Toppersnotes
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# UPSC Mains

## Union Public Service Commission

## Volume – 4

## Agriculture, Disaster Management & Internal Security

SIERRA INNOVATIONS

# INDEX

# INDEX

## Previous Year Questions

| Year | Questions |
|---|---|
| 2013 | India needs to strengthen measures to promote the pink revolution in the food industry for better nutrition and health. Critically elucidate the statement. |
| 2013 | Establish the relationship between land reform, agriculture productivity and elimination of poverty in the Indian Economy. Discuss the difficulty in designing and implementation of the agriculture friendly land reforms in India. |
| 2013 | The food security bill is expected to eliminate hunger and malnutrition in India. Critically discuss various apprehensions in its effective implementation along with the concerns it has generated in WTO. |
| 2013 | What are the different types of agriculture subsidies given to farmers at the national and state levels? Critically analyze the agriculture subsidy regime with the reference to the distortions created by it. |
| 2014 | The right to fair compensation and transparency land acquisition, rehabilitation and resettlement act, 2013 has come into effect from 1 January 2014. What implication would it have on industrialisation and agriculture in India? |
| 2014 | There is also a point of view that agriculture produce market committees (APMCs) set up under the state acts have not only impeded the development of agriculture but also have been the cause of food inflation in India. Critically examine. |
| 2014 | "In the villages itself no form of credit organisation will be suitable except the cooperative society." - All Indian rural credit survey. Discuss this statement in the background of agriculture finance in India. What constraints and challenges do financial institutions supplying agricultural finances? How can technology be used to better reach and serve rural clients? |
| 2015 | How can the 'Digital India' programme help farmers to improve farm productivity and income? What steps has the Government taken in this regard? |
| 2015 | Livestock rearing has a big potential for providing non-farm employment and income in rural areas. Discuss suggesting suitable measures to promote this sectors in India. |
| 2015 | In view of the declining average size of land holdings in India which has made agriculture non-viable for a majority of farmers, should contract farming and land leasing be promoted in agriculture? Critically evaluate the pros and cons. |
| 2015 | What are the impediments in marketing and supply chain management in industry in India? Can e- commerce help in overcoming these bottlenecks? |
| 2016 | What is water-use efficiency? Describe the role of micro-irrigation in increasing the water-use efficiency. |
| 2016 | What is allelopathy? Discuss its role in major cropping systems of irrigated agriculture. |
| 2016 | Given the vulnerability of Indian agriculture to vagaries of nature, discuss the need for crop insurance and bring out the salient features of the Pradhan Mantri Fasal Bima Yojana (PMFBY) |
| 2016 | Discuss the role of land reforms in agricultural development. Identify the factors that were responsible for the success of land reforms in India. |

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| 2017 | What are the major reasons for declining rice and wheat yield in the cropping system? How crop diversification is helpful to stabilize the yield of the crop in the system? |
| 2017 | Explain various types of revolutions, took place in Agriculture after Independence in India. How have these revolutions helped in poverty alleviation and food security in India? |
| 2017 | What are the reasons for poor acceptance of cost effective small processing units? How will the food processing unit be helpful to uplift the socio-economic status of poor farmers? |
| 2017 | How do subsidies affect the cropping pattern, crop diversity and economy of farmers? What is the significance of crop insurance, minimum support price and food processing for small and marginal farmers? |
| 2018 | Sikkim is the first 'Organic State' in India. What are the ecological and economical benefits of Organic State? |
| 2018 | Assess the role of National Horticulture Mission (NHM) in boosting the production, productivity and income of horticulture farms. How far has it succeeded in increasing the income of farmers? |
| 2018 | How has the emphasis on certain crops brought about changes in cropping patterns in the recent past? Elaborate the emphasis on millets production and consumption. |
| 2018 | Examine the role of supermarkets in supply chain management of fruits, vegetables and food items. How do they eliminate the number of intermediaries? |
| 2018 | What do you mean by Minimum Support Price (MSP)? How will MSP rescue the farmers from the low income trap? |
| 2019 | How can biotechnology improve the living standards of farmers? |
| 2019 | How far is the Integrated Farming System (IFS) helpful in sustaining agricultural production? |
| 2019 | Elaborate on the impact of the National Watershed Project in increasing agricultural production from water-stressed areas. |
| 2019 | How India benefited from the contributions of Sir M.Visvesvaraya and Dr. M. S. Swaminathan in the fields of water engineering and agricultural science respectively? |
| 2019 | Elaborate on the policy taken by the government of India to meet the challenges of the food processing sector. |
| 2019 | What are the reformative steps taken by the government to make the food grain distribution system more effective? |
| 2020 | What are the main constraints in transport and marketing of agricultural produce in India ? |
| 2020 | What are the major factors responsible for making the rice-wheat system a success? In spite of this success, how has this system become banned in India? |
| 2020 | Suggest measures to improve water storage and irrigation system to make its judicious use under depleting scenarios. |
| 2021 | How did land reforms in some parts of the country help to improve the socio-economic conditions of marginal and small farmers? |
| 2021 | How and to what extent would micro-irrigation help in solving India's water crisis? |
| 2021 | What are the present challenges before crop diversification? How do emerging technologies provide an opportunity for crop diversification? |
| 2022 | What are the major challenges of the Public Distribution System (PDS) in India? How can it be made effective and transparent? |
| 2022 | Elaborate the scope and significance of the food processing industry in India. |

| | |
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| 2022 | What are the main bottlenecks in the upstream and downstream process of marketing of agricultural products in India? |
| 2022 | What is Integrated Farming System? How is it helpful to small and marginal farmers in India? |
| 2023 | How does e-Technology help farmers in production and marketing of agricultural produce? Explain it. |
| 2023 | State the objectives and measures of land reforms in India. Discuss how land ceiling policy on landholding can be considered as an effective reform under economic criteria. |
| 2023 | Explain the changes in cropping pattern in India in the context of changes in consumption pattern and marketing conditions. |
| 2023 | What are the direct and indirect subsidies provided to the farm sector in India? Discuss the issues raised by the World Trade Organization in relation to agricultural subsidies. |
| 2024 | Explain the role of millets for ensuring health and nutritional security in India. |
| 2024 | What are the major challenges faced by the Indian irrigation system in recent times? State the measures taken by the government for efficient irrigation management? |
| 2024 | Elucidate the importance of buffer stocks for stabilizing agricultural prices in India. What are the challenges associated with the storage of buffer stock? |
| 2025 | Explain the factors influencing the decision of the farmers on the selection of high value crops in India. (Answer in 150 words) |
| 2025 | Elaborate the scope and significance of supply chain management of agricultural commodities in India. (Answer in 150 words) |
| 2025 | Examine the scope of the food processing industries in India. Elaborate the measures taken by the government in the food processing industries for generating employment opportunities. (Answer in 250 words) |

# 1 CHAPTER

# Agriculture Inputs

**Agriculture** refers to the art and science of soil cultivation, crop production, and livestock rearing.

- India's agriculture sector has shown strong resilience, recording an average annual growth rate of 5% between FY17 and FY23.
- As per the Agricultural Census (2021), 73.2% of rural women participate in agricultural activities, yet only 12.8% own landholdings.
- An RBI study (2019) highlighted that 28% of agricultural credit still comes from informal sources such as moneylenders, traders, and relatives. Among small farmers, nearly 60% lack access to bank credit.

**International Commitments to Agriculture**

- **UN SDG-1:** Eradication of poverty in all its forms.
- **UN SDG-2:** Ending global hunger, safeguarding indigenous seeds and crop varieties, and doubling agricultural productivity and small farmers' incomes by 2030.

**Indian Commitments to Agriculture**

- **Agriculture** falls under the **State List**.
- **Entry 14** of the State List covers agriculture.
- **Entry 33** of the Concurrent List relates to trade and commerce in agricultural products.

## Agriculture Finance

- Agriculture finance refers to the flow of credit, insurance, investments, subsidies, and institutional support required to carry out agricultural and allied activities.
- It is a critical input that influences productivity, technology adoption, diversification, and farmer resilience.

### A. Importance of Agriculture Finance

- ✓ **Capital-intensive nature of modern agriculture:** Mechanisation, high-yield seeds, irrigation, fertilisers, cold chains, and post-harvest infrastructure requires upfront investment.
- ✓ **Supports shift to high-value agriculture:** Horticulture, dairy, fisheries, and commercial farming need more formal credit.
- ✓ **Risk mitigation:** It helps farmers withstand climate shocks, market volatility, and crop losses.
- ✓ **Enabling diversification:** The availability of credit facilitates shift from rice–wheat cropping to millets, pulses, fodder crops, and allied sectors.
- ✓ **Reduces dependence on informal sources:** It curbs exploitation by moneylenders; promotes formal financial inclusion.

### B. Institutional Architecture

- ✓ **RBI** issues policy directions for agricultural credit, including PSL norms, KCC guidelines, and rules related to priority-sector lending.
- ✓ **NABARD** provides refinance support, manages the Rural Infrastructure Development Fund (RIDF), strengthens the cooperative credit structure, and finances watershed and farm-level infrastructure.

- ✓ **Commercial Banks** hold the largest share of formal agricultural lending in India.
- ✓ **Regional Rural Banks (RRBs)** primarily serve small and marginal farmers in rural areas.
- ✓ The **Cooperative Credit System**, consisting of PACS, DCCBs, and SCBs, plays a key role in providing short-term crop finance.
- ✓ **NBFCs, MFIs, and FinTechs** offer digital lending solutions for small-ticket agricultural credit using tools such as predictive credit scoring and satellite-based assessments.
- ✓ **Government Schemes** like PM-KISAN, the Interest Subvention Scheme, and PMFBY support farmers through income assistance, lower loan costs, and risk reduction.

**C. Types of Agriculture Finance**

- ✓ **Short-Term Finance (Crop Loan):**
  - It is basically for seeds, fertilisers, labour, irrigation, electricity, pesticides.
  - Kisan Credit Card (KCC) is the primary instrument.
- ✓ **Medium-Term Finance:**
  - It is for farm machinery, pumpsets, livestock, borewells, fencing.
- ✓ **Long-Term Finance:**
  - It is for land development, irrigation structures, warehouses and storages.
  - NABARD's Long-Term Irrigation Fund, Agriculture Infrastructure Fund.
- ✓ **Value Chain Finance:**
  - It is for Agri-startups, FPOs, contract farming, processors, supply-chain logistics.

**D. Key Schemes & Instruments**

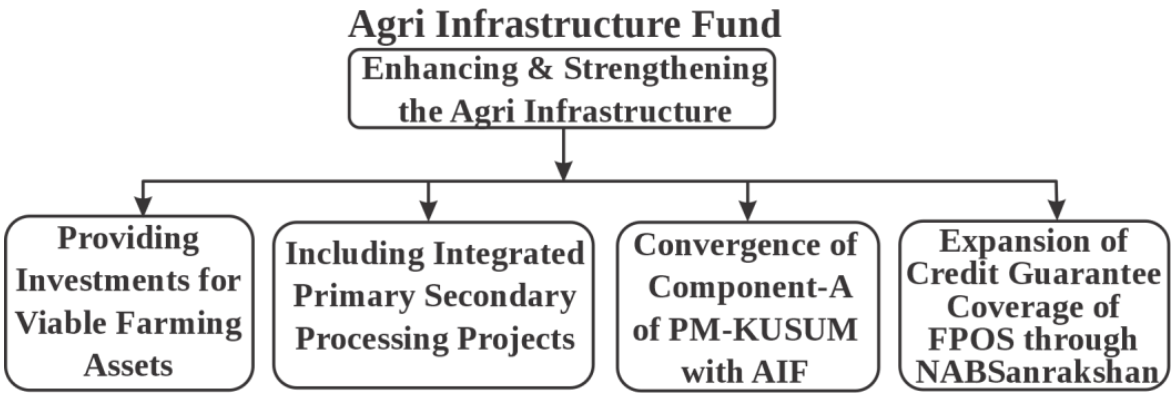
**1. Kisan Credit Card (KCC)**

- ✓ It is flexible revolving credit for crop loans.
- ✓ It covers short-term credit, consumption needs, and marketing costs. It also includes accident insurance.
- ✓ It has the target of Universal KCC for farmers, including dairy & fisheries.

**2. Interest Subvention Scheme (ISS)**

- ✓ It is primarily for Indian farmers, providing subsidized loans at a low effective interest rate (around 4%) by paying option of the interest directly to banks.

**3. Agriculture Infrastructure Fund (AIF) (2020–2032)**




- ✓ A ₹1 lakh crore financing facility has been introduced to support the development of post-harvest infrastructure such as warehouses, grading and sorting units, cold chains, and primary processing centres.

4. **PM-KISAN**
   - ✓ An income support of ₹6,000 per year is provided to farmers, which helps reduce their dependence on credit for meeting working-capital needs.
5. **Rural Infrastructure Development Fund (RIDF)**
   - ✓ It is a NABARD-managed fund for states to build irrigation, rural roads, and bridges.
6. **FPO Support – Equity Grant & Credit Guarantee**
   - ✓ Encourages collectivisation for better credit access and scale advantages.

**Data**

- ➢ Agriculture accounts for around 15-18% of the total institutional credit in India.
- ➢ Although 80% of India's farmers are small and marginal, they receive less than 50% of the formal sector credit.
- ➢ Digital agricultural lending is expanding rapidly, growing at a CAGR of 35-40%, largely due to fintech participation.
- ➢ Formal institutions meet only 35-40% of rural credit requirements, making informal lenders still a significant source of finance in rural areas.

**E. Challenges in Agriculture Finance**

1. **Structural Issues**
   - ✓ Small landholdings provide low collateral, creating a high perceived risk for lenders.
   - ✓ Fragmented land records and pending mutations make loan assessment difficult for financial institutions.
   - ✓ Heavy reliance on consumption loans disguised as crop loans.
2. **Systemic Challenges**
   - ✓ Over-concentration of bank lending in a few crops like rice, wheat, sugarcane.
   - ✓ Under-financing of allied sectors, value chains, post-harvest infra.
   - ✓ High NPAs in the agriculture sector lead to more cautious lending by banks.
   - ✓ Cooperative credit structure weaknesses (dual control, limited capital).
3. **Farmer-Side Issues**
   - ✓ Low financial literacy & poor documentation.
   - ✓ Lack of access to insurance and risk management tools.
   - ✓ Limited awareness of credit products beyond KCC.

**Agricultural Credit and Indebtedness in India**

- ➢ Over 50% of agricultural households in India were indebted in 2018. The average outstanding loan per household rose to **₹74,121 in 2018**, up from **₹47,000 in 2013**.
- ➢ According to the Economic Survey 2022-23, the average monthly income of an agricultural household in 2018-19 was ₹10,218, marking a 59% increase from ₹6,426 in 2012–13.

| Causes of High Indebtedness | Measures to Improve the Situation |
|---|---|
| ➢ Using Credit for Domestic Purpose<br>➢ Inadequate access to low-cost financing is at the root of rural misery.<br>➢ The ability of rural poor households to provide assets as collateral is a | ➢ Access to affordable credit<br>➢ Agricultural Loans with Gold as Collateral<br>➢ Restricting Farm Loan Waivers<br>➢ Credit Guarantee Plan for Agriculture, example Kisan Credit Card Scheme and PM Kisan Yojana.<br>➢ Increasing Credit to Allied Activities, for example, PM SAMPADA yojana to promote food processing |

| | |
|---|---|
| major determinant of their access to institutional lending.<br>➢ Factor of Social Identities<br>➢ High input costs<br>➢ Fluctuating commodity prices | industry is a welcome step and it provides credit to associated allied sectors as well.<br>➢ Land Consolidation<br>➢ Disparities on credit access across states. |

**F. Reforms & Way Forward**

1. **Digitisation of land records (DILRMP)** for transparent collateralisation.
2. **Satellite monitoring & AI-based credit scoring** to reduce information asymmetry.
3. **Extending KCC to all allied sectors** (dairy, fisheries, sericulture, poultry).
4. **Strengthening PACS (Primary Agricultural Credit Societies):**
   - ✓ Integrating PACS with Core Banking.
   - ✓ Expanding PACS into multi-service centres enables them to provide inputs, storage facilities, and marketing services to farmers.
5. **Promoting Value-Chain Finance:**
   - ✓ Linking FPOs with banks to ensure formalisation of the economy.
   - ✓ Tripartite agreements in contract farming to reduce the role of middle-man's.
6. **Developing Weather Derivatives & Crop Insurance Integration** for risk mitigation.
7. **Shift from subsidy-driven to investment-driven finance**, especially long-term infra.
8. **Green Finance for Agriculture:**
   - ✓ Climate-smart agriculture, solar pumps, micro-irrigation, carbon farming.
   - ✓ India needs **$20–30 billion/year** climate-agriculture finance by 2030.

# Crop Insurance

- ➢ Crop insurance is a critical risk-management tool designed to protect farmers against crop losses arising from natural calamities, pests, diseases, and market fluctuations.
- ➢ It supports income stability, encourages investment in modern technologies, and strengthens the resilience of the agricultural sector.

**A. Need for Crop Insurance**

1. **High vulnerability of Indian agriculture:**
   - ✓ Around 52% of the country's net sown area is rainfed.
   - ✓ Climate events (heatwaves, unseasonal rains, droughts) are increasing in frequency.
2. **Protects farmers from income shocks** during crop loss.
3. **Facilitates credit flow:** Banks lend more confidently when crops are insured.
4. **Encourages technology adoption** - farmers invest in HYVs, micro-irrigation, fertilisers when risk is reduced.
5. **Supports national food security** by stabilizing agricultural output.

**B. PMFBY – Pradhan Mantri Fasal Bima Yojana (2016)**

- ➢ PMFBY is India's flagship crop insurance programme.
- ➢ Its objectives include providing financial support to farmers, stabilising their incomes, encouraging modern agricultural practices, and ensuring quick settlement of insurance claims.

**Key Features**

1. **Low farmer premium:**
   - ✓ Farmers need to pay 2% for Kharif crop, 1.5% for Rabi crop and 5% for commercial / horticultural crop and remaining premium shared by Centre & States.

2. **Coverage:**
   - ✓ Prevented sowing, standing crop, post-harvest losses, localised calamities.
   - ✓ Now optional for farmers (earlier mandatory for loanee farmers).

**Data and Facts**

- ➢ Around 3.6 crore farmers enroll in PMFBY every year on average.
- ➢ About 95-97% of the insurance claims are settled annually, although delays still occur in many states.
- ➢ PMFBY covers only 30–35% of India's gross cropped area, which remains significantly lower than global benchmarks such as the United States, where coverage is around 80%.
- ➢ Since its launch, the scheme has paid claims worth approximately ₹1.4 lakh crore.
- ➢ States such as Maharashtra, Madhya Pradesh, Rajasthan, and Karnataka have emerged as the major beneficiaries of the scheme.

## C. Challenges in India's Crop Insurance

### 1. Operational Challenges

- ✓ Delayed crop cutting often leads to delayed insurance payouts for farmers.
- ✓ Rising insurance premium burdens have caused some states to opt out of the scheme, as seen initially in Andhra Pradesh and West Bengal.
- ✓ Inaccurate land records and tenancy issues result in many sharecroppers being excluded from coverage.
- ✓ Farmer awareness remains very low, with many not fully understanding the scheme's coverage and benefits.

### 2. Financial Challenges

- ✓ High claim ratios during extreme weather years place a heavy financial burden on both insurers and state governments.
- ✓ Delays by states in releasing their share of the premium subsidy lead to blockages in claim processing for farmers.

### 3. Structural Challenges

- ✓ Uniform premiums may not reflect region-specific risks.
- ✓ Insufficient use of digital tools in some districts.
- ✓ Moral hazard & adverse selection concerns.

### 4. Inclusion Gaps

- ✓ Tenant farmers, sharecroppers are often excluded from the scheme because they lack formal land titles.
- ✓ Only about 20% of insured farmers opt for coverage through voluntary enrollment.

## D. Reforms & Way Forward

- ➢ **Full digitisation of land records & Fasal Bima Enrollment via Dharani / Bhulekh** will help improve transparency, accuracy, and inclusion in the crop insurance system.
- ➢ A **transition to hybrid yield, weather and satellite index models** can significantly reduce dependence on traditional CCEs for yield estimation.
- ➢ **Income Insurance Pilots: Combine MSP & yield risk to protect farm income**, offering a more comprehensive safety net for farmers.
- ➢ **Customized insurance products for millets, horticulture, protected cultivation, and livestock** will allow risk coverage tailored to diverse agricultural activities.

- **Strengthening State participation:** Timely release of premium subsidies is essential for smooth claim processing and uninterrupted scheme implementation.
- **Expansion to allied sectors:** dairy disease insurance and fisheries storm insurance will broaden the coverage beyond crop-based risks.
- **Dedicated Agri-Disaster Funds to complement PMFBY during extreme climate years** can provide additional financial support when large-scale losses occur.
- **Crop Insurance Literacy Campaigns through FPOs, Krishi Vigyan Kendras (KVKs), and CSCs** can enhance farmer awareness and improve voluntary enrollment.

# Irrigation Systems

- Irrigation systems refer to the physical structures, institutions, and methods used to deliver water to croplands for assured production.
- In India, irrigation is a decisive factor in crop productivity, diversification, and resilience to climate variability.

**A. Significance of Irrigation in Indian Agriculture**

- **Stabilizes yields** in drought-prone and rainfed regions (rainfed India contributes ~40% of foodgrain output).
- **Enables multi-cropping** and shifts to high-value horticulture.
- **Reduces groundwater dependence** when canal and micro-irrigation are optimized.
- **Helps climate adaptation** by mitigating rainfall variability impacts.
- **Promotes mechanisation and input efficiency**, especially fertilisers and seeds.

- **Irrigation coverage** in India increased from **49.3% to 55%** of the **gross cropped area** between **FY16 and FY21**.
- Under **PMKSY – Per Drop More Crop**, around **32 lakh hectares** have been brought under **micro-irrigation**.
- Under **PMKSY – Har Khet Ko Pani**, **395 water bodies** were **renovated/repaired** during **2018–2021** to improve irrigation potential.

**B. Major Irrigation Sources in India**

**1. Groundwater Irrigation (dominant source)**

- ✓ Accounts for around **65% of India's irrigation**, highest globally.
- ✓ Tubewells and borewells expanded rapidly post-Green Revolution.
- ✓ Particularly dominant in **UP, Punjab, Rajasthan, Bihar, Haryana**.
- ✓ **Concerns:**
  - Falling water tables, energy-intensive extraction, and regional over-exploitation, with 45 percent of assessed blocks classified as semi-critical, critical, or over-exploited, are putting increasing pressure on India's groundwater resources.

**2. Surface Irrigation**

- ✓ Includes canals, tanks, diversion structures.
- ✓ Contributes around **25% of irrigation share overall.**
- ✓ More prominent in **Andhra Pradesh, Telangana, Tamil Nadu, Karnataka**.
- ✓ Command Area Development (CAD) is crucial for water-use efficiency.
- ✓ It can recharge groundwater and support large, contiguous command areas.

**3. Tank Irrigation**

- ✓ Traditional systems, especially in **South India** (Tamil Nadu, Karnataka).
- ✓ Critical for drought-prone and semi-arid regions.

- ✓ Tanks also provide fisheries, groundwater recharge, and flood mitigation.
- ✓ The major challenge includes encroachment, siltation, poor maintenance, decline in community management.

**4. Lift Irrigation**

- ✓ Used where terrain prevents gravity flow.
- ✓ Popular in **Maharashtra, Telangana, Madhya Pradesh**.
- ✓ Energy-intensive but useful for undulating topography.

**5. Micro-Level Irrigation Structures**

- ✓ **Check dams**, **farm ponds**, **anicuts**, **percolation tanks**.
- ✓ Important for local water storage, aquifer recharge, and supplemental irrigation.

**C. Key Government Initiatives for Irrigation**

**1. PMKSY (Pradhan Mantri Krishi Sinchayee Yojana) – "More Crop Per Drop"**

A flagship umbrella programme for irrigation development.

**Components:**

- ✓ **Accelerated Irrigation Benefit Programme (AIBP):** Finishes long-pending major/medium irrigation projects.
- ✓ **Har Khet Ko Pani:** Expands irrigation coverage, including water harvesting structures and micro-irrigation.
- ✓ **Watershed Development Component:** Soil-moisture conservation, check dams, ridge-to-valley treatment.
- ✓ **Per Drop More Crop:** Focuses on micro-irrigation expansion.

**2. Command Area Development & Water Management (CADWM)**

- ✓ Improves distribution efficiency through lining, field channels, and drainage.
- ✓ Aims to increase water use efficiency in canal commands.

**3. National Aquifer Mapping & Management Programme (NAQUIM)**

- ✓ It maps aquifers with high-resolution GIS.
- ✓ Supports scientific groundwater management plans.

**4. Atal Bhujal Yojana**

- ✓ It is a performance-based groundwater management across **7 states**.
- ✓ Focuses on community participation and demand-side management.

**D. Structural and Operational Issues in Irrigation**

**1. Skewed Dependence on Groundwater**

- ✓ Creates **regional water imbalance** (Punjab and Haryana over-extraction vs Eastern India's under-utilisation).

**2. Inefficiency of Canal Systems**

- ✓ Distribution losses up to **35-40%** due to seepage, siltation, and poor maintenance.
- ✓ Tail-end farmers often face inequitable access.

**3. Low Irrigation Water-Use Efficiency (WUE)**

- ✓ India's agricultural WUE is around **35-40%**, far below global benchmarks (China ~55-60%).

**4. Incomplete Projects**

- ✓ Long delays in major/medium irrigation projects cause cost overruns and under-utilised potential.

**5. Poor Conjunctive Use Practices**

- ✓ Excessive groundwater extraction combined with the underuse of surface water leads to unsustainable aquifer depletion.

6. **Climate Change Impacts**
   - ✓ High temperature leads to more evaporation.
   - ✓ Greater variability in the monsoon increases the need for more regulated water storage.

**E. Reforms & Way Forward**

1. **Shift to Demand-Side Water Management instead of just expanding supply** to ensure long-term sustainability of water resources.
2. **High-frequency irrigation scheduling using drones, soil moisture sensors, and IoT meters** enables precise water application and reduces wastage.
3. **Irrigation Service Fee (ISF) reforms for equitable and efficient water distribution** can improve cost recovery and promote responsible water use.
4. **Promote piped distribution systems to reduce canal seepage losses**, thereby improving overall irrigation efficiency.
5. **Water budgeting at Gram Panchayat level, as piloted in Atal Bhujal Yojana**, helps communities plan and regulate their water use effectively.
6. **Expand tank modernisation programmes in South India and restore traditional water bodies** to strengthen decentralised water storage.
7. **Incentivise crop diversification away from water-intensive paddy and sugarcane** to reduce pressure on groundwater and canal systems.
8. **Interlinking of rivers (ILR) only where hydrologically feasible; focus on basin-based planning** to ensure ecological and economic sustainability.
9. **GIS-based real-time irrigation monitoring dashboards for transparency and project completion tracking** can enhance accountability and improve implementation outcomes.

## Water Storage

- Water storage refers to capturing and holding rainfall/river water in structures for regulated, year-round release.
- It is the backbone of drought-proofing, Rabi irrigation, and groundwater recharge in Indian agriculture.

**Why Storage Matters**

- India gets around 75% rainfall in just four months, so adequate storage is essential to convert seasonal rain into a perennial water supply.
- It helps buffer dry spells, delayed monsoons, and erratic rainfall, while supporting multi-cropping and horticulture, thereby stabilising agricultural output.
- Storage also promotes groundwater recharge, which helps reduce over-extraction from aquifers.

- **Major Storage Structures**
  - ✓ Large **dams and barrages** such as **Bhakra–Nangal, Hirakud, and Sardar Sarovar** provide large command areas, generate **hydropower**, and support **flood moderation**.
  - ✓ However, they face major problems such as **siltation**, **evaporation losses**, long gestation periods, **displacement**, and significant **ecological impacts**.
  - ✓ **Medium and minor tanks**, which are vital in **South and East India**, are efficient for small command areas and aid **groundwater recharge**, but they are affected by **siltation**, **encroachment**, and weak community management.
  - ✓ **Check dams and anicuts**, built as small barriers on streams, are crucial in semi-arid regions like **Rajasthan, Maharashtra, and Bundelkhand** for improving **groundwater recharge**.

- ✓ **Farm ponds** serve as on-farm water storage pits that provide supplemental irrigation during critical crop stages.
- ✓ **Percolation tanks** are constructed primarily to enhance **aquifer recharge** in dry zones.
- ✓ **Rooftop rainwater harvesting** and traditional **village tanks** offer micro-level water security, especially in states such as **Tamil Nadu and Rajasthan**.
- ✓ **Multi-purpose water models** integrate irrigation with **fisheries**, **livestock needs**, and **drinking water supply**, maximising overall utility.

➢ **Schemes Supporting Storage**

- ✓ **PMKSY – Har Khet Ko Pani (Pradhan Mantri Krishi Sinchai Yojana)** promotes the creation of **check dams**, **ponds**, and **groundwater recharge structures** to ensure water availability for every field.
- ✓ **AIBP (Accelerated Irrigation Benefits Programme)** provides financial support for **major and medium irrigation projects** that are linked to water storage.
- ✓ **DRIP (Dam Rehabilitation and Improvement Project)** focuses on **dam safety** and the **life extension of reservoirs**, ensuring structural and operational efficiency.
- ✓ **Watershed programmes** combined with **MGNREGA** support **ridge-to-valley treatment**, construction of **bunds**, **farm ponds**, and **small check dams** for improved soil and water conservation.

➢ **Key Challenges & Way Forward**

- ✓ **Rapid siltation** and **poor catchment treatment** are causing a steady decline in **live storage capacity** in many reservoirs.
- ✓ **High evaporation losses** in arid zones and **small landholdings** limit the scope for effective on-farm storage.
- ✓ There is a growing need for **decentralised storage** (i.e., *"many small over few big"*), along with **desiltation drives**, **catchment treatment**, and **geospatial planning** for better water management.
- ✓ Promoting **community-based tank management** (e.g., **Kudimaramath**) and adopting **climate-resilient designs** that account for future rainfall extremes are essential for long-term sustainability.

➢ **Measures for Water Conservation and Groundwater Rejuvenation**

- ✓ **Reclaiming traditional water bodies:**Initiatives like Telangana's **Mission Kakatiya** revive minor irrigation tanks and traditional water structures, improving local water storage.
- ✓ **SWAR technology:** The **System of Water for Agriculture Rejuvenation (SWAR)** supplies moisture directly to the root zone, improving water efficiency, supporting soil micro-organisms, and meeting precise crop needs.
- ✓ **River catchment management:** Green corridors, mapped recharge channels, and artificial recharge structures, especially in urban areas with deeper groundwater levels, help reduce depletion. Defunct borewells can also be used to recharge clean rainwater.
- ✓ **Groundwater rejuvenation:** The **Bhungrroo** system stores excess rainwater underground for use during summer, a model useful for urban water-scarce regions.
- ✓ **Wastewater management:** Dual sewage systems for greywater and blackwater, along with treated wastewater reuse in agriculture and horticulture, should be promoted. Industries must improve efficiency, treat effluents, and aim for zero liquid discharge.

- ✓ **Role of grassroots institutions:** Empowering ULBs and Panchayati Raj institutions enhances community participation and awareness on efficient irrigation and water conservation.
- ✓ **Social regulation of groundwater:** A participatory groundwater management approach focused on community rights, awareness, and coordinated action, helps regulate extraction in defined aquifer areas.

## Water Use Efficiency (WUE)

- **Water Use Efficiency (WUE)** means maximising **crop output** or **₹ output per unit of water**.
- With India becoming a **water-stressed** country and agriculture consuming **around 80% of freshwater**, improving WUE is essential for ensuring both **food security** and **water security.**
- India's **per-capita water availability is below 1,500 $m^3$/year**, and **surface irrigation efficiency is often under 40%**, indicating high levels of water stress and wastage.
- **Technical Measures**
  - ✓ **Laser land levelling** can save **20-30% of irrigation water**, while practices such as bunding and proper irrigation scheduling further improve water efficiency.
  - ✓ Improved irrigation methods include alternate wetting and drying for paddy and furrow or surge irrigation for row crops.
  - ✓ **Soil moisture conservation** techniques such as **mulching** and **conservation tillage** help reduce evaporation losses and improve water retention.
  - ✓ Crop diversification, shifting from paddy and sugarcane toward millets, pulses, and oilseeds, helps reduce pressure on water resources.
  - ✓ **Precision agriculture tools**, including **soil moisture sensors**, **IoT-controlled irrigation**, and **drone-based evapotranspiration (ET) mapping**, enable highly efficient, data-driven water management.
- **Policy & Institutional Support**
  - ✓ **Per Drop More Crop (PMKSY- Pradhan Mantri Krishi Sinchai Yojana)** provides subsidies to promote **micro-irrigation** systems such as drip and sprinkler irrigation.
  - ✓ **CADWM (Command Area Development & Water Management Programme)** supports **canal lining**, construction of **field channels**, and **rotational water supply (warabandi)** to improve irrigation efficiency.
  - ✓ **Atal Bhujal Yojana** focuses on **village-level water budgeting** and **demand-side water management** to address groundwater stress in critical blocks.
  - ✓ **NMSA (National Mission for Sustainable Agriculture)** along with state initiatives such as **Pani Panchayats** and **Jalyukt Shivar** promotes **conservation farming** and enhances **Water Use Efficiency (WUE)** across diverse agro-climatic regions.
- **Challenges & Way Forward**
  - ✓ A **behavioural bias toward over-irrigation**, combined with **low awareness** and **poor canal maintenance**, continues to reduce irrigation efficiency.
  - ✓ **Free or flat-rate power** encourages excessive **groundwater pumping**, while modern irrigation technologies often remain **unaffordable for small farmers**.
  - ✓ There is a strong need for **volumetric water delivery**, **metered electricity with DBT**, and **participatory irrigation management through WUAs (Water User Associations)**.
  - ✓ Policy support must also include **MSP and procurement incentives for low-water crops** and **real-time digital advisories** to guide farmers on optimal irrigation practices.

# Micro-Irrigation (Drip & Sprinkler)

- Micro-irrigation uses **low-pressure, controlled water application** (mainly drip and sprinkler) to deliver water near plant roots or canopy.
- It is a cornerstone of **"Per Drop More Crop"**, especially in **water-stressed and horticulture-dominant regions**.

**Importance & Status**

- **Drip irrigation saves about 40-60% water**, while **sprinkler systems save around 30-40%**, compared to traditional flood irrigation.
- Micro-irrigation often results in a **yield increase of nearly 15-40%** due to improved moisture control and efficient fertigation.
- India currently has about 150 lakh hectares under micro-irrigation, against a potential of around 650 lakh hectares, which means only about 23 percent of the potential has been achieved.
- The **leading states** in micro-irrigation adoption include **Andhra Pradesh, Gujarat, Rajasthan, and Karnataka**.

- **Types**
  - ✓ **Drip irrigation** delivers water **drop-by-drop directly to the root zone**, making it ideal for **orchards, vegetables, sugarcane, and cotton**, while also enabling **precise fertigation**.
  - ✓ **Sprinkler irrigation** distributes water in a **rainfall-like spray**, making it suitable for **sandy soils** and for **field crops** grown in areas where **land levelling is difficult**.
  - ✓ **Micro-sprinklers and foggers** are used in **nurseries, horticulture, polyhouses, and controlled environments**, offering fine and uniform water application.
- **Policy Support**
  - ✓ **PMKSY - Per Drop More Crop** serves as the **main subsidy scheme** for promoting **drip and sprinkler irrigation** across the country.
  - ✓ The **Micro-Irrigation Fund (NABARD)** provides **low-cost finance** to states for implementing large-scale **micro-irrigation (MI) projects**.
- **Micro Irrigation Fund**
  - ✓ Micro Irrigation Fund (MIF) with a corpus of Rs. 5000 crore was operationalized in NABARD.
  - ✓ The objective of the fund is to facilitate State Governments efforts in mobilising additional resources for expanding coverage under micro irrigation and incentivizing its adoption.
  - ✓ Under MIF, the State Governments are provided loans at \$3 \%\$ below the cost of funds; the 3% being compensated by the Govt. of India as interest subvention.
  - ✓ Several **state schemes** support micro-irrigation, including **sugarcane drip promotion in Tamil Nadu (TN)** and the development of **large horticulture clusters in Andhra Pradesh (AP) and Gujarat**.
- **Advantages**
  - ✓ Micro-irrigation leads to **higher water productivity** and improves **crop quality** in terms of size, uniformity, and sugar content.
  - ✓ It results in **fertilizer savings of 30-50%**, along with **reduced weed growth** and **lower soil erosion**.
  - ✓ It also reduces **labour and energy demand**, and in certain systems such as **drip irrigated paddy**, there is potential for **lower methane emissions**.

- **Challenges & Way Forward**
  - ✓ **High initial costs**, frequent **emitter clogging**, **fragmented landholdings**, and **poor after-sales support** remain major constraints to wider adoption of micro-irrigation.
  - ✓ There is a need to **promote cluster- or FPO-based micro-irrigation networks**, develop **low-pressure drip systems** suitable for **small and hilly farms**, integrate micro-irrigation with **solar pumps**, enforce **strong quality standards**, strengthen **farmer training**, and expand **digital automation** using **IoT devices and mobile apps** for efficient irrigation scheduling.

# Fertilisers

- Fertilisers are chemical or organic substances supplied to crops to enhance nutrient availability and improve soil fertility.
- In India, fertilisers are a crucial agricultural input influencing productivity, cropping intensity, and overall food security.
- However, imbalanced use, environmental impacts, and subsidy burdens make fertilizer management a complex policy challenge.

**A. Importance of Fertilisers in Indian Agriculture**

- **Productivity Enhancement -** Fertilisers have been a **key driver of the Green Revolution**, contributing to **over 50% of yield growth in cereals**.
- **Improves Soil Nutrient Availability -** They supply essential **macronutrients (N, P, K)** along with important **secondary and micronutrients**, improving overall soil fertility.
- **Supports High-Yielding and Hybrid Seeds - HYVs and hybrid seeds** require a reliable and balanced nutrient supply to achieve their full yield potential.
- **Enables Higher Cropping Intensity- Multi-cropping systems** depend on regular nutrient replenishment after each crop cycle to maintain productivity.
- **Addresses Soil Deficiencies -** Fertilisers help correct deficiencies in Indian soils, many of which lack **nitrogen** and **micronutrients such as zinc (Zn), iron (Fe), and boron (B)**.

**B. Types of Fertilisers**

**1. Chemical (Inorganic) Fertilisers**

- ✓ **Nitrogenous fertilisers**, such as **Urea** and **Ammonium Sulphate**, supply nitrogen required for vegetative growth in crops.
- ✓ **Phosphatic fertilisers**, including **DAP (Di-Ammonium Phosphate)** and **SSP (Single Super Phosphate)**, provide phosphorus essential for root development and flowering.
- ✓ **Potassic fertilisers**, mainly **MOP (Muriate of Potash)**, supply potassium that strengthens plants and improves disease resistance.
- ✓ **NPK complexes** offer a balanced combination of nitrogen, phosphorus, and potassium in a single fertiliser formulation.

**2. Organic Fertilisers**

- ✓ Organic nutrient sources include **farmyard manure**, **compost**, **green manure**, **poultry manure**, and **city compost**, all of which help improve soil structure and long-term fertility.

**3. Bio-Fertilisers**

- ✓ Biofertilisers include **Rhizobium**, **Azotobacter**, **PSB (Phosphate Solubilising Bacteria)**, and **Mycorrhiza**, all of which enhance nutrient availability and support sustainable soil health.

**4. Nano-Fertilisers (New-age)**

- ✓ **Nano-urea** and **nano-DAP** help achieve **higher nutrient-use efficiency** while also reducing the **environmental footprint** of fertiliser use.

**Fertiliser Consumption Patterns in India**

- ➢ India shows a **high dependence on nitrogen**, leading to **N-heavy fertiliser use** across many regions.
- ➢ The country's **NPK ratio is skewed at 7:2.7:1**, compared to the **ideal balance of - 4:2:1**, mainly due to the **overuse of urea** arising from price distortions.
- ➢ There are significant **regional imbalances**, with much higher fertiliser use in **Punjab, Haryana, and Uttar Pradesh**, and markedly lower use in the **Northeastern states**.
- ➢ India's import reliance is increasing, with the country importing about **25-30% of its urea**, **55-60% of its phosphates**, and **100% of its potash**.
- ➢ National fertiliser demand continues to rise, with annual consumption reaching around **62-65 million tonnes**.

## C. Government Policies & Reforms

**1. Fertiliser Subsidy Regime**

- ✓ **Urea** is sold at a **controlled price with a fixed MRP**, resulting in a **high subsidy burden** on the government.
- ✓ **P&K fertilisers** are subsidised under the **Nutrient Based Subsidy (NBS) scheme**, which provides support based on the nutrient content rather than a fixed selling price.

**2. Neem-Coating of Urea**

- ✓ **Neem-coating of urea** has been made mandatory to **reduce diversion**, **slow the release of nitrogen**, and **improve nutrient-use efficiency (NUE)**.

**3. Nutrient Based Subsidy (NBS) Policy**

- ✓ The subsidy for **P&K fertilisers** is linked to their **nutrient content**, encouraging **balanced fertiliser use** across farms.

**4. One Nation One Fertiliser (ONOF)**

- ✓ Under this initiative, all fertilisers are sold under a **single brand "Bharat"**, helping reduce **marketing and logistics costs**.

**5. Direct Benefit Transfer (DBT) for Fertiliser Subsidy**

- ✓ Under DBT, the **subsidy is transferred to fertiliser companies** only after the product is sold to farmers through **PoS machines**, improving transparency and reducing leakages.

**6. Promotion of Nano-Fertilisers**

- ✓ **Nano-urea** has been officially approved for field use because of its **high nutrient-use efficiency (NUE of 80-90%)**.

**7. Soil Health Card Scheme**

- ✓ The scheme provides **crop-wise nutrient recommendations**, helping farmers correct both **overuse and underuse** of fertilisers.

## D. Issues & Challenges

1. **Imbalanced Fertiliser Use -** excessive **nitrogen application** leads to **soil degradation**, **groundwater pollution**, and ultimately **lower crop yields**.
2. **High Subsidy Burden -** India's annual **fertiliser subsidy exceeds ₹2-2.5 lakh crore**, placing significant pressure on **fiscal resources**.

3. **Environmental Concerns - Nitrogen volatilisation** releases **nitrous oxide ($N_2O$)**, a potent greenhouse gas. Runoff from fields causes **eutrophication** of rivers and lakes.
4. **Declining Soil Health -** Continuous **urea-heavy fertilisation** reduces **soil organic carbon** and depletes essential **micronutrients**.
5. **Import Vulnerability -** Dependence on imported fertilisers exposes India to **global price fluctuations**, affecting both **farmers** and **subsidy bills**.
6. **Inefficient Nutrient Use -** Average **nutrient-use efficiency (NUE)** in India remains low:
   - ✓ **Nitrogen:** 30-40%, **Phosphorus:** 15-20% and **Potash:** 50-60%
7. **Supply Chain Constraints -** Frequent **delays in fertiliser supply**, especially **DAP during the Rabi season**, disrupt timely nutrient application.

**E. Reforms & Way Forward**

**1. Promote Balanced Fertilisation**
- ✓ Adoption of the **4R principles** - **Right source, Right dose, Right time, and Right place**, is essential to correct nutrient imbalance.
- ✓ Encouraging **NPK blending** and **customised fertilisers** can further improve nutrient delivery.

**2. Expand Nano & Bio-Fertilisers**
- ✓ Scaling up **nano-fertilisers** and **bio-fertilisers** will help reduce dependence on **imported raw materials**.
- ✓ Greater use of **microbe-based nitrogen fixers** and **phosphate solubilisers** can improve nutrient efficiency sustainably.

**3. Rationalise Subsidies**
- ✓ Introducing **direct benefit transfer (DBT) to farmers** on a pilot basis can improve targeting and reduce leakages.
- ✓ A gradual shift from **product-based subsidies** to **income support** may create a more efficient fertilizer regime.

**4. Strengthen Soil Health Management**
- ✓ **Mandatory soil testing** before fertilizer purchase similar to the model used in Israel, can ensure appropriate nutrient application.
- ✓ Promoting **organic carbon enhancement** through composting and **green manuring** helps restore soil health.

**5. Crop Diversification**
- ✓ Reducing the area under **nutrient-intensive crops** like rice and sugarcane can lower fertilizer demand.
- ✓ Promotion of **millets, pulses, and oilseeds** supports sustainable nutrient cycles and soil regeneration.

**6. Improve Fertiliser Logistics**
- ✓ Digitising the fertiliser supply chain with **GPS tracking of wagons** and **warehouse monitoring** can streamline distribution and reduce delays.

**7. Promote Integrated Nutrient Management (INM)**
- ✓ INM combines **chemical fertilisers**, **organic sources**, and **bio-fertilisers** to maintain **holistic and long-term soil fertility**.

# Organic Farming

- Organic farming is a holistic agricultural system that avoids synthetic chemicals (fertilisers, pesticides, growth regulators) and relies on natural processes to maintain soil fertility, ecological balance, and sustainable productivity.
- It integrates crops, livestock, soil biology, and ecological cycles to create resilient farm systems.

**A. Core Principles of Organic Farming**

- **Health** focuses on enhancing the well-being of **soil, plants, animals, and humans**, recognising their interconnectedness.
- **Ecology** emphasises working **in harmony with natural ecosystems** rather than disrupting ecological processes.
- **Fairness** seeks to ensure **equitable returns and just relationships** among farmers, workers, consumers, and the environment.
- **Care** promotes a **precautionary approach** to safeguard the environment and protect **future generations** from potential harm.

**B. Key Features of Organic Agriculture**

- No use of synthetic fertilisers or pesticides.
- Use of **organic manures** (compost, FYM, green manure).
- **Crop rotations** to maintain soil fertility and break pest cycles.
- **Biological pest control** through natural predators, pheromone traps.
- **Soil health enhancement** with legumes, cover crops, and microbial inoculants.
- Emphasis on **local resource recycling** - farm waste, biomass, cow dung, bio-digesters.

**Types/Systems of Organic Farming**

**1. Traditional Organic Farming**

- ✓ Traditional organic farming consists of low external input systems commonly practiced in rainfed tribal areas.
- ✓ It relies on indigenous seeds, mixed cropping patterns, and strong integration with livestock.

**2. Scientific/Regulated Organic Farming**

- ✓ Scientific or regulated organic farming follows certification-based systems that comply with national and international standards.
- ✓ It primarily targets export markets and branded organic produce.

**3. Zero Budget Natural Farming (ZBNF) / Subhash Palekar Natural Farming**

- ✓ Zero Budget Natural Farming uses formulations such as *Jeevamrit*, *Bijamrit*, mulching, and *Waaphasa* (soil aeration), and it aims to minimize external inputs.

| Organic Farming | ZBNF |
|---|---|
| Organic fertilisers and manures like compost, vermicomposting, cow dung manure, etc. are used and added to farmlands from external sources. | In natural farming decomposition of organic matter by microbes and earthworms is encouraged right on the soil surface itself. |
| It requires basic agro practices like ploughing, tilling, mixing of manures, weeding, etc. to be performed. | In natural farming, there is no ploughing, tilling, no fertilisers, and no weeding is done. |
| It is still expensive due to the requirement of bulk manures, and it has an ecological impact on surrounding environments. | Natural agriculture is an extremely low-cost farming method, completely moulded with local biodiversity. |

**4. Integrated Organic Farming Systems (IOFS)**

- ✓ Integrated Organic Farming Systems combine crops, dairy, poultry, horticulture, and bio-digesters to enable efficient internal nutrient cycling.

## C. Government Initiatives to Promote Organic Farming

### 1. Paramparagat Krishi Vikas Yojana (PKVY)

- ✓ PKVY promotes organic farming through a cluster-based approach.
- ✓ It provides financial assistance for input production, certification, and marketing.

### 2. Mission Organic Value Chain Development for North Eastern Region

- ✓ It focuses on organic value chain development in the North Eastern states.
- ✓ It supports aggregation, processing, packaging, and branding activities.

### 3. National Mission on Sustainable Agriculture (NMSA)

- ✓ NMSA promotes the use of organic manures, green manuring, and vermicomposting to enhance soil health.

### 4. Jaivik Kheti Portal

- ✓ The Jaivik Kheti Portal serves as a national platform for organic farmers, providing services for certification, transactions, and marketing.

### 5. Regional Councils & Certification Bodies

- ✓ These bodies facilitate the Participatory Guarantee System (PGS) for domestic markets and help streamline certification processes.

## D. Benefits of Organic Farming

- ➢ **Ecological Benefits**
  - ✓ **Enhanced soil health:**
    - Complete elimination of chemical fertilizers has improved soil fertility and reduced degradation.
    - Natural farming has increased soil organic matter and boosted microbial activity.
  - ✓ **Biodiversity conservation:**
    - Promotion of indigenous seed varieties has helped preserve local genetic diversity.
    - The absence of pesticides protects beneficial insects and pollinators.
  - ✓ **Water conservation:**
    - Organic practices have reduced water pollution caused by agricultural runoff.
    - Natural farming has improved the soil's water retention capacity.
- ➢ **Economic Benefits**
  - ✓ **Premium market access:**
    - Organic certification allows farmers to tap into high-value markets.
    - Certified products receive **15–20% higher prices** in domestic and global markets.
  - ✓ **Cost reduction:**
    - Eliminating chemical inputs reduces overall production costs.
    - Indigenous techniques lower dependence on external inputs.
  - ✓ **Tourism boost:**
    - Growth of agri-tourism and eco-tourism opportunities.
    - Strengthens a unique brand identity for Sikkim's agricultural products.

## E. Challenges & Constraints

### 1. Yield Reductions During Transition

- ✓ Organic farming often experiences an initial yield drop of 5-25% until soil biology stabilizes.
- ✓ A transition period of 2-3 years is required for farmers to obtain organic certification.

2. **Limited Organic Input Availability**
   - ✓ Inputs such as compost, bio-pesticides, and green manure seeds are not easily accessible in many regions.
3. **Certification & Traceability Barriers**
   - ✓ Certification involves costly and lengthy procedures, making it difficult for small farmers. PGS is easier but still has limited recognition in larger markets.
4. **Market and Supply Chain Constraints**
   - ✓ **Organic** markets face inconsistent demand and lack adequate cold chain and processing facilities. Farmers risk losing premium prices when assured buyers are not available.
5. **Labour Intensive**
   - ✓ Organic farming requires more manual work, including weeding, mulching, and composting.
6. **Knowledge Gaps**
   - ✓ Farmers need training on chemical-free pest control, nutrient management, and maintaining proper compost quality.

**F. Way Forward**

1. **Cluster-Based Organic Zones -** Expand PKVY models to create region-specific organic corridors that promote concentrated organic farming areas.
2. **Strengthen Domestic Market -** Improve labelling and traceability through QR codes, support e-commerce tie-ups, and promote farmer producer companies to boost domestic demand for organic produce.
3. **Certification Reforms -** Reduce certification costs, simplify procedures, and expand the recognition of PGS to make certification more accessible for small farmers.
4. **Bio-Input Industry Support -** Promote scalable composting units, biofertiliser plants, and microbial inoculant production to ensure reliable availability of organic inputs.
5. **Research & Extension -** Develop crop-specific organic nutrient schedules and introduce integrated pest management innovations tailored to tropical pests.
6. **Link Organic Farming with Eco-Tourism -** Establish model farms, learning centres, and agri-tourism initiatives to diversify farmer incomes and increase public awareness of organic practices.
7. **Promote Organic Livestock Standards -** Strengthen standards for organic livestock to ensure complete organic value chains for products such as milk, ghee, and eggs.

Organic farming is a significant pathway to achieving sustainable agriculture in India. Although challenges persist, particularly during the transition period. It offers long-term ecological, economic, and health advantages. With supportive policies, strengthened value chains, and adequate farmer training, India can expand organic cultivation while ensuring that food security remains fully protected.