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

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ABSTRACT

In India, climatic factors changing very rapidly and climate-induced extreme events are increased during the period of 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 its impacts on land, water, and agriculture. To adapt farmers to 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 but yet the adaptability is not that high. It means, there exists considerable knowledge gaps in understanding climate vulnerability, socio-economic impacts, and suitable ways to build resilience. Therefore the study is planned 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 help to build the resilience of the farming community to climate change and mobile application (FarmPrecise app) is an effective way of their dissemination. Farmers are 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 Change, Climate Resilient Agriculture (CRA) , Mobile Application, e-Extension, Agricultural Extension

Introduction:

In the last 30 years, the damage caused by climate change in India has doubled and is increasing day by day. The damage to agriculture is the

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biggest and its adverse effects need to be considered very seriously (ACT, 2018; Jogesh and Paul, 2020). 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., 2012). This view is strongly underscored by both the IPCC and India's Second National Communication to United Nations Framework Convention on Climate Change (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). In this view, 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 farmers to build resilience and adaptive capacities.

In this view, to assess the effectiveness and ground 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 of dissemination (FarmPrecise app). Therefore a study was planned to improve CRA through farmers' feedback into agromet advisories disseminated through the FarmPrecise app.

Objective

To assess the farmers feedback to understand the adoption and appropriateness of agromet advisories disseminated through the app (FarmPrecise)

Material and Methods

Study Area:

Telangana state is emerging as a key rice-producing state in the country. Also, 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 recorded in 2015-16 increased by four times 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 being actively engaged in the Narayanpet district through its various project activities. Therefore, for the study, 100 farmers of five villages of Narayanpet block of Telangana state were selected who have been using the FarmPrecise App for paddy. Both qualitative and quantitative data are collected for both the seasons (Kharif and Rabi) of the year 2020-21. The location map of the study district is shown in Figure 1.

Study Design: Experimental Design, Sampling and Data Collection

The study design is depicyed in Figure 2 which the farmers feedback to understand the adoption and appropriateness 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 in the selected villages of the Narayanpet district of Telangana. A questionnaire-based tool was designed in Telugu and English languages to collect the data and then converted it 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 a 95% confidence level and 10% confidence interval. So, a total of 100 farmers and equally divided into study villages who are recipients of 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 process of data collection was divided into three stages during the cropping cycle- the early stage, mid-stage, and end/harvesting stage of the crop. The survey team was closely monitored during the data collection process and required inputs and clarification were given to them to avoid gaps and errors in the data.

Figure 1. Study Area- Narayanpet district on the map of Telangana

Village Sample Selection	**Study Site: Telangana** District: Narayanpet Villages: Laxmipur, Ammireddypalle, Perapalla, Appireddypalle, and Lingampalli	**Jan-May 2020**
	Sampling frame of Villages: All 05 villages have been receiving agromet advisories disseminated through the FarmPrecise app	
	A sampling of Villages: Simple random sampling, 05 villages (20 farmers/village/ season) have been using agromet advisories for paddy	
Data Collection	**Face to face interviews: Kharif Season 2020-21** The first round of face to face interviews Interviewed 100 farmers and collected data for paddy (Kharif)	**June-December 2020**
	Face to face interviews: Rabi Season 2020-21 The second round of face to face interviews Interviewed 100 farmers and collected data for paddy (Rabi)	**October-May 2021**
Analysis	**Data Analysis:** Status of adoption, Farmer's feedbacks on agromet advisories for paddy	**June-October 2021**

Figure 2. Study Design

Results and Discussion

Present Status of Farmers Adoption of Weather-based CRA Advisories

Table 1 revealed the status of farmers' adoption (%) of weather-based CRA advisories disseminated through the FarmPrecise app for paddy during the Kharif and Rabi season of the year 2020-21. The average farmer's adoption of advisories of cultural practices is highest (about 85%) followed by advisories of daily weather information and weather alerts (about 83%) and lowest for crop-specific advisories (about 25%). Also, the average farmer's adoption of advisories of Integrated Nutrient Management (INM) is about 63%, and for Integrated Pest Management (IPM) is about 40%.

Table 1 Status of farmer's adoption of weather-based CRA advisories

Weather-based location and crop-specific climate-resilient advisories		Adoption (%)
Advisories of Cultural Practices:	Advisory of puddling	92
	Advisory of crop geometry	91
	Advisory of weeding	72
	Gap filling required in the field	6
	Re-sowing required in the field	4

Advisories of Integrated Nutrient Management:	Advisory to apply organic manures (FYM/ Vermicompost/ Compost) and green manuring	61
	Advisory of Amrutpani and Jeevamruit application	79
	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
	Advisory of trap crop	11
	Advisory of pheromone trap	59
	Advisory of the 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) are appropriate for your region and agricultural activities in the field	80
	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
	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

Impact of Weather-based CRA Advisories

Table 2 revealed that overall about more than 90% of farmers benefited atleast by an increase in crop yield or reduction in the cost of field inputs or reduction in the cost of cultivation and labor cost or saving of irrigation water.

Crop Yield: 43% of farmers observed that crop yield is increased by 25% and more by following agromet advisory while 57% observed no change concerning the average historical crop yield.

Field Inputs: 91% of farmers observed that the cost of field inputs (like fertilizers, pesticides, insecticides) is decreased by 25% and more by following agromet advisory while 5% observed not much difference with average historical input cost.

Cost of Cultivation and Labor: 90% of farmers observed that the cost of cultivation and labor cost is decreased by 25% and more by following agromet advisory while 7% observed that the cost of cultivation and labor is not decreased much, but it is approximately equal to the average historical cost.

Water Saved: 93% of farmers observed that irrigation water saved is up to 25% by following agromet advisory while 6% observed that irrigation water is not saved much, but it is approximately equal to average historical water applied.

Table 2 Impact of weather-based CRA advisories on crop yield, cost of field inputs, cost of cultivation and labour cost, and application of irrigation water of Paddy crop

Crop yield increased by following advisories	Yes (Increased by 25 % and more)	Yes, but crop yield near about equal to average historical yield	No
	43	57	0
Cost of field inputs (like fertilizers/ Pesticides/ Insecticides) decreased by following advisories	Yes (Decreased by 25 % and more)	Yes, but the cost of field inputs near about equal to the average historical cost	No
	91	5	4

Cost of cultivation and labour cost decreased by following advisories	Yes (Decreased by 25 % and more)	Yes, but the cost of cultivation and labour cost near about equal to the average historical cost	No
	90	7	3
Irrigation water saved by following advisories	Yes (Decreased up to 25 % and more)	Yes, but irrigation water applied near about equal to the average historical amount	No
	93	6	1

Usefulness (Farmers Rating) of Weather-based CRA Advisories:

Figure 3 revealed that the usefulness of advisories disseminated through the FarmPrecise app was rated by farmers in the spectrum of Very Low, Low, Average, Good, and Very Good. About 70-73% of farmers rated the overall usefulness of advisories are good to very good, and 27% of farmers rated as average.

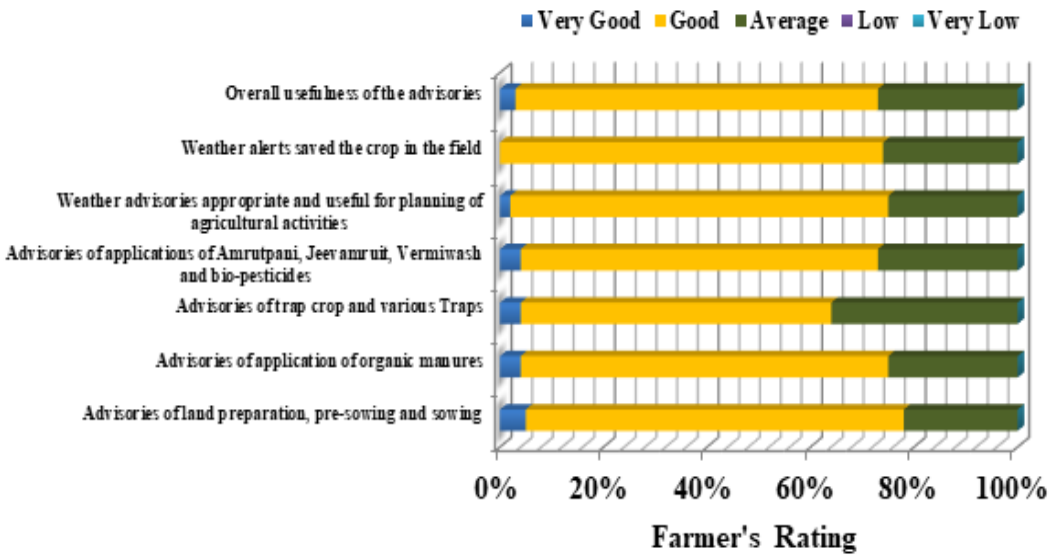

Figure 3 Status of the overall usefulness of advisories for paddy crop

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 discussed below.

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) while land preparation.	Adoption is about 60%, lower 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 else farmers have to develop their capacity to produce a sufficient amount of organic manure.	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 scale with proper use ingredients of seed treatment.

Advisory of crop geometry.	Adoption is about 90%.	Farmers are facing the issues of the 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 availability of the machines.
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.
Advisory of pheromone trap.	Adoption is about 60%.	20-40% of farmers are not aware of the techniques, 30% of the farmers observed that timely none availability of lures and traps in the local market, 15-20% of the farmers observed that it is easy to use chemical spraying trap.	Needs to develop a network with the agriculture service centre (ASC) for smooth supply of traps and lures in the local market.
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 follow advisory but material/ instrument have not available locally.	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 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. Needs 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 a 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 traps, etc.**

Conclusion:

It may be concluded from the above findings that, at the present level of farmers adoption of weather-based CRA advisories, 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. There is a need to develope strong institutional mechanisms to fine-tune CRA-related knowledge gaps, and essential agromet advisories for successful implementation of region-specific agriculture action plans. However, 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 the 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 community-level capacity building, dissemination of small videos on the good practices and communicating the advisories in colloquial language will have a greater uptake.

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