Effectiveness of Mobile Application Based Agromet Advisory Service: Case Study in Telangana, India

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ABSTRACT: In India, climatic factors are changing rapidly and climate-induced extreme events have increased over the last two decades. Consequently, India is facing a double challenge of sustaining rapid economic growth while combating the threat of climate change, especially regarding impacts on land, water, and agriculture. To prepare farmers for the changes, the government and other external agencies are providing several kinds of support like crop insurance, subsidies, loan free of interest/lowest rate, agro-advisories, etc., yet the adaptability is not that high. It means there exist considerable knowledge gaps in understanding climate vulnerability, socio-economic impacts, and suitable ways to build resilience. A study was done to assess the effectiveness and to improve weather-based location and crop-specific climate-resilient advisories through farmers' feedback. Advisories were disseminated via mobile application (FarmPrecise app) for *kharif* and *rabi* seasons of the year 2020-21 for the paddy crop of the Narayanpet district of Telangana. Results indicate that weather-based climate resilient agriculture (CRA) advisories helped to build the resilience of the farming community to climate change and mobile application (FarmPrecise app) is an effective way of their dissemination. Farmers were able to reduce the input cost and increase the net profit for the crops. However, farmers' feedback revealed that community-level capacity building is required to increase the adoption of weather-based CRA advisories and communicating advisories in colloquial language will have a greater uptake.

Keywords: Climate resilient agriculture (CRA), agro-advisories, mobile application

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Introduction

In the last 30 years, the damage caused by climate change in India has doubled and is increasing day by day (ACT, 2018). It is an estimated loss of nearly $87 billion, and the costs are expected to increase WMO (2020). The damage to agriculture is the biggest and its adverse effects need to be considered very seriously. Additionally, with the advent of the green revolution, Indian farming has become more and more dependent on external inputs, most of which are synthetic and chemical products. Excessive use of synthetic fertilizers and agrochemicals for plant nutrition and protection measures not only increases the cost of cultivation but also degrades the natural resource base of soil and water (Singh *et al.,* 2019). Given the multidimensional impacts of climate change and climate variability, and faulty agricultural practices, there exist considerable knowledge gaps in understanding climate vulnerability, sustainable agriculture practices, socio-economic impacts, and suitable ways to build resilience (Birkmann *et al.,* 2013). This view is strongly underscored by both the IPCC and India's second national communication to UNFCCC, which recommended integrated research on operational strategies and approaches for adaptation of region and sector-specific policy interventions that build resilience and adaptive capacities of communities (Raghunandan, 2020). Reducing the impacts of changing climate on agriculture will require efforts in generating granular climate data, integrating those in informing farming decisions, improving quality of inputs, enhancing knowledge on better cultivation practices, and adopting better management practices for resource conservation (ISC, 2021). Farmers need a dynamic decision support system that is tailored to their specific farms and provides them weather-responsive advisories across key aspects of agricultural operations. This will help them mitigate weather-induced risks, reduce losses and costs of production, increase productivity and improve incomes (Lobo *et al.,* 2017). In this regard, Watershed Organisation Trust (WOTR) has developed "FarmPrecise"- an android based mobile application (app) that provides location and crop-specific weather-based climate resilient agriculture (CRA) advisories on up-to-date farming techniques, fertilizer and nutrient management, integrated pest and disease management, irrigation water management, and market prices of different crops in nearby markets at a local scale (Bhagat and Gholkar, 2021). As of now, the FarmPrecise app is available for free and can be downloaded from the "Google Play Store" which provides advisories to farmers in English, Hindi, Marathi and Telugu languages, and soon it will be available in other Indian languages. Presently more than 50000 farmers have downloaded this app WOTR (2022). The farmer's feedback has shown that the FarmPrecise app is a boon for profitable farming (Joshi, 2020). But still, there is a great need to develop policy interventions/strategies to improve weather-based CRA advisories into actionable information for

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farmers to build resilience and adaptive capacities. In this view, to assess the effectiveness and feedback on weather-based CRA advisories, there is a need to study the status of the adoption of advisories, their usefulness, improvements needed in advisories, and any modification required in the design of the media for the dissemination (FarmPrecise app). Therefore, a study was planned to improve CRA through farmers' feedback into agromet advisories disseminated through the FarmPrecise app.

Material and Methods

Study area

Telangana state is emerging as a key rice-producing state in the country. Telangana, called the rice bowl of South India which grows rice in about 44 lakh acres, has seen its share to the national rice production improve considerably from 29 lakh tonnes in 2015-16 to 1.3 crore tonnes in 2019-20 (RBI, 2021). Narayanpet is one of the major rice-producing districts of Telangana state (Sharma and Raju, 2016) and WOTR is actively engaged in the Narayanpet district through its various project activities. Therefore, for the study, 100 farmers of five villages of Narayanpet district of Telangana state were selected who have been using the FarmPrecise App for paddy. Both qualitative and quantitative data were collected for both the seasons (*kharif* and *rabi*) of the year 2020-21.

Experimental design, sampling and data collection

We designed the trial to assess the farmers' feedback to understand the adoption, impact and effectiveness of agromet advisories disseminated through the app (FarmPrecise). The unit of analysis is an individual farmer. The major crop/most grown crop was preferred for the data collection. A questionnaire was prepared in Telugu and English languages to collect data which was then converted into Open Data Kit (ODK) format so that it can be assessed online and digital data collection is possible using a mobile or a tab. The sample size was determined at 95% confidence level and 10% confidence interval. The simple random sampling technique was used for selection of farmers. The data collection was done in 5 villages (Laxmipur, Ammireddypalle, Perapalla, Appireddypalle and Lingampalli) of Narayanpet district of Telangana state for the *kharif* and *rabi* seasons of the year 2020-21. A total of 100 farmers, 20 from each village who were receiving FarmPrecise advisories were interviewed to collect the feedback on the e-agromet advisory service. The survey team was trained for the data collection using the ODK application before the data was collected. The data collections were divided into three stages during the cropping cycle- the early stage, mid-stage, and end/harvesting stage of the crop. The survey farmers were closely monitored during the data collection process and required inputs and clarification were given to them to avoid gaps and errors in the data.

Results and Discussion

Present status of farmer's adoption of weather-based CRA advisories

Table 1 revealed the status of farmer's adoption (%) of weather-based CRA advisories disseminated through the FarmPrecise app for paddy during the *kharif* and *rabi* seasons 2020-21. The average farmer's adoption of advisories of cultural practices was highest (about 85%) followed by advisories of daily weather information and weather alerts (about 83%) and lowest for crop-specific advisories (about 33%). Also, the average farmer's adoption of advisories of integrated nutrient management (INM) was about 52% and for integrated pest management (IPM), about 40%.

Table 1: Status of farmers' adoption of weather-based CRA advisories

Weather-based location and crop-specific climate-resilient advisories		Adoption (%)	Avg. Adoption (%)
Advisories of cultural practices	Advisory of puddling	92	53
	Advisory of crop geometry	91	
	Advisory of weeding	72	
	Gap filling required in the field	6	
	Re-sowing required in the field	4	
	Advisory to apply organic manures (FYM/ vermicompost/ compost) and green manuring	61	
Advisories of integrated nutrient management	Advisory of *Amrutpani* and *Jeevamrut* application	79	52
	Advisory of vermiwash spraying	22	
	Advisory of the recommended dose of chemical fertilizer	90	
	Advisory of split-dose application	62	
	Used fertilizer calculator tool of FarmPrecise app	32	
	Saved cost on fertilisers by using fertilizer calculator	18	

Advisories on integrated pest management	Advisory of seed treatment	98	40
	Advisory of trap crop	11	
	Advisory of pheromone trap	59	
	Advisory of light trap	13	
	Advisory of bio-pesticides (*Dashparni* ark/NSKE/Neemark)	12	
	Advisory of chemical pesticides to control the pest/disease infestation	45	
Advisories of daily weather, and weather alerts	Weather alerts (heavy rainfall/hail storm/pest-disease attacks) appropriate for region and agricultural activities in the field	80	83
	Fallow weather alerts (heavy rainfall/ hail storm/pest-disease attacks) for agricultural activities in the field to save the crops	85	
Crop specific advisories	Advisory of nursery preparation	83	33
	Advisory of Azolla application	3	
	Advisory of application of buried green leaves of Gliricidia @ 3 tones/ha during puddling	1	
	Advisory of paddy transplanting at 20 x 20 cm or 25 x 25 cm	91	
	Advisory of application of urea: DAP briquettes	21	
	Advisory of silicon spray @ 1-2 gram or 1-3 ml/liter of water	10	
	Advisory of a spray of 00:52:34 @70 G, Multi Micro-Nutrients @50 g and silicon @15 ml in 15 liters of water at panicle emergence stage	22	

Farmers' feedback on the adoption of weather-based CRA advisories and possible actions

Farmers' feedback on the adoption of advisories, and possible actions to increase the adaptability through improving advisories and media of dissemination (FarmPrecise app) are shown in Table 2.

Table 2: Farmers' feedback on the adoption of advisories, and possible actions to increase the adoption

Advisory	Adoption	Remark	Action
Advisory of land preparation (Puddling or ploughing and harrowing)	Adoption is about 90%.	Farmers are interested to know and use of new implements and modern tools and technologies to save both energy and time at the field level.	Advisories need to be updated with information on new mechanization techniques (e.g. modern machines / implements /tools for sowing /transplanting /harvesting etc.).
Advisory to incorporate organic manures (FYM, vermicompost, compost, and green manuring) during land preparation	Adoption is about 60%, low due to the insufficient quantity of manures that were available and was not ready to apply at the household level. Also, 30-35% of farmers are willing to purchase organic manures but are not available locally.	Opportunity to produce the organic manures commercially.	Green manuring is one of the better options to address the shortage of organic manure.
Advisory of seed treatment	Adoption is about 98%.	Field demonstration is required to increase the accuracy of proper seed treatment.	Scope to spread the technology at large scale with proper use of ingredients for the seed treatment.
Advisory of crop geometry	Adoption is about 90%.	Farmers are facing the lack of availability of machines during the period of sowing or transplanting.	Opportunity to strengthen custom hiring centres (CHC) or group of people can purchase the machines with their contribution or commercially make the machines available.
Advisory of trap crop	Adoption is about 15%.	Farmers are not aware of the technique and selection of trap crops.	Advisories need to be updated with the selection of appropriate trap crops. Capacity building of farming community through field training and technology demonstration.

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Advisory	Adoption	Remark	Action
Advisory of pheromone trap	Adoption is about 60%	20-40% of farmers are not aware of the techniques, 30% of the farmers observed non-availability of lures and traps in the local market in time, 15-20% of the farmers observed that it is easy to use chemical spray.	Need to develop a network with the agriculture service centre (ASC) for timely supply of traps and lures in the local market. Need to train the farmers for the proper installation of traps and make them aware of their features through field training and technology demonstration.
Advisory of the light trap	Adoption is about 13%	30-70% of farmers don't have an idea of technology, installation, and features of instruments. 15-55% farmers willing to follow advisory but material/instrument is not available locally.	
Advisory of application of *Amrutpani* and *Jeevamruit*	Adoption is about 85%	The raw material was not available to prepare it	The opportunity of commercial production of biological formulations locally. Raw material (plant leaves) can be available by growing the required plants on field borders. Need to demonstrate technologies by field training.
Advisory of spraying of Vermiwash	Adoption is about 9-35%	Farmers don't have an idea about the technique. Didn't make provision to collect Vermiwash from the Vermi-bed.	
Advisory of application of Bio-pesticides (*Dashparniark*/ NSKE/ Neemark)	Adoption is about 5-15%	60-70% of farmers are not aware of technology, the raw material was not available to prepare it for 10-50% farmers, 34% are interested to purchase from the market but not available in the market.	
Advisories of application of recommended dose of chemical fertilizer	Adoption is about 90%	62% of farmers are following the technique of split-dose application. 32% of farmers use the fertiliser calculator tool in the app (FarmPrecise).	Needs to develop the user-friendly interface of fertilizer calculator. In-house training is required to train farmers.
Advisories of application of chemical pesticides/ insecticides	Adoption is about 40%	Application of bio-pesticides reduced the use of chemical pesticides/ insecticides.	Advisories of the application of pesticides/ insecticides need to be updated with information on their latest trade names available in markets.
Advisories of daily weather and weather alerts	Adoption is about 85-100	Farmers got benefited by saving their crops to a different extent.	Scope to increase the accuracy of advisories at the local/micro level.

*CRA advisories need to be updated with their exact purpose and benefits including short videos of best practices, preparation of biological formulations, installation of traps, etc.

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Conclusion

At present, the level of farmers' adoption of weather-based CRA advisories lags behind the expected level. There is a need for additional support and efforts by the government and other agencies beyond the existing strategies. The adoption of weather-based CRA advisories is a broad issue like adaptation to climate change. Therefore, it needs to be undertaken at a strong collaborative level between farmers, research institutions, funding agencies, governments, non-government organisations and private sectors. Strong institutional mechanisms to address CRA-related knowledge gaps, and essential agromet advisories for successful implementation of region-specific agriculture action plans need to be developed. Weather-based CRA advisories disseminated through the mobile app (FarmPrecise) helped farmers to increase their knowledge about sustainable farming practices including modern technologies and nature-friendly solutions. Farmers are able to reduce the input cost and increase the net profit for paddy. Also, the mobile app (FarmPrecise) is an effective way to disseminate agromet advisories and build the resilience of the farming community to climate change. To enable farmers to adapt to weather-based CRA advisories, continuous efforts are needed in the form of capacity building. Dissemination with small videos on good practices and communicating the advisories in colloquial language will have a greater impact.

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Disclaimer

The contents and views expressed in this study are the views of the authors and do not necessarily reflect the views of the organizations they belong to.

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