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12. Strategies for Doubling Farmers' Income in the Face of Climate Challenges

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Abstract:

The strategy to double farmers' income in context of climate challenges necessitates a collaborative approach involving government and farmers. Government actions encompass sustainable policies, enhanced productivity, and improved market access. Concurrently, farmers must embrace modern practices, crop diversity, and supplementary income sources.

Climate-smart techniques like conservation agriculture and agroforestry enhance productivity and resilience. Crop diversification, notably with climate-resilient options like millets, mitigates risks and captures markets. Rural infrastructure, tech advancements, and financial support enhance productivity and decision-making. A unified effort involving government, research, private sector, and farmers is vital. With millets gaining prominence and initiatives like the International Year of Millets 2023, the path to doubling farmers' income and climate-resilient farming appears optimistic.

Keywords:

DFI, climate change, sustainable agriculture, climate smart practices, government schemes

12.1 Introduction:

Doubling Farmer's Income- What it is?

India is known as an "Agrarian Economy" as Agriculture plays a vital role in the country's economy by providing livelihoods to the millions of the people of the country. However, the agrarian-farming community of India has faced many challenges *viz.*, low productivity, insufficient access to resources, and poor market linkages *etc* while growing crops and marketing their farm produce which ultimately reduces their net income and affects their living standard.

The government of India has set a goal of doubling farmers' income by 2022 while considering the problems faced by the farmers. Towards achieving the objective of doubling the farmers' income the government had established an Inter-Ministerial committee in April, 2016. The committee has examined the problems faced by farmers and issues related to DFI goal and finally recommended various strategies to the government in its final report of 14 volumes in September, 2018. The report containing strategy for doubling farmers' income by implementing various policies, programs and reforms.

Why Double Farmers' Income?

- The initiative to double farmers' income is essential for various reasons. Firstly, the farming community in India is the largest employer, which gives employment to around 50% of the country's population. However, the majority of farmers are small and marginal (less than 1 to 2 hectares of land) and they have very limited access to farm resources, technology, and market linkage facilities, leading to low productivity and low income. Therefore, doubling farmers' income is crucial to uplift the living standard of these farmers and ensure their socio-economic development.
- Secondly, the agriculture sector is the backbone of the country which shares about 18 % of India's Gross Domestic Product (GDP). However, the growth rate of the primary-agricultural sector has been declining over the past few years had negative impacts on the overall economy. Therefore, increasing farmers' income is the key to accelerating the growth and boost the Indian economy.
- Thirdly, the initiative to double farmers' income is in line with the United Nations' SDGs -Sustainable Development Goals, *viz.*, SDG 1 and SDG 2, aim to eradicate poverty (No poverty), ensure food security (Zero Hunger) and sustainable agriculture. By increasing farmers' income, the initiative contributes to the achievement of these goals.

The Inter- Ministerial Committee identified seven sources of income growth to meet the objective of doubling farmer's income:

a. By increasing crop productivity
b. By increasing livestock productivity
c. Resource use efficiency – by reducing in cost of production
d. By increasing cropping intensity
e. Diversification towards high value agriculture
f. Remunerative prices on farm produces
g. By Transferring surplus manpower (agri-labour) from farm to non-farm occupations

(Source: Ministry of Agriculture & Farmers Welfare, GoI. Retrived from: Press Information Bureau (pib.gov.in) &

https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1886630)

A. Increase in crop productivity:

Improving crop productivity is an important strategy for increasing farmers' income. The government has emphasized on modern improved agriculture practices such as improved seed varieties, and efficient irrigation systems as a priority.

These include providing farmers with access to high-quality seeds, encouraging cultivation of hybrid and genetically modified crops, and precision farming technologies. Furthermore, the government has allocated funds for agricultural research and development with the goal of developing high-yield crop variations and disseminating best practices via agricultural extension services.

B. Increase in livestock productivity:

Livestock farming is an integral part of agriculture and can significantly contribute to farmers' income. The government has implemented various initiatives to enhance livestock productivity, such as providing veterinary services, improving breed quality, promoting scientific feeding practices, and developing better animal healthcare infrastructure. Additionally, efforts have been made to facilitate the availability of improved breeds and promote the adoption of modern practices like artificial insemination, breed management, and disease control measures.

C. Resource use efficiency – by reducing cost of production.

Improving resource use efficiency is crucial to reducing the cost of production and increasing farmers' income. The government has focused on promoting sustainable agriculture practices, such as efficient use of water, fertilizers, and pesticides. This includes promoting precision agriculture techniques, drip irrigation systems, integrated nutrient management, and integrated pest management. By adopting these practices, farmers can optimize input usage, reduce costs, and improve productivity, thereby increasing their income.

D. Increase in cropping intensity:

Increasing cropping intensity refers to cultivating multiple crops on the same land in a year. The government has encouraged farmers to adopt multiple cropping patterns, such as intercropping, mixed cropping, and relay cropping.

This helps maximize land utilization, increase agricultural output, and generate additional income for farmers. Furthermore, the government has supported the development of infrastructure like irrigation facilities and rural roads to enable farmers to practice multiple cropping effectively.

E. Diversification to high-value agriculture:

Diversifying into high-value agriculture involves shifting from traditional, low-value crops to high-value crops and horticulture. The government has promoted the cultivation of cash crops, fruits, vegetables, spices, and medicinal plants. These crops generally command higher prices in the market, leading to increased income for farmers. The government has provided financial assistance, technical support, and market linkages to encourage farmers to diversify into high-value crops.

F. Remunerative prices on farm produces:

Ensuring farmers receive remunerative prices for their produce is crucial for increasing their income. The government has implemented various measures to support farmers in this regard. These include minimum support price (MSP) programs, where the government sets a minimum price for certain crops to protect farmers from market price fluctuations.

The government has also established agricultural produce marketing infrastructure, such as mandis (marketplaces), to facilitate fair price discovery and reduce farmers' dependency on middlemen. Additionally, the promotion of farmer producer organizations (FPOs) and direct marketing initiatives has helped farmers access better prices for their produce.

G. Transferring of surplus manpower (agri-labour) from farm to non-farm occupations:

The government recognizes the need to create employment opportunities outside the agricultural sector to increase farmers' income. Policies have been formulated to promote rural entrepreneurship, skill development, and the development of rural industries.

Government scheme such as Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) provide rural employment opportunities, enabling surplus manpower from the agricultural sector to engage in non-agricultural occupations.

This shift helps diversify income sources, reduce dependence on agriculture, and increase overall income levels. By focusing on these seven sources of income growth, the government aims to address the various aspects of agricultural development and improve farmers' livelihoods.

These strategies collectively work towards the objective of doubling farmers' income, ensuring sustainable and inclusive growth in the agriculture sector.

Table 12.1: Some of Government schemes which helps in enhancing Farmers' Income

Sr. No.	Government Initiative	Objective
1.	**Increase in crop productivity:**	
a)	**Soil Health Card Scheme (SHC, 2015):**	The Soil Health Card scheme provides farmers with personalized soil nutrient status and recommendations for appropriate fertilizer use. This helps optimize nutrient management and improve crop productivity.
b)	**Pradhan Mantri Krishi Sinchayee Yojana (PMKSY, 2015):**	This scheme implemented to improve crop productivity and water management by expanding irrigation coverage, enhance water-use efficiency, and promote precision irrigation technologies.
c)	**National Mission on Sustainable Agriculture (NMSA, 2014-15):**	This scheme emphasizes on climate-resilient agriculture by promoting integrated farming system, the use of organic inputs and conservation agriculture.
2.	**Livestock productivity enhancement**	
a)	**Rashtriya Gokul Mission (2014)**	This initiative focuses on conserving and developing indigenous cattle breeds to enhance livestock productivity, genetic improvement, and breed development.

Sr. No.	Government Initiative	Objective
b)	**National Livestock Mission (NLM, 2014):**	NLM supports various interventions such as breed improvement, animal nutrition, and disease control to increase livestock productivity and enhance farmers' income.
3.	**Resource use efficiency – by reducing cost of production:**	
a)	**Pradhan Mantri Fasal Bima Yojana (PMFBY, 2016):**	This crop insurance scheme provides financial assistance to farmers in the situation of crop loss or damage, increasing their income security by reducing their financial risks
b)	**Paramparagat Krishi Vikas Yojana (PKVY, 2015):**	PKVY promotes organic farming practices, minimizing the use of chemical inputs and reducing production costs.
4	**Increase in cropping intensity:**	
a)	**Pradhan Mantri Krishi Sinchayee Yojana (PMKSY, 2015-16):**	PMKSY aims to promote the adoption of micro-irrigation systems, which enable farmers to practice multiple cropping and increase cropping intensity on the same land.
5.	**Diversification to high-value agriculture:**	
a)	**National Horticulture Mission (NHM, 2005-06):**	NHM promotes the cultivation of high-value horticultural crops, providing farmers with better market opportunities and higher returns on their produce. b. National Food Processing Policy: This policy encourages investment in food processing infrastructure, enabling value addition and reducing post-harvest losses, thereby increasing farmers' income.
6.	**Remunerative prices on farmers' produce:**	
a)	**Minimum Support Price (MSP):**	The government sets minimum prices for various crops to ensure farmers receive fair and remunerative prices for their produce.
b)	**Electronic National Agriculture Market (e-NAM, 2016):**	e-NAM is an online trading platform that facilitates transparent price discovery and efficient marketing of agricultural commodities, ensuring better price realization for farmers.
7.	**Shift of surplus manpower (agri-labour) from farm to non-farm occupations:**	
a)	**Pradhan Mantri Kaushal Vikas Yojana (PMKVY, 2015):**	PMKVY provides skill development training to rural youth, equipping them with industry-relevant skills for employment in non-farm sectors.
b)	**National Rural Livelihood Mission (NRLM, 2010):**	NRLM aims to create sustainable livelihood opportunities for rural households, including skill development and entrepreneurship promotion.

The basis of the doubling farmers' income approach depends on the given fundamental principles:

a. Increasing agricultural output through obtaining higher levels of productivity
b. reducing production costs
c. Obtaining remunerative prices for agricultural output
d. Effective risk-mitigation.
e. Adopting long-term/ sustainable technological solutions

According to these principles, the government implemented several schemes, policies, reforms and developmental programmes to increase income of the farmers either directly or indirectly.

Table 12.2: Governtment initiative towards the Doubling of Farmers' Income by 2022

Sr. No.	Key Area	Details
1	**Unprecedented enhancement in budget allocation**	Increased financial resources allocated to the Ministry of Agriculture and FW (including DARE, DAH, and F) budget allocation.
2	**Pradhan Mantri Kisan Samman Nidhi Yojana (PM-KISAN, 2019)**	This scheme provides income support to eligible farmers in 3 equal installments of Rs. 2000 per year (Total amount: 6000Rs./year)
3	**Pradhan Mantri Fasal Bima Yojana (PMFBY, 2016)**	Crop insurance scheme with increased coverage and reduced premium rates.
4	**Institutional credit for agriculture sector**	Credit availability increased through Kisan Credit Cards (KCC) and target for institutional credit. Concessional credit extended through KCC (at 4% interest rate) to Animal Husbandry and Fisheries farmers.
5	**Fixing of Minimum Support Price (MSP)**	Increased MSP for all mandated crops to ensure a return of at least 50% over cost of production.
6	**Promotion of organic farming**	This schemes introduced to promote organic farming and sustainable natural farming systems.
7	**Per Drop More Crop scheme (PDMC, 2015-16)**	This effort aims to improve water use and production by encouraging the use of micro irrigation technologies such as drip and sprinkler irrigation systems.

Sr. No.	Key Area	Details
8	**Micro Irrigation Fund (MIF, 2018)**	Fund created with NABARD to support Micro Irrigation projects.
9	**Promotion of Farmer Producer Organisations (FPOs)**	The Hon'ble Prime Minister inaugurated a New Central Sector Scheme on February 29, 2020, which aims to establish and develop 10,000 new Farmer Producer Organizations (FPOs) with budget allocation of Rs 6865 crore till the year of 2027-28.
10	**National Beekeeping and Honey Mission (NBHM, 2020)**	Mission aims to increase crop productivity through pollination and honey production as part of Atma Nirbhar Bharat Abhiyan.
11	**Agricultural Mechanization**	It concerned with promotion of farm mechanization through various schemes and subsidies. Subsidies provided for machinery like tractors, power tillers, etc.
12	**Soil Health Card Scheme (SHC, 2015)**	This scheme implemented to provide soil health cards to farmers for better nutrient management and improved productivity.
13	**Electronic National Agriculture Market (e-NAM, 2016)**	The e-NAM program seeks to create a single national market plateform for agricultural commodities by connecting the APMCs of our country (Agricultural Produce Market Committees).
14	**National Mission for Edible Oils – Oil Palm (NMEO, 2021-22)**	This mission seeks to establish workable prices for fresh fruit bunches (FFBs), ensuring farmers' connection to a guaranteed purchasing system by the industry through a more straightforward pricing mechanism. If the industry's payment falls below the sustainable rate, the Central Government will provide compensation to farmers to bridge the gap in viability payments until October 2037.
15	**Agri Infrastructure Fund (AIF, 2020)**	This initiative focuses on financing agricultural infrastructure projects. Since its inception, the AIF has sanctioned a total of Rs. 13681 crore for more than agricultural infrastructure 18133 projects.
16	**Improvement in farm produce logistics (2020)**	The Ministry of Railways has introduced this concept of the "Kisan Rail," a railway service designed specifically for transporting perishable farm products farm commodities.

Sr. No.	Key Area	Details
17	**Mission for Integrated Development in Horticulture-Cluster Development Programme (MIDH, 2014)**	The Cluster Development Programme of the MIDH scheme initiated with the aim to leverage geographical specialization of horticulture clusters and to promote integrated and market-led development of pre-production, production, post-harvest, logistics, branding, and marketing activities.
18	**Creation of a Start-up Eco system**	This emphasis on developing a startup ecosystems in agri and allied sectors.
19	**Export of Agri and Allied Agri- Commodities**	Emphatic growth in the export of agri and allied commodities.

(Source: Ministry of Agriculture & Farmers Welfare, GoI. Retrived from: Press Information Bureau (pib.gov.in) &

https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1886630)

(Situation Assessment Survey, 2014 and Situation Assessment Survey, 2021)

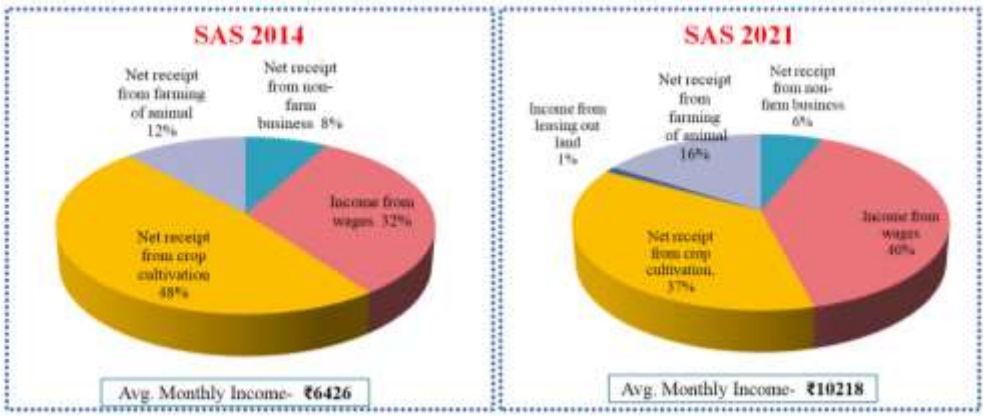

Figure 12.1: Composition of Average Monthly Income of Agricultural Households

(Source: Economic Survey 2021-22 (Based on data of SAS, 2014 and SAS, 2021))

In the above context, according to Economic Survey 2021-22, Based on data of Situation Assessment Survey- SAS, 2014 and SAS, 2021 conducted by National Statistical Office-NSO, estimated average monthly income per agricultural household were Rs.6426 and Rs.10,218 respectively. The average monthly nominal income has increased substantially

over the seven-year period, indicating improved economic conditions. The notable changes in income sources include a decrease in the contribution of crop production and non-farm business activities. Conversely, livestock production and wages have shown increased contributions to the average monthly income.

What is Climatic change?

Climate change is a long term abutment weather condition specifically related with temperature and rainfall or precipitation. This may be due to the result of natural calamities such as volcanic eruptions or anthropogenic activities like greenhouse gas emission, forest fires, and land-use changes *etc.* (Reddy, 2015). Climate change is one of the most critical global problems of our present era. Recent events have emphatically demonstrated our growing vulnerability to climate change. These implications range from damaging agriculture and increasing food security issues to sea level rise and the fast degradation of coastal districts. Furthermore, we are experiencing increased natural catastrophe intensity, losses of species, and the spread of vector-borne diseases.

Impact of climate change on Agriculture sector

- Soil: becomes drier and hence reduced productivity
- Irrigation: Increased demand with limited supply
- Pests: Increased pest ranges
- Production: Reduced production per unit area
- Livestock: Severity of diseases increased and issues of heat stress
- Fishery: Impact on abundance and reproduction of fishes
- Economic impact: Reduced agricultural output and therefore income of farmers
- According to IPCC (Intergovernmental Panel on Climate Change) report agricultural productivity in India was estimated to decreased by 2.5 to 10 per cent in 2020 to 5 to 30 per cent by 2050.

(Source: Report of the Committee on Doubling Farmers' Income Volume V "Sustainability Concerns in Agriculture" November 2017)

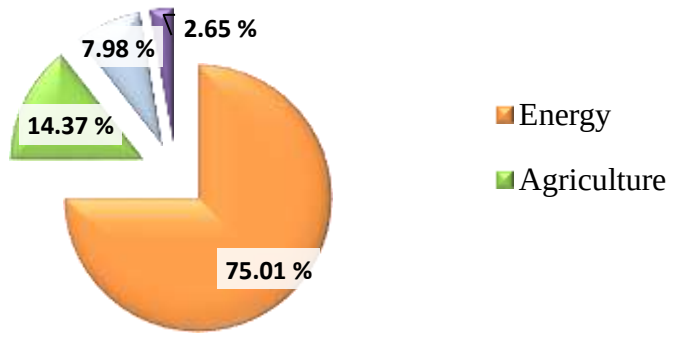

Figure 12.2: Sector-wise contribution (%) in GHG emission in India

(Source: Ministry of Environment, Forest and Climate Change, GoI 2021(MoEFCC); Retrived from: https://cckpindia.nic.in/)

12.2 Impact of Climate Change on Indian Agriculture:

The Indian government acknowledges climate change's impact on farming and farmers. Various network centers around the country conducted extensive investigations utilizing crop simulation models to investigate how future climates (2050 and 2080) would affect crops. Climate change has been demonstrated to reduce agricultural yields and the nutritional content of produce. Droughts, for example, have a detrimental influence on food and nutrient intake, severely affecting farmers. In the absence of adoption of adaptation measures for climate change projection in reduction in yield of some crop given below:

Table 12.3: The projected reduction in yield of crops by 2050 and 2080

Crop	Projected reduction in yield of crops (%)	
	2020	2050
Rainfed Rice	20.00	47.00
Irrigated Rice	3.50	5.00
Wheat	19.30	40.00
Kharif Maize	18.00	23 .00

(Source: Ministry of Agriculture and Farmers Welfare, Retrived from: https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1909206)

12.3 Impact of Climate Change on Goal of Doubling Farmers' Income:

Climate change significantly affects the doubling farmers' income goal in India it is mentioned by various research and reports of the government. How climate change affects farmers' income

A. **Erratic rainfall patterns**: The Indian agricultural sector heavily relies on monsoon rains for crop production. However, climate change has led to irregular and unpredictable rainfall patterns. According to the Indian Network on Climate Change Assessment (INCCA), studies suggest that the frequency and intensity of extreme rainfall events have increased in many parts of the country. This erratic rainfall adversely affects crop yields, leading to reduced income for farmers.
B. **Rising temperatures and heat stress**: Climate change causing rise in average temperatures across India. The Intergovernmental Panel on Climate Change (IPCC) reports that heatwaves are becoming more frequent and intense. Higher temperatures and heat stress negatively impact crop growth and productivity, leading to lower yields and reduced income for farmers.
C. **Water scarcity and changing hydrological patterns**: Climate change affects water availability and hydrological patterns. The Indian Agricultural Research Institute (IARI) highlights that changing precipitation patterns and increased evapotranspiration

due to higher temperatures contribute to water scarcity. This scarcity hampers irrigation practices, affecting crop growth and yield, thereby impacting farmers' income.

D. **Increased risk of pests and diseases**: Climate change creates favorable conditions for the proliferation of pests and diseases in agricultural ecosystems. The Indian Council of Agricultural Research (ICAR) emphasizes that rising temperatures and altered rainfall patterns affect pest life cycles and the spread of diseases, leading to crop losses and reduced income for farmers.
E. **Crop damage from extreme weather events**: Climate change increases the frequency and intensity of extreme weather events, such as cyclones, storms, and droughts. The Ministry of Earth Sciences, Government of India, states that these events can cause significant damage to crops, resulting in yield losses and financial hardships for farmers.
F. **Impacts on livestock and dairy farming**: Climate change affects livestock productivity and dairy farming. The National Action Plan on Climate Change (NAPCC) highlights that heat stress reduces milk production in dairy animals, leading to income losses for dairy farmers. Additionally, changing rainfall patterns and availability of fodder impact livestock health and productivity.
G. **Vulnerability of smallholder farmers:** Small and marginal farmers, who constitute a major part of the farming community in India, are considered vulnerable with the impacts of climate change. According to NABARD (National Bank for Agriculture and Rural Development) reports, small farmers have limited resources to cope with climate change impacts. They often lack access to modern technologies, financial resources, and information on climate-resilient practices. This vulnerability puts their income at greater risk when faced with the challenges of climate change.
H. **Changes in cropping patterns**: Climate change affect favourable environmental condition required by different crops and hence, cropping patterns. The Indian Network on Climate Change Assessment (INCCA) highlights that shifting climate conditions may necessitate changes in the choice of crops and cropping seasons. Farmers may need to adopt new varieties, modify planting and harvesting schedules, and diversify their crops with changing climate situation, which can have implications for their income.
I. **Market fluctuations and price volatility**: Climate change can lead to market fluctuations and price volatility, affecting farmers' income. Extreme weather events and changing climatic conditions can disrupt agricultural production and supply chains, leading to fluctuations in commodity prices. This volatility can impact farmers' profitability and income stability, making it challenging for them to plan and invest in their farming operations.
J. **Increased costs of inputs and production**: Climate change impacts can also result in increased costs of agricultural inputs and production. For instance, water scarcity may necessitate the installation of irrigation systems, which can incur additional expenses for farmers. Similarly, the need for climate-resilient crop varieties, pest management practices, and infrastructure improvements can raise the overall production costs, potentially reducing farmers' income.

Overall, climate change affects farmers' income in India through multiple channels, including erratic rainfall patterns, rising temperatures, water scarcity, pest and disease risks, crop damage from extreme weather events, impacts on livestock and dairy farming, changes in cropping patterns, market fluctuations, and increased production costs. These factors pose significant challenges to farmers' livelihoods and highlight the urgent need for climate-

resilient strategies, support systems, and policy interventions to mitigate the adverse effects and ensure sustainable income for farmers in the face of climate change.

12.4 Government Initiatives to Mitigate Climate Change:

A. National Action Plan on Climate Change (NAPCC):

- The National Action Plan on Climate Change (NAPCC) was launched by the Prime Minister on 30th June 2008.
- It is national strategy-plans to help the country to adapt to climate change and improve ecological sustainability, hence accelerating India towards the development phase.
- It focuses on maintaining a high growth rate which is needed for increasing living standards of India's vast population by reducing their vulnerability to the impacts of climate change.
- The core of the National Action Plan comprises eight National Missions. They focus on promoting of climate change understanding, adaptation and mitigation strategies, efficient use of energy and conservation of natural resources.

Table 12.4: Eight National Missions of NAPCC on climate change

Sr. No.	Government Initiatives to Mitigate Climate Change	Year of Launch	Aim/Objective
1	National Solar Mission	2010	To promote the development and use of solar energy in the country
2	National Mission for Enhanced Energy Efficiency	2010	To promote energy efficiency measures in various sectors
3	National Mission on Sustainable Habitat	2010	To promote sustainable practices in urban and rural habitats
4	National Mission for Sustaining the Himalayan Eco-system	2010	To conserve biodiversity, protect the Himalayan ecosystem, and promote sustainable development in the region
5	National Mission for Sustainable Agriculture	2010	To increase forest cover and enhance ecosystem services
6	National Water Mission	2011	To improve water use efficiency, water conservation, and management
7	National Mission for a Green India	2014	To increase forest cover and enhance ecosystem services
8	National Mission on Strategic Knowledge for Climate Change	2014	To support research, development, and innovation in climate change-related areas

It is important to note that while all the eight missions of the National Action Plan on Climate Change (NAPCC) have their significance, the NMSA stands out in terms of its direct focus on agriculture, farmers' income, and sustainable agricultural practices.

B. National Mission for Sustainable Agriculture (NMSA, 2010):

- The National Mission on Sustainable Agriculture (NMSA) initiated in 2010 by the Department of Agriculture and Farmers Welfare with the objective of making Indian agriculture more resilient to climate change and promote eco-friendly practices.
- Major focus of NMSA includes Integrated Farming System- Combining different farming activities for better results; Water use efficiency- using water efficiently in farming; Soil health- keeping soil fertile and healthy; Resource use efficiency-making the best use of available resources; Boost agricultural productivity, especially in rainfed regions by using integrated farming, managing water well, maintaining soil health, and utilizing resources effectively.

12.5 Objectives of NMSA:

- Integrated Farming Systems: Promoting location-specific farming systems to improve productivity, sustainability, income, and climate resilience.
- Resource Conservation: Taking steps to conserve natural resources, including soil and water, through smart practices.
- Soil Health Management: Using soil fertility maps and tests to apply nutrients effectively, reducing fertilizer waste.
- Efficient Water Use: Managing water resources efficiently in order to achieve objective of "more crops per drop" or with less water.
- Climate Change Capacity: Educating farmers and stakeholders about climate adaptation and mitigation.
- Adopting rainfed farming technologies through NICRA: Testing rainfed techniques to improve productivity, supported by resources from various schemes such as MGNREGS (Mahatma Gandhi National Rural Employment Guarantee Scheme) and IWMP (Integrated Watershed Management Programme).

National Mission on Sustainable Agriculture Initiatives:

A. Rainfed Area Development (RAD): Implemented since 2010

- Area-based approach for natural resource and farming system development.
- Integrates watershed and soil conservation efforts from various sources.
- Promotes diverse farming systems, including crops, horticulture, livestock, fishery, and forestry.
- Focus on soil health, resource conservation, and local agro-climatic suitability.

B. Sub-Mission on Agroforestry (SMAF): Launched in 2016-17:

- Encourages tree planting on farmland along with crops.
- Implemented in states with relaxed transit regulations for certain tree species.
- Aim- to increase farmer income, tree cover, and soil organic matter.

C. National Bambo Mission (NBM):

- Focuses on domestic cultivation of quality bamboo species.
- Addresses India's bamboo diversity and production challenges.
- Bamboo's versatile uses: construction, furniture, paper, textiles, energy, and more.
- Aims to revitalize rural economy, increase employment, and double farmers' income.

D. Soil Health Management (SHM): Implemented since 2010

- Promotes location-specific and crop-specific sustainable soil health practices.
- Includes residue management, organic farming, nutrient management, and erosion control.
- Addresses problem soils (acidic, alkaline, saline) through reclamation efforts.

E. Climate Change and Sustainable Agriculture (CCSAMMN): Implemented since 2010

- Pilots climate change adaptation/mitigation projects.
- Demonstrates climate-smart farming practices and integrated systems.
- Supports rainfed technology dissemination and convergence with flagship schemes.
- Aids climate change monitoring, knowledge sharing, and skill development.

These are the five components of the National Mission for Sustainable Agriculture (NMSA).

Each component aims to achieve specific objectives and implementation strategies for promoting sustainable agriculture, enhancing farmers' income, and ensuring climate resilience in the agricultural sector. (Source: National Mission for Sustainable Agriculture (NMSA) - Agriculture Notes (prepp.in))

The National Innovations on Climate Resilient Agriculture (NICRA) as a separate component integrates the objectives of the National Mission for Sustainable Agriculture (NMSA) ultimately helps to achieve goal of doubling farmers' income. While both NICRA and NMSA focus on sustainable agriculture and climate resilience, they have distinct goals and approaches.

National Innovations on Climate Resilient Agriculture (NICRA):

- The Indian Council of Agricultural Research (ICAR) introduced the National Innovations on Climate Resilient Agriculture (NICRA) in 2011.
- **Objective**: NICRA aims to enhance the resilience of Indian agriculture to climate change and climate variability in order to ensure food and livelihood security for farmers. The program focuses on developing and promoting climate-resilient technologies and management practices in the agricultural sector.
- Implementation of NICRA involves collaboration between various research institutes, state agricultural universities, Krishi Vigyan Kendras (KVKs), and other stakeholders.

The key implementing institutions under NICRA include:

- **ICAR -Indian Council of Agricultural Research :** ICAR as an apex institute leads and supports NICRA. It's in charge and guides the plan with its knowledge.
- **NARS Institutes -National Agricultural Research System:** These are research centers connected to ICAR and state universities. They create tough farming methods using climate knowledge.
- **SAUs (State Agricultural Universities) :** SAUs do vital work at the state level. They research, show how things work, train, and give advice about climate-friendly farming. They make strategies that fit each area's weather.
- **KVKs-Krishi Vigyan Kendras :** KVKs are farm centers made by ICAR. They spread knowledge and tech. They bring research to farmers. KVKs help farmers directly, especially in local areas.

The implementation of NICRA involves several components and activities aimed at developing and promoting climate-resilient agriculture. These include:

- **Research and Technology Development:** NICRA focuses on research and development of climate-resilient technologies, crop varieties, and management practices. This includes the identification and evaluation of climate-resilient crop varieties, conservation agriculture techniques, water management strategies, pest and disease management, and innovative farming systems.
- **On-Farm Demonstrations:** NICRA conducts on-farm demonstrations of climate-resilient agricultural practices to showcase the effectiveness and benefits of adopting these practices. Farmers are encouraged to participate in these demonstrations and learn from the experiences of successful adopters.
- **Capacity Building and Training**: NICRA conducts training sessions, workshops, and awareness campaigns to empower farmers, extension workers, and others with skills in climate-smart agriculture. These programs boost understanding and abilities for dealing with climate challenges and making positive changes in farming practices.
- **Knowledge Sharing and Dissemination:** NICRA promotes information and experience sharing among researchers, farmers, and policymakers. This includes the publication of research findings, technical bulletins, newsletters, and the development of web portals and mobile applications to disseminate information on climate-resilient agricultural practices.
- **Policy Support:** NICRA provides inputs and recommendations to policymakers for the development of climate-resilient agriculture policies and strategies. It aims to influence policy decisions that promote the adoption of climate-smart practices, incentivize climate-resilient agriculture, and support farmers in adapting to climate change.

Overall, NICRA works to close the gap between scientific research and on-the-ground implementation by creating and promoting climate-resilient agricultural technology and practices.

NICRA's joint activities with research institutes, universities, and extension organizations aim to improve Indian agriculture's adaptive ability to climate change and assure farmers' sustainable livelihoods.

There have been several other initiatives launched after 2011 to boost farmers' income by mitigating/reducing the impacts of climate change. Here are a few notable initiatives:

- **PMKSY-Pradhan Mantri Krishi Sinchayee Yojana (2015):** This scheme aims to improve the efficiency of water use in agriculture and enhance water security. It includes various components such as the Accelerated Irrigation Benefit Program (AIBP), Har Khet Ko Pani (Water to Every Field), Per Drop More Crop, and Watershed Development. By providing better access to irrigation and promoting efficient water management practices, PMKSY helps farmers increase their agricultural productivity and income.
- **PKVY-Paramparagat Krishi Vikas Yojana (**2015**):** This scheme encourages organic farming practices and certification. It encourages farmers to adopt organic farming methods, reduce chemical inputs, and enhance soil health. Organic produce often commands premium prices in the market, thus providing an opportunity for farmers to increase their income.
- **PMFBY-Pradhan Mantri Fasal Bima Yojana (**2016**):** This is a crop insurance scheme that aimed at providing financial protection to farmers in case of crop failure caused by natural calamities or pests or diseases severity. This scheme helps farmers to stabilize their income and protect them against climate-related uncertainties by lowering the risks associated with crop loss.
- **SHC-Soil Health Card Scheme (**2015**):** This scheme aims to offer precise information to farmers about their soil nutrient status. Based on soil test results, farmers receive recommendations on the appropriate use of fertilizers and soil amendments. This helps optimize fertilizer use, reduce input costs, and improve crop productivity, leading to increased income.

These initiatives, along with NMSA and NICRA, form a comprehensive framework to address climate change challenges and enhance farmers' income. They focus on improving water management, promoting sustainable and organic farming practices, providing crop insurance, and enhancing soil health, all of which contribute to climate resilience and increased agricultural productivity.

National Mission on Natural Farming (NMNF, 2023-24)

- The Indian government is actively promoting chemical-free agricultural and natural farming techniques. This initiative is now known as the National Mission on Natural Farming (NMNF) and initiated in the current financial year 2023-24. This mission is a separate initiative that grew out of the Bhartiya Prakritik Krishi Paddati (BPKP).
- **Objective:** Encourage farmers to switch from chemical-based inputs to indigenously produced inputs made from the cow urine, dung and other locally available materials. This transformation requires constant efforts to raise awareness, provide training, provide advice, and build farmer capacity, particularly in the initial years of farming.
- In the budget proposal for the fiscal year 2023-24, a provision of Rs 459.00 crores has been allocated for the NMNF, taking into careful consideration the financial requirements.

- **The National Standard of Organic Production (NSOP):** Organic farming was introduced as a method of achieving long-term production without the use of external chemical resources such as pesticides and fertilizers. This farming practice is well-known for its environmentally friendly characteristics, such as fostering a low reliance on external inputs, encouraging recycling and reuse, and eliminating the need for chemical-based goods. The Indian Council of Agricultural Research (ICAR) has created a complete set of rules for organic production within both cropping and farming systems through the All India Network Programme on Organic Farming.
- **Climate-Smart Agriculture (CSA):** Climate-smart agriculture (CSA) is a holistic landscape management approach that includes farms, livestock, forests, and aquatic resources. This plan efficiently addresses the interrelated challenges of guaranteeing food security while minimizing the effects of climate change. It encompasses a broader range of environmentally sensitive farming approaches, such as integrated farming systems, conservational agriculture, nature-based farming, chemical-free farming, precision-oriented farming, revitalizing agriculture, soil recuperation, and reducing food loss and waste. The key aims are to increase agricultural productivity and financial gains in a sustainable manner, to adapt to and fortify against climate change, and to reduce greenhouse gas emissions wherever possible.

How National Mission on Natural Farming enhances farmers' income while facing the challenges posed by climate change?.

a. **Reduced input costs:** Local resources and on-farm inputs are used, eliminating the need for expensive external inputs.
b. **Increased productivity**: Improved soil health and nutrient cycling lead to higher crop yields.
c. **Climate change resilience**: Natural farming helps farmers adapt to changing climatic conditions and mitigate risks.
d. **Cost-effective pest management**: Ecological approaches minimize the need for chemical pesticides.
e. **Carbon sequestration**: Natural farming practices contribute to increased carbon storage in the soil.
f. **Market demand for organic and natural products**: Farmers can access premium markets and command higher prices.
g. **Capacity building and support**: Training and guidance enable farmers to adopt natural farming effectively.

Overall, the NMNF offers a comprehensive approach that addresses the challenges posed by climate change while simultaneously improving farmers' income. By promoting sustainable and climate-resilient farming practices, the mission empowers farmers to adapt, prosper, and thrive in the face of climate uncertainties. (Source: Ministry of Agriculture and Farmers Welfare. (2023). Union Budget 2023-24: Agriculture and Farmers' Welfare)

The International Year of Millets 2023 (IYoM, 2023):

- Initiated by Prime Minister Shri Narendra Modi, India proposed to the United Nations that 2023 year be declared as the International Year of Millets (IYoM). This proposal

supported by 72 countries' of the world, resulting in its official announcement by the United Nations General Assembly (UNGA) in March 2021.

- The IYoM-2023 roadmap focuses on enhancing different millet-related activities such as production, consumption, exports, and branding.
- Shri Narendra Singh Tomar, Honorable Central Agriculture Minister, outlined a detailed strategy for marking the International Year of Millets 2023 (IYoM-2023). The primary goals of the strategy are to develop measures to increase millet production, consumption, export, and overall branding activities.
- **Production Linked Incentive (PLI) scheme:** The Indian government launched the Production Linked Incentive (PLI) strategy in order to expand the millet sector. This effort, is part of the Aatmanirbhar Bharat Abhiyan, has been given a budget of INR 10,900 crores over a seven-year period. The key objective of this strategy is to promote the expansion of the food processing industry. The PLI strategy aims to establish India's dominance in the global food industry by building of strong players in global food production and the globalization of Indian brands. The primary target areas are marketing of millet-based goods, which include ready-to-cook and ready-to-eat food items. These segments have been identified as having substantial potential for growth.

'**Seven Sutras**' (key themes) for the International Year of Millets (IYOM) of government which executed by the respective Ministries and Departments given below:

a. Enhancement of Production or Productivity by Department of Agriculture &Farmers Welfare/Department of Agricultural Research and Education
b. Nutrition and Health benefits by Ministry of Health/ Food Safety and Standards Authority of India
c. Value Addition, Processing and Recipe Development by Ministries of Food Processing Industries & Tourism
d. Entrepreneurship/Startup/Collective Development by Ministry of Commerce and Department of Agriculture &Farmers Welfare
e. Awareness creation including Branding Labelling and Promotion by All the Ministries
f. International Outreach by Commerce & Ministry of External Affairs and
g. Policy Interventions for Mainstreaming by Department of Food and Public Distribution and Department of Agriculture &Farmers Welfare
h. India plays a significant role in millet production, contributing to 80% of Asia's output and 20% of the world's total production. The country boasts an above-average millet yield compared to the global average. The Indian government has been proactive in endorsing millets, exemplified by the commemoration of the National Year of Millets in 2018 and the classification of millets as nutri-cereals. These efforts are further underscored by the incorporation of millets into the POSHAN Mission Abhiyan, a campaign focusing on nutrition. Leveraging the potential of millets, several entrepreneurial ventures are engaging in the millet value chain. The Indian Institute on Millet Research has been instrumental in nurturing numerous startups, extending crucial funding support to facilitate their advancement. The overarching objective of these endeavors is to stimulate both local and international demand for millets, furnish nourishing sustenance to the populace, and propel the expansion of the millet industry. (Ministry of Agriculture and Farmers Welfare)

How the International Year of Millets 2023-24 plays a significant role in enhancing farmers' income while facing climate challenges ?.....

a. **Market Expansion**: The designation of the International Year of Millets brings global attention to millets as a nutritious and sustainable food option. This increased awareness can lead to a surge in demand for millet-based products, both domestically and internationally. As a result, Indian farmers who cultivate millets can tap into expanded markets, command higher prices for their produce, and generate additional income.
b. **Diversification of Income**: Millets offer an alternative crop option for farmers, diversifying their income sources. By promoting millet cultivation, farmers can reduce their dependency on traditional crops, which may be vulnerable to climate change impacts, and tap into new market opportunities.
c. **Climate Resilience:** Millets are known for their resilience to adverse weather conditions, such as drought, heat, and pests. By cultivating millets, farmers can mitigate the risks associated with climate change and protect their income against unpredictable climatic events.
d. **Reduced Input Costs:** Millets are hardy crops that require minimal inputs, including water and chemical fertilizers. By adopting millet cultivation, farmers can reduce input costs associated with conventional crops, thereby increasing their net income.
e. **Enhanced Soil Health:** Millets have the ability to improve soil health and fertility. They are often grown using sustainable farming practices, such as intercropping, organic fertilization, and minimal tillage, which promote nutrient cycling and reduce soil degradation. Improved soil health translates into better crop productivity and increased income for farmers.
f. **Value Addition and Processing:** Millets can be processed into a variety of value-added products, including flour, snacks, and beverages. By adding value to millet produce, farmers can access higher-value markets and generate additional income streams.
g. **Knowledge and Skill Development:** The International Year of Millets promotes knowledge sharing, capacity building, and skill development among farmers. It provides opportunities for farmers to learn about modern millet cultivation techniques, innovative farming practices, and market-oriented approaches. Equipped with enhanced knowledge and skills, farmers can optimize millet production and effectively respond to climate challenges, leading to improved income.

Hence, the announcement of the International Year of Millets 2023 brings new opportunities for Indian farmers to double their income. With market expansion, diversification of income, climate resilience, reduced input costs, value addition, and knowledge development, the promotion of millets empowers farmers to enhance their livelihoods and achieve the goal of doubling their income. This initiative highlights the potential of millets in increasing farmers' income and promoting sustainable agricultural practices in the face of climate change challenges.

12.6 Conclusion:

The strategies of doubling farmers' income in the face of climate change require a multifaceted approach that involves both the government and the farmers themselves. The government needs to implement policies and schemes that promote sustainable agriculture,

increase productivity, and provide market access to farmers. Farmers, on the other hand, need to adopt modern agricultural practices, diversify their crops, and explore alternative sources of income. Firstly, adopting climate-smart agricultural practices such as conservation agriculture, precision farming, and agroforestry can enhance productivity, resource efficiency, and resilience to climate variability. Secondly, promoting diversification of crops and income sources, including the cultivation of high-value and climate-resilient crops like millets, enables farmers to mitigate risks and capture market opportunities. Additionally, investing in rural infrastructure, irrigation systems, and technology can improve productivity and reduce post-harvest losses. Furthermore, providing farmers with access to credit, insurance, and markets, along with capacity building and knowledge transfer, empowers them to make informed decisions and adapt to changing climate patterns. Collaborative efforts involving government, research institutions, private sector, and farmers' organizations are crucial in implementing these strategies and achieving sustainable agricultural development. By integrating climate change resilience with income enhancement strategies, we can ensure the well-being and prosperity of farmers, safeguard food security, and contribute to a sustainable and climate-resilient future for all. The climate-resilient crops like millets have the potential to play a significant role in enhancing farmers' income. With the announcement of the International Year of Millets 2023 and the government's focus on promoting millets through schemes like the Production Linked Incentive (PLI) scheme, there is a positive outlook for Doubling Indian Farmers' income in the future.

12.7 References:

1. Economic Survey (2021-22). Department of Economic Affairs. Ministry of Finance. Government of India. Retrived from: https://www.indiabudget.gov.in/economicsurvey/ebook_es2022/index.html.
2. Indian Agricultural Research Institute. (2014). Climate Change Impact and Adaptation in Indian Agriculture: A Review. Retrieved from:
3. http://www.iari.ernet.in/files/Climate_Change_Final_II.pdf
4. Indian Council of Agricultural Research. (n.d.). Climate Change and Agriculture. Retrieved from: https://www.icar.org.in/climate_change
5. Intergovernmental Panel on Climate Change. (2014), Retrieved from https://www.ipcc.ch/report/ar5/wg2/
6. Ministry of Agriculture & Farmers Welfare, GoI. Retrived from: Press Information Bureau (pib.gov.in) & https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1886630
7. Ministry of Agriculture and Farmers Welfare. (2023). Union Budget 2023-24: Agriculture and Farmers' Welfare. Retrieved from: https://pib.gov.in/PressReleasePage.aspx?PRID=1783526
8. Ministry of Environment, Forest and Climate Change, GoI 2021(MoEFCC), Retrived from: https://cckpindia.nic.in/
9. National Mission for Sustainable Agriculture (NMSA) - Agriculture Notes (prepp.in))
10. Reddy, P. P. (2015). Climate Resilient Agriculture for Ensuring Food Security, Vol. 373. New Delhi: Springer.
11. Report of the Committee on Doubling Farmers' Income Volume V "Sustainability Concerns in Agriculture" November 2017.