Original Research Article

Agromet Advisory Services for Climate Smart Agriculture

ABSTRACT

Climate smart agriculture (CSA) is a strategy for guiding the transformation and reorientation of agricultural production in light of the new realities of climate change. CSA manage the climate risks by adapting and building resilience of agricultural and food security system to climate change at multiple levels. CSA involves dissemination of the advance weather information to the farmers through different state of art information technology (SMS, apps and e-mail) are being taken to control and minimize of loss of crop due to pest and diseases incidences. Increase agricultural productivity and incomes; adapt to and build resilience to climate change; and reduce or eliminate greenhouse gas emissions from agriculture are the three pillars of the CSA. Under the Gramin Krishi Mausam Sewa (GKMS) scheme, the Agrometeorological Advisory Service (AAS) of the India Meteorological Department (IMD), Ministry of Earth Sciences (MoES), collects and organises climate/weather, soil, and crop information and combines it with weather forecast to assist farmers in making management decisions. Gramin Krishi Mausam Sewa (GKMS), District Agro-Met Units (DAMUs), and the IMD Mausam Website are examples of CSA projects. They deliver crop-specific alerts to farmers using meteorological parameters and a variety of print, visual, radio, and IT-based media, including short message service (SMS) and Interactive Voice Response Service (IVRS). This CSA will assist farmers in anticipating the occurrence of pests and illnesses, allowing for the scientific and sensible scheduling of preventative actions.

Keywords: Climate smart agriculture (CSA), IMD, GKMS, DAMU, Agromet Advisory Services

INTRODUCTION

According to the United Nations Food and Agriculture Organization (FAO), feeding the world's population will necessitate a 60% increase in total agricultural production. The food security issues are enormous, as many of the resources required for long-term food security are already stressed. Climate change, on the other hand, is already having a negative impact on agricultural production both globally and locally. Cropping, livestock, and fisheries are all predicted to be more vulnerable to climate change in the next decades, particularly in low-income nations with little adaptation potential. Impacts on agriculture threaten both food security and agriculture's pivotal role in rural livelihoods and broad-based development (FAO, 2013). Creating a world that is food secure has always been tough, but it will become considerably more difficult as the climate changes. With existing farming practises, a temperature increase of 2°C could reduce agricultural yields by 15%, according to the Intergovernmental Panel on Climate Change (IPCC), while the FAO estimates that 60 percent more food will be needed by 2050 to meet rising demand. Furthermore, because food systems account for up to a third of greenhouse gas emissions, they must be reduced in order to minimise global warming. Climate-Smart Agriculture is a strategy for addressing these issues in a holistic way (Campbell, 2017).

i. Climate-smart agriculture (CSA) is an integrative approach to landscape management which seeks to assist agricultural techniques, livestock, and crops adjust to the impacts of climate change and, where possible, alleviate them by reducing the emissions, even while taking into consideration the increasing world population to ensure food security. Lipper et al. (Lipper et al., 2014). The United Nations Food and Agriculture Organization (FAO) came up with the notion in 2010 in response to the necessity to adapt agricultural production to the difficulties of climate change. Regardless of the fact that it is built on existing sustainable agriculture knowledge, methods, and philosophies, CSA is unique in several ways. To begin with, it lays a heavy emphasis on climate change mitigation. Second, in a systematic way, CSA considers the synergies and trade-offs that occur between productivity, adaptation, and mitigation. Finally, in attempt to close the investment deficit, CSA wishes to take advantage of new financial benefits. Increase agricultural productivity and incomes; adapt to and build resilience to climate change; and reduce or eliminate greenhouse gas emissions from agriculture are the three pillars of the CSA (Fig 1). CSA also aspires to achieve three goals at the same time. Increased productivity: Grow more

and better quality food to enhance nutrition security and earnings, particularly for the 75 percent of the world's poor who live in rural areas and rely heavily on agriculture.

ii. Enhanced resilience: Reduce vulnerability to drought, pests, diseases, and other climate-related risks and shocks, as well as boost capacity to adapt and flourish in the face of longer-term pressures like as shorter seasons and irregular weather patterns.Reduced emissions: Reduce emissions per calorie or kilogramme of food produced, avoid agricultural deforestation, and find techniques to absorb carbon from the environment (www.worldbank.org).

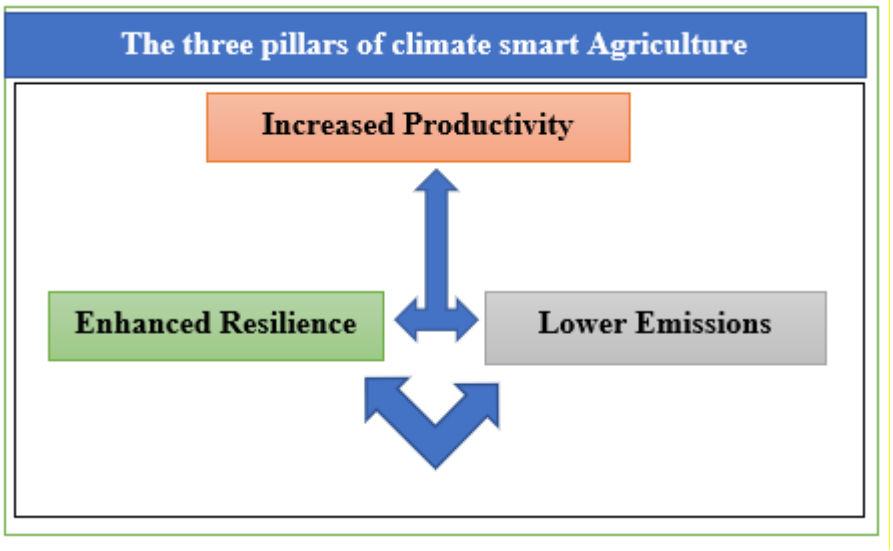

Fig 1: The three pillars of Climate-Smart Agriculture

The ultimate purpose of the CSA is to support efforts at all levels, from local to global, to ensure food and nutrition security for all people at all times, while also allowing for necessary adaptation and mitigation. The World Bank Group (WBG) is currently scaling up climate-smart agriculture. The World Bank committed to collaborating with countries to produce climate-smart agriculture that achieves the triple win of higher production, enhanced resilience, and emissions reductions in its first Climate Change Action Plan (2016-2020), as well as the upcoming update spanning 2021-2025. Climate adaptation and mitigation will get 52 percent of World Bank finance in agriculture by 2020. (www.worldbank.org).

Materials and method

Under the Gramin Krishi Mausam Sewa (GKMS) scheme, the Agrometeorological Advisory Service (AAS) of the India Meteorological Department (IMD), Ministry of Earth Sciences (MoES), collects and organises climate/weather, soil, and crop information and

combines it with weather forecast to assist farmers in making management decisions. Farmers receive weather-based agromet advice at the district level through a network of 130 Agro-Met Field Units (AMFUs) placed in each Agro Climatic Zone (ACZ). Under the GKMS plan, AMFUs produce and distribute agromet advisories twice a week (on Tuesday and Friday) to 690 districts. Through the mKisan platform, 4.37 crore farmers are currently receiving SMS alerts on their cell phones. In response to the need for more crop and location-specific Agromet Advisory Services (AAS) to address wide variations in weather within the country, IMD is establishing 530 District Agromet Units (DAMUs) in the premises of Krishi Vigyan Kendras (KVKs) in collaboration with the Indian Council of Agricultural Research (ICAR). Because of the high resolution forecast and suitable agromet recommendations for farmers in specific blocks, the implementation of block level AAS would benefit a larger number of farmers (IMD, 2020). Thus the approach for CSA by the farmers can be boosted through AAS.

RESULTS AND DISCUSSION

Role of Agromet Advisory services in Climate smart agriculture

Agro-Met Advisory Services (AAS) will be more effective if they are delivered in a clear, local language that farmers can understand. Agro-Met Advisory Services will also be supported by: (a) agro meteorological database, (b) crop conditions, (c) real-time weather, research results on crop-weather relationships, and (d) skilled manpower in multidisciplinary resources and users interface in order to make it a more successful and continuous process (Anderson, 2007). Weather and climate information can help policymakers, organizations, and community make better decisions that minimize risks and increase opportunities, improve the efficient use of limited resources, and increase crop, livestock, and fisheries production. One such adaptation strategy in which India has already made significant success is weather-based agro-advisory.

These services must be improved further, notably by creating weather forecasts at a scale smaller than a district to a block rather than a village, extending the temporal range of weather forecasts, and implementing an active extension, outreach, and agro-met advise dissemination system. It is critical to establish an operational unit at the district level in order to operate at the block level (Singh et al., 2019). As a result, it is planned that District Agro-met Units (DAMUs) be established throughout the country. These stations could be

combined with current Krishi Vigyan Kendras (KVKs), which are funded and overseen by ICAR and operate through State Agriculture Universities, ICAR Institutions, and NGOs, among others. Some of the adaptive measures communicated through the Agromet Advisory bulletins are:

- By avoiding the flowering phase overlap with the hottest period, planting dates can be adjusted to decrease the effect of temperature increase-induced spikelet sterility and reduce yield instability.
- Changing the cropping calendar to take advantage of the rainy season while avoiding extreme weather events (such as cyclones and storms) during the growing season.
- Cultivation of lodging-resistant crop varieties (e.g., short rice cultivars) that can tolerate strong winds during the vulnerable stage of crop growth.
- Development of climate-resilient cultivars; adoption of innovative farming techniques that address the management of stressed crops, plant pests, and disease
- Changes in crop planting dates to make better use of soil moisture.
- Crop sowing dates are moved ahead in a crop rotation schedule, allowing farmers to plant a second crop, possibly a vegetable with a short growing period.
- Increased evapotranspiration requires a move away from traditional crops and more towards agriculture that is not vulnerable to evapotranspiration.
- Cultivation of heat-resistant crop types based on genetic resources that are better suited to warmer, drier circumstances

For the principal crops and livestock, the agromet advisory bulletins include possible risk mitigation methods. AMFU's and DAMU's multidisciplinary and agromet scientists prepare district-level agromet advisory bulletins based on the weather forecast. Farmers and other stakeholders in the relevant district receive these messages.

Mechanism of Agromet Advisory Services

Today, IMD uses a five-tiered system to implement operational agrometeorological schemes across the country:

- In Delhi, there is a top-level policy planning body.
- The National Agromet Service headquarters in Pune is in charge of the execution.
- State Agromet Centres are in charge of coordination and monitoring.
- Definition of the agro-meteorological zone

- District or local level extension and training for input management advisory service

Dissemination Mechanism of Agromet Advisory Service

There are 130 district level Agromet Field Unit for prepare Agromet advisory and first phase of DAMU also working in collaboration with State Department of Agriculture on Tuesday and Friday. The Agromet advisory is disseminated through All India Radio (AIR), Print Media, Doordarshan, Website and SMS. Inclusion of these services will cover large fraction of farmers in the country to get the benefit. Moreover, Agro met Division; IMD is establishing linkages with the State level ICTs like Kisan Kerala, e-livestock. ICT for agriculture knowledge management needs to be establishment, etc. All FM channels of AIR and now casting centres of Doordarshan presented in Fig 2.

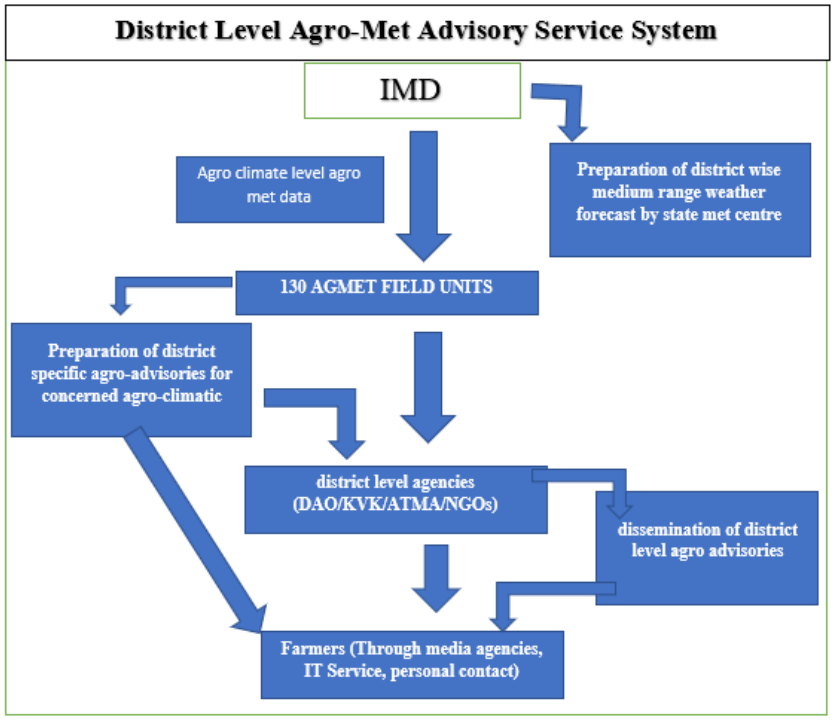

Fig 2: Dissemination Mechanism of Agromet Advisory Service

CASE STUDIES

Vincent and Balasubramanian, 2021 in the Anantapur area of Andhra Pradesh, studied the effects of agromet advising services on beneficiary farmers' climate wise agriculture practises in order to protect them from the dangers and impacts of climate change. Climate smart agriculture practices/technologies have been adopted by farmers in the research area for two

reasons. First, there's "induced adoption," and then there's "wilful adoption." Increased weather irregularities and uncertain climatic conditions, such as irregular rainfall, monsoon failure, frequent drought, lack of other livelihood options, and so on, have prompted them to adopt any new practise or technology that could improve the agriculture system's resilience in the current situations.

Farmers in Colombia, who had previously enjoyed relatively consistent rainfall, now had to deal with more frequent flooding and drought. The CGIAR Research Program on Climate Change, Agriculture, and Food Security (CCAFS) is developing agro-climatic forecasts and advisories with the International Centre for Tropical Rainfall (CIAT) and an alliance made up of the Ministry of Agriculture, the national agricultural research service, six producer organisations, and NGOs to strengthen the resilience of Colombian farmers. Such partners have learned how to integrate climate and other site-specific information into their strategic planning with the help of local agro-climatic technical working groups, and they are now able to provide farmers with agro-climatic estimates and managerial advisories that are designed to meet the needs and contexts. The drought and moisture surplus tolerance of maize, rice, beans, and cassava varieties has been validated with the experimental. Agro-climatic alerts are now being sent to over 150,000 farmers, and 6,000 have embraced climate-smart techniques. 170 rice farmers in Colombia escaped severe losses in 2014 by following the advise of their producers' federation, FEDEARROZ, and not planting in the first of two yearly producing seasons. Farmers who followed the advise saved an estimated USD 3.6 million in economic damages. FEDEARROZ acted on a prediction made by a group of CCAFS experts at CIAT. The project is projected to reach 1,588,640 farmers in total (Loboguerrero et al., 2018). Niger is a tropical country that is particularly sensitive to climate change and malnourished women and children. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) taught over 10,000 women in Niger to reclaim degraded fields in response to both issues. Women are taught restorative cultivation techniques including digging zai-pits in hardened soil and filling them with manure to concentrate nutrients and water for plants once the rainy season begins. They were also given assistance in negotiating for the long-term use of common marginal areas. These efforts to enable women to reclaim marginal lands enhanced soil production and carbon sequestration, as well as women's resilience to climate change.

Climate smart villages through CSA

Watershed interventions in four villages of Bellary district in Karnataka's mining belt have been carried out by ICRISAT in collaboration with the Karnataka State Department of Agriculture, District Watershed Development, NGOs, and the local community. This strategy focuses on restoring farmers and employs a set of climate-smart agricultural practises established by ICRISAT, which have resulted in higher crop yields and farmer incomes. The watershed strategy included interventions such as weather monitoring, mapping soil health, and picking climate tolerant types, as well as water harvesting and enhanced livelihoods (Reddy *et al*., 2018).

Crowdsourcing for CSA: Bolivian Andes

FAO's Fall Armyworm Monitoring and Early Warning System app encourages farmers and extension workers to report the outbreak of the Armyworm pest. Other global initiatives that provide innovative digital advisory services – such as Precision for Development (5.4 million smallholder farmer users) and Digital Green (2.3 million smallholder farmer users) – are using crowdsourced data from smallholder farmers in Africa, Asia and Latin America. These global initiatives are attracting increased funding from a plethora of private foundations, international development agencies, corporations and multilateral agencies. Compared to phone surveys and other means of remotely gathering farm-level information, crowdsourcing is a step forward as it promotes continuous interaction, fostering joint problem-solving and the co-development of locally tailored solutions (Taborga, 2021).

CONCLUSION

The use of the term "agricultural" in CSA is potentially undesirable, because we should be concentrating on larger food system challenges, value chains, policy issues, and critical services as well (such as climate-informed advisories, insurance and credit). However, in many CSA conversations, technologies and behaviours receive the greatest focus. Furthermore, CSAs frequently focus on the farm and farmers rather than some of the more fundamental landscape concerns that must be addressed. We need a broad definition of what is to be considered under CSA — anything that contributes to the achievement of the three goals (pillars). As a result, CSA can be viewed as a strategy for boosting agricultural development in response to the difficulties of climate change adaptation and mitigation through AAS, with the ultimate goal of improving people's livelihoods. Providing AAS to farmers, allowing them to conduct operations sensibly and on time. Since 2010, CSA has grown in popularity, with participants ranging from small farmers to international organisations. However, as the public's interest in CSA methods develops, it's more necessary than

ever to track and assess outcomes, as well as interpret them in a site-specific context. Only in this way, in collaboration with other approaches to sustainable agriculture, can CSA contribute to the livelihoods of people all over the world.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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