REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

The review of the literature is a comprehensive inclusion of everything known on a given research topic and its related topics or a short summary of the literature most pertinent to the specific topic under study. An outline of the literature review to be written is often very helpful, especially for longer reviews. This outline is determined by the topic and how the research relates to it and to other related issues. (Best and Kahn, 2016)

To provide a clear understanding of the various aspects of kitchen gardening, the literature reviewed for the present study is presented in two sections which are as follows:

2.1. Theoretical Orientation

- 2.1.1. Meaning and Importance of Kitchen Garden
- 2.1.2. Aspects of Developing Kitchen Garden
  - 2.1.2.1. Development of Kitchen Gardens
  - 2.1.2.2. Horticultural and Environmental Aspects
  - 2.1.2.3. Problems related to the Kitchen Garden
- 2.1.3. Household Compost
  - 2.1.3.1. Meaning and Benefits
  - 2.1.3.2. Materials for Household Compost
  - 2.1.3.3. Preparation of Household Compost

2.2. Related Research Studies

- 2.2.1. Studies Conducted in India
- 2.2.2. Studies Conducted Abroad

2.3. Conclusion of Review of Literature

2.1 Theoretical Orientation

2.1.1 Meaning and Importance of Kitchen Garden

The value of gardens in residence is on the rise because gardens provide several opportunities to improve health in enhancing quality of life. The natural environment is deteriorating because of factors like industrialization, environmental pollution, population growth, housing shortages, and lack of facilities like hospitals and schools. The rehabilitation of urban greenbelts is significantly aided by gardens. It contributes to the preservation of many plant species and replenishes the oxygen in the atmosphere. The beauty of a place is also enhanced by a garden. By offering a location for physical activity close to nature, it aids in enhancing health, preventing diseases, lowering stress, and maintaining fitness. Gardening may offer a concentrated, contemplative escape from continual noise and bustle for people who are invaded by the speed of modern life. Others place value on having a sense of ownership over a piece of land, including its flora and soil.

Residential or private domestic gardens, sometimes known as "front or back gardens," are the most prevalent type of garden. The front garden could be considered a formal and semi-public area, and as such, be subject to restrictions imposed by custom and local legislation. A residential garden also includes utility area, in which all services are planned such as garbage disposal, composting, garden storage, wash area and clothes drying line. The private and the utility areas of a residential garden are generally attached to private areas of the residence such as dining room, kitchen and bedroom. A kitchen garden plays the role of an extension of the kitchen. It can be planned in the private or the utility area for residential garden for ease of accessibility. A garden can be set up on a roof, in an atrium or courtyard, on a balcony, in window boxes, or on a patio in most residential properties. These gardens can include flowering plants, ornamental plants, medicinal plants as well as fruits and vegetable plants. In an Indian residential garden, herbs and medicinal plants are usually found. Thus, kitchen gardens are prevalent in India. A kitchen garden, also known as a potager in France and a kailyard in Scotland, is an area that is closely associated with a person's kitchen and daily life. Vegetables, fruits, and herbs are produced

specifically for culinary purposes in this space of a house and its surroundings. A kitchen garden can range in size from a few garden boxes on a patio or deck to a formal stone garden that is several hundred square feet in size. The goal is the same, regardless of size: a garden that is consistently managed and regularly utilized for daily needs. It's not a farm or a vegetable patch. It is substantially smaller and requires a fraction of the effort to develop and maintain (Burke, 2020).

According to Kharkongor and Lyngdoh, 2013,

> "Kitchen Garden is an art of growing vegetables on a small piece of land in a planned way in the vicinity of living /residential house to meet the needs of the family with fresh produce all year around regularly."

According to Collins Dictionary,

> "A kitchen garden is a garden, or part of a garden, in which vegetables, herbs, and fruit are grown."

According to Britannica Dictionary,

> "A garden where you grow fruits and vegetables for your own use."

Kitchen gardening, often known as 'Bari,' is a food production method that is done by the family members, for the family members, with an emphasis on productivity and sustainability. Home gardens are gardens that are located near a house, with a great diversity of plants, and their output is supplemental rather than the primary source of family consumption or revenue. The primary goals of backyard kitchen gardening are nutritional security for the family, providing for supplemental income, proper use of the backyard, and increasing the range of involvement of the household. A kitchen garden enables efficient use of natural resources. Gardening provides nutrient recycling and bio-mass waste management to improve households' food security (Satapathy et al., 2018).

A kitchen garden is significant to a home in multiple ways. It helps develop the space around the house and it can be kept beautiful and clean. Kitchen gardens can enhance

the look of a home. It facilitates procurement of fresh, healthy and pesticide free vegetables regularly. It can be good substitute for expensive vegetables and fruits available in the market. Wastewater taken for home use can be used in it. Plant names, crop identification, farming methods and its usefulness, environmental benefits and health benefits of a garden can be taught to children and other family members in the house, developing their interest in kitchen gardening. Working out in the kitchen garden provides physical exercise for healthy living. A kitchen garden helps to maintain the air-quality and atmospheric temperature around the home. Good relationships are built by sharing extra vegetables and fruits from the kitchen garden with neighbours. While kitchen gardens hold higher importance for a household or family, it has its positive impact on the community also. The general public get an opportunity to contribute their produce for sale to members of the community as well as learn about the efforts made by the farming community in production of crops for consumption. It can be said that any addition of greenery on planet earth is important for the entire world. At household level, a kitchen garden is the best way to contribute to the improvement of environmental quality of the whole world at large, as it benefits at multiple levels i.e., household, community and global levels (Burke, 2020).

2.1.2 Aspects of Developing Kitchen Garden

The aspects are divided into:

- Development of kitchen garden
- Horticultural and Environmental Aspects
- Problems related to the Kitchen Garden

2.1.2.1 Development of Kitchen Garden

Kitchen gardening is gaining unprecedented popularity, and for all the right reasons. Everyone wants to try their hand at kitchen gardening because organic food is getting more expensive every day, the better option is to grow vegetables and fruits in the space available in the residence. Users get to enjoy fresh, flavorful produce from their own garden while saving money [(5)].

As stated by Burke (2020), there are various steps involved in creating and growing a kitchen garden. First and foremost, the correct spot must be selected for the kitchen garden. After that the necessary kitchen garden element should be gathered, followed by installation of kitchen garden structures. Once the structures are installed, the soil

should be filled in the beds or containers followed by watering it. Further, a plan is to be developed for crop rotation and a calendar for the produce can be prepared. Once the calendar is prepared, the plantation through seeds or sapling, depending on the type of plant should be done. As part of the development of the kitchen garden, care and maintenance of the kitchen garden is an important step to enjoy the harvest in the end.

For developing any kitchen garden, the foremost important thing to decide is the location of the kitchen garden in a residence. The placement of a kitchen garden is the most important factor in determining its success. In earlier times, there was a small piece of land near the house, where people used to harvest the produce for their consumption. But due to urbanization, many people have shifted to apartments and flats, due to which they don't have land space to develop a kitchen garden. This demotivates them to develop one. This encouraged the researcher to spread information about utilization of various spaces of residences to develop a kitchen garden. Sometimes, there is a lack of space outside a residence to develop a kitchen garden. In such cases, balcony, terrace, or other space in a residence, where there is sufficient sunlight available can be utilized for developing kitchen gardening. Where there is limitation of space, plants can be grown in containers and placed in places with full sunlight.

Dhaliwal (2017) had suggested the principles to be considered while designing a kitchen garden.

1. If it is a land garden, then it preferably be selected in the backyard of the garden and rectangular shape is better than the square shape.
2. The layout of the garden should have access to all sections of the garden.
3. Fast-growing fruit trees, like papaya and lime, tend to throw shade on other plants, thus they should be planted on the north side of the garden.
4. On the fence, climbers like cucumber, pea, and others can be raised.
5. To ensure a consistent supply of vegetables for a longer length of time, several sowings or succession of sowings of one crop, such as fenugreek, radish, okra, cauliflower, etc., should be done at short intervals.
6. Root vegetables like radishes and turnips should be grown in the ridges that divide the beds.

7. Turnip, radish, leaf beet, and other fast-growing crops should be planted between slower-growing crops like cauliflower, cabbage, eggplant, etc.

The size of the garden and the family's preferences are two elements that influence the plants chosen for the kitchen garden. Only veggies that are suitable for the area and offer an acceptable yield are produced. The breed of the plant should be chosen based on their compatibility with the area and time of year. The crops that are most significant for freshness in terms of edibility and nutritional content are prioritized (Dhaliwal, 2017).

The stages for creating a kitchen garden have been highlighted by Vaishali (2020). She has suggested five considerations that must be considered while creating a kitchen garden, whether it is on a piece of land, a balcony, a terrace, or even in containers. They are site selection, protection, land preparation, sowing and planting, and irrigation management.

1. Site Selection: There are not many options when choosing a location for kitchen gardens, and the backyard of the house is typically the best option. But it is not always possible to have a backyard space available for garden development. People residing in flats and apartments always find it difficult to choose the site for a kitchen garden. They can always find the best spot on the balcony or in terrace available to them. There are numerous things to ponder about while creating a new kitchen garden. For example, cattle should be kept away from the location, it should be closer to a water supply. The greatest place for vegetables to grow is flat, with loose, well-drained soil, and exposure to at least six hours of direct sunlight every day (eight to ten hours is ideal). It is advisable to have fertile soil. Avoid growing plants close to trees and bushes because they compete with them for nutrients and water and may cast too much shade. The location should be easily accessible so that working in the garden during idle time is convenient. Sites that are too near to structures may prevent plants from getting enough sunlight. It is suggested that if one can observe the shadowing patterns throughout the growth season before beginning the garden, this can help them to plan their vegetable and fruit plants as per the availability of sunlight.
2. Protection: Protecting the kitchen garden area is necessary. Animals should not be able to access the area. There should be a permanent fence built. Thorny plants can be

trimmed and utilized to build a fence, but the best way to safeguard the garden is to establish a green fence.

3. Land preparation: Choosing the appropriate soil mixture is crucial since the nutrients in the soil affect how healthily the plants will develop. To keep everything organic, use cow dung. For the soil to be fertile, sweeping pits, liquid manure, mulching, and green manure must be applied. First, a depth of 30 to 40 cm is dug with a thorough spade. The removal of perennial weeds, shrubs, and stones needs to be done. The soil is amended with 100 kg of well decomposed farmyard manure or vermicompost. Depending on the need, ridges and grooves are constructed at intervals of 45 or 60 cm. Ridges and grooves can be replaced with flat beds.
4. Sowing and planting: Maximum production and a year-round supply of vegetables are the major goals of a kitchen garden. On one side of the ridges, direct-seeded crops including bhindi, cluster beans, and black-eyed pea can be sown. Amaranthus can be spread seeded in the plots (meant for entire plant take off and cutting). Along the bunds of plots, little onions, mint, and coriander can be planted or sowed. After sowing and covering with topsoil, seeds of transplanted crops like tomato, brinjal, and chilies can be put in nursery beds or pots one month in advance. This will protect the seeds from getting contaminated. The perennial plants should be placed on one side of the garden, often at the back, so they don't shadow out other crops or compete with other food crops for nutrients. If seeds and seedlings are spaced too far apart, weeds will fill the empty space and take over. Weeds require valuable resources like compost and water, and their removal requires extra effort.
5. Irrigation management: The kitchen garden should have enough moisture, which is essential. Check the soil's dampness by pushing on it with fingertips, and then water the plant as needed to ensure that it receives the right amount of water. It is likely that there is not enough water to irrigate the kitchen garden if there is no irrigation for the primary food crops. However, if rainwater collection techniques are implemented, more water may be saved, resulting in a reduction in the amount of water required. Kitchen wastewater may be collected and used to irrigate the garden. Irrigate at night or in the evening during the hot season rather than throughout the day.

   Regular inspection after the development of the kitchen garden is also necessary. One needs to regularly inspect the plants to stop insects from reproducing. For the cultivation of several crops one after the other, one can rotate the crops after

harvesting. Every month the soil should be added with fertilizers and neem oil should be sprayed to deter mosquitoes and other insects. The soil has to be aerated by loosening the top layer of the soil. Participation in routine weeding is required to maintain the growth of plants (Vaishali, 2020).

A kitchen garden can be developed in various spaces of the house. Any available space in the residence can be transformed into the kitchen garden, whether it is available land space in the front or back yard, balcony, terrace or even the windowsill. A kitchen garden can be developed even in containers where there is a lack of space available. A careful choice of plants and accessories may give new life to neglected balconies, disorganized verandas, empty space in the front yard and backyard, and terrace. Explore a variety of designs, layouts, and construction methods to help you create your own outdoor area. It is possible to put up the herb or vegetable kitchen garden on any balcony, regardless of its size. One can produce tomatoes, cabbage, radishes, and more. By purchasing tomato plants, brinjal, and chili that are ready for transplant, one can save time. Seeding is required for carrots, spinach, and bottle gourd. One can grow a variety of vegetables and herbs on a balcony kitchen garden with the right sunshine and care. To hold a line of different planters, one can set up many platforms. In this manner, one can fit more plants in a much smaller area. Terrace gardening is a good choice if the terrace is largely unoccupied and receives direct sunshine. One may select a kitchen garden design that is both useful and fashionable depending on the size of space and personal preferences. Urban gardening containers are the best since they can be moved around simply as necessary. One may pick the appropriate size for the container, fill it with dirt, and then grow several plants inside of it. One can also rotate the location or alter the soil after one growing season [(19)].

2.1.2.2 Horticultural and Environmental Aspects

The basics for designing any kitchen garden are considering the horticultural aspects and environmental aspects.

Horticultural Aspects of Kitchen Gardening

The horticultural aspect of kitchen gardening includes vegetables and fruits, herbs and medicinal plants, their growth patterns, requirements for planting, etc. All

these aspects should be considered whenever one decides to develop a kitchen garden in their residence.

According to Patel & Patel, 2015 every person is recommended to consume 175 grams of fruits and 300 grams of vegetables (90:90: 120 tubers: leafy: green vegetables) daily to lead a healthy life. But in India only 80 grams of fruits and 170 grams of vegetables are consumed in the diet per person. Due to which a person cannot live a healthy life. Various vegetables such as peas, turiya, bananas, tomatoes, eggplants and various fruits like bananas, papayas, lemons etc. are of great importance in the human diet. Vegetables and fruits are rich in nutrients that play an important role in the physiological function of the body. In addition to Vitamin A, Vitamin B, Vitamin C, Folic Acid, Iron, Magnesium, Carbohydrates, vegetables also contain Proteins and Fats. According to the recommendations of doctors involved in diet and nutrition, an adult should consume 300 grams of vegetables and 100 grams of fruits in his diet every day, including beans, tubers, green leafy vegetables (150 grams). Thus, vegetables and fruits help in the metabolism of the body and help in digestion by eliminating constipation, simplifying bodily functions, and making the body healthy. Since vegetables are rich in protein, carbohydrates, minerals, vitamins, it is essential to use vegetables in one's daily diet to maintain good health. Like milk and fruits, vegetables are also an important preservative. Leafy vegetables have good amounts of water and cellulose or fiber.

Kitchen gardening is an excellent way to get fresh nutritious vegetables and fruits from own garden. In today’s age, vegetables and fruits can be grown by oneself without any chemicals that are harmful to health through kitchen gardening, which requires very little time and effort (Patel & Patel, 2015).

According to Joshi et al., 2015, Using the available land around the house, the method of planting vegetables that meet daily needs is called kitchen garden. Currently, there is a possibility of having chemical fertilizers, residues of toxic pesticides or sewage salts in most of the vegetables available in the market. Eating such contaminated vegetables adversely affects the health of the body in the long run. So, we should grow vegetables at home. Joshi et al., 2015 has suggested important points of growing vegetables at home. They are:

- Selection of vegetable crops should be done according to weather, season, and area.
- It is very important that the selected planting space of the house has enough sunlight during the day.
- For vegetable crops, it is essential to select winter, monsoon and summer crops according to the location of the kitchen garden.
- Crops such as brinjal, tomato, chilli, cabbage, cauliflower, onion should be grown as sapling first and then planted.
- For crops like tindora, parvar, a trellis or pavilion structure should be made in the corner of the space and planted in one or two holes and raised.
- Cultivation of climbing vegetables crops like, dudhi, galka, turiya on trees, terrace or fencing as required.
- Shady areas should be used to grow crops such as fenugreek, coriander, mint, spinach, ginger, etc.
- Plantation should be planned in such a way that after completion of monsoon season crops during winter season crops can be sown.
- Make a small compost pit in the garden corner, so that garden waste, grass, and leaves can be converted into compost.
- Apart from this, if there is more space, one or more plants of crops like papaya, curry leaves, lemon, banana, drumstick, can also be planned in the garden.
- Cultivation, fertilizer, water, and crop protection measures should be taken as needed.
- It is very important to have small tools useful for gardening work in the garden like spade, hoe, shovel, claw, sprayer pump etc.

Once all these points are understood properly, one can easily develop their kitchen garden in their residence. For developing a kitchen garden, one also needs to understand the seasonal requirements for growing vegetable crops in the garden.

In Gujarat, monsoon is from the month of June to September and the monsoon crops need to be planted during the month June to July. The best time for planting winter crops is the months of October to November; as winter season is from November to February. For the summer season crops, the plantation should be done during the month February to March as summer season is from March to May.

Plate 1 shows the Vegetable crop calendar for growing vegetables at home. The green colour in plate 1 represents the vegetables which can be sown in the winter as well as in monsoon. The months for sowing vegetables crops like; chili, brinjal, bottle gourd, tomato, lady's finger, sponge gourd, ridge gourd, bitter gourd, amaranth, cluster beans and pigeon beans are January to March and from June to September. Other vegetables like; elephant yam, purple yam, beet root, ginger and turmeric should be sown from April to September. During the months of April to May and from October to December, onion, garlic, coriander, fenugreek leaves and spinach should be sown. Crops like; potato, pigeon beans and field beans should be sown in the months of October to January and vegetables like; amaranth, cluster beans, snack gourd, lvy gourd should be sown in the months of February and march (Patel & Patel, 2015).

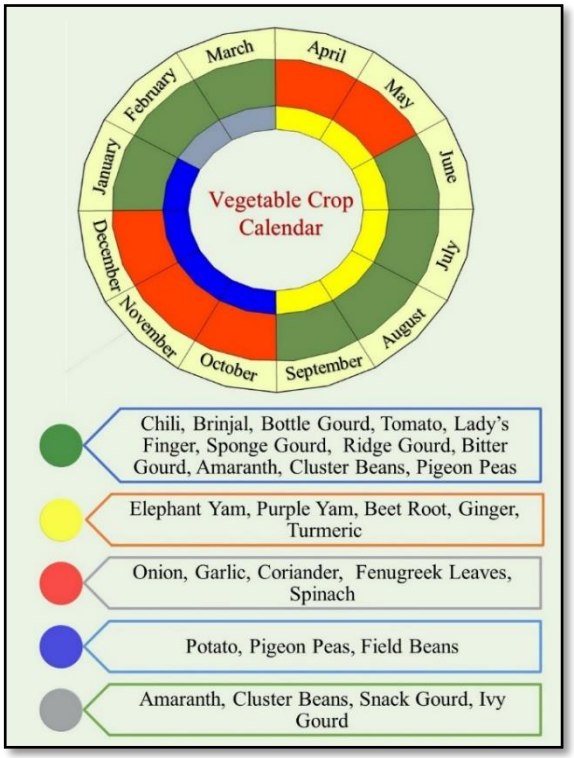

Plate 1 Seasonal Chart for Growing Vegetables at Home (Patel & Patel, 2015)

For growing vegetables at home, along with the knowledge of vegetable crop calendar, knowledge of techniques to grow vegetables is also important. Table 1 shows the techniques, time of sowing, seed quantity or sapling pieces, sowing method, planting distance, days of ripening and estimated production. All these aspects are required to take care of growing vegetables and fruits in a kitchen garden successfully. Below table shows all the aspects of vegetable growing. With the knowledge of each crop, one can successfully develop their own kitchen garden in the available space in their residence (Kotecha et al., 2015).

Table 1 Details of vegetable crops grown in kitchen garden (Kotecha et al., 2015)

Sr. No.	Crop Name	Time of Sowing	Seed Quantity/ Sapling Pieces	Sowing Method	Planting Distance (cm)	Days of Ripening	Estimated Production (kg)
1.	Brinjal	May – June, October – November	5gms	Planting of Sapling	60 x 90	After 60 to 70 days	4 to 6
2.	Tomato	May – June, October – November	5gms	Planting of Sapling	60 x 90	After 60 to 70 days	4 to 6
3.	Chilli	May – June, October – November	5gms	Planting of Sapling	60 x 90	After 60 to 70 days	4 to 6
4.	Bottle Guard	June - July	10gms	Direct Planting	2mt x 1.5mt	After 45 to 60 days	3 to 4
5.	Bitter Gourd	June - July	10gms	Direct Planting	2mt x 1.5mt	After 45 to 60 days	3 to 4
6.	Sponge Gourd	June - July	10gms	Direct Planting	2mt x 1.5mt	After 45 to 60 days	3 to 4

7.	Ridge Gourd	June - July	10gms	Direct Planting	2mt x 1.5mt	After 45 to 60 days	3 to 4
8.	Snake Gourd	June - July	10gms	Direct Planting	2mt x 1.5mt	After 45 to 60 days	3 to 4
9.	Cucumber	June - July	10gms	Direct Planting	2mt x 1.5mt	After 45 to 60 days	3 to 4
10.	Broad Beans	June - July	10gms	Direct Planting	2mt x 1.5mt	After 45 to 60 days	3 to 4
11.	Ivy Gourd	February - March	20 pcs	Plant two cuttings	2mt x 2mt	After 75 to 90 days	3 to 4
12.	Pointed Gourd	February - March	20 pcs	Plant two cuttings	2mt x 2mt	After 75 to 90 days	3 to 4
13.	Colocasia Leaves	June - July	40 nodes	Direct planting	45 x 30	After 45 to 60 days	5 to 6
14.	Beetroot	September - November	10gms	Planting Seeds	30 x 15	After 60 days	4 to 7
15.	Carrot	September - November	10gms	Planting Seeds	30 x 15	After 60 days	4 to 7

16.	Yam	September - November	10gms	Planting Seeds	30 x 15	After 60 days	4 to 7
17.	Radish	September - November	10gms	Planting Seeds	30 x 15	After 60 days	4 to 7
18.	Radish Pods	September - November	10gms	Planting Seeds	30 x 15	After 60 days	4 to 7
19.	Onions	September - November	10gms	Planting Seeds	30 x 15	After 60 days	4 to 7
20.	Ginger	April - May	1.5kg	Planting Nodes	30 x 15	After 260 days	7 to 10
21.	Turmeric	April - May	1.5kg	Planting Nodes	30 x 15	After 260 days	7 to 10
22.	Cabbage	September - November	2gms	After Preparing saplings	45 x 45	After 60 to 90 days	7 to 8
23.	Cauliflower	September - November	2gms	After Preparing saplings	45 x 45	After 60 to 90 days	7 to 8

24.	Coriander	Perennial	15gms	Spreading seeds	Spreading seeds	After 45 days	4 to 6
25.	Fenugreek Leaves	Perennial	15gms	Spreading seeds	Spreading seeds	After 45 days	4 to 6
26.	Spinach	Perennial	15gms	Spreading seeds	Spreading seeds	After 45 days	4 to 6
27.	Amaranthus Leaves	Perennial	15gms	Spreading seeds	Spreading seeds	After 45 days	4 to 6

Environmental Aspects of Kitchen Gardening

According to Ahmed et al., 2016, even the best-laid plans might go away if they are carried out without first thoroughly examining the climatic conditions and nearby surroundings. To design the ideal kitchen garden, it is important to have a thorough awareness of factors including sunshine, rainfall, and soil. India is a geographically diverse nation with widely differing climatic conditions across every location. In the west, what thrives in the north might not. The plant selection and garden design will benefit from the knowledge of India's six climate zones. Most plants and trees may be cultivated across the nation despite different climate zones. However, certain plants will survive better in specific climatic settings, thus it's important to know where each plant will prosper.

To make sure that the plants adapt to the weather and thrive, plan the garden while taking climatic factors like temperature, sunshine, wind, rainfall, and soil into consideration.

- Temperature: Varied plants require different temperatures. Photosynthesis, transpiration, respiration, and growth will not occur unless we set a certain minimum and maximum temperature for each species.
- Sunlight: Through the process of photosynthesis, sunlight aids in the development of plants. The quantity of sunshine that an area receives is crucial when deciding what plants to grow. Some plants, like tomatoes and peppers, require a lot of sunshine to develop successfully, other plants, like lettuce, do well with less sunlight.
    - Full sun - Cucumbers and melons, for example, grow in locations that receive plenty of sunshine. Plants may become stressed and more susceptible to disease from prolonged exposure to direct sunshine. The leaves might potentially smolder from too much sun. Plants will require frequent watering since sunny locations can get quite heated. Plants may be shielded from the sun by using awnings and garden shades.
    - Partial sun - Plots that face east or west provide a good blend of light and shade and are ideal for many plants. Carrots, cabbages, and other vegetables do well in partial sunlight. Partial light is possible for many sun-loving plants, but it will limit their ability to flourish as well. Try

eliminating shadow-producing plants and structures from the garden to help open up the gloomy areas. Urban environments with densely populated buildings generate pockets of sunshine and shadow that can be utilized to grow delicate plants.

  - Shade - Most leafy plants require some shade; if placed in direct sunlight, they may burn. Some plants, including pumpkin, melons, and cucumbers, only allow their seeds to germinate in complete darkness. Colder and taking longer to warm up in the spring are shadier plots. When cultivated in shadow, plants that like the sun become weak and brittle.

- Wind: Numerous factors, including wind, influence how plants grow and develop. Although some wind is necessary for pollen and seed dispersion, strong winds harm plants and have a negative impact on their habitat. In order to ensure the plants' protection, especially in exposed balconies and roof gardens, it is important to determine how much wind the growing area receives.
  - Windy sites - Plants may be cooled down by a little wind if they have access to enough water to prevent loss of moisture. Plants may scorch, shatter, or even transpire in strong, hot winds like the Loo, which increases their susceptibility to disease. Urban environments are especially susceptible to wind damage because neighbouring structures can act as wind funnels, increasing wind speed and power. Trellises and screens are efficient wind filters and wind speed reducers. Low-level barriers, such netting or plastic sheets, can aid in the protection of low-growing plants. Bougainvillea and shrubby honeysuckle are two wind-resistant plants that may be used to create an eye-catching garden feature.
  - Protected Sites - Strong winds are not immediately exposed to protected places. They are perfect for cultivating fruits and vegetables that cannot withstand strong winds. It is advisable to grow young plants in these locations until they are robust enough to withstand severe gusts. In sheltered areas, gentle winds prevent water from stagnating and keep plant diseases from thriving. Large structures in metropolitan locations provide wind shelter and heat absorption, which are great for container gardening of crops like okra, sweet corn, and chilies.

- Rainfall and Humidity: The main source of water for plants in the open is rainfall. The humidity level, which is influenced by the atmospheric water vapour and the moisture content of the soil, is also essential. Before making decisions on which plants to cultivate and how to care for them, one must consider both factors.
    - Rainy and Humid Sites - The edges of garden ponds and pools are perfect places to grow water-loving plants. Some plants, including ferns and mosses, do best in very humid environments. The amount and frequency of rainfall vary; therefore, it could be essential to supplement it with additional watering. If drainage isn't improved, excessive rainfall is especially damaging to plants since it prevents them from growing in wet areas. Plants are particularly vulnerable to fungi that cause illnesses like grey mold in environments with high humidity.
    - Drought-prone Sites - No plant can go for a prolonged period without water. But other plants, including achillea, daylily, and zinnia, may survive on less water. Drought in the summer is bad and can make plants wilt and finally die. In regions with little rainfall, mulching and weeding can enhance the quantity of water that is accessible to plants. Larger pots are beneficial since they don't dry up soon. Avoid drowning plants in water since this might wash compost away or undermine the soil, exposing the plant roots.
- Soil: Good soil serves as the foundation for a healthy garden and is the secret to growing plants that provide abundant fruit whether one grow plants in pots, borders, or raised beds. There are three types of soil viz: clay soil, sandy soil, and loamy soil. Soil type varies from regions to regions. The selection of plants depends on the soil type.
    - Clay soil - This soil drains poorly yet retains nutrients effectively. It might be difficult to dig when damp and hot in the summer.
    - Sandy soil - Light sandy soil has big particles that enable for easy drainage, moisture, and nutrient leaching.
    - Loamy soil - This soil is ideal for gardens since it has an evenly distributed blend of clay, sand, and silt particles.

By rubbing a small amount between the fingertips, one may clearly determine the type of soil. Clay soil is simple to form into balls that maintain their shape due to its sticky nature. While loamy soil feels silky to the touch and molds into forms reasonably well, sandy soil feels rough and does not hold together.

Both clay and sandy soils can be improved with well-rotted organic matter. Instead of digging it in, spread it out as mulch and let earthworms pull it into the soil. Worms aerate and enhance the structure of the soil as they tunnel and consume. Clay soil's inability to drain properly might result in waterlogging. Working coarse organic materials through it will enhance drainage. The clay is broken up, becoming lighter and permeable to water as a result. Plants might perish in sandy soil due to a lack of water and nutrients in the soil. Mulch it with thick organic materials to make it better. Like a sponge, this aids in retaining moisture and nutrients in the soil for a longer length of time. Most plants thrive in loamy soil, especially fruits and vegetables. It doesn't require much adjustment, although one may increase the quantity of certain nutrients in it by adding a thin layer of mulch or compost. A by-product of the coir industry called coco peat can be added to soil. Nutrients and enzymes in processed coco peat increase soil aeration. It serves as a lightweight planting medium for containers (Ahmed et al., 2016).

It is necessary to understand the soil, water and climatic condition of any region while working in the field of Horticulture and Gardening. Since the present study focused on developing kitchen gardens in Vadodara city, it is important to understand the topography of this region. Vadodara city is in the state of Gujarat and its soil depth class in central Gujarat ranges from shallow to deep. The western section has deep and extremely deep soil, whereas the eastern part has shallow soil. The soil depth class of the Vadodara district's soils ranges from shallow to deep. The soils of Vadodara district tend to be fine textured (clayey), followed by medium textured (loamy), and coarser as we get closer to the border between Vadodara and Dahod districts (sand). In contrast, the soil in Vadodara is yellow loamy soil. In the western section of the Vadodara district, the soil is generally mildly to moderately salinized. In Vadodara, the soil is slightly to moderately salinized, and it is somewhat sodic overall. In the Vadodara district, the soil drainage ranges from adequately drained to moderately draining, to rather excessively draining (Joshi & Doshi, 2016).

Gardening requires a lot of consideration of the local climate. The type of plants and trees in a location depends on its climate. Vadodara experiences a dry climate. Vadodara experiences a hot climate from March through July. During these months, the city's highest temperature is 45° C., and 23° C is the absolute minimum at this time. The highest temperature is 30° C from November to February. 15° C. is the typical lowest temperature. Dry weather between the months of November and February characterizes the climate. During the monsoon, Vadodara's climate gets more humid. Mid-June to mid-September is Vadodara's monsoon season, and the city receives 93 cm of rain on average per year. The city's highest recorded temperature during the monsoon is 46° C, while its lowest recorded temperature is 31° C (Joshi & Doshi, 2016).

2.1.2.3 Problems related to the Kitchen Garden

In today's world, where the fruits and vegetables available in the market are full of chemicals and pesticides and less nutritious, it is a necessity to grow your own fruits and vegetables in the part of residential garden, known as kitchen garden. The kitchen garden can be developed with the help of professionals or can be self- developed. While one is developing or willing to develop a kitchen garden, one can face many problems related to it. Kitchen gardening seems easy but there are many efforts required for developing and maintaining it and while doing so many problems are faced by homeowners. Many people residing in small spaces or in the apartments or flats always find a space crunch while developing kitchen garden in their residence. Less space is the major issue in the developing world. Houses becoming small and having almost less or no outdoor space demotivates people to develop their own kitchen garden. The problems related to finances and availability of the materials required to develop or maintain kitchen gardens are often faced by people. Many other homeowners face problems in developing, utilizing, and maintaining their kitchen gardens due to lack of knowledge regarding the growth patterns and horticultural requirements of various fruits and vegetables grown at household level. Lack of awareness related to kitchen gardening aspects, such as sowing season, growing pattern, requirements of sunlight, water, drainage etc. affects poor cultivation of crops leading to demotivation related to kitchen gardening. Homeowners who

already have developed kitchen gardens also face various problems related to their kitchen garden; viz, related to soil, drainage, amount of sunlight, pests, seedlings, plants, fruits, etc. All these problems play a major role in the growth of vegetables and fruits in the kitchen garden. All these problems have to be studied in-depth when discussing about the development of kitchen garden.

Every gardener runs into a few typical problems at some time when producing vegetables. These problems include wilted seedlings, plants that remain stunted and seem yellow, scorched-looking leaves on the plants, plants that appear distorted and harsh, and snap bean buds that don't expand. Common issues with vegetable and fruit crops include wilting plants, weak, spindly plants, plants that grow too slowly and are yellow or light green in colour, dark spots on leaves and stems, curling leaves, white spots or coatings on the plants, shredded leaves with holes, poor yields of few or no fruits, irregular fruit, and vegetable growth, etc. With a young plant, issues might occur even before anybody expects any fruit. Before the plants start to produce fruit, one must identify and address the common issues to ensure a successful harvest. Unfortunately, growing vegetables may and probably will lead to several additional problems. Nevertheless, it's crucial to take a systematic and patient approach. [(1)]

Growing vegetables is not always as successful as anticipated. Similar problems with yielding may be seen in many vegetable gardens. Some reasons for having problems related to kitchen garden are poor soil, varied temperature, low light, lack of nutrients in soil, excess of fertilizer, irregular watering, rocky soil, lack of fencing, flea beetles, fungus or chemical burns, low pollination, etc. All these problems affect the growth of fruit and vegetable plants (Speake, 2022). There are other problems related to pests and diseases which have to be addressed and need to be solved to ensure the proper nutritional growth of the plants.

Above mentioned problems can be solved by careful measures and using home remedies to prevent pests and diseases. The solution to availability of less space or no outdoor space, one can always develop their kitchen garden in balcony, terrace or even in containers. Many fruits and vegetables are grown in containers with the same nutritious value. Homeowners who find it difficult to find the materials for developing a kitchen garden can contact to their nearby nurseries

or even the Government Agriculture Department also helps in availability of materials for developing kitchen garden at home, like, seeds, saplings, organic fertilizer, medicines for plant diseases. Many other problems related to plant growth and pest control can be solved by taking proper precautions. In vegetable crops grown in the backyard, pest infestation is initially found on some parts of the plant (bud, bud, flower, fruit). So, first, removing such infested parts and disposing of them properly is important. Do not overwater, which may rot the plants. Extensive use of organic fertilizers (slurry manure, cow dung, vermicompost, press-mud etc.) and biofertilizers can prevent termite infestation. Use of neem pods and poultry manure provides crop protection against worms. Leaf extract of some local plants (neem, karanj, mahudo, ardooso, matsyagandhati, pili karen, dhaturo, fudino, sitafali, bougainvillea) provides protection against pests when sprayed in vegetable crops. Among all these plants, neem has proved to be very important for pest control. Fresh neem leaves (10) and neem nut powder (5% extract) have been found to be effective in reducing their populations. The use of such herbal products prevents the mites from laying their eggs and the mites that cannot eat the sprayed area die slowly. (Satodia & Patel, 2015)

Patel and Soni, 2015 has suggested home remedies as mentioned below related to plant growth.

- Onion- Onion has a strong odor. Cut onion into small pieces and make a paste by crushing it in a mixer. Mix the prepared paste with water and spray this water on the plants to get rid of ants.
- Garlic- Garlic also has a very strong odor. Rest two cloves of garlic in 1 liter of water for 20 to 25 minutes and take it out of the water. Use this mixture to spray the plants twice a week to protect against ants and pests.
- Red Chili - Mix 1 teaspoon of chili powder in 1 teaspoon of liquid dish soap with 1 liter of water and spray this mixture on leaves and plants to be protected from pests.
- Borax and Sugar - Mix borax powder and sugar in equal proportions. Ants eat sugar as well as borax powder, which is harmful to them, and helps to get rid of ants. Adding citric acid and warm water will also help to get rid of ants.

- Salt - Dissolve 3 teaspoons of salt in 2 liters of water and spray the mixture on plants to kill the insects.
- Baking soda - Mix 1 teaspoon of baking soda in 1 liter of water. Add 1 teaspoon of soap powder to it, mix and spray it will kill the pests.
- Dish Soap - Mix 5 ml liquid dish soap or 20 gm dish soap in 5 liters of water and spray it to get rid of ants and caterpillars.

Every problem has solutions if one desires to solve it. Many kitchen garden problems occurred due to the lack of knowledge, lack of patience or lack of availability of resources required for proper growth of the plant. It becomes necessary to educate and create awareness regarding various problems faced by homeowners regarding the kitchen garden for the benefit of society.

Household Compost

Now-a-days the major problem is waste disposal. As the population is increasing the amount of waste generated is also on the rise. Water waste is treated and then it is left to the river or sea, but the solid waste is just dumped on the ground, and it is not properly treated, which is the serious threat to land pollution. The land is being polluted due to the improper disposal of waste. The waste collected by the municipal corporation sometimes is not even segregated which is a big problem in the current scenario. The best one can do is segregate it to the household level only. By segregating the waste into wet and dry, recyclable, non-recyclable and e-waste will be helpful to the residents as well as to the community. This practice will help to decrease the amount of waste which is being dumped on the grounds for landfill.

Bio-degradable waste will be useful at the household level only. By using the bio-degradable waste to prepare the compost, one can have healthy plants and healthy environment surrounding. Bio-waste is defined as biodegradable waste, such as garden waste, food waste, kitchen waste, leftover food or peelings of vegetables and fruits, etc. The main environmental threat from this waste is the methane production at the landfills, which is harmful. At the landfill sites, there are not proper directives which prescribe the specific treatments for these wastes. The best practice is proper management of bio-waste by preparing the compost at household level which will be useful in the residential garden or can be useful for the community garden as well. The

compost prepared from the bio-waste will be useful to enhance the soil quality and resource efficiency [6].

2.1.3.1 Meaning and Benefits

Composting the kitchen waste materials saves the money of the house owner as well as the municipality. By using the kitchen waste to make compost at one's own home, one can save the cost of buying compost and fertilizers to improve the kitchen garden. Municipalities save money and their resources when these wastes are managed at home instead of operating drop-off sites or curb side collection programme. Besides having value as a resource, themselves, this waste would take up a lot of landfill space if not treated properly. By using such kitchen and garden waste to create the compost we can save up to lot of landfill space.

According to Singh & Longkumer, 2018

> "Compost is a mixture of properly decomposed organic matter that can be used as a supplement for soil conditioning and supplying the nutritional requirements of the crops."

According to Cromell, 2010

> "A beneficial, soil-like substance, compost is a mixture of decayed and decaying organic matter that improves soil structure and provides nutrients for plants."

Compost is considered as a nutrient for the soil, which helps the soil to be healthy and disease free. It is not only fertilizer, but it also provides various nutrients such as nitrogen phosphorus and potassium for the soil. With this soil amendment it will help to improve the structure and tilth of a soil. Compost will help the soil to be moist and will help the plants to penetrate their roots for a better growth. Composting also helps the soil to increase the number and type of microbes in the soil and will help plants to obtain nutrients and maintain the balance among microbes to help limit the number of disease-causing organisms [7].

The use of compost for one's kitchen garden has various benefits for the soil like improvement of soil health by cultivation, increasing water retention and proper air circulation through air pockets for better plant growth. Composting helps gardeners to

use chemistry to produce their own garden soil enhancements. Organic materials such as leaves, garden waste, vegetable and Fruit scrapes that are decomposed and broken down and then turns into manure and doesn't breakdown further is called compost. Decomposition takes place through fungi, bacteria and other organisms like earthworms, sow bugs, millipedes, and others. Compost making is a resourceful gardening practice because it helps to recycle and reuse the valuable nutrients through organic matter which is returned to the garden. This is a free source of organic fertilizer manure for gardens. (Krans, 2016)

Benefits of Composting

Composting offers a whole list of benefits – for one's garden, wallet, and the Earth. Livingston, 2018 has suggested the following benefits of composting.

Free Fertilizer: Compost is best for improving the texture of the soil, so that it can hold the water and air for the betterment of the plants. For healthy root development in the plants compost is also good as it adds nutrients to the soil. The household compost is beneficial to give all the benefits to the garden owner free of cost.

No Harmful Chemicals: Commercial compost contains harmful herbicides which hinder the growth of the plant instead of nourishing it. The chemicals of commercial compost are called killer compost as they kill the plant. Preparing the compost at household level will help plants to be chemical free.

Less Waste: Kitchen and garden waste makes up the majority of the household waste. One can help save the environment by dumping all this waste in the waste bin which ultimately adds to the landfill. Instead, if this waste can be utilized to create household compost which will be beneficial to the garden can save money ending to managing the waste at landfill.

A Cleaner Planet: One of the practices which can help in saving the planet is utilizing kitchen and garden waste to create compost at household level. The kitchen waste produces methane when it breaks down in landfill which is a greenhouse gas; whereas in the compost pile while decaying the waste less methane is produced, which can be helpful in fighting global warming. In fact, using homemade compost in the garden can reduce the use of chemical fertilizers for the plants.

2.1.3.2 Materials for Household Compost

By converting organic waste, such as stale bread, yard trimmings, peels, leftover food, and more, into nutrient-rich, chemical-free compost, it is simple to make compost at home for plants. Compost is regarded as "black gold" due to its many advantages. It is a natural amendment that can be given to the soil at any time of year without having to worry about burning the plants. Compost is a fantastic soil amendment for gardens, and it makes it simpler to work with clay soils. Compost increases the soil's ability to store water in sandy soils. By incorporating organic matter into the soil, compost can aid in enhancing plant development. Leaf and other yard trash may be recycled effectively by composting.

Any kind of kitchen waste, which includes the vegetable and fruit scrapes can go into the compost pile. Even actual plants and their parts, paper, sawdust, dryer lint if it’s made from natural fibre can also be used in the compost pile.

Some fundamental components are required for all composting:

- Browns - This primarily consists of twigs, dead leaves, and branches.
- Greens - Materials like grass clippings, coffee grounds, vegetable trash, and fruit scraps are "greens."
- Water - The proper amount of water is crucial for the growth of compost.

There should be an equal ratio of brown to green materials in compost pile. The brown materials contribute carbon to composting process, the green elements contribute nitrogen, and the water offers moisture to aid in the breakdown of organic materials. Various types of garden waste can also be used for composting. Components which are gathered to properly begin a compost pile such as fruit scraps, vegetable scraps, coffee grounds, eggshells, grass and plant clippings, dry leaves, finely chopped wood and bark chips, shredded newspaper, straw, sawdust from untreated wood can easily be available in the house [(8)].

Livingston, 2018 recommended compost materials which can be used to make household compost which are: The ideal ratio for compost is two to three parts "brown materials" to one part "green materials." When one talks about brown materials, various things can be considered as brown materials. Brown materials are rich in carbon and dry in nature. Paper products including toilet paper rolls, office paper, newspaper, and

cardboard may all be used for preparing compost. To ensure that they decompose more quickly and don't mat, it is preferable to shred these items before placing them in the trash. Glossy paper, as well as paper printed with colour, should not be composted. Dried yard trash, which includes little twigs, dry leaves, and pine needles, may all be composted. Hay, which includes seeds, may also be composted, but it's not recommended because there's a chance that the seeds may sprout in the compost. Small twigs and branches can be added, but they take a very long time to decompose. Pine needles shouldn't be used in big quantities since they are quite acidic. Compost may be made from woody waste, including wood chips, clean sawdust, and even ashes from clean materials. However, because these materials are all rich in carbon, they should be used with caution. On the other hand, green materials include things which are moist and rich in nitrogen. Compost may be used for a variety of kitchen scraps, including eggshells, coffee grinds, tea bags (with the staples removed), nutshells, and fruit and vegetable peels. Fish, bones, and meat leftovers should not be composted since they can draw pests to the pile. Dairy products and fatty or oily meals shouldn't be added to the compost, either. Fruits that are organic should not have an issue with pesticide residue on the peels of oranges, peaches, or bananas. Green leaves, branches, blossoms, and grass clippings are all considered moist yard waste if the grass is herbicide-free. Only weeds that have not gone to seed may be placed in the compost bin. Avoid adding any sick plants to the compost pile.

Composting Kits in Indian Market

Manoj, 2022 mentioned in an article “Top 10 Composting Kits Available in India & Tips to Choose the Right One for Your Home”, various composting kits available in an Indian market. Converting kitchen waste into organic manure that improves crops is a clear and concise technique that takes some knowledge. Offline and online retailers sell ready compost packages that may be used in less than 30 minutes a day for gardeners who are just starting off or who need a little push. Here is a list of several composting kits and items from India that offer to enhance overall gardening abilities:

1. **Organic Composter**: This set includes a 25-litre organic composter and a bag of microorganisms. The package is perfect for a three-person family. 70% of the entire amount of kitchen garbage may be turned into manure. One litre of trash can be digested in a single day. Within 25 to 30 days of the bin being full, the bacteria make waste conversion simple. As a result, 5-8 kg of manure are produced.

Plate 2 Green Bin Organic Composter [9]

2. **Portable Twin Drum Composter:** The difficulty of transporting the compost pit is resolved by this MYSA composter. A larger amount of storage is aided by the double drums. The thermo-control and UV-resistant polyethene drums also take up less room. Any things containing citric acid as well as the necessary amounts of dry leaves or cocopeat can be added to kitchen waste. The compost is ready for usage in two to four weeks.

Plate 3 MYSA Spintech Polyethylene Portable Twin Drum Composter [10]

3. **Home Terracotta Composter:** For people who don't compromise on sustainability, the product is ideal. One lidded clay container, a compost maker, microorganisms, a metal rake, and nitrile gloves are all included in the set. As a result of the employment of the compost maker, no mixing is necessary. The procedure has a maximum waste storage capacity of 1.5 kg, which is composted in 30 days. The supply is more than adequate for a family of five people.

Plate 4 Urban Row Home Composter Small Terracotta - with Complete Home Composting Kit [11]

4. **Bucket Indoor Composter:** This set includes a compost machine, a bucket with a 30-liter capacity, and comprehensive instructions for composting successfully. The bucket has a fashionable design and is constructed of food-grade plastic. A drainer is positioned beneath the bucket to collect any excess sewage, which may then be drained through the tap at the bottom of the bucket. This water can also be applied as fertiliser at the conclusion of the composting process.

Plate 5 BIO Drops BOKASHI Bucket Indoor Composter [12]

5. **Indoor Compost Bin Kit**: The Daily Dump makes this three-tier composter, which also includes gloves, a manual, and compost maker powder. Each day, it can hold up to 500 g of kitchen trash. After storage, compost will be available in 45 days. Using a layer composter has the advantage that, after one cycle, the compost will be accessible all year long. Since the compost from the upper tier may be used, we don't need to wait another 45 days for it to be ready.

Plate 6 Daily Dump Gobble Junior Aerobic Compost Kit [13]

6. **Home Composter Set**: A family with five people or more may simply transform their kitchen trash with this 35-litre composter combination of two containers. To make the procedure less dirty, it also comes with a set of reusable gloves and a stirrer. An odour elimination liquid is also added in addition to these, which scientifically lessens the bad odour and speeds up the composting process. When the compost is prepared, an activator is offered to be applied to enhance its quality.

Plate 7 Biocare India Pvt. Ltd Biozap Plastic 35 L Home Composter [14]

7. **Compost Bin**: The GreenTech Life package comes with three 20-litre bins, three drainers, a pair of rubber gloves, three stands, 3 kg of microorganisms, three taps, four curing bags, and camphor pills. The package contains a reference to the installation instructions for the setup. It is perfect for households with three to six people. 30 to 45 days will pass before the compost is ready.

Plate 8 GreenTech Life Smart Bin Air/Compost Bin [15]

8. **Organic Waste Composting Bin**: This simple container has a drainer and a tap connected, and it can hold up to 30 litres of fertiliser. It is composed of polypropylene, and the set also includes a block of cocopeat. Kitchen garbage may fill up to 90% of the bin, and after being full, the compost will be ready in 30 days. Add more manure for quicker outcomes.

Plate 9 Surprise Organic Waste Composting Bin-Compost Genie [16]

9. **Home Composter**: Two 35-litre bins with supports and other accessories are included in the kit. The kit also includes a 2 kg supply of an accelerator comprised of sawdust and microorganisms. The product, which is made of high-quality plastic, is ideal for families with 3-6 members.

Plate 10 Sampoorn Home Composter [17]

10. **Indoor Composter Starter Kit**: A compost container, a compost maker, and a comprehensive instruction booklet are included in this sample package. In addition, a drainer and a tap are supplied. A modest family of two or three people can test out the 14-litre bin. Within four to six weeks, the compost will be ready.

Plate 11 Trust Basket Trustbin - Indoor Compost bin [18]

With the combination of brown and green materials in a chosen compost bin available in the market, one can prepare household compost for their kitchen garden. With the prepared compost one can grow healthy, chemical-free and nutritious vegetables and fruits at home. With the materials and composting kits, one also needs to have a good knowledge of the methods of preparation for making compost.

2.1.3.3. Preparation of Household Compost

To improve the health and productivity of plants, compost is an organic substance that can be added to the soil. Organic waste, such as leaves and food scraps, can be naturally recycled through composting to create a beneficial fertilizer that can improve soil and plants. Composting speeds up the procedure by providing an ideal environment. However, the ensuing decomposed material, which seems to be fertile garden soil, is referred to as compost. Because it is nutrient-rich, compost is frequently used in agricultural, horticultural, and gardening areas. This is the essential nutritional supplement one should provide to the garden plants. It is also easy to prepare and safe for the environment.

By converting organic waste, such as stale bread, green waste, peels, leftover food, and more, into nutrient-rich, chemical-free compost, it is simple to make compost at home for plants. Compost is regarded as "black gold" due to its many advantages. It is a natural amendment that can be given to the soil at any time of year without having to worry about burning the plants. Compost is a fantastic soil amendment for gardens, and it makes it simpler to work with clay soils. Compost increases the soil's ability to store water in sandy soils. By incorporating organic matter into the soil, compost can aid in enhancing plant development. Leaf and other garden trash may be recycled effectively by composting [(4)].

Mittenthal, 2007 recommended four important conditions that are essential for composting to occur. They are proper pile size, sufficient air movement, sufficient water availability and a proper carbon-to-nitrogen ratio. They are discussed below.

> Proper Pile Size: Compost piles may reach temperatures of up to 82 C/180 F because of the heat produced by bacteria as they feed on organic matter. The bacteria that compost the best thrive at this heat, but they can only keep the right temperature level if the pile they start working in is large enough for them to do

so. The minimal size to begin with is a cubical pile that is 1 m (3 ft) on a side. If it obtains adequate air, a pile bigger than that is okay. Composting may be done on whatever size you choose; in fact, some towns compost vegetable and yard waste into windrows that can measure hundreds of metres (yards) long, 2 metres (approximately 6.5 feet) high, and 1-2 m (3-6.5 feet) broad.

Sufficient Air Movement: Bacteria require air to fulfill their function of digesting dead organisms. The piles one creates shouldn't be too large to permit air movement throughout the pile. If one uses a bin or other container to store compost, it should have several openings on both sides to promote airflow. Gardeners who carefully manage their compost additionally typically "turn" a compost pile two or three times at intervals of between 4 and 14 days to get air to all portions of the pile. To do this, remove the pile from its current site by digging it up using a spade or spading fork. The oxygen-dependent "aerobic" bacteria that one wants will be unable to thrive and grow in compost pile if there is not enough airflow, and unfavorable "anaerobic" bacteria will take over. While the anaerobic bacteria in compost pile can continue to decompose the materials there even without oxygen, they do so far more slowly than the aerobic bacteria. Additionally, they foul up the smell of compost heap.

Sufficient Water Availability: The bacteria that break down organic matter need water to survive and breed, just like all other living things. If one digs into compost pile and it appears dry 15–30 cm (6–12 in) into the pile, one should water it thoroughly to prevent anaerobic bacteria from growing. To water it, use a stick or the handle of a gardening tool to make several deep holes, and then pour water into them.

A Proper Carbon-To-Nitrogen Ratio: When one remove away the water from a living organism, the majority of what is left is carbon, which is used for a variety of activities (in plants, for example, carbon makes up most of the weight of cellulose, the material that plants use to build their stems). Nitrogen, which all living things utilise to create proteins, is another essential element. While nitrogen is more uncommon in nature than carbon, it is nonetheless required in much lesser quantities. The bacteria that perform the composting process typically require 30 units (kilogrammes or pounds) of carbon for each unit of

nitrogen that is available to them. When choosing items to put in a compost pile, the gardener strives to offer this so-called "carbon to nitrogen ratio" of 30:1. Most gardeners simply do this roughly, and the composting process works just fine, while one may expect that this would need complex chemical analysis of the kitchen or yard waste.

It is important to focus on these four conditions for preparing compost at household level. If these conditions are taken care of while preparing the compost, the prepared compost is healthy and nutritious for the plants (Mittenthal, 2007).

Composting methods can be done either indoors or outdoors. The ideal way to compost at home depends on several factors, including location of house, amount of space in the house, availability of organic waste (including yard and kitchen garbage) at home and composting process time. There are three types of households composting: cold composting, hot composting and vermicomposting. According to the suitability of space and materials, one can choose the composting method and can prepare compost at home [(4)].

Cold composting: The simplest approach for composting is cold composting. Although one should not worry about the ratio of compost components, aerate often, or keep an eye on moisture levels, cold composting is done with little to no interaction. With little organic waste to compost and little time to devote to the process, this is the ideal method. Depending on the type of cold treatment, it may take one to two years before obtaining useful compost. In addition, a cold composting process will not achieve a high enough temperature during decomposition to eliminate microorganisms. The result may contain weed seeds as well as remaining dangerous pathogenic bacteria, fungus, protozoa, worms, and other sorts of parasites, depending on what is added to the pile. In addition to decomposing more slowly than hot piles, cold piles may also smell worse or be wetter. In order to create a pile for cold composting, the planter must alternately stack organic waste products such shredded paper, straw, dead leaves, and grass clippings. This approach requires more time because it is an open procedure. However, the procedure may be completed with less effort from the gardener [(4)].

Hot composting: Composting in the heat is more controlled and quicker. Maintaining the ideal ratio of nitrogen and carbon is important for the decomposition of organic waste. The final compost product might be ready in 4 weeks to 12 months under

favorable circumstances. This kind of composting is referred to as hot because it may produce internal heat with a temperature of around 71°C. Composting is a quick process that can yield useful garden manure. Hot compost uses 3-foot cube-shaped compost bins. However, the most desired shape is a 4-foot cube [(4)].

Vermicomposting: For vermicomposting process worms are added in the pile. Specifically red worms are inserted into the composting pit. They consume the trash and hasten the decaying process. Additionally, their feces are very nutrient-rich for the soil, which results in fertilizer that is better for the plants [(4)].

The most environmentally friendly approach to dispose of kitchen and garden waste is by composting at home, which also provides compost that is wonderful for enhancing soil.

Throughout the year, it is done whenever sufficient resources are available in the house or garden. The best period to make compost is from late summer to early winter. There are 8 steps for preparing household compost. They are as follows: [(2)]

Step 1 Choose the Type of Compost Bin: Wooden pallets or corrugated iron can be used to create a bin. An enclosed one will keep heat and hasten the decomposition process. The larger the pile, the more heat there is. 1mx1m is the ideal minimum size. For a small area, a plastic compost container is perfect. The plastic cover and sides hold in heat and moisture to promote quick decomposition.

Step 2 Choose Composter Location: The finest spot is a sunny area of the garden. Ideally, it should be level and well-drained. It ought to be placed in an accessible location.

Step 3 Right Balance of Composting Materials: To promote drainage and aeration, start by adding a layer of coarse debris (such as twigs). Add some leaves to cover this layer. Next, layer brown materials in between layers of green materials (materials high in nitrogen) (carbon-rich material).

Step 4 Do Not Add to the Compost: There are various materials, which should be avoided to be added in the compost pile, such as meat, fish, dairy products, oils, diseased or infected plant, etc. They will hinder the process of composting.

Step 5 Making Compost with Alternate Layer: Between the brown and green layers, sprinkle a thin layer of completed compost or high-quality garden soil to speed up the process of conversion and produce superior compost. Use a garden hose to spray each layer to add moisture.

Step 6 Continue to Add Layers until Bin is Full: As the contents of the bin or pile start to rot, they will get smaller. So, when the kitchen and yard garbage build up, keep adding it. Turn the pile once it is full of trash each week. The pile will produce finished compost more quickly if it is mixed properly at regular intervals.

Step 7 Harvest the Compost: The active composting phase lasts between 14 days to six months. A mature batch of compost will be dark brown, have the consistency of crumbly dirt, and smell earthy. Leave the unfinished materials in the bin to continue decaying while removing all the completed compost from it.

Step 8 Use of Compost: A few times annually, fertilize your lawn with prepared compost. Use prepared compost as a soil amendment for vegetable and flower areas as well as around the bases of trees and bushes. Combine compost with the soil for flower beds and gardens. Fill the hole with half compost and half dirt when planting or transplanting trees, flowers, and shrubs to use as a soil conditioner.

For producing "compost tea" to nourish the plants, 1 litre of compost should be placed in cheese cloth or an old pillowcase. Tie the bag's top and let it "steep" in a garbage can with water for a varied amount of time (24–48 hours). This "undiluted tea" can be sprayed on plant parts or used to irrigate lawns and gardens [(2)].

The step-by-step procedure of preparing household compost can be followed repeatedly as required. One can enjoy the nutritious and chemical free compost from their own kitchen waste and garden waste which helps them to grow vegetables and fruits chemical free in their kitchen garden.

2.2 Related Research Studies

This section covers various studies conducted in Outside India and India in the field of kitchen gardening and composting.

2.2.2 Studies conducted Outside India

Nsimbe et al. (2018) conducted a cross-sectional study to collect quantitative data from 368 residents of Masaka municipality, Central Uganda. A semi-structured interviewer administered questionnaire was used which assessed knowledge, perceptions, and practices of composting. The data were analyzed using STATA 13.0, and binary logistic regression was used to determine the factors that influence composting at the household level. Of the 368 participants, 11.4% were engaged in composting. The data also revealed that most participants had heard about composting (87.2%), with majority (92.2%) of the participants stating that it was important to engage in household composting. Only 011.4% of the participants were engaged in household composting. More than half (58.4%) had a garden, and (50.8%) were segregating their domestic waste. Two-thirds (66.0%) stated that composting required technical knowledge to engage in, and (67.1%) said it was not worthwhile to compost unless time was sufficient. The factors associated with household level composting were age of 46 years and above, possession of a garden, engagement in waste segregation, and peri-urban residence. The practice of composting at the household level was low. The results highlighted that there was a need for urban authorities to develop initiatives for promoting composting at the household level while considering the identified predictors associated with composting.

Gomes et al. (2017) conducted a study to evaluate the effect of planting herb or vegetable seeds and seedlings on the household availability of fruits and vegetables through an intervention study combining various actions (educational practices, home visits, and distribution of seeds and seedlings) for the promotion of fruit and vegetable consumption in multiple settings. Data from 70 families were analyzed. Using the stratified sampling technique, the participant families were selected from a stratum within a population of 1,743 families living in three low-income communities in the city of Rio de Janeiro, Brazil. Three post-

intervention groups were formed and compared: families that did not receive the seeds and seedlings during the intervention; families that received but did not plant the seeds and seedlings; families that received and planted the seeds and seedlings. The results revealed that among the families that did not grow their own fruits and vegetables before the intervention, those that received and planted the seeds and seedlings achieved an increase in household availability of fruits and vegetables up to three times higher ($p<0.05$) than that achieved by the families who did not receive the seeds and seedlings and those that received but did not plant them. The results also revealed that there were no differences in the household availability of fruits and vegetables among the families that grew their own fruits and vegetables before the intervention, and those who did not receive the seeds and seedlings, and among those that received and planted them, and those that received but did not plant them.

Mengistu et al. (2017) conducted a study on comparative effectiveness of different composting methods on the stabilization, maturation and sanitization of municipal organic solid wastes and dried faecal sludge mixtures. The composting treatments were arranged in a completely randomized block design with three replications. The changes in physio-chemical and biological characteristics of the compost were examined at 20 days interval for 100 days using standard laboratory procedures. The analysis of variance was done using SAS software and the significant differences were determined using Fisher's LSD test at $P \leq 0.05$ level. The results revealed that the evolution of composting temperature, pH, EC, NH^+_4, NO^-_3, NH^+_4: NO^-_3 ratio, OC, C:N ratio and total volatile solids varied significantly among the composting methods and with composting time. The evolution of total nitrogen and germination index also varied significantly ($P \leq 0.001$) with time, but their variation among the composting methods was not significant ($P > 0.05$). Except for pit composting, all other methods of composting satisfied all the indices for stability/maturity of compost at the 60th day of sampling, whereas pi composting achieved the critical limit values for most of the indices at the 80th day. A highly significant differences ($P \leq 0.001$) were noted among the composting methods regarding their effectiveness in eliminating pathogens (faecal coliforms and helminth eggs). The combined windrow and

vermicomposting (WVC) method was most efficient in eliminating the pathogens complying with WHO's standard.

Mohsin et al. (2017) conducted a study in the district Bahawalpur, Pakistan. The objectives were to explore the main benefits of kitchen gardening, to identify the places used for this activity, to identify the growers' perceptions and to give suggestions to improve the project. For the study, two urban and one rural tehsils of district Bahawalpur were selected as study areas. A total 100 growers (35 each from Bahawalpur City and Bahawalpur Saddar, respectively, and 30 from Ahmedpur East tehsil (subdistrict) were selected as target samples. Secondary data were collected from several sources while primary data gathered through a mobile phone survey which was analyzed by applying descriptive and inferential statistics using SPSS software. Out of 100 respondents who had purchased seed kits from sales centers, 84% respondents have sown their seed kits for vegetable growing. About 16% respondents had not planted their seeds. Many growers (77.4%) utilized house's lawn for the purpose of growing vegetables, 17.9% used house roofs for the growing of vegetables due to the absence of lawn or availability of less vacant space at home. The rest of the growers used earthen pots (2.4%) and plastic bottles (2.4%) for vegetable production. The findings justified that the dominant share of growers have sown the seed kits for vegetables production, mostly for home consumption and were satisfied with the quality and price of seed kit. Most of the growers also certified the efficiency of the project in the regular provision of fresh and healthy vegetables.

Pillai et al. (2016) conducted a two cross-sectional nutrition survey at different time points, the baseline in October–November 2013 and endline in May–June 2014. Between the surveys, an intervention consisting of three interactive nutrition education sessions was conducted in December 2013. The study targeted forty households owning home gardens in urban areas of Morogoro municipality. Mixed methods were used to collect data, including semi-structured questionnaires for quantitative data and focus group discussions for qualitative data. The estimated marginal means showed small statistically non-significant improvements in knowledge scores for vitamin A ($p = 0.145$, partial $\eta 2 = 0.065$) and iron ($p = 0.403$, partial $\eta 2 = 0.022$). There were more positive scores observed

for both nutrients at endline compared with baseline. Composite knowledge scores calculated for participants revealed improvements in the category with scores between 3 and 6 points, for both nutrients. While a statistically significant improvement in knowledge scores was not observed, an increase in the number of positive scores and composite knowledge scores indicate an improvement in nutrition knowledge among participants. The results revealed that families having home gardens and who are provided with nutrition education can improve the quality of their household diets. Nutrition education in combination with other agricultural interventions could be a potential tool to improve nutritional status and should be integrated into public health programmes and strategies.

Aworinde et al. (2013) conducted a survey of thirty home gardens in Odeda Local Government Area (LGA) of Ogun State, Southwestern Nigeria to assess plants grown and maintained by household members and the diversity of vegetal species and their uses. A semi-structured questionnaire and structured interviews were used to collect useful information. A total of 120 plant species belonging to 50 botanical families were documented. From the data, Euphorbiaceae, Solanaceae, Rutaceae, Malvaceae, Caesalpiniaceae, Poaceae and Apocynaceae (in order of decreasing number of species) were the most frequent families. Taxa such as Musa species, Vernonia amygdalina, Citrus species, Psidium guajava and Terminalia catapa were found to be the common food/medicinal plants as evidenced by their densities in the study sites. The household members cited most of the plants as food, others as medicinal and ornamental. Miscellaneous uses include cosmetics, ceremonial and scouring. Findings from the study indicated that majority of the respondents were females. The level of education of household members interviewed ranged from Primary School Certificate (PSC), Junior Secondary School Certificate (JSSC), Senior School Certificate (SSC), and Nigeria Certificate in Education (NCE) to First Degree (FD). The ethnic groups identified were Yoruba and Igbo. Igbo incorporates the Nupe. All the interviewed members were literate, but a good percentage were self-employed. Home gardens studied proved to be a basic agro-forestry system mainly for food, medicinal and ornamental plants and occupied an area between 53 and 583 m2 with a mean of 158.5 m2 and standard deviation of 162.42. The shape, size and number of species varied for each home garden but were most commonly rectangular (63%), square

(13.3%) (not perfect), and triangular (3.3%). Irregular shapes (20%) were also identified. Structurally, vertical dimension took the largest percentage (53.3%), while horizontal (26.7%) and random settings (20%) were also encountered. All the species sighted were reported to be useful for several purposes.

Njuguna, (2013) conducted research on workers at James Finlay Kenya to investigate the role of kitchen gardens in addressing food security and nutritional diversity. The research used both qualitative and quantitative approaches to collect data from households and stakeholders. Stratified sample was used to pick household respondents. The findings revealed that the kitchen gardens at James Finlay were small organic gardens which were started about six years ago. The majority of them were about 10 square meters. The size of the garden was designed to be big enough to produce sufficient vegetables for the household but small enough to be replicated in many areas in Kenya where land as a production unit had become too small. In the innovation uptake the social capital (in this case the predominant Seventh Day Adventist teaching of healthy living by promoting the use of plants as the major source of nutrients, the goodwill from the management) and the human capital in the form of traditional knowledge (71% had kitchen gardens before) played a big role. The management decision to reinforce this innovation by hiring a consultant to bring a positive change to food security and nutritional diversity of the workers acted as a trigger. Almost 48% of the respondents did not buy vegetables after establishing kitchen gardens as compared to 4.2% who were not buying vegetables before the gardens were formalized. About 99% of the respondents opined that the kitchen garden had improved their nutritional diversity. Compared to the monoculture of the few gardens that existed before the formal gardens, more than 18 different varieties of vegetable and fruits were recorded in different households during the study indicating that a wide diversity has been achieved. 85 % had replicated the garden in their rural homes, and 98% had learnt a new skill indicating that the kitchen garden seems to be positively addressing food security and nutritional diversity and further demonstrating the central role of agriculture in meeting household needs.

Qaiser et al. (2013) conducted a study in the hilly areas of Arokas and Ghoragali nearby Muree to study the impact of technical demonstration for efficient utilization of water resources and impact of watershed management through means of kitchen gardening activity. The data was collected through a well-developed interview schedule to elicit information from the kitchen gardening trainees. From the survey it was reported that the potential land availability of kitchen gardening in court yards was 55% while cultivated around house and fields was 23%, similarly existing area under fruits and vegetables was 42.86% in field followed by 38.10% was around the house. The data also revealed that economically, kitchen gardening improved the livelihood of local community after starting kitchen gardening in the targeted area. It was acknowledged that after the training, all the participants were taking more interest. The practice of kitchen gardening increased from 53% to 87%, similarly the cultivated land was also increased after the kitchen gardening training.

Rehman et al. (2013) conducted a study on three different colonies of Islamabad, Rawal Town, Margalla Town, and Terlai to analyze the attitudes of people towards kitchen gardening. Rawal Town is located near Rawal Dam, Islamabad. The research was based on primary data and data were collected through personal interview using questionnaire, designed to achieve the pre-set objective based on personal observations and literature review. The findings of the research revealed that the area which was used for kitchen gardening was backyard and on average middle income groups people had 71 sq. yards area while higher income group people had 96 sq. yards. Majority were the women who managed the activities of garden like 21 % daughters, 16% mothers, 13% sisters, and very less men were involved in this activity. 73.9% female got financial support from the head of the house as father, husband or they also used their own finances to manage the activities of kitchen garden. The results also depicted that on average a household can consume 7-8 Kg vegetables from the garden. And average consumption was 10 Kg weekly and 3-5 kg daily.

Rupel (2013) conducted a study on demographic differences between food growers and non-food growers with respect to their attitudes and perspectives about backyard food growing. The positive associations, the problems and

barriers residents encountered, and the resources they needed to begin food gardening, were identified through questionnaires and in-depth interviews administered to study participants in Palm Beach County, Florida, U.S.A. The demographic groups that were most likely to food garden were those in long-term relationships, higher income brackets, those with college education and residents over 50 years old. Incentives and programs focused on producing more from existing gardens most appropriate for people in these demographic groups, while other groups will require basic food growing information. Study participants highly valued intangible benefits of food gardening (e.g., relaxation, feelings of happiness and satisfaction), often more than the provision of food. Most barriers and problems with backyard food growing, such as lack of space and the need for gardening information, were similar for those who food garden and those who do not.

2.2.3 Studies conducted in India

Deepalakshmi, 2019 conducted a study to understand the socio-economic background of urban women developing organic kitchen garden at their residence in Coimbatore city and to know the cultivation practice carried out by them and to analyze the perception of the respondents towards organic kitchen garden. Both primary and secondary data were used wherein the primary data have been collected using a structured questionnaire. From the data it was inferred that most (40.8 per cent) of the respondents belonged to the age group ranging from 36 to 45 years. Based on education level the majority (55.2 per cent) of the respondents possessed school level education. It was traced out that the majority (68 per cent) of the respondents were homemakers. Based on the family income most (32 per cent) of the respondents had their family monthly income ranging between Rs. 20001 and Rs.30000 and majority (80.8 per cent) of the respondents were living in their own house. The data also revealed that 'regular watering' was the most important activity to be carried out for effective growth of organic kitchen garden and hence it was assigned rank 1. Followed by rank 2 is assigned to 'Keeping the garden clean and trimming the hedges during growing seasons.' Next rank 4 is assigned to' topsoil replenishment' and rank 5 was assigned to 'using bio fertilizers. Rank 6 was to 'weeding', rank 7 is to 'using organic pesticides', rank

8 was assigned to ‘equipment replacement’ and last rank 9 was assigned to ‘maintaining a greenhouse’. Hence, most of the respondents have considered ‘regular watering’ as an important activity for maintaining an effective organic kitchen garden.

Singh, et.al, (2018) undertook a study on “Kitchen Gardening: A Promising Approach Towards Improving Nutritional Security in Rural Households” with a purpose to improve the availability of vegetables and nutrient intake at household level and to improve the knowledge of rural women regarding various technological aspects of kitchen gardening and its importance. Families with 4-6 members were purposefully chosen to undertake demonstrations. Each family was given a 250m2 plot of land to plant a kitchen garden. Krishi Vigyan Kendra, Sagar, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Madhya Pradesh, India conducted 56 nutritional kitchen gardening demonstrations over a 1.40-hectare area from 2007 to 2016. Previously, in the same communities, a total of eight training programmes with 164 participants on the importance and construction of nutritional kitchen gardens were held. Participants' pre- and post-training knowledge of several areas of kitchen gardening was assessed using a questionnaire. The findings revealed an increase in the availability of veggies for eating in both households and individuals. Vegetable availability per capita increased from 172 to 278 gram per day. Beneficiaries' knowledge was also been enhanced as a result of training programmes.

Tripathy (2018) conducted an experimental study on the organic plot at the back of the University of Ranchi. A plot of (5×4) m2 was selected for kitchen garden. There were five beds of (0.8×4) m2. The gap between two beds was 0.2 m and the selected crops were Ridge gourd, Basella, Cowpea, Okra and Kangkong. At first seeds were treated with 10% cow urine solution. From the results of yield it was revealed that organically vegetables can be grown within a small plot in front of the house or in the back of the house. A plot of (5×4) m2 can easily supply vegetables for a family of 4 people. In urban areas people mostly live in flats nowadays. In their balcony they can grow vegetables in the pots. It is very low cost and doesn't need more time for cultivation. People who have less time for

gardening can also cultivate the kitchen garden. As it was in a very limited area it was very easy to conduct intercultural operations like weeding tilling.

Chatterjee et al. (2016) conducted a study on the existing pattern of biodiversity in vegetable crops around home gardens of sub-Himalayan districts of West Bengal, India. Sample village level survey was conducted in Cooch Behar (89o 23′53″ East longitude and 26o 19′86″ North latitude) and Jalpaiguri (88°4' and 89°53' East longitudes and 26o 16′ and 27°0' North latitudes) districts during 2011 and 2012. Twenty-four number of villages were purposively selected considering the intensity of home garden. Fifty home gardeners from different villages were selected randomly. Information was collected through participatory field observation and questionnaire survey. The results revealed that home garden is the reservoir of crop biodiversity, and the favourable climatic condition of sub-Himalayan districts of West Bengal encourages cultivation diverse vegetables crops throughout the year. Individual family food preference, belief, tradition, culture, and economic situation determine the crop diversity in home garden. Regular experimentation in the form of introduction of new crops, new varieties, underutilized crops, and wild plants enriched the crop diversity in the garden. Diverse ethno medicinal use of the indigenous vegetables, wild and weedy crops also promoted the species diversity of the garden.

Sarkar et al. (2016) The principal aim was to develop a composting system that showed a distinctive thermophilic phase. Market waste was collected from different daily markets at Tobin Road, Belghoria and Nimta situated in the north of Kolkata metropolis. All field work was undertaken at Gupta Niwas (ISI Farm) near Dunlop Bridge, B. T. Road Kolkata, (Latitude 220 39' 18.99" N; Longitude 880 22' 32.91" E). during the months of November to April. Different methodologies were adopted to devise a standard composting method from which thermophilic microorganisms can be isolated. The methodologies adopted for composting were in pits, in earthen pot and by piling or heaping. The results revealed that pH was recorded between 7.2 to 8.2 and moisture content remained 65 to 70% during composting. At the end of the study period the moisture content was recorded at 58%. The initial C/N ratio was 15 due to the high nitrogen content of the waste being composted. It gradually decreased to 7.5 in the second heating

phase, the final C/N ratio of matured compost was 6.1. A long thermophilic phase was observed when the moisture content was kept around 60% and composting was done in heaps and piles rather than pits and earthen pots. In the composting system, a large number of polymers (i.e., starch, cellulose and casein) degrading thermophilic bacteria were enumerated. The matured compost appeared dark and was devoid of any foul smell. Thus, this method of composting was repeated for further enzymatic and microbial studies highlighting the thermophilic phase.

Vazhacharickal (2014) conducted a study to characterize the different balcony and terrace gardens in Mumbai Metropolitan Region and to study their role in local food production and urban greening. The data was collected via primary and secondary data from various sources. This study revealed the overall scenario of balcony and terrace gardens in Mumbai Metropolitan Region which were based on sustainability in urban food production. City farming in Mumbai Metropolitan Region had a great potential in environmental, social, economic aspects. City farming should be integrated into the city planning; however, their full integration may be restricted by limitations and difficulties. The production of food and non-food goods improves the architecture, reducing food miles, and improving resource usage and energy efficiency as well as mitigating climatic changes. These production systems could contribute additional contributions for urban food production which can even be used for demonstration as well as learning for school children.

Siddick (2013) conducted a study to Enhance food and nutrition security at individual, household, and community levels, understanding gender dimensions of poverty and socio-economic empowerment of women. The study was conducted with the aid of Participatory Rural Appraisal, Focus Group Discussions and a study on local food habits and local food intake. The results revealed that 80 % increase in vegetable consumption (from 4kgs to 7.5 kgs /month/ 4 member HH), increase in consumption of greens and legumes were found amongst the women participants. The results also revealed that the dependency on the local market and shops for vegetable buying was reduced. There was an increased adoption of Good Home gardening Practices viz., Seed

collection, nursery raising, adoption of crop calendar, vegetable diversity, water and pest management, mulching, compost application.

2.3 Conclusion of Review of Literature

A review of researches revealed that, studies conducted outside India, focused on plant growth and variety of species in home gardens, water management for kitchen gardens, allocation and location of space for a kitchen garden, comparison of food growers and non-food growers with respect to their attitudes and perspectives about backyard food growing, nutrition survey and its diversity regarding home grown foods, assessment of knowledge, practices adopted and effectiveness of various methods of composting at household level and benefits of kitchen gardening. Studies conducted within India, revealed that research focused on nutritional security attained through kitchen gardening in rural households, urban households and community, patterns of biodiversity in vegetable crops in home gardens, the socio-economic background of urban women developing organic kitchen garden at their residence and development of composting system for kitchen garden, role of balcony and terrace gardens in local food production and urban greening. Review of various studies revealed a dearth of researches focusing on design development for kitchen gardens based on problems of users with existing kitchen gardens. Thus, the present study was undertaken.