency.

In the long term, home gardening can play a vital role in the prevention of nutritional blindness in Bangladesh. It is also a familiar, traditional concept to people in the rural areas of Bangladesh.



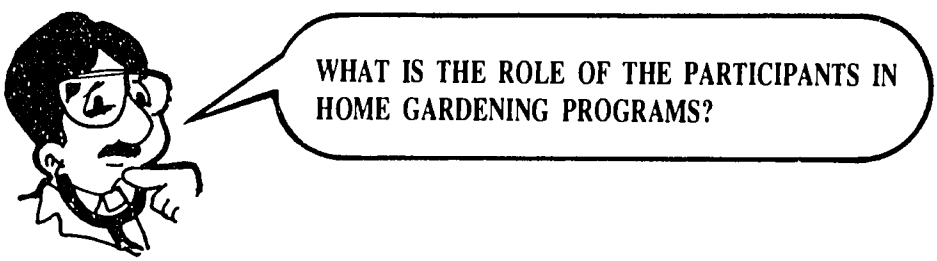
In Bangladesh, the prevalence of night blindness due to vitamin A deficiency is 3.2%, which is well above the World Health Organization (WHO) criteria for a major public health problem. More than a million children have visible signs of vitamin A deficiency and about half a million children under 6 are suffering from nightblindness. 30,000 children go blind every year and almost half of them die within a year of becoming blind. Moreover, a child deficient in vitamin A faces higher risks of morbidity and mortality than a healthy child. One of the primary causes of the high level of vitamin A deficiency is the low intake of vegetables.

The United Nations World Summit for Children and the WHO/UNICEF conference on "Ending Hidden Hunger" called for a reduction in child blindness, morbidity and mortality by the worldwide control or elimination of vitamin A deficiency.



There are much higher levels of production and consumption of cereal crops (mainly rice) than of horticultural crops (vegetables and fruit) in Bangladesh. Despite the opportunities for home gardening, home production remains a low priority in agricultural development.

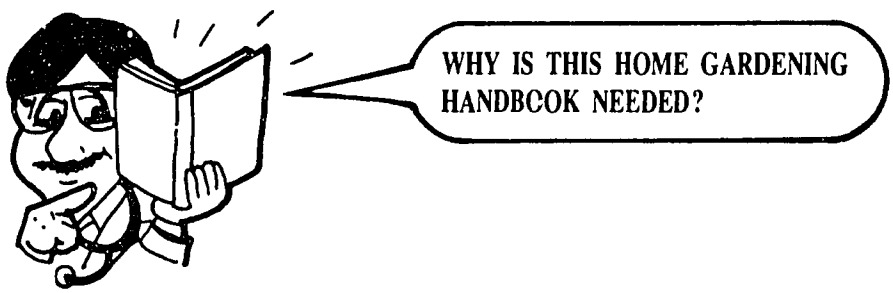
A number of Governmental Organizations (GOs) and Non-Governmental Organizations (NGOs) are already encouraging the development of home gardening in some parts of the country. However, coverage of high-risk areas is thin and patchy. Around 100 organizations are presently involved in some way in home gardening activities. Twenty of these organizations are working on different aspects of home gardening management. Some organizations are providing training in home gardening and nutrition/health education and promoting low-cost inputs. Most organizations encourage the participation of women.



Planners and program managers have various approaches to home gardening promotion. This handbook is based on the knowledge that in order to develop suitable and adaptable technology, community knowledge as well as scientific knowledge is essential. The handbook recognizes that the home gardeners are the ultimate decision makers. Scientific knowledge and experiments should be used according to the needs of home gardeners and their ability to apply such knowledge.

A successful home gardening program should be implemented across the board, involving managers, extension workers/agents and community members. To allow for the proper transfer of technology at different

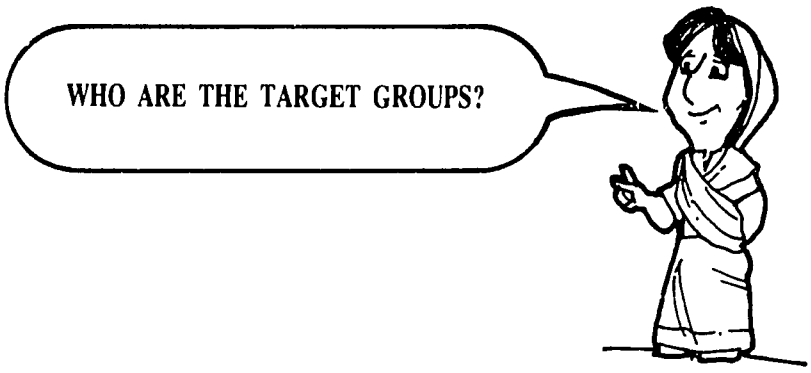
levels, the handbook is targetted at the various levels in a home gardening project. Experience gained from different home gardening projects, rather than rigid principles, was used in developing this handbook. It is intended to be a flexible tool for home gardening practice, which can be adapted to local situations.



A number of organizations, with differing objectives, are working in the field of home gardening. Some are focusing not on vitamin A but on other issues such as income generation, credit programs or social activities. Different levels of field staff are working in this area. Those who are involved in transferring technology at different levels will understand the need to implement successful home gardening programs.

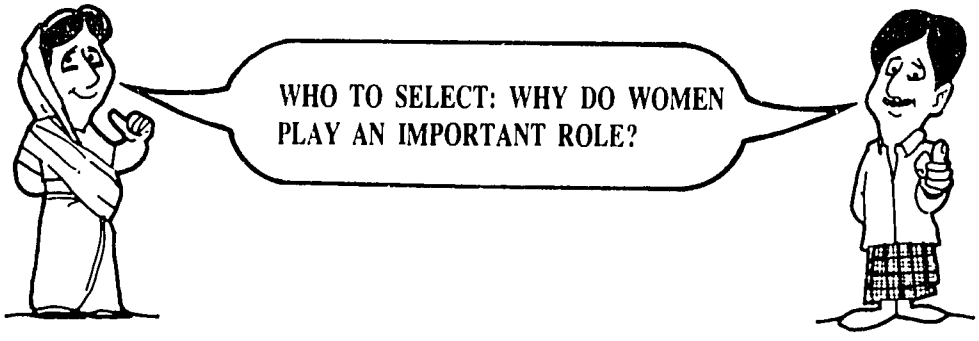
This book is based primarily on the lessons which Helen Keller International Bangladesh (HKI) has learned from its experience in different home gardening projects. It attempts to cover the important aspects and basic requirements of home gardening.

2 TARGETING



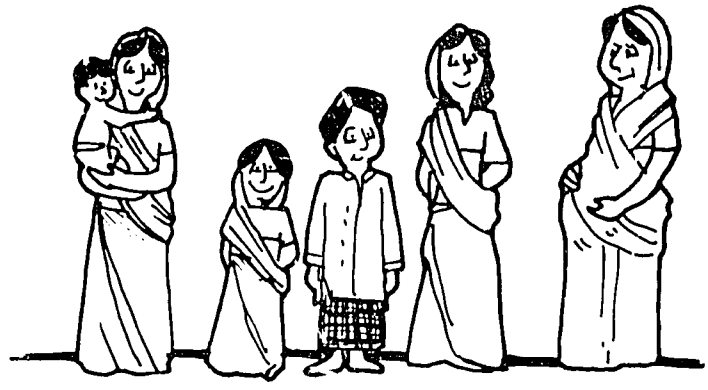
The most recent National Nutrition Survey indicated that about 59% of rural families were deficient in calories, 60% were protein deficient and 81% were calcium and vitamin A deficient. In general, the situation appears to be worse for lower income groups. Although the soil and climate are suitable for growing a wide variety of vegetables and fruit, per capita annual production of fruit declined from 30 kg in 1950 to only 16 kg in 1983. The per capita annual production of vegetables also declined (from 21 kg to 13 kg) during the same period.

To meet the vegetables and fruit requirements of the poor population, it is necessary to organize them into groups for vegetable and fruit production in the home. These groups must be taught how to obtain nutritious food from their immediate surroundings through small home gardening programs. Those who are particularly vulnerable to vitamin A deficiency, for example pregnant and lactating women, infants and children, should be the primary targets of the programs.



Home gardening programs should encourage the involvement of women. Women can play an important role in managing home gardens for vegetable

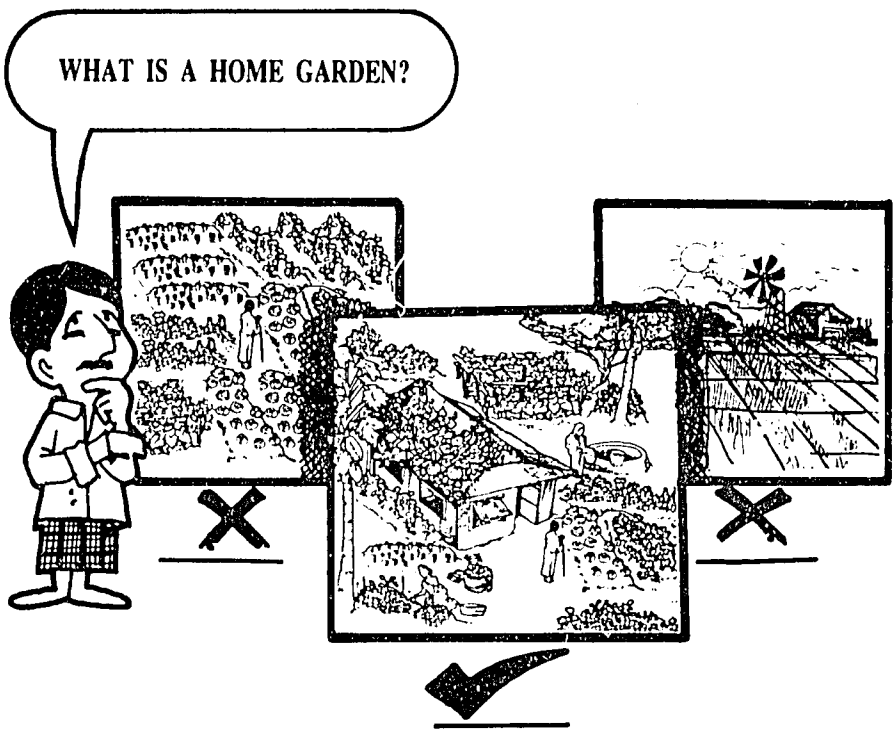
production. Limited management is required, making it possible to combine maintenance of the garden with other household chores. Home garden management involves many different activities which include preparing the land, sowing, planting, fertilizing, weeding, thinning, irrigating, draining, harvesting and producing seeds. Apart from land preparation, all these tasks are relatively quick and unstrenuous and can easily be done by women.



Women are primarily responsible for household food preparation. If a woman becomes involved in home gardening, it will inevitably increase her involvement in family nutrition which in turn will increase the likelihood of the family members most vulnerable to vitamin A deficiency benefiting from the availability of garden produce.

In Bangladesh, rural poor women are unemployed for most of the year because they have little opportunity to go outside the home to find work. Involving them in the production of vegetables is a good way of making use of their available time and skills. Women can also supplement the family income by selling surplus produce at the local market. Experience has shown that home gardeners use income obtained from the sale of vegetables mainly to buy food. Income from the home garden thus goes towards improving the welfare and nutritional status of the family.

3 INTRODUCTION TO HOME GARDENING

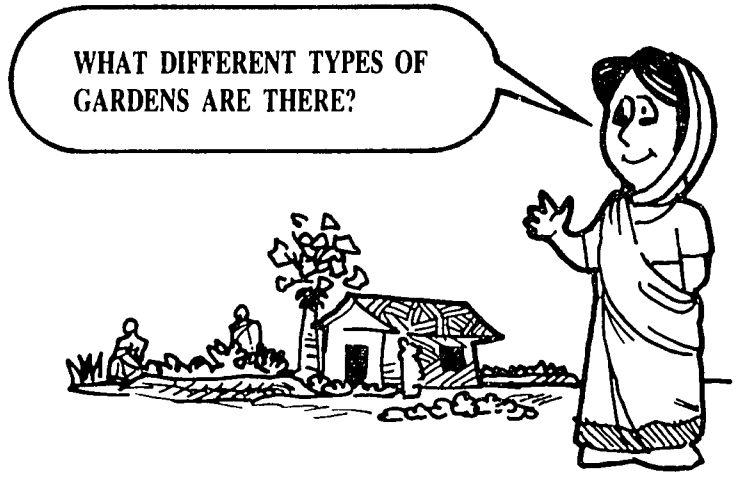


A home garden is an area around the home where different vegetables and fruit are grown throughout the year to meet family nutritional requirements. This activity exists in different parts of the world under such names as home garden, kitchen garden, door yard garden and back yard garden. The basic function of all these gardens is the same.

The essential characteristics of a home garden are:

- Proximity to the home.
- Small plot size (scattered or fixed).
- Cultivation of different varieties of vegetables and fruits.
- Cultivation throughout the year.
- Production primarily for consumption.
- Management by members of household (wife, husband, children).
- Use of low-cost inputs.
- Use of indigenous varieties; reducing dependence on exotic or imported varieties.

If home gardening is to succeed, it is important to consider the socio-economic and cultural norms of the target community in addition to the technical aspects. In the case of technology, home gardening is likely to be more successful if local practices and methods are incorporated.

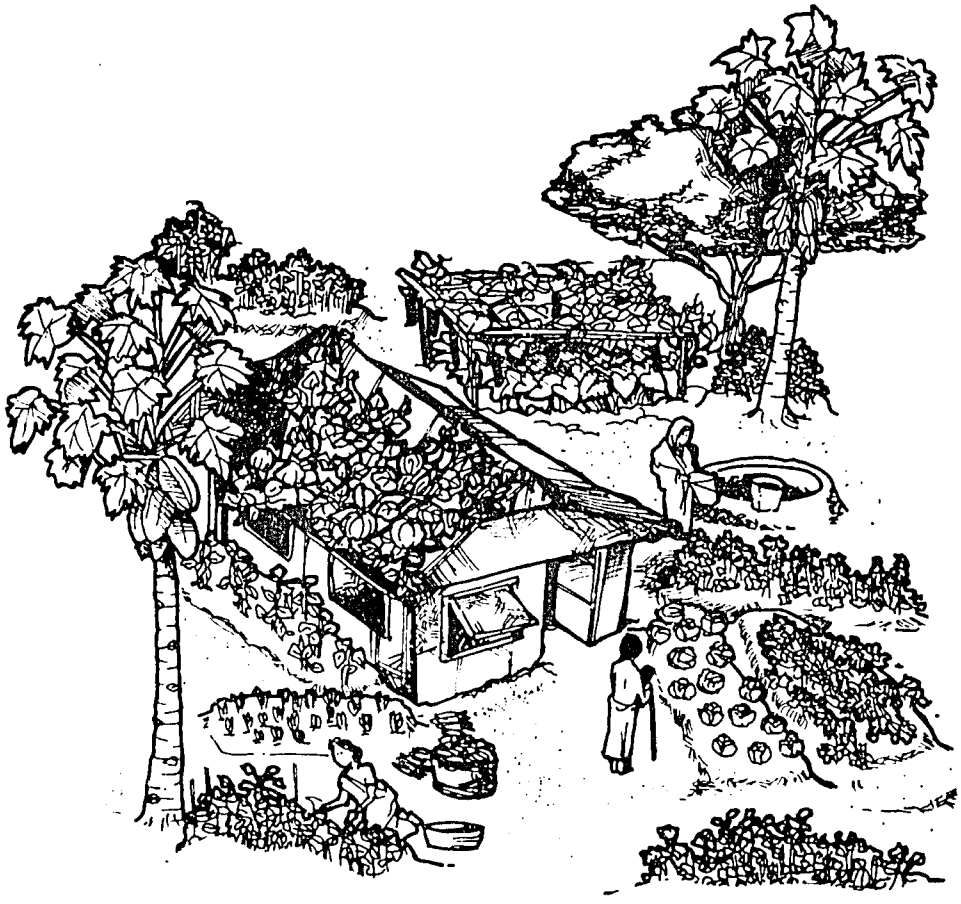


There are two main types of home gardens: fixed and scattered. In a fixed garden the land is compact. It can be divided into different sections and beds prepared as necessary. A scattered garden consists of plots in different areas.

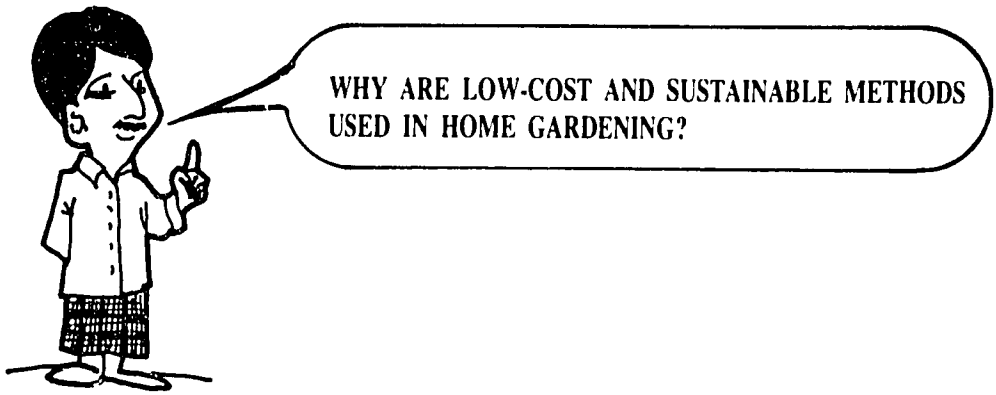
Many families do not have a fixed piece of land; they have various small areas of land around the home. The use of these small areas to grow different varieties of vegetables constitutes a scattered garden. Scattered gardens are more familiar than fixed gardens to the landless and marginal population.

Different areas around the home have different characteristics: wet near the ringwells and tubewells, less moist or dry by the roadside, shady under the trees, low land and high land with good sunlight. These areas can be used to grow different types of vegetables, thus ensuring a varied supply of vegetables throughout the year. Some vegetables, such as mint, helencha and black arum leaves, can be grown near the ringwells and tubewells. Certain fruit vegetables such as tomato, eggplant and okra require full sunlight and can accordingly be grown in areas exposed to sunlight. Other types of vegetables such as climbers (gourds), drought -resistant vegetables (legumes and kangkong) and shade-tolerant vegetables

(lal shak, data shak and other leafy vegetables) can be grown in areas close to the house, by the roadside, and under the shade of other plants respectively.

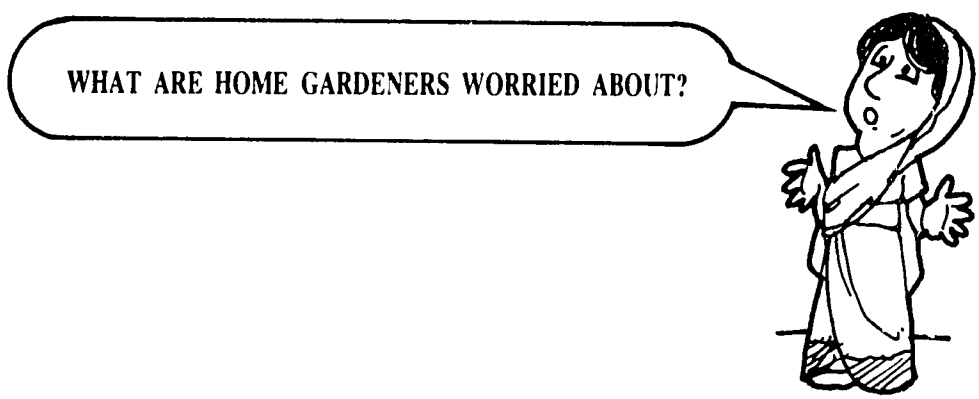


A Typical Home Garden

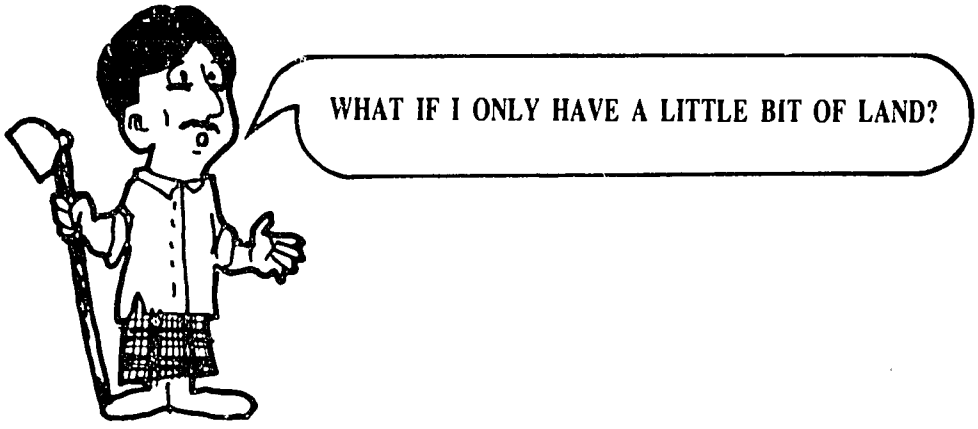


Experience and studies indicate that in Bangladesh about 40% of rural families traditionally grow vegetables. Most of this cultivation, however, is seasonal or occasional. The main reasons why home gardening is not practiced to a greater extent are problems relating to inputs such as seeds, seedlings and fertilizer, and lack of motivation or awareness on the part of the rural population. Some of these problems can be solved with suitable, locally adaptable, low-cost and sustainable technology.

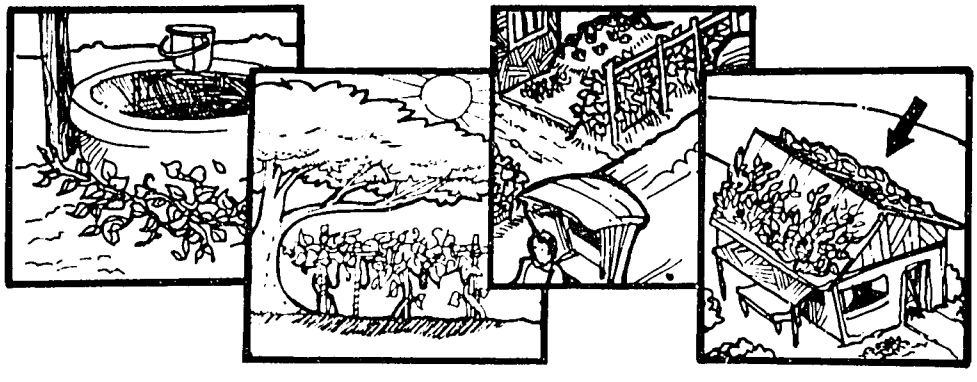
This handbook provides information on low-cost methods such as composting, improving soil fertility by the use of locally available resources, small-scale seed production and non-chemical methods of pest and disease control. If it can help home gardeners to adapt low-cost and sustainable methods to their own needs, they will be more interested in cultivating vegetables throughout the year.

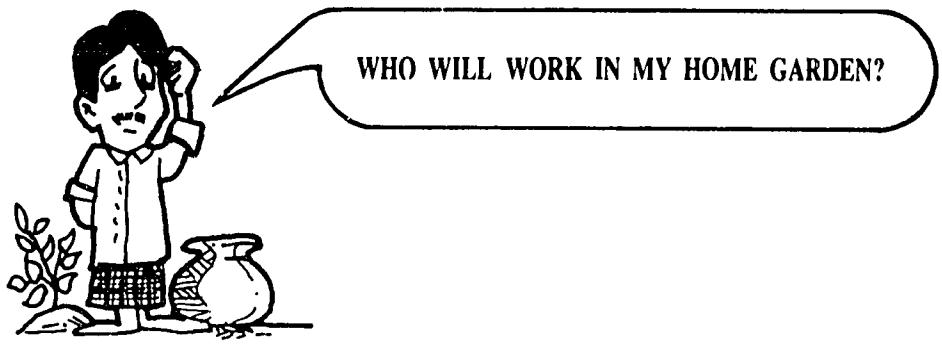


Many people believe that home gardening is difficult because of the need for sufficient land, time and capital. However, anyone interested in trying home gardening, can easily overcome these problems.

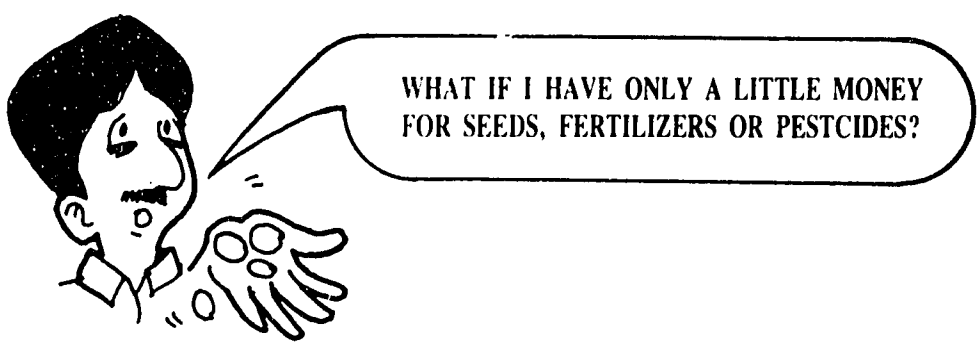


Vegetable cultivation for family consumption does not require either a large area or a fixed area of land. Even a very small amount of land around the house (including the roof) can make a good garden. The soil and climate in Bangladesh are suitable for a wide range of vegetables and fruits. If all the land around the home is properly used, it is possible to have a flourishing garden throughout the year. Numerous vegetables can be grown around the home. Some vegetables such as mint, helencha and balck arum can be grown near the ringwells or tubewells. Shade-loving vegetables such as sweet potato, amaranth and taro can be grown in shady places. Gourd-type vegetables can be grown near the home on the roof or on a trellis. Sweet potatos and kangkong can be grown by the roadside.





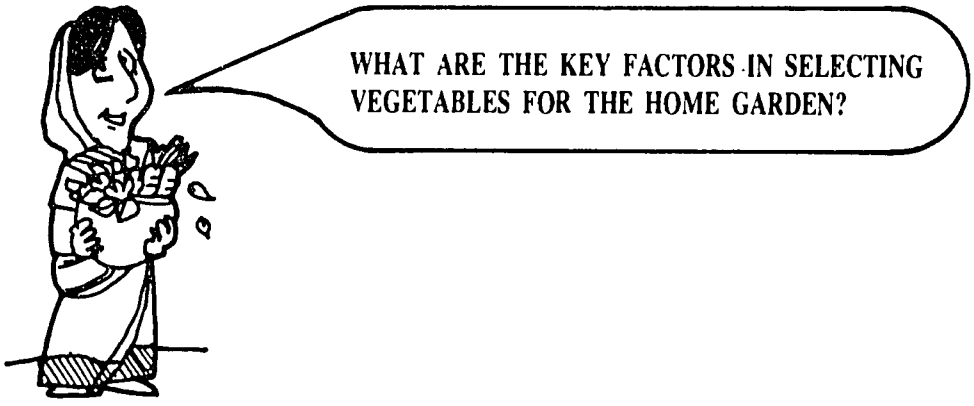
In rural areas the population consists mostly of poor, landless people who work mainly outside the home as farmers, share croppers and day laborers. A home garden requires some management including land/pit preparation, sowing/planting, weeding and composting. The amount of time spent in the garden will depend on its size, although continuous and hard labor is not required. The work of managing the garden can be done by individual family members at different times of the day.



Inputs (such as seeds, seedlings, fertilizers and pesticides) are important elements in vegetable production. It is difficult for landless and marginal

families to afford such high cost inputs. A good vegetable garden can be maintained using low-cost inputs and technology such as compost, local fencing materials or live fencing and biological/mechanical/cultural methods of pest control. Many types of vegetable seeds can be produced locally in the garden. It is also possible to produce a large number of good local varieties of vegetables such as bati shak, china shak, radish and kangkong.

Therefore it is possible to have a successful home garden without significant inputs of land, labor, time or money.



The following points need to be considered when planning a home garden:

Household Choice

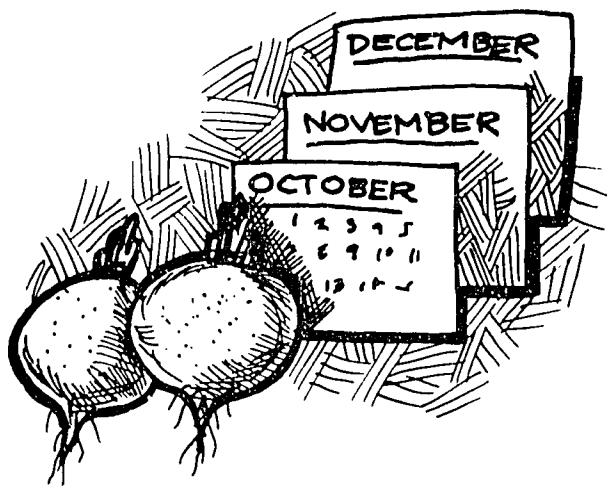
The choice of vegetables for consumption differs from area to area, community to community and household to household. Choice is frequently influenced by individual tastes, culture, locality and other factors.

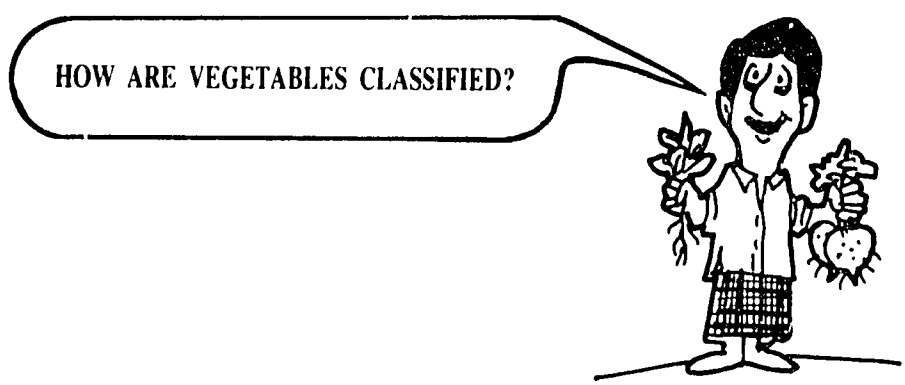
Availability of Resources

The choice of particular vegetables depends mainly on the climate and soil of a given area: certain vegetables grow very easily in some areas but not in others. The selection of crops should be made on the basis of garden size and family choice.

Remember these important points when making the selection.

- Select crops that require minimum outlay are low-risk and give maximum output.
- Give sufficient importance to indigenous varieties as they are technically and culturally feasible.
- Choose many different varieties to reduce the risk of crop loss in different seasons and to ensure better consumption.





There are more than 60 different varieties of vegetables in Bangladesh. It is useful for home gardeners to be familiar with the different categories

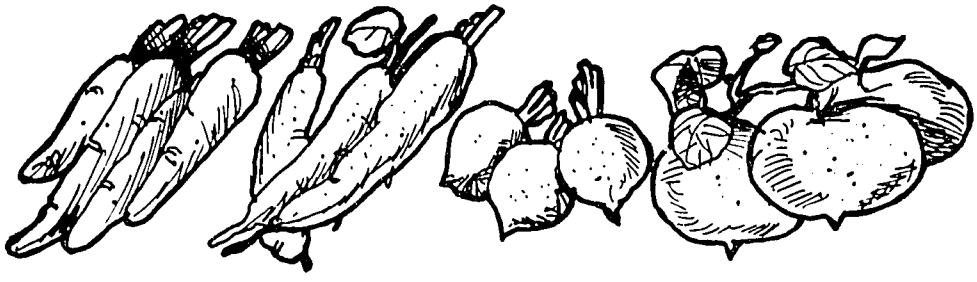
of vegetables. There are many different methods of classification; the one adopted in this handbook is one which household gardeners, extension workers and community leaders can easily understand. This will facilitate the discussion of production practices relating to these different categories of vegetables.

Leafy Vegetables

Red amaranth, green amaranth, spinach, indian spinach, kangkong, bati shak, china shak, jute leaves, mint, helencha, coriander leaves, lettuce, black arum leaves, botua, napa/lapha shak.

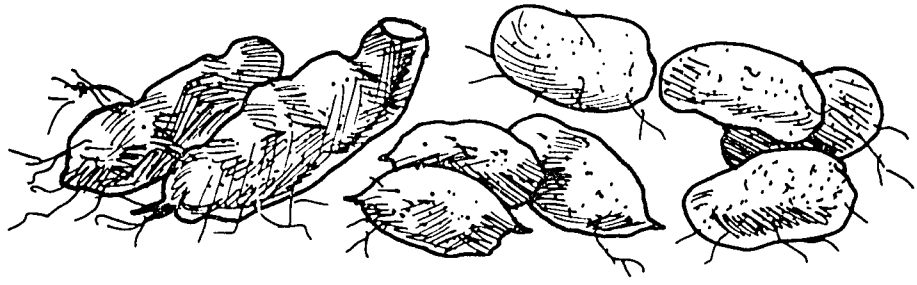
Root Vegetables

Radish, carrot, beet, turnip.



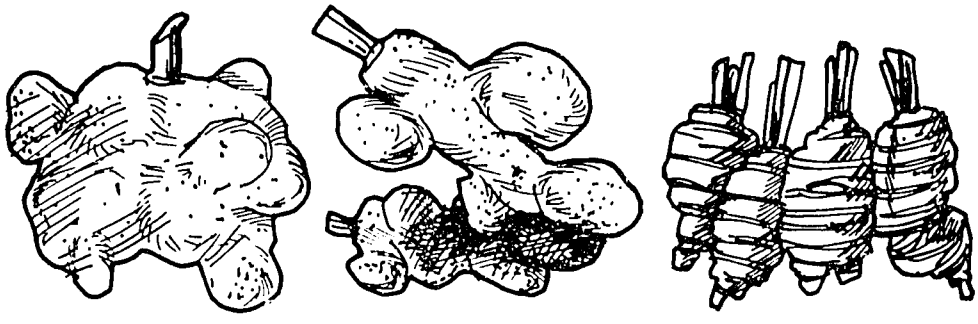
Tubers

Potato, sweet potato, ground patato, yam bean/potato bean.



Taro/Arum (Kochu)

Elephant yam (ole kochu), taro/arum tubers (mukhi kochu), giant taro (man kochu), coco yam (doodh kochu), dasheen (panchumukhi kochu).

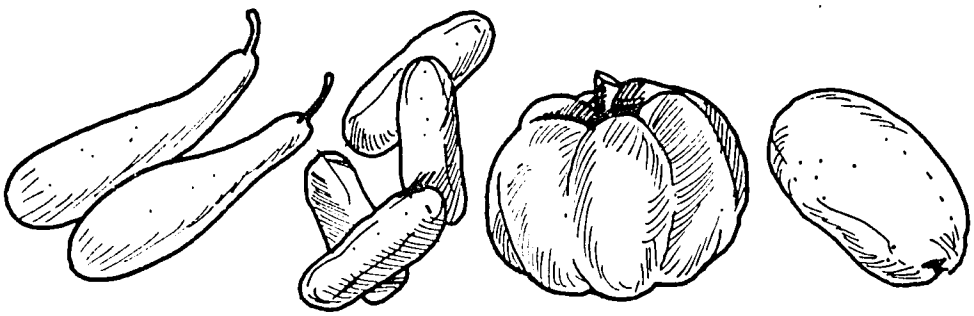


Fruit Vegetables

Eggplant, tomato, okra, papaya.

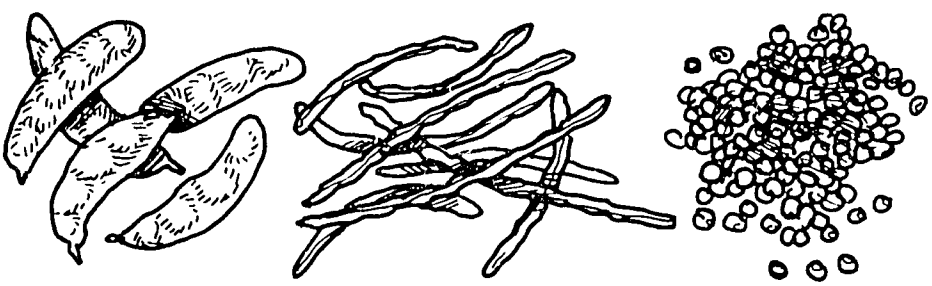
Gourd Vegetables

Sweet gourd/pumpkin, bottle gourd, ash gourd, squash, bitter gourd, snake gourd, ridge gourd (jhinga), sponge gourd (dhoondol), pointed gourd (palwal), teasel gourd (kakrol), cucumber.



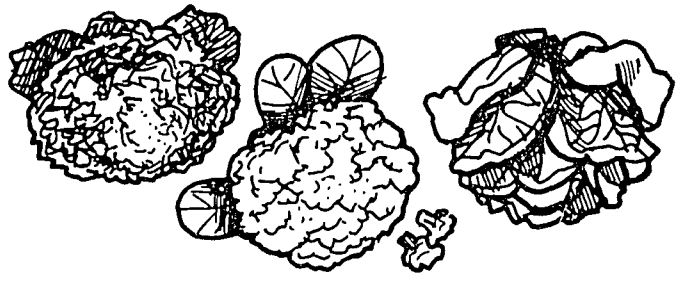
Bean Vegetables

Country bean, yard long bean, french bean, soybean, garden pea/field pea (motor shooti).

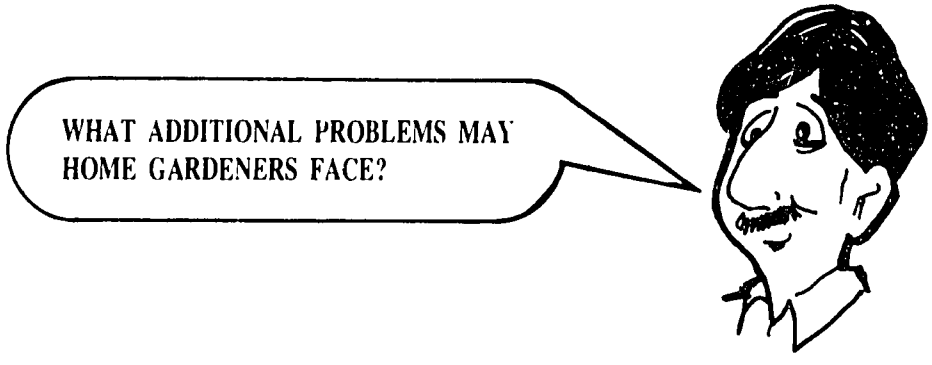


Cole Vegetables (Kopi-type)

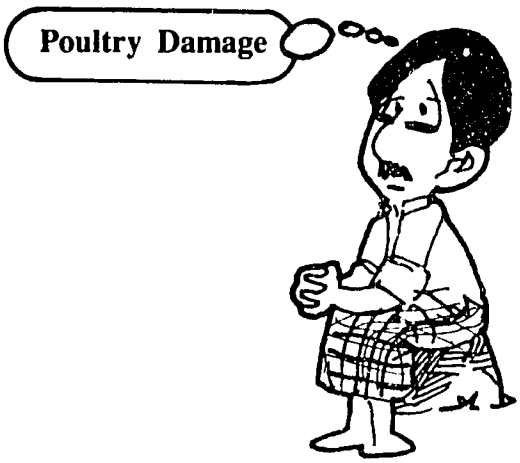
Cabbage, cauliflower, kohlrabi/knolkohl, chinese cabbage, broccoli.



See also:
Appendix I for "Crop Calendar for Different Vegetables and Fruit" and
Appendix II for "Table of Production Practices Relating to Different Vegetables"



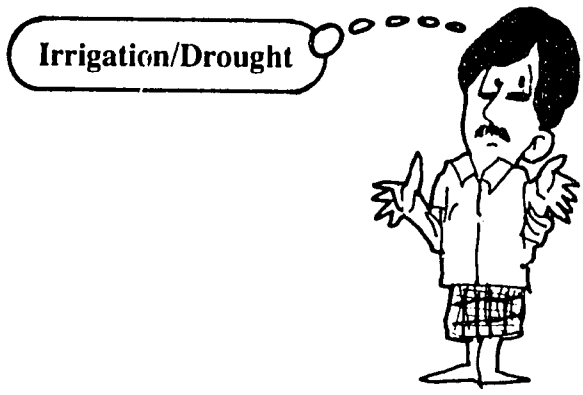
Landless and marginal families have to face problems and constraints in the cultivation of vegetables other than those of a technical nature. Some common problems are poultry damage, irrigation/drought and floods.



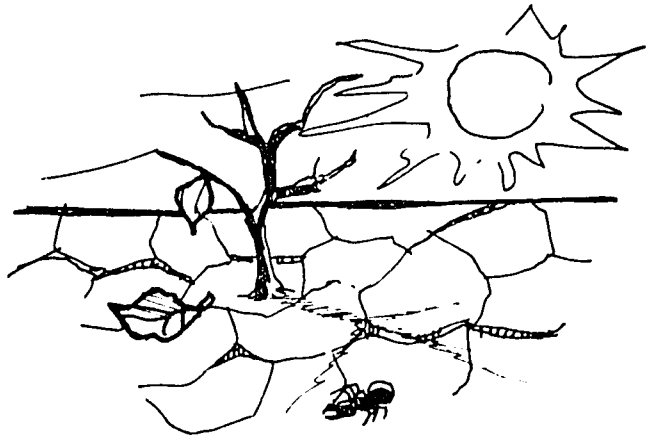
In poor households chickens are sometimes kept, mainly to earn some additional income. Many home gardens have no fencing, which creates problems for the cultivation of vegetables because the chickens are inclined to destroy the beds where the vegetable seeds have been sowed.

There are two solutions to this problem. First, the garden can be fenced off. Household gardeners cannot afford conventionsl fencing materials, so low-cost live fencing should be used instead. Certain local plants such as red gram (arohor), hedge plants, epil epil, and koroi make good live fences.

Another way to solve the problem is to prevent the chickens from entering the vegetable garden. This can be achieved by motivating the farmers through group discussion to control their chickens, especially before the plants have emerged.



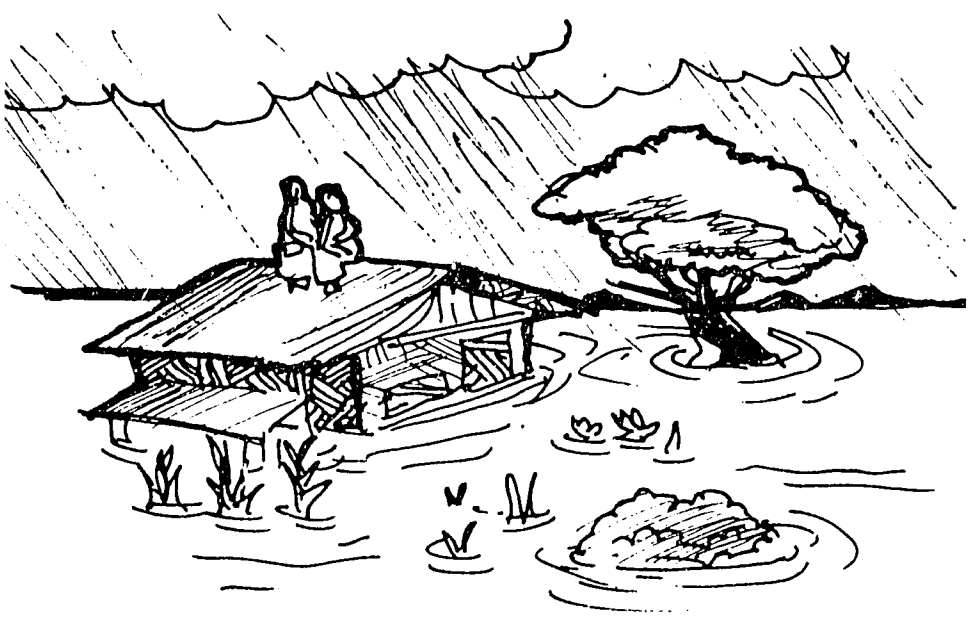
The irrigation of vegetables throughout the year is difficult for many households. There is a limited number of tubewells in rural areas and those which do exist are usually a long way from the home. Ringwells are the main source of water for most of the target groups in home gardening programs. During the hottest and driest time of the year rain can be scarce or non-existent. This can result in the underground water level going below the capacity of the ringwells. Sometimes even supplementary sources of water for irrigation such as rivers, ponds and beels dry up. This kind of drought can seriously hamper vegetable production.



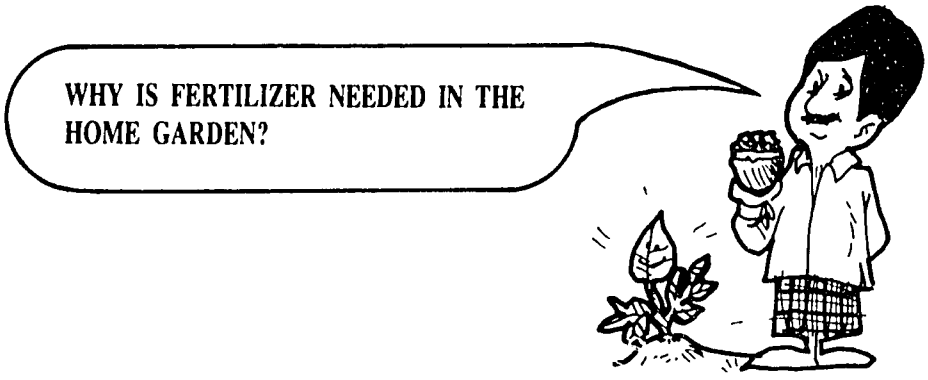
A number of measures can be taken to combat this problem. As far as irrigation is concerned, efforts should be made to grow crops requiring less irrigation. The most important time for irrigation should also be identified. As for the problem of drought, covering the plant with materials such as water hyacinth and banana leaves can be used to provide moisture

to the crops. Drought-resistant crops such as sweet potato and kangkong can also be grown. In addition, measures directed at maintaining soil moisture can be taken including the use of more organic matter in the soil, and mulching with locally available materials such as straw and leaves.

Bangladesh is a flood-prone country. Every year heavy rain causes floods that can seriously damage home gardens. We cannot control floods but we can take steps to minimize the damages they cause. Some simple suggestions are to grow flood-resistant crops such as kangkong, to establish better drainage systems and to use a system of raised beds in the garden.

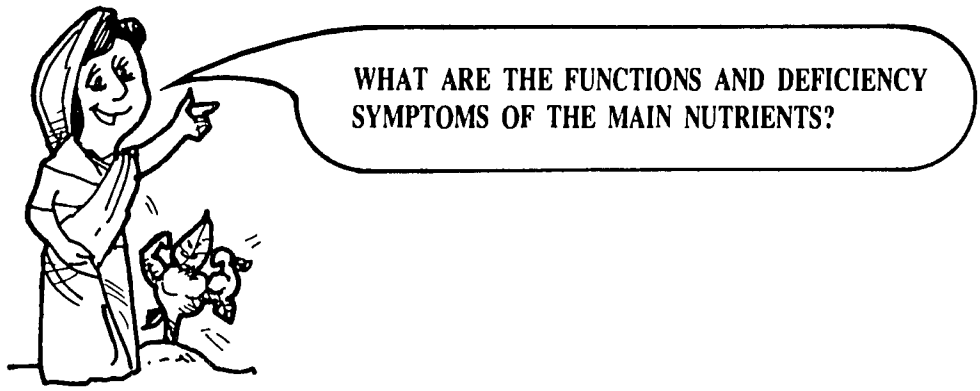


4 FERTILIZER MANAGEMENT



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: only some species require all of them. Generally, leafy vegetables need more nitrogen (N), flower and fruit vegetables need more phosphorus (P) and root vegetables need more potassium (K). In Bangladesh, the soil is frequently deficient in nitrogen, phosphorus and potassium (NPK). Fertilizers commonly used to remedy these deficiencies are Urea for Nitrogen deficiency, Triple Super Phosphate (TSP) for Phosphorus deficiency and Murate of Potash (MP) for Potassium deficiency. Sulfur (S) and Zinc (Zn) fertilizers are also being used to obtain the maximum benefit from NPK fertilizers.

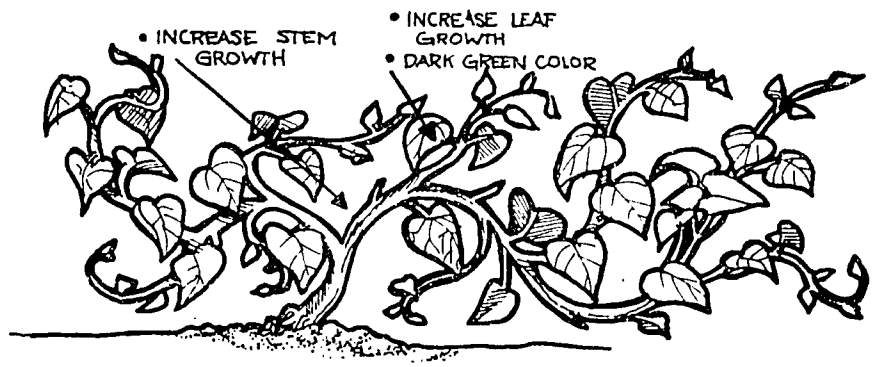
In order to grow healthy vegetables it is necessary to understand the functions of the main nutrients and their deficiency symptoms.



Nitrogen

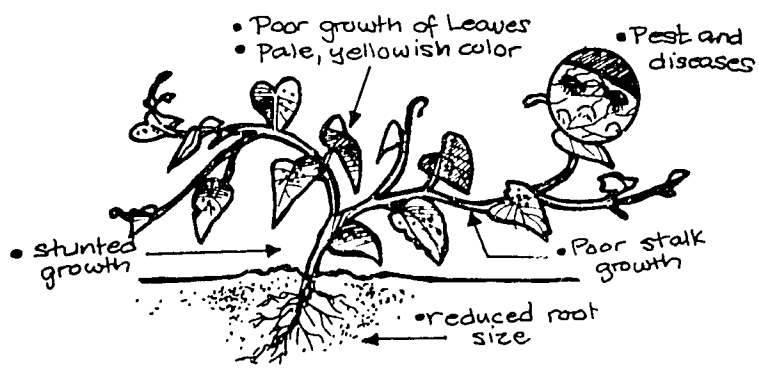
Functions

- Increases leaf and stem growth and gives dark green color to plants.
- Regulates the use of phosphorus and potassium fertilizer.
- Makes plants less susceptible to attack by pest and diseases.
- Increases the protein content of some foods and feed crops.



Deficiency Symptoms

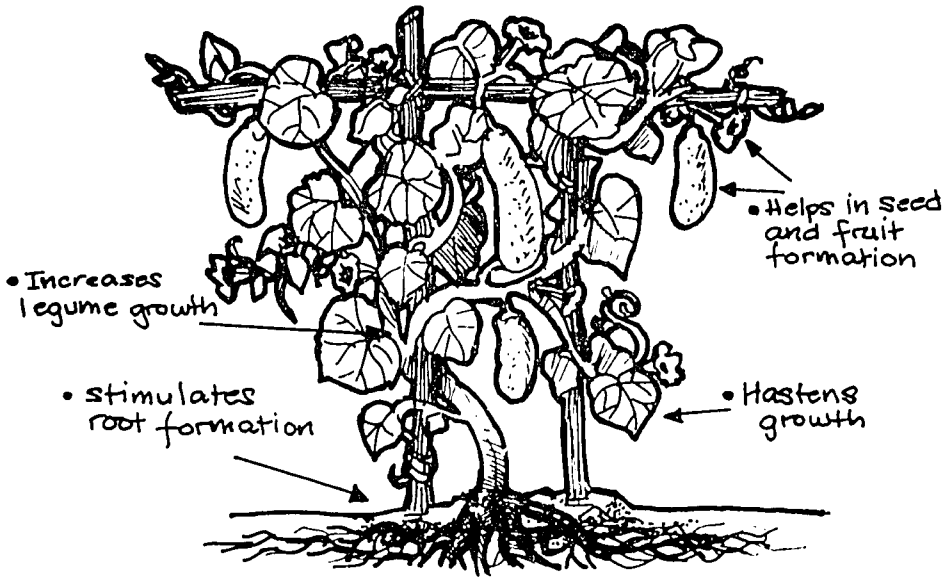
- Leaves become pale green and then turn yellow.
- There is poor growth and development of leaves, stalks and branches resulting in stunting.
- Roots, shoots and fruits are smaller.



Phosphorus

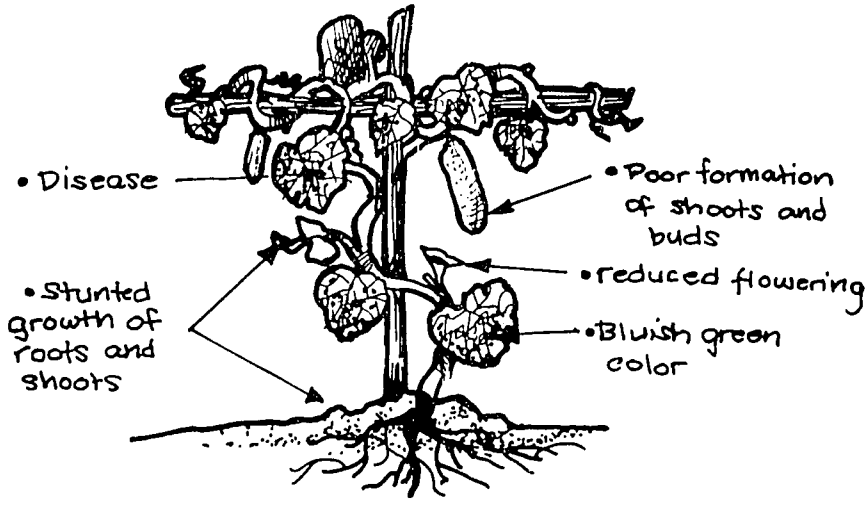
Functions

- Makes plants more drought-resistant and hardy.
- Hastens maturity.
- Helps seed and fruit formation.
- Increases legume growth and helps legume nodule formation.
- Stimulates root formation.



Deficiency Symptoms

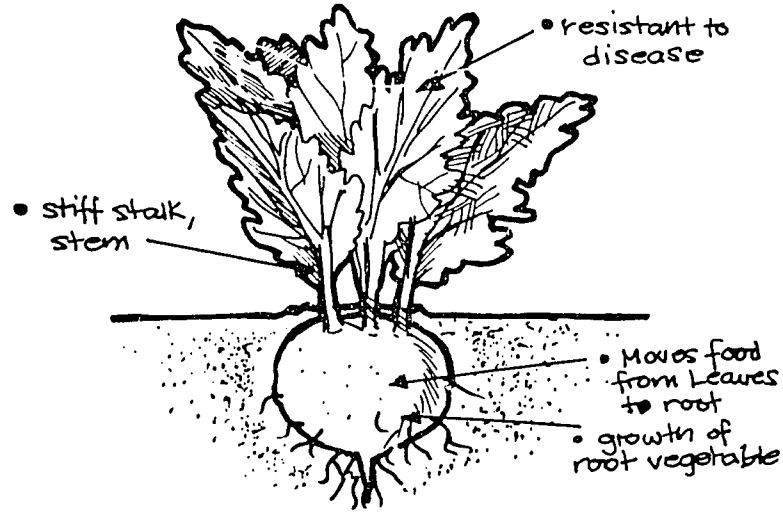
- Growth of shoots and roots is stunted.
- There is poor formation of lateral shoots and buds.
- Flowering is reduced and bud and leaf opening is delayed.
- Resistance to disease decreases.
- A bluish-green color is visible on the leaf surface.



Potassium

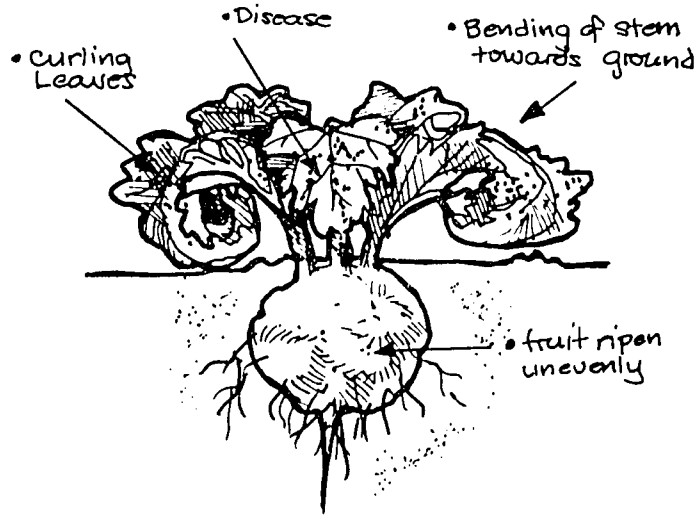
Functions

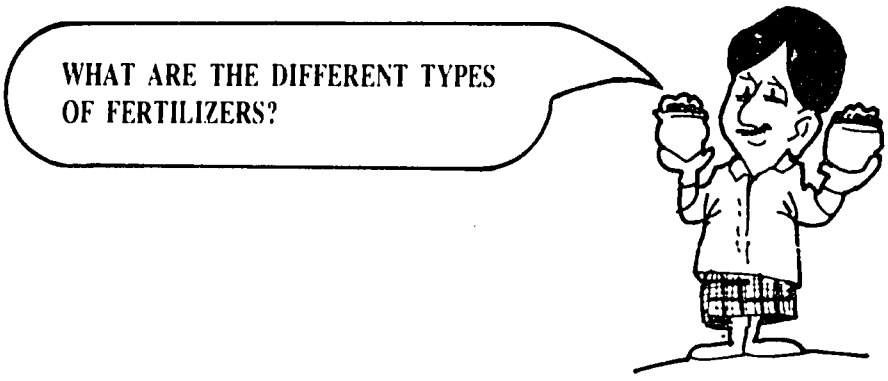
- Increases the resistance of plants to disease.
- Produces stiff stalks and stems thus reducing waterlogging.
- Helps to move food from leaves to root.
- Creates winter hardiness and drought resistance.
- Increases grain plumpness and growth of fruit and root vegetables.



Deficiency Symptoms

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



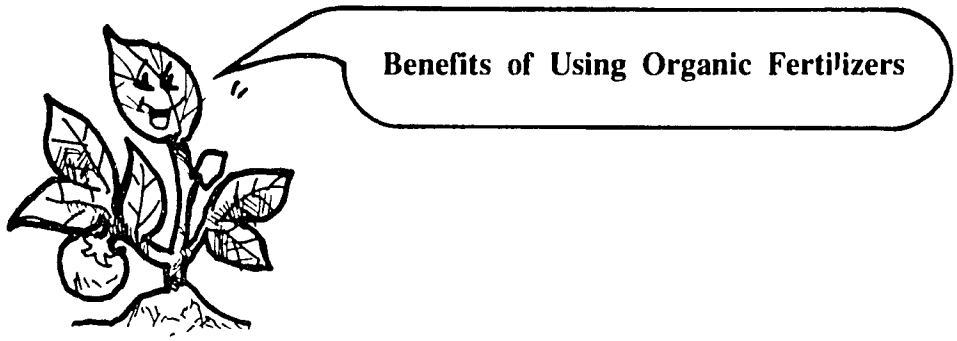


Fertilizers supply a combination of food elements to help with plant growth and development. There are two basic types of fertilizers: Organic and inorganic.

I. Organic Fertilizers

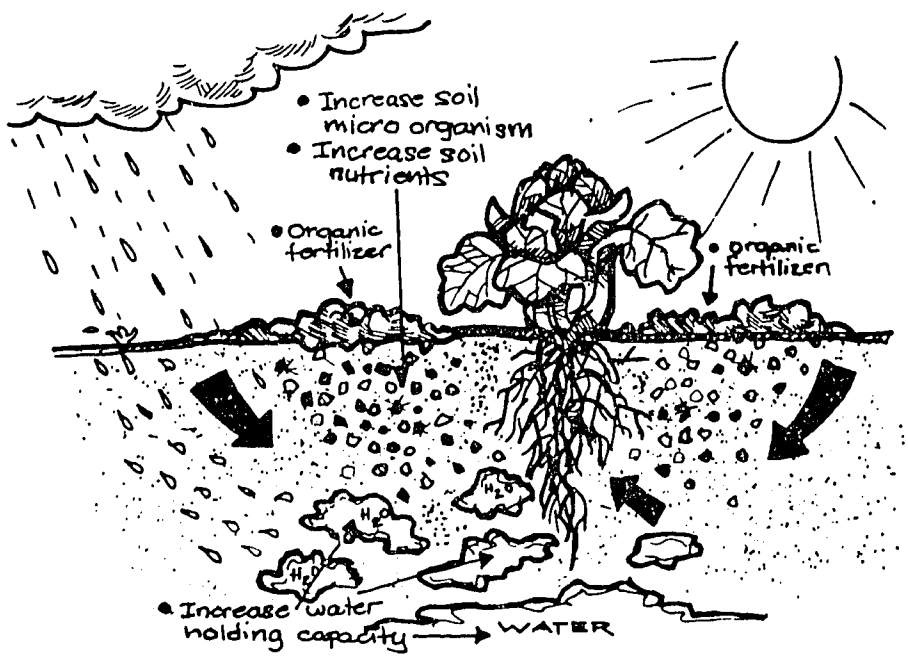
Organic fertilizers are used to maintain soil fertility and increase production. The most common sources of organic fertilizers are animal manure and urine, crop by-products and the remains of dead plants.

Organic fertilizers contain all the nutrients needed by 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.

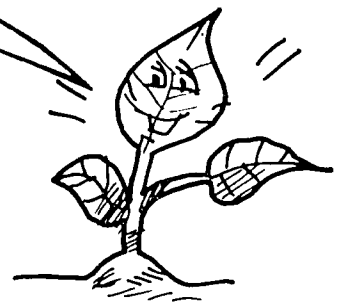


The benefits of using organic fertilizers can be summarized as follows:

1. Increases soil fertility.
2. Supplies nitrogen, phosphorus, potassium and other nutrients.
3. Increases the water-holding capacity of the soil which is important for sandy or coarse loamy soil where rainfall is marginal.
4. Increases the population and activity of soil micro-organisms which help to improve nitrogen fertility status.
5. Improves the Cation Exchange Capacity (CEC) of the soil which becomes a storehouse of plant nutrients.
6. Prevents compactions, reduces soil erosion and supplies more oxygen to the root.
7. Improves the physical condition of the soil, making it easier to cultivate.
8. Helps in the effective use of chemical fertilizers. Can also help to reduce the amount of chemical fertilizers required.
9. Reduces the toxicity of the soil caused by the use of chemical fertilizers and insecticides.



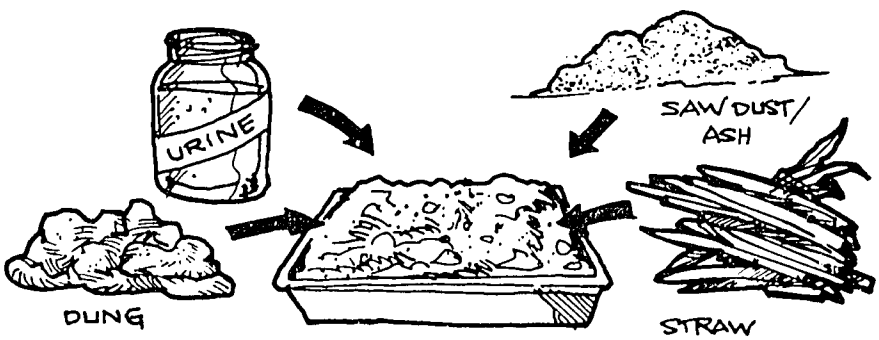
Types of Organic Fertilizers



Four main types of organic fertilizers are available in Bangladesh.

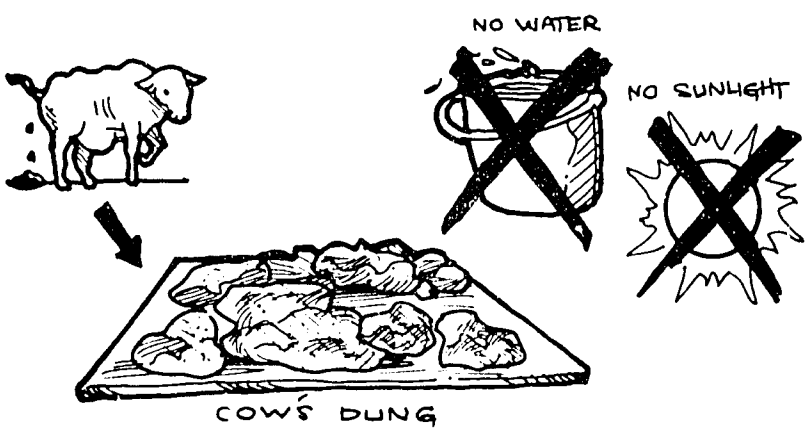
1. Farmyard Manure

This is produced by the rotting together or individually of the dung and urine of domestic animals, poultry litter, straw, ash and sawdust.



2. Dung Fertilizer

Dung Fertilizer is produced by preserving animal urine and dung. Dung contains NPK and organic matter. It is generally available to all farmers. The preservation of dung is important as exposure to direct sunlight or rainwater diminishes its quality.

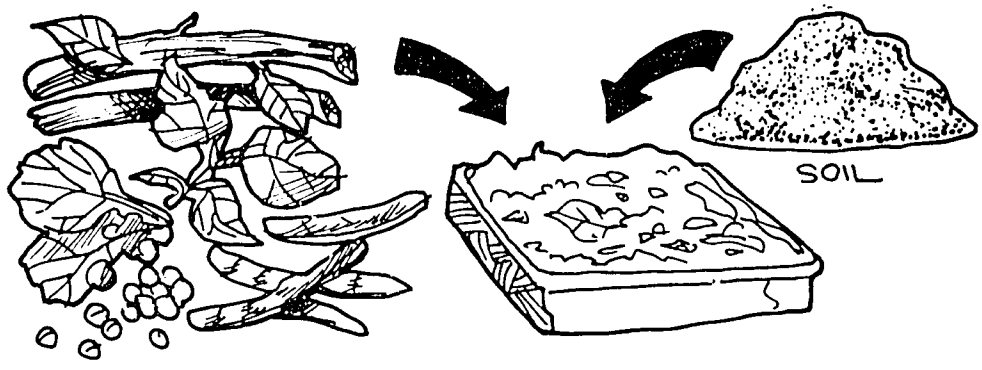


3. Compost

Compost is fertilizer produced from such materials as rotted house waste (including kitchen scraps), waste straw, dead plant materials, water hyacinth, leaves and weeds, plant stalks, fruit skins, eggshells, crop residue, animal manure and urine, poultry litter and fish waste.

4. Green Manure

Green manure is produced by the decomposition of cultivated crops and plowed soil. There are many green manuring and leguminous crops which supply plant nutrients (especially nitrogen) to the soil such as dhaincha, sun hemp, pulses and beans.



Others

Other organic fertilizers exist, some of which are industrially manufactured. These include bone meal, fish meal, blood dust, ash, rotted leaves and cake made from mustard, peanuts, coconut or sesame/til.

II. Inorganic (Chemical) Fertilizers

Inorganic or chemical fertilizers are always manufactured industrially. They supply plants with nutrients but do not improve the soil structure. Chemical fertilizers must be applied in balanced doses. Inorganic fertilizers are not always locally available and tend to be expensive.

Types of Inorganic Fertilizers

There are many different types of inorganic fertilizers. These are categorized below according to the number of plant food nutrients they supply.

1. Simple Fertilizer

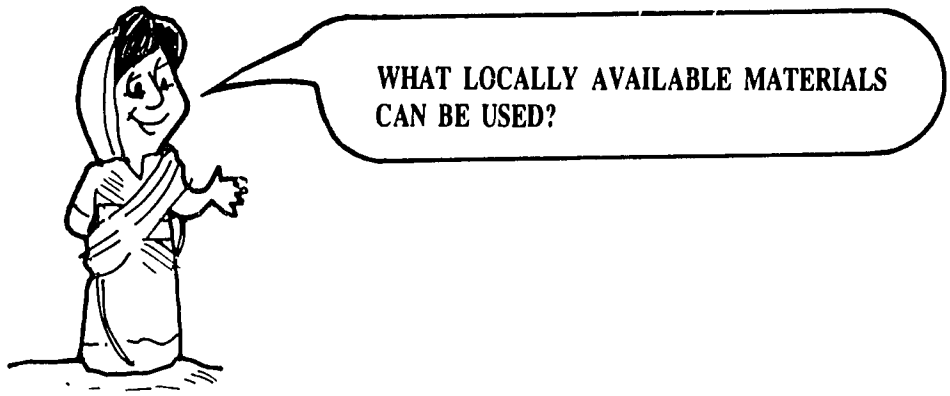
Simple fertilizers such as Urea, TSP and MP supply only one nutrient. This is the most widely available fertilizer in Bangladesh.

2. Mixed Fertilizer

Mixed fertilizer contains more than one but not all of the nutrients that plants need.

3. Complete Fertilizer

Complete fertilizer supplies all the basic nutrients needed by plants.



It will be seen that many locally available materials from plant and animal sources can be used as organic fertilizers in the home garden. It is possible to obtain a good yield from many vegetables using only organic fertilizers.

The following tables show the nitrogen. phosphorus and potassium content of different organic materials which are available in rural areas.

Percentage of NPK in Different Types of Manure

Manure	Nitrogen %	Phosphorus %	Potassium %
Cow (old dung)	2.41	0.75	0.88
Buffalo	1.09	0.82	0.70
Broiler	3.17	3.29	2.41
Layer	2.85	4.21	2.00
Goat	1.50	1.50	2.00

Percentage of NPK in Different Organic Materials

Organic Material	Nitrogen %	Phosphorus %	Potassium %
Water Hyacinth Compost	3.00	2.00	3.00
Compost (general)	0.60	0.48	0.85
Town Compost	1.40	1.00	1.40
Sun Hemp	0.75	0.12	0.51
Dhaincha	0.62	–	–
Cowpea	0.71	0.15	0.58
Mustard Cake	5.20	1.80	1.20
Sesame/Til Cake	6.20	2.00	1.20
Tishi Cake	5.50	1.40	1.30
Groundnut/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
Wheat Straw	0.63	0.46	0.86

Assessment of Available Materials as Source of NPK

Material	Nitrogen	Phosphorus	Potassium
Rice Bran	2	1	1
Wheat Bran	2	1	1
Peanut Shells	1	1	1
Eggshells	1	1	1
Sugar by-product	1	3	1
Feathers	3	1	1
Tea Leaves	2	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

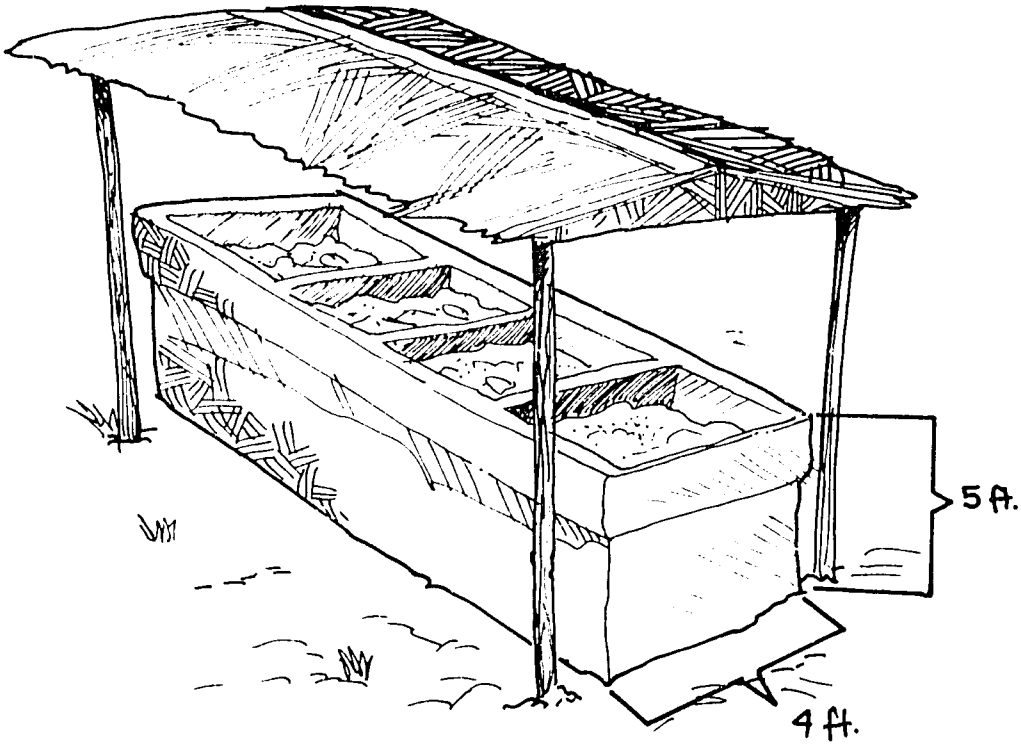
Compost is a low-cost or cost-free organic fertilizer which can be prepared from various locally available organic materials. It takes between two weeks and three months to make, depending on the materials used. The materials used become compost when they have completely rotted. There are techniques of preparing compost: the Pit and Heap methods.

In Bangladesh, the Pit method where compost is made in a hole or pit is used most often. There are two main disadvantages to this technique. Firstly, it takes a long time to make and secondly, most of the nutrients are lost in the ground around the pit. Better quality compost can be prepared using the Heap method.

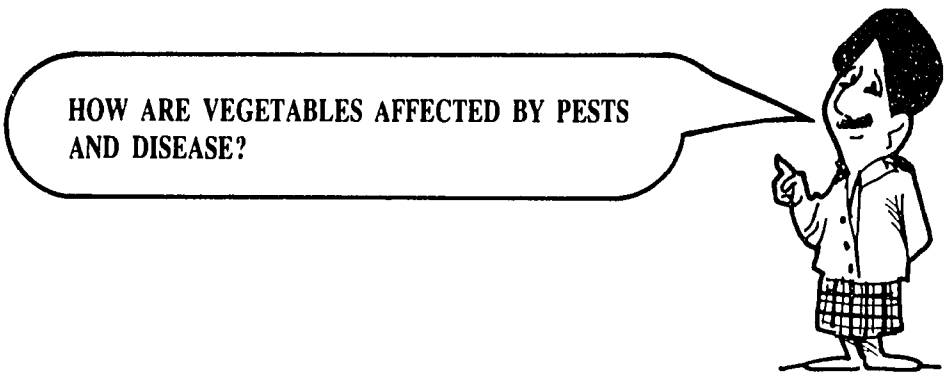
There are many ways of preparing compost using the Heap method but an easy method is the following : The length of the heap will vary according to individual requirements but it should be four feet in width and five feet in height. Ideally there should be more than one chamber. Starting from the bottom up, there is a one foot layer of straw followed by a one foot layer of animal manure and poultry litter. On top of these layers is a two and a half foot layer of waste from the home (rotted leaves, ash and plant materials). The top layer which consists of a mixture of good soil and animal manure should be half a foot high. If possible, the whole compost heap should be covered with a roof. If not, it should at least be covered with materials that will keep the rain off. Within a few days the heap will become very hot at the center, which means that the materials are decomposing. It must not be allowed to get too dry or too wet. It should

be turned over every week within the same chamber or into a different chamber until the materials have completely rotted. The compost will be ready in 3 to 4 weeks, and will look like rich, black soil.

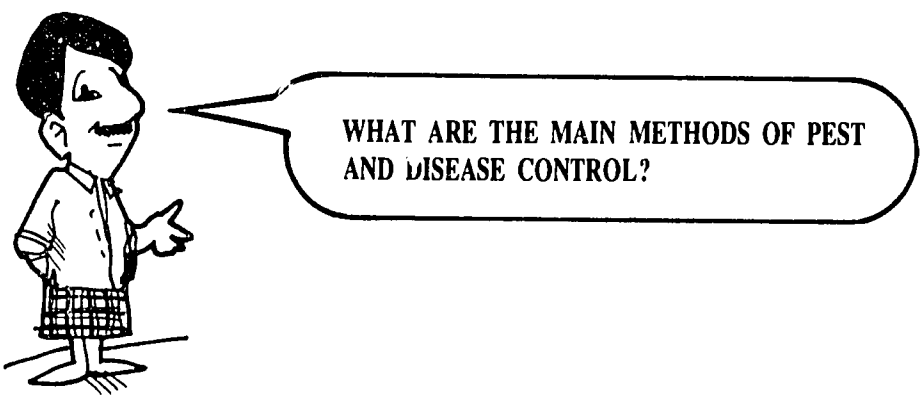
A typical compost pit



5 VEGETABLE PESTS AND DISEASES



Pests and dieases are enemies of the home gardener. They can damage the vegetable crop, reducing the yield, impairing quality and reducing the market price. Pests and disease can attack a plant at any stage from the sowing of the seed, to harvesting and storage. Loss of vegetable crops in Bangladesh due to pests and disease is estimated at 25% and 15% respectively. Crops can be either partially damaged or completely destroyed. Adopting appropriate methods to control pests and disease can improve vegetable production and quality and thus increase market values.



There are four main methods of pest/disease control.

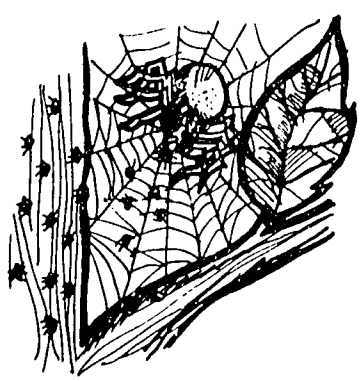
1. Mechanical Control

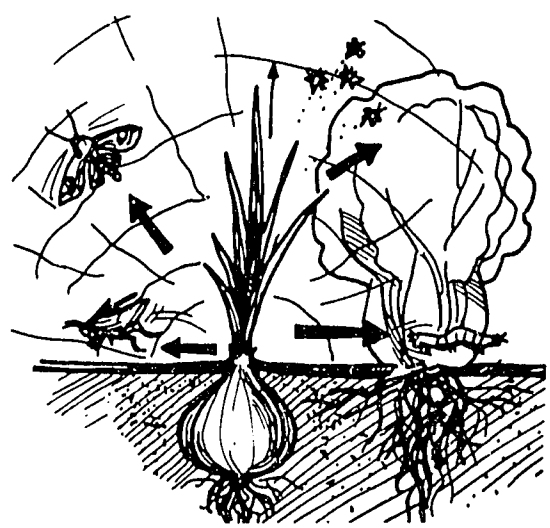
Mechanical control of pests and diseases is carried out by hand, sweeping net or light trap. For instance, some insects (such as caterpillars and

aphids) can be picked off by hand or crushed. Some diseases can be controlled by uprooting part or all of the diseased plant and removing it from the garden.

2. Biological Control

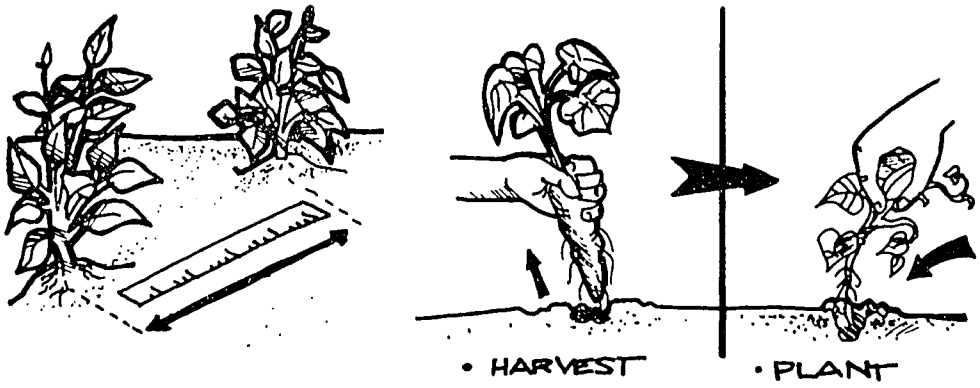
The control of harmful insects by the use of beneficial insects, animals or plants is known as biological control. For instance, harmful insects may be eaten by other insects, spiders, toads or birds. Certain insect-repellent plants such as mint, tomato, tobacco, onion, chilli, garlic and marigolds also may be cultivated in the home garden to repel insects.





3. Cultural Control

Cultural control involves the improvement of cultivation practices (such as using pest and disease-resistant varieties, plant spacing and carefully timed cultivation and harvesting). The basic principles of this method are crop rotation, tillage, water management, fertilizer management and the use of early-maturing varieties.



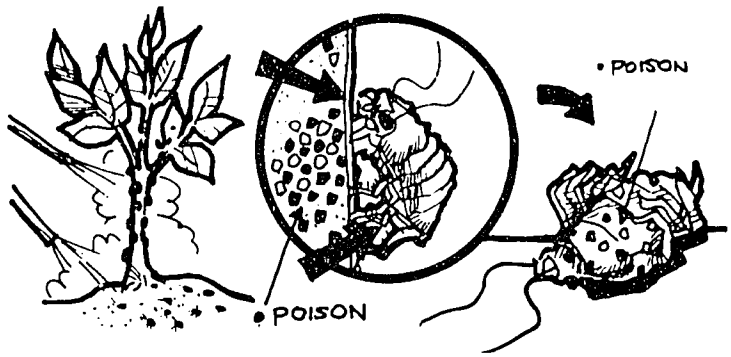
4. Chemical or Inorganic Control

The chemical method of pest control is the most common and the most effecctive, although this is offset by the considerable disadvantages attached to its use. The pesticides available at the local market for controlling pests and disease have different uses, methods of application and modes of action. Pesticides fall into one of four categories on the basis of their mode of action. Some pesticides are effective in more than one mode.

4a. *Contact Pesticide*

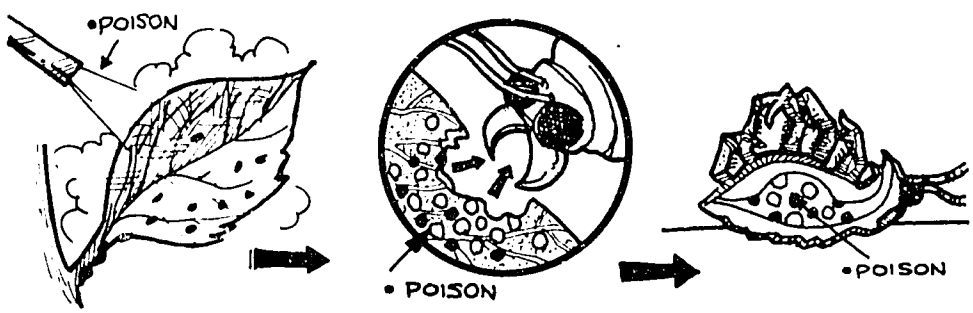
Contact pesticide kills pests through contact. The pesticide is sprayed onto the soil or directly onto plants. It is very effective against sucking

insects and soil insects. Contact pesticide enters the insect's body through the dermal or cuticular route. Examples include Heptachlor, Cloroden, Dialdrin, Malathion and Sumithion.



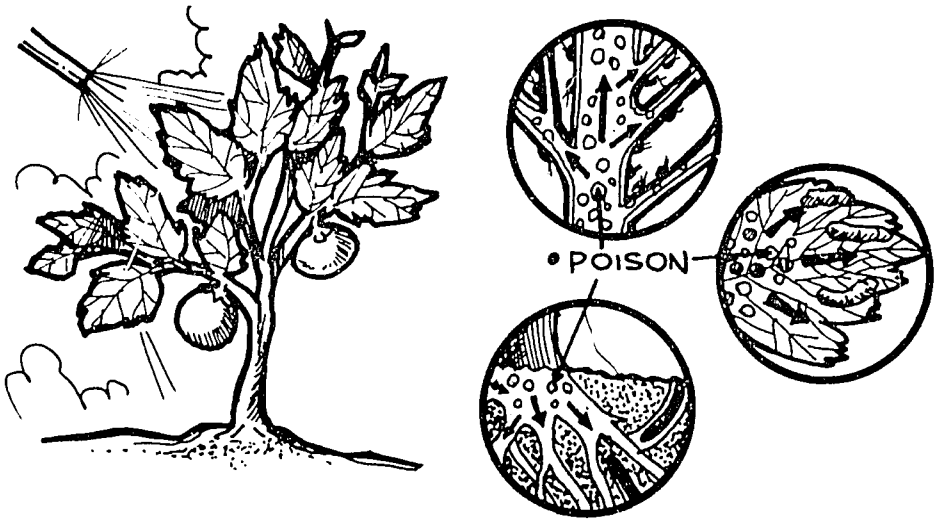
4b. *Stomach Pesticide*

Stomach pesticide kills 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 by mouth. Examples include Nogos and zinc phosphate (Zn P04).



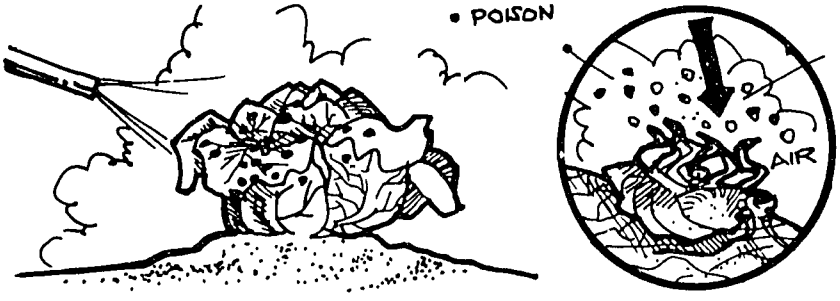
4c. *Systemic Pesticide*

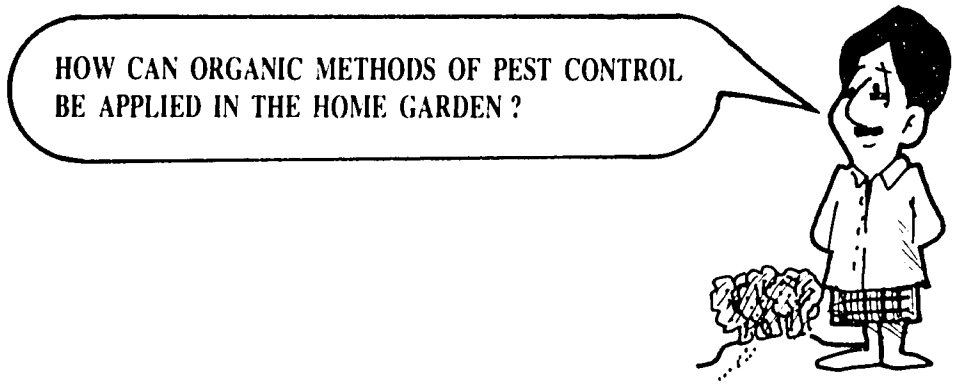
If systemic pesticide is sprayed on any part of a plant or nearby soil the whole of the plant becomes poisonous. Insects die when they suck, bite or chew any part of the plant. The poison kills by moving to different parts of the insect's body. Examples include Basudin, Ripcord, Simbush, Diazinon and Furadan.



4d. *Fumigant Pesticide*

Fumigant pesticide turns into poisonous gas when it comes into contact with air. This gas obstructs the respiration of grain insects and rats, which subsequently die. Examples include Sinogas and Phostoksin.





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 disease 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 above, 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.

To control chewing insects, home gardeners can apply locally made organic insecticides. These can be made from such materials as neem leaves, chilli, garlic, tobacco, mint, onion and marigolds. For example, boil a mixture of tobacco, chilli, mint or marigold leaves and garlic, add water in the proporation 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.

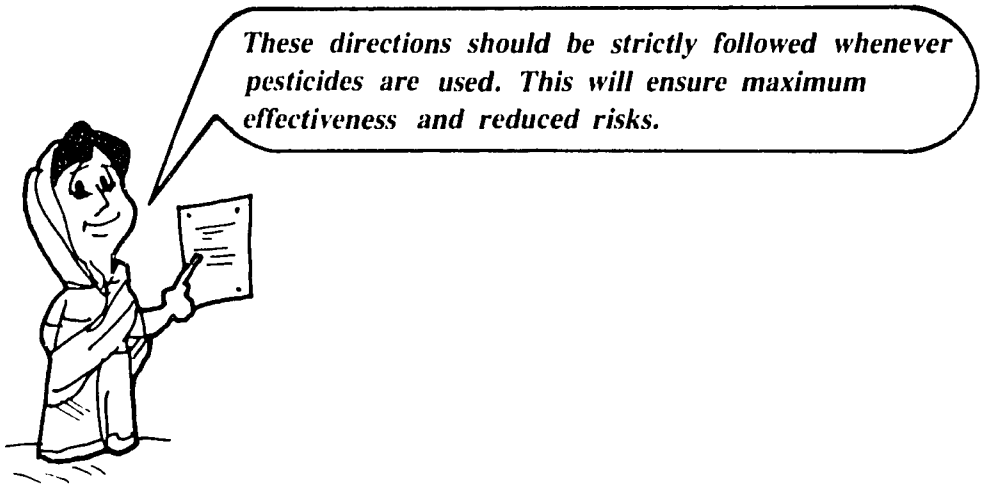
Neem leaves are, on their own, also extremely effective against any kind of pest.

WHAT IS THE CORRECT USE OF PESTICIDE TO CONTROL PESTS AND DISEASES?

Insecticides are harmful to man, 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 for insecticides. This can be done by biological and mechanical methods. When trying to control pests and disease in the home garden we should first exhaust all the possibilities using organic methods.

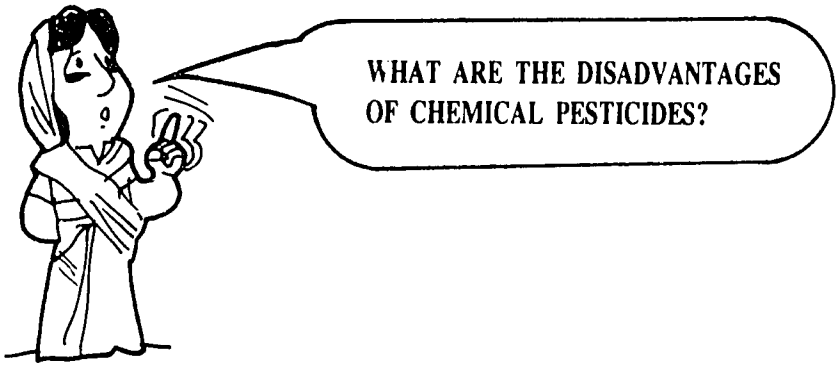
If it is really necessary to use an inorganic insecticide, it must be selected and applied very carefully. Pesticide should be used when pests are liable to cause considerable damage to the standing vegetable crop and then only when all other methods have failed. It should not be used to control an insignificant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

All pesticides are poison. They pose a serious danger to gardeners if they are not used properly. They can be affected by these in a number of ways, for example, through skin contact or by breathing in either the chemical or something contaminated by it. Some pesticides cause nausea, dizziness and genereal 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 which are often hard to cure, such as sterility, birth defects, nervous disorders and cancers of the liver, lung or stomach. Ponds, rivers and canals bordering fields can also become polluted. Water can become unsafe for drinking resulting in fish, snails and other food sources being poisoned. Pesticide can also have a residual effect on crops and soil.

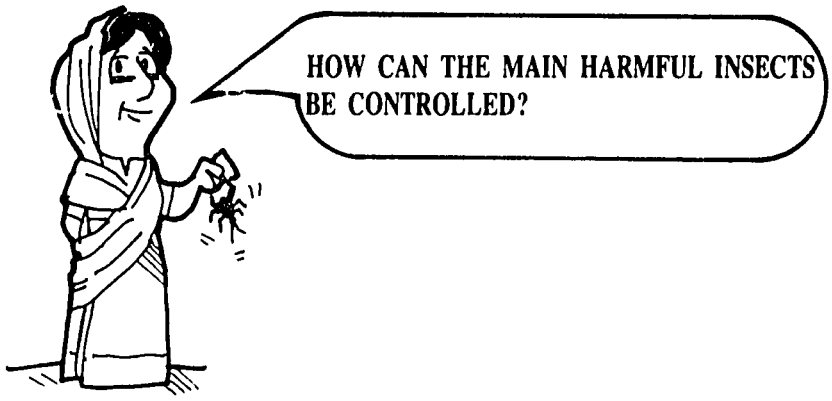


- Use the correct pesticide for your particular problem. Never buy banned pesticide.
- Keep pesticide away from food, animal feed and all water sources and out of reach of children.
- Read labels carefully before use and follow directions.
- Never smell pesticide to identify it.
- Make sure you know how to operate the sprayer before using it.
- Try to use gloves and wear a mask over your mouth and nose when mixing and using pesticide. Do this outside the home in a well-ventilated area.
- Never use household utensils to measure and mix pesticide. Never stir or 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 pesticide, first pour the water into the sprayer, then mix the powder with a little water in a separate container. Pour this solution into the sprayer and stir it. For liquid pesticide, pour the water into the sprayer, then add the exact amount of pesticide required and stir the mixture.
- Do not use a leaky or defective sprayer: the solution may come into contact with your body.
- Clothes covering the whole body and a mask over the mouth and nose should be worn when spraying.
- Do not blow the nozzle to clear it.

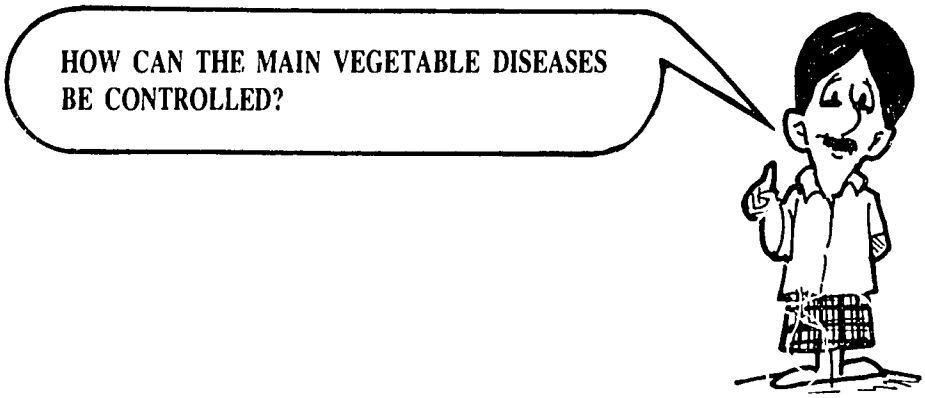
- Never smoke, eat or drink while mixing or applying pesticide.
- Do not spray against the wind: it may contaminate the surrounding area.
- To reduce loss by evaporation and to avoid burning the plants, do not spray on very hot days.
- Do not spray too often; it may increase pest/disease resistance to 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 which have been used for pesticide 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 the symptoms of mild poisoning. Stop spraying if you have any of these symptoms. Wash thoroughly and apply first aid where necessary. If the symptoms persist, consult a doctor.



1. High cost.
2. Residual effect on vegetables.
3. Residual effect on soil resulting in degradation of quality.
4. Pollution of the environment.
5. Danger in the home.
6. Destruction of beneficial insects.



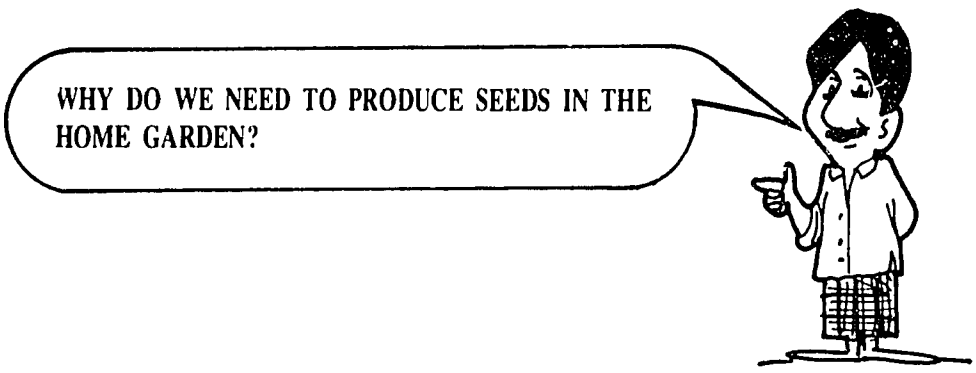
Insect	Vegetable Attacked	Method of Control
1. Fruit Fly	All Gourds, Tomato, Okra, Bean Cucumber.	Pick the affected shoots and put them in the soil. Control the insects with poison bait (food and poison).
2. Aphid	Cabbage, Cauliflower, Kohlrabi, Turnip, Radish, Yard Long Bean, Tomato.	The preferable method of control is to crush the aphids by hand. If this is not efffective, they should be controlled with prescribed pesticide being careful not to destroy bees and propagated insects for seed production.
3. Beetle	Gourd-type Vegetable, Cucumber.	Beetles can be controlled by hand and and by spraying a mixture of wood ash and kerosene. In case of a serious attack by insects, spray Furadan, Basudin or similar granular pesticide onto the soil.
4. Cutworm	Cabbage, Cauliflower, Papaya, Eggplant, Potato, Tomato.	Search for cutworms near attacked plant (observing stem and shoot cuttings) and destroy them. Control pests with ash/kerosene mixture around young plants.
5. Shoot and Fruit Borer/Stem Borer	Okra, Eggplant, Tomato, Bean	Collect affected shoots and fruits and destroy away from the plant. Destroy eggs collected from leaves and shoots. Use ashes on plant.



Disease	Vegetable Attacked	Method of Control
1. White Rust	Lal Shak and Data Shak.	Destroy the attacked parts of the plant.
2. Mosaic Virus	Okara Tomato, Papaya, Pumpkin, Potato, Cucumber, Cabbage	Uproot the affected plants and burn them to destroy the aphids, leaf-hopper and any other vectors.
3. Leaf Curl Virus	Okra, Pumpkin,	Pull up the attacked plants immediately and remove weeds. Control the insects carrying these diseases.
4. Leaf Spot Disease	Cabbage, Spinach, Indian Spinach, Radish, Bean Tomato, Eggplant, Bottle Gourd, Bitter Gourd.	Uproot the affected plant parts or whole plant. Apply Bordo mixture. Weeding and crop rotation can be done,
5. Damping Off	Cabbage, Cauliflower, Tomato, Eggplant.	Use disease-free seed and provide proper drainage facilities. Apply Diathane M-45.
6. Fusarium Wilt	Cabbage, Cauliflower, Tomato, Eggplant, Bean, Cucumber.	Use disease-resistant seed, rotate crops, uproot diseased plants and use Bordo mixture.
7. Powdery Mildew	Tomato, Eggplant, Pumpkin, Bottle Gourd, Bean, Cucumber.	Weed control. Spray Bordo mixutre or Diathane M-45 on the affected plant.
8. Downy Mildew	Spinach, Pumpkin, Bottle Gourd, Bean, Ash Gourd, Bitter Gourd.	Burn the affected plant part or whole plant and spray Bordo mixture.

NOTE: THE INORGANIC METHODS SUGGESTED ABOVE SHOULD BE USED ONLY IF ALL ORGANIC METHODS HAVE FAILED.

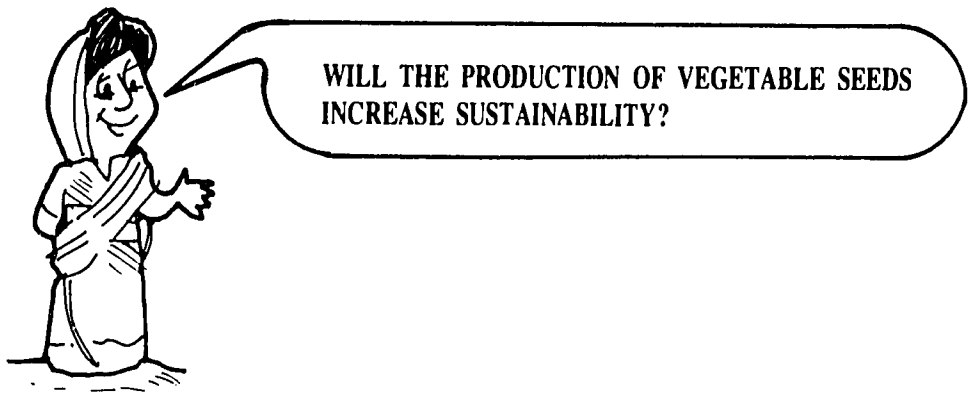
6 SMALL-SCALE PRODUCTION OF VEGETABLE SEEDS



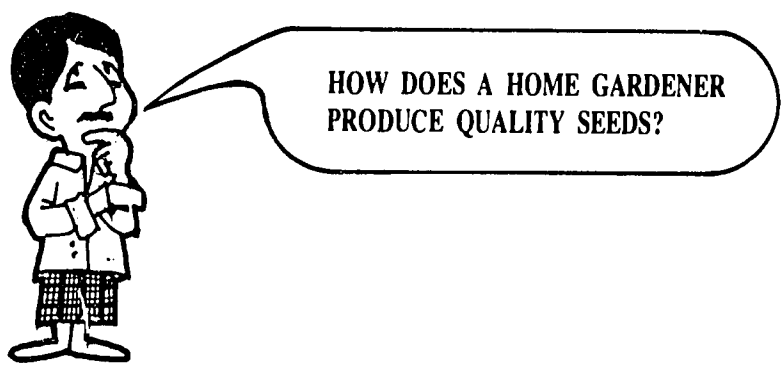
An important input in vegetable cultivation are seeds. The use of good quality seeds is an essential prerequisite for high levels of production. The production of vegetable seeds at the household level is still the most common source of seeds for small-scale cultivators. However, the variety is very limited and of poor quality. According to BADC/FAO, at present, only 2% of the total national demand for vegetable seeds is met by the public sector, 60% by the private sector. The remaining 38% are produced at home and exchanged or sold at local markets.

The main advantages of producing vegetable seeds in the home garden are that:

- Production is cheap.
- Seeds are available at any time.
- Gardeners can be independent.
- Quality is assured.
- There is no difficulty in procuring small amounts of seeds.



The success of a vegetable crop is determined by the quality of the seeds used. However, several studies show that one of the main problems in vegetable cultivation is obtaining good quality seeds. Home gardeners do not generally know where to acquire 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 and often do not germinate properly. The purchase of seeds every year is also very expensive. The availability of good quality seeds at the household level makes it possible to grow vegetables successfully throughout the year.



Type of Seeds Required

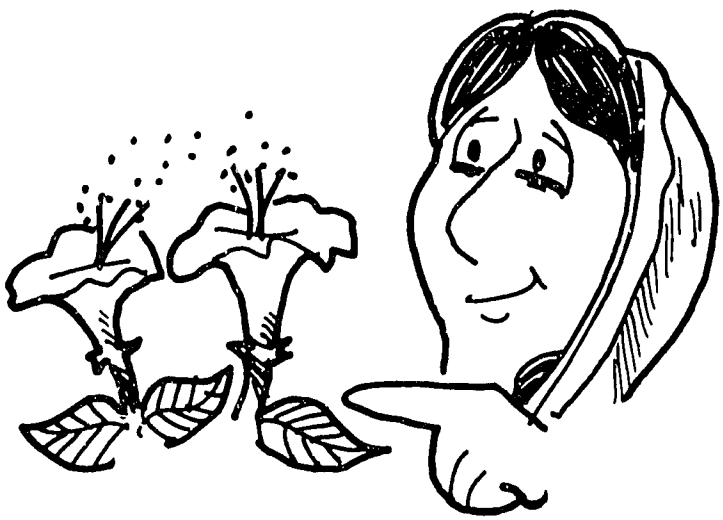
Hybrid seeds (F1) are imported and therefore expensive. They need significant inputs to produce a superior yield.

Open-pollinated (OP) seeds, however, are 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.

After 3-5 years of producing seeds from one original source the variety usually deteriorates, as manifested by changes in the plant and loss of upto 30% of the original yield. For this reason it is necessary to regenerate seeds from time to time.

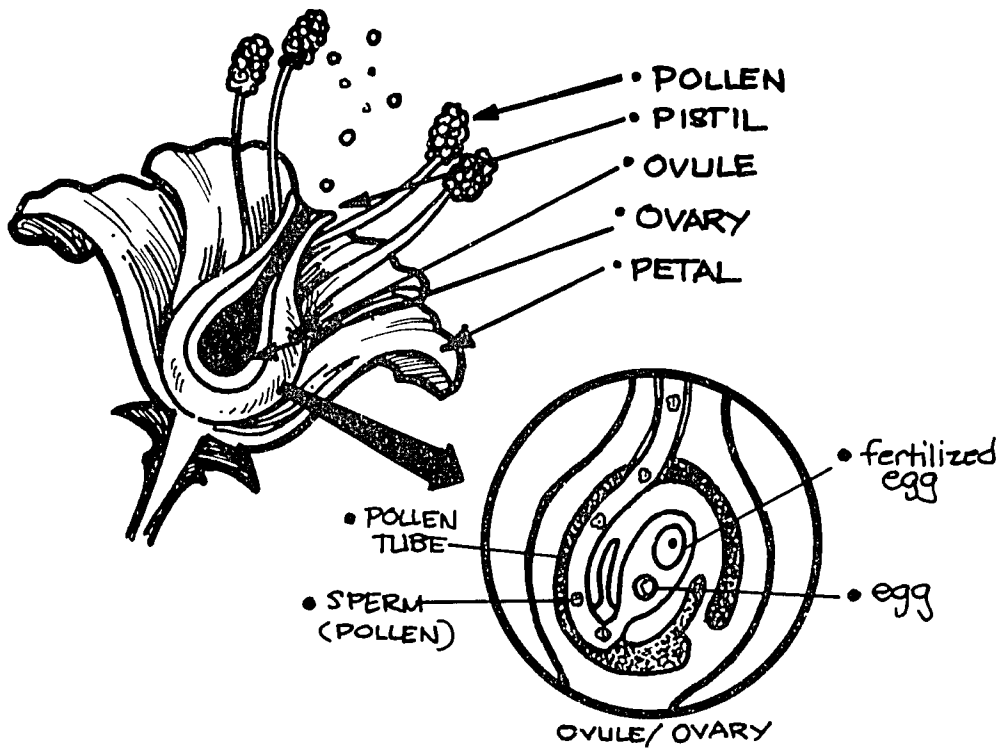
Home gardeners can be taught easy and safe techniques for producing quality seeds for their own use. If the original seeds are of good quality and the prescribed techniques are followed, then seeds can be kept for generations. Gardeners must also be aware of the characteristics that they should look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

Pollination



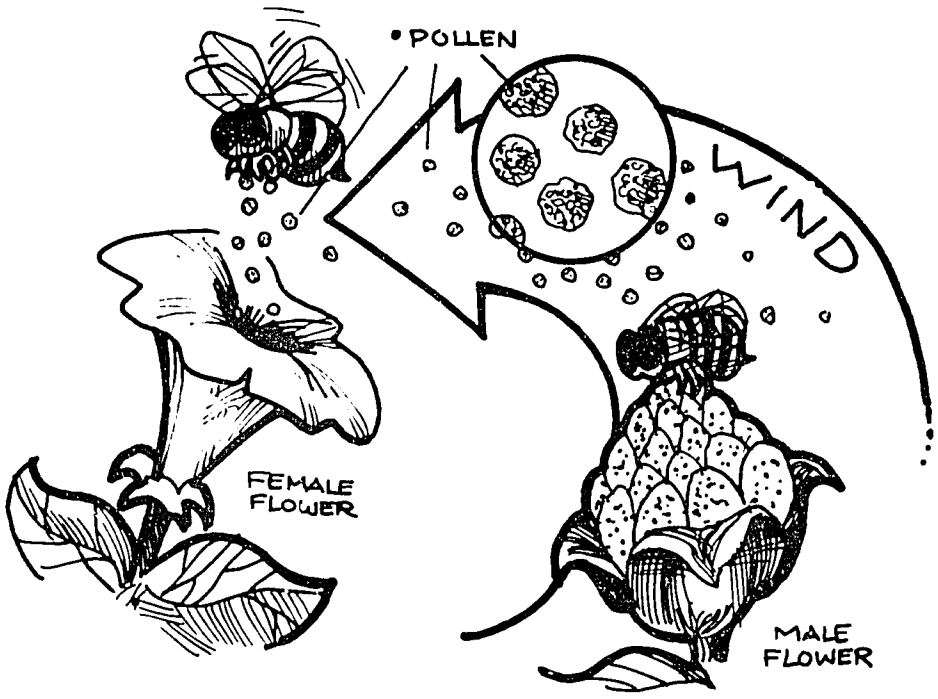
For successful seed production, it is important to understand the pollination behavior of each vegetable. Vegetables are pollinated in one of three ways: Self-Pollination, Cross-Pollination or Partial Cross-Pollination.

1. Self-Pollination



The flowers of self-pollinated vegetbales (such as beans, tomatoes or lettuce) are complete, that is, they contain both male and female parts. Self-pollination occurs when the pollens of one flower fertilizes the same flower or another flower on the same plant.

2. Cross-Pollination



Cross-pollination occurs when an insect or wind transfers pollen from the flower of one plant to the flower of another, as occurs with pumpkin, radish and bati shak.

3. Partial Cross-pollination

The morphology of the flowers of some self-pollinated vegetables, such as okra and eggplant, result in a certain amount of cross-pollination. These vegetable are therefore categorized as partially cross-pollinated.

Pollination Behavior of Some Vegetable/Fruit Seed Crops

Vegetable/Fruit	Mode of Pollination	Pollination Medium
Red/Green Amaranth	Cross	Wind
Radish, Carrot, Beet, Turnip	Cross	Insect
Cabbage, Cauliflower, Broccoli, Kohlrabi, Bati Shak, China Shak	Cross	Insect
Pumpkin, Ash Gourd, Bottle Gourd, Snake Gourd, Bitter Gourd, Ridge Gourd, Cucumber, Watermelon	Cross	Insect
Tomato, Chilli, Capsicum	Self	Insect
Okra, Eggplant	Partial Cross	Insect
Kangkong (Gima Kolmi)	Cross	Insect
Papaya	Cross	Insect
Spinach	Cross	Insect/Wind
Indian Spinach	Cross	Wind
Bean, French Bean, Yard Long Bean, Soybean	Self	Insect
Lettuce	Self	Insect

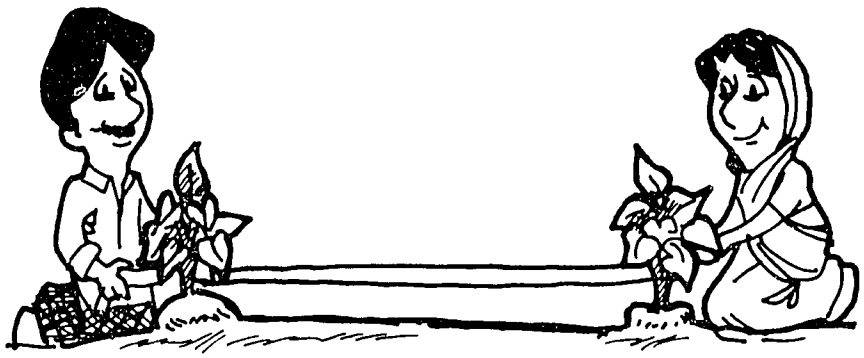
Origin of the Seeds

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

Land Requirements

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

Isolation Distance



To prevent cross-fertilization of different varieties of the same vegetable, it is important to know and maintain correct varietal 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 standards for FAO '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.

Isolation distances can sometimes be difficult to maintain. In such cases, contamination from fields of the same crop in too close proximity can be prevented, for instance, by providing the neighbor with the same seeds or by choosing a protected plot surrounded by trees or high fencing.

Recommended Isolation Distance for Seed Production of Different Varieties of Vegetables

Vegetable	Isolation Distance (m) (Certified Seed)
Lal Shak, Data Shak	200
Cauliflower, Cabbage, Broccoli, Kohlrabi, Turnip, China Shak, Bati Shak	1,000
All Bean Crops*	10
Radish	1,000
Carrot, Beet	800
Spinach, Indian Spinach	500-1,000
Tomato*	10
Eggplant	200
Chilli/Capsicum	200
Okra	200
Kangkong (Gima Kolmi)	200
Pumpkin, Bottle Gourd, Ash Gourd, Snake Gourd, Bitter Gourd, Cucumber, Watermelon, Ridge 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)

Healthy Crop Means Healthy Seeds

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

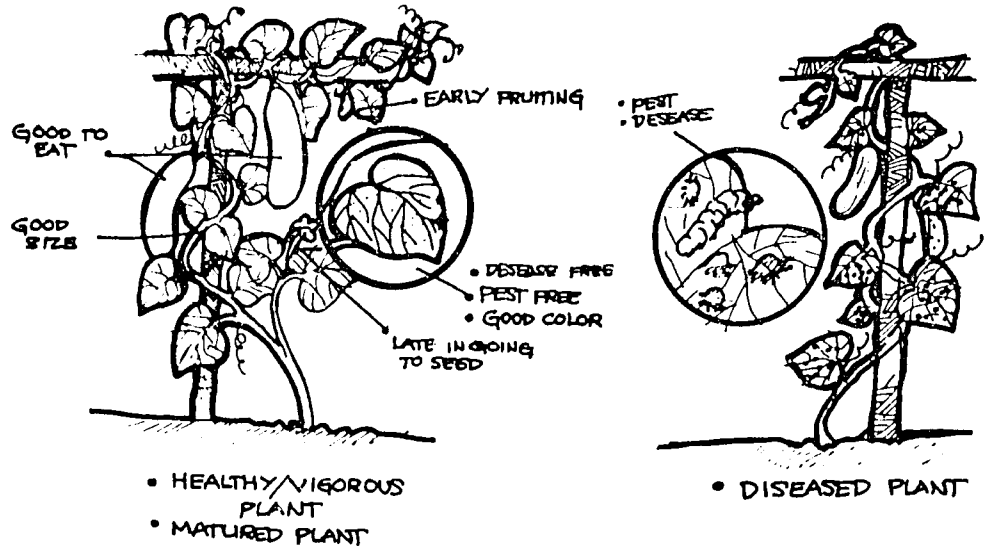
Roguing

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. Roguing is the action by which off-types are removed and destroyed.

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 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. A pictorial representation of the desired characteristics for each variety should be provided to those who intend to make the selection.



Seed Collection and Extraction

Plants selected to be used for seeds should be marked so that they are not harvested accidentally.

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 avoids many problems with disease.
- 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 which have been collected for seed production from those collected for vegetable production.

Cleaning and Grading of Seeds

The cleaning and grading process is one by which undesirable materials are physically separated from desired ones. The undesirable materials are mainly:

- Inert matter.
- Weed seeds.
- Other crop seeds.
- Light-damaged or deteriorated seeds.

The cleaning process usually removes 5-10% by weight of the rough seed harvest in the form of undesirable material.

Home gardeners perform this process mainly by winnowing and by gravity separation using the local kula (bamboo winnowing tray).

Seed Drying

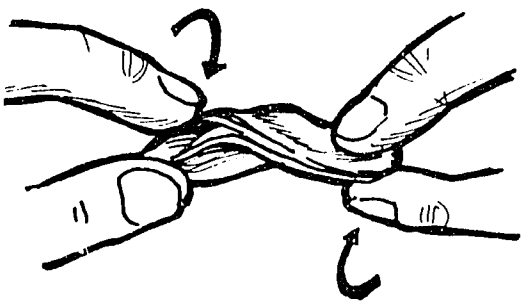
Seed drying is important as it increases longevity and viability of the seed and facilitates storing. Drying removes the excess moisture that causes excessive respiration, heating and fungal invasion. They should be dried in the sun on a clean, uniform surface. Seeds should not be dried on the ground. 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 borne in mind when drying seeds:

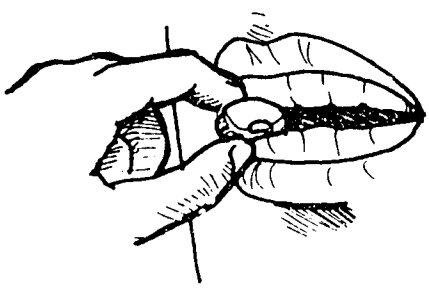
- Choose a spot which is sunny all day.
- Spread the seeds thinly over the mat.
- Seeds should be turned over gently 4 or 5 times a day to ensure that they dry evenly.
- In the evening, bring the seeds inside.
- Continue this process until the seeds are properly dried.

There are several local methods which home gardeners use to establish whether seeds are dry enough for storage. All vegetable seeds are divided into three categories (depending on their size) for the purpose of these tests:

1. Large, thin seeds will break with a snapping sound when twisted between the fingers. This method works with seeds from pumpkins and all types of 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 seeds from amaranth, radish, bati shak and china shak.

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 quite 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 mice-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 seed dry.

7. Do not put a small amount of seed in a large container.
8. Remember that heat kills seeds, so store your seed in a cool, shady and dry place.
9. Do not place the seed directly over the fire (cooking place) or in direct sunlight.

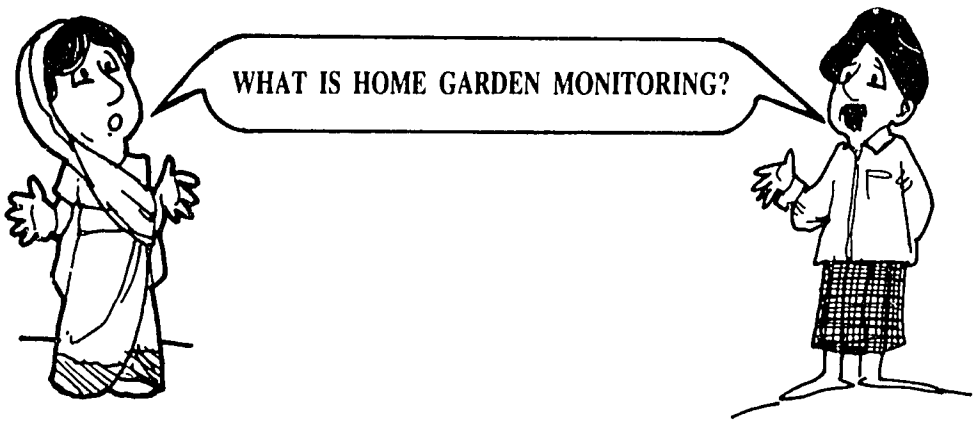
Germination Test

If all the steps described above have been carefully followed, the home gardener should have good healthy seeds. But the seeds he has produced will usually be stored for 6-8 months before it is used. Controlling storage in Bangladesh, especially during the monsoon season, is very difficult. It is therefore advisable to carry out a simple germination test before using the seed or selling/giving it to others.

- Take an earthen pot (curd pot), fill it with river sand and water it.
- Sow 100 seeds and wait for about a week, maintaining a high level of moisture.
- Count the seedlings that have come up. There should be at least 50-80 (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 seed they intend to sow.

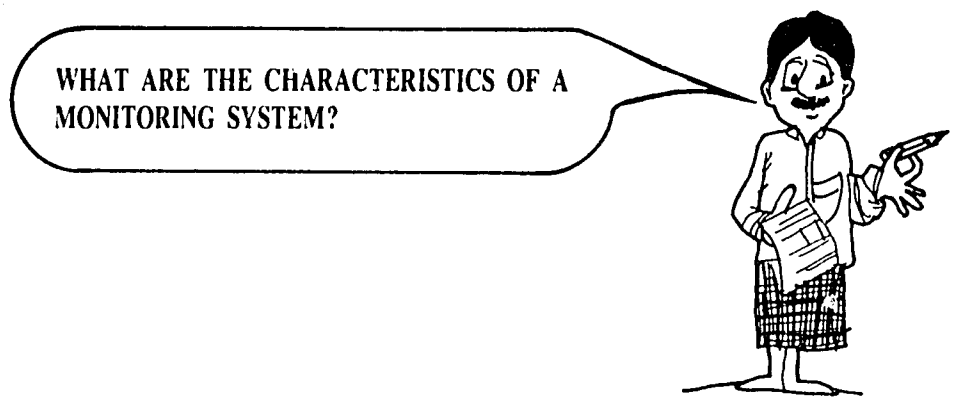
7 MONITORING OF HOME GARDENING PROGRAMS



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

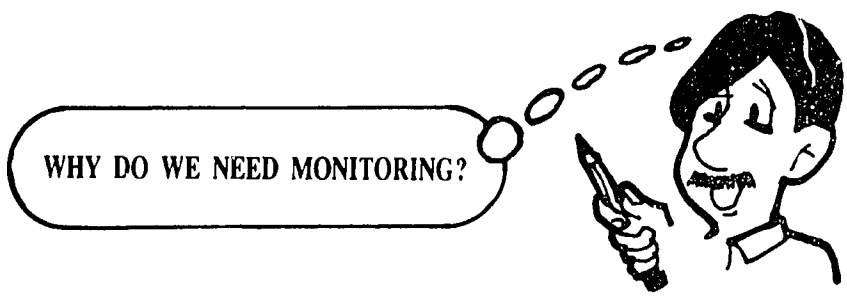
Monitoring involves the continuous gathering of information on different activities in the garden. On the basis of the information collected, necessary modifications can be made to the program.

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 to determine how far goals and objectives have been achieved. The results of the evaluation process are useful for future planning and decision making.



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

- It should be simple and easily understandable.
- It should operate continuously.
- 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.
- Data should be acted upon immediately.



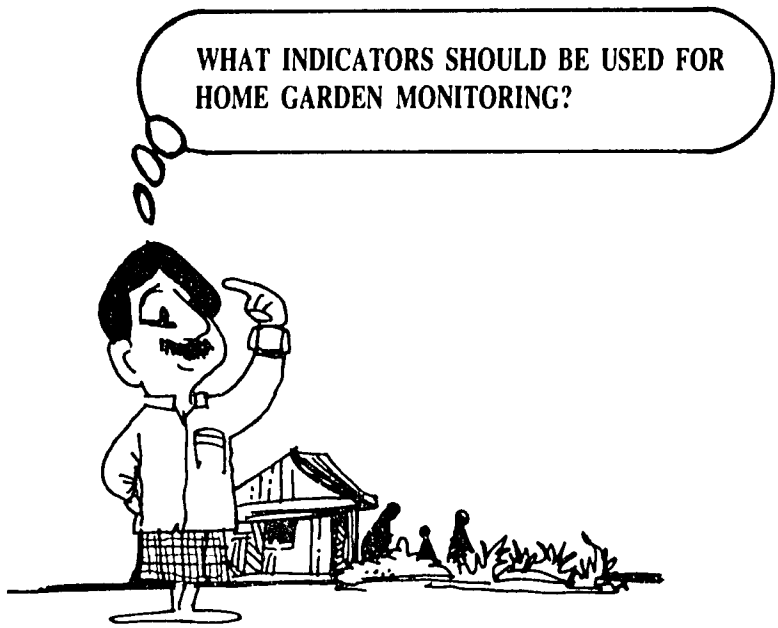
Monitoring forms part of all home gardening programs. The main purpose of monitoring is not to measure the success or failure of a program but to improve program activities, design, strategies and local techniques as well as to strengthen the local organization. The results of monitoring and evaluation will be used by people inside and outside the program.

As far as intervention activities are concerned, monitoring is important for program sustainability. Any suscessful 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 with a monitoring system. A program will be sustainable only if the local community participates in monitoring activities. Hence, the need for community-based monitoring.

Continuous community-based monitoring involves the monitoring of different activities in the home garden by field workers through the active participation of community members. This monitoring system helps the target group to identify problems and find possible solutions. Local communities should take part in designing and carrying out the evaluation of garden interventions.

The main objectives of community-based monitoring are:

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



Home gardening programs have two principal components: vegetable production and nutrition education to promote vegetable consumption. Vegetable production includes a variety of different management activities which have already been described in detail earlier in this handbook. Nutrition education promotes appropriate processing, storage and cooking techniques to protect the pro-vitamin A content of food. There are many factors which 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 are germination, crop density, absence of weeds, crop color and crop growth. Village-level workers and home gardeners can assess the status of any vegetable using these indicators. They 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.

Germination

This is the next stage after sowing the seeds. This indicator will reveal the status of the crop after sowing, which reflects the quality of the seeds, soil moisture and any fencing problems in the garden.

Crop Density

This shows their spacing and the population of the different vegetables in the garden.

Weed Freeness

Weeds affect plant growth and vegetable production. By observing the extent to which the land is free of weeds, we can obtain a picture of the growth of the vegetables.

Crop Growth

This indicator shows the status of crop growth at different stages, which measures the performance of the crop. The height and healthiness of the plant are measured.

Crop Color

Crop color shows the status of different vegetables growing in the plot. It is also an indication of nutrient deficiencies.

APPENDIX I

CROP CALENDAR FOR DIFFERENT VEGETABLES AND FRUITS

A large variety of vegetables and fruit can be grown during the year in the home garden. Some vegetables, such as tomato, cabbage and cauliflower, are grown in a particular season. Others, such as pumpkin, bottle gourd and data shak, can be harvested over a long period. Another group of vegetables, including lal shak, kangkong and mint, 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 Bangladesh, the number of available vegetables fluctuates throughout the year. Home gardeners should, however, be able to grow and harvest at least 6 or 7 different vegetables throughout the year.

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

JANUARY-FEBRUARY MAGH			
Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Banana (Kola)	Red Amaranth (Lal Shak)	Papaya (Pepe)
Radish Leaves (Moola Shak)	Papaya (Pepe)	Radish & Leaves (Moola & Shak)	Guava (Peyara)
Spinach (Palong Shak)	Watermelon (Tormooj)	Spinach (Palong Shak)	Banana (Kola)
Helencha Leaves (Helencha Shak)		Helencha Leaves (Helencha Shak)	
Mint (Pudina Pata)		Mint (Pudina Pata)	
Coriander Leaves (Dhonia Pata)		Coriander Leaves (Dhonia Pata)	
Okra/Lady's Finger (Dherosh)		Turnip & Leaves (Shalgom & Shak)	
Cucumber (Shosha)		Beet	
Ridge Gourd (Jhinga)		Kholrabi/Knolkohl (Olkopi)	
Pumpkin (Mishti Komra)		Carrot (Gajor)	
Bati Shak		Potato (Aloo)	
China Shak		Brinjal/Eggplant (Begoon)	
Thankooni Leaves (Thankooni Pata)		Tomato	
		Cauliflower (Phoolkopi)	
		Cabbage (Badhakopi)	
		Broccoli (Shobooj Phoolkopi)	
		Sweet Potato & Leaves (Mishti Aloo & Shak)	
		Bottle Gourd & Leaves (Lau & Shak)	
		Bati Shak	
		China Shak	
		Lettuce	

FEBRUARY-MARCH

PHALGOON

Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Banana (Kóla)	Red Amaranth (Lal Shak)	Banana (Kola)
Green Amaranth (Data (Shak)	Papaya (Pepe)	Spinach (Palong Shak)	Papaya (Pepe)
Kangkong (Kolmi Shak)	Watemelon (Tormooj)	Thankooni Leaves (Thankooni Pata)	
Jute Leaves (Pat Shak)		Helencha Leaves (Helencha Shak)	
Mint (Pudina Pata)		Mint (Pudina Pata)	
Indian Spinach (Pui Shak)		Carrot (Gajor)	
Sweet Potato (Mishti Aloo)		Radish & Leaves (Moola & Shak)	
Snake Gourd (Chichinga)		Kholrabi & Leaves (Olkopi & Shak)	
Ridge Gourd (Jhinga)		Turnip & Leaves (Shalgom & Shak)	
Ash Gourd (Chal Koomra)		Beet	
Bitter Gourd (Korola)		Tomato	
Pumpking (Mishti Koomra)		Eggplant (Begoon)	
Cucumber (Shosha)		Potato (Aloo)	
Okra (Dherosh)		Cabbage (Badhakopi)	
Yard Long Bean (Borboti)		Cauliflower (Phoolkopi)	
Bati Shak		Broccoli (Shobooj Phoolkopi)	
China Shak		Bottle Gourd & Leaves (Lau & Shak)	
		Pumpkin & Leaves (Mishti Koomra & Shak)	
		Sweet Potato & Leaves (Mishti Aloo & Shak)	
		Bean (Sheem)	
		Bitter Gourd (Korola)	
		Bati Shak	
		China Shak	

APPENDIX I

MARCH-APRIL

CHOITRO

Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Banana (Kola)	Red Amaranth (Lal Shak)	Banana (Kola)
Mint (Pudina Pata)	Papaya (Pepe)	Mint (Pudina Pata)	Papaya (Pepe)
Sweet Potato (Mishti Aloo)	Bitter Plum(Boroi)	Helencha Leaves (Helencha Shak)	Custard Apple (Ataphol)
Green Amaranth (Data Shak)		Thankooni Leaves (Thankooni Pata)	
Kangkong (Kolmi Shak)		Indian Spinach (Pui Shak)	
Indian Spinach (Pui Shak)		Green Amaranth (Data Shak)	
Jute Leaves (Pat Shak)		Kangkong (Kolmi Shak)	
Ash Gourd (Chal Koomara)		Sweet Potato & Leaves (Mishti Aloo & Shak)	
Snake Gourd (Chichinga)		Jute Leaves (Pat Shak)	
Ridge Gourd (Jhinga)		Ridge Gourd (Jhinga)	
Bitter Gourd (Korola)		Bitter Gourd (Korola)	
Pumpkin (Mishti Koomra)		Bottle Gourd & Leaves (Lau & Shak)	
Drumstick (Shajna)		Pumpkin & Leaves (Mishti Koomra & Shak)	
Okra (Dherosh)		Carrot (Gajor)	
Bean (Sheem)		Beet	
Cucumber (Shosha)		Tomato	
Yard Long Bean (Borboti)		Okra (Dherosh)	
Eggplant (Begoon)		Palwal (Potol)	
Bati Shak		Yard Long Bean (Borboti)	
China Shak		Bean (Sheem)	
Black Arum Leaves (Kalo Kochu Shak)		Drumstick & Leaves (Shajna Shak)	
		Cucumber (Shosha)	
		Bati Shak	
		China Shak	

APRIL-MAY

BOISHAKH

Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Papaya (Pepe)	Red Amaranth (Lal Shak)	Papaya (Pepe)
Black Arum Leaves (Kalo Kochu Shak)	Jackfruit (Kathal)	Mint (Pudina Pata)	Banana (Kola)
Kangkong (Kolmi Shak)	Coconut (Narikel)	Helencha Leaves (Helencha Shak)	Jackfruit (Kathal)
Indian Spinach (Pui Shak)	Custard Apple (Ataphol)	Sweet Potato Leaves (Mishti Aloo Shak)	Custard Apple (Ataphol)
Green Amaranth (Data Shak)	Lichi (Lichu)	Kangkong (Kolmi Shak)	Mango (Am)
Drumstick (Shajna)	Hog Plum (Amra)	Indian Spinach (Pui Shak)	Black Berry (Jam)
Yard Long Bean (Borboti)	Amla (Amloki)	Jute Leaves (Pat Shak)	Coconut (Narikel)
Cucumber (Shosha)	Olive (Jolpai)	Green Amaranth (Data Shak)	Lemon (Lebu)
Eggplant (Begoon)	Pomelo (Jamboora)	Snake Gourd (Chichinga)	Watermelon (Tormooj)
Teasle Gourd (Kakrol)	Bilimbi (Kamranga)	Ridge Gourd (Jhinga)	
Snake Gourd (Chichinga)	Lemon (Lebu)	Pumpkin & Leaves (Mishti Koomra & Shak)	
Ridge Gourd (Jhinga)	Mango (Am)	Bottle Gourd & Leaves (Lau & Shak)	
Ash Gourd (Chal Koomra)	Black Berry (Jam)	Bitter Gourd (Korola)	
Pumpkin (Mishti Koomra)	Wood Apple (Bel)	Drumstick & Leaves (Shajna & Shak)	
Bean (Sheem)		Cucumber (Shosha)	
Okra (Dherosh)		Palwal (Potol)	
Bati Shak		Okra (Dherosh)	
China Shak		Yard Long Bean (Borboti)	
		Bati Shak	
		China Shak	

MAY-JUNE

JOISHTO

Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Papaya (Pepe)	Red Amaranth (Lal Shak)	Papaya (Pepe)
Mint (Pudina Pata)	Jackfruit (Kathal)	Mint (Pudina Pata)	Jackfruit (Kathal)
Sweet Potato (Mishti Aloo)	Coconut (Narikel)	Helencha Leaves (Helencha Shak)	Coconut (Narikel)
Green Amaranth (Data Shak)	Custard Apple (Ataphol)	Thankooni Leaves (Thankooni Pata)	Custard Apple (Ataphol)
Indian Spinach (Pui Shak)	Lichi (Lichu)	Sweet Potato Leaves (Mishti Aloo Shak)	Lichi (Lichu)
Kangkong (Kolmi Shak)	Hog Plum (Amra)	Indian Spinach (Pui Shak)	Hog Plum (Amra)
Ridge Gourd (Jhinga)	Amla (Amloki)	Jute Leaves (Pat Shak)	Amla (Amloki)
Snake Gourd (Chichinga)	Olive (Jolpai)	Green Amaranth (Data Shak)	Olive (Jolpai)
Pumpkin (Mishti Koomra)	Pomelo (Jamboora)	Kangkong (Kolmi Shak)	Pomelo (Jamboora)
Cucumber (Shosha)	Bilimbi (Kamranga)	Ridge Gourd (Jhinga)	Bilimbi (Kamranga)
Eggplant (Begoon)	Lemon (Lebu)	Bitter Gourd (Korola)	Lemon (Lebu)
Yard Long Bean (Borboti)	Mango (Am)	Pumpkin (Mishti Koomra)	Mango (Am)
Teasle Gourd (Kakrol)	Black Berry (Jam)	Palwal (Potol)	Black Berry (Jam)
Bean (Sheem)	Wood Apple (Bel)	Cucumber (Shosha)	Wood Apple (Bel)
Okra (Dherosh)		Yard Long Bean (Borboti)	Watermelon (Tormooj)
Bati Shak		Okra (Dherosh)	
China Shak		Eggplant (Begoon)	
Black Arum Leaves (Kalo Kochu Shak)		Drumstick & Leaves (Shajna & Shak)	
Drumstick (Shajna)		Bati Shak	
		China Shak	

JUNE-JULY

ASHARH

Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Jackfruit (Kathal)	Red Amaranth (Lal Shak)	Pineapple (Anarosh)
Mint (Pudina Pata)	Coconut (Narikel)	Mint (Pudina Pata)	Guava (Peyara)
Helencha Leaves (Helencha Shak)	Custard Apple (Ataphol)	Helencha Leaves (Helencha Shak)	Lichi (Lichu)
Kangkong (Kolmi Shak)	Lichi (Lichu)	Thankooni Leaves (Thankooni Pata)	Papaya (Pepe)
Green Amaranth (Data Shak)	Hog Plum Amra)	Indian Spinach (Pui Shak)	Banana (Kola)
Indian Spinach (Pui Shak)	Amla (Amloki)	Black Arum Leaves (Kalo Kochu Shak)	Jackfruit (Kathal)
Cucumber (Shosha)	Olive (Jolpai)	Kangkong (Kolmi Shak)	Custard Apple (Ataphol)
Teasle Gourd (Kakrol)	Pomelo (Jamboora)	Pumpkin (Mishti Koomra)	Mango (Am)
Pumpkin (Mishti Koomra)	Bilimbi (Kamranga)	Jute Leaves (Pat Shak)	Black Berry (Jam)
Okra (Dherosh)	Lemon (Lebu)	Palwal (Potol)	Coconut (Narikel)
Yard Long Bean (Borboti)	Mango (Am)	Ridge Gourd (Jhinga)	Lemon (Lebu)
Been (Sheem)	Black Berry (Jam)	Snake Gourd (Chichinga)	Watermelon (Tormooj)
Bati Shak	Wood Apple (Bel)	Bitter Gourd (Korola)	
China Shak		Ash Gourd (Chal Koomra)	
		Pumpkin & Leaves (Mishti Koomra & Shak)	
		Okra (Dherosh)	
		Yard Long Bean (Borboti)	
		Eggplant (Begoon)	
		Cucumber (Shosha)	
		Bati Shak	
		China Shak	

JULY-AUGUST

SRABON

Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Pineapple (Anarosh)	Red Amaranth (Lal Shak)	Papaya (Pepe)
Mint (Pudina Pata)	Lemon (Lebu)	Mint (Pudina Pata)	Guava (Peyara)
Helencha Leaves (Helencha Shak)	Pomelo (Jamboora)	Helencha Leaves (Helencha Shak)	Banana (Kola)
Spinach (Palong Shak)	Bitter Plum (Boroi)	Thankooni Leaves (Thankooni Pata)	Pineapple (Anarosh)
Radish (Moola)	Banana (Kola)	Black Arum Leaves (Kalo Kochu Shak)	Coconut (Narikel)
Green Amaranth (Data Shak)	Guava (Peyara)	Kangkong (Kolmi Shak)	Lichi (Lichu)
Pumpkin (Mishti Koomra)	Lichi (Lichu)	Sweet Potato Leaf (Mishti Aloo Shak)	Jackfruit (Kathal)
Bean (Sheem)	Jackfruit (Kathal)	Indian Spinach (Pui Shak)	Lemon (Lebu)
Yard Long Bean (Borboti)	Black Berry (Jam)	Green Amaranth (Data Shak)	Mango (Am)
Eggplant (Begoon)	Coconut (Narikel)	Snake Gourd (Chichinga)	
Bottle Gourd (Lau)		Ash Gourd (Chal Koomra)	
Bati Shak		Ridge Gourd (Jhinga)	
China Shak		Bitter Gourd (Korola)	
Kangkon, (Kolmi Shak)		Pumpkin (Mishti Koomra)	
		Cucumber (Shosha)	
		Palwal (Potol)	
		Teasle Gourd (Kakrol)	
		Okra (Dherosh)	
		Yard Long Bean (Borboti)	
		Eggplant (Begoon)	
		Bati Shak	
		China Shak	

AUGUST-SEPTEMBER

BHADRO

Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Pineapple (Anarosh)	Red Amaranth (Lal Shak)	Papaya (Pepe)
Mint (Pudina Pata)	Coconut (Narikel)	Mint (Pudina Pata)	Pineapple (Anarosh)
Helencha Leaves (Helencha Shak)	Jackfruit (Kathal)	Helencha Leaves (Helencha Shak)	Guava (Peyara)
Radish (Moola)	Bitter Plum (Boroi)	Thankooni Leaves (Thankooni Pata)	Coconut (Narikel)
Spinach (Palong Shak)	Black Berry (Jam)	Spinach (Palong Shak)	Lemon (Lebu)
Coriander Leaves (Dhonia Pata)		Indian Spinach (Pui Shak)	Banana (Kola)
Green Amaranth (Data Shak)		Kangkong (Kolmi Shak)	
Napa/Lafa (Lafa Shak)		Radish Leaves (Moola Shak)	
Sweet Potato (Mishti Aloo)		Green Amaranth (Data Shak)	
Bottle Gourd (Lau)		Black Arum Leaves (Kalo Kochu Shak)	
Bitter Gourd (Korola)		Ash Gourd (Chal Koomra)	
Palwal (Potol)		Ridge Gourd (Jhinga)	
Been (Sheem)		Pumpkin (Mishti Koomra)	
Yard Long Bean (Borboti)		Yard Long Bean (Borboti)	
Eggplant (Begoon)		Okra (Dherosh)	
Cabbage (Tadhakopi)		Eggplant (Begoon)	
Cauliflower (Phoolkopi)		Bitter Gourd (Korola)	
Broccoli (Shobooj Phoolkopi)		Cucumber (Shosha)	
Kholrabi (Olkopi)		Bati Shak	
Tomato		China Shak	
Bati Shak			
China Shak			

APPENDIX I

SEPTEMBER-OCTOBER

ASHIN

Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Papaya (Pepe)	Red Amaranth (Lal Shak)	Papaya (Pepe)
Mint (Pudina Pata)	Banana (Kola)	Mint (Pudina Pata)	Banana (Kola)
Helencha Leaves (Helencha Shak)	Pineapple (Anarosh)	Helencha Leaves (Helencha Shak)	Guava (Peyara)
Napa/Lafa (Lafa Shak)		Thankooni Leaves (Thankooni Pata)	Coconut (Narikel)
Black Arum Leaves (Kalo Kochu Shak)		Spinach (Palong Shak)	Lemon (Lebu)
Spinach (Palong Shak)		Indian Spinach (Pui Shak)	
Coriander Leaves (Dhonia Pata)		Radish & Leaves (Moola & Shak)	
Green Amaranth (Data Shak)		Green Amaranth (Data Shak)	
Carrot (Gajor)		Bottle Gourd & Leaves (Lau & Shak)	
Beet		Coriander Leaves (Dhonia Pata)	
Kholrabi (Olkopi)		Yard Long Bean (Borboti)	
Radish Leaves (Moola Shak)		Eggplant (Begoon)	
Turnip (Shalgom)		Pumpkin (Mishti Koomra)	
Sweet Potato (Mishti Aloo)		Napa/Lafa (Lafa Shak)	
Pumpkin (Mishti Koomra)		Bati Shak	
Bottle Gourd (Lau)		China Shak	
Bitter Gourd (Korola)		Kangkong (Kolmi Shak)	
Palwal (Potol)			
Eggplant (Begoon)			
Potato (Aloo)			
Tomato			
Bean (Sheem)			
Cabbage (Badhakopi)			
Cauliflower (Phoolkopi)			
Broccoli (Shobooj Phoolkopi)			
Bati Shak			
China Shak			

OCTOBER-NOVEMBER

KARTIK

Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Papaya (Pepe)	Red Amaranth (Lal Shak)	Papaya (Pepe)
Mint (Pudina Pata)	Banana (Kola)	Mint (Pudina Pata)	Banana (Kola)
Helencha Leaves (Helencha Shak)		Helencha Leaves (Helencha Shak)	Guava (Peyara)
Napa/Lafa (Lafa Shak)		Thankooni Leaves (Thankooni Pata)	
Coriander Leaves (Dhonia Pata)		Radish & Leaves (Moola & Shak)	
Spinach (Palong Shak)		Bottle Gourd & Leaves (Lau & Shak)	
Green Amaranth (Data Shak)		Coriander Leaves (Dhonia Pata)	
Potato (Aloo)		Sweet Potato & Leaves (Mishti Aloo & Shak)	
Sweet Potato (Mishti Aloo)		Spinach (Palong Shak)	
Carrot (Gajor)		Green Amaranth (Data Shak)	
Radish & Leaves (Moola & Shak)		Napa/Lafa (Lafa Shak)	
Beet		Pumpkin & Leaves (Mishti Koomra & Shak)	
Turnip (Shalgom)		Cabbage (Badhakopi)	
Kholrabi (Olkopi)		Cauliflower (Phoolkopi)	
Cabbage (Badhakopi)		Yard Long Bean (Borboti)	
Cauliflower (Phoolkopi)		Eggplant (Begoon)	
Broccoli (Shobooj Phoolkopi)		Papaya (Pepe)	
Bottle Gourd (Lau)		Carrot (Gajor)	
Bitter Gourd (Korola)		Bati Shak	
Palwal (Potol)		China Shak	
Eggplant (Begoon)		Lettuce	
Tomato		Kangkong (Kolmi Shak)	
Bati Shak			
China Shak			

APPENDIX I

NOVEMBER-DECEMBER

OGRAHAYON

Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Papaya (Pepe)	Red Amaranth (Lal Shak)	Papaya (Pepe)
Mint (Pudina Pata)	Watermelon (Tarmooj)	Mint (Pudina Pata)	Guava (Peyara)
Helencha Leaves (Helencha Shak)		Sweet Potato Leaves (Mishti Aloo Shak)	
Napa/Lafa (Lafa Shak)		Bottle Gourd & Leaves (Lau & Shak)	
Coriander Leaves (Dhonia Pata)		Spinach (Palong Shak)	
Spinach (Palong Shak)		Napa/Lafa (Lafa Shak)	
Radish & Leaves (Moola & Shak)		Radish & Leaves (Moola & Shak)	
Carrot (Gajor)		Carrot (Gajor)	
Beet		Beet	
Turnip (Shalgom)		Cabbage (Badhakopi)	
Kholrabi (Olkopi)		Cauliflower (Phoolkopi)	
Cabbage (Badhakopi)		Broccoli (Shobooj Phoolkopi)	
Broccoli (Shobooj Phoolkopi)		Pumpkin & Leaves (Mishti Koomra & Shak)	
Eggplant (Begoon)		Bean (Sheem)	
Bitter Gourd (Korola)		Yard Long Bean (Borboti)	
Potato (Aloo)		Eggplant (Begoon)	
Sweet Potato (Mishti Aloo)		Tomato	
Tomato		Lettuce	
Bati Shak		Bati Shak	
China Shak		China Shak	
Lettuce			

DECEMBER-JANUARY

POUSH

Sowing/Planting		*Harvesting*	
Vegetable	*Fruit*	*Vegetable*	*Fruit*
Red Amaranth (Lal Shak)	Watermelon (Tormooj)	Red Amaranth (Lal Shak)	Papaya (Pepe)
Mint (Pudina Fata)		Mint (Pudina Pata)	Guava (Peyara)
Helencha Leaves (Helencha Shak)		Sweet Potato & Leaves (Mishti Aloo & Shak)	
Coriander Leaves (Dhonia Pata)		Coriander Leaves (Dhonia Pata)	
Napa/Lafa (Lafa Shak)		Napa/Lafa (Lafa Shak)	
Spinach (Palong Shak)		Spinach (Palong Shak)	
Radish (Moola)		Radish & Leaves (Moola & Shak)	
Carrot (Gajor)		Turnip (Shalgom)	
Beet		Carrot (Gajor)	
Pumpkin (Mishti Koomra)		Beet	
Tomato		Bottle Gourd & Leaves (Lau & Shak)	
Eggplant (Begoon)		Pumpkin (Mishti Koomra)	
Bati Shak		Eggplant (Begoon)	
China Shak		Bean (Sheem)	
Lettuce		Tomato	
Thankooni Leaves (Thankooni Pata)		Potato (Aloo)	
		Cabbage (Badhakopi)	
		Cauliflower (Phoolkopi)	
		Kholrabi (Olkopi)	
		Broccoli (Shobooj Phoolkopi)	
		Lettuce	
		Bati Shak	
		China Shak	

APPENDIX II

PRODUCTION PRACTICES RELATING TO DIFFERENT VEGETABLES

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

Soil

Soil is an important medium for growing vegetables. Different vegetables need different types of soil. Loamy and sandy loam soil is suitable for most vegetables. 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 the way that is most appropriate for the type of vegetable and size of seed. For smaller seeds like lal shak, bati shak or data shak, the land should be well pulverized. For gourd-type vegetables such as pumpkin and bottle gourd, it is better to prepare pits.

Sowing/Planting Time

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

Spacing

For some vegetables such as lal shak, data shak 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 seed that is sowed directly, a 10-15% higher rate should be used. Thinning should be done 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 spinach, indian spinach and kolmi shak 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 as 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, 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 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.

List of Abbreviations

CDCOM	Cowdung Compost
TD	Top-Dress
DAS	Days After Sowing
DAE	Days After Emergence
DAP	Days After Planting
DAT	Days After Transplanting
T.S.P.	Triple Super Phosphate
M.P.	Murate of Postash
Dec.	Decimal (1 Dec = 40^2m)

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

LEAFY VEGETABLES

Name of Vegetable	Soil	Sowing/ Planting Time	Spacing in cm	Seed Rate per Dec or 40 sqm	Days Needed to Germinate
Babori Shak	**Sandy loam and loam.**	**November-December**	**Plant to plant: 10-15**	**30-40 g**	**8-10**
Bati Shak	Any soil but sandy loam is best.	Whole year (but better not to grow in excessive rain).	Line to line: 45-50 Plant to plant: 30	5 g	4-5
Botua **(Pigweed)**	**Sandy loam & loam.**	**November-January**	**Plant to plant: 12-15**	**5-6 g**	**4-6**
Data Shak (Green Amaranth)	Any soil except sandy. Loam & sandy loam is best.	Whole year but best time for sowing is March to July.	Line to line: 25-30 Plant to plant: 5-8 after thinning	10-15 g	4-5
Dheki Shak	**Loam and clay loam.**	**May-June**	**—**	**—**	**—**
Dhonia Pata (Coriander Leaves)	Sandy loam and clay loam.	September-November	Plant to plant: 10-15	70-80 g	7-10
Helencha	**Any soil.**	**Throughout the year**	**Plant to plant: 30**	**6,000-7,000 stems**	**—**
Kalo Kochu Shak (Black Arum Leaves)	Sandy loam but grows in all types of soil.	April-May	Plant to plant: 10-15	200-250 root cuttings	5-6
Kolmi Shak **(Kangkong)**	**It can grow in any type of soil. Loam & clay loam is best. It can tolerate waterlogged conditions.**	**Kangkong can grow at any time of the year. Best time for sowing is February to July.**	**Line to line: 30 Plant to plant: 15**	**40-50 g It can grow from both seeds and stem cuttings.**	**6-8**
Lal Shak (Red Amaranth)	Any soil, but sandy loam is best	Year round	Both broadcast and line sowing can be done. For line sowing distance line to line is 20-25	20 g	4-5

Variety	Amount of Fertilizer per Dec with Application					Depth to Sow Seed	Crop Duration Harvest	Yield in kg per Dec or 40 sqm	Remarks
	Application	CDCOM	Urea	T.S.P.	M.P				
Local	**During land preparation**	**40 kg**	**—**	**—**	**—**	**1-2 cm**	**30-40 DAS**	**12-15**	
HYV	Basal	40 kg	—	800 g	—	0.5-1 cm	60-65 DAS 40-45 DAT	70-80	Both direct sowing & transplanting can be done but transplanting is recommended for better growth & yield. Transplant 20-25 days old seedlings.
	1st TD at 20-25 DAS	—	700 g	—	250 g				
	During top dress fertilizer will mix with soil in the bed.								
Teltua, Batua.	**During land preparation**	**40 kg**	**—**	**—**	**—**	**1-1.5 cm**	**30-40 DAS**	**10-15**	
For stem: Katoa Shobooj, Sureswari Dakkin Bas Pata. **For leaf:** Amoni. Pusa Bari.	Basal	40 kg	—	400 g	400 g	0.5-1 cm	50-60 DAS. Data shak can be harvested 25-30 DAS.	70-100 (both stem & leaf)	Land should be well pulverized because seeds are very small. Both direct and line sowing can be done.
	1st TD at 15 DAS	—	300 g	—	—				
	2nd TD at 30 DAS	—	300 g	—	—				
Local	**During land preparation**	**40 kg**	**—**	**—**	**—**	**2-4 cm**	**45-60 DAP**	**20-25**	**Grows naturally. Does not need any management.**
Local	During land preparation	40 kg	—	—	—	1 cm	25-45 DAS	15-20 (leaf)	
Local	**During land preparation**	**40 kg**	**—**	**—**	**—**	**3-4 cm**	**45-60 DAP**	**80-100**	**Grows in wet places. After planting, spreads to cover whole area.**
Local	During land preparation	40 kg	—	—	—	5-7 cm	45-60 DAP	80-120	Grows in all types of soil but normally in wet places.
Gima Kolmi.	**Basal**	**40 kg**	**300 g**	**200 g**	**100 g**	**1.5-2.5 cm**	**45-60 DAS. Harvesting can start 40 DAS and continues for 9 months.**	**120-140**	**Seed must be soaked for 24 hours before sowing. Two seeds should be sown per pit.**
	1st TD at 30 DAS	**—**	**100 g**	**—**	**—**				
	2nd TD at 60 DAS	**—**	**100 g**	**—**	**—**				
	3rd TD at 90 DAS	**—**	**100 g**	**—**	**—**				
All are local varieties. Altapeti is good.	Basal	20 kg	400 g	200 g	200 g	1 cm	30-40 days. Harvesting can continue for a long time.	25-30	Soil should be kept moist until the seeds have germinated. Land should be well pulverized because seeds are very small.

LEAFY VEGETABLES

Name of Vegetable	Soil	Sowing/ Planting Time		Spacing in cm	Seed Rate per Dec or 40 sqm	Days Needed to Germinate
Lettuce	**All types of loamy soil.**	**Seed *Sowing* 15 Sept-Nov**	**Seedling *Planting* Nov-Jan**	**Line to line: 30-40 Plant to plant: 20-25**	**1 g 350-400 seedlings**	**7-10**
Napa Lafa	Loam and sandy loam.	October-November		Plant to plant: 3-5	60-70 g	5-7
***Notay* (Amaranathus)**	**All types of soil.**	**March-May**		**Plant to plant: 4-6**	**3-4 g**	**5-6**
Palong Shak (Spinach)	Loam, sandy loam & clay loam. Loam is best	September-January		Line to line: 15-20 Plant to plant: 10-15 after thinning.	125-150 g	5-7
***Pat Shak* (Jute Leaves)**	**Any soil with some organic matter.**	**March-May**		**Line to line: 10-15**	**25-30 g**	**4-6**
Pudina Pata (Mint)	Any soil but loamy is best	Throughout the year		Plant to plant: 15-20	13,500 stems	—
***Pui Shak* (Indian Spinach)**	**Sandy loam & clay loam with good drainage. Sunlight is beneficial.**	**February-June is the best time.**		**Line to line: 40-50 Plant to plant: 20 after thinning.**	**15-20 g 3-4 seeds/hill**	**5-7**
Roshoom Shak	Loam and clay loam.	May-September		Plant to plant: 15	8,000-10,000 cuttings	—
Shorisha Shak	**Sandy loam.**	**September-November**		**Plant to plant: 8-10**	**10-15 g**	**3-7**
Thankoom Pata	Sandy loam rich in organic matter	December-January		Plant to plant: 15-20	1,350 stem cuttings	—

Variety	Amount of Fertilizer per Dec with Application					Depth to Sow Seed	Crop Duration Harvest	Yield in kg per Dec or 40 sqm	Remarks
	Application	CDCOM	Urea	T.S.P.	M.P.				
King Crown, Imperial, Simpson.	Before land preparation 1st TD at 15 DAS 2nd TD at 25 DAS 3rd TD at 35 DAS	20 kg — — —	— 300 g 250 g 250 g	150 g — — —	150 g — — —	1-1.5 cm	80-90 DAS 30-40 DAT	80-100	Seedlings should be 30-35 days old. Both direct sowing and seedling transplanting can be done but transplanting is better.
Local varieties are Napa & Hapa	Before land preparation 1st TD at 10-15 DAS 2nd TD at 25-30 DAS	20 kg — —	— 100 g 100 g	50 g — —	25 g 25 g 25 g	1-2 cm	30-90 DAS	40-50	
Local	During land preparation	40 kg	—	—	—	1-1.5 cm	60-90 DAS	15-20	
All are local Important varieties are Kope Palong & Pusa Jayati	Before land preparation TD at 15 DAS TD at 25 DAS TD at 35 DAS	20 kg — — —	— 300 g 250 g 250 g	150 g — — —	150 g — — —	1.5 cm	60-90 days. Harvesting can start 45 DAS	40-50 kg Cut the outer leaves often to prolong the harvest.	Seeds must be soaked in water for 24 hours before sowing.
Deshi, Tosha.	During land preparation	40 kg	—	—	—	0.5 cm	30-60 DAS	35-45	Deshi variety is most suitable.
Local	During land preparation	40 kg	—	—	—	3-4 cm	45-60 DAP	60-70	Grows in wet places. After planting, spreads to cover whole area.
Mainly two varieties: white or green stemmed and red stemmed.	Before land preparation TD at 25 DAS TD at 35 DAS TD at 45 DAS	15 kg — — —	— 150 g 150 g 100 g	400 g — — —	— 150 g 150 g 100 g	1.5 cm	60-70 DAS. 40 days after emergence, harvesting can start. The more the leaves and stems are cut, the more they will grow.	60-90	Seeds must be soaked in water for 24 hours before sowing.
Local	During land preparation	40 kg	—	—	—	3-5 cm	25-30 DAP	18-22	Stem cutting is planted
Tori, T.S-72 (Kalayania), S.S-75 (Sampad), Sambal.	During land preparation	40 kg	—	—	—	0.5 cm	25-40 DAS	20-30	Early sowing advisable to avoid pest & disease.
Local	During land preparation	40 kg	—	—	—	3 cm	45-60 DAP	15-20	Stem part with root is used as cutting.

TARO/ARUM

Name of Vegetable	Soil	Sowing/ Planting Time	Spacing	Seed Rate per Dec or 40 sqm	Days Needed to Germinate
Shoji Kochu (Arum Tuber)	Sandy soil rich in organic matter.	April-May	Lint to line: 75 cm Plant to plant: 25 cm	80-120 (tubers)	5-7

ROOT VEGETABLES

Name of Vegetable	Soil	Sowing/ Planting Time	Spacing	Seed Rate per Dec or 40 sqm	Days Needed to Germinate
Beet	Loam & sandy loam.	October to December is the best time.	Line to line: 20-25 cm Plant to plant: 10-12 cm after thinning	20 g	5-7
Gajor (Carrot)	A loose sandy, loam or sandy loam with drainage facilities. Seeds are very small, so land should be well pulverized	15 September to 15 January but 15 October to 15 December is best.	Line to line: 20-25 cm Plant to plant: 5-8 cm after thinning	15 g	Germination is slow: 10-20 days are required.
Moola (Radish)	It can be grown in nearly all types of soil but best results are obtained in loam & sandy loam.	July-December but best time for sowing is 15 Sept-15 Nov	Line to line: 20-30 cm Plant to plant: 8-10 cm after thinning	25-30 g	4-5
Shalgom (Turnip)	Any soil except extremely light clay or very sandy soil. Loam & clay loam are best.	15 September to November	Line to line: 20-25 cm Plant to plant: 10-15 cm	10 g or 350-400 seedlings	5-7

Variety	Amount of Fertilizer per Dec.with Application					Depth to Sow Seed	Crop Duration Harvest	Yield in kg per Dec or 40 sqm	Remarks
	Application	CDCOM	Urea	T.S.P.	M.P.				
Local	Basal	40 kg	—	500 g	—	5-8 cm	90-120 DAP	140-200	Vegetative part of matured plant is dried. Tuber can then be preserved for 30-35 days in the soil.
	1st TD at 20 DAP	—	300 g	—	350 g				
	2nd TD at 40 DAP	—	300 g	—	350 g				

Variety	Amount of Fertilizer per Dec with Application					Depth to Sow Seed	Crop Duration Harvest	Yield in kg per Dec or 40 sqm	Remarks
	Application	CDCOM	Urea	T.S.P.	M.P.				
Detroit Dark Red, Detroit Red, Ruby Queen, Crimson Globe.	Basal	20 kg	400 g	600 g	400 g	1.5-2.5 cm	65-90 DAS. After 60 days harvesting can start.	60-70	Both direct sowing and transplanting can be done but direct sowing is better. Earthing up is necessary once or twice per season.
	1st TD at 30 DAS	—	200 g	—	200 g				
	2rd TD 45 DAS	—	200 g	—	200 g				
	Application	CDCOM	Urea	T.S.P.	M.P.				
Vita Longa, Nantes, Chantenay, Imperator.	Basal	40 kg	400 g	600 g	400 g	0.5 cm	70-120 DAS. Young carrots can be harvested 60 DAS	Yield depends on time of harvest. 60-100	Direct sowing in the bed is good for carrots. Seed should be soaked in water for 12 hours before sowing.
	1st TD at 30 DAS	—	200 g	—	200 g				
	2nd TD at 45 DAS	--	200 g	—	200 g				
	Application	CDCOM	Urea	T.S.P.	M.P.				
Important varieties are Tasakisan, Mino Early, Miasiki, Red Bombai.	Basal	40 kg	400 g	600 g	400 g	1-1.5 cm	30-55 DAS. Leaves are ready to harvest 15-20 DAS. Root is ready 30 DAS.	Depends on time of harvest. 75-110	Soil for radish should be well prepared. Hard soil hampers root growth.
	1st TD at 25 DAS	—	200 g	—	200 g				
	2nd TD at 40 DAS	—	200 g	—	200 g				
	Application	CDCOM	Urea	T.S.P.	M.P.				
Purple, Top Purple and White Globe.	Basal	40 kg	250 g	400 g	300 g	1-1.5 cm	50-75 DAS. Leaves can be harvested 30-35 DAS.	60-90	Both direct sowing & transplanting can be done but direct sowing is better. One earthing up is required.
	1st TD at 30 DAS	—	125 g	—	150 g				
	2nd TD at 45 DAS	—	125 g	—	150 g				

FRUIT VEGETABLES

Name of Vegetable	Soil	Sowing/ Planting Time		Spacing	Seed Rate per Dec or 40 sqm	Days Needed to Germinate
Begoon (Eggplant)	Any loamy soil with irrigation & drainage.	It can grow all year. Best time for sowing in the seed bed is: Winter Summer Rainy	 15 July-Sept Nov-Dec Feb-April	Line to line: 75 cm Plant to plant. 45 cm If large variety, then plant to plant: 55-60 cm	2 g About 70-80 seedlings/Dec	6-8
Dherosh (Okra)	It can grow in almost any soil with good drainage. Loam is best.	Any time of the year but best time for sowing is Feb. to May. Direct sowing is recommended.		Line to line: 60-75 cm Plant to plant: 45 cm	25-30 g	6-8
Pepe (Papaya)	It can be grown in any well-drained soil. Best performance is seen in rich sandy loam.	Seed *Sowing* 15 Feb-15 April 15 Sept-15 Nov	Seedling *Planting* 15 Mar-15 May 15 Oct-15 Dec	Line to line: 2 m Pit to pit: 1.5 m Size of pit: 60 x 60 x 50 cm	3-5 g 250-350g/ha	8-10 days in in summer 15-20 days in winter
Tomato	Tomato is grown in many types of soil from sand to heavy clay. A well-drained light fertile loam is excellent.	Seed *Sowing* Early 15-30 Aug Mid Sept-Oct Late November	Seedling *Planting* Up to Sept 15 Oct-Nov December	Line to line: 60-80 cm Plant to plant: 45-50 cm	1.5 g 90-100 seedlings	6-8
Shajna (Drumstick)	Any type of soil.	All year but April-May is best		Plant to plant: 2.5-3 m	3-4 stem cuttings	—

Variety	Amount of Fertilizer per Dec with Application					Depth to Sow Seed	Crop Duration Harvest	Yield in kg per Dec or 40 sqm	Remarks
	Application	CDCOM	Urea	T.S.P.	M.P.				
Islampuri, Khotkhotia, Singnath, Uttara, Muktakeshari, Nayankazal.	Basal	60 kg	—	600 g	800 g	.5-1.5 cm	Depends on variety. 90-100 DAS.	70-100	Seedlings should be 35-40 days old with 5-6 leaves.
	1st TD at 15 DAT	—	350 g	—	—				
	2nd TD at 40 DAT	—	350 g	—	—				
	3rd TD at harvt. stage	—	300 g	—	—				
	Application	CDCOM	Urea	T.S.P.	M.P.				
Pusa Showni, Penta Green and Kabuli Dwarf.	Basal	50 kg	—	500 g	—	1-2 cm	60-90 DAS	35-40	Seed must be soaked for 24 hours before sowing. It cannot tolerate water logged conditions and contaminating virus during continuous rain.
	1st TD at 20 DAS	—	200 g	—	200 g				
	2nd TD at 40 DAS	—	200 g	—	200 g				
	3rd TD at 60 DAS	—	200 g	—	200 g				
	Application Per Pit	CDCOM	Urea	T.S.P.	M.P.				
CO2, Rachi, Pusa Dwarf, Pusa Giant, Pusa Majesty.	10-12 days before planting	20 kg	—	250 g	—	2-2.5 cm	6-7 months after transplanting, ripe papaya can be harvested.	25 to 35 per plant	Seed must be soaked for 24 hours before sowing. 5-7 week old seedlings about 15cm high should be planted in pit. 3 seedlings should be planted in each pit and finally thinned out to one after removing male & weak plants.
	1st TD at 15 DAT	—	150 g	—	100 g				
	2nd TD at 45 DAT	—	150 g	—	100 g				
	3rd TD at 60 DAT	—	150 g	—	200 g				
	Application	CDCOM	Urea	T.S.P.	M.P.				
Manik, Raton Roma VF, Marglobe, Oxheart and Money Maker.	Basal	50 kg	—	700 g	—	1 cm	70-90 DAT 100-120 DAS	70-100	28-35 day old seedlings about 8-10 cm high with 5-6 leaves should be planted. It is necessary to maintain a constant moisture supply. Stake the young plants and prune off the excess stems.
	1st TD at 7 DAT	—	300 g	—	200 g				
	2nd TD at 21 DAT	—	300 g	—	200 g				
	3rd TD at 35 DAT	—	300 g	—	200 g				
	Application Per Pit	CDCOM	Urea	T.S.P.	M.P.				
Local	During land preparation	20 kg	—	—	—	25-30 cm	250 DAP	30-40	Leaf, flower and drumstick are consumed.

GOURD VEGETABLES

Name of Vegetable	Soil	Sowing/ Planting Time	Spacing	Seed Rate per Dec or 40 sqm	Days Needed to Germinate
Chal Koomra (Ash Gourd)	Well-drained loam & sandy loam is good.	March-May October-January It can grow all year but March-May is the best time.	Pit to pit: 2 m Size of pit: 60 x 60 x 50 cm	2 g 4-5 seeds/pit	5-7
Chichinga (Snake Gourd)	Sandy and clay loam.	March-July	Line to line: 2 m Pit to pit: 1.5 m Size of pit: 60 x 60 x 50 cm	15 g 4-5 seeds/pit	5-7
Jhinga and Dhoondol (Bath Sponge)	Can grow in any soil.	March-June	Pit to pit: 1.5 m Size of pit: 60 x 60 x 50 cm	8-10 g 4-5 seeds/pit	5-7
Kakrol (Teasle Gourd)	Loam, clay loam and sandy loam.	March-May	Line to line: 2 m Pit to pit: 2 m Size of pit: 60 x 60 x 45 cm	8-12 root/tuber cuttings/Dec 2-3 cuttings/pit	—
Korola (Bitter Gourd)	Well-drained fertile sandy loam, clay loam & loam.	It can grow throughout the year but best time for sowing seed is: Choitali — Jan-March Borshati — April-June Rabi — Oct-Dec.	Line to line: 1 m Pit to pit: 1 m Size of pit: 45 x 45 x 30 cm	25 g 4-5 seeds/pit	5-7

Variety	Amount of Fertilizer per Dec with Application					Depth to Sow Seed	Crop Duration Harvest	Yield in kg per Dec or 40 sqm	Remarks
	Application Per Pit	CDCOM	Urea	T.S.P.	M.P.				
Local improved varieties	7-10 days before sowing	10 kg	—	150 g	40 g	1.5-2 cm	120 DAS harvesting can start.	70-90 start.	It needs trellis. Keep two healthy plants per pit & remove the rest. It can be stored for a long time.
	1st TD at 20 DAS	—	75 g	—	20 g				
	2nd TD at 40 DAS	—	75 g	—	20 g				
	3rd TD at 60 DAS	—	75 g	—	20 g				
	Application Per Pit	CDCOM	Urea	T.S.P	M.P				
There are many local improved varieties. One good variety is Jhumlong.	10-12 days before sowing	10 kg	—	150 g	40 g	1.5 cm	70-80 DAS harvesting can start. Young fruit can be harvested for better marketing.	50-60	Seed must be soaked for 24-36 hours before sowing. Keep two healthy plants and remove the rest from the pit. Snake Gourd needs trellis.
	1st TD at 15 DAE	—	100 g	--	30 g				
	2nd TD at 30 DAE	—	100 g	--	30 g				
	Application Per Pit	CDCOM	Urea	T.S.P.	M.P.				
Local varieties.	10-12 days before sowing	10 kg	—	150 g	40 g	1-1.5 cm	60 DAS harvesting can start.	35-45	Seed must be soaked for 24 hours before sowing. Keep two healthy plants and remove the rest from the pit. Plant needs trellis.
	1st TD at 15 DAE	—	100 g	—	30 g				
	2nd TD at 30 DAE	—	100 g	—	30 g				
	Application Per Pit	CDCOM	Urea	T.S.P.	M.P.				
Large & small sizes but small variety is good & popular.	10-12 days before sowing	10 kg	—	100 g	—	Depth to root of plant 4-6 cm.	70-80 days. 60 days after emergence harvesting can start.	40-50	Provide trellis in time. 5% male plants needed for pollination. Artificial (by hand) pollination can be done.
	1st TD at 20 DAE	—	50 g	—	30 g				
	2nd TD at 40 DAE	—	50 g	—	30 g				
	Application Per Pit	CDCOM	Urea	T.S.P.	M.P.				
There are many good local varieties, mainly long & small ones.	10-12 days before sowing	10 kg	—	100 g	—	1.5-2.5 cm	Harvesting starts 50-60 DAS.	20-25	Seed should be soaked for 24 hours before sowing. Trellis required for long variety. Cover small variety with straw. Keep 2-3 healthy plants and remove the rest from the pit.
	1st TD at 20 DAS	—	50 g	—	30 g				
	2nd TD at 40 DAS	—	35 g	—	20 g				

GOURD VEGETABLES

Name of Vegetable	Soil	Sowing/ Planting Time		Spacing	Seed Rate per Dec or 40 sqm	Days Needed to Germinate
Lau (Bottle Gourd)	It can grow in any clay & loamy soil.	Two main seasons for sowing:		Line to line: 1.5-2 m Pit to pit: 1.5-2 m size of pit: 60 x 60 x 50 cm	6 g 5 seeds/pit 6 pits/Dec	4-7
		Season	*Sowing Time*			
		Winter	Aug-Nov			
		Summer	Mar-May			
Mishti Koomra (Pumpkin/Sweet Gourd)	Can grow in any well-drained soil.	*Season*	*Seed Sowing*	Line to line: 1.5 m Pit to pit: 1.5 m Size of pit: 50 x 50 x 50 cm	5 g 4-5 seeds/pit 5-6 pits/Dec	4-7
		Boishaki	Nov-January			
		Bhaduri	April-15 June			
		Maghi	July-15 Sept			
Shosha (Cucumber)	It can grow in all types of loamy soil.	Can grow all year but good in Kharif season. March-June is best.		Line to line: 2 m Pit to pit: 1.5 m Size of pit: 60 x 60 x 50 cm	2-3 g 4-5 seeds/pit	4-6
Potol (Palwal)	Well-drained loam & sandy loam is good.	October-March		Line to line: 1.5 m Plant to plant: 45 cm	About 45-50 cuttings from stem or root.	5-7

Variety	Amount of Fertilizer per Dec with Application					Depth to Sow Seed	Crop Duration Harvest	Yield in kg per Dec or 40 sqm	Remarks
	Application Per Pit	CDCOM	Urea	T.S.P.	M.P.				
Many good local varieties. One important variety is Keth Lau.	10-12 days before sowing	20 kg	—	75 g	—	2-2.5 cm	Needs about 100-120 DAS to mature. Leaf can be harvested earlier.	Depends on size. 80-100 20-30 kg per plant.	Local variety needs trellis in both seasons. Keth Lau needs trellis in summer season. After emergence keep two healthy plants and remove the rest from the pit.
	1st TD at 30 DAS	—	30 g	—	20 g				
	2nd TD at 50 DAS	—	35 g	—	20 g				
	3rd TD at 70 DAS	—	35 g	—	20 g				
	Application Per Pit	CDCOM	Urea	T.S.P.	M.P.				
Many local varieties but the most common & best variety is Baro Mashi.	10-12 days before sowing	20 kg	—	125 g	—	2-2.5 cm	Needs 100-120 DAS to mature.	Depends on size. 80-100 20-30 kg per plant.	In rainy season plants are grown on trellis. At other times plants trail on ground. (Advisable to keep straw on the ground.) After sprouting keep two healthy plants and remove the rest from the pit
	1st TD at 30 DAS	—	50 g	—	30 g				
	2nd DT at 45 DAS	—	50 g	—	35 g				
	3rd TD at 60 DAS	—	50 g	—	35 g				
	Application Per Pit	CDCOM	Urea	T.S.P.	M.P.				
Baro Mashi, Zetset, Green King.	10-12 days bfore sowing	10 kg	—	150 g	40 g	1.5-2 cm	70-80 DAS harvesting can start.	40-60	Seed must be soaked in water for 24 hours before sowing. Keep 2-3 healthy plants in the pit & remove the rest.
	1st TD at 15 DAE	—	100 g	—	30 g				
	2nd TD at 30 DAE	—	100 g	—	30 g				
	Application	CDCOM	Urea	T.S.P.	M.P.				
Mainly Bali and Murshida Badi.	Basal	50 kg	—	600 g	400 g	Stem cuttings should be planted. 4-6 cm depth.	Can be harvested 110-120 DAP	60-70	For every 20 female plants one male plant is needed. It is advisable to put straw on ground by trellis. Can be harvested all year except winter season.
	1st TD at 20 DAE	—	300 g	—	—				
	2nd TD at 40 DAE	—	250 g	—	—				
	3rd TD at 60 DAE	—	250 g	—	—				

BEAN VEGETABLES

Name of Vegetable	Soil	Sowing/ Planting Time	Spacing	Seed Rate per Dec or 40 sqm	Days Needed to Germinate
Borboti (Yard Long Bean)	It can grow in any soil containing sufficient organic matter. Soil must be well-drained. Loam & sandy loam is best.	February to July but March to April is the best time for sowing.	Line to line: 1 m Pit to pit: 0.5 m Size of pit: 38 x 38 x 38 cm	20 g 4-5 seed/pit	4-5
Sheem (Bean)	It can grow in any soil but loam & sandy loam is best.	July-September	Line to line: 2.5 m Pit to pit: 1.5 m Size of pit: 45 x 45 x 45 cm	25-30 g 4-5 seeds/pit	4-7
Soybean	Loam, clay loam & sandy loam.	Kharif: 15 June-31 August Rabi: 10 December-31 January	*Kharif* Line to line: 40 cm Plant to plant: 10 cm *Rabi* Line to line: 30 cm Plant to plant: 5 cm	*Kharif* 200 g *Rabi* 270 g	5-7 4-6

TUBERS

Name of Vegetable	Soil	Sowing/ Planting Time	Spacing	Seed Rate per Dec or 40 sqm	Days Needed to Germinate
Mishti Aloo (Sweet Potato)	Best soil for sweet potato is well-drained sandy loam. It can also be grown in loamy to clay loam soil.	15 October to 15 November but November is best time for planting.	Line to line: 50 cm Plant to plant: 25-30 cm	250-285 Stem cutting-size of stem should be 25-30 cm with 4-5 internodes.	—

Variety	Amount of Fertilizer per Dec with Application					Depth to Sow Seed	Crop Duration Harvest	Yield in kg per Dec or 40 sqm	Remarks
	Application	CDCOM	Urea	T.S.P.	M.P.				
Important & popular variety is Kagor Natoky.	Basal	40 kg	400 g	400 g	300 g	2-2.5 cm	70-75 DAS harvesting can start.	40-45	Seed can be soaked for 8 hours before sowing, if necessary. Trellis is essential. Provide when 15-20 cm high.
	1st TD at 15 DAT	—	200 g	—	150 g				
	2nd TD at 30 DAT	—	200 g	—	150 g				
	Application Per Pit	CDCOM	Urea	T.S.P.	M.P.				
There are many good local varieties.	10-12 days before sowing	10 kg	—	100 g	—	1.5-2.5cm	110-130 DAS	30-40	Seed can be soaked for 8 hours before sowing. Trellis essential. After emergence keep 2-3 healthy plants and remove the rest from the pit.
	1st TD at 20 DAE	—	50 g	—	50 g				
	2nd TD at 40 DAE	—	50 g	—	50 g				
	Application	CDCOM	Urea	T.S.P.	M.P.				
Pb-1, Bragg	During land preparation	40 kg	—	—	—	3-4 cm	*Kharif* 95-115 DAS *Rabi* 110-125 DAS	*Kharif* 6-8 *Rabi* 8-10	

Variety	Amount of Fertilizer per Dec with Application					Depth to Sow Seed	Crop Duration Harvest	Yield in kg per Dec or 40 sqm	Remarks
	Application	CDCOM	Urea	T.S.P.	M.P.				
Kamala Sundari, Tripti and local varieties.	Basal	50 kg	—	400 g	100 g	Depth to plant vine is 2.5-4 cm	130-160 DAP	100-140	It grows under the soil, so the soil should be pulverized to a good depth and free from clods.
	1st TD at 30 DAP	—	250 g	—	300 g				
	2nd TD at 60 DAP	—	250 g	—	300 g				

COLE VEGETABLES

Name of Vegetable	Soil		Sowing/ Planting Time		Spacing	Seed Rate per Dec or 40 sqm	Days Needed to Germinate
Badhakopi (Cabbage)	Can be grown in nearly all soils with good water supply. Sandy loam & clay loam is good.		Seed *Sowing*	Seedling *Planting*	Line to line: 60 cm Plant to plant: 45 cm	1.5 to 2 g or 120-150 seedlings	5-8
		Early	15-Aug	Oct			
		Mid	Sept	Nov-Dec			
		Late	Nov	Jan			
Olkopi (Kholrabi/ Knolkhol)	It can grow in all types of soil but fertile loam is best.		September to December		Line to line: 25-30 cm Plant to plant: 15-20 cm	3-4 g or 230-260 seedlings	4-6
Phoolkopi (Cauliflower)	Can be grown in all types of fertile soil but loamy soil is best.		Seed *Sowing*	Seedling *Planting*	Line to line: 55-60 cm Plant to plant: 40-45 cm	1.5-2 g or 140-150 seedlings	4-6
		Early	August	Up to 15 Sept			
		Mid	September	Up to 15 Oct			
		Late	October	Up to 15 Nov			
Shobooj Phoolkopi (Broccoli)	Fertile loam & sandy loam.		Seed *Sowing* Sept-Nov	Seedling *Planting* Oct-Dec	Line to line: 50-60 cm Plant to plant: 40-45 cm	1.5 g 140-150 seedlings	4-6

Variety	Amount of Fertilizer per Dec with Application					Depth to Sow Seed	Crop Duration Harvest	Yield in kg per Dec or 40 sqm	Remarks
	Application	CDCOM	Urea	T.S.P.	M.P.				
Early: Green Express, Atlas 70, **Mid:** K-Y Cross, Provati, K-K Cross, Green Express. **Late:** Altas 70, Provati, Drum head.	Basal	40 kg	—	500 g	—	0.5-1 cm	Depends on variety. 50-80 DAT 80-120 DAS	160-200	Transplant 30-35 day old seedlings with 5-6 true leaves about 8-10 cm high.
	1st TD at 10 DAT	—	300 g	—	200 g				
	2nd TD at 25 DAT	—	350 g	—	200 g				
	3rd TD at 35-45 DAT	—	350 g	—	200 g				
	Application	CDCOM	Urea	T.S.P.	M.P.				
Purple Vienna and White Vienna.	Basal	30 kg	—	500 g	—	0.5 cm	45-60 DAT	70-100 Average weight per olkopi is 250-300g	Direct sowing and transplanting can both be done but transplanting is best. Age of seedlings is 25-35 days.
	1nd TD at 15 DAT	—	350 g	—	300 g				
	2nd TD at 30 DAT	—	350 g	—	300 g				
	Application	CDCOM	Urea	T.S.P.	M.P.				
Early: Agrahani, Early Snowball, Early Patna. **Mid season:** Snowball X, Snowball Y, Poushali. **Late:** Maghi, Banarashi, White Mountain, Unic Snowball.	Basal	40 kg	—	600 g	—	0.5-1 cm	60-70 DAT	120-140	Transplant 25-30 day old seedlings with 5-6 true leaves about 8-10 cm high. Irrigate when necessary.
	1st TD at 10 DAT	—	300 g	—	200 g				
	2nd TD at 20 DAT	—	350 g	—	200 g				
	3rd TD at 30 DAT	—	350 g	—	200 g				
	Application	CDCOM	Urea	T.S.P.	M.P.				
Green Comet, Green Duke, Premium Crop.	Basal	40 kg	—	600 g	—	1-1.5 cm	90-100 DAS 60-70 DAT	60-70	Seedlings should be 30-35 days old.
	1st TD at 10 DAT	—	300 g	—	200 g				
	2nd TD at 20 DAT	—	350 g	—	200 g				
	3rd TD at 30 DAT	—	350 g	—	200 g				

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