



La-Net

CPS 401

VEGETABLE CROPS PRODUCTION



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- Course code: CPS 401
- Course title: Vegetable Crops Production
- Course credit load: 2

Series 1: Foundations of Vegetable Crop Production

Series outline

- **1.1 Historical and Conceptual Foundations**
 - 1.1.1 Definition of vegetable crops
 - 1.1.2 Historical development of vegetable crop production
 - 1.1.3 Classification of vegetable crops
- **1.2 Importance and Roles of Vegetable Crops**
 - 1.2.1 Nutritional and health significance
 - 1.2.2 Economic and social contributions
 - 1.2.3 Cultural and ecological relevance
- **1.3 Systems and Scope of Vegetable Crop Production**
 - 1.3.1 Types of vegetable production systems
 - 1.3.2 Integration with fruit crop production
 - 1.3.3 Enterprise perspectives in vegetable production

Introduction

Vegetable crops have been cultivated for centuries, serving as vital sources of food, nutrition, and livelihood across societies. In Nigeria and beyond, their production forms the backbone of horticultural enterprises, contributing to health, economic growth, and cultural practices. As learners embarking on this course, it is important to first grasp the foundations of vegetable crop production, since this knowledge will provide the framework for all subsequent Series.

The aim of this Series is to introduce you to the historical, conceptual, and practical foundations of vegetable crop production, equipping you with the ability to define, classify, and evaluate the importance of vegetables within agricultural systems.



We shall commence this Series by examining the historical and conceptual foundations of vegetable crops, including their definition, development, and classification. Next, we will explore the importance and roles of vegetable crops, focusing on their nutritional, economic, and ecological contributions. Finally, we will wrap up by considering the systems and scope of vegetable crop production, highlighting enterprise perspectives and integration with fruit crops.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 1.1** define vegetable crops and explain their historical development,
- **SLO 1.2** classify vegetable crops according to recognised categories,
- **SLO 1.3** analyse the nutritional, economic, and ecological importance of vegetable crops, and
- **SLO 1.4** evaluate different systems of vegetable crop production and their enterprise scope.

1.1 Historical And Conceptual Foundations

1.1.1 Definition of vegetable crops

A **vegetable crop** refers to a plant cultivated primarily for its edible parts, which may include leaves, stems, roots, flowers, or seeds. These crops are distinct from staple cereals and fruits because they are usually consumed fresh or cooked and are valued for their nutritional content, particularly vitamins, minerals, and dietary fibre. The term vegetable is often cultural rather than strictly botanical, since some plants classified as vegetables in daily use may actually be fruits in scientific terms.

Fill in the blank: A vegetable crop is cultivated mainly for its _____ parts, which may include leaves, stems, roots, flowers, or seeds.



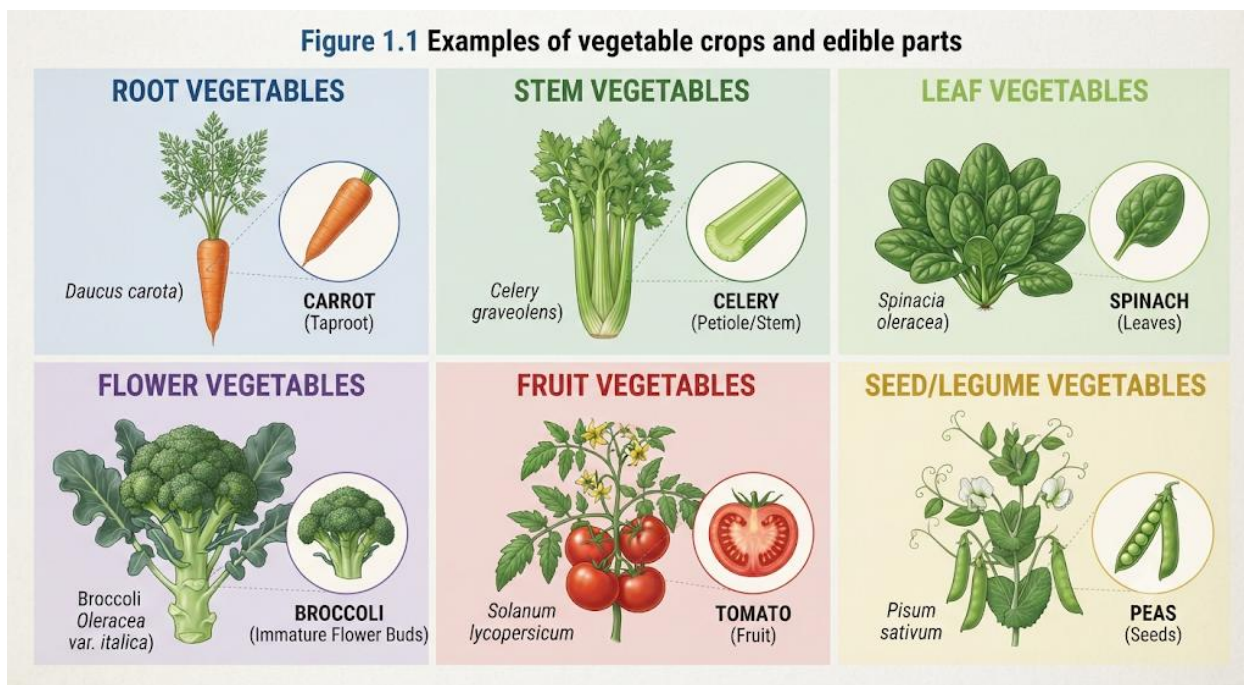


Diagram showing examples of vegetable crops and their edible parts
Caption: Figure 1.1 Examples of vegetable crops and edible parts

1.1.2 Historical development of vegetable crop production

The history of vegetable crop production dates back to early human settlements, where communities cultivated plants for food security and medicinal purposes. Over time, vegetable cultivation evolved from subsistence farming to organised horticultural enterprises. In Nigeria, traditional vegetables such as fluted pumpkin and African spinach have long been grown, while colonial influence introduced exotic crops like cabbage and lettuce. Today, vegetable production combines indigenous knowledge with modern agricultural practices, ensuring both local consumption and commercial enterprise.

Fill in the blank: Traditional Nigerian vegetables include fluted pumpkin and _____ spinach.





Image showing traditional Nigerian vegetable crops such as fluted pumpkin and African spinach

Caption: Plate 1.1 Traditional Nigerian vegetable crops

1.1.3 Classification of vegetable crops

Classification refers to the systematic grouping of vegetable crops based on shared characteristics. Vegetables can be classified according to their botanical families, edible parts, life cycle, or ecological requirements. For example, leafy vegetables such as spinach and lettuce are grouped separately from root vegetables like carrots and yams. Another classification considers whether crops are annuals, biennials, or perennials. This system helps farmers and learners to organise knowledge, plan cultivation, and manage production effectively.

Fill in the blank: Vegetables may be classified according to their botanical families, edible parts, life cycle, or _____ requirements.



Table 1.1 Classification of vegetable crops by edible parts

Category	Examples
Leafy vegetables	Spinach, lettuce 
Root vegetables	Carrot, yam 
Stem vegetables	Celery, asparagus 
Fruit vegetables	Tomato, cucumber 

Pilot questions 1.1

1. Which edible parts are typically harvested from vegetable crops?
2. Name two traditional Nigerian vegetables.
3. What is the significance of classification in vegetable crop production?
4. Identify one exotic vegetable introduced into Nigeria.
5. State one way vegetables can be classified apart from edible parts.

1.2 Importance And Roles Of Vegetable Crops

1.2.1 Nutritional and health significance

Vegetable crops are highly valued for their **nutritional content**, which refers to the essential vitamins, minerals, and dietary fibre they provide. They play a critical role in maintaining good health by reducing the risk of chronic diseases such as heart disease and diabetes. For example, leafy vegetables like spinach are rich in iron, while carrots provide beta-carotene, which supports vision. A balanced diet that includes vegetables ensures proper growth, development, and overall wellbeing.

Fill in the blank: Carrots are rich in _____, which supports vision.



Figure 1.2 Nutritional contributions of selected vegetables

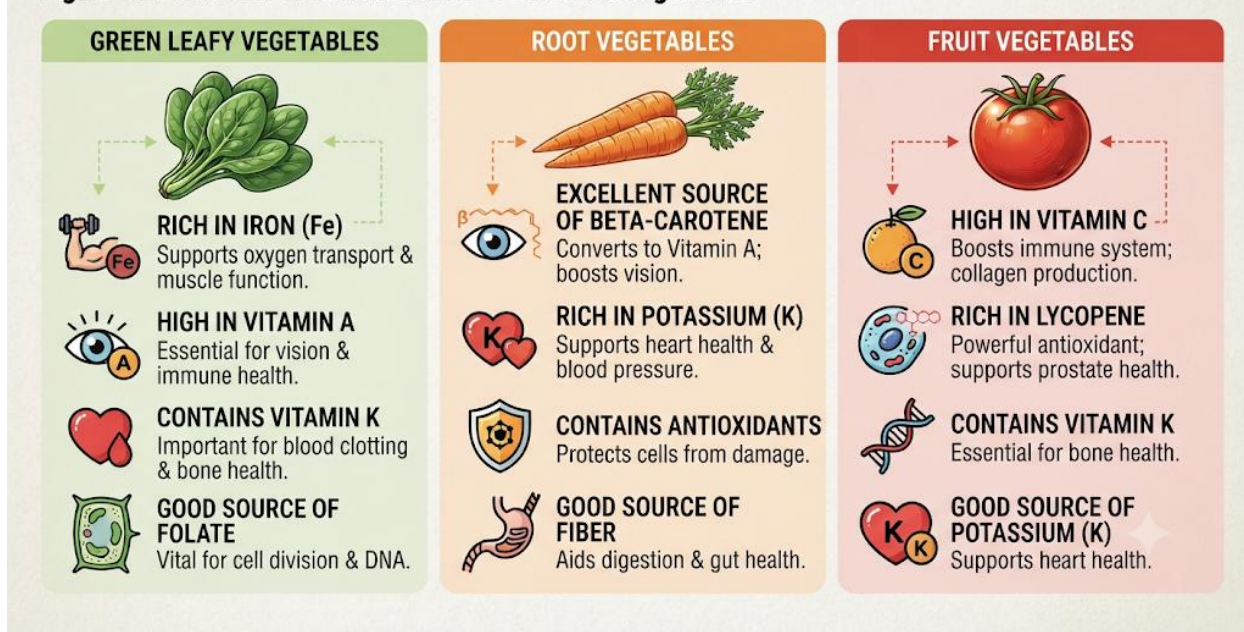


Diagram showing nutritional contributions of selected vegetables Caption: Figure 1.2 Nutritional contributions of vegetables

1.2.2 Economic and social contributions

Vegetable crops also have significant **economic importance**, meaning they contribute to income generation, employment, and trade. Farmers often rely on vegetable production as a source of livelihood, while markets benefit from the steady demand for fresh produce. Socially, vegetables are integral to cultural practices, festivals, and traditional meals. In Nigeria, vegetables such as okra and pumpkin leaves are staples in local dishes, reinforcing their role in community life.

Fill in the blank: Vegetable crops contribute to income generation, employment, and ____.





Image showing vegetable market scenes in Nigeria Caption: Plate 1.2 Vegetable market scenes in Nigeria

1.2.3 Cultural and ecological relevance

Vegetables hold **cultural relevance**, meaning they are deeply embedded in traditions, cuisines, and social identity. They also have **ecological importance**, since their cultivation supports biodiversity, soil fertility, and sustainable farming systems. For instance, intercropping vegetables with cereals can improve soil health and reduce pest infestations. Moreover, vegetables contribute to food security by diversifying diets and reducing reliance on a single crop.

Fill in the blank: Intercropping vegetables with cereals can improve soil health and reduce _____ infestations.



Box 1.1 Cultural and ecological roles of vegetables

Cultural Role:

- Symbol of cultural identity in Nigeria.
- Integral part of traditional ceremonies (weddings, festivals).
- Essential component of daily meals and local cuisine.
- Transgenerational transmission of culinary traditions.



Ecological Role:

- Promotes biodiversity in farming systems.
- Used in intercropping and agroforestry practices.
- Improves soil health and fertility.
- Sustainable agricultural resource.



Box 1.1 Cultural and ecological roles of vegetables [

Pilot questions 1.2

1. Which nutrient found in carrots supports vision?
2. How do vegetable crops contribute to economic development?
3. Name one Nigerian vegetable commonly used in traditional meals.
4. What ecological benefit is achieved by intercropping vegetables with cereals?
5. State one way vegetables contribute to cultural identity.

1.3 Systems And Scope Of Vegetable Crop Production

1.3.1 Types of vegetable production systems

A **production system** refers to the organised method by which crops are cultivated, managed, and harvested. Vegetable production systems vary depending on scale, resources, and objectives.

Common systems include subsistence farming, where families grow vegetables mainly for household consumption, and commercial farming, which focuses on large-scale production for markets. Other systems involve organic farming, which avoids synthetic chemicals, and hydroponics, where vegetables are grown in nutrient solutions without soil. Each system has its advantages and limitations, and farmers often select one based on ecological conditions and economic goals.

Fill in the blank: Hydroponics is a system where vegetables are grown in _____ solutions without soil.



Figure 1.3 Types of vegetable production systems

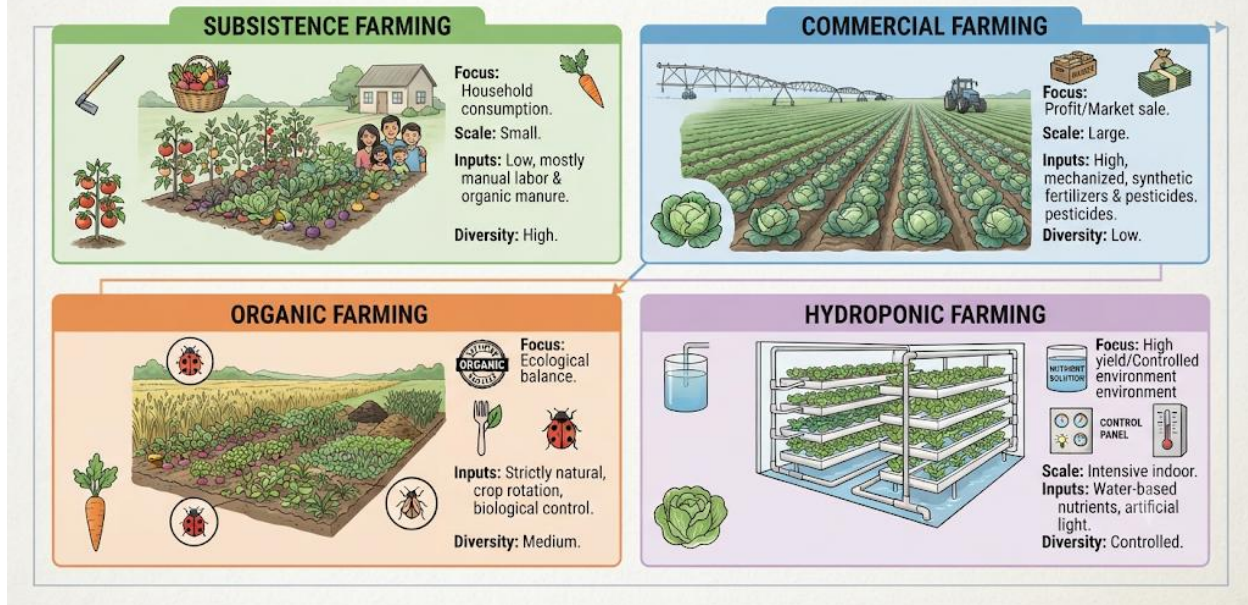


Diagram showing different vegetable production systems (subsistence, commercial, organic, hydroponic) Caption: Figure 1.3 Types of vegetable production systems

1.3.2 Integration with fruit crop production

Vegetable production is often integrated with **fruit crop production**, meaning both are cultivated together to maximise land use and diversify farm outputs. This integration allows farmers to balance short-term income from vegetables with long-term returns from fruit trees. For example, planting tomatoes alongside citrus orchards provides immediate harvests while the fruit trees mature. Such integration also improves soil fertility and reduces risks associated with monocropping.

Fill in the blank: Planting tomatoes alongside citrus orchards provides immediate harvests while the _____ trees mature.





Image showing integrated vegetable and fruit crop farming Caption: Plate 1.3 Integrated vegetable and fruit crop farming

1.3.3 Enterprise perspectives in vegetable production

Vegetable production is not only an agricultural activity but also an **enterprise**, meaning it is managed as a business venture. Farmers must consider costs, market demand, profitability, and sustainability. Enterprise perspectives include planning production schedules to meet market needs, adopting technologies to improve yields, and ensuring quality standards for consumer satisfaction. In Nigeria, vegetable enterprises range from small-scale roadside sellers to large agribusinesses supplying supermarkets and export markets.

Fill in the blank: Vegetable production as an enterprise requires farmers to consider costs, market demand, profitability, and _____.



Box 1.2 Enterprise perspectives in vegetable production

Vegetable enterprises in Nigeria vary widely, from small-scale sellers to large agribusinesses. Success depends on planning, technology adoption, and meeting consumer expectations.

Small-Scale Sellers

- Local market focus
- Direct-to-consumer
- Low initial investment



Commercial Farms

- Broader supply chain
- Medium-scale operations
- Enhanced productivity



Large Agribusinesses

- National distribution
- High technology adoption
- Quality certification



Box 1.2 Enterprise perspectives in vegetable production

Pilot questions 1.3

1. What is the main difference between subsistence and commercial vegetable farming?
2. Which production system avoids synthetic chemicals?
3. Give one example of integrating vegetable and fruit crop production.
4. What are two key considerations in vegetable production as an enterprise?
5. State one advantage of integrating vegetables with fruit crops.

Series Summary

This Series has introduced you to the foundations of vegetable crop production, setting the stage for deeper exploration in later Series. We began by examining the historical and conceptual foundations, where you learnt the definition of vegetable crops, their development over time, and their classification. Then, we explored the importance and roles of vegetable crops, focusing on their nutritional, economic, cultural, and ecological contributions. Finally, we considered the systems and scope of vegetable crop production, including different production systems, integration with fruit crops, and enterprise perspectives.

By engaging with these topics, you should now be able to define vegetable crops and explain their historical development, classify them according to recognised categories, analyse their nutritional, economic, and ecological importance, and evaluate different systems of vegetable crop



production and their enterprise scope. These abilities directly align with the Series Learning Outcomes and provide you with a strong foundation for the rest of the course.

Series Glossary

- **Classification:** The systematic grouping of vegetable crops based on shared characteristics such as edible parts, botanical families, or life cycle.
- **Cultural relevance:** The role of vegetables in traditions, cuisines, and social identity.
- **Economic importance:** The contribution of vegetable crops to income generation, employment, and trade.
- **Enterprise:** The management of vegetable production as a business venture, considering costs, profitability, and sustainability.
- **Nutritional content:** The essential vitamins, minerals, and dietary fibre provided by vegetables.
- **Production system:** The organised method by which crops are cultivated, managed, and harvested, such as subsistence, commercial, organic, or hydroponic farming.
- **Vegetable crop:** A plant cultivated primarily for its edible parts, including leaves, stems, roots, flowers, or seeds.

Concept Check Questions [Series 1]

Objective questions

1. Which nutrient found in carrots supports vision? (Linked to SLO 1.3)
2. Which vegetable production system avoids synthetic chemicals? (Linked to SLO 1.4)
3. Fluted pumpkin is an example of which type of vegetable? (Linked to SLO 1.1)

Short-answer questions

4. Define a vegetable crop and give two examples. (Linked to SLO 1.1)
5. Explain one economic contribution of vegetable crops in Nigeria. (Linked to SLO 1.3)
6. State one advantage of integrating vegetable and fruit crop production. (Linked to SLO 1.4)

Long-answer questions

7. Analyse the importance of vegetable crops in terms of nutrition, economy, and ecology. (Linked to SLO 1.3)
8. Evaluate the strengths and limitations of subsistence and commercial vegetable production systems. (Linked to SLO 1.4)

Answers to Concept Check Questions [Series 1]



Objective questions

1. Beta-carotene.
2. Organic farming.
3. Leafy vegetable.

Short-answer questions

4. A vegetable crop is a plant cultivated for its edible parts such as leaves, stems, roots, flowers, or seeds. Examples include spinach and carrot.
5. Vegetable crops generate income for farmers through sales in local and international markets.
6. Integration improves land use efficiency and balances short-term and long-term farm returns.

Long-answer questions

7. **Basic response:** Vegetables provide essential nutrients, generate income, and support ecological balance. **Value-added response:** Beyond these roles, vegetables also contribute to food security, cultural identity, and sustainable farming practices through biodiversity enhancement and soil fertility improvement.
8. **Basic response:** Subsistence farming ensures household food supply, while commercial farming provides large-scale market produce. **Value-added response:** Subsistence farming may limit income potential, whereas commercial farming requires higher investment and faces market risks, yet both systems can complement each other in achieving national food security.

Answers to Pilot Questions [Series 1]

Part 1.1

1. Leaves, stems, roots, flowers, or seeds.
2. Fluted pumpkin and African spinach.
3. It helps organise knowledge and plan cultivation.
4. Cabbage.
5. Ecological requirements.

Part 1.2

1. Beta-carotene.
2. Income generation, employment, and trade.



3. Okra.
4. Pest infestations.
5. Use in traditional ceremonies and meals.

Part 1.3

1. Subsistence farming is for household use, while commercial farming is for markets.
2. Organic farming.
3. Tomatoes intercropped with citrus orchards.
4. Costs and profitability.
5. Improved soil fertility.

References and Attributions [Series 1]

- Figure 1.1 Examples of vegetable crops and edible parts: Suggested AI prompt “Diagram of vegetable crops showing edible parts such as leaves, roots, stems, flowers, and seeds”. Search string: “vegetable crops edible parts diagram OER”.
- Plate 1.1 Traditional Nigerian vegetable crops: Suggested AI prompt “Photograph of fluted pumpkin and African spinach in Nigerian farms”. Search string: “fluted pumpkin African spinach Nigeria OER image”.
- Table 1.1 Classification of vegetable crops by edible parts: Suggested AI prompt “Table showing classification of vegetables by edible parts with examples”. Search string: “classification of vegetables by edible parts OER table”.
- Figure 1.2 Nutritional contributions of vegetables: Suggested AI prompt “Diagram showing vegetables with their nutrients such as spinach with iron, carrots with beta-carotene, tomatoes with vitamin C”. Search string: “nutritional value of vegetables diagram OER”.
- Plate 1.2 Vegetable market scenes in Nigeria: Suggested AI prompt “Photograph of Nigerian vegetable market with farmers selling okra, pumpkin leaves, and tomatoes”. Search string: “Nigerian vegetable market OER image”.
- Box 1.1 Cultural and ecological roles of vegetables: Suggested AI prompt “Text box summarising cultural and ecological roles of vegetables in Nigeria”. Search string: “cultural ecological importance of vegetables Nigeria OER”.
- Figure 1.3 Types of vegetable production systems: Suggested AI prompt “Diagram comparing subsistence, commercial, organic, and hydroponic vegetable production systems”. Search string: “types of vegetable production systems diagram OER”.



- Plate 1.3 Integrated vegetable and fruit crop farming: Suggested AI prompt “Photograph of farm showing vegetables like tomatoes intercropped with fruit trees such as citrus”. Search string: “integrated vegetable and fruit crop farming Nigeria OER image”.
- Box 1.2 Enterprise perspectives in vegetable production: Suggested AI prompt “Text box summarising enterprise perspectives in vegetable production in Nigeria”. Search string: “vegetable farming enterprise Nigeria OER”.

Series 2: Ecology And Adaptation Of Vegetables In Nigeria

Series Outline

- **2.1 Ecological distribution of vegetables in Nigeria**
 - 2.1.1 Major ecological zones in Nigeria
 - 2.1.2 Distribution of indigenous vegetables
 - 2.1.3 Distribution of tropical fruit crops
- **2.2 Adaptation of exotic vegetables and fruits**
 - 2.2.1 Introduction of exotic species
 - 2.2.2 Environmental factors influencing adaptation
 - 2.2.3 Case studies of successful adaptation
- **2.3 Environmental requirements for vegetable production**
 - 2.3.1 Soil conditions and fertility
 - 2.3.2 Climatic factors: rainfall, temperature, and sunlight
 - 2.3.3 Water management and irrigation practices
- **2.4 Challenges and opportunities in ecological adaptation**
 - 2.4.1 Constraints to adaptation of vegetables
 - 2.4.2 Opportunities for improved production
 - 2.4.3 Role of research and extension services

Introduction



Nigeria's diverse ecological zones provide unique opportunities and challenges for vegetable crop production. From the humid rainforest to the semi-arid savannah, each zone supports different types of vegetables and fruits, shaping the agricultural landscape and influencing food security. Understanding how vegetables are distributed and adapted to these environments is essential for learners who wish to engage in vegetable production as an enterprise.

The aim of this Series is to equip you with knowledge of Nigeria's ecological zones, the distribution of indigenous and tropical vegetables, and the adaptation of exotic crops. It also intends to help you evaluate environmental requirements and identify challenges and opportunities in ecological adaptation.

We shall commence this Series by exploring the ecological distribution of vegetables across Nigeria's major zones, focusing on indigenous and tropical crops. Next, we will examine the adaptation of exotic vegetables and fruits, considering environmental factors and case studies of successful integration. Following that, we will study the environmental requirements for vegetable production, including soil, climate, and water management. Finally, we will conclude by analysing the challenges and opportunities in ecological adaptation, highlighting the role of research and extension services.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 2.1** describe the ecological zones of Nigeria and explain the distribution of indigenous and tropical vegetables,
- **SLO 2.2** analyse how exotic vegetables and fruits adapt to Nigerian environments,
- **SLO 2.3** evaluate the environmental requirements necessary for successful vegetable production, and
- **SLO 2.4** assess the challenges and opportunities in ecological adaptation, including the role of research and extension services.

2.1 Ecological Distribution Of Vegetables In Nigeria

2.1.1 Major ecological zones in Nigeria

Nigeria is divided into several **ecological zones**, which are regions defined by climate, vegetation, and soil characteristics. The major zones include the rainforest, derived savannah, Guinea savannah, Sudan savannah, and Sahel savannah. Each zone provides different conditions for vegetable production. For example, the rainforest zone supports crops that thrive in high rainfall and humidity, while the Sahel savannah favours drought-tolerant vegetables. Recognising these zones helps farmers plan cultivation strategies suited to local conditions.

Fill in the blank: The _____ savannah favours drought-tolerant vegetables due to its dry climate.



Figure 2.1 Ecological zones of Nigeria



Map showing Nigeria's ecological zones and their distribution
Caption: Figure 2.1 Ecological zones of Nigeria

2.1.2 Distribution of indigenous vegetables

Indigenous vegetables are those native to Nigeria and traditionally cultivated for food and cultural purposes. Examples include fluted pumpkin, African spinach, okra, and garden egg. These vegetables are widely distributed across ecological zones, with some adapted to specific conditions. For instance, fluted pumpkin thrives in the rainforest and Guinea savannah, while okra is more common in the Sudan savannah. Indigenous vegetables are vital for nutrition, cultural identity, and local economies.

Fill in the blank: Fluted pumpkin thrives in the rainforest and _____ savannah zones.





Image showing indigenous Nigerian vegetables such as fluted pumpkin and garden egg
Caption:
Plate 2.1 Indigenous Nigerian vegetables

2.1.3 Distribution of tropical fruit crops

Nigeria also supports a wide range of **tropical fruit crops**, which are cultivated alongside vegetables. These include mango, citrus, pawpaw, and banana. Their distribution depends on ecological conditions, with mango and citrus thriving in savannah zones, while pawpaw and banana prefer humid rainforest areas. The integration of fruit crops with vegetables enhances biodiversity and provides farmers with diversified sources of income.

Fill in the blank: Mango and citrus fruits thrive best in the _____ zones of Nigeria.



Table 2.1 Distribution of selected tropical fruit crops in Nigeria

Fruit crop	Preferred ecological zone	
Mango	Guinea and Sudan savannah	
Citrus	Guinea savannah	
Pawpaw	Rainforest	
Banana	Rainforest	

Caption: Table 2.1 Distribution of selected tropical fruit crops in Nigeria

Pilot questions 2.1

1. Name two major ecological zones in Nigeria.
2. Which ecological zone favours drought-tolerant vegetables?
3. Give two examples of indigenous Nigerian vegetables.
4. In which ecological zone does fluted pumpkin thrive?
5. State one tropical fruit crop suited to the rainforest zone.

2.2 Adaptation Of Exotic Vegetables And Fruits

2.2.1 Introduction of exotic species

Exotic vegetables and fruits are plant species introduced from outside Nigeria, often from temperate or subtropical regions. Examples include cabbage, lettuce, carrot, and strawberry. These crops were introduced through colonial influence, trade, and agricultural research programmes. Their successful cultivation depends on how well they adapt to Nigeria's ecological conditions. Farmers often experiment with these crops to diversify production and meet consumer demand for new varieties.

Fill in the blank: Examples of exotic vegetables introduced into Nigeria include cabbage, lettuce, carrot, and _____.





Image showing exotic vegetables such as cabbage and lettuce grown in Nigeria Caption: Plate 2.2
Exotic vegetables cultivated in Nigeria

2.2.2 Environmental factors influencing adaptation

The adaptation of exotic crops is influenced by **environmental factors**, which include climate, soil, and water availability. For instance, cabbage and lettuce require cooler temperatures and are often grown in highland areas such as Jos Plateau. Carrots adapt better in sandy soils with good drainage, while strawberries demand consistent irrigation. Farmers must match crop requirements with ecological conditions to achieve successful adaptation.

Fill in the blank: Cabbage and lettuce are often grown in the _____ Plateau due to cooler temperatures.



Figure 2.2 Environmental factors influencing adaptation of exotic crops

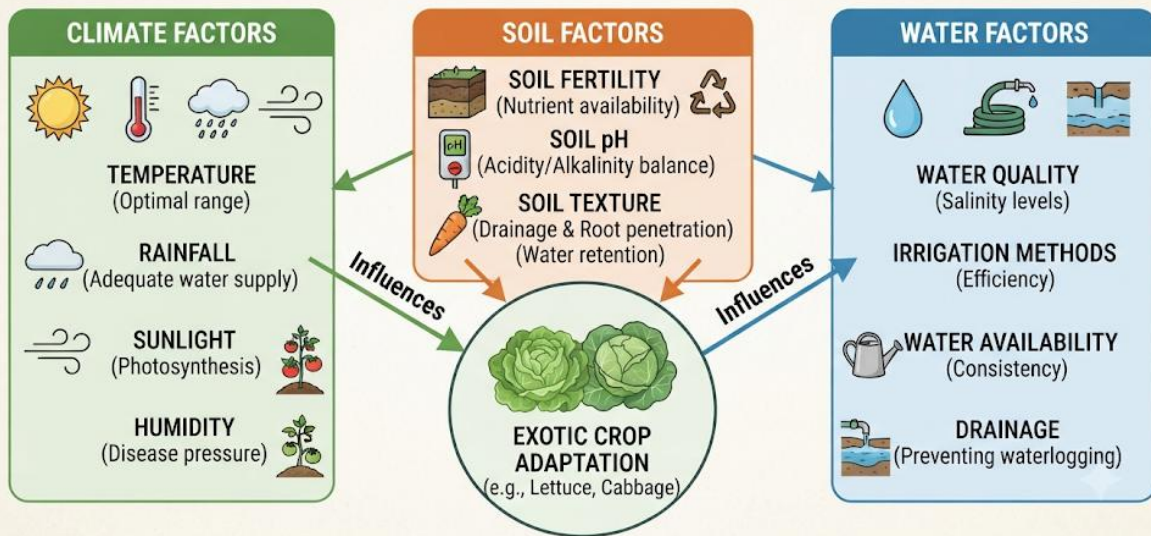


Diagram showing environmental factors influencing adaptation of exotic crops Caption: Figure 2.2 Environmental factors influencing adaptation of exotic crops

2.2.3 Case studies of successful adaptation

Several case studies highlight the successful adaptation of exotic crops in Nigeria. For example, cabbage and lettuce thrive in Jos Plateau due to its cool climate, while carrots are widely grown in sandy soils of northern Nigeria. Strawberries, though more demanding, have been successfully cultivated in controlled environments with irrigation systems. These examples demonstrate that with proper management, exotic crops can complement indigenous vegetables and expand market opportunities.

Fill in the blank: Strawberries have been successfully cultivated in Nigeria using controlled environments and consistent _____ systems.



Box 2.1 Case studies of exotic crop adaptation in Nigeria

Cabbage and Lettuce

- Thriving in Jos Plateau
- Due to cool climate
- High-altitude advantage



Carrots

- Adapted to sandy soils
- In northern Nigeria
- Deep root systems



Strawberries

- Cultivated in controlled environments
- With advanced irrigation
- Off-season production



Box 2.1 Case studies of exotic crop adaptation in Nigeria

Pilot questions 2.2

1. Name two exotic vegetables introduced into Nigeria.
2. Which environmental factor makes Jos Plateau suitable for cabbage and lettuce?
3. What type of soil is most suitable for carrot cultivation?
4. How are strawberries successfully cultivated in Nigeria?
5. State one benefit of adapting exotic crops to Nigerian conditions.

2.3 Environmental Requirements For Vegetable Production

2.3.1 Soil conditions and fertility

Soil fertility refers to the ability of soil to provide essential nutrients for plant growth. Vegetables generally require soils that are rich in organic matter, well-drained, and moderately acidic to neutral in pH. Sandy loam soils are particularly suitable because they allow roots to penetrate easily and ensure good aeration. Farmers often improve soil fertility through composting, crop rotation, and the application of organic or inorganic fertilisers.

Fill in the blank: Sandy _____ soils are particularly suitable for vegetable production because they allow roots to penetrate easily.



Figure 2.3 Soil profiles for vegetable production

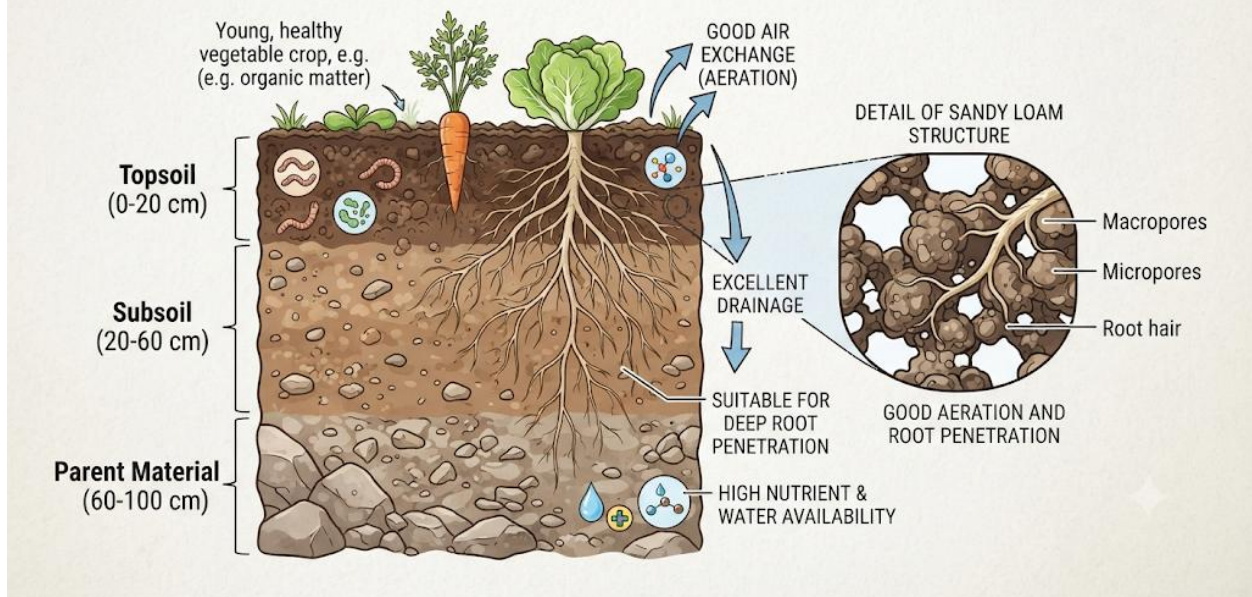


Diagram showing soil profiles suitable for vegetable production Caption: Figure 2.3 Soil profiles for vegetable production

2.3.2 Climatic factors: rainfall, temperature, and sunlight

Vegetable crops are highly sensitive to **climatic factors**, which include rainfall, temperature, and sunlight. Adequate rainfall ensures water supply, but excessive rainfall may cause flooding and root rot. Temperature influences crop growth, with cool-season vegetables such as cabbage requiring lower temperatures, while warm-season crops like okra thrive in higher temperatures. Sunlight is essential for photosynthesis, and most vegetables require at least six hours of direct sunlight daily.

Fill in the blank: Most vegetables require at least _____ hours of direct sunlight daily for effective growth.



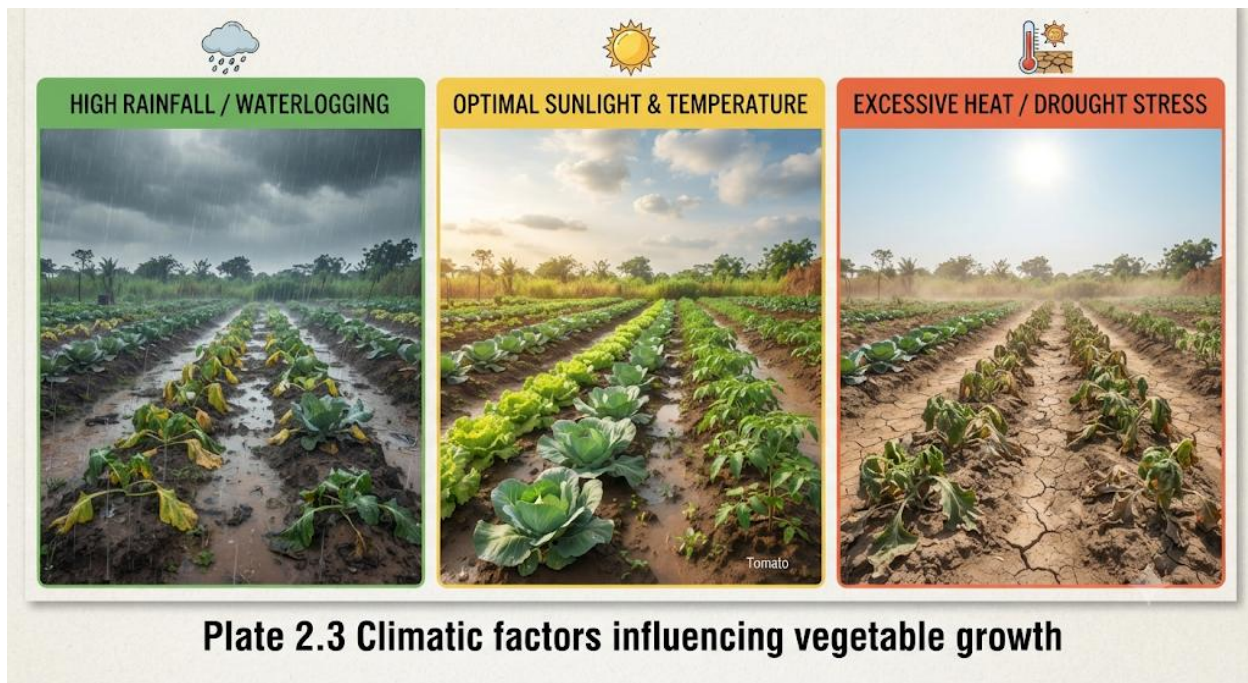


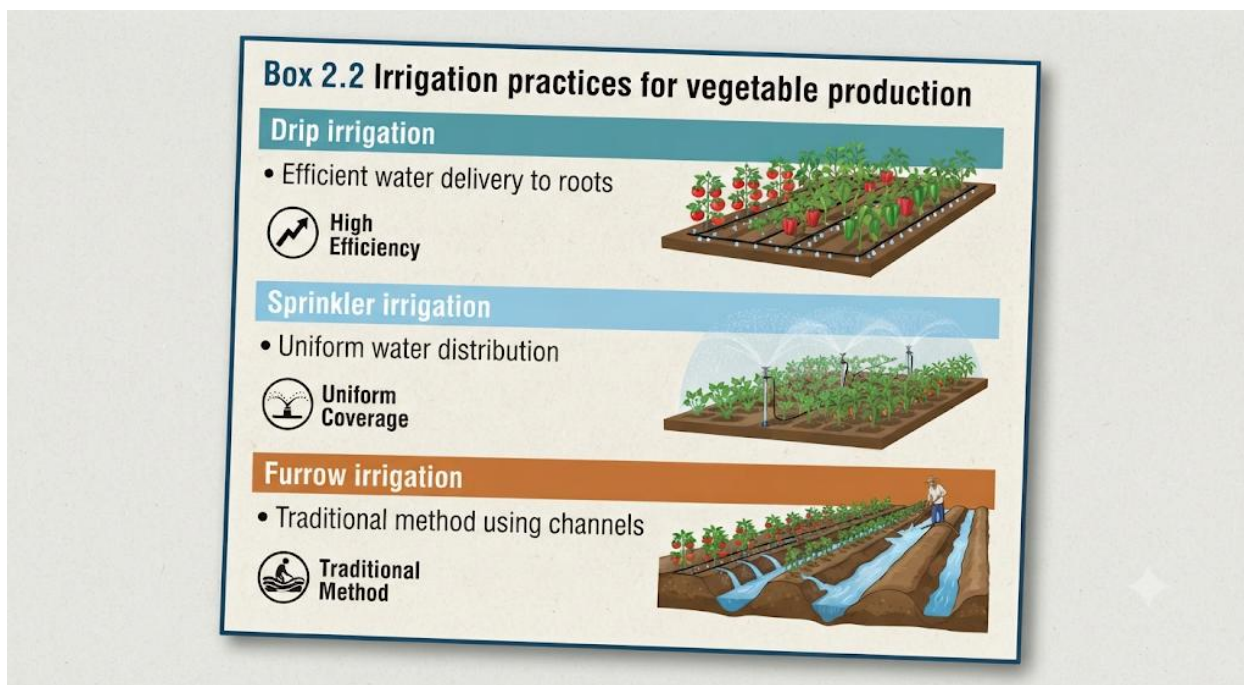
Image showing vegetable crops under different climatic conditions Caption: Plate 2.3 Climatic factors influencing vegetable growth

2.3.3 Water management and irrigation practices

Water management involves the careful regulation of water supply to crops, ensuring they receive adequate moisture without excess. Irrigation practices such as drip irrigation, sprinkler systems, and furrow irrigation are commonly used to supplement rainfall. Drip irrigation is particularly efficient, as it delivers water directly to the root zone, reducing wastage and preventing diseases caused by waterlogging. Proper water management is vital for consistent yields and sustainable production.

Fill in the blank: _____ irrigation delivers water directly to the root zone, reducing wastage and preventing waterlogging.





Box 2.2 Irrigation practices for vegetable production

Pilot questions 2.3

1. Which soil type is most suitable for vegetable production?
2. Name one method farmers use to improve soil fertility.
3. How many hours of direct sunlight do most vegetables require daily?
4. Give one example of a cool-season vegetable and one warm-season vegetable.
5. Which irrigation method delivers water directly to the root zone?

2.4 Challenges And Opportunities In Ecological Adaptation

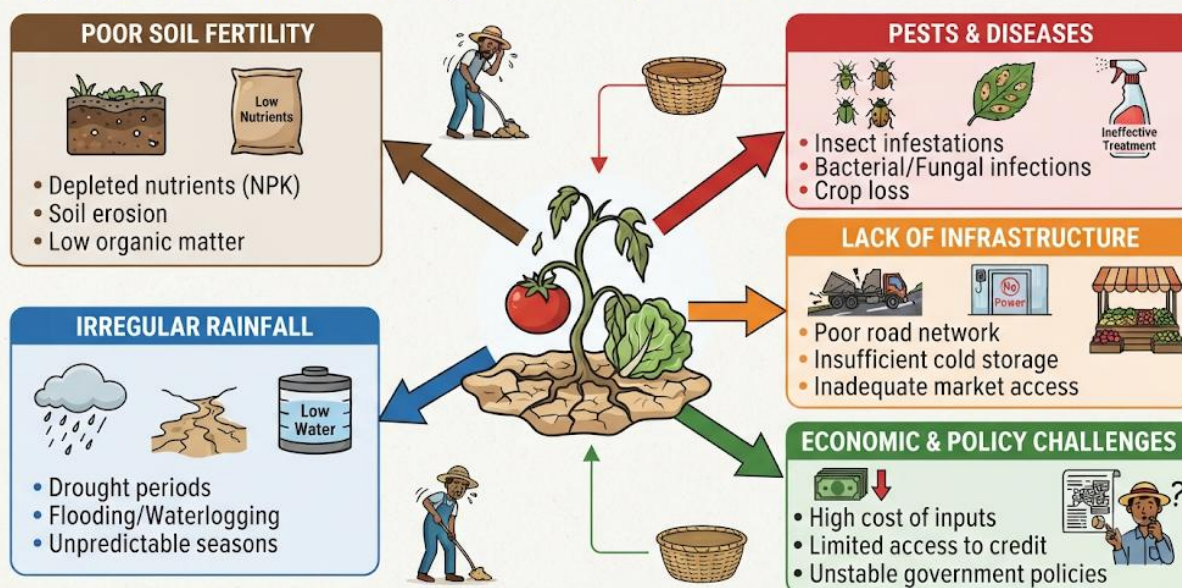
2.4.1 Constraints to adaptation of vegetables

Vegetable production in Nigeria faces several **constraints**, meaning limitations that hinder successful adaptation. These include poor soil fertility in some zones, irregular rainfall patterns, pest and disease outbreaks, and limited access to improved seeds. Farmers also struggle with inadequate infrastructure such as irrigation facilities and storage systems. These constraints reduce productivity and discourage the widespread adoption of certain vegetable crops.

Fill in the blank: Irregular _____ patterns are one of the major constraints to vegetable adaptation in Nigeria.



Figure 2.4 Constraints to vegetable adaptation



] Diagram showing constraints to vegetable adaptation in Nigeria Caption: Figure 2.4 Constraints to vegetable adaptation

2.4.2 Opportunities for improved production

Despite these challenges, there are many **opportunities** for improving vegetable production. Advances in agricultural technology, such as improved seed varieties and irrigation systems, can enhance adaptation. Government programmes and private investments also provide support for farmers through training and subsidies. Furthermore, growing consumer demand for vegetables creates market opportunities, encouraging farmers to expand production. These opportunities highlight the potential for vegetable farming to become a profitable and sustainable enterprise.

Fill in the blank: Improved seed varieties and _____ systems are examples of opportunities for enhancing vegetable production.





] Image showing farmers using improved irrigation systems in vegetable farming Caption: Plate 2.4 Opportunities for improved vegetable production

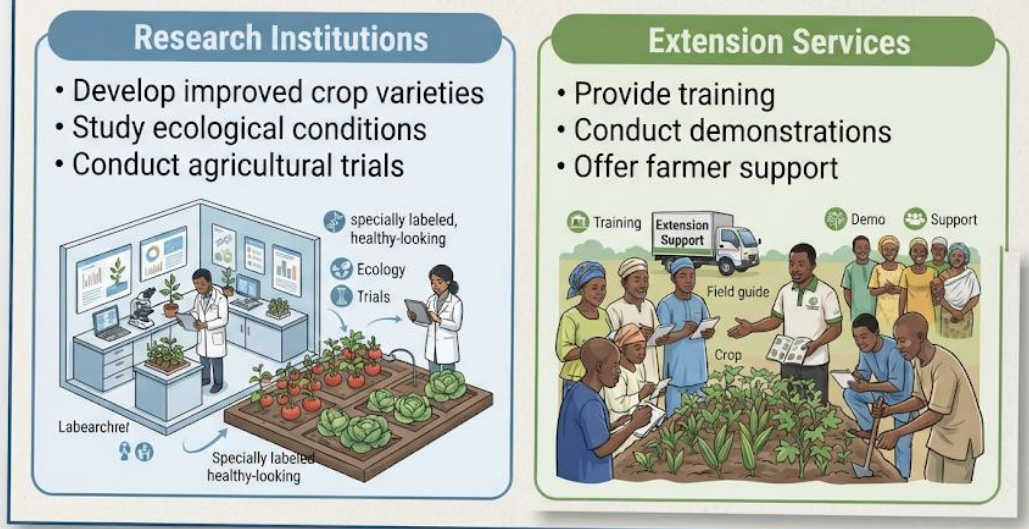
2.4.3 Role of research and extension services

Research and extension services play a crucial role in supporting ecological adaptation. Research institutions develop improved crop varieties and study ecological conditions, while extension services transfer this knowledge to farmers through training and demonstrations. These services help farmers adopt best practices, manage pests and diseases, and optimise production systems. Strengthening research and extension networks ensures that farmers are better equipped to overcome challenges and seize opportunities in vegetable production.

Fill in the blank: Extension services transfer knowledge to farmers through training and ____.



Box 2.3 Role of research and extension services



Box 2.3 Role of research and extension services

Pilot questions 2.4

1. Name two constraints to vegetable adaptation in Nigeria.
2. Give one example of an opportunity for improved vegetable production.
3. How do improved seed varieties contribute to adaptation?
4. What role do extension services play in supporting farmers?
5. State one benefit of strengthening research networks in vegetable production.

Series Summary

This Series has guided you through the ecology and adaptation of vegetables in Nigeria, highlighting the importance of environmental conditions in shaping production. We began by examining the ecological distribution of vegetables across Nigeria's zones, focusing on indigenous and tropical crops. Then, we explored the adaptation of exotic vegetables and fruits, considering environmental factors and case studies of successful integration. Following that, we studied the environmental requirements for vegetable production, including soil, climate, and water management. Finally, we analysed the challenges and opportunities in ecological adaptation, emphasising the role of research and extension services.

By completing this Series, you should now be able to describe Nigeria's ecological zones and vegetable distribution, analyse the adaptation of exotic crops, evaluate environmental requirements for production, and assess challenges and opportunities in ecological adaptation.



These abilities directly align with the Series Learning Outcomes and provide you with practical knowledge for vegetable crop production in diverse Nigerian environments.

Series Glossary

- **Adaptation:** The process by which crops adjust to new ecological conditions, enabling successful growth and production.
- **Ecological zone:** A region defined by climate, vegetation, and soil characteristics that influence crop distribution.
- **Exotic vegetables:** Plant species introduced from outside Nigeria, often requiring specific conditions for successful cultivation.
- **Indigenous vegetables:** Native Nigerian crops traditionally cultivated for food and cultural purposes.
- **Irrigation:** The artificial application of water to crops to supplement rainfall and ensure adequate moisture.
- **Soil fertility:** The ability of soil to provide essential nutrients for plant growth.
- **Tropical fruit crops:** Fruits such as mango, citrus, pawpaw, and banana that thrive in Nigeria's ecological zones.

Concept Check Questions [Series 2]

Objective questions

1. Which ecological zone favours drought-tolerant vegetables? (Linked to SLO 2.1)
2. Name one exotic vegetable introduced into Nigeria. (Linked to SLO 2.2)
3. How many hours of direct sunlight do most vegetables require daily? (Linked to SLO 2.3)

Short-answer questions

4. Define indigenous vegetables and give two examples. (Linked to SLO 2.1)
5. Explain one environmental factor influencing the adaptation of exotic crops. (Linked to SLO 2.2)
6. State one opportunity for improving vegetable production in Nigeria. (Linked to SLO 2.4)

Long-answer questions

7. Analyse the distribution of indigenous and tropical vegetables across Nigeria's ecological zones. (Linked to SLO 2.1)
8. Evaluate the challenges and opportunities in ecological adaptation of vegetables in Nigeria. (Linked to SLO 2.4)



Answers to Concept Check Questions [Series 2]

Objective questions

1. Sahel savannah.
2. Cabbage.
3. Six hours.

Short-answer questions

4. Indigenous vegetables are native Nigerian crops traditionally cultivated for food and cultural purposes. Examples include fluted pumpkin and African spinach.
5. Climate is a key factor; cabbage and lettuce adapt better in cooler highland areas such as Jos Plateau.
6. Improved seed varieties and irrigation systems.

Long-answer questions

7. **Basic response:** Indigenous vegetables such as fluted pumpkin thrive in rainforest and Guinea savannah zones, while okra is common in Sudan savannah. Tropical fruits like mango and citrus are suited to savannah zones, while pawpaw and banana prefer rainforest areas. **Value-added response:** Beyond distribution, these crops contribute to biodiversity, food security, and cultural identity, with integration of vegetables and fruits enhancing farm sustainability.
8. **Basic response:** Challenges include poor soil fertility, irregular rainfall, and pest infestations, while opportunities involve improved technologies, government support, and growing consumer demand. **Value-added response:** Strengthening research and extension services further enhances adaptation, enabling farmers to adopt best practices and expand production sustainably.

Answers to Pilot Questions [Series 2]

Part 2.1

1. Rainforest and Guinea savannah.
2. Sahel savannah.
3. Fluted pumpkin and okra.
4. Guinea savannah.
5. Pawpaw.

Part 2.2



1. Cabbage and lettuce.
2. Cool climate.
3. Sandy soil.
4. Controlled environments with irrigation.
5. Expanded market opportunities.

Part 2.3

1. Sandy loam soil.
2. Composting.
3. Six hours.
4. Cabbage (cool-season) and okra (warm-season).
5. Drip irrigation.

Part 2.4

1. Poor soil fertility and irregular rainfall.
2. Improved seed varieties.
3. They enhance yields and resilience.
4. Training and demonstrations.
5. Development of improved crop varieties.

References And Attributions [Series 2]

- Figure 2.1 Ecological zones of Nigeria: Suggested AI prompt “Map of Nigeria showing ecological zones: rainforest, Guinea savannah, Sudan savannah, Sahel savannah”. Search string: “Nigeria ecological zones map OER”.
- Plate 2.1 Indigenous Nigerian vegetables: Suggested AI prompt “Photograph of fluted pumpkin, African spinach, okra, and garden egg in Nigerian farms”. Search string: “indigenous Nigerian vegetables OER image”.
- Table 2.1 Distribution of selected tropical fruit crops in Nigeria: Suggested AI prompt “Table showing distribution of tropical fruit crops across Nigerian ecological zones”. Search string: “distribution of tropical fruit crops Nigeria OER table”.
- Plate 2.2 Exotic vegetables cultivated in Nigeria: Suggested AI prompt “Photograph of cabbage and lettuce farms in Nigeria”. Search string: “cabbage lettuce farming Nigeria OER image”.



- Figure 2.2 Environmental factors influencing adaptation of exotic crops: Suggested AI prompt “Diagram showing climate, soil, and water factors affecting exotic vegetable adaptation in Nigeria”. Search string: “environmental factors exotic vegetable adaptation Nigeria OER diagram”.
- Box 2.1 Case studies of exotic crop adaptation in Nigeria: Suggested AI prompt “Text box summarising case studies of exotic crop adaptation in Nigeria”. Search string: “case studies exotic vegetable adaptation Nigeria OER”.
- Figure 2.3 Soil profiles for vegetable production: Suggested AI prompt “Diagram of sandy loam soil profile showing root penetration and aeration for vegetable crops”. Search string: “sandy loam soil profile vegetable farming OER diagram”.
- Plate 2.3 Climatic factors influencing vegetable growth: Suggested AI prompt “Photograph of vegetable crops showing effects of rainfall, sunlight, and temperature”. Search string: “climatic factors vegetable farming Nigeria OER image”.
- Box 2.2 Irrigation practices for vegetable production: Suggested AI prompt “Text box summarising irrigation practices for vegetable production”. Search string: “irrigation practices vegetable farming Nigeria OER”.
- Figure 2.4 Constraints to vegetable adaptation: Suggested AI prompt “Diagram showing constraints to vegetable adaptation including poor soil, irregular rainfall, pests, diseases, and lack of infrastructure”. Search string: “constraints vegetable adaptation Nigeria OER diagram”.
- Plate 2.4 Opportunities for improved vegetable production: Suggested AI prompt “Photograph of Nigerian farmers using irrigation systems and improved seed varieties for vegetable farming”. Search string: “opportunities vegetable farming Nigeria OER image”.
- Box 2.3 Role of research and extension services: Suggested AI prompt “Text box summarising role of research and extension services in vegetable adaptation”. Search string: “research extension services vegetable farming Nigeria OER”.

Series 3: Systems And Practices In Vegetable And Fruit Production

Suggested Parts and Sub-Parts

- **3.1 Traditional and modern production systems**



- 3.1.1 Traditional practices in Nigeria
- 3.1.2 Modern horticultural systems
- 3.1.3 Comparative advantages and limitations
- **3.2 Cropping systems and patterns**
 - 3.2.1 Monocropping and mixed cropping
 - 3.2.2 Intercropping vegetables with fruits
 - 3.2.3 Crop rotation and sustainability
- **3.3 Cultural practices in vegetable and fruit production**
 - 3.3.1 Land preparation and planting methods
 - 3.3.2 Weeding, mulching, and pruning
 - 3.3.3 Harvesting and post-harvest handling
- **3.4 Commercialisation and enterprise practices**
 - 3.4.1 Market-oriented production strategies
 - 3.4.2 Value addition and processing
 - 3.4.3 Supply chains and distribution networks

Introduction

Vegetable and fruit production in Nigeria involves a wide range of systems and practices that determine the success of farming enterprises. From traditional methods passed down through generations to modern horticultural innovations, these approaches shape productivity, sustainability, and profitability. Understanding these systems and practices is essential for learners who wish to engage in vegetable and fruit production as both a livelihood and a business venture.

The aim of this Series is to introduce you to the different systems and practices used in vegetable and fruit production, equipping you with the ability to compare traditional and modern approaches, apply cropping patterns, implement cultural practices, and evaluate enterprise strategies for commercialisation.

We shall commence this Series by examining traditional and modern production systems, highlighting their comparative advantages and limitations. Next, we will explore cropping systems and patterns, including monocropping, mixed cropping, and crop rotation. Following that, we will study cultural practices such as land preparation, planting, weeding, mulching, pruning, and post-harvest handling. Finally, we will conclude by analysing commercialisation and enterprise practices, focusing on market strategies, value addition, and supply chains.



Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 3.1** compare traditional and modern systems of vegetable and fruit production,
- **SLO 3.2** apply cropping systems and patterns to enhance sustainability,
- **SLO 3.3** demonstrate cultural practices essential for vegetable and fruit production, and
- **SLO 3.4** evaluate commercialisation and enterprise practices in vegetable and fruit production.

3.1 Traditional And Modern Production Systems

3.1.1 Traditional practices in Nigeria

Traditional practices in vegetable and fruit production refer to methods passed down through generations, often relying on indigenous knowledge and simple tools. These include small-scale subsistence farming, use of local seed varieties, manual land preparation, and reliance on rainfall for water supply. While these practices are low-cost and culturally significant, they often result in limited yields and are vulnerable to environmental changes.

Fill in the blank: Traditional practices in Nigeria often rely on _____ seed varieties and manual land preparation.



Image showing traditional vegetable farming in Nigeria Caption: Plate 3.1 Traditional vegetable farming practices in Nigeria

3.1.2 Modern horticultural systems



Modern horticultural systems involve the use of improved technologies, scientific knowledge, and mechanisation to enhance productivity. Examples include greenhouse farming, use of hybrid seeds, mechanised land preparation, and controlled irrigation systems. These systems allow for higher yields, better pest management, and year-round production. However, they require significant investment and technical expertise, which may limit accessibility for smallholder farmers.

Fill in the blank: Modern horticultural systems often use _____ farming to achieve year-round production.

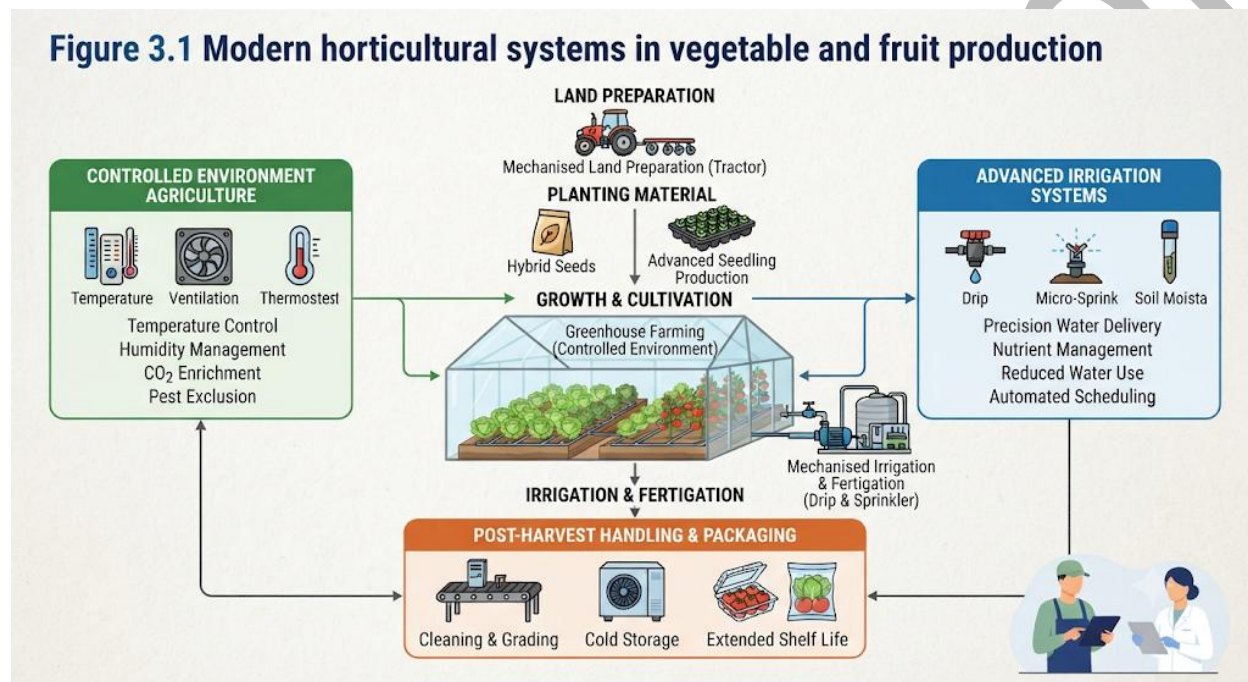


Diagram showing modern horticultural systems such as greenhouse farming and mechanised irrigation Caption: Figure 3.1 Modern horticultural systems in vegetable and fruit production

3.1.3 Comparative advantages and limitations

Comparing traditional and modern systems reveals both **advantages and limitations**. Traditional practices are affordable, culturally rooted, and accessible to rural farmers, but they often produce low yields. Modern systems, on the other hand, provide higher productivity, better quality produce, and improved resilience to climate change, but they demand higher costs and technical skills. Farmers may adopt a blend of both systems, integrating indigenous knowledge with modern innovations to achieve sustainable production.

Fill in the blank: Modern systems provide higher productivity but demand higher _____ and technical skills.



Box 3.1 Comparative advantages and limitations of traditional and modern systems

Traditional Systems	Modern Systems
• Affordable: Low initial investment • Culturally rooted: Indigenous practices & crops • Low yields: Dependent on weather & manual labor	• High productivity: Consistent yields & faster turnover • Better quality: Uniform produce & reduced pests • Costly: High capital and operating costs • Require expertise: Technical knowledge & skills
	

Box 3.1 Comparative advantages and limitations of traditional and modern systems [

Pilot questions 3.1

1. What are two features of traditional vegetable production practices in Nigeria?
2. Name one modern horticultural system used in vegetable farming.
3. What is one advantage of traditional systems?
4. What is one limitation of modern systems?
5. How can farmers achieve sustainable production by combining both systems?

3.2 Cropping Systems And Patterns

3.2.1 Monocropping and mixed cropping

Monocropping refers to the practice of growing a single crop on a piece of land during a season. It allows for specialised management but can lead to soil nutrient depletion and increased vulnerability to pests. **Mixed cropping**, on the other hand, involves cultivating two or more crops simultaneously on the same land. This system reduces risk, improves soil fertility, and provides dietary diversity. Farmers often choose between these systems based on resources, ecological conditions, and market demand.

Fill in the blank: Monocropping can lead to soil nutrient _____ and increased vulnerability to pests.



Figure 3.2 Monocropping versus mixed cropping

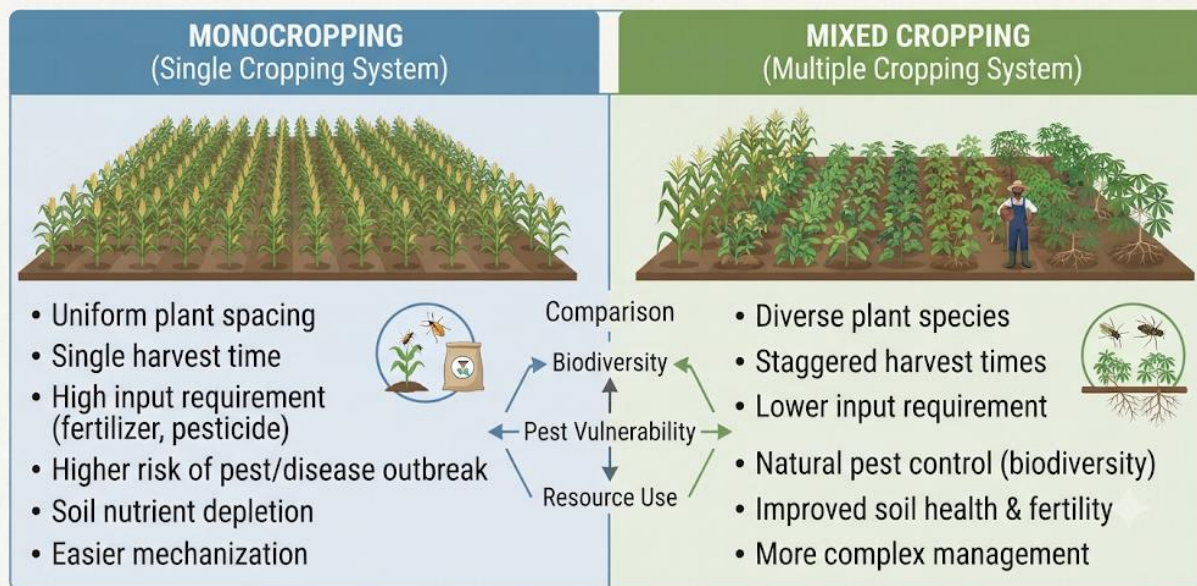


Diagram comparing monocropping and mixed cropping systems Caption: Figure 3.2 Monocropping versus mixed cropping

3.2.2 Intercropping vegetables with fruits

Intercropping is the practice of growing vegetables alongside fruit crops to maximise land use and enhance biodiversity. For example, tomatoes may be intercropped with citrus trees, providing short-term harvests while the fruit trees mature. Intercropping reduces pest infestations, improves soil fertility, and diversifies farm income. It is a sustainable approach that combines ecological benefits with economic gains.

Fill in the blank: Intercropping vegetables with fruit crops helps to reduce _____ infestations and diversify farm income.





Image showing intercropping of vegetables with fruit trees Caption: Plate 3.2 Intercropping vegetables with fruit crops

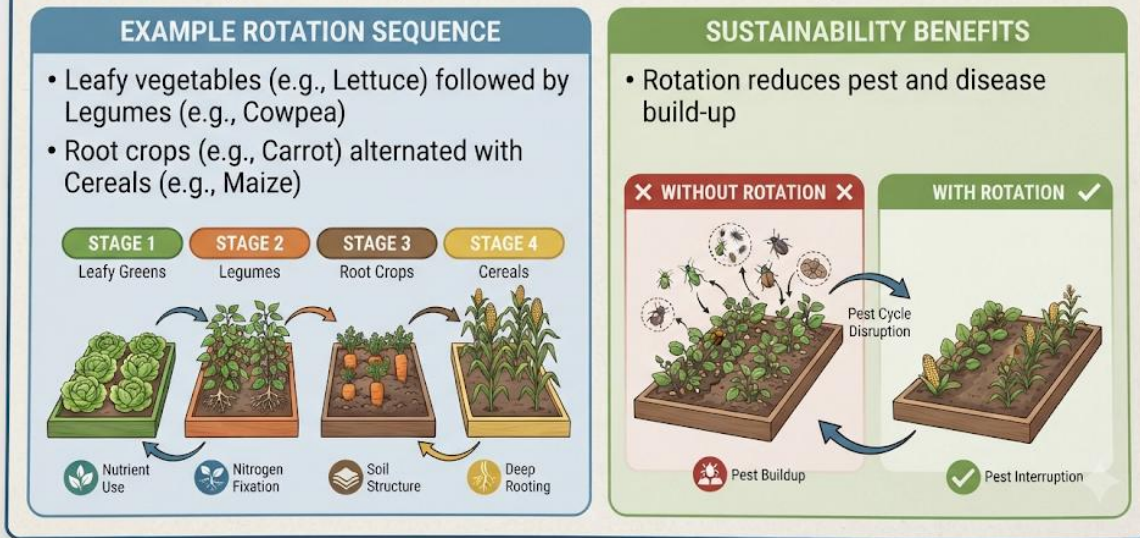
3.2.3 Crop rotation and sustainability

Crop rotation involves growing different crops sequentially on the same land to maintain soil fertility and reduce pest and disease build-up. For instance, leafy vegetables may be followed by legumes, which enrich the soil with nitrogen. Crop rotation is a key practice for sustainable farming, ensuring long-term productivity and ecological balance. It also helps farmers manage risks and optimise resource use.

Fill in the blank: Legumes enrich the soil with _____, making them suitable for crop rotation.



Box 3.2 Crop rotation practices for sustainability



Box 3.2 Crop rotation practices for sustainability

Pilot questions 3.2

1. What is the main difference between monocropping and mixed cropping?
2. Give one advantage of mixed cropping.
3. Provide an example of intercropping vegetables with fruit crops.
4. How does crop rotation contribute to sustainability?
5. Which nutrient do legumes add to the soil during crop rotation?

3.3 Cultural Practices In Vegetable And Fruit Production

3.3.1 Land preparation and planting methods

Land preparation is the first step in vegetable and fruit production. It involves clearing, ploughing, and harrowing to create a suitable seedbed. Proper land preparation improves soil aeration, root penetration, and water infiltration. Planting methods vary depending on the crop: direct seeding is common for vegetables like okra, while transplanting is used for crops such as tomatoes and cabbage. Correct spacing ensures healthy growth and reduces competition for nutrients.

Fill in the blank: Transplanting is commonly used for crops such as _____ and cabbage.



Figure 3.3 Land preparation and planting methods for vegetables and fruits

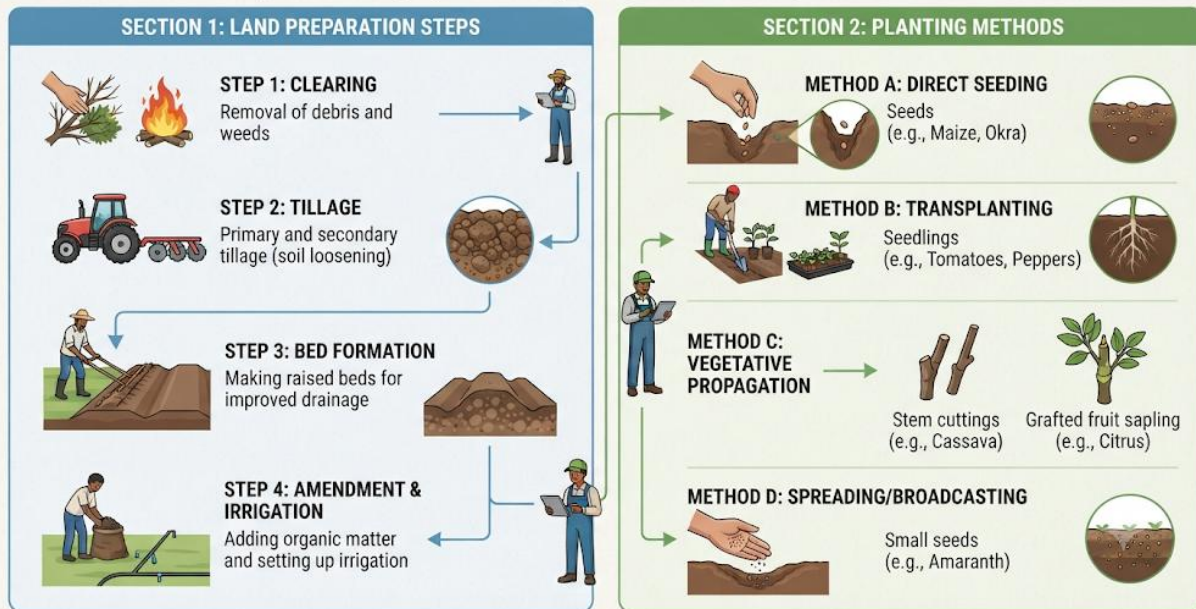


Diagram showing land preparation and planting methods Caption: Figure 3.3 Land preparation and planting methods

3.3.2 Weeding, mulching, and pruning

Weeding is essential to remove unwanted plants that compete with crops for nutrients, water, and sunlight. **Mulching** involves covering the soil with organic or synthetic materials to conserve moisture, suppress weeds, and regulate soil temperature. **Pruning** is the selective removal of plant parts, especially in fruit crops, to improve airflow, reduce disease incidence, and enhance fruit quality. These practices collectively improve crop health and yield.

Fill in the blank: Mulching helps conserve soil moisture and suppress _____ growth.





MULCHING WITH STRAW



PRUNING FRUIT TREES

Plate 3.3 Mulching and pruning practices in fruit farming

Image showing mulching and pruning practices in fruit farming Caption: Plate 3.3 Mulching and pruning practices in fruit farming

3.3.3 Harvesting and post-harvest handling

Harvesting is the process of collecting mature crops at the right time to ensure quality and market value. Vegetables such as tomatoes must be harvested when firm and slightly coloured, while fruits like mangoes are picked when mature but not overripe. **Post-harvest handling** includes sorting, grading, packaging, and storage. Proper handling reduces losses, maintains freshness, and increases consumer satisfaction. Cold storage and improved packaging materials are increasingly used to extend shelf life.

Fill in the blank: Post-harvest handling includes sorting, grading, packaging, and _____.



Box 3.3 Post-harvest handling practices

Sorting and grading

- Ensures uniform quality



Packaging

- Protects produce during transport



Storage

- Prolongs shelf life and reduces losses



Box 3.3 Post-harvest handling practices

Pilot questions 3.3

1. What is the purpose of land preparation in vegetable and fruit production?
2. Which planting method is commonly used for tomatoes?
3. State one benefit of mulching.
4. Why is pruning important in fruit crops?
5. Name two activities involved in post-harvest handling.

3.4 Commercialisation And Enterprise Practices

3.4.1 Market-oriented production strategies

Market-oriented production means planning farming activities to meet consumer demand and market trends. Farmers select crops based on profitability, seasonal demand, and buyer preferences. For example, producing tomatoes during the dry season when supply is low can yield higher profits. Market-oriented strategies also involve aligning production schedules with distribution channels to ensure consistent supply.

Fill in the blank: Producing tomatoes during the _____ season when supply is low can yield higher profits.



Figure 3.4 Market-oriented production strategies

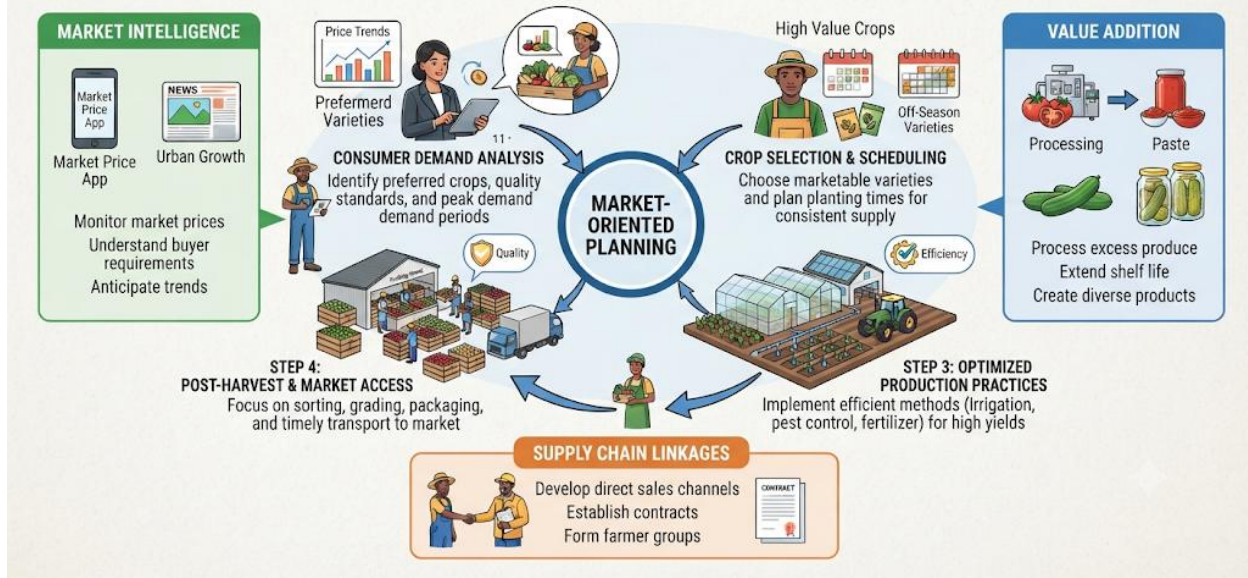


Diagram showing market-oriented production strategies Caption: Figure 3.4 Market-oriented production strategies

3.4.2 Value addition and processing

Value addition refers to activities that increase the worth of produce beyond its raw form. Examples include processing tomatoes into paste, drying vegetables for longer shelf life, or packaging fruits attractively for supermarkets. Value addition reduces post-harvest losses, creates employment, and increases profitability. Farmers and agribusinesses often invest in small-scale processing units to capture more value from their crops.

Fill in the blank: Processing tomatoes into _____ is an example of value addition.





Plate 3.4 Value addition in vegetable and fruit production

Image showing value-added products such as tomato paste and packaged fruits
Caption: Plate 3.4
Value addition in vegetable and fruit production

3.4.3 Supply chains and distribution networks

Supply chains connect farmers to consumers through intermediaries such as wholesalers, retailers, and exporters. Efficient distribution networks ensure that vegetables and fruits reach markets quickly and in good condition. Cold storage facilities, transport systems, and market linkages are critical for reducing losses and maintaining quality. Strengthening supply chains enhances farmer income and consumer access to fresh produce.

Fill in the blank: Cold _____ facilities are critical for reducing losses and maintaining quality in supply chains.



Box 3.4 Supply chains and distribution networks



Box 3.4 Supply chains and distribution networks

Pilot questions 3.4

1. What is the purpose of market-oriented production strategies?
2. Give one example of value addition in vegetable production.
3. Why are cold storage facilities important in supply chains?
4. How does value addition reduce post-harvest losses?
5. State one benefit of strengthening distribution networks.

Series Summary

This Series has introduced you to the systems and practices that underpin vegetable and fruit production in Nigeria. We began by comparing traditional and modern production systems, highlighting their respective strengths and limitations. We then explored cropping systems and patterns, including monocropping, mixed cropping, intercropping, and crop rotation, showing how these approaches enhance sustainability. Following that, we examined cultural practices such as land preparation, planting, weeding, mulching, pruning, harvesting, and post-harvest handling. Finally, we considered commercialisation and enterprise practices, focusing on market-oriented strategies, value addition, and supply chains.

By completing this Series, you should now be able to compare traditional and modern systems, apply cropping patterns for sustainability, demonstrate cultural practices, and evaluate enterprise strategies for commercialisation. These abilities align directly with the Series Learning Outcomes and provide practical skills for managing vegetable and fruit production as a viable enterprise.



Series Glossary

- **Crop rotation:** Sequential planting of different crops on the same land to maintain soil fertility and reduce pests.
- **Cultural practices:** Farming activities such as land preparation, planting, weeding, mulching, pruning, and harvesting.
- **Intercropping:** Growing vegetables alongside fruit crops to maximise land use and diversify income.
- **Market-oriented production:** Planning farming activities to meet consumer demand and market trends.
- **Mixed cropping:** Cultivating two or more crops simultaneously on the same land.
- **Monocropping:** Growing a single crop on a piece of land during a season.
- **Value addition:** Activities that increase the worth of produce beyond its raw form, such as processing or packaging.

Concept Check Questions [Series 3]

Objective questions

1. Which system involves growing a single crop on a piece of land? (Linked to SLO 3.2)
2. Which planting method is commonly used for tomatoes? (Linked to SLO 3.3)
3. Processing tomatoes into paste is an example of what? (Linked to SLO 3.4)

Short-answer questions

4. State one advantage of mixed cropping. (Linked to SLO 3.2)
5. Why is pruning important in fruit crops? (Linked to SLO 3.3)
6. Give one benefit of strengthening supply chains in vegetable and fruit production. (Linked to SLO 3.4)

Long-answer questions

7. Compare traditional and modern systems of vegetable and fruit production, highlighting their advantages and limitations. (Linked to SLO 3.1)
8. Evaluate the role of cultural practices in ensuring successful vegetable and fruit production. (Linked to SLO 3.3)

Answers to Concept Check Questions [Series 3]

Objective questions



1. Monocropping.
2. Transplanting.
3. Value addition.

Short-answer questions

4. Mixed cropping reduces risk and improves soil fertility.
5. Pruning improves airflow, reduces disease incidence, and enhances fruit quality.
6. Strengthening supply chains reduces losses and ensures timely delivery of fresh produce.

Long-answer questions

7. **Basic response:** Traditional systems are affordable and culturally rooted but produce low yields, while modern systems provide higher productivity and better quality but require higher costs and technical skills. **Value-added response:** Integrating indigenous knowledge with modern innovations can achieve sustainable production, balancing affordability with efficiency.
8. **Basic response:** Cultural practices such as land preparation, planting, weeding, mulching, pruning, and post-harvest handling ensure crop health and yield. **Value-added response:** These practices also contribute to sustainability, reduce losses, and enhance market value, making them essential for both subsistence and commercial farming.

Answers to Pilot Questions [Series 3]

Part 3.1

1. Use of local seed varieties and manual land preparation.
2. Greenhouse farming.
3. Affordable and culturally rooted.
4. High costs.
5. By blending indigenous knowledge with modern innovations.

Part 3.2

1. Monocropping grows one crop, mixed cropping grows multiple crops.
2. It reduces risk and improves soil fertility.
3. Tomatoes intercropped with citrus trees.
4. It maintains soil fertility and reduces pest build-up.
5. Nitrogen.



Part 3.3

1. To improve soil aeration, root penetration, and water infiltration.
2. Transplanting.
3. Conserves moisture.
4. Enhances fruit quality and reduces disease incidence.
5. Sorting and storage.

Part 3.4

1. To meet consumer demand and market trends.
2. Processing tomatoes into paste.
3. They reduce losses and maintain quality.
4. By extending shelf life and creating new products.
5. Increased farmer income and consumer access.

References And Attributions [Series 3]

- Plate 3.1 Traditional vegetable farming practices in Nigeria: Suggested AI prompt “Photograph of Nigerian farmers using traditional tools and indigenous seeds for vegetable farming”. Search string: “traditional vegetable farming Nigeria OER image”.
- Figure 3.1 Modern horticultural systems in vegetable and fruit production: Suggested AI prompt “Diagram showing greenhouse farming, hybrid seeds, mechanised land preparation, and irrigation systems”. Search string: “modern horticultural systems vegetable fruit farming Nigeria OER diagram”.
- Box 3.1 Comparative advantages and limitations of traditional and modern systems: Suggested AI prompt “Text box summarising comparative advantages and limitations of traditional and modern vegetable production systems”. Search string: “traditional vs modern vegetable farming Nigeria OER comparison”.
- Figure 3.2 Monocropping versus mixed cropping: Suggested AI prompt “Diagram showing monocropping with one crop and mixed cropping with multiple crops on the same land”. Search string: “monocropping vs mixed cropping diagram OER”.
- Plate 3.2 Intercropping vegetables with fruit crops: Suggested AI prompt “Photograph of farm showing tomatoes intercropped with citrus trees”. Search string: “intercropping vegetables with fruit crops Nigeria OER image”.



- Box 3.2 Crop rotation practices for sustainability: Suggested AI prompt “Text box summarising crop rotation practices for sustainable vegetable farming”. Search string: “crop rotation practices vegetable farming Nigeria OER”.
- Figure 3.3 Land preparation and planting methods: Suggested AI prompt “Diagram showing land preparation steps and planting methods for vegetables and fruits”. Search string: “land preparation planting methods vegetable fruit farming Nigeria OER diagram”.
- Plate 3.3 Mulching and pruning practices in fruit farming: Suggested AI prompt “Photograph of mulching with straw and pruning of fruit trees in Nigeria”. Search string: “mulching pruning fruit farming Nigeria OER image”.
- Box 3.3 Post-harvest handling practices: Suggested AI prompt “Text box summarising post-harvest handling practices for vegetables and fruits”. Search string: “post-harvest handling practices vegetable fruit farming Nigeria OER”.
- Figure 3.4 Market-oriented production strategies: Suggested AI prompt “Diagram showing market-oriented vegetable production strategies including seasonal planning and consumer demand”. Search string: “market-oriented vegetable production Nigeria OER diagram”.
- Plate 3.4 Value addition in vegetable and fruit production: Suggested AI prompt “Photograph of tomato paste production and packaged fruits in Nigeria”. Search string: “value addition vegetable fruit farming Nigeria OER image”.
- Box 3.4 Supply chains and distribution networks: Suggested AI prompt “Text box summarising supply chains and distribution networks for vegetable and fruit production”. Search string: “supply chain distribution vegetable fruit farming Nigeria OER”.

Series 4: Propagation, Nurseries, And Crop Protection

Series Outline

- **4.1 Propagation methods of vegetables and fruits**
 - 4.1.1 Seed propagation
 - 4.1.2 Vegetative propagation (cuttings, grafting, layering)
 - 4.1.3 Factors affecting propagation success
- **4.2 Nursery establishment and management**



- 4.2.1 Site selection and preparation
- 4.2.2 Nursery practices (sowing, watering, shading)
- 4.2.3 Transplanting techniques
- **4.3 Common pests and diseases in nurseries and fields**
 - 4.3.1 Insect pests (aphids, caterpillars, beetles)
 - 4.3.2 Fungal diseases (blight, damping-off, mildew)
 - 4.3.3 Viral and bacterial infections
- **4.4 Principles and methods of crop protection**
 - 4.4.1 Preventive measures (sanitation, resistant varieties)
 - 4.4.2 Cultural, biological, and chemical control methods
 - 4.4.3 Integrated pest management (IPM) approaches

Introduction

Propagation, nursery management, and crop protection are fundamental aspects of vegetable and fruit production. Propagation ensures the multiplication of crops through seeds or vegetative methods, nurseries provide a controlled environment for young plants to establish, and crop protection safeguards plants against pests and diseases. Together, these practices determine the success of farming enterprises, influencing yield, quality, and sustainability.

The aim of this Series is to equip you with knowledge of propagation techniques, nursery establishment and management, common pests and diseases, and crop protection methods. By mastering these practices, learners can improve survival rates of seedlings, reduce losses, and enhance productivity in vegetable and fruit farming.

We shall commence this Series by exploring propagation methods, including seed and vegetative techniques. Next, we will examine nursery establishment and management, focusing on site selection, practices, and transplanting. Following that, we will study common pests and diseases in nurseries and fields. Finally, we will conclude with principles and methods of crop protection, highlighting preventive measures and integrated pest management approaches.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 4.1** describe propagation methods of vegetables and fruits,
- **SLO 4.2** explain nursery establishment and management practices,
- **SLO 4.3** identify common pests and diseases affecting nurseries and fields, and



- **SLO 4.4** evaluate principles and methods of crop protection, including integrated pest management.

4.1 Propagation Methods Of Vegetables And Fruits

4.1.1 Seed propagation

Seed propagation is the most common method for multiplying vegetables and fruits. It involves planting seeds directly in the field or in nurseries. Success depends on seed quality, soil conditions, and proper management. Crops like tomatoes, okra, and garden egg are usually propagated by seeds. Farmers often use certified seeds to ensure high germination rates and disease resistance.

Fill in the blank: Crops such as tomatoes and _____ are commonly propagated by seeds.

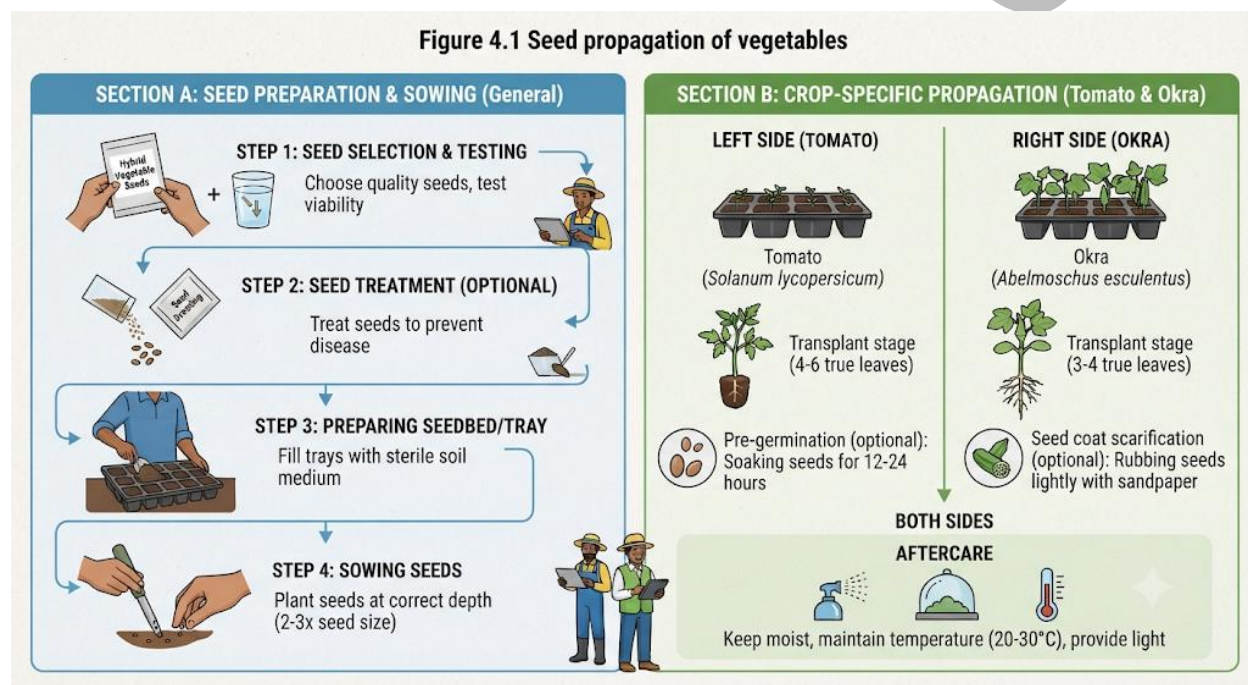


Diagram showing seed propagation process Caption: Figure 4.1 Seed propagation of vegetables

4.1.2 Vegetative propagation (cuttings, grafting, layering)

Vegetative propagation involves using plant parts such as stems, roots, or leaves to grow new plants. Methods include:

- **Cuttings**: planting stem or root sections (e.g., sweet potato vines).
- **Grafting**: joining two plant parts to combine desirable traits (e.g., citrus fruits).
- **Layering**: bending a branch to the ground until it forms roots, then separating it.

Vegetative propagation ensures uniformity and faster maturity compared to seeds.



Fill in the blank: _____ involves joining two plant parts to combine desirable traits.

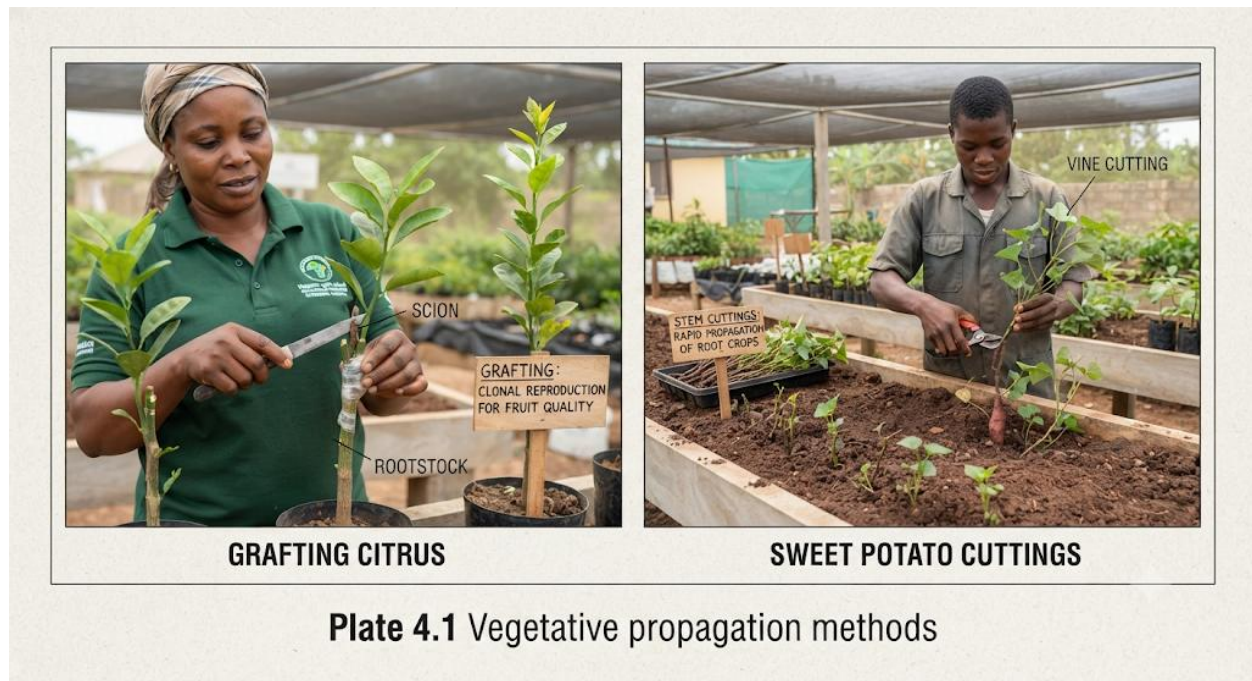


Image showing vegetative propagation methods (cuttings, grafting, layering) Caption: Plate 4.1 Vegetative propagation methods

4.1.3 Factors affecting propagation success

Propagation success depends on several **factors**, including:

- Seed quality and viability
- Soil fertility and moisture
- Temperature and light conditions
- Pest and disease control
- Proper handling of plant materials

Farmers must ensure favourable conditions to achieve high survival rates of seedlings and cuttings.

Fill in the blank: Propagation success depends on seed quality, soil fertility, and effective _____ control.



Box 4.1 Factors affecting propagation success

SEED QUALITY

- Seed quality and viability



SOIL CONDITIONS

- Soil fertility and moisture



ENVIRONMENT

- Temperature and light conditions



PLANT HEALTH

- Pest and disease control



Box 4.1 Factors affecting propagation success

Pilot questions 4.1

1. Name two crops commonly propagated by seeds.
2. Which vegetative method involves planting stem or root sections?
3. What is grafting used for in fruit crops?
4. State one factor affecting propagation success.
5. Why is vegetative propagation often preferred over seed propagation?

4.2 Nursery Establishment And Management

4.2.1 Site selection and preparation

A **nursery** is a controlled environment where young plants are raised before being transplanted to the main field. Proper site selection is critical: nurseries should be located on fertile, well-drained soils, close to a water source, and protected from strong winds. Preparation involves clearing, tilling, and sometimes sterilising the soil to reduce pests and diseases.

Fill in the blank: Nurseries should be located on fertile, well-drained soils close to a _____ source.



Figure 4.2 Nursery site selection and preparation

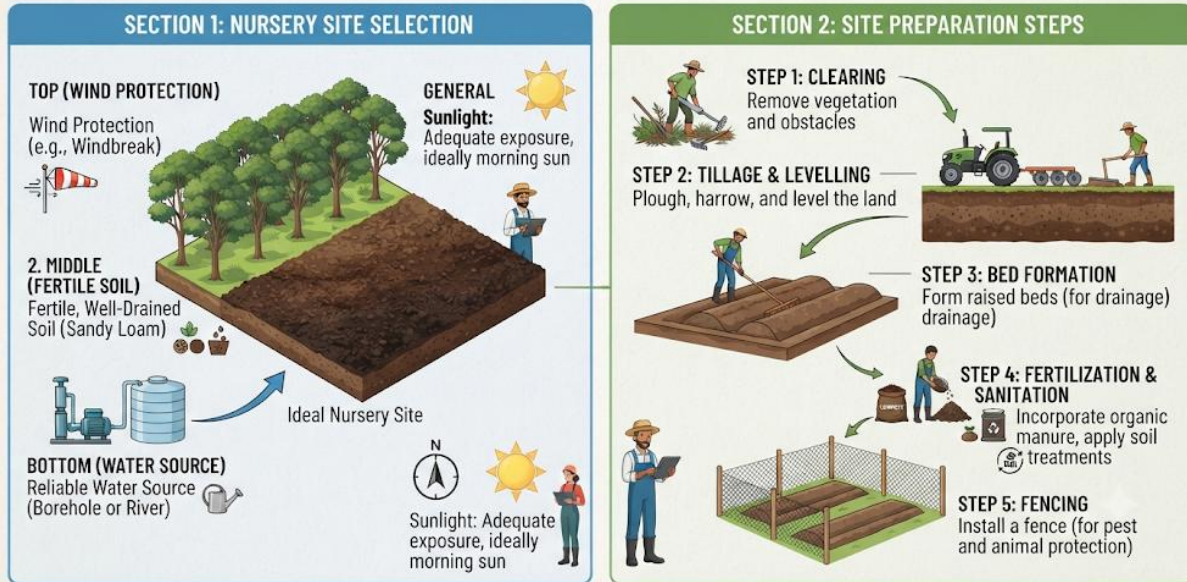


Diagram showing nursery site selection and preparation steps Caption: Figure 4.2 Nursery site selection and preparation

4.2.2 Nursery practices (sowing, watering, shading)

Nursery practices ensure healthy seedling growth. Seeds are sown in seedbeds, trays, or pots. Watering must be regular but not excessive to avoid damping-off disease. Shading protects seedlings from intense sunlight and heavy rainfall. Farmers may use shade nets or palm fronds to regulate light and temperature. These practices improve germination rates and seedling vigour.

Fill in the blank: Shading in nurseries protects seedlings from intense _____ and heavy rainfall.





Plate 4.2 Nursery practices for vegetable seedlings

Image showing nursery practices such as sowing, watering, and shading
Caption: Plate 4.2 Nursery practices for vegetable seedlings

4.2.3 Transplanting techniques

Transplanting involves moving seedlings from the nursery to the main field once they are strong enough. Proper techniques include watering seedlings before removal, handling them gently to avoid root damage, and transplanting during cool hours of the day. Correct spacing in the field ensures healthy growth and reduces competition. Transplanting improves survival rates and allows farmers to manage crop timing effectively.

Fill in the blank: Seedlings should be transplanted during the _____ hours of the day to reduce stress.



Box 4.2 Transplanting techniques for vegetable seedlings

STEP 1: PRE-TRANSPLANT WATERING

- Water seedlings before removal



STEP 2: GENTLE HANDLING

- Handle gently to avoid root damage



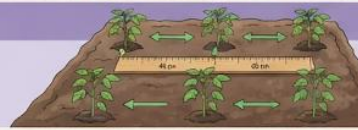
STEP 3: TIMING

- Transplant during cool hours



STEP 4: FIELD SPACING

- Ensure correct spacing in the field



Box 4.2 Transplanting techniques for vegetable seedlings

Pilot questions 4.2

1. What is the purpose of a nursery in vegetable production?
2. Name one factor to consider when selecting a nursery site.
3. Why is shading important in nurseries?
4. State one precaution to take during transplanting.
5. When is the best time of day to transplant seedlings?

4.3 Common Pests And Diseases In Nurseries And Fields

4.3.1 Insect pests (aphids, caterpillars, beetles)

Insect pests are among the most serious threats to vegetable and fruit seedlings.

- **Aphids** suck sap from tender shoots, causing stunted growth.
- **Caterpillars** chew leaves, reducing photosynthetic capacity.
- **Beetles** damage roots and stems, weakening young plants.

Early detection and control are essential to prevent severe losses in nurseries and fields.

Fill in the blank: Aphids damage seedlings by sucking _____ from tender shoots.



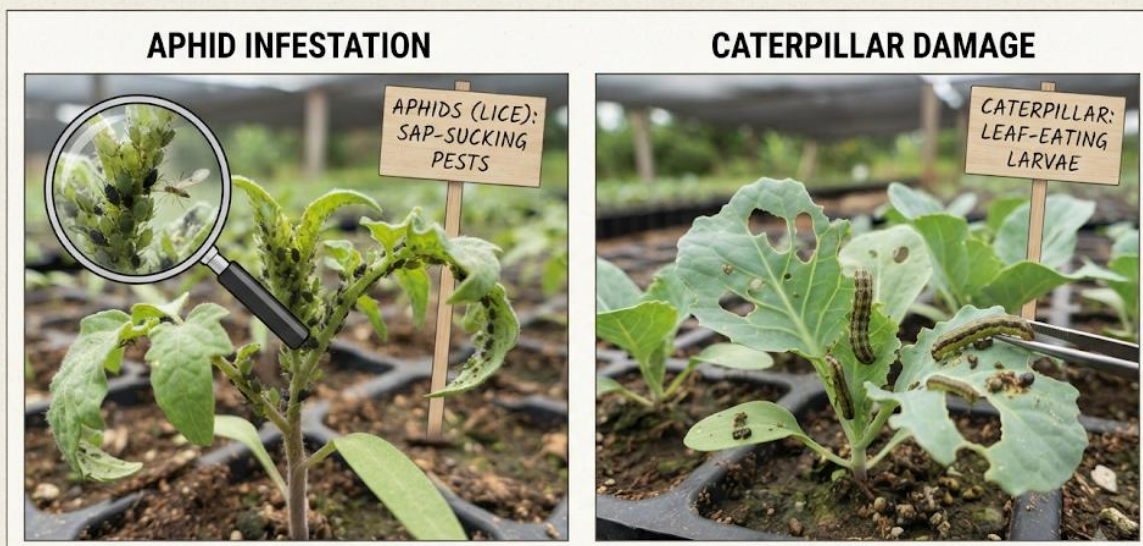


Plate 4.3 Insect pests affecting vegetable nurseries

Image showing aphids and caterpillars on vegetable seedlings
Caption: Plate 4.3 Insect pests affecting vegetable nurseries

4.3.2 Fungal diseases (blight, damping-off, mildew)

Fungal diseases thrive in humid nursery conditions.

- **Blight** causes leaf spots and wilting.
- **Damping-off** affects seedlings, leading to sudden collapse.
- **Mildew** produces white or grey patches on leaves, reducing growth.

Good sanitation, proper spacing, and controlled watering reduce fungal outbreaks.

Fill in the blank: Damping-off disease causes seedlings to suddenly _____ after germination.



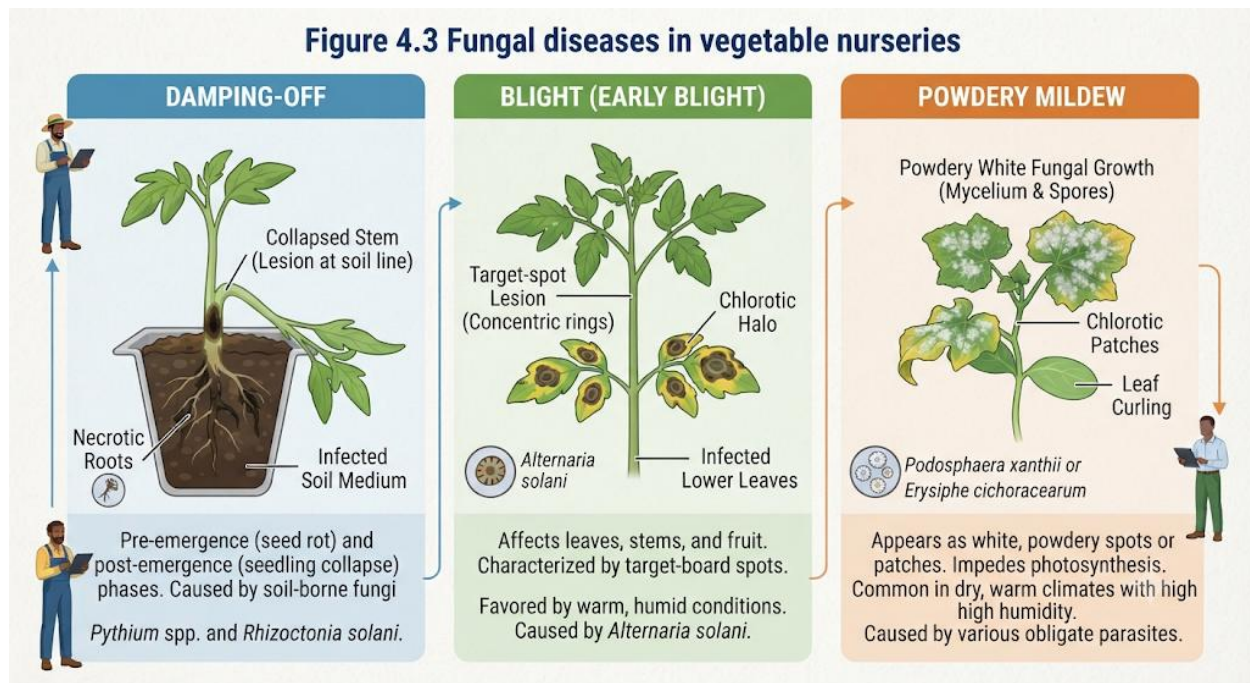
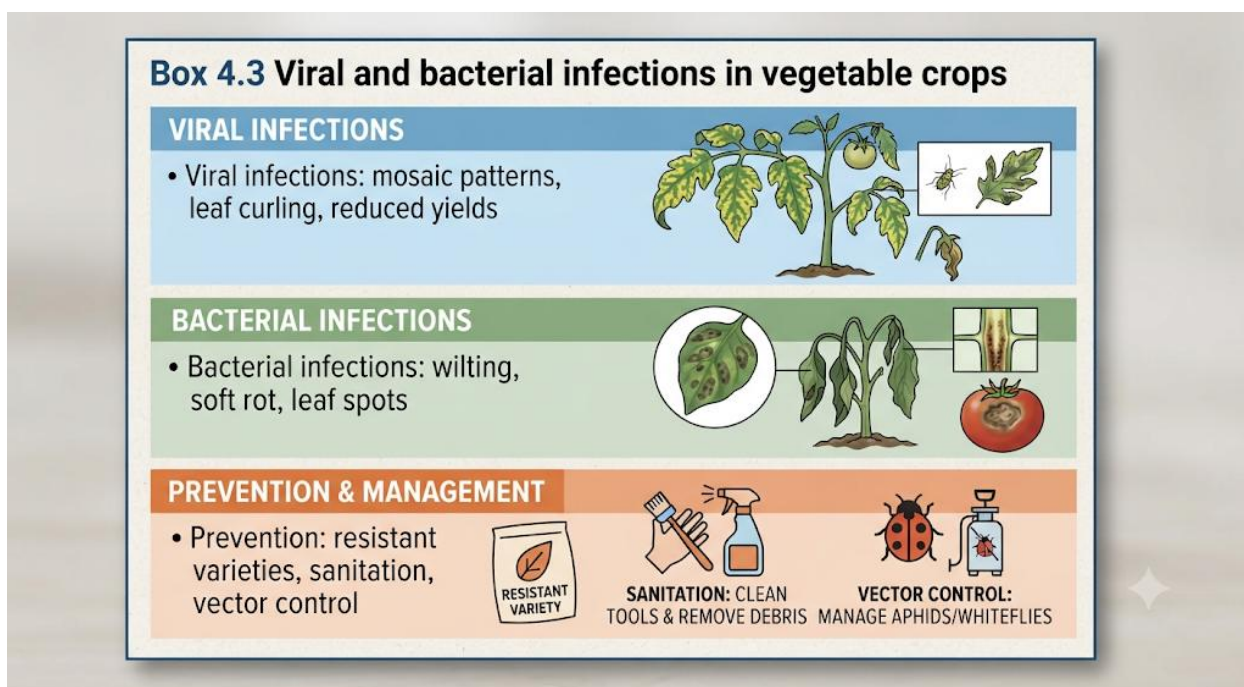


Diagram showing symptoms of fungal diseases in vegetable crops Caption: Figure 4.3 Fungal diseases in vegetable nurseries

Viral infections often cause mosaic patterns, leaf curling, and reduced yields. They are spread by insect vectors such as whiteflies. **Bacterial infections** lead to wilting, soft rot, and leaf spots. These diseases are difficult to cure, so prevention through resistant varieties and sanitation is critical.

Fill in the blank: Viral infections in vegetables are often spread by insect vectors such as _____.





Box 4.3 Viral and bacterial infections in vegetable crops

Pilot questions 4.3

1. Name two insect pests that affect vegetable nurseries.
2. What symptom does damping-off disease cause in seedlings?
3. Give one example of a fungal disease in vegetables.
4. How are viral infections commonly spread?
5. State one preventive measure against bacterial infections.

4.4 Principles And Methods Of Crop Protection

4.4.1 Preventive measures (sanitation, resistant varieties)

Preventive measures are the first line of defence in crop protection. Good sanitation practices such as removing diseased plants, sterilising nursery soil, and cleaning tools reduce the spread of pathogens. Using **resistant varieties** helps farmers avoid losses from common pests and diseases. Preventive measures are cost-effective and sustainable compared to curative approaches.

Fill in the blank: Removing diseased plants from the nursery is an example of _____ practice.



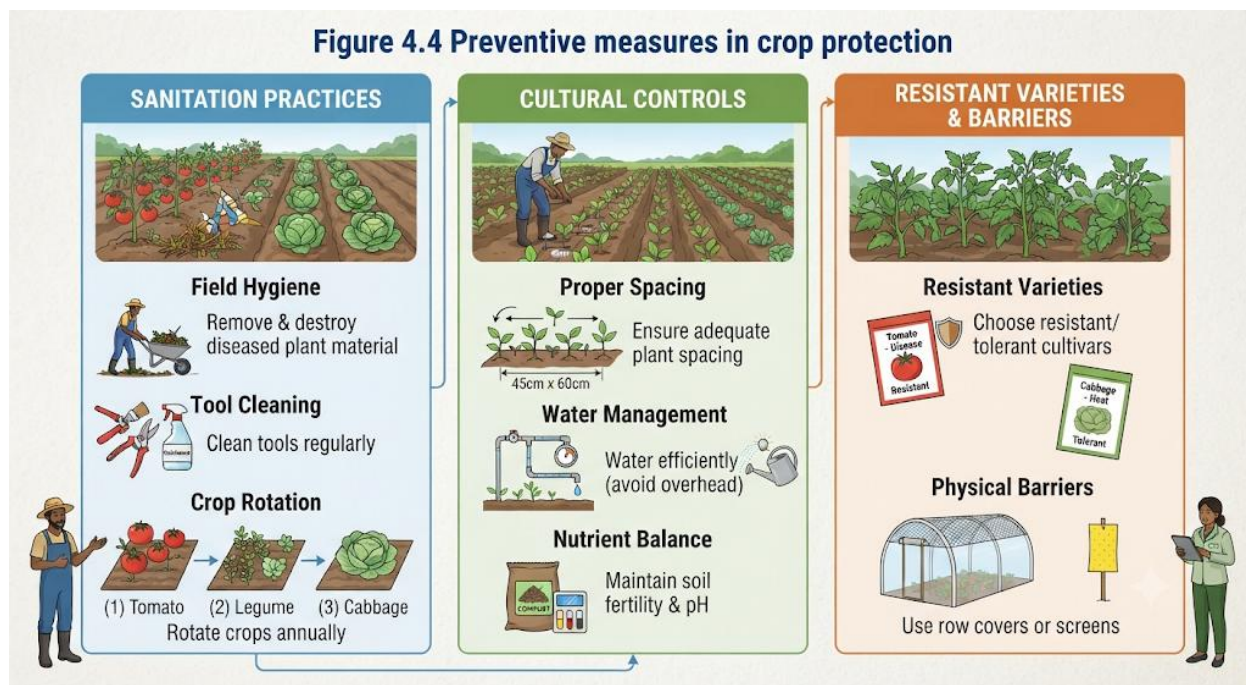


Diagram showing preventive crop protection measures Caption: Figure 4.4 Preventive measures in crop protection

4.4.2 Cultural, biological, and chemical control methods

Crop protection methods can be grouped into three categories:

- **Cultural control**: practices such as crop rotation, intercropping, and proper spacing to reduce pest build-up.
- **Biological control**: using natural predators (e.g., ladybirds against aphids) or biopesticides.
- **Chemical control**: applying pesticides carefully, following safety guidelines and regulations to avoid environmental harm.

Fill in the blank: Ladybirds are natural predators used in _____ control of aphids.



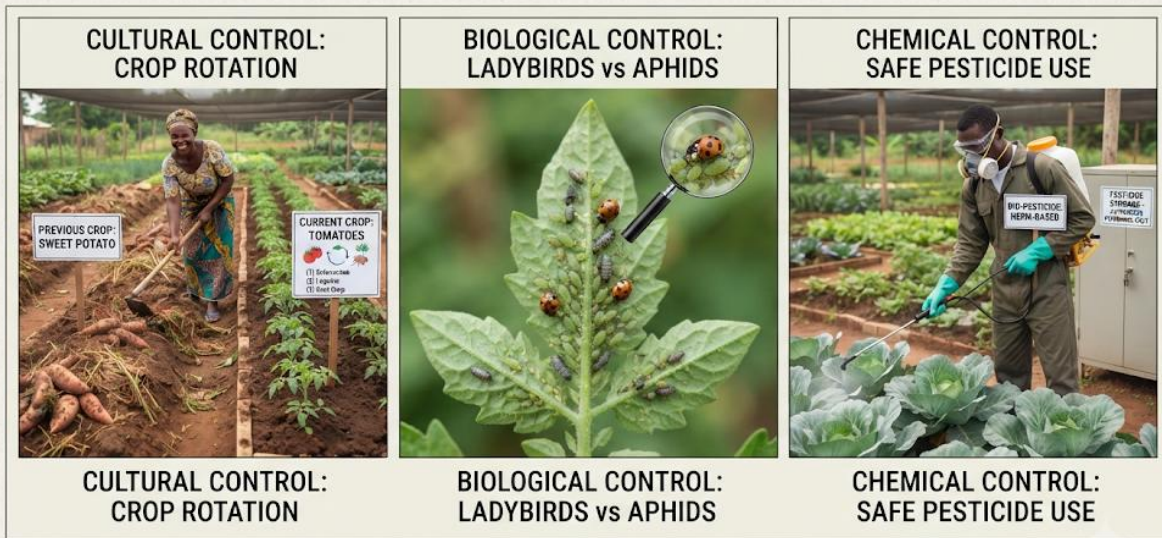


Plate 4.4 Crop protection methods in vegetable farming

Image showing cultural, biological, and chemical control methods
Caption: Plate 4.4 Crop protection methods in vegetable farming

4.4.3 Integrated pest management (IPM) approaches

Integrated Pest Management (IPM) combines preventive, cultural, biological, and chemical methods to achieve sustainable crop protection. IPM emphasises monitoring pest populations, using thresholds to decide when control is necessary, and prioritising eco-friendly methods before chemical use. It reduces costs, minimises environmental damage, and ensures long-term productivity.

Fill in the blank: Integrated Pest Management combines preventive, cultural, biological, and _____ methods for sustainable crop protection.



Box 4.4 Integrated Pest Management (IPM)

1. PREVENTIVE MEASURES

- Preventive measures: sanitation, resistant varieties



2. CULTURAL PRACTICES

- Cultural practices: crop rotation, intercropping



3. BIOLOGICAL CONTROL

- Biological control: natural predators, biopesticides



4. CHEMICAL CONTROL (LAST RESORT)

- Chemical control: safe pesticide use when necessary



Box 4.4 Integrated Pest Management (IPM)

Pilot questions 4.4

1. What is one example of a preventive measure in crop protection?
2. Name one cultural method of pest control.
3. Which natural predator is used against aphids?
4. Why is chemical control considered the last option in IPM?
5. What is the main advantage of Integrated Pest Management?

Series Summary

This Series has guided you through the essential practices of **propagation, nursery management, and crop protection** in vegetable and fruit production. We began by examining propagation methods, including seed and vegetative techniques, and the factors influencing their success. Next, we explored nursery establishment and management, focusing on site selection, sowing, watering, shading, and transplanting. We then studied common pests and diseases in nurseries and fields, such as insect pests, fungal infections, and viral/bacterial diseases. Finally, we analysed principles and methods of crop protection, highlighting preventive measures, cultural, biological, chemical control, and integrated pest management (IPM).

By completing this Series, you should now be able to describe propagation methods, explain nursery practices, identify common pests and diseases, and evaluate crop protection strategies. These abilities align directly with the Series Learning Outcomes and provide practical skills for



ensuring healthy seedlings, reducing losses, and achieving sustainable vegetable and fruit production.

Series Glossary

- **Aphids:** Small insect pests that suck sap from tender shoots, causing stunted growth.
- **Cuttings:** Vegetative propagation method using stem or root sections to grow new plants.
- **Damping-off:** Fungal disease causing sudden collapse of seedlings after germination.
- **Grafting:** Joining two plant parts to combine desirable traits in fruit crops.
- **Integrated Pest Management (IPM):** A sustainable approach combining preventive, cultural, biological, and chemical methods.
- **Nursery:** A controlled environment where young plants are raised before transplanting.
- **Sanitation:** Preventive practice involving removal of diseased plants and cleaning tools to reduce pathogen spread.

Concept Check Questions [Series 4]

Objective questions

1. Which propagation method involves planting seeds directly in the field? (Linked to SLO 4.1)
2. What is the purpose of shading in nurseries? (Linked to SLO 4.2)
3. Which insect pest sucks sap from tender shoots? (Linked to SLO 4.3)

Short-answer questions

4. State one factor affecting propagation success. (Linked to SLO 4.1)
5. Why is transplanting done during cool hours of the day? (Linked to SLO 4.2)
6. Give one example of a fungal disease in vegetable nurseries. (Linked to SLO 4.3)

Long-answer questions

7. Describe the steps involved in nursery establishment and management. (Linked to SLO 4.2)
8. Evaluate the role of Integrated Pest Management in sustainable vegetable production. (Linked to SLO 4.4)

Answers to Concept Check Questions [Series 4]

Objective questions

1. Seed propagation.
2. To protect seedlings from intense sunlight and heavy rainfall.



3. Aphids.

Short-answer questions

4. Seed quality and viability.
5. To reduce stress and improve survival rates.
6. Damping-off.

Long-answer questions

7. **Basic response:** Nursery establishment involves selecting a fertile, well-drained site near a water source, preparing the soil, sowing seeds, watering, shading, and transplanting seedlings. **Value-added response:** Proper nursery management improves germination rates, seedling vigour, and survival, ensuring successful crop establishment in the main field.
8. **Basic response:** IPM combines preventive, cultural, biological, and chemical methods to manage pests sustainably. **Value-added response:** By emphasising monitoring, thresholds, and eco-friendly practices, IPM reduces costs, minimises environmental damage, and ensures long-term productivity.

Answers to Pilot Questions [Series 4]

Part 4.1

1. Tomatoes and okra.
2. Cuttings.
3. To combine desirable traits.
4. Soil fertility.
5. Because it ensures uniformity and faster maturity.

Part 4.2

1. To raise young plants before transplanting.
2. Fertile, well-drained soil near water.
3. Protects seedlings from sunlight and rainfall.
4. Handle seedlings gently to avoid root damage.
5. Cool hours of the day.

Part 4.3

1. Aphids and caterpillars.



2. Sudden collapse of seedlings.
3. Blight.
4. By insect vectors such as whiteflies.
5. Sanitation and resistant varieties.

Part 4.4

1. Sanitation.
2. Crop rotation.
3. Ladybirds.
4. To minimise environmental harm.
5. Sustainable pest management.

References And Attributions [Series 4]

- Figure 4.1 Seed propagation of vegetables: Suggested AI prompt “Diagram showing seed propagation steps for tomatoes and okra”. Search string: “seed propagation vegetables Nigeria OER diagram”.
- Plate 4.1 Vegetative propagation methods: Suggested AI prompt “Photograph of grafting citrus plants and sweet potato cuttings”. Search string: “vegetative propagation methods Nigeria OER image”.
- Box 4.1 Factors affecting propagation success: Suggested AI prompt “Text box summarising factors affecting propagation success in vegetable farming”. Search string: “factors affecting propagation success vegetables Nigeria OER”.
- Figure 4.2 Nursery site selection and preparation: Suggested AI prompt “Diagram showing nursery site selection near water source, fertile soil, and wind protection”. Search string: “nursery site selection vegetable fruit farming Nigeria OER diagram”.
- Plate 4.2 Nursery practices for vegetable seedlings: Suggested AI prompt “Photograph of vegetable nursery with seedbeds, watering cans, and shade nets”. Search string: “vegetable nursery practices Nigeria OER image”.
- Box 4.2 Transplanting techniques for vegetable seedlings: Suggested AI prompt “Text box summarising transplanting techniques for vegetable seedlings”. Search string: “transplanting techniques vegetable seedlings Nigeria OER”.
- Plate 4.3 Insect pests affecting vegetable nurseries: Suggested AI prompt “Photograph of aphids on leaves and caterpillars feeding on vegetable seedlings”. Search string: “aphids caterpillars vegetable nursery Nigeria OER image”.



- Figure 4.3 Fungal diseases in vegetable nurseries: Suggested AI prompt “Diagram showing blight, damping-off, and mildew symptoms in vegetable seedlings”. Search string: “fungal diseases vegetable nursery Nigeria OER diagram”.
- Box 4.3 Viral and bacterial infections in vegetable crops: Suggested AI prompt “Text box summarising viral and bacterial infections in vegetable crops”. Search string: “viral bacterial infections vegetable crops Nigeria OER”.
- Figure 4.4 Preventive measures in crop protection: Suggested AI prompt “Diagram showing sanitation practices and resistant crop varieties for vegetable farming”. Search string: “preventive crop protection measures vegetable farming Nigeria OER diagram”.
- Plate 4.4 Crop protection methods in vegetable farming: Suggested AI prompt “Photograph showing crop rotation, ladybirds controlling aphids, and safe pesticide use”. Search string: “crop protection methods cultural biological chemical Nigeria OER image”.
- Box 4.4 Integrated Pest Management approaches: Suggested AI prompt “Text box summarising Integrated Pest Management approaches in vegetable farming”. Search string: “integrated pest management IPM vegetable farming Nigeria OER”.

Series 5: Horticultural Equipment And Ornamental Plant Management

Series Outline

- **5.1 Types and uses of horticultural equipment**
 - 5.1.1 Hand tools (hoes, pruners, watering cans)
 - 5.1.2 Power tools and machinery (lawn mowers, sprayers, irrigation systems)
 - 5.1.3 Maintenance and safety practices
- **5.2 Ornamental plant propagation and establishment**
 - 5.2.1 Seed and vegetative propagation methods
 - 5.2.2 Nursery practices for ornamentals
 - 5.2.3 Transplanting and establishment in landscapes
- **5.3 Cultural practices in ornamental plant management**
 - 5.3.1 Watering, fertilisation, and mulching



- 5.3.2 Pruning, training, and shaping
- 5.3.3 Pest and disease management in ornamentals
- **5.4 Landscaping and aesthetic management**
 - 5.4.1 Principles of landscape design
 - 5.4.2 Use of ornamentals in public and private spaces
 - 5.4.3 Sustainable landscaping practices

Introduction

Horticultural equipment and ornamental plant management are vital components of horticulture that combine functionality with aesthetics. Equipment ensures efficiency in farming and gardening operations, while ornamental plants enhance the beauty of landscapes, homes, and public spaces. Together, they contribute to productivity, sustainability, and environmental enrichment.

The aim of this Series is to introduce you to the types and uses of horticultural equipment, methods of propagating and establishing ornamental plants, cultural practices for their management, and principles of landscaping. By mastering these areas, learners will be able to apply practical tools, manage ornamentals effectively, and design sustainable landscapes.

We shall commence this Series by examining horticultural equipment, including hand tools, power tools, and safety practices. Next, we will explore ornamental plant propagation and establishment. Following that, we will study cultural practices such as watering, fertilisation, pruning, and pest management. Finally, we will conclude with landscaping and aesthetic management, focusing on design principles and sustainable practices.

Series Learning Outcomes

Upon completing this Series, you should be able to:

- **SLO 5.1** describe types and uses of horticultural equipment,
- **SLO 5.2** explain propagation and establishment methods for ornamental plants,
- **SLO 5.3** demonstrate cultural practices in ornamental plant management, and
- **SLO 5.4** evaluate landscaping and aesthetic management practices.

5.1 Types And Uses Of Horticultural Equipment

5.1.1 Hand tools (hoes, pruners, watering cans)

Hand tools are simple, manually operated equipment used in horticulture.

- **Hoes:** for weeding and soil preparation.



- **Pruners:** for cutting branches and shaping plants.
- **Watering cans:** for irrigating seedlings and ornamentals.

They are affordable, easy to use, and essential for small-scale operations.

Fill in the blank: _____ are hand tools used for cutting branches and shaping plants.



Image showing common hand tools used in horticulture Caption: Plate 5.1 Hand tools for horticultural operations

5.1.2 Power tools and machinery (lawn mowers, sprayers, irrigation systems)

Power tools and machinery increase efficiency in horticultural practices.

- **Lawn mowers:** for trimming grass in landscapes.
- **Sprayers:** for applying pesticides and fertilisers.
- **Irrigation systems:** for supplying water to crops consistently.

These tools save time and labour but require investment and maintenance.

Fill in the blank: Lawn _____ are power tools used for trimming grass in landscapes.



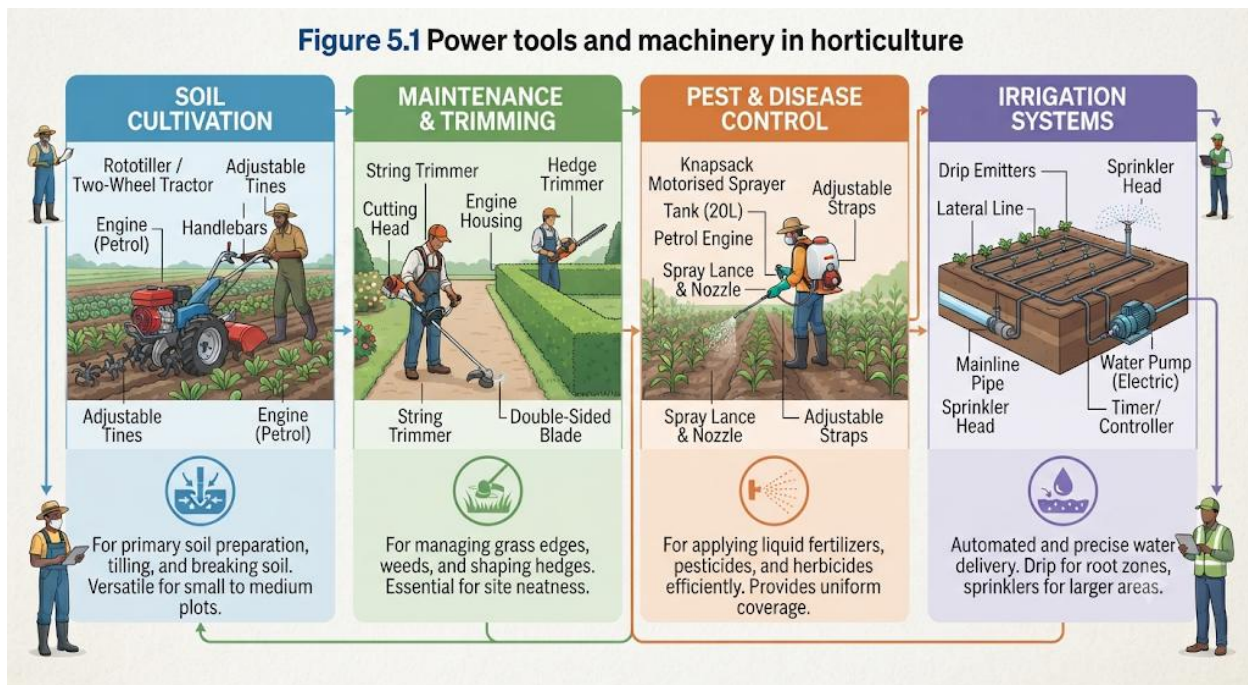


Diagram showing power tools and machinery in horticulture Caption: Figure 5.1 Power tools and machinery in horticulture

5.1.3 Maintenance and safety practices

Proper **maintenance and safety practices** ensure equipment longevity and safe use.

- Clean tools after use to prevent rust and contamination.
- Store equipment in dry, secure places.
- Use protective gear (gloves, goggles) when operating machinery.
- Follow manufacturer instructions for power tools.

These practices reduce accidents and improve efficiency.

Fill in the blank: Wearing gloves and goggles when operating machinery is an example of _____ practice.



Box 5.1 Maintenance and safety practices for horticultural equipment

1. POST-USE MAINTENANCE

- Clean tools after use



2. PROPER STORAGE

- Store in dry places



3. PERSONAL SAFETY

- Use protective gear



4. POWER TOOL SAFETY

- Follow instructions for power tools



Box 5.1 Maintenance and safety practices for horticultural equipment

Pilot questions 5.1

1. Name two examples of hand tools used in horticulture.
2. What is the main purpose of a lawn mower?
3. State one advantage of using power tools in horticulture.
4. Why is it important to clean tools after use?
5. Give one example of a safety practice when using horticultural equipment.

5.2 Ornamental Plant Propagation And Establishment

5.2.1 Seed and vegetative propagation methods

Ornamental plants can be propagated through **seeds** or **vegetative methods**.

- **Seed propagation:** used for annual ornamentals like marigolds and zinnias.
- **Vegetative propagation:** includes cuttings, grafting, layering, and division, often used for perennials such as bougainvillea and hibiscus.

Vegetative methods are preferred when uniformity and faster establishment are required.

Fill in the blank: Marigolds and zinnias are commonly propagated by _____.



Figure 5.2 Propagation methods of ornamental plants

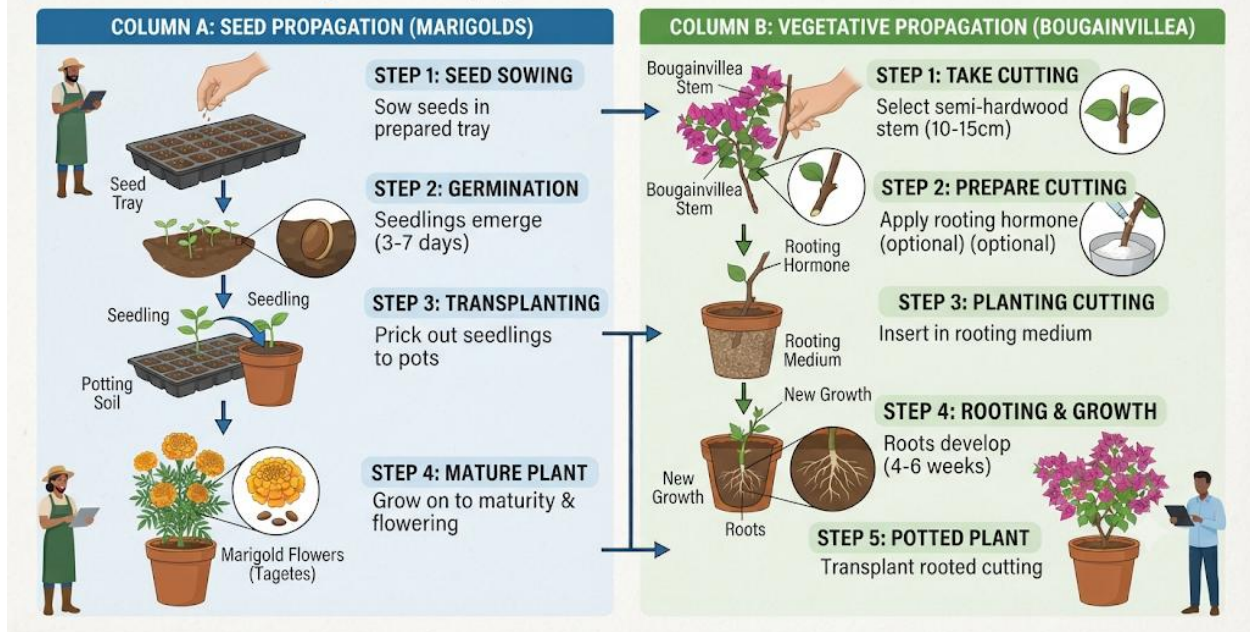


Diagram showing seed and vegetative propagation of ornamentals Caption: Figure 5.2 Propagation methods of ornamental plants

5.2.2 Nursery practices for ornamentals

Nurseries provide a controlled environment for raising ornamentals before transplanting. Practices include:

- Preparing seedbeds or containers with fertile soil.
- Regular watering and shading to protect seedlings.
- Using pots, trays, or polybags for easy handling.

Nursery management ensures healthy seedlings and reduces transplanting shock.

Fill in the blank: Ornamentals are often raised in pots, trays, or _____ for easy handling.



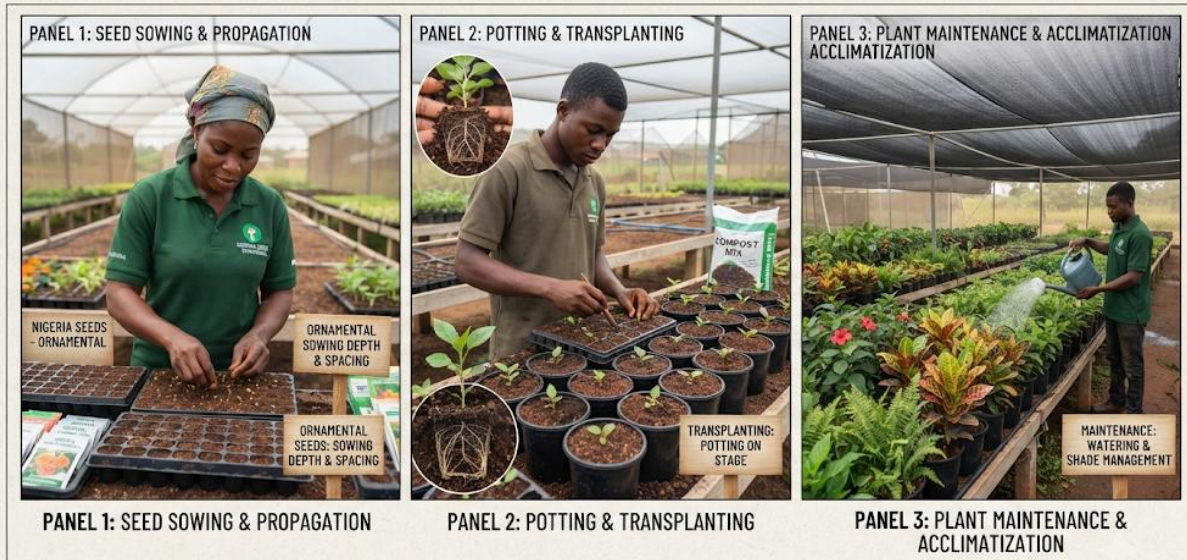


Plate 5.2 Nursery practices for ornamental plants

Image showing nursery practices for ornamentals Caption: Plate 5.2 Nursery practices for ornamental plants

5.2.3 Transplanting and establishment in landscapes

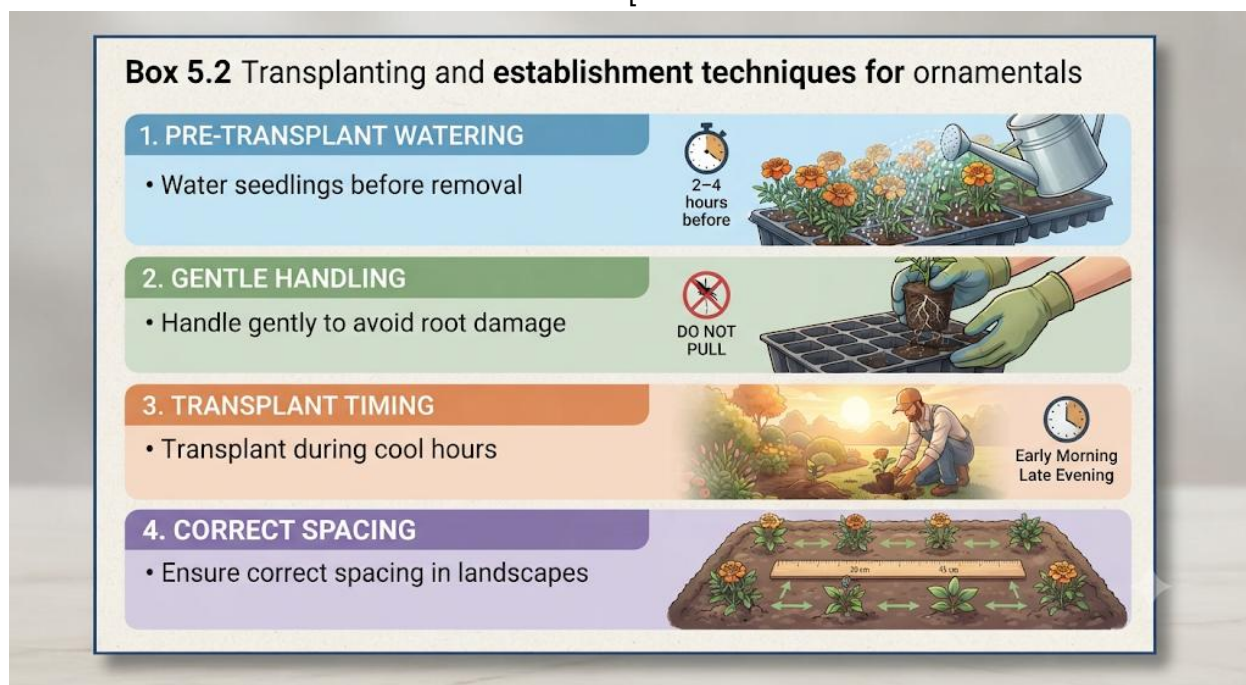
Transplanting involves moving ornamentals from nurseries to gardens or landscapes. Proper techniques include:

- Watering seedlings before removal.
- Handling gently to avoid root damage.
- Planting during cool hours of the day.
- Ensuring correct spacing for growth and aesthetics.

Establishment requires regular watering, mulching, and protection from pests.

Fill in the blank: Ornamentals should be transplanted during the _____ hours of the day to reduce stress.





Box 5.2 Transplanting and establishment techniques for ornamentals

Pilot questions 5.2

1. Name one ornamental plant commonly propagated by seeds.
2. Which propagation method ensures uniformity in ornamentals?
3. State one nursery practice for ornamentals.
4. Why is spacing important when establishing ornamentals in landscapes?
5. When is the best time of day to transplant ornamentals?

5.3 Cultural Practices In Ornamental Plant Management

5.3.1 Watering, fertilisation, and mulching

Ornamental plants require regular **watering** to maintain their aesthetic appeal. Overwatering should be avoided to prevent root rot. **Fertilisation** supplies essential nutrients, often using organic compost or balanced fertilisers. **Mulching** conserves soil moisture, suppresses weeds, and improves soil structure around ornamentals.

Fill in the blank: Mulching helps conserve soil moisture and suppress _____ growth.





Plate 5.3 Watering, fertilisation, and mulching practices

Image showing watering, fertilisation, and mulching of ornamentals Caption: Plate 5.3 Watering, fertilisation, and mulching practices

5.3.2 Pruning, training, and shaping

Pruning involves removing unwanted branches to improve plant form and health. **Training** directs plant growth using stakes or wires, while **shaping** enhances the aesthetic appeal by trimming plants into desired forms (e.g., hedges, topiary). These practices are essential for maintaining ornamental value in landscapes.

Fill in the blank: Shaping ornamentals into hedges or topiary is part of _____ practices.



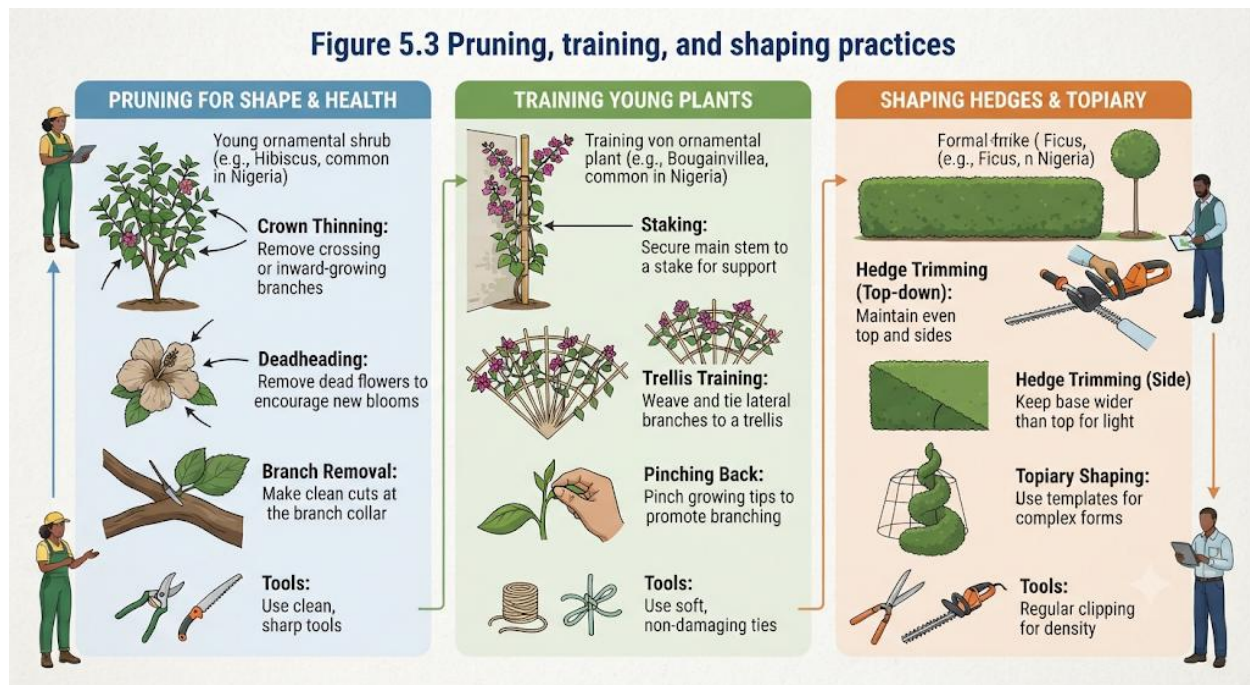


Diagram showing pruning, training, and shaping of ornamentals Caption: Figure 5.3 Pruning, training, and shaping practices

5.3.3 Pest and disease management in ornamentals

Ornamentals are susceptible to pests such as aphids and mealybugs, and diseases like powdery mildew. Management practices include:

- Regular inspection and early detection.
- Use of resistant varieties.
- Biological control (ladybirds against aphids).
- Safe application of pesticides when necessary.

Fill in the blank: Powdery _____ is a common fungal disease affecting ornamental plants.



Box 5.3 Pest and disease management in ornamentals

1. MONITORING

- Inspect plants regularly

Nigerian
gardener



2. PREVENTION

- Use resistant varieties



3. BIOLOGICAL CONTROL

- Apply biological control



4. CHEMICAL CONTROL (LAST RESORT)

- Use pesticides safely when needed



Box 5.3 Pest and disease management in ornamentals

Pilot questions 5.3

1. Why is mulching important in ornamental plant management?
2. What is the purpose of pruning ornamentals?
3. Name one practice used to direct plant growth.
4. Give one example of a pest affecting ornamentals.
5. State one method of managing diseases in ornamentals.

5.4 Landscaping And Aesthetic Management

5.4.1 Principles of landscape design

Landscape design involves arranging plants, structures, and spaces to create functional and visually appealing environments. Principles include balance, proportion, unity, and variety. Ornamentals are selected based on colour, texture, and seasonal appeal to enhance aesthetics.

Fill in the blank: Balance, proportion, unity, and variety are principles of _____ design.



Figure 5.4 Principles of landscape design

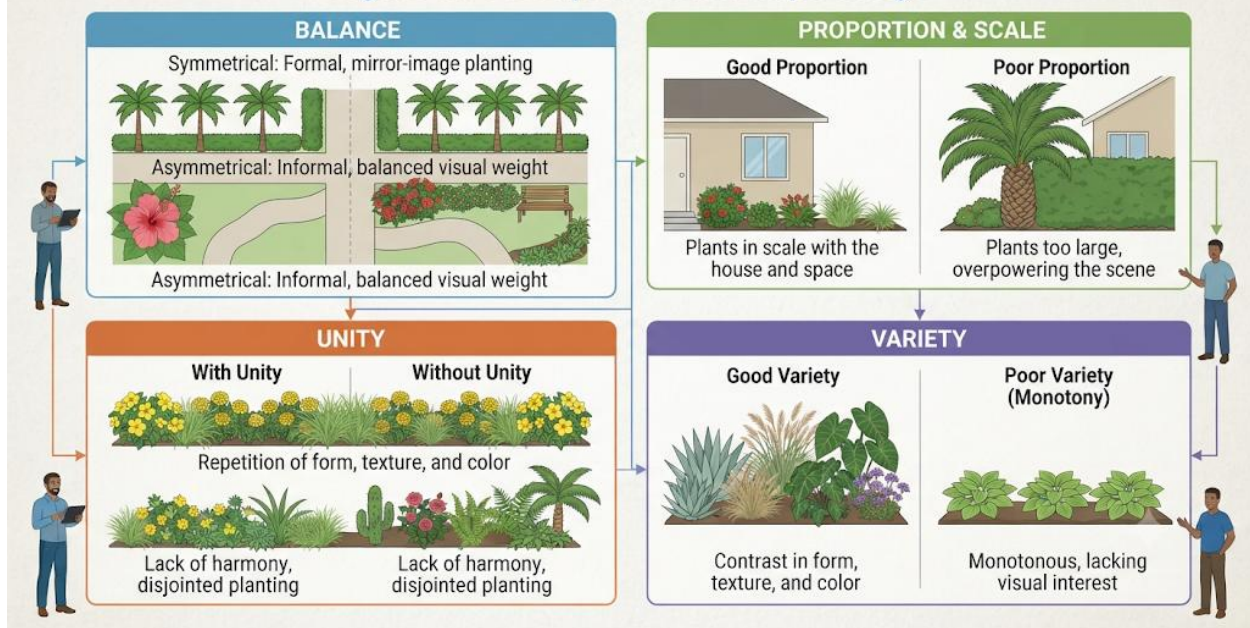


Diagram showing principles of landscape design Caption: Figure 5.4 Principles of landscape design

5.4.2 Use of ornamentals in public and private spaces

Ornamentals are widely used in **public spaces** such as parks, schools, and offices, and in **private spaces** like home gardens. They provide shade, reduce noise, improve air quality, and beautify surroundings. Their placement enhances both environmental and social well-being.

Fill in the blank: Ornamentals in public spaces such as parks and schools provide shade and improve _____ quality.





Plate 5.4 Use of ornamentals in public and private spaces

Image showing ornamentals in public and private spaces Caption: Plate 5.4 Use of ornamentals in public and private spaces

5.4.3 Sustainable landscaping practices

Sustainable landscaping focuses on conserving resources and protecting the environment. Practices include:

- Using native plants adapted to local conditions.
- Conserving water through drip irrigation and mulching.
- Recycling organic waste into compost.
- Minimising chemical use to protect biodiversity.

Fill in the blank: Sustainable landscaping encourages the use of _____ plants adapted to local conditions.





Box 5.4 Sustainable landscaping practices

Pilot questions 5.4

1. Name two principles of landscape design.
2. State one benefit of ornamentals in public spaces.
3. Why are native plants important in sustainable landscaping?
4. Give one example of a sustainable landscaping practice.
5. How do ornamentals contribute to social well-being?

Series Summary

This Series has introduced you to the dual aspects of **horticultural equipment** and **ornamental plant management**. We began by exploring the types and uses of horticultural equipment, including hand tools, power tools, and the importance of maintenance and safety practices. Next, we examined propagation and establishment methods for ornamentals, covering seed and vegetative techniques, nursery practices, and transplanting. Following that, we studied cultural practices such as watering, fertilisation, mulching, pruning, training, shaping, and pest management. Finally, we concluded with landscaping and aesthetic management, focusing on design principles, the use of ornamentals in public and private spaces, and sustainable landscaping practices.

By completing this Series, you should now be able to describe horticultural equipment, explain ornamental propagation and establishment, demonstrate cultural practices, and evaluate



landscaping principles. These abilities align directly with the Series Learning Outcomes and provide practical skills for managing both functional and aesthetic aspects of horticulture.

Series Glossary

- **Hand tools:** Simple, manually operated equipment such as hoes, pruners, and watering cans.
- **Power tools:** Mechanised equipment like lawn mowers, sprayers, and irrigation systems.
- **Propagation:** Multiplication of plants through seeds or vegetative methods.
- **Pruning:** Cutting unwanted branches to improve plant health and form.
- **Topiary:** Shaping plants into decorative forms.
- **Landscape design:** Arrangement of plants and structures to create functional and aesthetic environments.
- **Sustainable landscaping:** Practices that conserve resources and protect biodiversity, such as using native plants and recycling organic waste.

Concept Check Questions [Series 5]

Objective questions

1. Which tool is used for cutting branches in horticulture? (Linked to SLO 5.1)
2. Marigolds are commonly propagated by which method? (Linked to SLO 5.2)
3. Powdery mildew is an example of what type of disease? (Linked to SLO 5.3)

Short-answer questions

4. State one advantage of using power tools in horticulture. (Linked to SLO 5.1)
5. Why is spacing important when establishing ornamentals in landscapes? (Linked to SLO 5.2)
6. Give one principle of landscape design. (Linked to SLO 5.4)

Long-answer questions

7. Describe nursery practices for ornamentals and explain their importance. (Linked to SLO 5.2)
8. Evaluate the role of sustainable landscaping in ornamental plant management. (Linked to SLO 5.4)

Answers to Concept Check Questions [Series 5]

Objective questions



1. Pruners.
2. Seed propagation.
3. Fungal disease.

Short-answer questions

4. They save time and labour.
5. To ensure healthy growth and aesthetic appeal.
6. Balance.

Long-answer questions

7. **Basic response:** Nursery practices include preparing seedbeds or containers, watering, shading, and using pots or trays. These practices ensure healthy seedlings. **Value-added response:** Proper nursery management reduces transplanting shock, improves survival rates, and ensures ornamentals establish successfully in landscapes.
8. **Basic response:** Sustainable landscaping conserves resources and protects biodiversity. **Value-added response:** By using native plants, conserving water, recycling organic waste, and minimising chemicals, sustainable landscaping enhances environmental health and long-term ornamental management.

Answers to Pilot Questions [Series 5]

Part 5.1

1. Hoes and pruners.
2. Trimming grass.
3. Efficiency and labour savings.
4. To prevent rust and contamination.
5. Wearing protective gear.

Part 5.2

1. Marigolds.
2. Vegetative propagation.
3. Regular watering and shading.
4. To allow growth and aesthetics.
5. Cool hours of the day.

Part 5.3



1. Conserves moisture and suppresses weeds.
2. To improve plant form and health.
3. Training with stakes.
4. Aphids.
5. Use resistant varieties.

Part 5.4

1. Balance and proportion.
2. Shade and improved air quality.
3. They are adapted to local conditions.
4. Recycling organic waste.
5. Beautification and improved well-being.

References And Attributions [Series 5]

- Plate 5.1 Hand tools for horticultural operations: Suggested AI prompt “Photograph of hoes, pruners, and watering cans used in horticulture”. Search string: “hand tools horticulture Nigeria OER image”.
- Figure 5.1 Power tools and machinery in horticulture: Suggested AI prompt “Diagram showing lawn mower, sprayer, and irrigation system in horticulture”. Search string: “power tools machinery horticulture Nigeria OER diagram”.
- Box 5.1 Maintenance and safety practices: Suggested AI prompt “Text box summarising maintenance and safety practices for horticultural equipment”. Search string: “maintenance safety practices horticultural equipment Nigeria OER”.
- Figure 5.2 Propagation methods of ornamental plants: Suggested AI prompt “Diagram showing seed propagation of marigolds and vegetative propagation of bougainvillea”. Search string: “ornamental plant propagation methods Nigeria OER diagram”.
- Plate 5.2 Nursery practices for ornamentals: Suggested AI prompt “Photograph of ornamental plant nursery with trays, pots, and shade nets”. Search string: “ornamental plant nursery practices Nigeria OER image”.
- Box 5.2 Transplanting and establishment techniques: Suggested AI prompt “Text box summarising transplanting and establishment techniques for ornamentals”. Search string: “transplanting establishment ornamental plants Nigeria OER”.



- Plate 5.3 Watering, fertilisation, and mulching practices: Suggested AI prompt “Photograph of ornamental plants being watered, fertilised, and mulched in a garden”. Search string: “watering fertilisation mulching ornamental plants Nigeria OER image”.
- Figure 5.3 Pruning, training, and shaping practices: Suggested AI prompt “Diagram showing pruning branches, training plants with stakes, and shaping hedges”. Search string: “pruning training shaping ornamental plants Nigeria OER diagram”.
- Box 5.3 Pest and disease management in ornamentals: Suggested AI prompt “Text box summarising pest and disease management in ornamental plants”. Search string: “pest disease management ornamental plants Nigeria OER”.
- Figure 5.4 Principles of landscape design: Suggested AI prompt “Diagram showing balance, proportion, unity, and variety in landscape design with ornamentals”. Search string: “principles of landscape design ornamentals Nigeria OER diagram”.
- Plate 5.4 Use of ornamentals in public and private spaces: Suggested AI prompt “Photograph of ornamentals in Nigerian parks, schools, and home gardens”. Search string: “ornamentals public private spaces Nigeria OER image”.
- Box 5.4 Sustainable landscaping practices: Suggested AI prompt “Text box summarising sustainable landscaping practices with ornamentals”. Search string: “sustainable landscaping practices ornamentals Nigeria OER”.

