DHYEYA IAS
most trusted since 2003

JULY 2023

DHYEYA'S KURUKSHETRA GIST

SUSTAINABLE AGRICULTURAL DEVELOPMENT

TECHNOLOGIES FOR SUSTAINABLE AGRICULTURE DEVELOPMENT

CLIMATE SUSTAINABLE AGRICULTURE

CONTRIBUTION OF WOMEN TO SUSTAINABLE AGRICULTURE DEVELOPMENT

TECHNOLOGIES FOR SUSTAINABLE AGRICULTURE DEVELOPMENT

Introduction:

- Agriculture is a vital sector in the Indian economy, employing 42.1% of the population.
- Traditional agricultural practices are unsustainable, harming the environment and human health.
- Adopting sustainable agricultural practices is essential to ensure the long-term viability of agriculture in India while preserving the environment and communities' well-being.

What is Sustainable Agriculture?

- Sustainable agriculture is a farming method that prioritizes the long-term health of the soil, environment, and the community.
- Its primary goal is to meet the increasing food demand without depleting natural resources for future generations.
- The importance of environmental preservation has led to significant attention towards sustainable agriculture in recent years.
- Sustainable agriculture aims to produce food, fiber, and other plant or animal products while safeguarding the environment, public health, human communities, and animal welfare.
- This farming approach involves practices that conserve and regenerate natural resources like soil, water, and air for the benefit of future generations.

Role of Technology in Developing Sustainable Agriculture:

Technology can help in reducing the use of fertilizers and pesticides, improves water management, and increases yields, benefits soil, bio-conservation and carbon sequestration.

- **Precision Farming:** Utilizing sensors, GPS mapping, and data analytics to optimize crop performance, enabling precise monitoring and resource management for more efficient and sustainable agriculture.
- **Agroforestry:** A land-use integrated system combining trees, shrubs, crops, and livestock to enhance sustainability and productivity, fostering ecological diversity and soil conservation for resilient farming practices.
- **Vertical Farming:** Cultivating crops in stacked controlled environments, offering efficient space usage, resource conservation, and potential for year-round production, contributing to urban agriculture and food security.
- **Hydroponics:** Growing plants in nutrient-rich water without soil, allowing for sustainable year-round crop cultivation, conserving water resources and potentially reducing land usage and environmental impact.
- **Renewable Energy:** Employing renewable energy sources to power farming operations, reducing greenhouse gas emissions and dependence on fossil fuels, promoting environmentally friendly and sustainable agriculture.
- **Robotics and Automation:** Implementing robotics and automation technologies to decrease labor costs, enhance crop yields, and improve efficiency in agricultural practices, contributing to sustainable and technologically advanced farming methods.

Gaps in Adopting Sustainable Agriculture:

- **Lack of Awareness and Knowledge:** A considerable number of farmers are unaware of the advantages of sustainable agriculture and face challenges in its effective implementation.
- **Limited Access to Finance:** Small and marginal farmers encounter difficulties in accessing the necessary finances for investing in sustainable agricultural infrastructure and technology.
- **Inadequate Policy and Regulatory Framework:** The absence of supportive policies and a robust regulatory framework hinders the widespread adoption of sustainable agricultural practices.
  - For example, The Ministry of Agriculture and Farmers' Welfare (MoAFW) allocates a mere 0.8% of its budget to the National Mission for Sustainable Agriculture.
- **Limited Research and Development:** Sustainable agriculture practices suitable for the Indian context require further research and development.
- **Lack of Infrastructure and Technical Support:** Inadequate infrastructure, including rural roads, storage facilities, and cold chains, poses a significant challenge to the agriculture sector in India.

- **Low Productivity:** Indian agriculture faces low productivity, evident from significantly lower crop yields compared to countries like China, where productivity is 50 to 100% higher.
- **Fragmented Landholdings:** The average small landholding size in India hinders the adoption of modern farming techniques, India's average size of landholding is 1.08 ha while that of the USA is 178.87 ha.
- **Lack of Market Access:** Farmers in India encounter significant challenges due to limited access to markets for their produce.
- **Inadequate Infrastructure:** Insufficient rural roads, storage facilities, and cold chains pose major obstacles for the agriculture sector in India, impeding transportation, storage, and sales of agricultural products.
- **Climate Change:** Changing weather patterns, erratic rainfall, and rising temperatures caused by climate change have adverse effects on water availability, pest and disease management, and crop yields, increasing the vulnerability of Indian farmers.

Initiatives:

- **National Mission for Sustainable Agriculture (NMSA)**
  - National Mission for Sustainable Agriculture (NMSA) is part of the National Action Plan on Climate Change (NAPCC).
  - NMSA aims to enhance agricultural productivity, sustainability, and climate resilience, with a focus on rainfed areas.
  - Strategies include promoting integrated farming systems, adopting technology for resource conservation, efficient water management, improved agronomic practices, and creating a soil database.
  - Integrated nutrient management, involving professionals, and targeted interventions in disadvantaged areas are also part of NMSA's approach.
- **Pradhan Mantri Krishi Sinchayee Yojana**
  - PMKSY is a Centrally Sponsored Scheme launched in 2015.
  - **Funding ratio:** Centre-States (except North-eastern region and hilly states) is 75:25, while for these regions, it is 90:10.
  - **Objectives:** Converge investments in irrigation, expand cultivable area under assured irrigation, improve on-farm water use efficiency, promote precision irrigation, recharge aquifers, and attract private investment in water-saving technologies.
- **Integrated Watershed Management Programme**
  - Integrated Watershed Development Programme (IWMP) is implemented by the Department of Land Resources, Ministry of Rural Development since 2009-10.
  - It aims to cover 55 million hectares of rainfed land by 2027, making it the world's second-largest watershed program.
  - IWMP restores ecological balance through watershed management, conserving and developing degraded natural resources like soil and water.
  - The program promotes multi-cropping, diverse agro-based activities, and provides sustainable livelihoods to people residing in the watershed area.
- **Integrated Nutrient Management**
  - Integrated Nutrient Management (INM) aims to maintain soil fertility and plant nutrient supply for sustainable crop productivity.
  - Advantages include improved soil health, increased crop yield, environmental benefits, and effective utilization of farm wastes.
  - INM promotes cost reduction by utilizing cheap organic sources and encourages judicious use of chemical fertilizers to address overuse issues in Indian agriculture.

- **Initiatives to promote sustainable agriculture practices:**
  - National Food Security Mission,
  - Pradhan Mantri Fasal Bima Yojana
  - Soil Health Card Scheme

Agri Tech Start-up Case Studies:

- **AgriApp Technologies:** It works to make the farmers ready for high-efficiency technology-enabled agriculture production and marketing.
- **Instinct Earth Aqua-Scaping Private Limited:** It is manufacturing various products like Clay Ball, Indoor Vertical Plant, etc., and providing services including Green Wall Installation, Gardening, and Vertical Garden Landscaping.
- Khetee promotes agroecological farming through the agroforestry model.
- **Pudhuvai Green Gas:** It produces organic waste agro-raw materials and biofertilizers.

Conclusion:

Sustainable agriculture in India holds the key to achieving environmental, social, and economic sustainability. Advanced technologies, combined with practices like crop rotation, organic farming, and efficient resource utilization, contribute to long-term agricultural viability. Despite challenges, the country has made progress in adopting sustainable practices. By addressing issues like indiscriminate pesticide use and climate change threats, sustainable agriculture can secure a brighter future for farmers, ensuring food security, preserving the environment, and fostering healthier communities through nutritious and safe food production.

CLIMATE SUSTAINABLE AGRICULTURE

Introduction:

- Agriculture faces formidable challenges due to climate change and the need for a 70% increase in food production by 2050 to feed the growing population.
- Climate Smart Agriculture (CSA) offers a sustainable solution to address these challenges.
- The world's population is projected to reach 9 billion by 2050 and 11 billion by 2100, leading to significant food security concerns.
- Rising temperatures caused by global warming are already impacting crop yields, with predictions of a 2-5°C temperature rise by 2100 (IPCC, 2014), creating an interdependent relationship between agriculture and climate change.

Challenges in Agriculture:

- Global food security requires a 70% increase in food production by 2050.
- Crop yields decline with rising temperatures: maize (-7.4%), wheat (-6.0%), rice (-6.2%), soybeans (-3.1%).
- Climate change leads to annual agriculture losses of US$ 9-10 billion, with potential cereal grain reductions of 20-40%.
- Agriculture, forestry, and land-use changes contribute 25% of human-induced greenhouse gas emissions.
- **Global Warming Challenge:**
  - **Agri-production faces a dual challenge:** protecting from global warming effects and increasing yields for a growing population.
  - Each 1°C temperature rise reduces global maize, wheat, rice, and soybean yields significantly.
  - Predicted 2.5-5.8°C temperature increase by 2100 poses immense damage to vulnerable crops like rice, wheat, soybeans, and more.
  - Sustainable agriculture requires an overhaul of production cycles to mitigate agriculture's contribution to climate change while adapting to its impacts through Climate-Smart Agriculture (CSA).

Climate-Smart Agriculture (CSA):

- Climate-smart agriculture (CSA) is an integrated approach that manages landscapes (cropland, livestock, forests, and fisheries) to address food security and climate change challenges. The goals of CSA are:
  - Increase productivity to improve food security and boost rural incomes, benefiting the world's poor.
  - Enhance resilience by reducing vulnerability to climate-related risks and adapting to changing conditions.
  - Decrease emissions per calorie or kilo of food produced, avoid agricultural deforestation, and explore carbon sequestration methods.
- Breeding resilient crop varieties is crucial to combat climate change impacts on agriculture.
- Climate-smart crops should tackle various challenges like pests, frosts, and extreme weather events.
- Efficient production and distribution are necessary to make climate-smart crop varieties accessible to farmers.

Climate-Smart Crop Production Practices

- Climate-smart agriculture requires smart management practices and technologies to address production and emissions issues.
- Practices focus on preventing soil damage, conserving soil and water, and increasing productivity.
- Crop varieties should be bred to resist climate-related phenomena like drought, floods, extreme heat, and salinity.
- Climate-smart crops must also consider other impacts like pest attacks and changing weather patterns.
- Securing food production and farmers' livelihoods requires efficient seedling production and distribution systems.
- The seed delivery process involves multiple stages such as multiplication, processing, storage, and marketing.

FAO recommends certain components for the successful implementation of a climate-smart agriculture strategy:

- **Conservation of Plant Genetic Resources for Food and Agriculture**
  - Urgent investment in safeguarding diverse plant genetic resources
  - Preservation in natural habitats, on farms, and in gene banks
- **Wide Range of Varieties**
  - Diverse portfolio of varieties across various crops
  - Increases chances of production systems adapting to climate change
- **Farmer Involvement in Breeding Process**
  - Participatory plant breeding for demand-driven crop improvements
  - Farmers' perspectives in selecting varieties for release and registration
- **Ensuring Affirmative Farmer Participation**
  - Acknowledging global warming from the farmers' livelihood perspective
  - Building trust in climate-resistant varieties to meet farmers' needs and requirements.

Other Methods

- **Importance of Biodiversity and Integrated Pest Management**
  - Monoculture systems require significant pesticide and herbicide investments.
  - Simplified agricultural ecosystems compromise species diversity and ecosystem services.
  - Diverse cropping systems ensure farm resilience, economic stability, and profitability.
  - Integrated Pest Management is an ecosystem approach to crop production and protection.
  - It involves careful consideration of pest management techniques while minimizing risks.
- **Improved Water Use and Management**
  - Climate change affects water resources for agriculture.
  - Sustainable water management includes soil and water conservation measures.
  - Deficit irrigation and efficient technologies can maximize crop yields with less water.
  - Integrating climate change in water infrastructure planning reduces risks to agriculture.
- **Sustainable Soil and Land Management**
  - Integrated landscape planning achieves climate-smart agriculture.
  - Sustainable soil management involves direct seeding and soil fertility practices.
  - Balanced nutrient cycling and soil protection are essential for sustainable intensification.
  - Practicing nutrient cycling and protecting soil enhance crop production.
- **Sustainable Mechanisation**
  - Appropriate machinery increases productivity and efficiency in crop management.
  - Smaller tractors and conservation agriculture reduce CO2 emissions and soil disturbance.
  - Timely availability of agricultural equipment improves yields and reduces losses.
  - Precision farming and controlled release technologies enhance input efficiency and reduce emissions.

Initiatives for Climate-smart Agriculture in India

- **National Innovation on Climate Resilient Agriculture (NICRA):** A network project of ICAR to enhance Indian agriculture's resilience to climate variability and change through improved technologies.
- **National Mission on Sustainable Agriculture (NMSA):** Implements NAPCC for climate actions, promoting sustainable development, energy-efficient technologies, and soil health management.
- **National Adaptation Fund for Climate Change (NAFCC):** Supports adaptation to climate change for vulnerable states and territories, including agriculture-related projects.

- **Climate Smart Village (CSV):** An institutional approach to test, implement, and promote CSA at the local level, helping farmers adapt to climate change.
- **Paramparagat Krishi Vikas Yojna (PKVY):** An extension of Soil Health Management, promoting organic farming through organic village clusters to improve soil health.
- **Biotech-KISAN:** A scientist-farmer partnership scheme connecting science laboratories with farmers for innovative solutions at the farm level.
- **Sub-Mission on Agro-forestry:** Launched to plant trees on farm bunds for sustainability in agriculture and mitigating climate change impacts.
- **National Livestock Mission:** Focuses on sustainable livestock development, protecting the environment, conserving biodiversity, and supporting farmers' livelihood.
- **National Water Mission (NWM):** Aims to conserve water sources, minimize wastage, and improve water use efficiency by 20%, including in agriculture.

Conclusion

The Government of India has taken strong measures to evaluate the impact of climate change on agriculture, with a focus on implementing interventions. District-level risk assessments for 572 rural districts have been prepared, and District Agriculture Contingency Plans have been developed for 650 districts in collaboration with ICAR and NARS, regularly updated to address climate change challenges. Additionally, 151 climate-vulnerable districts have climate-resilient villages under the NICRA Project, showcasing location-specific technologies. Fertilizer policies have positively contributed to crop production, resulting in an additional 13.66 Mt of food grain production, preventing the conversion of 11.48 million hectares of forest land and reducing 2013 Mt of GHG emissions. Neem-coated urea has further enhanced nutrient use efficiency and reduced GHG emissions. The promotion of Zero Budget Natural Farming (ZBNF) across India has gained momentum as a commercially viable and environmentally friendly alternative to conventional agriculture, providing better climatic adaptation. Moreover, agro-forestry area is increasing, leading to more carbon fixation and reduced GHG emissions.

DRYLAND FARMING

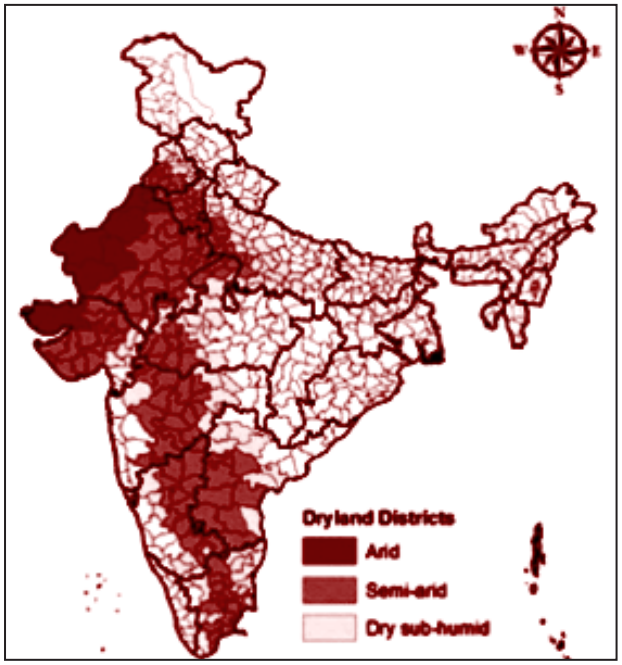
Introduction

- India's unique geographical location creates great variability in climatic conditions, resulting in different agro-climatic zones and farming systems, including dryland farming.
- Dryland areas are characterized by low rainfall (375 mm to 1125 mm), uneven distribution, high variability, and uncertainty, making them less productive and economically fragile.
- Dryland farming, reliant on natural rainfall and with limited or no irrigation, is increasingly vital for ensuring sustainable food security despite an increasing population and pressure on natural resources.
- Dryland areas often have poor or degraded soils with low water holding capacities and nutrient deficiencies, making them vulnerable to environmental stresses and shocks, leading to agrarian distress and poor economic conditions for farmers.

Dryland Farming:

Differentiating Dry Farming, Dryland Farming, and Rainfed Farming:

- Dry farming is a farming practice applied in regions with annual rainfall of less than 750 mm and a crop growing season lasting under 200 days. This method involves cultivating crops solely relying on natural rainfall, without irrigation.
  - Dry farming is specifically suitable for areas experiencing very limited rainfall and a shorter growing season. Crops cultivated under this method must be well-adapted to drought and water scarcity.
- Dryland farming, on the other hand, is a cultivation approach suitable for areas with rainfall ranging from 750 mm to 1150 mm, including semi-arid regions. Similar to dry farming, dryland farming also depends on natural rainfall for crop growth and production.
  - Dryland farming caters to regions with slightly higher rainfall compared to dry farming. It is commonly practiced in semi-arid areas, where water availability remains a significant concern for agriculture.



- Rainfed farming is practiced in regions receiving around 1150 mm of rainfall, mainly found in humid and sub-humid areas. In this type of farming, irrigation is not employed, and crops solely depend on rainwater for their growth and development.
  - Rainfed farming, with relatively higher annual rainfall, is often practiced in more humid and sub-humid regions where rainwater is sufficient for crop cultivation without the need for additional irrigation. However, farmers still need to manage water resources effectively during dry spells to ensure successful crop yields.
- **Major Crops in Dryland Agriculture**
  - Important crops include millets, oilseeds, pulses, maize, cereals, and cotton.
  - Millets are known for their drought resistance, climate resilience, and eco-friendly characteristics.
  - Oilseeds and pulses hold crucial roles in rainfed regions, supporting vegetable oil production and promoting soil health.

Supporting Schemes:

- The National Mission for Sustainable Agriculture (NMSA) is a part of the National Action Plan on Climate Change (NAPCC), targeting climate change-related issues.

- Under the NMSA, the Sub-Mission on Agroforestry was launched for a four-year period from 2016 to 2020.
- The National Agroforestry Policy 2014 aims to bring coordination and synergy among various aspects of agroforestry across government missions and programs.
- The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) was introduced in 2015, providing comprehensive irrigation solutions, including water sources and distribution networks.
- Agriculture Contingency Plans at the district level were created by ICAR's CRIDA in collaboration with state agricultural institutions to address abnormal monsoon conditions and extreme events impacting crops, livestock, and fisheries.
- In a bid to promote dryland crops like millets, the Indian government declared 2018 as the Year of Millets.

Contribution of Dryland Farming

- Approximately 80% of Sorghum (Jowar) and Maize, 90% of Pearl millet (Bajra), 75% of oilseeds, and about 95% of pulses come from dryland agriculture.
- Drylands also play a significant role in wheat and rice production, with 33% of wheat and 66% of rice being rainfed.
- Moreover, drylands contribute over 70% of cotton production to the textile industries.
- Despite challenges such as limited resources, environmental stress, and low productivity, dryland agriculture accounts for nearly 44% of the total food grains produced in the country.

Strategy for development of Dryland Farming

- Selecting appropriate cropping systems tailored to the area is crucial for profitable dryland farming.
- Effective management of sowing time contributes to increased productivity.
- Proper tillage, fertilizer management, weed control, and plant protection measures play essential roles in boosting yields.
- Drought-tolerant crop varieties are valuable for enduring prolonged dry periods.
- Improving soil condition through cover crops enhances soil health, water availability, and pest control.
- Cover crops increase resilience to drought and erratic rainfall.
- Mulching is a common technique to conserve soil moisture and prevent evaporation in dryland farming.

Challenges Associated with Dryland Farming

- **Erratic and Uncertain Rainfall:** Dryland farming heavily relies on natural rainfall, making it vulnerable to erratic and unpredictable rainfall patterns, leading to crop failures and yield fluctuations.
- **Drought and Water Scarcity:** Dryland areas are prone to droughts, causing a shortage of water for crops and livestock, leading to reduced productivity and economic losses for farmers.
- **Poor Soil Quality:** Dryland regions often have poor or degraded soils with low water-holding capacities and nutrient deficiencies, posing challenges for crop growth and productivity.
- **Limited Access to Resources:** Farmers in dryland areas face difficulties in accessing resources such as water, seeds, fertilizers, and modern agricultural technologies, hindering their ability to improve productivity.
- **Soil Erosion:** Soil erosion is a significant problem in dryland farming, as the lack of vegetation and vulnerability to heavy rainfall can lead to soil loss and reduced fertility.
- **Pest and Disease Pressure:** Dryland crops are more susceptible to pest and disease attacks due to stress from water scarcity and adverse climatic conditions, leading to crop losses.
- **Climate Change Impact:** Dryland farming is particularly affected by climate change, with rising temperatures and changing weather patterns exacerbating existing challenges and uncertainties.
- **Economic Vulnerability:** Dryland farmers often face economic instability due to fluctuating yields and market prices, making their livelihoods precarious.
- **Limited Crop Choices:** Only certain crops are suitable for dryland conditions, limiting farmers' options and reducing crop diversity.

- **Land Fragmentation:** Fragmented and small land holdings in dryland areas make it challenging to implement efficient and sustainable farming practices, further impacting productivity.

Strategies for Sustainable Dryland Farming:

- **Integrated Farming:** Dryland farmers can enhance productivity by adopting integrated farming models with multiple crops.
- **Crop Selection:** Selecting suitable crops adapted to dryland conditions is essential for maximizing productivity.
- **Technology Adoption:** Implementing drip irrigation, water harvesting, and precision farming improves water-use efficiency and yields.
- **Soil Conservation:** Practices like contour ploughing, terracing, and mulching help mitigate erosion and retain soil moisture.
- **Capacity Building:** Empowering farmers through training and knowledge transfer on dryland farming techniques is crucial.
- **Market Support:** Strengthening market infrastructure and value chains enhances profitability and market access for dryland farmers.
- **Research and Development:** Continuous efforts are necessary to develop crop varieties and technologies specifically tailored for dryland farming.

Way Forward:

- CRIDA has formulated 'The Vision 2050,' encompassing future scenarios, emerging challenges, network strengths, and strategies for short and long-term goals in dryland agriculture.
- Location-specific research and efficient delivery are guiding principles for sustainability.
- The vision prioritizes rainwater harvesting and soil health management, scaling up successful field experiences.
- Integrated farming modules for various production environments aim to protect small and marginal farmers.
- Cutting-edge technologies like remote sensing and GIS will aid in resource characterization and land-use planning.
- Nanotechnology-based products for dryland agriculture will be developed.
- Large-scale demonstrations will focus on improving resource efficiency in rainfed areas.
- Small farm mechanization and energy efficiency are crucial areas for attention.
- Adoption of solar power and renewable sources will be promoted in dryland regions.
- With suitable crop selection and integrated farming models, dryland farmers can achieve bountiful yields even in challenging conditions.

Conclusion:

Dryland farming in India has significant potential for sustainable agriculture. By comprehending local conditions, adopting suitable practices, and offering necessary support, dryland farmers can overcome challenges and achieve abundant crop production, contributing to food security and rural development.

SUSTAINABLE AGRICULTURE: CHALLENGES AND WAY FORWARD

Introduction:

Sustainable agriculture is becoming an essential alternative to conventional input-intensive farming practices in India. The long-term impacts of conventional agriculture, such as topsoil degradation, declining groundwater levels, and biodiversity reduction, have highlighted the need for more sustainable approaches. In sustainable agriculture, the focus is on implementing less resource-intensive farming solutions, promoting greater diversity in crops and livestock, and empowering farmers to adapt to their local circumstances. This approach aims to ensure the long-term viability of agriculture while safeguarding the environment and promoting resilience in the face of changing conditions.

Sustainable Agriculture

Sustainable agriculture emphasizes the responsible use of finite resources, considering the well-being of nature and future generations. It advocates for renewable energy adoption, efficient land use, and pollution reduction to ensure a sustainable and environmentally friendly approach to farming. According to FAO, *"Sustainable agricultural development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such development conserves land, water, plant, and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable, and socially acceptable."*

Principles of Sustainable Agriculture

Five major principles of Sustainable Agriculture Practices:

- Continuous production of crops
- Protection and conservation of natural resources like soil, water, etc.
- Improve the social and economic well-being of the people
- Use of state-of-art technology
- Require government support for the institutional changes in production, marketing, law enforcement, etc.

Apart from this there are 3 basic pillars:

- **Economy:** This pillar focuses on promoting the growth and profitability of farming businesses by efficiently utilizing available resources.
- **Society:** Ensuring food security for the world's expanding population and providing equitable employment and fair compensation opportunities for the local community.
- **Environment:** This pillar is dedicated to safeguarding the environment through ecologically sustainable farming practices and reducing reliance on finite resources.

Proper coordination among the pillars of economy, society, and environment is crucial for successful implementation of sustainable agricultural practices. These practices protect natural ecosystems, maintain soil integrity, support biodiversity, and reduce pollution. Economically, they ensure food security, decrease production costs, and promote self-reliance. In society, they foster equality and improve public health by reducing chemical contamination and promoting healthier crops. As the current agricultural practices are not sustainable, adopting sustainable agriculture is vital for the long-term food requirements of our growing population.

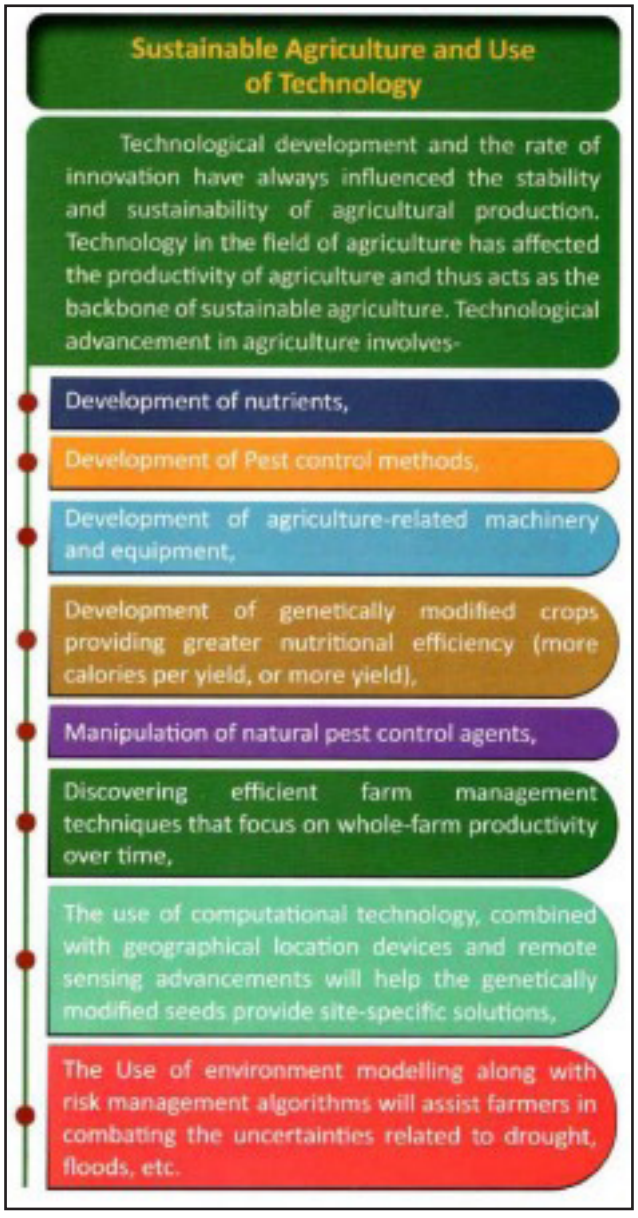
Major Sustainable Agriculture Practices:

- **Crop Rotation and Diversity:** Planting different crops in succession improves soil health, reduces pest pressure, and maintains fertility, promoting sustainable and resilient farming practices.
- **Water and Energy-efficient Irrigation:** Utilizing efficient irrigation techniques conserves water, reduces energy consumption, and ensures optimal water distribution for crops, enhancing resource sustainability.
- **Reduced Tillage:** Adopting no-till or reduced-till methods preserves soil structure, minimizes erosion, and promotes soil health by preserving natural soil layers.
- **Integrating Livestock and Crops:** Integrating livestock on farms allows for mutual benefits as livestock feed on crop by-products, while their manure enhances soil fertility.

- **Adopting Agroforestry:** Planting trees alongside crops preserves soil cover, protects water resources, provides supplementary income, and supports biodiversity and ecosystem services.
- **Cover Crops:** Sowing cover crops during off-seasons prevents soil erosion, adds organic matter to the soil, and suppresses weeds, benefiting the main crops.
- **Integrated Pest Management:** Proactive pest management strategies, such as biological control and cultural practices, help protect crops and reduce the need for chemical pesticides, promoting ecological balance.

Sustainable Agriculture in India

- Less than four percent of Indian farmers have adopted most Sustainable Agriculture Practices (SAPs).
- Crop rotation is popular, covering around 30 million hectares (Mha) and approximately 15 million farmers in India.
- Agroforestry and rainwater harvesting have significant coverage of 25 Mha and 20-27 Mha, respectively, especially among large cultivators.
- Organic farming covers only 2% of India's net sown area of 140 Mha.
- Natural farming is the fastest-growing sustainable agricultural practice in India, with around 800,000 farmers adopting it.
- Integrated pest management (IPM) has reached a coverage area of 5 Mha due to sustained promotion over the years.
- Practices like floating farming and permaculture have minimal impact and coverage.



National Mission for Sustainable Agriculture

- The National Mission for Sustainable Agriculture (NMSA) was launched by the Government of India in 2014-15.
- The mission aims to enhance agricultural productivity, particularly in rainfed areas, by promoting integrated farming systems, water use efficiency, soil health management, and resource conservation.
- The main objectives of NMSA are to make agriculture more productive, sustainable, remunerative, and climate resilient through location-specific integrated/composite farming systems.
- The mission focuses on comprehensive soil health management practices, including soil fertility mapping and judicious use of fertilizers based on soil test results.
- It aims to optimize water resources utilization for achieving 'More Crop Per Drop' through efficient water management practices.
- NMSA seeks to develop the capacity of farmers and stakeholders in climate change adaptation and mitigation measures in collaboration with other ongoing missions and initiatives.
- The mission aims to pilot models in select blocks to improve rainfed farming productivity by mainstreaming rainfed technologies and leveraging resources from other schemes and missions such as MGNREGS, IWMP, and RKVY.

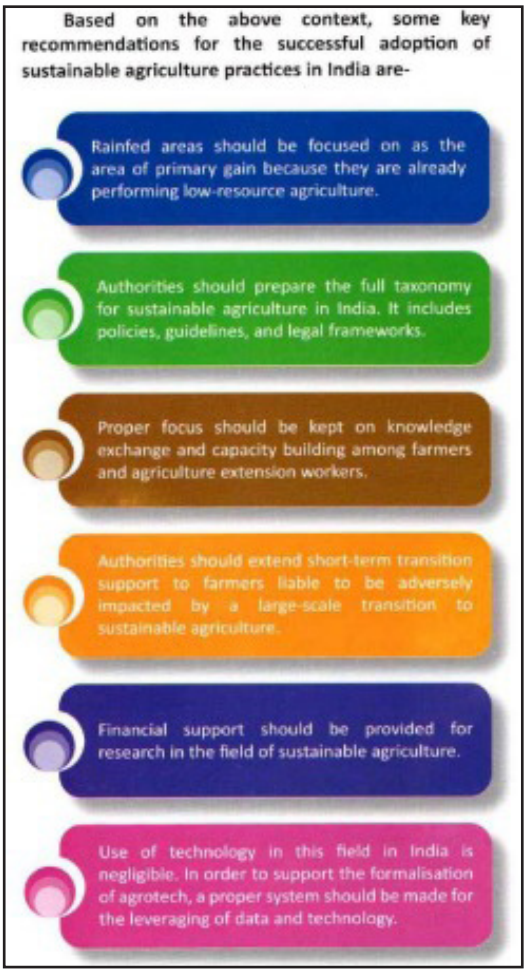
Main Objectives:

- Enhance productivity, sustainability, and climate resilience in agriculture.

- Adopt comprehensive soil health management practices.
- Optimize water resource utilization for 'More Crop Per Drop.'
- Develop capacity of farmers & stakeholders.

Major Components:

- **Rainfed Area Development (RAD):** Adopts area-based conservation of natural resources and regulates soil nutrients. Develops common resources like grain banks, fodder, biomass shredders, and combined marketing initiatives.
- **On-Farm Water Management (OFWM):** Promotes advanced water conservation equipment and technologies for optimum water utilization.
- **Soil Health Management:** Encourages location-specific sustainable practices to preserve soil health for different crop types.



Challenges to Sustainable Agriculture Practices (SAPs):

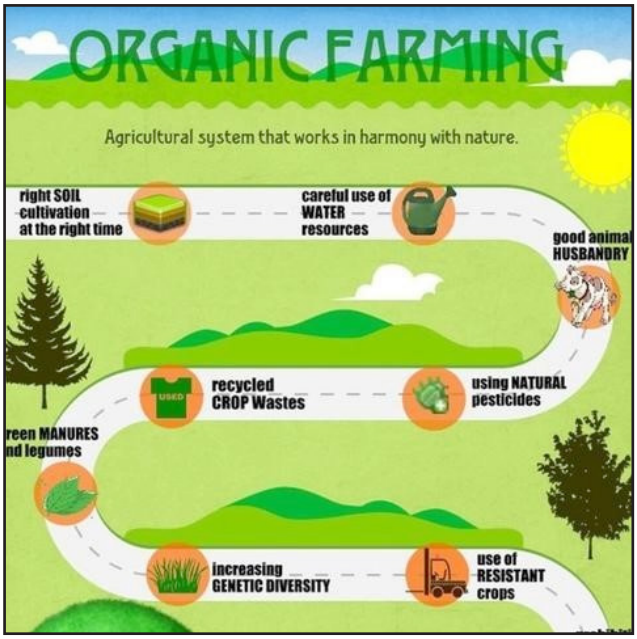
- Inadequate budgetary allocation to NMSA, only 0.8% of the total budget of the Ministry of Agriculture and Farmers' Welfare.
- Knowledge-intensive techniques require proper knowledge exchange among Indian farmers, posing a challenge for widespread adoption.
- Capacity building among farmers is a major challenge, with civil society organizations mainly concentrated in Maharashtra, Rajasthan, and Madhya Pradesh.
- Lack of specific guidelines or policies from the government to protect SAPs, except for organic farming.
- Niche nature of SAPs leads to limited mechanization options, making them labor-intensive for medium to large farmers.
- Low awareness among farmers about climate-resilient farm practices, hindering their willingness to adopt SAPs.

ORGANIC FARMING: STATUS AND POTENTIAL

Organic farming, as defined by the National Standard of Organic Production (NSOP), involves designing and managing farms to achieve sustainable productivity without artificial off-farm inputs like chemical fertilizers and pesticides. It is considered a climate-friendly practice that promotes minimal external input usage, recycling, and reduced reliance on synthetics. The Indian Council of Agriculture Research (ICAR), through its All India Network Programme on Organic Farming, has developed a set of practices for organic production in cropping and farming systems.

Organic farming is recognized as a climate-friendly approach that emphasizes minimal external inputs, recycling, and reduced use of synthetic substances in agriculture. The government's initiatives, such as Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development for North Eastern Region (MOVCDNER), have contributed to a substantial expansion of organic agriculture acreage.

Overview of organic farming:



- Organic agriculture is practiced in 187 countries worldwide.
- Approximately 72.3 million hectares of agricultural land were managed organically by at least 3.1 million farmers globally, based on the 2021 FiBL survey.
- Australia has the highest organic agricultural land with 35.69 million hectares, followed by Argentina with 3.63 million hectares and Spain with 2.35 million hectares.
- Global sales of organic food and drinks surpassed 106 billion euros in 2019.
- India stands out among the 187 countries practicing organic agriculture, with 30% of the world's total organic producers.
- India is home to 27,59,660 total organic farmers, including 11,60,650 under Participatory Guarantee System (PGS) and 15,99,010 under India Organic.
- The country also has 1703 organic processors and 745 organic traders.
- As of March 2019, approximately 2.30 million hectares of farmland in India were under organic cultivation, which accounts for only 2% of the country's total net sown area of 140.1 million hectares.

Export of organic food from India:

- The global organic market has grown at a CAGR of 8.7% from 2015 to 2020, reaching US $129 billion in 2020.
- India produced around 3430735.65 MT of certified organic products in 2021-22, including various agricultural and processed items.
- Organic food export realization was approximately Rs. 5249.32 Crore (USD 771.96 million), with major destinations being USA, European Union, Canada, etc.
- India's domestic consumption base for agriculture products, including organic ones, is a primary reason for its relatively low share in world organic exports.
- The government is taking steps to increase India's share in global organic product trade through initiatives like buyer-seller meets, webinars, and adding more area under organic agriculture through PKVY.

Organic agricultural products exported during last 3 years

S. No.	Year	Exported Qty (In MT)	Value (In Cr)	Value (In USD Million)
1.	2021-22	460320	5249.32	771.96
2.	2020-21	888179	7078.50	1040.96
3.	2019-20	638998	4686.00	689.10

Image: Organic agricultural products export

Source: Kurukshetra

Government initiatives to promote organic farming:

- "Paramparagat Krishi Vikas Yojana" (PKVY) launched in 2015, focuses on organic villages, soil health management, and subsidies for organic farmers.
- "Rashtriya Krishi Vikas Yojana" promotes organic methods in states, aims for nutritional benefits, and improves health, especially for marginalized sectors.
- "Mission Organic Value Chain Development for North Eastern Region" (MOVCDNER) aims to develop organic farming in northeastern states, create market value chains, and devise market link strategies.
- "National Mission on Oilseeds and Oil Palm" (NMOOP) promotes edible oil production and oil palm plantations.
- "Capital Investment Subsidy Scheme (CISS) Under Soil Health Management Scheme" focuses on soil health, environmental safety, and reducing chemical synthesizer usage.
- "National Horticulture Mission" provides training and distributed land for economic organic farming.
- "One District-One Product" (ODOP) enhances economic planning and promotes indigenous products in Uttar Pradesh.
- "Zero Budget Natural Farming" avoids synthetic fertilizers and is crucial for the economy of organic farming.
- "Agri-Export Policy" promotes organic farming and impacts the market for economic planning.
- "National Project on Organic Farming" (NPOF) improves organic production, biopesticides, biofertilizers, and encourages certification programs for organic farming.
- **Organic certification scheme:**
  - National Programme for Organic Production (NPOP) Certification System: An independent organization reviews the entire process of production, processing, handling, storage, and transport to ensure compliance with organic standards.
  - Participatory Guarantee System (PGS): Under the Ministry of Agriculture and Farmers' Welfare, this system certifies organic products, guaranteeing adherence to quality standards.
  - A dedicated web portal, www.jaivikkheti.in, has been set up to assist farmers in obtaining improved prices for their organic produce.

MILLETS: FUTURE OF SUSTAINABLE AGRICULTURE

Introduction

Millets, recognized as nutri-cereals worldwide, offer the potential to enhance the nutritional balance of our diets. They are rich in proteins, fibers, vitamins, and essential minerals, serving as gluten-free alternatives to cereals. Establishing a robust supply-chain and value-chain, addressing export compliance, and ensuring adherence to sanitary and phytosanitary measures are crucial for meeting the global demand for millets produced in India.

Overview of millet cultivation in India

- India is the largest global producer of millets, contributing 19% of the world's millet production and covering 20% of the millet-growing area.
- The major millet varieties produced in India are pearl millet (bajra), sorghum (jowar), and finger millet (ragi).
- The top 10 millet-producing states in India are Andhra Pradesh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, Uttar Pradesh, and Uttarakhand.
- These ten states together account for about 98% of India's millet production, with six states contributing more than 83% of the total.
- India's average productivity of millets stands higher at 1,239 kg/ha compared to the world average of 1,229 kg/ha.
- Millets, also known as nutri-cereals, are gaining popularity due to their high nutritional content, eco-friendly cultivation practices, and potential for higher returns.
- The Indian government has taken initiatives to promote millets, including declaring 2018 as the National Year of Millets and 2023 as the International Year of Millets.
- The nutritional enrichment, environmentally friendly cultivation practices, and promising market prospects make millets an important component of India's agricultural landscape.

Power-pack Nutrititon

- Nutritional imbalances can lead to long-term health issues like stunting in children, anaemia in adolescents, diabetes, and obesity in adults.
- Millets have been recognized as nutri-cereals worldwide, offering the potential to enhance nutritional sensitivity in people's diets.
- Millets are rich in proteins, fibers, vitamins, and essential minerals, making them a valuable gluten-free alternative to traditional cereals.
- Millets can play a significant role in achieving nutritional balance in our diets and ensuring nutritional security.
- The nutritional benefits of millets include low absorption of fats and low glycemic indices, contributing to better health outcomes.

Grains	Energy (kcal)	Protein (g)	Carbohydrate (g)	Starch (g)	Fat (g)	Dietary Fibre (g)	Minerals (g)
Sorghum	334	10.4	67.6	59	1.9	10.2	1.6
Pearl millet	363	11.6	61.7	55	5	11.4	2.3
Finger millet	320	7.3	66.8	62	1.3	11.1	2.7
Proso millet	341	12.5	70.0	-	1.1	-	1.9
Foxtail millet	331	12.3	60.0	-	4.3	-	3.3
Kodo millet	353	8.3	66.1	64	1.4	6.3	2.6
Little millet	329	8.7	65.5	56	5.3	6.3	1.7
Barnyard millet	307	11.6	65.5	-	5.8	-	4.7
Maize	334	11.5	64.7	59	3.6	12.2	1.5
Wheat	321	11.8	64.7	56	1.5	11.2	1.5
Rice	353	6.8	74.8	71	0.5	4.4	0.6

Image: Nutritional profile of millets and cereals

Source: Kurukshetra

Environmental Sustainability

- **Adaptability:** Millets are versatile crops, capable of thriving in various conditions. They exhibit drought resistance and can withstand a wide range of temperatures.
- **Cropping duration:** Millets have a shorter cropping duration compared to other cereals, making them suitable for crop rotation practices.
- **Irrigation:** Millets demand less irrigation than crops like rice and wheat, making them a preferred option in regions with limited water resources.
- **Mixed cropping:** Millets can be grown in mixed cropping systems, benefiting soil fertility and pest control.

Initiatives for promoting millet production and consumption:

Production:

- **Area Under Cultivation of Millets in India:**
  - From 2013-14 to 2021-22, the area under cultivation of millets in India ranged between 12.3 and 15.5 million hectares.
  - In 2022-23, the production of millets in India was 159 lakh tons, according to advance estimates.
  - The production target set by the government for 2022-23 was 205 lakh tons.
  - The total production of millets increased from 137 lakh tons in 2018-19 to 160 lakh tons in 2021-22.
  - Productivity also improved from 1,163 kg/ha to 1,239 kg/ha over the same period.

Largest Area cultivated under Millets and Highest Millet Production in 2021-22

States	Bajra	Jowar	Ragi
Area ('000 hectares)	Rajasthan (3,736)	Maharashtra (1,649)	Karnataka (846)
Production ('000 tonnes)	Rajasthan (3,740)	Maharashtra (1,558)	Karnataka (1,127)

Source: Lok Sabha Unstarred Question No. 2447 answered on 15.03.2023

- **Minimum Support Prices (MSP) for Millets:**
  - The government of India fixes Minimum Support Prices (MSP) for crops, including ragi, jowar, and bajra.
  - Assured prices through MSP ensure a guaranteed income for millet growers, reducing risks and information asymmetry.
  - From 2014-15 to 2023-24, MSP for paddy increased 1.6 times, while MSP for jowar, bajra, and ragi increased by 2.1, 2.0, and 2.5 times, respectively.
  - Bajra shows the highest return over cost among the millets.

Minimum Support Price for Millets

Crop	MSP 2014-15	MSP 2022-23	MSP 2023-24	Cost* of production 2022-23	Increase in MSP (Absolute)	Return over cost (in per cent)
Paddy	1,360	2,040	2,183	1,455	143	50
Jowar	1,530	2,970	3,180	2,120	210	50
Bajra	1,250	2,350	2,500	1,371	150	82
Ragi	1,550	3,578	3,846	2,564	268	50

Consumption:

- **Targeted Public Distribution System (TPDS):** The government promotes millet consumption through the TPDS to provide subsidized millet to eligible beneficiaries.
- **Pradhan Mantri Poshan Shakti Nirman (PM-POSHAN):** This program aims to improve nutrition and promote millet consumption among women and children.
- **Integrated Child Development Scheme (ICDS):** Millets are included in the ICDS to enhance the nutritional value of meals provided to children.

- **One District One Product (ODOP) scheme:** This scheme promotes millets as a unique product from specific districts, encouraging their consumption and production.
- **Sub-mission on Nutri-Cereals under National Food Security Mission:** The sub-mission focuses on increasing the production and consumption of millets to ensure food security.
- **Indian Institute of Millets Research (IIMR):** The institute in Hyderabad conducts research on millets and shares best practices with other countries to promote millet cultivation and consumption.
- **Awareness campaigns and nutritional programs:** Various awareness campaigns, including commemorative coins and stamps, as well as initiatives by the Food Corporation of India, are conducted to raise awareness about the benefits of millets for consumers.

Conclusion:

Indian millets have gained recognition in international markets, becoming a symbol of economic prosperity. To strengthen the supply chain, APEDA has taken initiatives like e-catalogues, capacity-building programs, and B2B meetings during international trade fairs. However, compliance with export measures remains a challenge. A flexible approach in promoting millets is essential to address agri-food issues, increase production, meet domestic demand, and boost exports. Emphasizing affordability can assure a steady market, leading to positive outcomes like improved nutrition, environmental sustainability, soil fertility, and higher incomes for farmers.

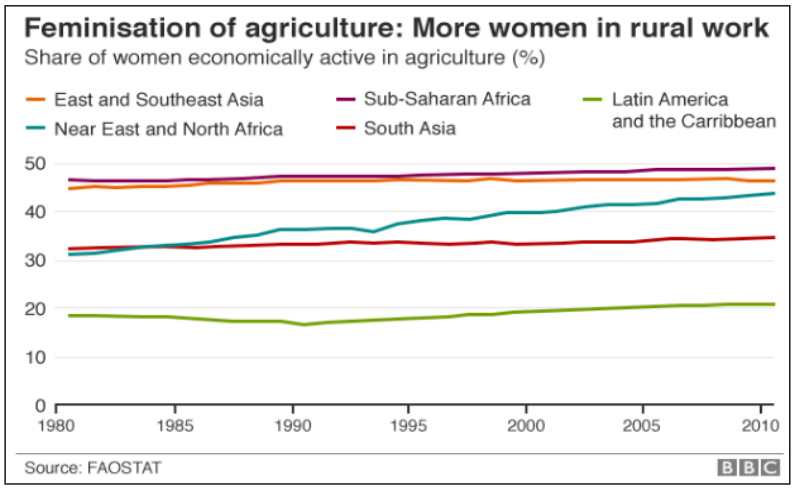
CONTRIBUTION OF WOMEN TO SUSTAINABLE AGRICULTURE DEVELOPMENT

Introduction

- Agriculture sector employs 45.6% of the workforce (2023 Periodic Labour Force Survey report) and contributes about 17.32% of gross value added (MoAFW 2022-23).
- Rural women significantly contribute as paid and unpaid laborers, managers/supervisors in agriculture, and post-harvest operations.
- Giving women equal access to facilities can boost agricultural productivity by about 2.5% and increase farm yields by 20 to 30%.

The Importance of Women in Agriculture and Allied Services

- Agriculture is the primary income source for nearly 70% of Indian households, with approximately 60% of the population working in this sector.
- Women play a significant role in agriculture, comprising 33% of the labor force and 48% of self-employed farmers.
- With growing urban migration by men, women are increasingly managing the agriculture sector.
- Rural women contribute to agriculture through various roles as cultivators, entrepreneurs, and laborers.



- They are involved in allied fields like livestock rearing, horticulture, post-harvesting operations, agro/social forestry, and fishing.
- Women perform labor-intensive manual tasks such as cattle management, milking, threshing, and winnowing.
- Their community management role aids in information dissemination and extension services.
- Approximately 80% of women in rural India depend on and contribute to agricultural development.
- The 'feminisation of agriculture' has led to an increase in women's roles in various aspects of farming.
- Women work as paid and unpaid workers on family-owned land and serve as managers in agricultural production and post-harvest operations.
- They also play a vital role in land and water management, including collecting water, firewood, and fodder essential for agriculture.
- Women are involved in diverse activities like livestock production, vegetable cultivation, fish processing, and dairy production, contributing significantly to agricultural practices.

Causes of Feminisation of Agriculture

- **Poverty:** Poverty forces women to work as agricultural laborers to supplement family income, and they often engage as unpaid workers on family-owned fields.
- **Agrarian Distress and Shift of Men to Casual Work:** Agrarian distress leads to disruption of farm labor and migration of males from agriculture to casual work, resulting in increased participation of women in agricultural and allied activities.
- **Migration to Urban Areas:** Rural-to-urban migration by men leads to the feminization of the agriculture sector, with more women taking up roles as cultivators, laborers, and entrepreneurs.
- **Mechanization of Agriculture:** As agriculture becomes more mechanized, men transition to non-farm activities, while women continue in traditional roles like winnowing, harvesting, sowing seeds, and livestock rearing.
- **Mobility Constraints:** Women's upward mobility for employment is restricted, and gender wage differentials further constrain their opportunities. Female migration for employment and better economic prospects is significantly lower compared to rural males.

Challenges Faced by Rural Women in Agriculture

- **Lack of Recognition:** Women's roles as primary producers are often overlooked, and they are treated merely as consumers of social services. This perpetuates a cycle of drudgery, limited skill development, and exclusion from decision-making processes.
- **Skill Development:** Limited avenues for skill development lead to women being relegated to low-skilled, time-consuming, and monotonous farm activities. The increasing mechanization of agriculture threatens their participation unless they are provided with opportunities to acquire new skills, such as operating machinery.
- **Land Ownership and Records:** Women own only 13.9 percent of operational holdings, reflecting a gender disparity in land ownership and prevailing land fragmentation practices. Though the Hindu Succession Act, 2005 allows daughters equal rights in ancestral property, the same is not true for agricultural land.
- **Poor Credit Access:** Lack of asset ownership makes credit facilities inaccessible to women. Rural financial institutions hesitate to serve female clients due to stringent requirements and their limited borrowing experience.
- **Inequality in Market Access:** Gender discrimination restricts women's mobility, limiting their access to marketplaces and hindering economic opportunities.
- **Gender Division of Labor:** Traditional gender roles often assign women to unpaid household chores and caregiving responsibilities, leaving them with less time and energy for agricultural work.
- **Social Norms and Cultural Barriers:** Deep-rooted gender norms and cultural practices limit women's decision-making power and control over resources in agriculture.
- **Limited Access to Modern Inputs:** Women have limited access to productive resources like quality seeds, fertilizers, and pesticides, impacting agricultural output.
- **Lack of Information and Training:** Women farmers often face a lack of information and training on modern agricultural practices, reducing their ability to adopt new technologies.
- **Infrastructure and Services:** Inadequate rural infrastructure and services, such as transportation, irrigation, and storage facilities, pose challenges for women farmers.
- **Climate Change and Environmental Risks:** Climate change affects agricultural productivity, and women farmers are particularly vulnerable to its impacts.

How to rectify those challenges

- **Recognition and Empowerment:** Acknowledge women as primary producers, providing them with equal opportunities for skill development, decision-making, and access to resources.
- **Skill Development Programs:** Establish comprehensive skill development programs for women farmers to enhance their capacity to engage in diverse and technologically advanced agricultural practices.
- **Land Ownership Rights:** Ensure equal land ownership rights for women through legal reforms and awareness campaigns. Proper documentation of land records should be facilitated.
- **Gender-Inclusive Financial Services:** Promote financial inclusion for women farmers by offering customized and accessible credit facilities, reducing collateral requirements, and establishing dedicated rural financial institutions for women.
- **Market Access and Mobility:** Address gender-based mobility constraints by providing better infrastructure, transportation facilities, and market linkages to enable women farmers' participation in commercial activities.
- **Gender-Sensitive Policies:** Introduce gender-sensitive policies and programs that prioritize women farmers' needs and consider their unique contributions to agriculture.
- **Supportive Institutional Mechanisms:** Establish farmer producer organizations and self-help groups that focus on women farmers' empowerment, skill enhancement, and collective bargaining power.
- **Strengthening Rural Infrastructure:** Invest in rural infrastructure development, including irrigation facilities, storage, and transportation, to support women farmers.
- **Climate-Resilient Agriculture:** Promote climate-resilient agricultural practices and provide women farmers with training on climate change adaptation and mitigation strategies.

Government Initiatives to empower female farmers

- **SHG-Bank Linkage Program by NABARD:**
  - The SHG-Bank Linkage Program has benefited over 9 crore women across India, providing them access to formal banking services and credit facilities through Self Help Groups (SHGs).
  - As of 2021, the program has facilitated the formation of more than 95 lakh SHGs, empowering women to save and access credit for agricultural and livelihood activities.
- **Mahila Kisan Sashaktikaran Pariyojana:**
  - Under the Mahila Kisan Sashaktikaran Pariyojana, over 18 lakh women farmers have been trained and equipped with knowledge and skills related to sustainable agriculture and allied activities.
  - The scheme has also reached out to more than 7 lakh landless women farmers, promoting their involvement in various farm-based and non-farm-based livelihood initiatives.
- **Encouraging Women's Leadership Roles in Farmer Producer Organizations:**
  - The government aims to establish 10,000 Farmer Producer Organizations (FPOs) by 2024, with a significant focus on encouraging women's leadership and participation.
  - As of 2021, approximately 25% of FPOs have women members in leadership positions, and the government is actively working to increase this representation.
- **Skill Development Programs under Pradhan Mantri Kaushal Vikas Yojana:**
  - Since its launch in 2015, Pradhan Mantri Kaushal Vikas Yojana has trained more than 1 crore women, including those engaged in agriculture, in various skill areas.
  - Around 45% of the total beneficiaries under PMKVY are women, indicating the growing emphasis on empowering women with market-relevant skills in the agricultural sector.
- **Financial Inclusion Schemes - Pradhan Mantri Jan Dhan Yojana and Pradhan Mantri Mudra Yojana:**
  - Under Pradhan Mantri Jan Dhan Yojana, over 43 crore bank accounts have been opened, with about 55% of the account holders being women.
  - Pradhan Mantri Mudra Yojana has facilitated the provision of more than 30 crore loans to micro and small entrepreneurs, with a substantial number of women beneficiaries in the agricultural sector.

Way Forward

- Enhancing access to credit, entrepreneurship opportunities, and recognition can boost women's participation in agriculture.
- Formation of women Farmer Producer Organizations (FPOs) under the central government's 10,000 FPOs scheme can provide them with access to resources and land records.
- Alternative approaches like Andhra Pradesh's Loan Eligibility Card (LEC) can be implemented in states without modifications to tenancy laws.
- Direct access to information on improved agricultural practices and market links through digital platforms can empower women in the farming sector.

Conclusion

Providing women with equal access to resources and opportunities can significantly boost agricultural productivity by approximately 2.5%, leading to a remarkable increase in farm yields by 20 to 30%. This transformation of women into self-reliant individuals will not only benefit them but also contribute to the overall progress of the nation. A recent event held in Punjab, 'Awareness on Agripreneurship cum Exhibition for Farm Women,' showcased the growing role of women in India's sustainable agriculture development. To ensure fairness and justice, we must go beyond the trope that "Women hold up half the sky" and recognize their crucial contribution to agriculture. Empowering mahila kisans (women farmers) is essential for the earth's interest, especially in the face of challenges posed by climate change. Nobel Prize winner Dan Shechtsman rightly emphasized that sustainable agriculture development hinges on women's ingenuity, making them a vital resource for the growth of Indian agriculture.

PAVING THE WAY FOR SUSTAINABLE GROWTH

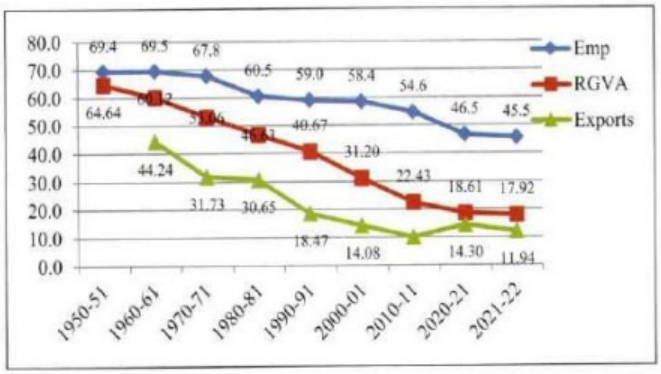
Introduction

Agriculture remains the cornerstone of India's economy. During the past seventy years, the country has witnessed substantial growth in food grain production, surpassing population growth and leading to a significant rise in per capita foodgrain availability. The liberalization of the economy has brought about a transformation in the agricultural sector, with a shift from traditional food crops to commercial and horticultural crops. As a result of this remarkable progress, India has now become the seventh-largest exporter of agricultural products globally.

Agriculture and Economy

- Agriculture, along with allied sectors, is a crucial part of the Indian economy, contributing significantly to national income, output, employment, and foreign exchange earnings.
- More than 50% of the total workforce in India is directly employed in agriculture, either as cultivators or agricultural laborers.
- From 1950-51 to 2021-22, the real gross value added (RGVA) by the primary sector (including agriculture, forestry, fishing, mining & quarrying) increased from Rs. 3,09,778 crore to Rs. 24,37,680 crore, with a compound growth rate of 2.91% per annum.
- The share of the primary sector in real gross value added decreased from 64.64% in 1950-51 to 17.92% in 2021-22, but it is still relatively high compared to the world average of 4% of global GDP.

Share of Agriculture & Allied Sector in Gross Value Addition, Employment and Exports (%)



Sources: (i) NSSO, Periodic LabourForce Survey 2021-22, February 2023.
(ii) Economic Survey 2022-23, Statistical Appendix, pp. 7-9, 112-118

- The farm sector's share in employment generation declined from 69.40% in 1950-51 to 45.5% in 2021-22, as per the NSSO's latest annual Periodic Labour Force Survey (PLFS) report for 2021-22.
- The contribution of agriculture and allied sectors to foreign exchange earnings decreased from 44.24% in 1960-61 to 11.94% in 2021-22.
- Despite the decline in its share in national output and employment, the agriculture and allied sectors remain the primary source of livelihood for over half of the country's population.

Trends in Agriculture Production:

- Over 7 decades, India achieved remarkable progress in foodgrain production.
- Total foodgrain production increased from 50.8 million tonnes in 1950-51 to 315.62 million tonnes in 2021-22.
- Compound growth rate of foodgrain production: 2.61% per annum.
- Cereal production increased nearly sevenfold, while pulses increased by 3.25 times.
- India emerged as the world's largest pulses producer.
- Per capita per day foodgrain availability increased from 395 grams in 1951 to 514.5 grams in 2022.
- Major commercial crops in India include cotton, jute, tea, coffee, rubber, sugarcane, and oilseeds.
- Among commercial crops, potato had the highest annual compound growth rate of 5.01% from 1950-51 to 2021-22.
- Rubber and cotton followed with growth rates of 3.97% and 3.33%, respectively.
- Oilseed production grew at a rate of 2.83%, increasing from 5.2 million tonnes to 37.7 million tonnes.
- Sugarcane production increased from 57.1 million tonnes to 431.8 million tonnes, with an annual growth rate of 2.89%.
- Cotton production witnessed a growth rate of 3.33% per annum, rising from 3.04 million bales to 31.2 million bales.

Commodity	1950-51	1970-71	1990-91	1910-11	2020-21	2021-22	CAGR (%)
Foodgrains	50.8	108.4	176.4	244.5	310.74	315.62	2.61
Cereals	42.4	96.6	162.1	226.3	285.28	288.31	2.74
Pulses	8.4	11.8	14.3	18.2	25.46	27.3	1.67
Oilseeds	5.2	9.6	18.6	32.5	36.57	37.7	2.83
Sugarcane	57.1	126.4	241	342.4	405.4	431.8	2.89
Cotton@	3.04	4.8	9.8	33	35.25	31.2	3.33
Jute & Mesta#	3.3	6.2	9.2	10.6	9.35	10.32	1.62
Tea	0.28	0.4	0.7	1	1.4*	-	2.36
Coffee	-	0.1	0.2	0.3	0.3*	-	2.22
Rubber	-	0.1	0.3	0.8	0.7*	-	3.97
Potato	-	4.8	15.2	42.3	56.17	53.39	5.01
Milk	17	22	53.9	121.8	210.0	221.1	3.68
Egg (Million No)	1832	6172	21101	63024	122049	129600	6.18
Fish	0.75	1.76	3.84	8.4	14.7	16.2	4.42

Image: Trends in Agriculture Production (Qty in million tonnes)

Source: Directorate of Economics & Statistics

Trends in Horticulture Production:

- India's diverse agro-climatic conditions and soil types enable cultivation of a wide range of horticultural products, including fresh fruits, vegetables, spices, flowers, and medicinal crops.
- Total horticultural production in India increased from 145.79 million tonnes in 2001-02 to 342.33 million tonnes in 2021-22, with an annual compound growth rate of 4.36%.
- Vegetable production contributes nearly 60% of the total horticultural output, reaching 204.84 million tonnes in 2021-22, cultivated across 11.35 million hectares.
- Fresh fruits constitute over 31% of total horticultural production, with an annual production of 107.24 million tonnes, cultivated across 7.05 million hectares.
- India is a prominent global producer of fruits and vegetables, securing the second position worldwide, just behind China.
- India holds the first rank in the world for the production of various fruits like mango, banana, sapota, pomegranate, and aonla, as well as vegetables like peas and okra.
- The country ranks second in the world for the production of brinjal, cabbage, cauliflower, and onion.
- India is the largest producer, consumer, and exporter of spices, with a total production of 10.81 million tonnes during 2021-22 from an area of 4.49 million hectares.

Year	Food Grain	Horticulture	Vegetables	Fruits	Other
2001-02	212.9	145.79	88.62	43.00	14.17
2005-06	208.6	182.8	111.40	55.36	16.04
2010-11	244.5	240.5	146.55	74.88	19.07
2015-16	251.6	286.2	169.06	90.18	26.95
2020-21	310.74	334.60	200.4	102.48	31.68
2021-22	315.62	342.33	204.84	107.24	30.25
CAGR (%)	1.99	4.36	4.28	4.68	3.87

Image: Horticulture Vis-a-vis Foodgrain Production in India (Quantity in Million Tonnes)

Source: Agriculture Statistics at a Glance 2022

Trends in Livestock Production:

- Livestock contributes nearly 30% to the overall agricultural and allied sector output in India.
- India is the largest producer of milk in the world, with a per capita availability of 427 grams per day in 2022-23.

- Total milk production in India increased from 17 million tonnes in 1950-51 to 221 million tonnes in 2021-22, growing at 3.68% annually.
- Poultry production has seen significant progress, with egg production increasing from 1,832 million to 129,600 million during the same period, at an impressive compound growth rate of 6.18%.
- Fisheries sector contributes more than 7% to the total output of agriculture and allied sectors, with total fish production increasing from 0.752 million tonnes in 1950-51 to 16.3 million tonnes in 2021-22, growing at 4.42% annually.
- The Fisheries and Aquaculture Infrastructure Development Fund (FIDF) aims to elevate annual fish production to 20 million tonnes and generate over 9.40 lakh employment opportunities by 2022-23.
- The Pradhan Mantri Matsya Sampada Yojana targets enhancing fish production to 22 million tons by 2024-25 and generating about 15 lakhs direct gainful employment opportunities.

Trends in Agricultural Trade:

- India achieved self-sufficiency in food grains and is now the seventh-largest net exporter of agricultural products in the world.
- Agricultural exports started to pick up after 1970-71 and saw significant growth from 1994-95 due to global trade reforms and reductions in agricultural tariffs under the WTO regime.
- India's export basket includes diverse products like rice, pulses, fruits, vegetables, tea, coffee, spices, meat, fish, and processed food.
- Agricultural exports grew from Rs. 284 crore in 1960-61 to Rs. 3,75,742 crore in 2021-22, with a compound annual growth rate of 14.27%.
- The trade balance of agricultural goods has been positive and increased nearly 30 times in the last three decades, playing a pivotal role in generating foreign exchange for the nation.
- India shifted towards exporting higher value-added items like processed fruits, vegetables, meat, fish, and packaged goods, catering to the emerging global market demands.
- The major export destinations for India's agricultural products include Bangladesh, China, Iran, Japan, the USA, and more.
- India's agri-export basket accounts for over 2.5% of world agri-trade but its overall share in total world exports remains below 1.7%.
- The Mission for Integrated Development of Horticulture (MIDH) was launched to promote holistic growth in the horticulture sector and enhance agricultural exports.

Years	Agriculture Exports	Percentage of Agriculture Exports to Total Exports	Agriculture Imports	Percentage of Agriculture Imports to Total Imports	Agriculture Trade Balance
1990-91	6013	18.49	1206	2.79	4807
1995-96	20398	19.18	5890	4.8	14508
2000-01	28657	14.23	12086	5.29	16571
2005-06	45711	10.78	15978	3.26	29733
2010-11	113047	10.28	51074	3.41	61973
2015-16	215396	12.55	140289	5.63	75107
2020-21	308830	14.30	154511	5.30	154319
2021-22	375742	11.94	231850	5.07	143892
ACGR(%)	14.27		18.49		

Image: Trends in Agricultural Trade Source: Agriculture Statistics at a Glance

Conclusion:

Indian agriculture has witnessed significant progress in the past seven decades, ensuring food security and contributing to foreign exchange earnings. The sector has shifted towards commercial and horticultural crops, adopting modern techniques. However, there is still room for improvement in yield per hectare. Enhancing agricultural productivity requires embracing modern farming practices, quality inputs, and easy access to credit. Government intervention is essential to support farmers and create fair market conditions, ultimately maximizing profits and sustaining agricultural growth.

Dhyeya IAS Now on Telegram

Join Dhyeya IAS Telegram Channel from link the given below

https://t.me/dhyeya_ias_study_material

नोट : पहले अपने फ़ोन में टेलीग्राम App Play Store से Install कर ले उसके बाद लिंक में क्लिक करें जिससे सीधे आप हमारे चैनल में पहुँच जायेंगे।

You can also join Telegram Channel through our website

www.dhyeyaias.com

www.dhyeyaias.com/hindi

ध्येय IAS
most trusted since 2003

Address: 635, Ground Floor, Main Road, Dr. Mukherjee Nagar, Delhi 110009
Phone No: 9205274741, 9205274742, 9205274744