



Part 1

Work with Life Forms



‘Life forms’ include all living things on earth. They include human beings, animals, birds, fish, plants, insects, and even bacteria and viruses. Projects on Work with Life Forms will help you work with living things in different ways. You can take up projects related to growing plants in various ways, recording the biodiversity around you, surveying medicinal plants, learning to care for domestic animals, and maintaining a nature journal. It is up to you to imagine all that you can do in the activities with your peers.

Two examples of projects are given in this section. You must take up only one project. You can either choose one of these projects or you can design a project of your own choice with the help of your teacher.

Project 1

School Kitchen Garden



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This project will help you learn about growing plants for food. You will create a kitchen garden on your school campus, either in plant beds or in pots (Figure 1.1).

As part of the project, you will be able to:

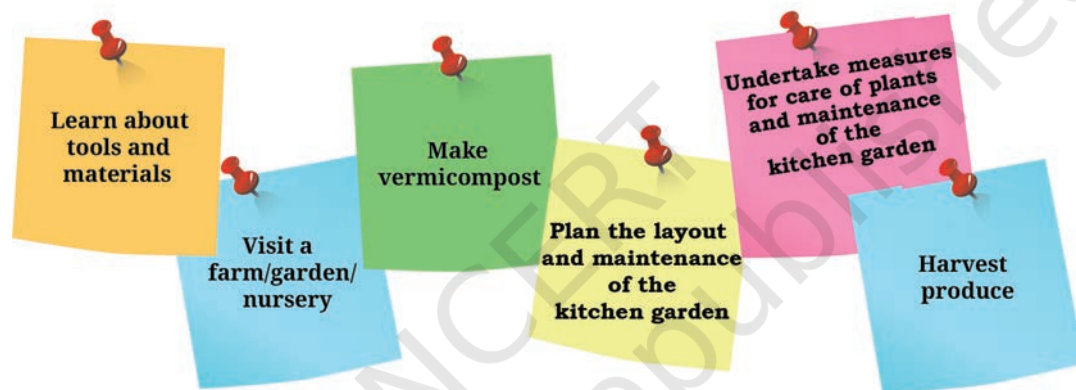


Figure 1.1: A school kitchen garden

We all enjoy different kinds of food. Some of us like to eat fresh fruits and vegetables, some like vegetables cooked with herbs and spices, yet others like preserved food, such as pickles and tomato sauce. Most of our food that comes from farms, vegetables, such as brinjal (eggplant), cucumber, chilli or herbs, coriander, and mint, can be grown in a kitchen garden.

A kitchen garden, also known as a vegetable garden, is a garden where fruits, vegetables, and herbs are grown. The 'produce' or yield from the garden is usually sufficient to meet a family's needs.

In this project you will learn about growing plants for food in your school. You will create a kitchen garden on your school campus, either in plant beds or in pots (Figure 1.1).



What will I be able to do?

At the end of the project, you will be able to:

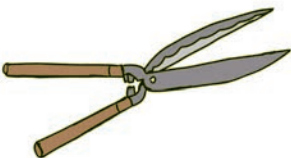
1. Identify common gardening tools, equipment and materials, and describe their uses;
2. Prepare soil either on the school ground or in pots using gardening tools;
3. Plant seeds or seedlings and help them grow through watering, use of manure and fertilisers and taking care;
4. Keep the plants in the kitchen garden safe with the help of fencing and organic pesticides; and
5. Harvest the produce in the kitchen garden or pots.



What will I need?

To carry out this project, you will need various tools and materials. Let us first try to learn about them (Table 1.1).

Table 1.1: Common tools and materials used for cultivating plants in a kitchen garden

Tools/Materials	Sketch	Uses
1. Garden trowel		This is used for digging up soil and planting seedlings.
2. Hand cultivator		This tool is used for loosening soil, removing weeds, and mixing manure in soil.
3. Watering can with rose attachment or hose pipe		These are used for watering plant beds or pots, seedlings and plants.
4. Gardening gloves (made of rubber)		This protective gear is used to protect hands and to provide a firm grip on tools.
5. Gardening shears		These are used for cutting branches, twigs and stems.

6. Seeds, seedlings, bulbs, rhizomes, cuttings, and so on.		These are used for growing plants in the garden.
7. Potting soil or mix. (A potting mix is a blend of material like compost, perlite vermiculite, soil, coir or peat-moss)		This material is used for filling containers or pots.
8. Organic mulching materials, such as grain straw, leaf mould, shredded leaves, grass clippings, etc.		They are used to retain moisture and suppress growth of weeds.
9. Plant labels		They are used to identify different plants in the garden.
10. Old pipes/Polyvinyl Chloride (PVC) pipes/wooden sticks/bamboo poles/metal poles and string		These are used to make a protective fence.

11. Bin and tarpaulin/ scrap of old thick cloth		These are used for preparing compost or vermicompost, which provide additional nutrition to plants.
12. Neem leaves and jerry can/large bottle		These materials may be used for preparing organic pesticide, which is used to kill or keep away pests or insects that are harmful for plants.
13. Manure		Manure is a natural fertiliser prepared from the dung of farm animals, which is used to provide additional nutrition to plants (Figure 1.2).
14. Spray bottle		It is used to spray small amount of a liquid.
15. Spade		It is a tool used for digging, edging and moving soil or other materials.

Note: If you cannot get all these tools and materials, do not worry. You can ask your teacher or the expert for alternatives.



Did you know?



Figure 1.2: *Dung from farm animals has been traditionally used in Bharat to make manure.*



How do I keep myself and others safe?

Some key precautions to be followed while doing kitchen gardening are as follows:

- Ask your teacher about the correct way to lift pots. If you feel the pot is too heavy, get someone to help you, and do not try to lift it alone (Figure 1.3).



Figure 1.3: *Stay safe while gardening, lift pots carefully, use tools correctly, use gloves and aprons, and read the available instructions for safe use of tools and materials.*

- Wear gloves when handling tools and materials to protect your skin. Ensure they fit well so that you have a good grip on tools.
- Follow instructions while using gardening tools and materials.
- Pay attention during demonstrations to understand correct techniques.
- Always ask for help if you are unsure about how to use a tool.

- Regularly clean the tools and equipment, and wipe them after washing to prevent rusting.
- Ensure tools are stored in an organised manner in a store or on shelves to prevent anyone from tripping over them.



Internet safety: Ask your teacher for help while using the Internet. Be careful not to upload or download anything without checking. Do not share personal information anywhere.



What do I need to know before I start?

To get first-hand knowledge of how to make your kitchen garden, you can visit an agricultural farm. If there are no farms near your school, you can visit a nursery, a garden or an orchard (Figure 1.4).



Figure 1.4: Learning from an expert

Activity 1: Visit to an agricultural farm/nursery/garden to interact with the farmer/nursery worker/gardener/expert

It is important to prepare a list of questions before the visit. Some are given below. See if you can think of more. You will answer these questions after your visit.

1. Which plants are being grown?

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2. Were all the plants planted at the same time? If not, why?

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3. Can all the plants be grown in a kitchen garden? Yes/No

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4. How is the soil prepared for sowing or planting?

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5. How are the plants provided nutrition in addition to what they get from the soil?

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6. How can plants be protected from any kind of harm from animals and pests?

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7. What were the two most interesting things you learnt during your visit?

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Discuss your observations with your peers and teacher, and write about what you learnt about growing plants after your visit.



Did you know?

The science of agriculture and plant life was given a lot of importance in ancient Bharat as the main work was farming and the rearing of animals. The distilled wisdom and experience related to plant health, growth and treatment of diseases was documented in a treatise called '*Vrikshayurveda*' (*Ayurveda* for trees).

There were two texts by the same name of *Vrikshayurveda*, one written by Salihotra (approximately 400 BCE) and the second one by Surapala (1000 CE). The only existing copy of a palm leaf manuscript of Surapala's *Vrikshayurveda* is preserved at Oxford University.

The text deals with the cultivation of many species of plants, water management, soil conservation, fertilisers, various diseases affecting plants and their treatment.

In the *Vrikshayurveda*, Surapala encourages the planting of sacred trees like *Bilva* (*Bael* or stone apple), *Nyagrodha* (banyan), *Ashwattha* (fig) and *Neem*. **The text says that planting trees is one of the means to attain the goals of human life.**

Climate change, soil erosion and increasing health concerns have led to renewed interest in the traditional knowledge contained in texts like *Vrikshayurveda*. This knowledge can be used to maintain the health of the soil, promote good agricultural practices and preserve biodiversity.



What do I have to do?

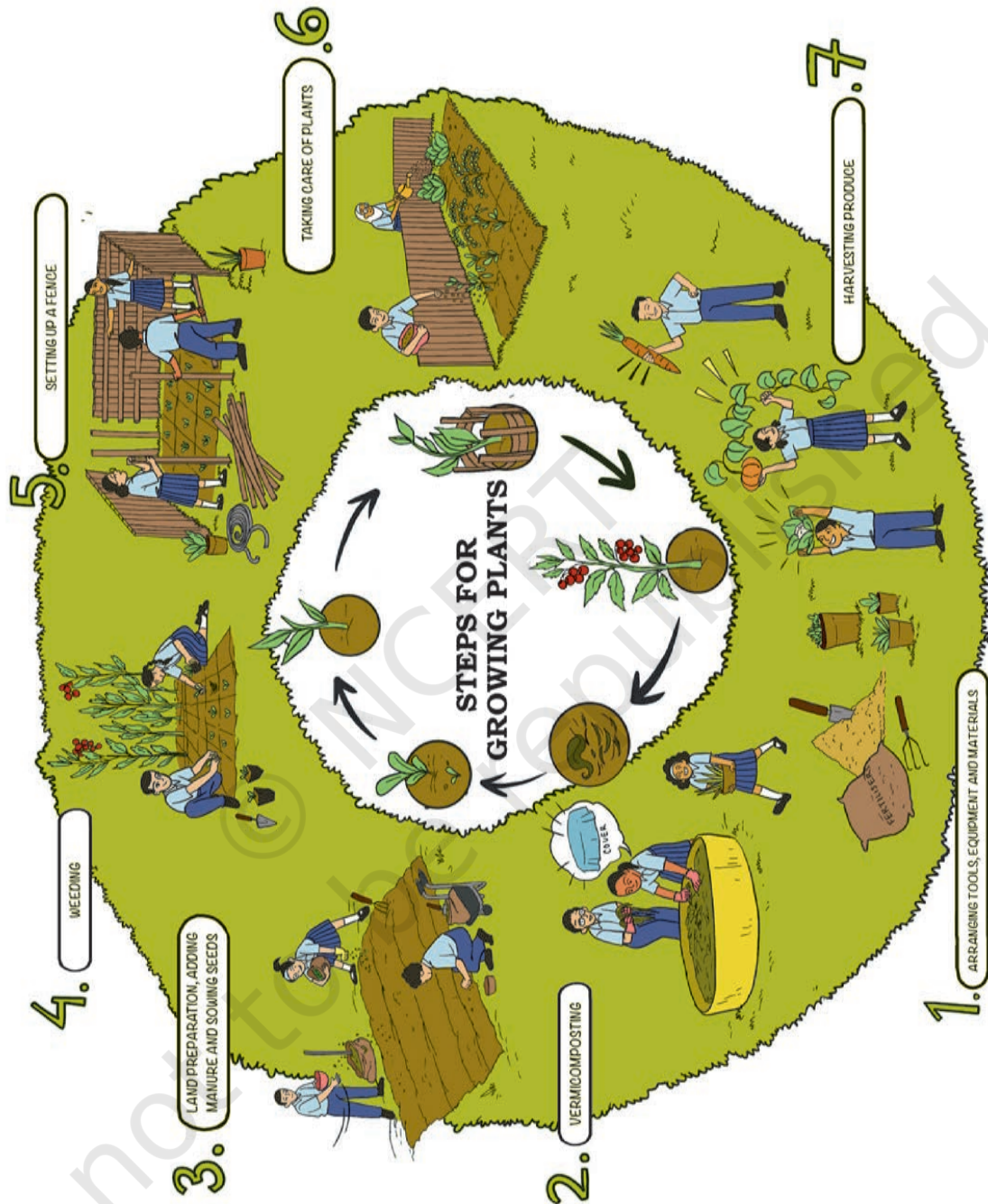


Figure 1.5: Growing plants in a kitchen garden

As you can see in Figure 1.5, a kitchen garden needs careful nurturing of plants to help them grow.

Let us now conduct the activities that will guide you on how to develop a kitchen garden and at the same time learn how to grow healthy plants.

Activity 2: Planning your school kitchen garden

The first step is to measure the land area and decide the various components of the kitchen garden (Figure 1.6). Some important decisions need to be taken; the questions below will help you with planning your kitchen garden.

1. Are you planning to make your school kitchen garden in the land available in school or in pots or both?

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2. How are you going to calculate the area of your kitchen garden?

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Figure 1.6: *Laying out the kitchen garden*

While selecting the location of your kitchen garden, you must consider factors, like exposure of plants to sunlight, drainage, and spacing requirements so that you are able to reach all the plants while watering.

3. What factors did you consider when selecting a location for the garden?

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Plants need nutrients to grow. Nutrients refer to specific elements, such as nitrogen, phosphorus and potash that plants absorb from the soil or growth medium for their growth and development. Organic fertilisers, such as manure, compost, vermicompost and green manure and inorganic fertilisers, such as urea and superphosphate are applied to the plants for supplying nutrients.

You can consider planting herbs or leafy vegetables that grow quickly. For example, you can grow herbs, like coriander, mint, spinach or leafy vegetables so that you can use the produce from your garden soon. These herbs and leafy vegetables are also very good for health as they are good source of vitamins and minerals.

Now, select the plants for your kitchen garden and get the seeds or seedlings for sowing or planting.

Activity 3: Making vermicompost

In this activity, you will learn how to make vermicompost.

There are many methods of preparing vermicompost. One such method is described below. You can also search for other methods on the Internet or ask farmers and other experts for advice.

1. Vermicompost is prepared in a bin made of plastic, wood or any other water-resistant material. The bin must be covered with tarpaulin or piece of old thick cloth. Holes must be made in its bottom to drain out extra water.
2. The compost bin should be filled with waste, such as kitchen waste, fallen leaves and other garden waste or any

biodegradable waste. You can use any organic waste from the midday meal in your school, or bring it from home or a nearby *Dhaba* or restaurant. These layers of waste are called 'bedding materials'.

3. Now add water to moisten the bedding material. Do this as per the instructions of the teacher.
4. Red earthworms (*Eisenia fetida*) should be introduced on top of the bedding material and allowed to burrow into it (Figure 1.7a). You can get them from a farm or nursery.
5. The earthworms must be fed by adding kitchen scraps, such as fruit and vegetable peelings, coffee grounds, eggshells, and non-greasy food waste to the bin. Avoid adding meat, dairy or oily foods, and citrus fruits, as they can attract pests or harm the worms.
6. The bedding should be kept moist by spraying it with water as needed, but not waterlogged. It should be covered with a lid to retain moisture and prevent pests.
7. Vermicompost from the bottom of the bin can be used once it becomes dark, crumbly, and earthy smelling, which usually happen within a few months (Figure 1.7b).



Figure 1.7 (a): Earthworms for preparing vermicompost



Figure 1.7 (b): Vermicompost prepared using scraps of leftover food



Did you know?

In case earthworms are not available, then you can make compost, using a process slightly different from that for vermicomposting.

You can search for the process of making compost on the Internet using the search keywords 'vermicomposting of solid waste'.

The following questions will help you check your learning:

1. Which materials you used to make the vermicompost?

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2. What types of food scraps did you add to the bin?

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3. What changes did you notice in the compost bin over a period?

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Activity 4: Preparing the kitchen garden for planting

Soil preparation involves clearing the soil of any debris, rocks, or unwanted plants that could hinder the growth of the plants. This ensures that your plants have room to grow and they get sufficient nutrition (Figure 1.8).



Figure 1.8: Plant beds (left) and pots (right) for the kitchen garden

The soil in plant beds or pots needs to be prepared before sowing the seeds or planting seedlings. You will have to mix manure with the soil as per the directions of your teacher.

The following questions will help you check your learning:

1. How did you prepare the soil for planting?

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2. Did you use organic manure? If yes, what proportion did you use for mixing organic manure with soil?

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Activity 5: Sowing seeds and planting of seedlings

You have already decided the plants to be grown in your kitchen garden in Activity 2.

Before planting seeds, read the instructions on the seed packets to understand the recommended planting depth, spacing, and season for planting. You can also use farm seeds preserved from the previous harvest by farmers or gardeners, in such case please ask them for guidance.

If you are transplanting seedlings, read any labels or tags that came with them for specific care instructions. If labels or tags are not available, ask the person who gave you the seedlings for guidance.

1. Sowing Seeds

Sow seeds as per the sequence below:

- (a) Make furrows or small holes in the soil according to the recommended spacing for sowing the seeds. If you are making your kitchen garden in pots, you will have to know the number of seeds or seedlings to be placed in each pot. The number of seeds or seedlings to be placed in each pot is decided by certain factors, including the type of plant, the size of pot and the desired plant growth.
- (b) Drop seeds into the furrows or holes. If the seeds are very small, sprinkle them evenly over the soil surface (Figure 1.9).
- (c) Cover the seeds lightly with soil, following the recommended planting depth.
- (d) Gently pat down the soil to ensure good seed-to-soil contact.



Figure 1.9: *Sowing seeds in furrows*

2. Planting seedlings

If you are planting seedling, then follow the steps given below:

- Dig holes in the prepared soil. The hole should be slightly larger than the length of the roots of the seedlings.
- Carefully remove seedlings from their containers, being mindful not to damage the roots.
- Place each seedling into the prepared hole. The soil level around the seedling should match the soil level in its original container.
- Gently fill the holes with soil, pressing lightly around the base of each seedling to secure the plant in its place.

Write the name of the plant and date of sowing on labels with the help of a permanent marker. These labels can be made of old plastic bags stuck on waste cardboard or even chart paper. Place the labels at the beginning of each row or section of the garden or in each pot to identify the date they were planted. This will help you keep track of your plants as they grow.

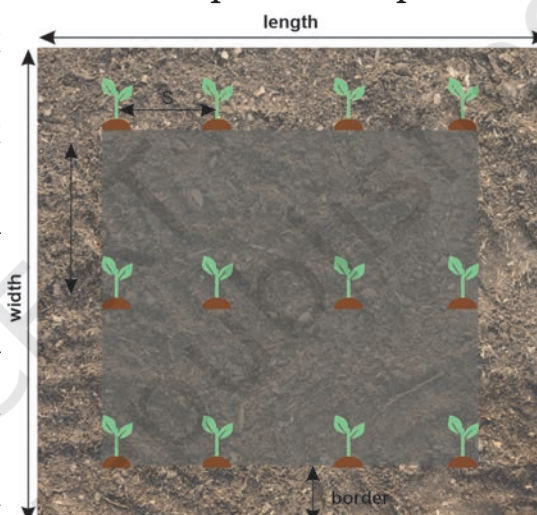


Figure 1.10: Soil background along with plant to plant space

Respond to the following questions to check your learning:

- How deep did you plant each type of seed? Use table 1.2 to fill the information.

Table 1.2: Data on seed sowing depth

S. No.	Name of Plant	Seed Sowing Depth (Centimetre)
1.		
2.		
3.		
4.		

2. How much space did you leave between one plant and the other? Use table 1.3 to fill the information.

Table 1.3: Maintaining data on plant to plant space

S. No	Name of Plant	Plant to Plant Space (Centimetre)
1.		
2.		
3.		
4.		

3. Was the plant to plant space same for all the plants grown by you? Yes ☐ No ☐

Activity 6: Taking care of plants

Plants need care to make sure they receive the nutrients, water and sunlight needed to thrive. Also, the plants are delicate and must be protected from any harm due to animals, pests, diseases or extreme weather.

General protection of plants include making a fence, companion planting, sanitation, weeding, wind protection, and using organic pesticides against pests and diseases.

1. Making a fence

You need to keep the plants safe from other animals and people who may step on them. You can do this by making a fence around your kitchen garden.

- The fence can be made using bamboo or locally available material.
- Measure the dimensions of the area that needs to be fenced.
- Draw a sketch of the area and decide where fence is to be placed.
- Collect locally available materials, like bamboo, old pipes or old wooden sticks for using them as 'poles' and use a strong string to bind the poles and make the fence.

The following questions will help you decide the quantity of materials you need:

1. What are the materials that you will use for fencing?

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2. How many poles and the length of string will you need for fencing?

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2. Steps for Plant Care and Maintenance

- (a) **Support your plants and creepers by staking:** Staking plants is a common practice to provide support and stability, especially for tall or weak stem plants that may otherwise become top-heavy and fall over (Figure 1.11). Plants, such as tomatoes, cucumbers, peas and beans require staking. First, you will need 'stakes'. You can use bamboo, a thin old branch that has fallen off a tree, or an old metal or plastic pipe as a stake. The height and thickness of the stake should be decided according to the length and weight of the plant. Now, using a string tie the plant with the stake.



Figure 1.11: *Staking a plant for support*

- (b) **Watering your plants:** It is essential to water plants regularly, ensuring that the soil remains consistently moist but not waterlogged, as overwatering is generally harmful for plants. Decide how the plants will be watered. You can use, a mug and bucket, watering can, or



Figure 1.12: *Watering freshly sown plant beds*

a pipe or something else (Figure 1.12). Develop a schedule to ensure plants receive sufficient water, especially during dry spells. New plants need more frequent watering. Water the plants in early morning or late afternoon to minimise water loss due to evaporation.

The questions below should be answered before watering the plants as it will help you to ensure watering as per the needs of plants.

1. How do you know when a plant needs water?

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2. How often do you need to water your plants?

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3. What is the best time for watering plants?

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4. What factors influence the quantity and frequency of watering?

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- (c) **Mulching post watering:** Apply a layer of mulch, such as straw, wood chips, or shredded leaves, around your plants to help retain moisture, suppress weeds, and ensure the soil temperature remains mostly the same.
- (d) **Monitoring the garden for signs of pests and applying organic pesticides:** Prepare organic pesticides using ingredients, like neem oil, garlic, chilli pepper, and soap. Apply organic pesticides as needed, and follow instructions carefully to minimise harm to beneficial insects, or birds and animals that are not harmful for plants.



Did you know?

Neem based pesticide is an organic pesticide used to control caterpillars, grasshoppers, whitefly and aphids in agricultural crops.

You can make an organic pesticide by following the steps given below:

1. Take 500 gram of neem leaves (if possible, you can ask an expert at the local *Krishi Vigyan Kendra* or Agriculture Research Centre to recommend any other bitter plant leaves), wash them and chop or break them into smaller pieces. You will experience a nice fragrance as the leaves are broken up.
2. Mix the *Neem* leaves with 5 litres of water.
3. Put the mixture in a jerry can/large size bottle and leave it for around 14 days.
4. Separate suspended solids from liquid using a strainer.
5. You can spray this pesticide on your plants using a spray bottle.



Figure 1.13: Removing weeds in a plant bed using hand cultivator

(e) **Removing weeds:** Check regularly for weeds and remove them as soon as they appear (Figure 1.13). It is good to use a hand cultivator, if you have one for weeding. You can ask your teacher for an alternative, if hand cultivator is not available.

Decorate Your Garden

Your garden must look beautiful with plants growing neatly in rows and with proper layout and decoration. Think of ways in which you can beautify your garden and act on them.

Some things you can do to decorate your kitchen garden are as follows:

1. Use stones to make the flower beds or pots look neat. You can paint these stones using attractive colours.
2. Make decorative items that can be kept outside in the garden, like painted clay pots, paintings made on stones, or using old objects lying around the school to make 'sculptures'.
3. You can even make a scarecrow to keep the garden safe from birds.

You can get some ideas from the work done by Shri Nek Chand, who created a beautiful garden called the Rock Garden using waste material in the Union Territory of Chandigarh.

Activity 7: Observing your plants grow

Tracking growth of plants can be helpful in understanding their development and needs. Keep track of the growth of the plants in your kitchen garden (Figure 1.14). Observe changes in plant height and record other observations, such as change in the colour of leaves, appearance of flowers, and even attack of pests. You can maintain a diary where you record your observations. Use table 1.4 to record your observations.



Figure 1.14: Keeping track of the growth of plants

Table 1.4: Observations of plants as they grow in the kitchen garden

Date of Observation	Observations (data of emergence of seedling, height of plants, pests, changes in colour of leaves, flowering, etc.)
Week 1 (Date: -----)	
Week 2 (Date: -----)	
Week 3 (Date: -----)	

Keep a record of the progress of your kitchen garden by taking photographs from different angles or drawing sketches or both. Make sketches or paste the photos in the space given below:

Week 1/Month 1

Week 2/Month 2

Activity 8: Harvesting

Once ready for consumption, harvest your produce (Figure 1.15) and sort it, based on quality and size. You must ask your teacher about the method to harvest produce. For example, for leafy greens, such as lettuce and spinach, use a cut-and-come-again approach, harvesting outer leaves while allowing the inner leaves to continue growing. For root vegetables, like carrots and radishes, gently loosen the soil around the base of the plant and pull them out by hand or with the help of a garden trowel. For produce like tomatoes, brinjals (Figure 1.16) and peppers, use gardening shears to cut them from the vine, leaving a short stem attached. Remove any debris, foreign matter, or produce that is damaged to ensure only the best-quality is retained.



Figure 1.15: *Enjoy the produce of your labour*



(a)



(b)

Figure 1.16 (a): *Brinjal plant*, and **(b):** *Harvested brinjals*

The following questions will help you to check your learning:

1. Which crop(s) you harvested?

(a)

(b)

(c)

2. How did you know they were ready for harvesting?

(a)

(b)

(c)

3. Which tools did you use to harvest the plants?

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4. What precautions you took to avoid damaging the plants while harvesting?

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5. What did you do with the produce after harvesting from the kitchen garden?

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Activity 9: Visit to the vegetable market

Visit the local vegetable market, observe the vegetables and fruits and note the price of different vegetables and fruits. Prepare a price chart (refer to table 1.5) of your vegetables, based on your observation.

Table 1.5: Price chart of vegetable produce in market

Vegetable name	Price (₹)	Vegetable name	Price (₹)
1.		5.	
2.		6.	
3.		7.	
4.		8.	

Activity 10: Setting a price

You can give the produce from your kitchen garden to the school kitchen for midday meal or decide what to do based on instructions with your teacher and peers. Estimating the price of produce from your kitchen garden involves considering many factors, such as cost of seeds or seedling, cost on soil amendments, cost of tools and equipment, label cost, etc. But what if you planned to sell the produce? You can set a price for each item of your produce. Discuss how a price is fixed for the produce with your peers and teacher.

Here is a simple method to learn how to calculate the price after filling the information in table 1.6.

Table 1.6: Estimating price of produce from kitchen garden

What did you grow? (1)	How much money was spent on the seeds/seedling and other materials? (2)	What was the quantity harvested (number, or by weight)? (3)	What is the market price of the produce? (4)	How much money would you get for your produce? (5)



Did you know?

Did you know that plants can be grown without soil? Take a cutting of a money plant and place it in an old bottle filled with water. Place the bottle in bright but indirect sunlight. Do remember to change the water every week or so. See what happens!



Smart Kitchen Garden with Artificial Intelligence

You can design and make a smart kitchen garden utilising Artificial Intelligence (AI). AI assists in plant identification, watering plants, recording plant growth, identifying pests and whatever else you need.

I. Planning and Designing using AI

1. Search for suitable vegetables and herbs and learn when they should be planted. AI apps on mobile phone suggest plants based on your location.
2. Plan the layout of the garden bed or the placement of the pots, considering sunlight and spacing requirements. Some plants grow better when they are surrounded by others while others need space.

II. Making the Kitchen Garden

1. Fill the raised bed or pots with appropriate potting mix and ensure that extra water drains out.
2. Plant seeds or seedlings following the recommended spacing and depth.
3. Label each plant with its name and planting date for easy identification. You can print the labels or you can even paste a photograph of the plant on the label.

III. Smart Care and Monitoring

Search for suitable garden management apps or garden growth recording apps. Observe the plants regularly and use the app to track their progress, identifying potential issues like pests or diseases.

1. Use an image recognition app to identify any unfamiliar plants that may appear. These could be weeds or plants growing from seeds that were left over from the previous season.
2. On the basis of AI app suggestions and additional Internet searches, determine appropriate watering schedules, manure to be added and early detection and control of pests.
3. Document observations of plant growth and other things that interest you, creating a record of your learning journey.

Geotagging that refers to the process of adding geographical information to various forms of media, such as photos, videos, websites or social media posts can be created for your kitchen garden. You can use digital technologies for geotagging your garden (even if it is in pots).



What did I learn from others?

Write three most important things that you learned from others (they could be about making a kitchen garden, looking after plants or simply working with others).

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What did I do and how long did it take?

It is important to understand how much time is required for an activity to be completed.

Calculate the approximate number of periods you spent on each activity. Mark them on the timeline below. If you did more than the activities suggested in the book, please add the number and time taken.

Activity	1	2	3	4	5	6	7	8	9
Time taken (Periods)	---	---	---	---	---	---	---	---	---



What else can I do?

1. Design a container garden at your home. Think and discuss with your teacher what materials you will need and how you will proceed.
2. Find out the scientific names of the plants you have grown.
3. Geo-tag your kitchen garden; include longitude and latitude coordinates.



Think and Answer

1. What did you enjoy doing?
2. What were the challenges that you faced during the activities?
3. What will you do differently next time?
4. What were the conditions that helped your plants grow? If your plants did not grow well, what should you do next time?
5. What jobs are related to the project? Look around, speak to people and write your answer. A few examples of jobs related to the activities that you did; are farmer, gardener, agricultural scientist, mechanic for agricultural equipment, such as tractors and harvesters.