



Impact of *Meghdoot* Mobile App - A Weather-based Agro-advisory Service in Cold arid Ladakh

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ARTICLE INFO

Keywords: *Meghdoot*, Agro-advisories services, Farmers, Registered, Non-registered

<http://doi.org/10.48165/IJEE.2022.58329>

ABSTRACT

The study was conducted to evaluate the impact of the *Meghdoot* mobile application-a weather-based agro-advisory service in cold arid Ladakh during 2020-21. A random sample of 100 registered farmers was selected which included 25 farmers each from Stok and Stakna villages and 50 farmers from Bazgoo village of Leh district. The data indicated that farmers of Leh district were very belittling of newspapers followed by radio. Almost, 70 per cent of registered farmers have followed information for agriculture practices through the *Meghdoot* application of agro-meteorology advisory services but non-registered farmers used to follow their traditional methods for agricultural practice due to a lack of knowledge of this application of agromet-advisory services. More than 50 per cent of farmers agreed that this application provided weather information in the local language with a mean score of 0.55. Similarly, in the case of wheat, an average yield superiority of 16.71 per cent was recorded in the case of registered farmers over non-registered farmers during 2020. The mobile application provided benefits to the registered farmers in comparison to non-registered farmers of district Leh, Ladakh.

INTRODUCTION

With the growing population of India, it is aimed to produce and support Indian agriculture for more food with more precision and correctness by weakening the impacts of extreme events. In view of this, weather information integrated with agro-advisories might support and bring economically viable sustainability for more agricultural production. Sharing knowledge through advisories as effective tools for proper understanding of user priorities needs to work in partnership with meteorological services to promote more environmentally friendly and sustainable development in Indian agriculture, especially in a country like India that has wealthy biodiversity and experiences extreme weather variability, crop failure, cloud burst, etc. India's Integrated Agrometeorological

Advisory Service (AAS) drive is the largest agro-meteorology information advisory program in the world by the Indian Meteorological Department based on weather-based services for farmers by radio broadcasting system since 1945. In 1976, IMD integrated its work involving state governments to help farmers by issuing forecast-based advisories, and in 1988 piloted by the National Centre for Medium-Range Weather Forecasting. In 2008, IMD launched the district-level Agrometeorological Advisory Service (DAAS). Ministry of Earth Sciences mobile App *Meghdoot* launched in August 2019 and covered 68 districts including the Leh district. Later the service was available in 150 districts across the country (Bijlwan, 2020). *Meghdoot* or Cloud Messenger, a joint initiative of the Indian Meteorological Department (IMD), Indian Institute of Tropical Meteorology (IITM), and Indian Council of

Agricultural Research (ICAR) aims to deliver critical information to farmers through a simple and easy to use mobile application for example. After installing, the app displays information like targeted weather parameters such as temperature, precipitation, etc. It also give information on major crops viz., cereals, vegetables fruit crops, and livestock grown in a particular location (Saini, 2019), also, provide crops and livestock advisories for specific locations every Tuesday and Friday in location-based languages. Also bear features by tracking past weather patterns in the selected region for the past seven days. The application seamlessly aggregates contextualized district and crop-wise advisories issued by Agro-Met Field Units (AMFU) every Tuesday and Friday with the forecast and historic weather information to the fingertips of the farmers (Vartika, 2019). This App is very useful in a region like Ladakh where all biotic and abiotic extremes have been noted in past. The advisories are also issued in vernacular wherever available. *MEGHDOOT* mobile application used in different organizations of Ladakh such as high mountain arid agriculture research institute (HMAARI), Stakna-Leh, SKUAST-Kashmir, and IMD centre-Leh for valuable information dissemination to the farmers through scientific expert advisories and essential need of motivating to more and more farmers for engagement with *Meghdoot* application of Agro-met Advisories Services (AAS). Hence, it emphasizes the need to study the psychological perception of farmers' *Meghdoot* mobile application of Agro-advisories in the cold arid region of Ladakh.

METHODOLOGY

The study was conducted in the purposively selected Leh district of the Union Territory of Ladakh in 2021. There are 16 blocks and 119 villages in the Leh district. Two blocks namely Kharu and Chuchot were selected on the basis of having a maximum number of farmers being registered under Agro-Meteorology Field Unit (AMFU) centered at SKUAST (K) HMAARI, Stakna, Leh. Three villages namely Stakna, Stok, and Bazgoo were identified from Kharu and Chuchot blocks on the basis of having a maximum number of farmers who have been registered under the agro meteorology field unit (AMFU). Random sampling for 100 farmers was carried out that included 25 farmers each from Stok and Stakna villages and 50 farmers from Bazgoo village. Perception of farming on information acquired through *Meghdoot* application of agro advisories on agriculture and weather which was measured on the basis of Follow vs Unfollow with a score of 2 and 1, respectively. The impact of farmers about the *Meghdoot* application has been assigned marks and one mark each was assigned for 'Yes' correct reply and zero scores each for 'No' reply, respectively. The descriptive statistics such as the percentage, mean score and average superiority yield of barley and wheat crops obtained by the registered farmers who used the *Meghdoot* application and non-registered farmers who did not use the *Meghdoot* application from 2019 to 2020 in Ladakh, were used. Tabular analysis was employed to assess the source of information, perception of farmers about agriculture and weather, psychological perceptions of farmers for *Meghdoot* mobile application and yield variation of crops (Barley and Wheat).

RESULTS AND DISCUSSION

The majority of farming communities belonged to small as well as marginal levels with limited resources and access to the latest

technologies and if not equipped with this type of advisories experience huge food deficits under extreme weather challenges under changing climate. Ladakh has been very keen and profound of radio information where all the information through All India Radio is broadcasted. Every household still relies on Radio news as compared to TV News. In interviews about the broadcasting of news, they are of the opinion that these are more accurate as compared to television. In addition to this, every house has at least a minimum of 5 people and 80 per cent maintains mobile. The source of information at high altitudes and remote regions like Ladakh where mobile apps have been found very effective in communication as well as apps specially developed for agricultural purposes. Almost cent per cent is the agrarian population in Ladakh where commodities like barley, wheat along with vegetables are the lifeline in this high mountain region which is locked from all directions for seven months during the winter season. Under such situations and natural disaster locations, these mobile apps bring together the Ladakhi people in an effective manner.

Table 1. Existing source of information for Farmers

Source of Information	Percentage
Radio	26
Television	28
Newspaper	05
Friends/Relatives	23
Mobile	18

The survey indicated (Table 1) that the dissemination of information at the farmers' level was found very effective through various modes of communication like radio, television, newspapers, friends/ relatives, and especially Mobile apps. The major source of information for farmers of Leh ranged between 25-28 per cent through television, radio, and in the present scenario the Mobile apps. And mobile is gaining much popularity as compared to television. Mutual interaction of exchange of information is between friends/ relatives. This mode of mutual exchange either from friends or mobile was recorded during the cloud-burst situation in 2010 when no causalities were recorded. The newspaper was the least and lowest source of information for the farmers of Leh i.e., 5% as this mode of information was always delayed 3 days due to its remote location. Thus, the data also indicated that the source of information has a major role in farmers' progress. All the modes besides newspapers are still working very effectively and they benefitted with increased income and increased marketing opportunities by accessing marketing information from these modes of communication. Similar findings were observed by Rahman et al., (2016) & Rahman et al., (2020) studied the source of information for farmers of different areas of agricultural practices. Likewise, it was observed that in mountain regions, radio and television are the major source for communicating with farmers on how to protect and stimulate agricultural development. This impact as seeing is believing and doing is learning if these media are working effectively.

Information of agriculture disseminated to farmers through the *Meghdoot* application of agro-advisory Services (Table 2) indicated that 80 per cent of registered farmers followed advisories about snowfall/ temperature/ rainfall through *Meghdoot* App through AAS

Table 2. Perception of the farming community on information acquired through *Meghdoot* mobile application of agro-advisories on agriculture and Weather

Information acquired by <i>Meghdoot</i> mobile application on Agriculture and Weather	Response category	Mean score of farmers
Snowfall/ temperature/ rainfall	Follow	0.80
	Not follow	0.20
Ploughing	Follow	0.74
	Not follow	0.26
Seedling/ Sowing/ Seeds/ varieties/ input on crops	Follow	0.70
	Not follow	0.30
Manurial application	Follow	0.66
	Not follow	0.34
Irrigation/ Availability of water	Follow	0.69
	Not follow	0.31
Intercultural operations (Weeding etc.)	Follow	0.64
	Not follow	0.36
Harvesting	Follow	0.69
	Not follow	0.31
Polyhouse related (winter) fertigation, preventive measures from pests	Follow	0.75
	Not follow	0.25
Advisories related to season change- time and stages of agriculture (shift from monocropping approaching winter activities)	Follow	0.86
	Not follow	0.14
Others (agricultural and environmental advisories)	Follow	0.71
	Not follow	0.29

and only 20 per cent of registered farmers did not follow about this aspect through AAS. Registered farmer respondents revealed that 74 per cent followed about ploughing through Agromet advisory services and 26 per cent of registered farmers had not followed about this aspect. Farming community registered followed to the tune of 70 per cent about advisories regarding seedlings/ sowing/ seeds/ varieties/ inputs on crops through AAS and 30 per cent of registered farmers had not followed about this aspect through AAS. Manurial application has been followed by 66 per cent of registered respondent farmers through AAS, whereas 34 per cent of registered farmers have not followed it. Further, 69 per cent of registered farming communities followed irrigation/ availability of water through AAS and 31 per cent of farmers had not followed this aspect. Intercultural operations practices had been followed by 64 per cent of registered farmers, whereas 36 per cent of farmers had not followed it. Registered farmers (69 per cent) followed about harvesting through and 31 per cent of had not followed. 75 per cent of registered farming communities followed polyhouse-related fertigation, and preventive measures against pests through AAS,

whereas 25 per cent of farmers had not followed this aspect. Further, 86 per cent of registered respondent farmers followed advisories related to season change-time and stages of agriculture through agro-advisory services. Finally, 71 per cent of registered farmers followed others (agricultural and environmental advisories) through AAS. On average basis, the majority of registered under the *Meghdoot* application of Agro-meteorology advisory services farmers (70%) followed agricultural practices but non-registered farmers used to follow their traditional methods for agricultural practice due to a lack of knowledge of this application of agromet-advisory services. IMD and SKUAST-Kashmir established more agro-meteorology field unit (AMFU) centers provided for the Ladakh region for the benefit of the farming community through the *Meghdoot* application. The results were in agreement with the findings of Sindhu (2017); Jiyawan (2010), and Kaur and Anand (2021) who studied the perception of different aspects in different regions.

The data indicated (Table 3) that more than 50 per cent of farmers agreed for motivation to others farmers registration in

Table 3. Perceptions of farmers about *Meghdoot* mobile app. of agro-advisories

Perception items	Percentage
Have you motivated other farmers to register in the <i>Meghdoot</i> mobile app	55
Have you been aware of being motivated by the farmers to register in the <i>Meghdoot</i> application	50
Do you think the <i>Meghdoot</i> app. provides valuable information for the cultivation of agriculture and climatic conditions to the farmers	60
Do you feel after registering <i>Meghdoot</i> mobile application provide help us	65
Do you feel about <i>Meghdoot</i> application is not good for the farmers	29
Do you think about <i>Meghdoot</i> application is good for the farmers	70
It helps to solve the constraints of agriculture farming	60
It helps to improve their agriculture yield	63
Does it give a stress-free life to the farmers?	54
It provides the helpful information to the farmers after post-disaster	51
It helps to provide important information spread to the farmers regarding the Covid-19 pandemic	62
Do you think about <i>Meghdoot</i> application is the mode of communication	52
It provides weather information in local/regional language	55

Meghdoot application with a mean score of 0.55. 50 per cent of farmers agreed for awareness to other similar farmers in this application of AAS. More than 60 per cent of farmers agreed for the *Meghdoot* application provided valuable information for the cultivation of agriculture and climatic conditions, 65 per cent of farmers agreed that *Meghdoot* mobile application provide help. Although, 29 per cent minimum farmers reported that *Meghdoot* application is not good but 70 per cent agreed for *Meghdoot* application is good for them. 60 per cent of the farmers agreed to undergo to solve the problems of agriculture farming through *Meghdoot* application whereas 60 per cent of farmers agreed to improve their socio-economic status with the help of it. half of farmers agreed to live a stress-free life with the help of it and 62 per cent of respondents agreed that it helps to provide helpful information to the farmers post-disaster whereas 60 per cent of farmer respondents agreed that it helps to provide important information spread to the farmers regarding COVID-19 pandemic. More than half of farmers agreed for the *Meghdoot* mobile application is a mode of communication. More than half of farmers agreed that this application provides weather information in the local language. Similar results were observed by Diaz et al., (2021), Krumpel (2019) & Kumbhare et al., (2019) who studied the psychological impact of a mobile application on the farmers from different regions.

The economic impact of the *Meghdoot* application was observed in terms of the yield performance of barley and wheat in the case of registered and non-registered farmers. The results (Table 4) revealed that during 2019 an average yield superiority of 12.13 per cent was recorded in the case of barley among the registered farmers over non-registered farmers. Similarly, in the case of wheat, an average yield superiority of 16.71 per cent was recorded in the case of registered farmers over non-registered farmers during 2020. As a result of this, this app provided benefits to the registered farmers in comparison to the non-registered farmers of Ladakh. This table also indicated the positive increase over the previous year in terms of respondents registering the App. While it just decreased

under non-registered and added to the App and showed the attraction towards the utility of this App for yield gain in crops.

The data in Table 5 revealed that the villages and farmers using the *Meghdoot* App were at different altitudes and distances and obtained higher yields significantly when the community utilized the mobile App '*Meghdoot*'. It is clear from the table that there is a significant gain over after registering with the App. It indicated that the utilization of App by the farming community was found very effective in the parameters for crop output. The Indian Meteorological Department since 1945 is broadcasting weather services by radio for the farmers and its Integrated Agrometeorological Advisory Service (AAS) is the largest agrometeorological information program in the world (Venkatasubramanian et al., 2014). All agrometeorological information directly benefits the livelihood of farmers for agricultural production. This App directly impacts the quality and quantity of produce and lastly income enhancement (Chattopadhyay & Chandras, 2018).

CONCLUSION

The government of India is regularly trying to promote innovative technology-based agriculture among the farmers. The respondent farmers of Leh were very less using newspaper. 70 per cent of registered farmers followed information for agriculture practices through the *Meghdoot* mobile application of agrometeorology advisory services but non-registered farmers used to follow their traditional methods for agricultural practice due to a lack of knowledge of this application of agromet-advisory services. More than 70 per cent farmers opined that the *Meghdoot* application is good for them. The district administration disseminates this mobile application on the large scale to the farmers of Ladakh with the help of SKUAST-Kashmir, IMD, and other N.G. O's. In overall, the mobile application provides benefits to the registered farmers in comparison to the non-registered farmers in terms of yield advantage which indirectly motivated the farmers to register for the App.

Table 4. Yield variation due to application of MEGHDOOT in Leh district

Crops	Registered farmers		Non-registered Farmers		Average yield (q/ha) under				Percent gain over non-registered	
	under <i>Meghdoot</i> mobile app				Registered category		Non-registered category			
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Barley	53	65	50	35	18	19	16	17	12.5	11.76
Wheat	55	50	50	45	20	22	17	19	17.64	15.78

Table 5. Validation of *Meghdoot* App in villages of different altitude in Leh-Ladakh

Villages	Farmer's name	Name of crops	Area (Kanal)	Yield of crop (kg/kanal)		Remarks Elevation (m)
				Without the <i>Meghdoot</i> app.	With the <i>Meghdoot</i> app.	
Stakna	Tsering Sandup	Barley	03 kanal	180	196	3287m, 33.9955°, 77.6851°
Stakna	Tsewang Chorol	Barley	06 kanal	363	382	3287m, 33.9955°, 77.6851°
Bazgoo	Tsering Youdol	Vegetables*	05 kanal	63	72	3292m, 34.1244°, 77.1741°
Stok	Stanzin Dorge	Wheat	05 kanal	316	371	3364m, 34.0644°, 77.5533°

(Note: 20 kanals= 1 hectare); * Cabbage, cauliflower, knol-khol, tomato, spinach, other leafy vegetables

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