CHAHAL ACADEMY

SUMMARY OF KURUKSHETRA

FEBRUARY 2025

Horticulture for Prosperity

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TOPIC 1: NUTRITIONAL AND HEALTH SECURITY THROUGH HORTICULTURE

1. Introduction

- **Definition**: Horticulture refers to the branch of agriculture that deals with the cultivation of fruits, vegetables, nuts, seeds, herbs, sprouts, mushrooms, algae, flowers, seaweeds, and non-food crops such as grass and ornamental trees.
- **Importance**: Plays a crucial role in ensuring nutritional security, improving health, and enhancing economic well-being.
- **Relevance**: With increasing malnutrition and non-communicable diseases, horticulture serves as a sustainable solution to improve diet diversity and health outcomes.

2. Role of Horticulture in Nutritional Security

A. Essential Nutrients from Horticultural Crops

- **Fruits**:
  - Rich in **vitamins (A, C, E, and K)**, minerals **(potassium, calcium)**, and fiber.
  - Examples: Mango (Vitamin A), Citrus fruits (Vitamin C), Banana (Potassium).
- **Vegetables:**
  - Provide **fiber, antioxidants, and micronutrients** (iron, folate, magnesium).
  - Examples: Spinach (Iron, Folate), Carrots (Beta-carotene), Tomatoes (Lycopene).
- **Nuts and Seeds**:
  - High in **healthy fats, proteins, and essential minerals**.
  - Examples: Almonds (Vitamin E), Walnuts (Omega-3 fatty acids), Sunflower seeds (Magnesium).
- **Herbs and Spices**:
  - Contain **bioactive compounds with medicinal properties**.
  - Examples: Turmeric (Curcumin), Ginger (Gingerol), Garlic (Allicin).
- **Mushrooms**:
  - Provide **Vitamin D, antioxidants, and amino acids**.
  - Example: Shiitake (Lentinan for immune function).

B. Contribution to Balanced Diet and Malnutrition Reduction

- **Reduces Micronutrient Deficiencies**: Addresses anemia, night blindness, and scurvy.
- **Enhances Gut Health**: High fiber content promotes digestion and prevents gastrointestinal diseases.
- **Boosts Immunity**: Phytochemicals and antioxidants improve disease resistance.

3. Role of Horticulture in Health Security

A. Preventing Non-Communicable Diseases (NCDs)

- **Cardiovascular Diseases**:
  - Solution: Potassium-rich fruits and vegetables regulate blood pressure.
  - Examples: Avocado, Bananas, Citrus fruits
- **Diabetes Management:**
  - Solution: Low glycemic index (GI) foods maintain blood sugar levels.
  - Examples: Leafy greens, berries, nuts.
- **Cancer Prevention:**
  - Solution: Antioxidant-rich foods reduce oxidative stress.
  - Examples: Broccoli, Garlic, Green tea.
- **Obesity Control:**
  - Solution: High-fiber diets promote satiety and weight management.
  - Examples: Whole grains, Legumes, Apples.

B. Medicinal Properties of Horticultural Crops

- **Turmeric**: Anti-inflammatory, boosts liver function.
- **Aloe Vera**: Supports skin health and digestion.
- **Basil (Tulsi)**: Reduces stress, regulates blood sugar.

4. Economic and Sustainable Benefits of Horticulture

A. Livelihood Generation

- **Employment**: Horticulture provides jobs in farming, processing, packaging, and distribution.
- **Entrepreneurship Opportunities**: Small-scale agribusiness in organic farming, herbal products, and food processing

B. Environmental Sustainability

- **Water Conservation**: Drip irrigation and hydroponics reduce water wastage.
- **Climate Resilience**: Certain crops (e.g., moringa, amla) withstand harsh climatic conditions.
- **Agroforestry Integration**: Enhances biodiversity and soil fertility.

5. Government Initiatives to Promote Horticulture

A. National and International Policies

- **Mission for Integrated Development of Horticulture (MIDH)**: Promotes area expansion, technology dissemination.
- **National Horticulture Mission (NHM)**: Supports farmers with infrastructure and market linkages.
- **PM-Kisan Samman Nidhi**: Financial aid to farmers for horticultural growth.
- **Eat Right India Movement (FSSAI Initiative)**: Encourages consumption of healthy horticultural produce.
- **FAO's Global Initiative on Nutrition and Agriculture**: Endorses diversified cropping for food security.

B. Technology Interventions

- **Precision Farming**: IoT-based irrigation, soil sensors for optimized crop yields.
- **Greenhouse and Hydroponics**: Year-round production of nutrient-rich crops.
- **Biofortification**: Genetic improvement of crops for higher vitamin and mineral content.

6. Challenges in Ensuring Nutritional and Health Security through Horticulture

A. Supply Chain and Market Issues

- **Post-Harvest Losses**: Over 30% of horticultural produce wasted due to lack of cold storage.
- **Price Fluctuations**: Seasonal supply-demand gaps affect farmer income.
- **Market Access**: Limited direct-to-consumer channels, reliance on intermediaries.

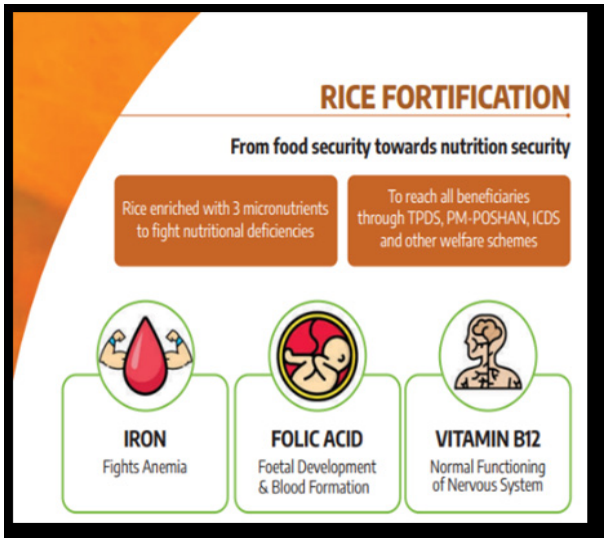
B. Environmental and Climate Constraints

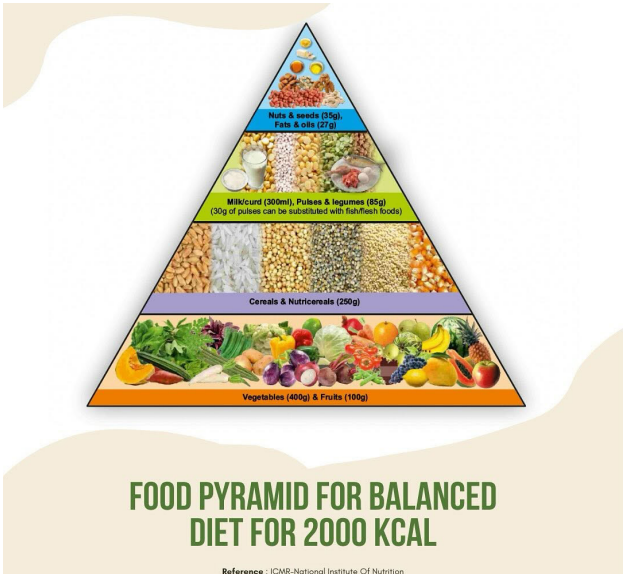
- **Water Scarcity**: Horticulture is water-intensive; climate change affects yield.
- **Pest and Disease Management**: Dependence on chemical pesticides affects food safety.
- **Land Degradation**: Overuse of fertilizers impacts soil fertility.

C. Nutritional Awareness and Dietary Habits

- **Lack of Consumer Awareness**: Limited knowledge about balanced diets and nutritional benefits.
- **Changing Food Preferences**: Increasing dependence on processed and fast food.
- **Affordability and Accessibility**: Nutrient-rich horticultural produce is often expensive for low-income groups.

7. Strategies to Enhance Nutritional and Health Security through Horticulture





TOPIC 2: FOOD PROCESSING IN HORTICULTURAL3 CROPS

1. Introduction

Food processing in horticultural crops refers to the various techniques and methods used to enhance the shelf life, nutritional value, and marketability of fruits, vegetables, and other horticultural produce. It includes preservation, value addition, and post-harvest management to reduce wastage and improve economic viability.

2. Importance of Food Processing in Horticultural Crops

- **Prevention of Post-Harvest Losses:** Minimizes wastage due to spoilage and damage.
- **Increased Shelf Life:** Enhances storage and transportability.
- **Value Addition:** Converts raw produce into more profitable processed products.
- **Nutritional Enhancement:** Fortification and enrichment improve health benefits.
- **Market Expansion:** Processed foods cater to domestic and international markets.

3. Methods of Food Processing in Horticulture

A. Primary Processing

- **Sorting and Grading:** Based on size, color, and quality.
- **Cleaning and Washing:** Removal of dirt, pesticides, and contaminants.
- **Blanching:** Partial boiling to inactivate enzymes before freezing or dehydration.

B. Secondary Processing

- **Dehydration:** Reducing moisture content to extend shelf life (e.g., dried fruits, vegetables).
- **Canning:** Heat treatment and sealing in airtight containers (e.g., canned tomatoes, mango pulp).
- **Freezing:** Quick freezing at low temperatures to retain freshness (e.g., frozen peas, berries).
- **Pickling and Fermentation:** Using brine, vinegar, or natural fermentation (e.g., pickles, kimchi).
- **Juicing and Beverage Processing:** Fruit and vegetable juices, nectars, and concentrates.

- **Pulping and Pureeing:** Conversion into pastes or purees for various uses (e.g., tomato paste, mango pure).

C. Advanced Processing Technologies

- **High-Pressure Processing (HPP):** Preserves nutrients and extends shelf life.
- **Irradiation:** Kills pathogens without affecting quality.
- **Modified Atmosphere Packaging (MAP):** Controls gases to enhance storage duration.
- **Cold Plasma Technology:** Emerging technique for microbial safety.
- **Freeze-Drying (Lyophilization):** Retains original taste and nutrients.

4. Value-Added Products from Horticultural Crops

A. Fruits

- Jams, jellies, marmalades
- Dehydrated fruits (e.g., banana chips, apple slices)
- Squashes, syrups, and RTS (ready-to-serve) beverages

B. Vegetables

- Dehydrated vegetables (e.g., onion flakes, garlic powder)
- Tomato ketchup, puree, and sauces
- Pickles and chutneys

C. Plantation and Medicinal Crops

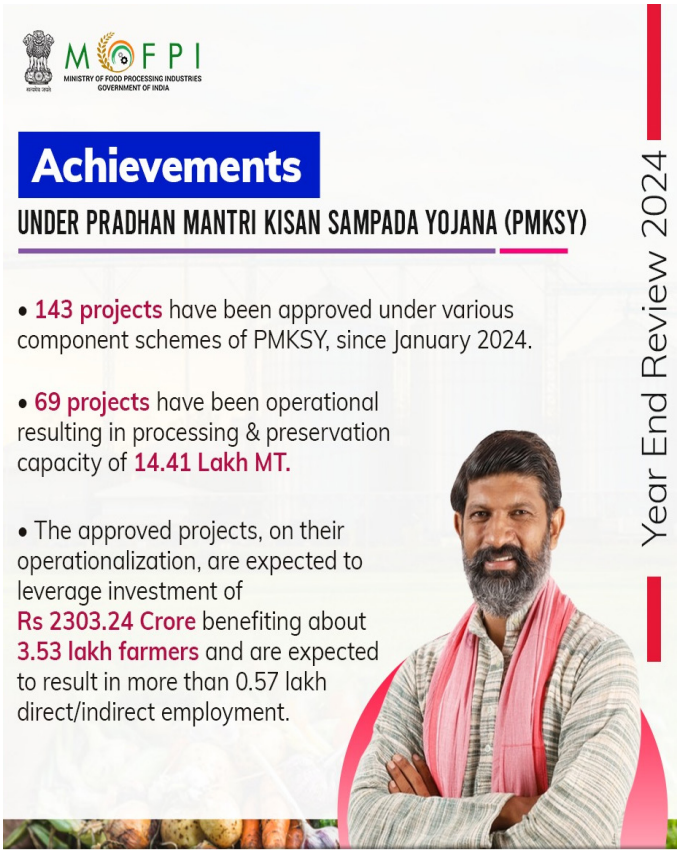
- Herbal teas and essential oils
- Spices processing (e.g., turmeric powder, dried chilies)
- Cocoa and coffee processing

5. Challenges in Food Processing of Horticultural Crops

- **Perishability:** High moisture content leads to rapid spoilage.
- **High Initial Investment:** Infrastructure and technology costs.
- **Quality Control:** Maintenance of hygiene and safety standards.
- **Market Fluctuations:** Price volatility affects profitability.
- **Supply Chain Gaps:** Need for better cold storage and logistics.

6. Government Initiatives and Policies

- **Pradhan Mantri Kisan SAMPADA Yojana (PMKSY)** – Financial support for food processing.
- **Mega Food Parks Scheme** – Infrastructure for food processing units.
- **Operation Greens** – Price stabilization for perishable crops like tomatoes, onions, and potatoes.
- **National Horticulture Mission (NHM)** – Promotes post-harvest management and value addition.



7. Future Prospects of Food Processing in Horticulture

- **Smart Packaging Solutions:** Use of biodegradable and intelligent packaging.
- **Blockchain in Food Supply Chain:** Ensures traceability and safety.
- **Superfoods and Functional Foods:** High-demand processed foods with added health benefits.
- **Export Potential:** Growth in global demand for processed Indian horticultural products.

8. Conclusion

Food processing in horticultural crops plays a crucial role in minimizing post-harvest losses, enhancing food security, and improving farmers' incomes. With technological advancements, policy support, and increasing consumer demand, the sector holds vast potential for sustainable growth and economic prosperity.

TOPIC 3: SUSTAINING RURAL LIVELIHOODS THROUGH HORTICULTURE

1. Introduction

Rural livelihoods depend largely on agriculture; however, conventional farming is becoming increasingly unsustainable due to low profitability and climate uncertainties. Horticulture offers an alternative that can enhance rural incomes, reduce migration, and promote environmental sustainability. With its high-value crops, short gestation periods, and significant export potential, horticulture can be a key driver for rural economic prosperity.

2. Importance of Horticulture in Rural Development

Economic Growth and Employment Generation

- Horticulture contributes 33% to India's agricultural GDP while occupying only 18% of the total agricultural area.
- Provides employment to millions, especially in rural areas, through farming, processing, marketing, and export activities.

High Yield and Profitability

- Productivity per unit area is significantly higher in horticulture than in conventional agriculture.
- Small and marginal farmers can achieve better incomes due to high-value crops like fruits, vegetables, and spices.

Food and Nutritional Security

- Ensures dietary diversity with essential vitamins, minerals, and nutrients.
- Plays a crucial role in combating malnutrition in rural areas.

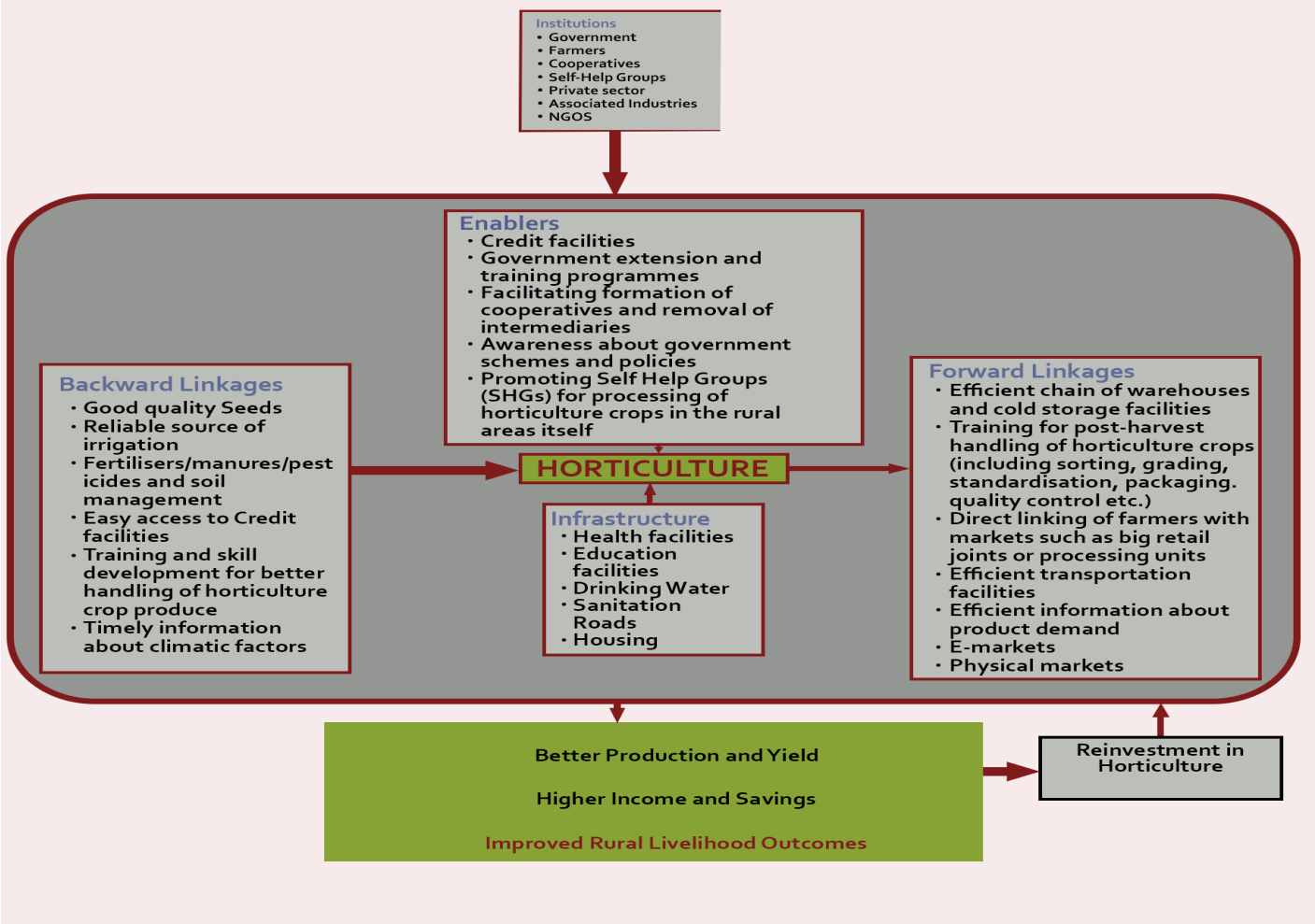
Sustainability and Climate Resilience

- Many horticulture crops require less water than traditional staple crops.
- Diverse cropping systems reduce risks associated with climate change and crop failures.

3. Current Trends in Indian Horticulture

- India is the second-largest producer of fruits and vegetables globally.
- Leading producer of bananas, limes, lemons, papayas, and okra.
- Export of horticulture products exceeded 4 lakh crores in 2023.
- Horticulture output surpassed food grain production since 2012-13.
- States like Uttar Pradesh, Madhya Pradesh, and West Bengal lead in horticulture production.
- Himalayan states remain underutilized despite favorable agro-climatic conditions.

4. Challenges in Horticulture-Based Livelihoods



Post-Harvest Infrastructure Deficiencies

- Inadequate storage, cold chain logistics, and processing units lead to high wastage.
- NABARD's Warehouse Infrastructure Fund (WIF) aims to bridge this gap, but state-wise disparities persist.

Limited Access to Quality Inputs

- Small and marginal farmers face challenges in obtaining quality seeds, irrigation facilities, and soil health management tools.

Financial and Institutional Constraints

- Low access to farm insurance and institutional credit hinders investment in horticulture.

Fragmented Land Holdings

- Small land parcels reduce economies of scale and hinder large-scale adoption of advanced farming techniques.

Climate Change and Environmental Stress

- Erratic weather patterns, extreme temperature fluctuations, and changing precipitation cycles affect crop yields.

Market and Supply Chain Bottlenecks

- Price volatility and market fluctuations impact farmer earnings.
- Poor information flow leads to farmers missing profitable opportunities in both domestic and export markets.

Lack of Value Addition and Processing Units

- The absence of processing facilities leads to higher post-harvest losses.
- Limited branding and packaging expertise restricts competitiveness in global markets.

5. Government Initiatives and Policy Support

Mission for Integrated Development of Horticulture (MIDH)

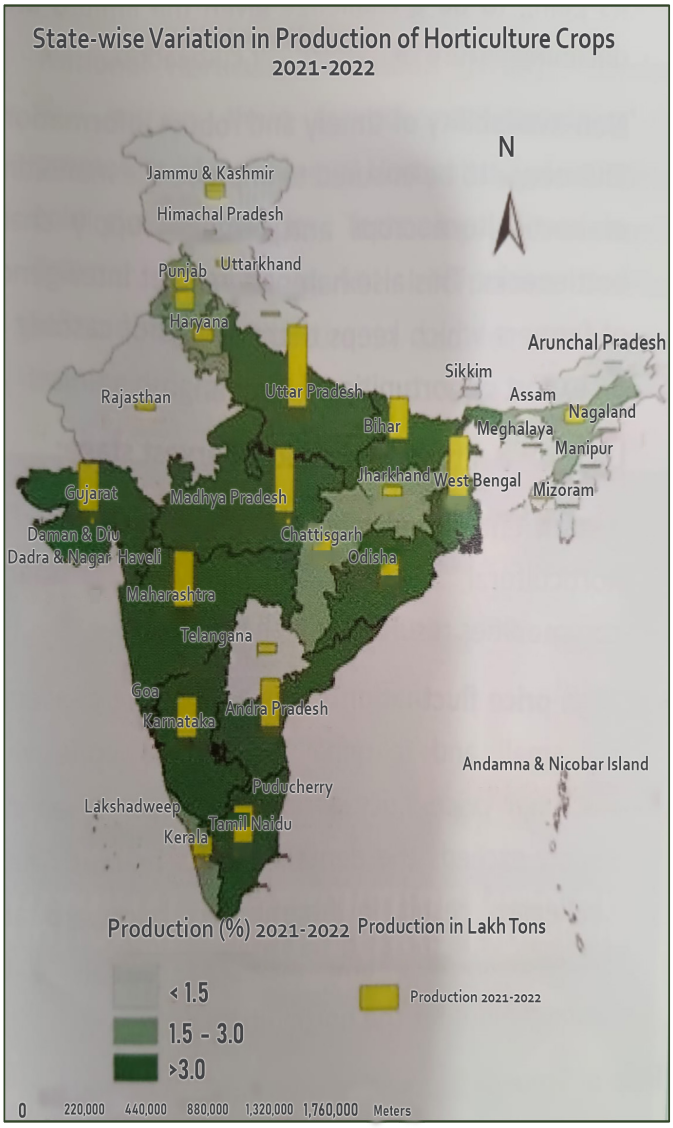
- Launched in 2014 to promote holistic development of the sector.
- Covers production, post-harvest management, and marketing.

National Horticulture Board (NHB)

- Implements cluster-based development programs.

- Focuses on cold storage, market linkages, and training programs.
- **Horticulture Mission for Northeast and Himalayan States (HMNEH)**
  - ➢ Provides 90% central funding for capacity-building and infrastructure development.
- **Coconut Development Board and Central Institute for Horticulture (CIH)**
  - ➢ Promote research, training, and value addition in specialized horticulture segments.
- **Agri-Infrastructure and Finance Support**
  - ➢ NABARD's Warehouse Infrastructure Fund (WIF) supports cold storage and processing infrastructure.
  - ➢ The government has encouraged FPOs (Farmer Producer Organizations) and SHGs (Self-Help Groups) to facilitate collective bargaining power.

6. Strategies for Sustainable Horticulture-Based Livelihoods



Developing a National Horticulture Policy

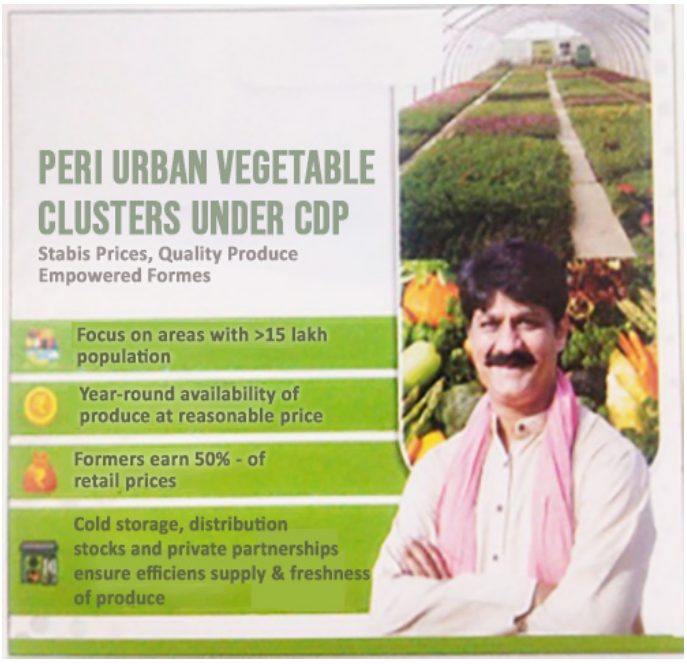
- Only Himachal Pradesh has a draft horticulture policy; other states should follow suit.
- A national framework ensuring region-specific strategies is required.

Strengthening Post-Harvest Management

- Investments in cold storage, food processing units, and supply chain logistics.
- Promotion of agro-processing industries linked to horticulture.

Expanding Credit and Insurance Access

- Providing easier access to farm credit, crop insurance, and risk mitigation strategies.
- Encouraging microfinance institutions to support small and marginal farmers.



Encouraging Research and Innovation

- Promoting climate-resilient and high-yielding horticulture varieties.
- Investing in precision farming and technology-driven solutions.
- Market and Export Facilitation
  - ➢ Strengthening market linkages through e-NAM (National Agricultural Market).
  - ➢ Improving branding and quality control measures for global competitiveness.
- Public-Private Partnerships (PPP) and Contract Farming

- Encouraging private sector participation in supply chain integration.
- Contract farming models to ensure fair prices and reduce farmer distress.

Skill Development and Capacity Building

- Training farmers in best horticultural practices, value addition, and organic farming.
- Expanding rural entrepreneurship through FPOs and cooperative societies.

7. Conclusion

Horticulture has the potential to transform rural economies by ensuring sustainable livelihoods, reducing out-migration, and increasing farmer incomes. While government initiatives have provided a strong foundation, further investment in post-harvest infrastructure, financial access, technological advancements, and policy reforms is needed. By fostering an enabling ecosystem and linking horticulture to agro-processing and global markets, India can position itself as a global leader in horticulture, ensuring prosperity for rural communities.

TOPIC 4: CLEAN PLANT PROGRAMME: REVOLUTIONIZING INDIAN HORTICULTURE

1. Introduction

India's horticulture sector, with its diverse climate and soil conditions, plays a pivotal role in the country's agricultural landscape. As the world's second-largest producer of fresh fruits and vegetables, India has immense potential to meet both domestic and international demands. However, to sustain and expand this leadership, the sector faces challenges such as enhancing crop quality, boosting productivity, and ensuring long-term sustainability. To address these concerns, the Union Cabinet approved the **Clean Plant Program (CPP)** in August 2024 under the **Mission for Integrated Development of Horticulture (MIDH)**, with an investment of **Rs. 1765.67 crore**.

The **Clean Plant Programme (CPP)** aims to provide virus-free, high-quality planting material to all farmers, ensuring inclusivity irrespective of landholding size or socioeconomic background. This initiative promises to enhance crop yields, reduce plant disease-related losses, and strengthen long-term food security.

2. Objectives and Features of the Clean Plant Programme

Providing High-Quality Planting Material

- Ensuring access to disease-free, superior planting materials.
- Boosting agricultural productivity by reducing losses due to plant diseases.

Establishment of Clean Plant Centers (CPCs)

- Setting up **nine state-of-the-art Clean Plant Centers** across India.
- Research, development, and distribution hubs for clean plant material.
- Implementation of cutting-edge horticultural technologies.

Enhancing Crop Resilience to Climate Change

- Developing **region-specific clean plant varieties** for diverse agro climatic conditions.
- Strengthening agricultural sustainability in the face of climate change.

Strengthening India's Export Market

- Ensuring Indian horticultural produce meets global quality standards.
- Enhancing competitiveness in international markets through virus-free, high-quality crops.

3. Key Benefits of the Clean Plant Programme

For Farmers

- Access to virus-free planting material improves crop yields and farm incomes.
- Healthier crops ensure reduced dependency on chemical pesticides and fertilizers.

For Nurseries

- **Streamlined certification processes** ensure standardized, high-quality plant material.
- **Infrastructure support** helps scale up production of clean planting materials.

For Consumers

- Availability of high-quality fruits and vegetables with **improved taste, nutritional value, and safety**.
- Reduction in chemical residue in food products.

For India's Export Market

- Strengthened position in the international fruit and vegetable trade.
- Compliance with global quality and disease-free certification standards.

4. Core Components Driving the Clean Plant Programme

Establishment of Clean Plant Centers (CPCs)

- **Nine CPCs across India** focusing on different crop types:
  - **Grapes:** NRC, Pune
  - **Apples, Almonds, Walnuts:** CITH, Srinagar & Mukteshwar
  - **Citrus Fruits:** CCRI, Nagpur
  - **Pomegranate:** NRC, Sholapur
  - **Mango, Guava, Avocado, Lychee:** IIHR, Bengaluru & CISH, Lucknow
  - **Tropical & Subtropical Fruits:** Eastern India
- Facilities include **tissue culture labs, diagnostic centers, and virus-elimination techniques**.

Strengthening Certification and Legal Framework

- Implementation of a **certification system under the Seeds Act, 1966**.
- Ensuring **traceability and accountability** in the distribution of planting material.

Infrastructure Support for Nurseries

- Upgradation of large-scale nurseries for efficient propagation and distribution.
- Improved **storage and transportation facilities**.

5. Integration with the Mission for Integrated Development of Horticulture (MIDH)

The **Clean Plant Programme (CPP)** aligns with **MIDH**, which was launched in **2014-15** to promote holistic growth in horticulture. While **MIDH** focuses on overall development, the **CPP** specifically targets the **quality of planting material**. Together, these programs strengthen India's horticultural sector by ensuring high productivity, sustainability, and improved farmer incomes.

Key Initiatives under MIDH

- **Plantation Infrastructure Development**
  - Establishment of **nurseries and tissue culture units** for high-quality seeds.
- **Area Expansion and Rejuvenation**
  - Development of new **orchards and modern irrigation techniques**.
  - Rejuvenation of **old, unproductive orchards**.
- **Protected Cultivation**
  - Promotion of **greenhouses, polyhouses, and micro-irrigation** systems.
- **Organic Farming**
  - Encouraging **organic certification** and sustainable farming practices.
- **Water Resource Management**
  - Creation of **community tanks, farm ponds, and water harvesting systems.**
- **Pollination Support & Beekeeping**
  - Promotion of **honeybee hives and pollination-friendly agriculture**.
- **Post-Harvest Management & Market Access**
  - Development of **cold storage, processing units, and farmer markets**.
  - Enhanced **direct market linkages** for better farmer incomes.

6. Conclusion: Transforming Indian Horticulture for a Sustainable Future

The **Clean Plant Programme (CPP)** is set to revolutionize India's horticulture sector by ensuring farmers have access to **virus-free, high-quality planting material**, thereby boosting **productivity, farmer income, and global competitiveness**. Through the establishment of **state-of-the-art Clean Plant Centers**, strengthening of **certification frameworks**, and integration with **MIDH**, India is moving towards a more **sustainable, resilient, and high-value horticulture sector**.

The holistic approach of the **CPP**, combined with supportive policies under **MIDH**, ensures that Indian horticulture remains globally competitive while benefiting farmers, consumers, and the economy at large. This initiative represents a **transformative step towards a prosperous, sustainable, and inclusive future for Indian agriculture.**

TOPIC 5: BEEKEEPING GENERATING EMPLOYMENT OPPORTUNITIES

1. Introduction

Honey bees represent one of nature's remarkable creations, offering numerous benefits to humanity. They produce honey, derived from the sugary secretion of plants such as floral nectar or the secretions of other insects like honeydew. This process involves regurgitation, enzymatic activity, and evaporation of water. Honey is stored in wax structures known as honeycombs. As humans mastered the art of domesticating bees and managing them in hives, significant advancements in beekeeping practices emerged. India, with its rich diversity of flora and fauna, stands as one of the world's mega-biodiversity hotspots, holding immense potential for beekeeping as a sustainable economic activity.

2. Migratory Beekeeping in India

To successfully engage in commercial migratory beekeeping, beekeepers plan their migrations according to available floral resources. In northern India, commercial beekeepers relocate their colonies between plains and hilly regions:

- **October–November**: Colonies are moved to the plains of Uttaranchal, Uttarakhand, Haryana, Punjab, and Rajasthan to take advantage of rapeseed and mustard blooms.
- **December–January**: Colonies are transferred to eucalyptus plantations in Uttar Pradesh and Haryana.
- **February–March**: Bee colonies are relocated to lychee orchards in Ramnagar and Dehradun, sunflower fields in Punjab and Haryana, and forest plantations in Uttar Pradesh to access shisham flowers until May.

3. Overview of Beekeeping in India

Beekeeping in India has evolved significantly:

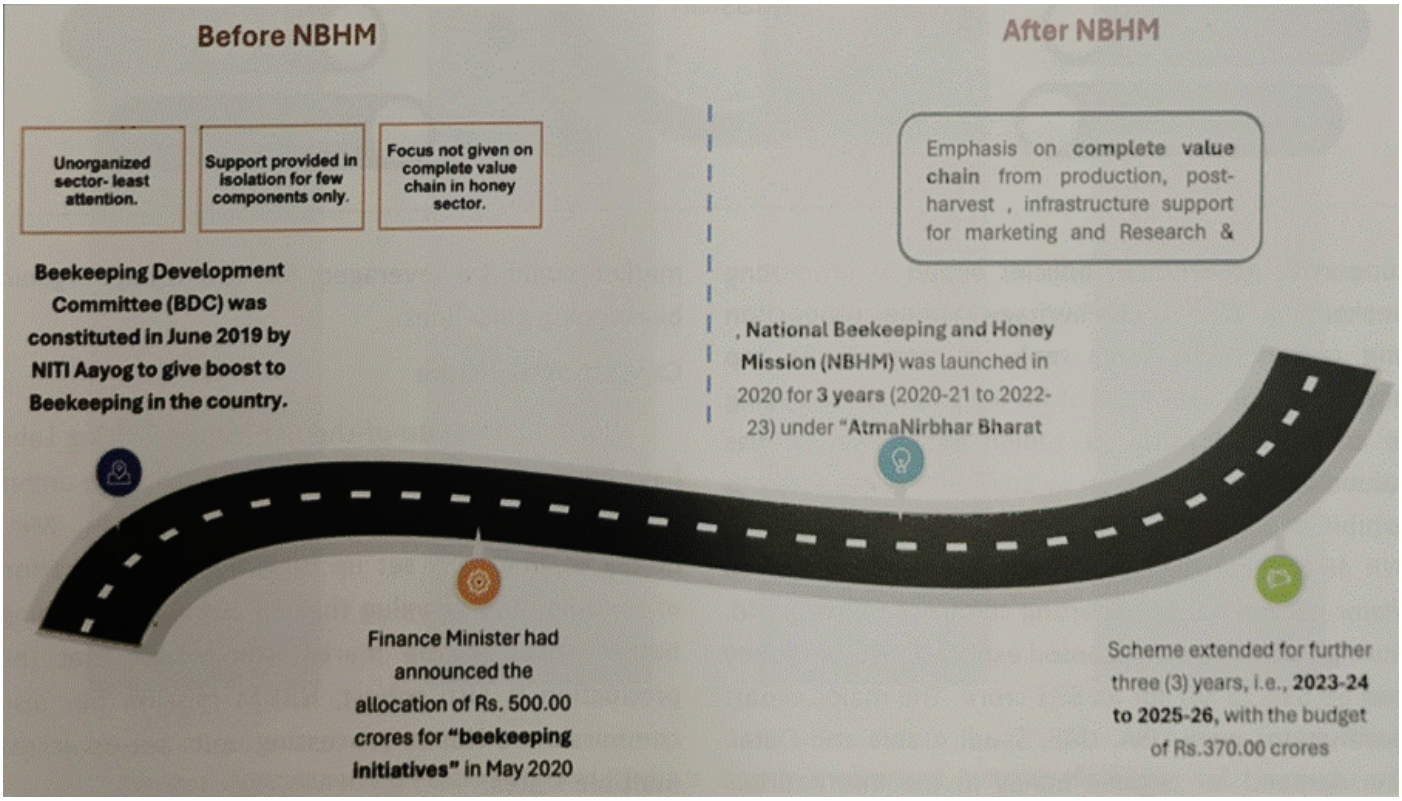
- **1909**: Rev. Father Newton designed a hive for Indian hive bees and established apiaries in Tamil Nadu.

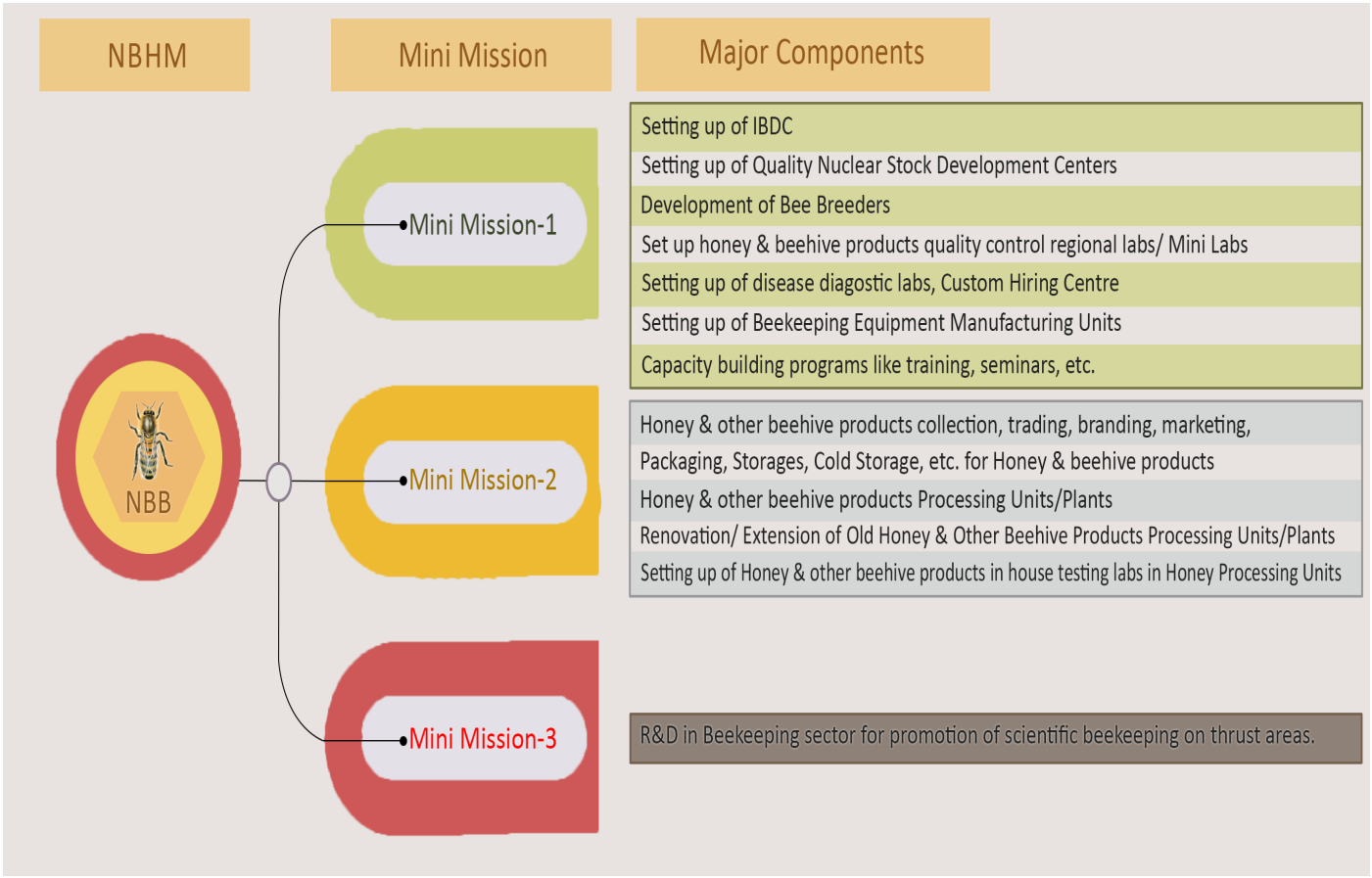
1917–1938: Beekeeping initiatives were introduced in Tamil Nadu (1917), Mysore (1925), Kashmir (1927), Punjab (1933), and Uttar Pradesh (1938).

- **Post-Independence**: The Khadi and Village Industries Commission (KVIC) recognized beekeeping as a key initiative.
- **1980**: ICAR launched the All India Coordinated Project (AICP) on Honeybee Research and Training.
- **1993**: The Department of Agriculture and Cooperation (DAC) initiated a national scheme to support research, training, and development in beekeeping.
- **2000**: National Bee Board (NBB) was formed as a registered society under the Society Registration Act 21 of 1860.
- **2006**: NBB was reconstituted with the Secretary of DA&FW as its chairman and became the nodal agency for the National Beekeeping and Honey Mission (NBHM).

Types of Honey-Based products:

National Beekeeping and Honey Mission (NBHM)





To realize the objectives of the "Sweet Revolution," the Government of India launched the **National Beekeeping and Honey Mission (NBHM)** as part of the **Atma Nirbhar Bharat Initiative (2020-21)**. The mission promotes:

- Scientific beekeeping practices
- High-quality honey and beehive product production
- Nationwide expansion of beekeeping

4. Honey Market in India

The honey market in India has grown remarkably over the past decade due to rising health awareness and government support:

- **Market Value (2023)**: INR 25.2 billion

- **Projected Growth (2024-2032)**: CAGR of 7.3%, expected to reach INR 48.6 billion by 2032
- **Global Position**: Among the top 10 natural honey exporters
- **Exports (2019-20)**: 59,536.75 metric tonnes worth INR 633 crore
- **Major Export Destinations**: USA, UAE, Saudi Arabia, and Qatar.

5. Infrastructure Development

- **Honey Testing Labs**: State-of-the-art facilities established to certify products and enhance market value.
- **Processing Units**: Commissioned under NBHM to ensure robust production and value addition.

6. Human Capital and Training Initiatives

- 35,000+ individuals trained in scientific beekeeping
- **5,000+ farmers trained under NDDB**
- **Women Empowerment**: 72 specialized SHG batches trained (25 women per batch)
- **CAPF Training (2023)**: 800+ master trainers trained across 144 units.

7. Revolutionizing Beekeeping in High-Altitude Regions

- **Key Honey Varieties**: Acacia, Solai, Jamun, Wild Ajwain, and Alfalfa honey
- **Initiatives:**
  - Mini testing labs (Bandipora, Pulwama, Kupwara, Ramban)
  - Honey processing/testing units (Uttarakhand, Assam)
  - Disease diagnostic labs (Himachal Pradesh, Uttarakhand)
  - Capacity building (Assam, Sikkim)

8. Digital Initiatives

- **Madhu Gandhi Portal (2021)**: Ensures honey traceability and digital registration of beekeepers and colonies
- **ONDC Integration**: Supports honey-based FPOs, promoting e-commerce and value-added business expansion.

9. Policy Initiatives

- **Minimum Export Price (MEP) Policy:**
  - Set at **USD 2,000 per metric tonne (PMT)**
  - Extended till **December 31, 2025**, ensuring fair trade practices
- **Quality Standards:**
  - Three FSSAI standards: Honey, Beeswax, and Royal Jelly
  - Revised FSSAI standards for honey operationalized in 2020
- World-Class Testing Infrastructure:
  - NABL-accredited quality control labs
  - Regional mini-labs in key honey-producing states.

10. Tapping Export Potential of Value-Added Products

- **Royal Jelly**: High-value export product, sold as dry powder in capsules
- **Bee Pollen**: Superfood, fetching premium prices
- **Bee Venom**: Used for arthritis treatment, priced between Rs. 5000-15000 per gram
- **Propolis**: Used in oral hygiene, wound healing, and inflammation treatment
- **Beeswax**: Key ingredient in cosmetics (lip balm, moisturizers, eyeliner, etc.)

11. Future Roadmap

- **Chemical Fingerprinting and GI Tagging**: Enhancing Indian honey's authenticity and market value
- **Strengthening Value-Added Supply Chains**: Building direct farmer-trader-processor-exporter linkages
- **Expanding Research on Honey Composition**: Unlocking therapeutic benefits and new market avenues.

12. Success Stories

(i) Sweet Success Story from Northeast India

- **M/S Salt Range Foods**: Established a direct

market linkage benefiting beekeepers and honey farmers.

- **Impact**: Strengthened honey FPOs, improved commercial honey production in the region.

(ii) Empowering Women in Tamil Nadu through Honey Bee Rearing

- **NBHM Initiative**: Rs. 120 lakh investment
- **37 SHGs Formed**: Across 13 districts
- **887 Women Trained**: Engaged in honey bee rearing, honey production, and nursery management
- **Impact**: Women entrepreneurs selling honey to tourists, enhancing income generation

13. Conclusion

Beekeeping is emerging as a powerful employment-generating industry in India, backed by policy initiatives, infrastructure development, digital integration, and value-added product expansion. With government support and technological advancements, beekeeping not only enhances rural livelihoods but also strengthens India's position in the global honey market. Future efforts must focus on research, market expansion, and empowering beekeepers to harness the full potential of this thriving sector.

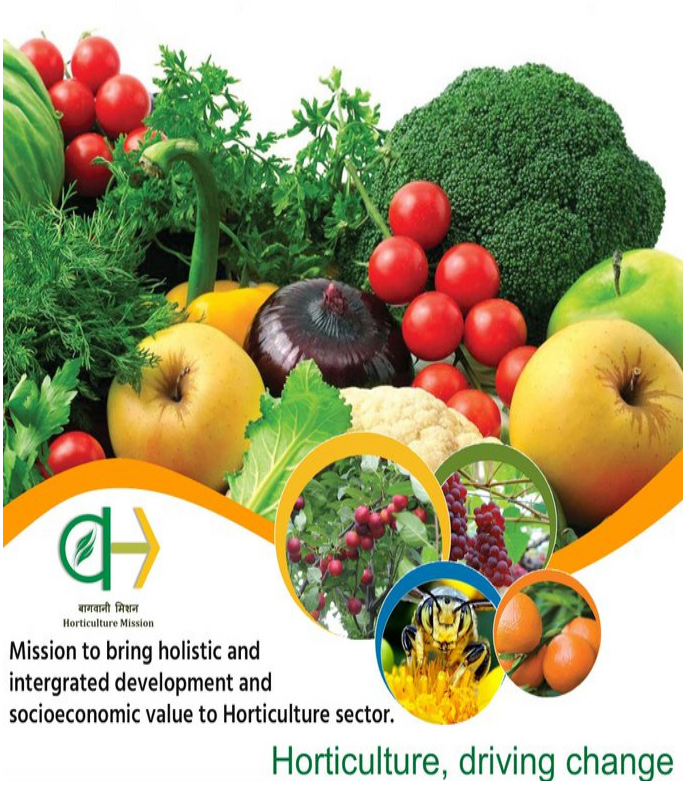
TOPIC 6: FRUIT-BASED FARMING SYSTEMS FOR IMPROVED INCOME AND LIVELIHOOD

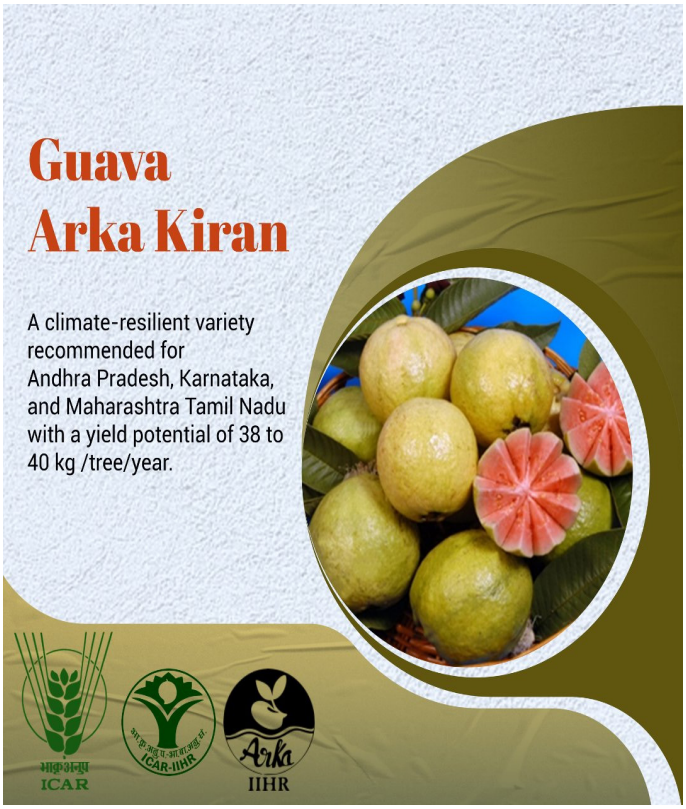
1. Introduction

India is a major global agricultural producer due to its diverse agro-climatic zones and a significant portion of its population engaged in farming. The horticulture sector plays a critical role in India's agriculture, contributing to income generation, employment, and export earnings. As of 2020-24, India's horticultural production reached **353.19 million tonnes**, with fruit production accounting for **112.73 million tonnes**. The fruit farming sector is expected to grow significantly, targeting **244 million tonnes by 2047** with a **2.99% annual growth rate**.

Fruit-based farming systems (FBFS) have emerged as a sustainable agricultural model, integrating fruit cultivation with other agricultural practices like vegetables, legumes, and livestock. This system enhances **land productivity, soil health, economic resilience, and ecological sustainability**. With increasing global demand for fruits and value-added products, fruit-based farming is becoming an essential component of rural livelihoods and food security.

Benefits of Fruit-Based Farming Systems





(i) Economic Upliftment

- Fruit crops provide **higher returns per unit area** than traditional crops.
- India's **fruit exports grew by 32.6%** in 2023-24, reaching **4.9 lakh MT**.
- High-value fruits such as mangoes, bananas, and grapes have **strong domestic and international demand**.
- **Export-oriented** fruit farming enhances India's foreign exchange earnings.

(ii) Environmental Sustainability

- **Soil conservation**: Practices like **mulching, contour farming, and crop rotation** prevent erosion.
- **Carbon sequestration**: Fruit trees help **absorb CO_2**, contributing to climate change mitigation.
- **Biodiversity enhancement**: Supports **natural pest control**, reducing dependency on chemical pesticides.
- **Eco-friendly practices**: Encourages **organic farming, water-efficient irrigation, and integrated farming**.

(iii) Contribution to Better Health

- Fruits are rich in **vitamins, minerals, and antioxidants**, improving nutrition.
- Enhances **food security** by **diversifying diets** and ensuring year-round availability of food.

(iv) Livelihood Diversification

- **Integrating fruit farming with livestock, vegetables, and agroforestry** minimizes income fluctuations.
- Value-added processing (e.g., **jam, juice, dried fruits**) generates **additional revenue streams**.
- **Employment generation**: Rural youth and women gain opportunities in **harvesting, processing, packaging, and marketing**.

3. Scope of Fruit-Based Farming Systems

(i) Arid and Semi-Arid Regions

- Drought-tolerant fruit varieties such as **pomegranate, date palm, and grapes** thrive in water-scarce areas.
- Techniques like **drip irrigation and mulching** enhance productivity in these regions.

(ii) Agroforestry and Mixed Cropping

- **Integration of fruit trees with cereals, pulses, and livestock** improves productivity and soil health.
- Reduces risks from **pests, diseases, and climate variability**.

(iii) Horticultural Tourism

- **Agro-tourism involving fruit picking, farm visits, and processing demonstrations** attracts visitors.
- Promotes **eco-tourism, local employment, and rural economy growth**.

(iv) Protected Cultivation of High-Value Crops

- Greenhouses and polyhouses enable **year-round cultivation** of fruits like **strawberries, dragon fruit, and guava**.
- Advanced **temperature and humidity control systems** improve fruit quality and yield.

(v) Diversification with Exotic Fruits

- High-value crops like **kiwi, avocado, passion fruit, and rambutan** provide new income opportunities.
- Demand for exotic fruits is **increasing in urban and export markets**.

4. Key Components of Fruit-Based Farming Systems

(i) Crop Selection and Zoning

- Identifying fruit crops based on **agro-climatic suitability** enhances productivity.
- Examples:
- **Mangoes** – Tropical & semi-arid regions.
- **Apples, pears** – Cool temperate zones.
- **Banana, pineapple** – Humid tropics.

(ii) Quality Planting Materials

- Establishing **certified nurseries** ensures access to **disease-resistant, high-yielding varieties**.
- Enhancing the availability of **grafted and tissue-cultured plants** can improve productivity.

(iii) Research and Development

- Investment in **climate-resilient and high-yield fruit varieties** can reduce risks associated with extreme weather.

- Technologies such as **genetic modifications and precision farming** can enhance efficiency.

(iv) Infrastructure Development

- **Cold storage and packhouses** extend shelf life and prevent post-harvest losses.
- Improved **transport and processing units** ensure better market access and higher profits.

(v) Climate-Resilient Farming Practices

- **Drought-resistant fruit crops** for dry areas: **Pomegranate, custard apple, fig**.
- **Flood-tolerant crops** for high-rainfall zones: **Banana, papaya, jackfruit**.
- **Windbreaks, shade nets, and rainwater harvesting** improve farm resilience.

(vi) Capacity Building

- Training farmers in **precision farming, integrated pest management (IPM), and post-harvest techniques**.
- Special focus on **women and small-scale farmers** for inclusive growth.

(vii) Market Linkages & Digital Platforms

- **E-marketplaces and AI tools** help farmers access real-time price trends.
- **E-NAM (National Agriculture Market), AgriApp, and Kisan Suvidha** provide farmers with **direct market access**.
- **GlobalGAP certification** enhances **export opportunities**.

5. Government Schemes for Fruit Farming

Scheme	Objective
National Horticulture Mission (NHM)	Infrastructure and technology support for fruit cultivation.
Mission for Integrated Development of Horticulture (MIDH)	Sustainable fruit farming practices and high productivity.
Pradhan Mantri Kisan Sampada Yojana (PMKSY)	Processing and cold chain development for value addition.
Pradhan Mantri Krishi Sinchai Yojana (PMKSY)	Efficient irrigation and water conservation for fruit farms.
Price Support Scheme (PSS)	Helps stabilize fruit prices and protect farmers from market fluctuations.

6. Challenges in Fruit-Based Farming Systems

Challenge	Impact
Land Fragmentation	Small landholdings limit mechanization and scalability.
Knowledge Gaps	Farmers lack awareness of modern fruit farming techniques.
High Initial Investment	Costly irrigation, saplings, and infrastructure hinder adoption.
Climate Vulnerability	Droughts, floods, and temperature variations affect productivity.
Post-Harvest Losses	Poor storage and transportation lead to fruit wastage
Market Instability	Price fluctuations and lack of MSP for fruits create Price fluctuations and lack of MSP for fruits create

7. Conclusion

Fruit-based farming systems provide a **sustainable, profitable, and environmentally friendly** approach to agriculture. By integrating **high-value fruits, efficient irrigation, protected cultivation, and modern market linkages**, farmers can **enhance income, food security, and economic resilience**. Government support, advanced research, and technology-driven solutions are crucial for overcoming challenges such as **climate risks, post-harvest losses, and fragmented landholdings**. Strengthening fruit-based farming systems will not only boost **rural livelihoods and national GDP** but also position India as a **global leader in fruit exports**.