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Climate-Smart Policy

Institutional Power Reshaping Farmer-Led Resilience

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Agriculture is highly vulnerable to climate change, with increasing temperatures, irregular rainfall, and frequent extreme weather events threatening crop productivity and farmer livelihoods. In this context, climate-smart policies have emerged as a strategic approach to ensure sustainable agricultural development while enhancing resilience. These policies aim to integrate adaptation, mitigation, and productivity goals. However, the role of institutional power governments, research bodies, financial institutions, and international organizations is crucial in shaping how these policies are implemented and how effectively farmers can build resilience.

Global distribution of countries based on the type of climate policy they have adopted, including carbon pricing mechanisms and net-zero emission targets. It highlights that many developed countries such as those in Europe, Canada, and parts of East Asia have implemented both carbon pricing policies and net-zero emission targets, indicating strong climate commitments. Several countries, including the United States, Australia, and parts of South America, show mixed approaches with either carbon pricing or net-zero targets only. A number of developing and least-developed regions, particularly in parts of Africa and Central Asia, still have no clear climate policy or lack available data

Concept of Climate-Smart Policy

Climate-smart policy refers to a set of strategies and frameworks designed to promote climate-smart agriculture (CSA). It focuses on three main objectives: increasing agricultural productivity, adapting to climate change, and reducing greenhouse gas emissions where possible. These policies encourage the adoption of improved practices such as efficient irrigation, drought-resistant crop varieties, integrated nutrient management, and agroforestry.

By aligning agricultural development with climate goals, climate-smart policies aim to create a balance between food security and environmental sustainability. However, the success of these policies depends largely on how institutions design and enforce them.

Why need of Policy on Climate smart

Climate-smart policy is essential for reshaping agriculture for farmers because Indian farming is highly vulnerable to climate change and its associated risks. Rising temperatures, irregular rainfall, frequent droughts, floods, and heatwaves are directly affecting crop growth, reducing yields, and increasing production uncertainty. At the same time, agriculture is facing serious resource constraints such as declining groundwater levels, soil degradation due to excessive chemical inputs, and reduced soil organic carbon, which together limit long-term productivity. Farmers also experience economic instability due to rising input costs and crop failures, making agriculture a high-risk occupation. Climate-smart agriculture policies address these challenges by promoting climate-resilient crop varieties, efficient water management practices like drip and micro-irrigation, balanced and organic nutrient management, and diversified cropping systems. These policies also support low-emission farming techniques to reduce greenhouse gas emissions from agriculture and strengthen food security by stabilizing production under changing climate conditions. In addition, climate-smart initiatives improve access to weather forecasting, digital advisory services, and crop insurance, helping farmers reduce risk and make better decisions. Overall, such policies are necessary to ensure sustainable agricultural growth, protect farmer livelihoods, and maintain long-term food security under the pressure of climate change.

Major Climate-Smart Agricultural Practices

1. Conservation Agriculture

Conservation agriculture is based on three principles: minimum soil disturbance, permanent soil cover, and diversified crop rotations. These practices improve soil structure, conserve moisture, reduce erosion, and enhance soil organic carbon. They also lower fuel consumption and greenhouse gas emissions while improving long-term crop productivity.

2. Precision Water and Nutrient Management

Precision management uses soil testing, sensors, GPS, and efficient irrigation systems to apply water and nutrients according to crop requirements. This approach improves water-use and nutrient-use efficiency, reduces fertilizer losses, lowers nitrous oxide emissions, and increases crop yield under changing climatic conditions.

3. Microbial Inoculants and Biofertilizers

Microbial inoculants such as Rhizobium, Azotobacter, Azospirillum, phosphate-solubilizing bacteria (PSB), and arbuscular mycorrhizal fungi (AMF) improve nutrient availability, stimulate root growth, and enhance drought and heat tolerance. They reduce dependence on chemical fertilizers while improving soil biological activity and sustainability.

4. Agroforestry

Agroforestry integrates trees with crops and sometimes livestock to create resilient farming systems. Trees improve soil fertility, reduce wind and water erosion, enhance biodiversity, provide additional income, and sequester atmospheric carbon, making agriculture more resilient to climate change.

Reshaping Farmer-Led Resilience

Farmer- led resilience refers to the ability of farmers to adapt to climate variability using their knowledge, skills, and available resources. Climate-smart policies, guided by institutions, are reshaping this resilience in several ways.

Institutional Power in Agriculture

Institutional power refers to the ability of organizations and governing bodies to influence decision-making, resource allocation, and policy implementation. In agriculture, institutions include government agencies, agricultural universities, extension services, NGOs, and financial organizations.

These institutions play a vital role in:

- Framing agricultural policies and regulations
- Providing financial support such as subsidies and credit
- Disseminating knowledge and technologies
- Facilitating market access and infrastructure

Institutional power can either empower farmers by providing resources and support or constrain them if policies are poorly designed or unequally implemented.

The salient achievements of ICAR on climate resilient agriculture 1888 climate resilient crop varieties including 891 of cereals, 319 of oilseeds, 338 of pulses, 103 of forage crops, 182 of fibre crops, 45 of sugar crops, and 10 of other crops have been developed and 88 biocontrol agents, 31 biopesticides and 41 Biofertilizers have been documented and circulated.

Participatory technology development of climate resilient practices has been undertaken involving farmers in risk assessment, demonstration and adaptation techniques in 151 clusters covering 454 villages, with a footprint of 2.13 lakh households, on 2.36 lakh hectares of land. 68 climate resilient technologies have been demonstrated in 454 villages on 15857 farmers' fields during 2014-23. Drip fertigation schedules for 35 crops and cropping systems for achieving higher water and nutrient use efficiency have been standardized. Also District Agriculture Contingency Plans (DACPs) for 650 Districts have been developed.

Indian Government Policies on Climate-Smart Agriculture

India has adopted several policies and missions to promote climate-smart agriculture, focusing on sustainability, resilience, and productivity under changing climatic conditions.

1. National Action Plan on Climate Change (NAPCC)

The Government of India launched National Action Plan on Climate Change (NAPCC) on 30th June, 2008. NAPCC provides the overall framework for climate action in India. It includes eight national missions, of which agriculture-related missions focus on adaptation and sustainability.

2. National Mission for Sustainable Agriculture (NMSA)

The National Mission for Sustainable Agriculture (NMSA) was launched in 2014-15 as part of the National Action Plan on Climate Change. The National Mission for Sustainable Agriculture is a key policy directly addressing climate-smart agriculture in India. It promotes climate-resilient farming practices aimed at helping farmers adapt to changing environmental conditions. The mission places strong emphasis on improving soil health, enhancing water-use efficiency, and encouraging integrated farming systems to ensure sustainability. Additionally, it supports the adoption of drought-tolerant crops and resource-efficient technologies, enabling farmers to maintain productivity while conserving natural resources.

3. Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)

The Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) was launched on **1st July 2015**. Pradhan Mantri Krishi Sinchayee Yojana aims to improve irrigation efficiency through its slogan "Per Drop More Crop". It promotes the use of micro-irrigation techniques such as drip and sprinkler systems, which help optimize water use in agriculture. By encouraging these practices, the scheme supports farmers in coping with water scarcity and adapting to climate variability, ultimately contributing to more sustainable and resilient farming systems.

4. Pradhan Mantri Fasal Bima Yojana (PMFBY)

The Pradhan Mantri fasal bima yojana (PMFBY) launched on 18 February 2016 by Prime Minister Narendra Modi. Pradhan Mantri Fasal Bima Yojana provides crop insurance to farmers against climate-related risks such as droughts, floods, and cyclones. By offering financial protection in the event of crop loss, it reduces the economic burden on farmers and helps stabilize their income. This support plays a crucial role in strengthening farmer resilience, especially during extreme weather events, enabling them to recover more quickly and continue agricultural activities.

5. Soil Health Card Scheme

The Soil Health Card (SHC) Scheme was launched by Prime Minister Narendra Modi on **19th February 2015.** The Soil Health Card Scheme promotes the balanced use of fertilizers by providing farmers with detailed information about the nutrient status of their soil. This helps improve soil fertility and productivity over time. The scheme also encourages integrated nutrient management, which is a key component of climate-smart agriculture, by guiding farmers to use a combination of organic and inorganic inputs in a sustainable manner.

6. Rashtriya Krishi Vikas Yojana (RKV RAFTAAR)

The Rashtriya Krishi Vikas Yojana (RKVY) was launched in **2007-08**. It was later revamped as **RKVY-RAFTAAR** (Remunerative Approaches for Agriculture and Allied sector Rejuvenation) with approval on November 1, 2017, for implementation from the 2017-18 financial year to focus on pre- and post-harvest infrastructure, agri-entrepreneurship, and innovation. Rashtriya Krishi Vikas Yojana supports innovation and promotes state-level climate-smart agricultural initiatives across India. It provides funding for the development of new technologies and infrastructure aimed at improving agricultural productivity and sustainability. Additionally, the scheme encourages farmer-led adaptive practices, enabling farmers to experiment with and adopt locally suitable solutions to cope with climate variability and enhance resilience.

7. National Food Security Mission (NFSM)

The National Food Security Mission (NFSM) was launched in **October 2007** by the Government of India. It was established to increase the production of rice, wheat, and pulses, with the mission subsequently expanding to include coarse cereals and commercial crops The National Food Security Mission promotes the adoption of improved crop production technologies to enhance agricultural productivity. It places particular focus on pulses and climate-resilient crops, which are better suited to withstand changing environmental conditions. By encouraging these practices, the mission helps strengthen food security, especially in the face of climate stress and variability.

8. Mission for Integrated Development of Horticulture (MIDH)

The Mission for Integrated Development of Horticulture encourages farmers to diversify into horticulture by supporting the cultivation of fruits, vegetables, and other high-value crops. This diversification helps reduce climate-related risks, as horticultural crops can offer greater resilience to changing weather conditions. At the same time, it improves income stability for farmers by providing opportunities for higher and more consistent returns compared to traditional cropping systems.

Regional Adoption of Climate-Smart Agriculture in India

Climate-Smart Agriculture (CSA) practices in India have been adopted across almost all agro-climatic regions, but their implementation is more prominent in areas facing climate stress. In **North-West India**, especially Punjab, Haryana, and western Uttar Pradesh, CSA is focused on water-saving technologies like drip irrigation and crop diversification from rice–wheat systems. In **Central India**, including Madhya Pradesh, Chhattisgarh, and parts of Maharashtra, the emphasis is on drought-resistant crops, soil moisture conservation, and low-input sustainable farming due to semi-arid conditions. In **Southern India** (Karnataka, Tamil Nadu, Andhra Pradesh, and Telangana), farmers are increasingly adopting drip irrigation, horticulture-based systems, and climate-resilient crop varieties. The **Eastern region** (Bihar, Odisha, West Bengal, and eastern Uttar Pradesh) focuses on flood-tolerant rice varieties, improved drainage, and agroforestry practices because of frequent floods and high rainfall variability. In **Rajasthan and Gujarat**, which are arid and semi-arid regions, CSA practices such as rainwater harvesting, millet cultivation, and drought management techniques are widely promoted. Overall, Climate-Smart Agriculture is spreading throughout India, but its adoption is strongest in regions that are most vulnerable to climate change and water scarcity.

Challenges in Implementation

Climate-smart policies hold significant promise, but their implementation faces several challenges. Many such policies follow a top-down approach, often overlooking the knowledge, experiences, and specific needs of local farmers. This disconnect can reduce their effectiveness on the ground. Additionally, there is inequality in access, as small and marginal farmers frequently lack the necessary resources, technology, and institutional support to benefit from these initiatives. Limited awareness is another major barrier, with many farmers not fully informed about climate-smart practices or the schemes available to support them. Furthermore, institutional gaps, including weak coordination among various agencies and organizations, can hinder the smooth execution and overall impact of these policies.

Conclusion

By the using of technologies we can minimize the effect of climate of our agriculture The Indian government and other bodies promotes Climate-Smart Agriculture (CSA) through the different programme like National Mission for Sustainable Agriculture (NMSA) etc key initiatives focus on enhancing water efficiency, soil health, and resilient farming practices (NICRA) to mitigate climate impacts on food security.

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