Climate Smart Agriculture Interventions: Lessons Learned And Implications for Future

Anupam Anand[1] and Pratiksha Singh[2]

ABSTRACT

Most of the developing countries including India are primarily dependent on agriculture as it provides livelihood to almost two-third of its population. Hence, it is of utmost concern for developing countries to design and implement appropriate Climate Smart Agriculture practices, and then identify factors which have negative impact on agriculture productivity. The review of literature revealed that agriculture is the most vulnerable and sensitive sector affected by climate change because of its dependency on local climate parameters like rainfall, temperature, soil health and so on. The impacts of climate change on crop yields indicate that yield losses may be up to 60 per cent depending on crop, location, and future climate scenario. To alleviate the challenges posed by climate change, agriculture has to become "climate smart". Climate-Smart Agriculture (CSA) is an approach to help agricultural systems worldwide, concurrently focusing on three major challenges: increased adaptation to climate change, mitigation of climate change, and ensuring global food security through innovative policies, practices, and financing. The paper discusses salient CSA innovations and key interventions which will address complex issues of climate change and guide the policy makers and decision makers to priorities investments and programme implementation for maximum impact.

Key words: Climate Change, Climate Smart Agriculture, Climate Smart Villages

Introduction

The Inter-Governmental Panel on Climate Change (IPCC, 2014) defines 'climate' as the "average weather," or more rigorously, as the statistical description in terms of the Mean and Variability (for example by using, statistical tests) of relevant quantities over a period of time ranging from months to thousands or millions of years". Climate change is one of the most potentially serious environmental problems ever confronting the global community (Kumar et al,

1. Consultant, MANAGE, Hyderabad

2. PhD Research Scholar, Department of Agricultural Communication, GBPUAT, Pantnagar

Corresponding Author E-mail: anandanupam.manage@gmail.com

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2019). United Nation Framework Convention on Climate Change (UNFCCC, 2010) refers climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods". Climate change is emerging as one of the major threats on agriculture, food security and livelihood of millions of people in many places of the world.

In Asia, agricultural crop yield are expected to decline by 5-30 per cent by 2050s due to rising temperature in Himalayas and this decline in agricultural yield will lead to food insecurity, which becomes a serious future problem for human beings (IPCC, 2007). The impacts of climate change on crop yields indicate that yield losses may be up to 60 per cent, depending on crop, location, and future climate scenario (Challinor et al., 2014). Threats can be reduced by increasing the adaptive capacity of farmers as well as increasing resilience and resource use efficiency in agricultural production systems (Lipper et al., 2014). To alleviate the challenges posed by climate change, agriculture has to become "climate smart". In response, the concept of Climate Smart Agriculture (CSA) has been developed to address three pillars: food security, adaptation and mitigation (FAO, 2013).

Concept of Climate-Smart Agriculture

Food and Agriculture Organization (FAO, 2014) defines Climate-Smart Agriculture (CSA) as "an approach for transforming and reorienting agricultural development under the new realities of climate change". The term Climate -Smart Agriculture was first used in 2009. The concept of CSA was presented and defined in the first Global Conference on Agriculture, Food Security and Climate Change held at The Hague in 2010, through the paper "Climate-Smart Agriculture: Policies, Practices and Financing for Food Security, Adaptation and Mitigation". CSA, an integrated approach to addressing the interlinked challenges of food security and climate change, focuses on three objectives mainly: sustainably increasing food security by increasing agricultural productivity and incomes, building resilience and adapting to climate change, and developing opportunities to reduce greenhouse gas emissions from agriculture (Sala et al., 2016). Enabling CSA at all levels requires a big initiative to implement its policies, capacity building, safety and economic matters from a number of institutions. The adaption of climate-related knowledge, technologies and practices to local conditions, promoting joint learning by farmers, researchers, extension personnel and widely disseminating Climate-Smart Agriculture (CSA) practices, is critical. CSA approach deals with these interlinked challenges in a holistic and effective manner (Bayala et al., 2016).

Table 1: Key Interventions of Climate-Smart Agriculture.

Sl.No.	Technology	Adaptation/Mitigation Potential
1.	**Water-smart**	Interventions that improve water use efficiency
a)	Rainwater Harvesting (RH)	Collection of rainwater not allowing to run-off and use for agricultural in rainfed/dry areas and other purposes on-site
b)	Drip Irrigation (DI)	Application of water directly to the root zone of crops and minimize water loss
c)	Laser Land Levelling (LL)	Levelling the field ensures uniform distribution of water in the field and reduces water loss (also improves nutrient use efficiency
d)	Furrow Irrigated Bed Planting (FIBP)	This method offers more effective control over irrigation and drainage as well as rainwater management during the monsoon(also improves nutrient use efficiency)
e)	Drainage Management (DM)	Removal of excess water (flood) through water control structure
f)	Cover Crops Method (CCM)	Reduces evaporation loss of soil water (also adds nutrients into the soil)
2.	**Energy-smart**	Interventions that improve energy use efficiency
a)	Zero Tillage	Reduces amount of energy use in land preparation. In long-run, it also improves water infiltration and organic matter retention into the soil
3.	**Nutrient-smart**	Interventions that improve nutrient use efficiency
a)	Site Specific Integrated Nutrient Management (SINM)	Optimum supply of soil nutrients over time and space matching to the requirements of crops with right product, rate, time and place
b)	Green Manuring (GM)	Cultivation of legumes in a cropping system. This practice improves nitrogen supply and soil quality
c)	Leaf Color Chart (LCC)	Quantify the required amount of nitrogen use based on greenness of crops. Mostly used for split dose application in rice but also applicable for maize and wheat crops to detect nitrogen deficiency

d)	Intercropping with Legume (ICL)	Cultivation of legumes with other main crops in alternate rows or mixed. This practice improves nitrogen supply and soil quality
4.	**Carbon-smart**	Interventions that reduce GHG emissions
a)	Agro Forestry (AF)	Promote carbon sequestration including sustainable land use management
b)	Concentrate Feeding for Livestock (CF)	Reduces nutrient losses and livestock requires low amount of feed
c)	Fodder Management (FM)	Promote carbon sequestration including sustainable land use management
d)	Integrated Pest Management (IPM)	Reduces use of chemicals
5.	**Weather-smart**	Interventions that provide services related to income security and weather advisories to farmers
a)	limate Smart Housing for Livestock (CSH)	Protection of livestock from extreme climatic events (e.g. heat/cold stresses)
b)	Weather based Crop Agroadvisory (CA)	Climate information based value added agro-advisories to the farmer
c)	Crop Insurance (CI)	Crop-specific insurance to compensate income loss due vagaries of weather
6.	**Knowledge Smart**	Use of combination of science and local knowledge
a)	Contingent Crop Planning (CC)	Climatic risk management plan to cope with major weather related contingencies like drought, flood, heat/cold stresses during the crop season
b)	Improved Crop Varieties (ICV)	Crop varieties that are tolerant to drought, flood and heat/cold stresses
c)	Seed and Fodder Banks (SFB)	Conservation of seeds of crops and fodders to manage climatic risks
Source: Khatri-Chhetri, et al., 2017.		

Lessons Leaned for Climate-Smart Agriculture (CSA)

The aim of CSA was to distill lessons learned for leveraging and developing enabling environments for prioritization of CSA options and linking those with opportunities for achieving CSA (Andrieu et al., 2017). There are many areas which need immediate action to increase adoption of CSA practices. These included gender responsive diagnostics and prioritization of climate-smart practices, support to farmer-to-farmer and community wide social learning, prioritization among CSA options and benefits for greater impact, monitoring CSA interventions with a real-time participatory tool etc, through which sustainability can be enhanced by combining and leveraging the strengths of different approaches, promoting local ownership, and providing continued technical support, understanding limiting factors to adoption of CSA and to create enabling environments for the promotion of CSA, in addition to formulating appropriate policies for promotion/ adoption of CSA which need immediate action to increase adoption of CSA practices.

Future Implications for Climate-Smart Agriculture

The key concept of Climate-Smart Agriculture is to provide location specific climate-Smart technologies. Multiple stakeholders i.e. from governments, civil societies, science and private sectors have to be involved in formulating the location-specific technologies like agriculture advisories through Digital Media – from customised advice to shared value with millions of farmers, climate-informed advisories to enhance production and resilience. Use of ICTs should be promoted to deal with climate change, need for a Gender specific approach, public - private partnerships and so on can be encouraged to promote CSA practices. The implementation of CSA would involve changes in the behaviour, strategies and agricultural practices of millions of farmers worldwide. Farmers need support to understand the impacts of climate change and to adopt CSA practices (Raj, S. & Garlapati, S. 2020).

Conclusion

Climate change is more complex and threatening than any other ecological problem. Farming practices are exposed to several, interconnected ecological, economic and social pressures motivated by climate change. Climate change can be eliminate or reduced with the help of Climate-Smart Agriculture practices. So there is need to enhance proper implementation and sound policy framework support. Thus there appears an immediate need to identify and prioritize Climate Smart Agriculture practices. Also a requirement for scientists, government and non-government agents and other stakeholders to focus on awareness creation on climate-smart agriculture interventions so that it may helps to tackle the risk of climate change.

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