

Impact assessment of weather based agro-advisory services of Indus plain farming community under cold arid Ladakh

YOGESH KUMAR, MAHENDRA SINGH RAGHUVANSHI*, KANEEZ FATIMA, MANJEET SINGH NAIN**,
JASBIR SINGH MANHAS***, DORJEY NAMGYAL, MAHESHWAR S KANWAR, MEHRAJUDDIN SOFI,
MAHENDER SINGH*# and SONAM ANGCHUK*##

High Mountain Arid Agriculture Research Institute, Leh – Ladakh, India

**ICAR-National Bureau of Soil Survey and Land Planning, Nagpur – 440 033 Maharashtra, India*

***Division of Extension Education, IARI, New Delhi, India*

****Division of Agricultural Extension Education, SKUAST - Jammu, India*

**#Agrometeorology Section, Division of Agronomy, SKUAST - Jammu, India*

**##Krishi Vigyan Kendra, SKUAST-K, Leh - Ladakh, India*

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e mail : omsai.msr@gmail.com

सार – लद्दाख के ठंडे शुष्क क्षेत्र के तहत प्राकृतिक संसाधनों की उपयोग दक्षता को समझने और कृषि किसानों की सामाजिक-आर्थिक स्थिति की पहचान करने के लिए पारंपरिक ज्ञान और आईएमडी आधारित एचएमएआरआई एग्रो एडवाइजरी सर्विसेज का उपयोग करके मौसम की भविष्यवाणी को अपनाने के प्रभाव मूल्यांकन का मूल्यांकन करने के लिए अध्ययन आयोजित किया गया था। हाई माउंटेन एरिड एग्रीकल्चर रिसर्च इंस्टीट्यूट, SKUAST (K), लेह-लद्दाख में सूचना का स्रोत, किसानों की धारणा और उनकी ज्ञान प्रतिक्रिया। लेह क्षेत्र के एग्रोमेट पंजीकृत 3 गांवों के कुल 100 किसानों को मल्टीस्टेज सैंपलिंग तकनीक का उपयोग करके यादृच्छिक रूप से चुना गया था। उत्तरदाताओं की सामाजिक-आर्थिक विशेषताओं से पता चला कि हालांकि सलाहकार सेवाओं का उपयोग करने से पहले, अधिकांश कृषक समुदाय मौसम की स्थिति की व्याख्या करने के लिए वर्षा/तापमान पूर्वानुमान की भविष्यवाणी करने के लिए पारंपरिक ज्ञान प्रणाली का उपयोग कर रहे थे। सलाहकार सेवाओं की शुरुआत के साथ, यह दर्ज किया गया कि वृद्ध किसानों ने सलाहकार सेवाओं का उपयोग 42 प्रतिशत तक करना शुरू कर दिया। जबकि 50 प्रतिशत से अधिक चयनित किसानों (मध्यम आयु वर्ग के गैर-पंजीकृत कृषि-मौसम सलाहकार सेवाओं के तहत) ने बदलते माहौल में भी पारंपरिक भविष्यवाणी का उपयोग किया। शिक्षा और भूमि जोत का आकार क्षेत्र में मौसम आधारित कृषि सलाहकार सेवाओं को अपनाने की संस्कृति को प्रभावित करने वाले सबसे महत्वपूर्ण कारक थे। यह दिलचस्प था कि वृद्ध लोग/किसान पारंपरिक ज्ञान के लिए सूचना के प्रमुख स्रोत हैं, उन्होंने मौसम की भविष्यवाणी के लिए सलाहकार सेवाओं को एकीकृत और अपनाया है। चूंकि यह सलाहकार सेवा योजना कृषि कार्यों के लिए व्यापक जानकारी प्रदान करती है। अधिकांश (80%) चयनित किसानों ने एग्रोमेट एडवाइजरी बुलेटिन की वर्तमान प्रणाली के साथ अपनी संतुष्टि की सूचना दी, जो कि द्वासप्ताहिक रूप से जारी किया जा रहा है। जबकि, लद्दाख क्षेत्र के कमजोर गांवों के गैर-पंजीकृत किसानों ने सलाहकार सेवा के बारे में कम जानकारी दिखाई और इसके मौसम ने विनाश की व्याख्या की।

ABSTRACT. The study was conducted to evaluate the impact assessment of adoption of weather prediction using traditional knowledge and IMD based HMAARI Agro Advisory Services to understand the utilization efficiency of natural resources under cold arid region of Ladakh and to identify socio-economic status of agriculture farmers, their source of information, perception of farmers and their knowledge response carried out at High Mountain Arid Agriculture Research Institute, SKUAST (K), Leh-Ladakh. Total 100 farmers from AgroMet registered 3 villages of Leh region were randomly selected using multistage sampling technique. Socio-economic characteristics of respondents revealed that although before using advisory services, majority of the farming community were using traditional knowledge system to

predict precipitation / temperature forecasting to interpret weather conditions. With the introduce of advisory services, it was recorded that old-aged farmers started using advisory services to the tune of 42 per cent. While more than 50 per cent of selected farmers (middle-aged non-registered under Agro-Met advisory services) utilized traditional prediction even under the changing climate. Education and land holding size were the most important factors influenced adoption culture of weather based Agro Advisory Services in the region. It was interesting that the old-aged people/farmers are the major source of information for traditional knowledge, have integrated and adopted the advisory services for weather prediction. As this advisory service scheme provided comprehensive information for agricultural operations. Majority (80%) selected farmers reported their satisfaction with present system of Agromet Advisory Bulletins, being issued biweekly. Whereas, the non-registered farmers of vulnerable villages in Ladakh region showed less knowledge about advisory service and its weather interpreted perdition.

Key words – Agromet advisory services, Farmers, Weather, Knowledge, Perception, Cold arid.

1. Introduction

Ladakh, also known as “Little Tibet”, is a wildly beautiful desert region high in the Western Himalayas at high altitudes. It is a region of limited resources with an extreme climate with a vast rain-shadow zone in the north (Raghuvanshi *et al.*, 2019). This cold dry tract of the zone referred to as cold arid region; spread over in the northern states such as the parts of Ladakh UT, Himachal Pradesh, Uttarakhand and Sikkim which altogether constituting approximately one lakh sq km area. (i) Western disturbances move across northwest India, causing good precipitation in the western Himalayas during January and February (Anonymous, 1973). As a result of which villages in the cold arid region, experience predominantly the winter precipitation when temperatures are very low. This contributes and supports agriculture with the harvesting of glacier water in the lap of Himalaya supports a small-scale farming system, well adapted to this unique and extreme environment (Raghuvanshi *et al.*, 2019). Temperature unevenness of a region is the most important factor for Ladakh climate and it may vary from (ii) Extreme temperatures (–40 °C in winter and 40 °C in summer); low annual precipitation (80-300 mm per year), high wind velocity, and low relative humidity (20-40%) (Wani *et al.*, 2011) and being a high elevation cold desert of India, it is marked by extreme aridity with acute moisture deficit throughout the year with an (iii) Erratic behaviour of precipitation regime, influencing the socio-economic conditions of the people of the region significantly (Shafiq *et al.*, 2016). On the other hand, Weather elements like cloud amount, precipitation, temperature wind speed and its direction have the most significant influence on agriculture and other economic activities. In Ladakh region, the other factors floods, drought/ dry spell, storms, and even aberration in weather cause an obvious impact on agriculture and has important impact and significantly influence on farming decisions. For the purpose, the Indian Meteorological Department (IMD) started various weather advisory services for the farmers with the aim to provide relevant weather information and management advisories at a district scale across the country through multi-institutional teams, or

“Agro-Meteorological Field Units” in each of the 127 agro-climatic zones (IMD).

In this context, Leh (Ladakh), which lies in the north-western Himalayas also exhibit the impact of global environmental changes. Even under this district, erratic behaviour of climatic parameters particularly glaciers with respect to latitude, elevation and climatic/weather shows retreat in their snout positions and they vary region to region. Considering these points, this study was carried out at Leh with the aim to evaluate the impact assessment of adoption of weather prediction using traditional knowledge and IMD based HMAARI Agro Advisory Services to understand the utilization efficiency of natural resources under cold arid region of Ladakh.

2. Research methodology

The present study was conducted purposively selected in Leh district of Union Territory of Ladakh during 2020. (iv) As per census 2011, Leh district has 17 blocks including Leh Town and 134 villages (Anonymous, 2016). Two blocks namely Chuchot and Thiksay were selected on the basis of having maximum number of farmers being registered under Agro-meteorology field unit (AMFU) center satakana, Leh. Three villages such as Chuchot, Shey and Ranbirpura were selected from Chuchot and Thiksay blocks on the basis of having maximum number of farmers being covered under Agro meteorology field unit (AMFU). A random sample of 100 farmers was selected which included 35 farmers each from Chuchot and Shey villages and 30 farmers from Ranbirpura village. The descriptive statistics to the frequency, percentage and tabular analysis were employed to assess the farmer’s knowledge and perception about agromet advisory services.

3. Results and discussion

Traditional subsistence agriculture is the economic mainstay of Ladakh region, underwent significant changeover in last few decades. During 1960, only five types of vegetables were grown and now 101 types of

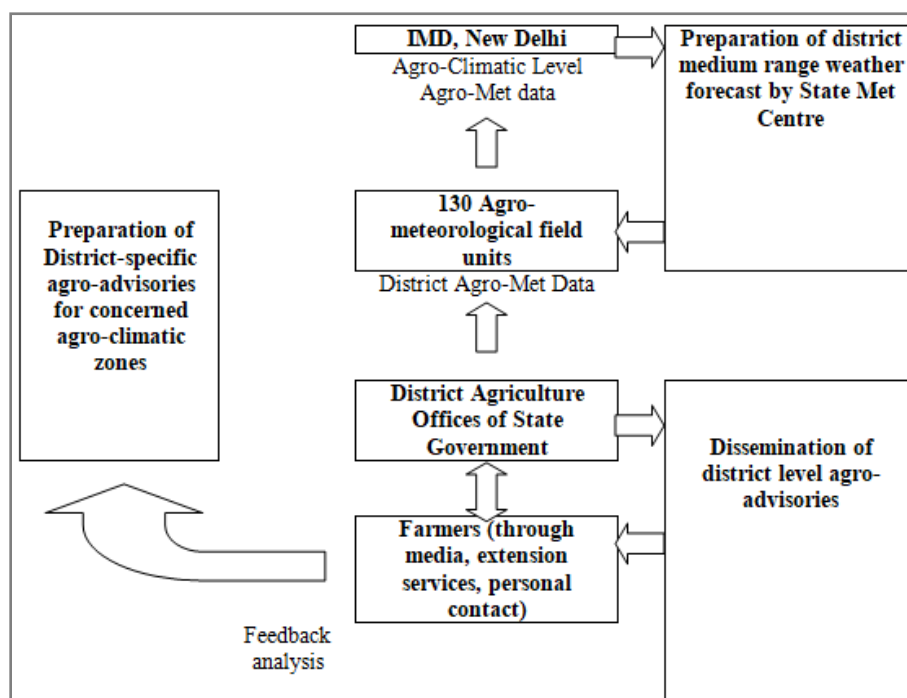


Fig. 1. AAS institutional mechanism to reach farmers in India (Venkatasubramanian, 2014)

vegetable have been demonstrated and 23 types of vegetables are commercially being grown due to change in demand, thereby enabling farmers to mitigate and adapt to the changing climate. With the upcoming modernization in all sectors under subsistence culture would certainly require a proper resource based agro-advisory approach to support farming community to regulate their agricultural activities accordingly to enhance and modify as per the (v) Mountainous topography and unpredictable weather. Now fast receding of snow cover, water has reduced considerably in streams and they often dry and 50% to 80% deficit in annual precipitation in Ladakh between 2013 and 2017 and 2016 (Joshi, 2018). Under such conditions, use of agro-advisory becomes immediate need for the remotely located region like Ladakh. For the purpose, India's Integrated Agro-meteorological Advisory Service (AAS) program is one of the largest agro-meteorological based information broadcasting weather services for the farmers. Under forecast updates since last few decades, IMD launched a District-level Agro-meteorological Advisory Service (DAAS) in 2008 with the aim to provide relevant weather information and management advisories at a district scale across the country. An attempt was made to understand the response of farming communities on these forecasts and services at Leh by taking three villages namely Chuchot, Shey and Ranbirpura where maximum number of farmers being covered under Agro meteorology field unit (AMFU).

Studies revealed that all age group people are responding this system of advisory services and its adoption is increasing with the advancement of family and farming structures like joint family, education, farming experiences, land holdings and particularly farmers' income in the changing scenario and forecast systems in the integration manners with traditional approaches.

Table 1 revealed that that 42 per cent AAS registered farmers were old aged while 44 per cent of non AAS registered farmers are in the middle-aged group. The age of farmers usually represents his experience in farming and old aged farmers are expected to have high experience and knowledge about farming and associated risks involved in it. 40 per cent of AAS registered farmers were graduates while equal percentage of non-registered AAS farmers were educated upto higher secondary. In both AAS registered as well as non-AAS farmers group, male participation in agricultural activities was high as compared to female participation. Majority of AAS registered farmers (44 per cent) and non-registered AAS farmers (46 per cent) had medium family size. Besides 60 per cent AAS registered farmers and 68 percent non-registered AAS farmers have nuclear family. Majority of AAS registered farmers (48 per cent) have farming experience more than 25 years whereas majority of (44 per cent) of non-registered AAS farmers have 16 to 25 years of farming experience (Table 1). Social participation

TABLE 1
Socio-economic characteristics of farmers of Leh district of UT Ladakh (n = 100)

S. No.	Particulars	Category	AAS Registered farmers		AAS Non- Registered farmers	
			Frequency	%	Frequency	%
1.	Age (Years)	Young (>35)	9	18	13	26
		Middle (36-45)	20	40	22	44
		Old (<46)	21	42	15	30
2.	Education	Illiterate	6	12	9	18
		Primary	10	20	13	26
		Higher secondary	14	28	20	40
		Graduation	20	40	8	16
3.	Gender	Male	30	60	27	54
		Female	20	40	23	46
4.	Family Size	Small (up to 5)	18	36	20	40
		Medium (6 to 8)	22	44	23	46
		Large (>9)	10	20	7	14
5.	Family type	Nuclear family	30	60	34	68
		Joint Family	20	40	16	32
6.	Farming experience	Low (up to 15 years)	10	20	11	22
		Middle (16-25 years)	16	32	22	44
		High (>25 years)	24	48	17	34
7.	Social participation	Yes	23	46	14	28
		No	27	54	36	72
8.	Land Holding (ha)	Marginal & small	17	34	24	48
		Medium	28	56	19	38
		Large	5	10	7	14
9.	Other Occupation	Yes	29	58	25	50
		No	21	42	25	50
10.	Farmer's Income	Less than 50,000	6	12	7	14
		50,000-100,000	19	38	22	44
		Above 100,000	25	50	31	62
11.	Institutional credit	Yes	24	48	16	32
		No	26	52	34	68

was also less in both the categories of respondents. 56 per cent of AAS registered farmers had medium land holding whereas 48 per cent non-registered AAS farmers had marginal and small land holding. Agriculture was the main source of farmers in both categories was engaged in off-farm employment for their alternative source of income. More than half of the AAS registered farmers and

two third of non-registered AAS farmers did not have access to institutional credit. The agromet advisories were disseminated to the farmers through various modes of communication like Radio, T.V, Newspapers, AAS bulletins, Mobile and Friends/Relatives (Fig. 2). The major source of information for AAS registered farmers was AAS bulletins (50 per cent) published and issued by

TABLE 2

Registered Farmer's perception towards Agromet Advisory Services of Leh-Ladakh (n = 50)

S. No.	Farmers perception statements	Frequency	%
1.	Perception about AAS		
	Very poor	5	10
	Poor	10	20
	Good	15	30
	Very good	20	40
2.	Perception about necessity of AAS		
	Yes	44	88
	No	6	12
3.	Perception about for which weather parameter AAS is essential		
	Temperature	29	58
	Rainfall	35	70
	RH	18	36
	Wind velocity	15	30
	Snow fall	35	70
4.	Perception about advantage of AAS		
	Yes	42	84
	No	8	16
5.	Perception about which way you are advantaged from AAS		
	Reducing cost during sowing	40	80
	Managing pest and disease	33	66
	Avoid post-harvest loses	19	38
	Raise production	44	88
6.	Perception about at what stage of crop AAS is essential		
	Sowing stage	40	80
	Flowering stage	20	40
	Harvesting stage	37	74
7.	Perception about Quality of AAS information disseminated		
	Good	40	80
	Average	5	10
	Poor	5	10
8.	Perception about frequency of forecasting		
	Daily	5	10
	weekly	15	30
	Bi-weekly	25	50
	Monthly	5	10
9.	Perception about willingness for pay based services		
	Yes	8	15
	NO	36	72
	Undecided	6	12
10.	Perception about overall satisfaction from AAS		
	Yes	40	80
	No	10	20

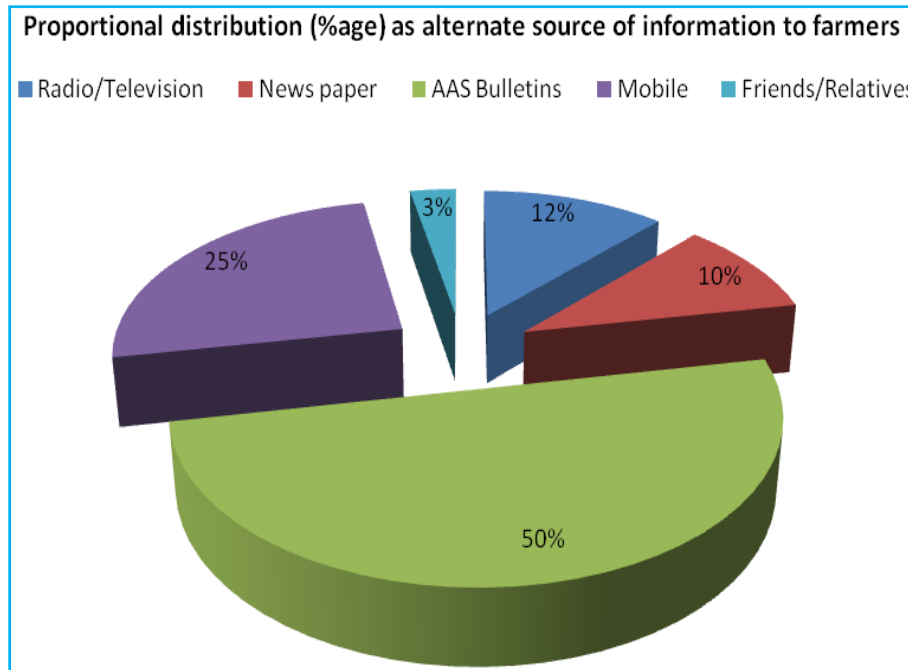


Fig. 2. Source of information for Agromet Advisory Services (AAS)

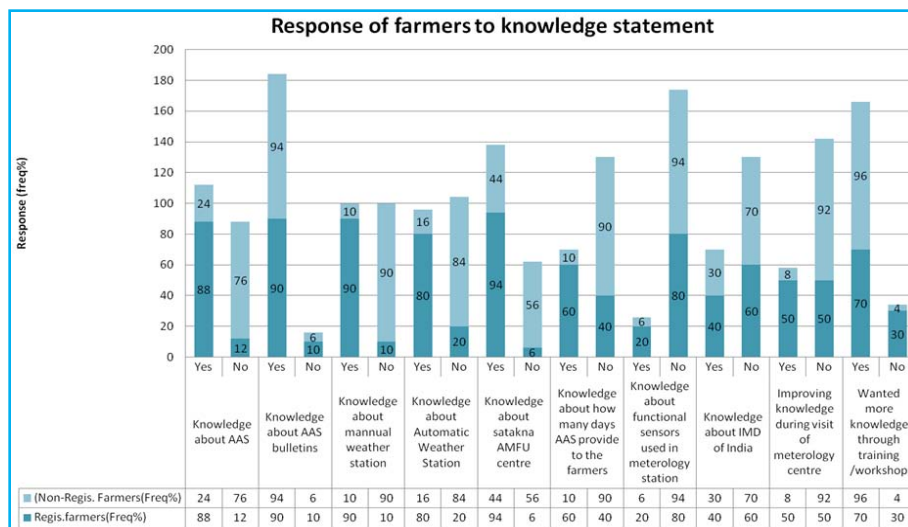


Fig. 3. Knowledge statements of farmers about Agromet Advisory Services

AMFU centre of Leh-UT of Ladakh, followed by mobile (25 per cent), radio/television (12 per cent), newspapers (10 per cent) and friends/relatives (3 per cent) respectively.

Perception on AAS revealed (Table 2) that the 40 per cent registered farmers rated the Agro-meteorology advisory services as very good on the scale of very poor to very good (Rana *et al.*, 2005). The majority of the farmers (88%) felt the necessity of the agro-meteorological

advisory services. where, (vi) 70 per cent of them felt that advisories based on predicted precipitation events are very effective and helpful for taking prior preventive measures even for protected agriculture during winter season. These results are in conformity with studies, reported by Maddison (2006). Majority of the farmers (80-88 per cent) perceived that AAS was helpful in raising production of crops, in reducing the agricultural production costs and pest management during cropping season and protected agriculture. Majority of farmers (80%) opined that real

time AAS was critical at sowing stage as dissemination of need-based weather advisories prior to cropping season particularly information on timely rainfall, temperature and humidity helped farmers to plan their farm activities timely and accurately. About 80 per cent of farmers perceived that micro-level AAS disseminated through AMFU (Agro-meteorology field unit) centre was good, accurate, timely available and 50 per cent of farmers opined that bi-weekly forecast information was good as it is helped to take short term decision on farming activities. Further farmers perception about willingness to pay for AAS indicates that 72 per cent farmers not willing to pay for AAS, as majority of respondents were small and marginal farmers with scarce farm resource and not in position to pay for service. From results, it is also showed that 80 per cent of AAS farmers were presently satisfied with AAS issued by the AMFU centre of Leh-UT of Ladakh.

Fig. 3 shows the knowledge of farmers about Agro-Meteorology Advisory services and 88 per cent farmers registered with AAS had knowledge about AAS. 24 per cent non-registered AAS farmers had knowledge about AAS. 90 per cent registered farmers and 94 per cent non-registered farmers had knowledge about AAS bulletins. Regarding knowledge manual weather station, 90 per cent registered and 10 per cent non-registered farmers had knowledge about this aspect. Further, 80 per cent registered farmers and 16 per cent non-registered farmers had knowledge about automatic weather station. 94 per cent registered farmers had knowledge about (vii) Stakna AMFU centre, whereas 44 per cent non-registered farmers had about it. With regard to statement “how many days AAS provide information to the farmers” 60 per cent registered farmers had knowledge about it whereas only 10 per cent non-registered farmers had knowledge about it. 20 per cent registered farmers had knowledge about functional sensors used in meteorology station whereas only 6 per cent non-registered farmers had knowledge about it. Further, 40 per cent registered and 20 per cent non-registered farmers had knowledge about IMD of India. 50 per cent registered respondents had improving knowledge during visit of meteorology centre, whereas 92 per cent non-registered respondents had not improving knowledge during visit of meteorology centre. Finally, 90 per cent registered and only 2 per cent non-registered farmers had knowledge about trainings/workshop schedule to be organised by AAS station.

4. Conclusions

On the basis of the findings, majority of farmers responded that this Agro-advisory has really impacted significantly in terms of implementation of agricultural activities timely as the span of cropping season is very

short and very useful for the Leh region as only one short season for crop impacts seriously on crop yield. Farmers were of opinion that they have been benefitted from this programme as well as timely input to agricultural fields in Indus Plains (Chuchot and Shey villages) especially when snowfall has considerably declined and now there is little water in the rivers and streams as experienced in the past few decades. However, timely advisories are sent to the farmers’ group for agricultural activities. The major source of information was AAS bulletins followed by mobile communication. The majority of AAS farmers perceived that their willingness to pay for the services was low and they were ready to use advisories free of cost due to their farm resource constraints. The higher percentage of respondent farmers was satisfied the service of Agromet advisories. There is maximum number of non-registered farmers showed that the less knowledge in all the Agromet Advisory statements especially in knowledge about manual weather station, knowledge about automatic weather station and knowledge about functional sensors used in meteorology station. The Agriculture university and AMFU centre organised more and more workshops/training camps in the villages of Leh district for respondent farmers about increasing more knowledge about weather station.

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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