Validation and Feedback Analysis of Agromet Advisory Services in Nizamabad district of Telangana under KVK Nizamabad

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ABSTRACT: The access to real time weather data supports the farmers in deciding their day-to-day field operations efficiently. District Agro-Met Unit (DAMU) utilizes the medium range weather forecast for issuing agro advisories at block level and disseminating the musing multimedia approach to reach maximum number of farmers at every corner of the village in India. During 2022-23a study was conducted to analyse the extent of impact of agromet advisories that benefitted the farming community of Nizamabad district through DAMU, KVK Nizamabad. The study was carried out in the month of March, 2023 using the platform of survey monkey using 103 whatsapp groups to collect the real time feedback information from the farmers to determine the extent of usage of weather forecasting service delivered during southwest monsoon 2022, northeast monsoon 2022, winter 2023 and determine the impact of DAMU, to know the accuracy and usefulness of advisories and importance of ICT tools in their dissemination. A total of 150 farmers responses have been recorded on the basis of block, usefulness of the weather forecasting service, its accuracy, their application in agricultural operations, satisfaction to the agromet advisories. The feedback from 150 farmers of Nizamabad district revealed that 81 % are receiving regular AAS bulletins out of which 68% are using them for their day-to-day farm operations with whatsapp being 78% best source for receiving agromet advisories and the district level rainfall forecast has high skill score in case of quantitative and qualitative analysis.

Keywords: Weather, Agromet advisories, District Agro-Met Unit (DAMU), Gramin Krishi Mausam Sewa (GKMS).

INTRODUCTION

Changes in the weather pattern are directly showing a severe impact on agriculture. The dissemination of accurate weather information helps the farmers to go for efficient weather based farming and prevent the damages with the maximum possible extent due to aberrant weather conditions in present changing climatic scenario. District Agro-Met Unit (DAMU) at Krishi Vigyan Kendra, Rudrur, Nizamabad was established in 2020 under Gramin Krishi Mausam Sewa (GKMS) scheme in joint collaboration by India Meteorological Department (IMD) and Indian Council of Agricultural Research (ICAR). Weather based agro advisories were prepared by DAMU, KVK Nizamabad and disseminated through various print and electronic media like whatsapp, text & voice messages through mobile, newspaper, radio, local tv channels, meghdoot mobile app etc., biweekly on every Tuesday and Friday to the farmers of different blocks of Nizamabad district under 7 Agri Sub Divisions i.e, Armoor, Bheemgal, Balkonda, Bodhan, Indalwai, Nizamabad Rural, Rudrur. Timely dissemination of weather based agro advisories minimizes the risk to agricultural production (Rathore and Parvinder 2008). A significant restriction for successful farm planning operations is the lack of

reliable and timely agrometeorological advice (Chaubey *et al.*, 2018). Weather based agromet advisory services are critical for weather tuned farm operations (Frisvold and Murugeshan 2013). Hence there is a need for making the farmers realize the utility of agromet advisories in management of day-to-day farm activities and thereby reducing the loss and enhancing the production (Rathore and Chattopadhyay 2016).

MATERIALS AN METHODS

A. Study Area

Nizamabad district is located in 18° 40' 40.80" N latitude and 78° 06' 7.20" E longitude in north-western region of Telangana state of India. It is bounded by Nirmal district in the North, Jagtial district to the East, Kamareddy district to the South and by Nanded district to the West of Maharastra State. It comprises 33 mandals with 7 agricultural sub divisions as Armoor, Balkonda, Bheemgal, Bodhan, Indalwai, Nizamabad Rural and Rudrur. The district experiences adverse weather conditions like late arrival of monsoon in the month of June, excess rainfall situations in the month of July, Cold wave occurrence from November to January, Unseasonal rains (Hail storms) from February to April,

Heat wave conditions from March to May showing a drastic impact on the agricultural production in both Kharif and Rabi seasons. Timely weather based agro advisories were disseminated to the farming community using nowcast, short range, medium range and long range weather forecast of IMD through whatsapp groups that are made at block level in coordination with district agriculture and allied sectors officers.

The advisories include weather forecast, farm related operation in agricultural and horticultural crops, livestock protection management, safety measures to be followed during thunderstorm activities. Similar study was observed by Venkatasubramanian *et al*. (2014).

B. Formulae and Error Structure for Rainfall Forecast Verification

(i) Quantitative verification. Error structure for quantitative verification of rainfall.

Correct Diff ≤ 25% of obs

Usable 25% of obs< Diff ≤ 50% of obs

Unusable Diff > 50% of obs

Where, Diff stands for Absolute difference of observed and forecasted in mm and obs stands for observed rainfall (in mm).

Root mean square error (RMSE) between the sum of absolute difference between observed values and forecasted values.

Calculating the correlation between the observed and the forecasted value (range: -1 to +1).

(ii) Qualitative verification methods

Forecast accuracy (ACC) or ratio score or hit score. It is the ratio of correct forecasts to the total number of forecasts used to measure of

forecasting efficiency. The ratio score was calculated using the below given formula

$$\text{Ratio score} = \frac{(YY + NN)}{(YY + NN + NY + NY)} \times 100$$

Hanssen and Kuipers scores or true skill score (HK score). It is the ratio of economic saving over climatology due to the forecast to that of a set of perfect forecasts. It ranges from –1 to +1 with 0 indicating no skill. The advantage of this method is equal emphasis to yes/no events

$$\text{HK score} = \frac{[(YY \times NN) - YN \times NY)}{[(YY + YN)\ (NY + NN)]} \times 100$$

where,

YY- Number of days when rain was forecasted and also observed,

NN- Number of days when rain was not observed and also not forecasted,

YN- Number of days when rain was observed but not forecasted,

NY- Number of days when rain was not observed but forecasted.

Similar quantitative and qualitative calculations have been used by Damrath *et al*. (2000) for rainfall verification.

RESULTS AND DISCUSSION

A. Impact of Real time Agromet Advisories

The impact of agromet advisories issued under DAMU project was studied by conducting a online survey using the platform of survey monkey. A total of 150 respondents have actively provided the real time feedback information. 78 % of the total respondents have revealed that whatsapp is the best source for receiving timely weather advisories (Fig. 2). The findings were similar to Ram Singh *et al*. (2015). 53 % of the respondents reported that the weather advisories are most helpful in all the crop growth stages, 14 % found useful for spraying of pesticides, 12 % valued beneficial at the time of harvesting and 11 % for sowing purpose (Fig. 3). Prasad *et al*. (2020) in their survey revealed that 65.0 per cent of farmers check weather forecast before going for spraying operation, 73.0 percent for irrigation and 55.0 per cent for animal husbandry activities. Majorly 44 % of the respondents conveyed that morning is the best convenient time for listening or viewing Agromet Advisories followed by 28 % as night (Fig. 4). Moreover 81 % are receiving regular Agromet advisory bulletins and are using them for their day-to-day farm operations (Fig. 1) with 49 % being satisfied and 9 % as highly satisfied to the service (Fig. 5). These findings are similar to Rajegowda *et al*. (2008). The study revealed that 63% and 34 % of the respondents found the agromet advisories as very helpful and helpful for their farming respectively. Similar results of timely dissemination of agro advisory services are found highly useful by the farmers as reported by Ram Singh *et al*. (2015) and Ravi *et al*. (2020).
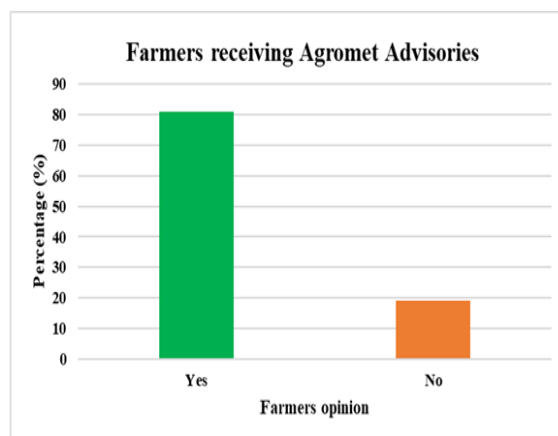

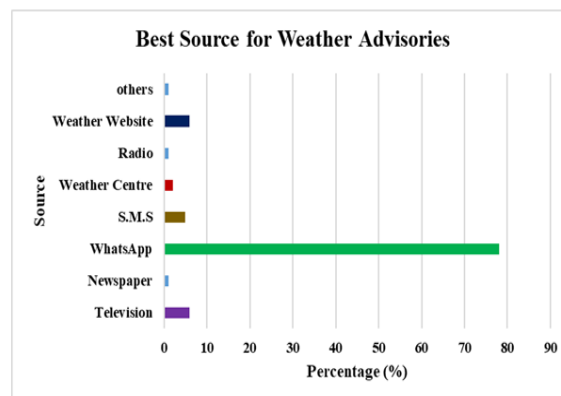**Fig. 1.** Respondents receiving Agromet Advisory bulletins.

Fig. 2. Most favourable medium for issuing Weather forecast and Agromet Advisories to the farmers.
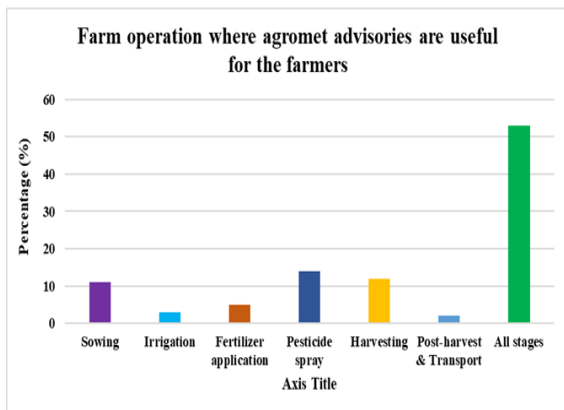
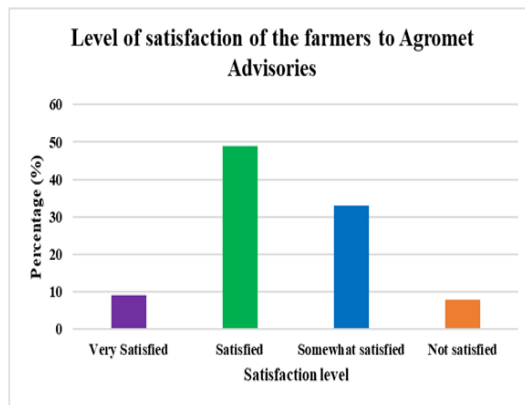**Fig. 3.** Stage of the crop where advisories are most helpful to the farmers.

Fig. 4. Most feasible time for the farmers in listening/viewing agromet advisories.

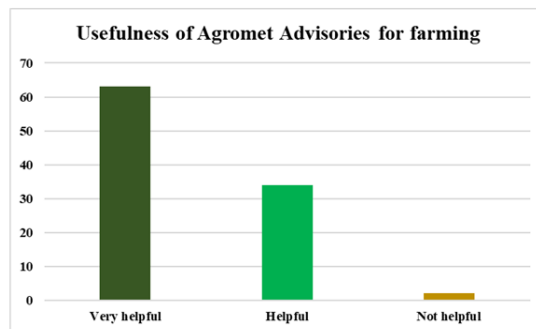**Fig. 5.** Satisfactory response of the farmers for Agromet advisories.

Fig. 6. Extent of usefulness of Agromet advisories to the farmers.

B. Validation of Rainfall Forecast at District and Agri Sub Divisional Level

The district and agri sub divisional (ASD) level rainfall forecast for Nizamabad district during southwest monsoon season of 2022 was verified with the observed rainfall data provided by Meteorological Centre, Hyderabad.

Table 1: The quantitative and qualitative methods of validation of southwest monsoon for district and block level forecast for Nizamabad district were presented.

	Particular	Symbol	NZB District level	Armoor ASD level	Bheemgal ASD level	Balkonda ASD level	Indalwai ASD level	NZB Rural ASD level	Bodhan ASD level	Rudrur ASD level
						Value				
1	No: of days when rain was forecasted and also observed	YY	59	25	27	30	26	30	24	33
2	No: of days when rain was observed but not forecasted	YN	18	33	47	31	41	42	52	32
3	No: of days when rain was not observed but forecasted	NY	10	17	10	17	8	15	12	15
4	No: of days when rain was not observed and also not forecasted	NN	35	47	38	44	47	35	34	42
5	No: of matching cases (YY +NN)	MAT	94	72	65	74	73	65	58	75
6	Total no: of forecast days, N=Total no: of days-no: of missing days	N	122	122	122	122	122	122	122	122
7	Skill Score or Ratio Score of rainfall (%)	RS	77.05	59.02	53.28	60.66	59.84	53.28	47.54	61.48
8	Hanssen & Kuipers index (H.K. Score)	H.K	0.54	0.17	0.16	0.21	0.24	0.12	0.05	0.24
9	Root Mean Square Error	RMSE	26.79	31.3	32.15	34.01	23.47	29.28	23.48	26.12
10	Error structure for rainfall (for matching cases)	Correct	53.19	65.28	60	59.46	64.38	53.85	58.62	56.00
		Usable	11.70	4.17	4.62	1.35	6.85	7.69	3.45	10.67
		Unusable	35.11	30.56	35.38	39.19	28.77	38.46	37.93	33.33
11	**Correlation of rainfall**	R	0.56	0.24	0.21	0.23	0.27	0.17	0.19	0.22

Note: Ratio score: High Skill (>=70%); Moderate skill (>=50% &<70%); Low Skill (<50%).
Hanssen and Kuipers (HK) Score: High Skill (>=0.25); Moderate skill (>=0.10 and <0.25); Low Skill (<0.10)

The results of the quantitative validation revealed that correctness of rainfall criteria showed moderate level of matching cases for all the agri sub divisions and district forecast level. It is observed as 65.28 % for Armoor, 64.38 % for Indalwai, 60 % for Bheemgal, 59.46 % for Balkonda, 58.62 % for Rudrur, 56 % for Bodhan, 53.85 % for Nizamabad Rural agri sub division and 53.19 % for Nizamabad district level forecast. Root mean square error between the sum of absolute difference between observed and forecasted values of lowest 23.47 and 23.48 were observed in Indalwai and Rudrur agri sub divisions respectively, while highest is 34.01 for Balkondaagri sub division. The results showed that correlation coefficient (r) of rainfall forecast were observed highest as 0.56 in case of Nizamabad district and lowest as 0.17 was observed in case of Nizamabad Rural agri sub division forecast. Similar findings were observed by Kumar *et al*. (2021).

The results of the qualitative revealed that high skill or ratio score of rainfall was observed as 77.05 % for Nizamabad district followed by moderate skill score of 61.48 % and 60.66 % for Bodhan and Balkondaagri sub divisions respectively and 53.28 % for Nizamabad rural and Bheemgal blocks, while Low skill score of 47.54 % was observed for Rudrur agri sub division. The Hanssen & Kuipers Index (H.K. Score) showed that high skill score was observed for Nizamabad district forecast as 0.54 while most of theagri sub divisions showed moderate skill with 0.24 value for Indalwai and Bodhan, 0.21 value for Balkonda, 0.17 for Armoor, 0.16 for Bheemgal, 0.12 for Nizamabad and low skill was observed in case of 0.05 for Rudrur agri sub division. These findings are similar to Rana *et al*. (2005).

CONCLUSIONS

From the present study, it is concluded that majority of the farmers are receiving regular agromet advisory bulletins and using them for their day-to-day farm operations with major response of satisfaction to the service of DAMU project with WhatsApp being the most preferable medium for them in receiving the advisories. Validation of qualitative and quantitative verification methods for southwest monsoon indicated that high skill score was observed for Nizamabad district forecast and moderate skill score for agri sub divisions. Hence, the forecast at block level need to be improved. It was also found out that progressive farmers from every village are taking a lead in providing the Agromet Advisories information to their fellow farmers by sharing the timely weather information and also adding them in Whatsapp groups. However, there is a need to focus on the mode of disseminating the weather advisories to reach the illiterate farmers.

FUTURE SCOPE

Effective response is received from the farmers while disseminating Agromet Advisory Bulletins and weather alerts in WhatsApp groups. Farmers are requesting for updating them with timely day to day weather forecast information in the present changing climatic conditions.

Hence, there is need to focus on dissemination of accurate weather information using now cast to long range forecast and agrometeorologists need to get expertise in crop weather modelling to predict the crop yield in prior to any occurrence of sudden weather changes and suggest timely alternative management strategies to the farming community and help them to prevent crop damage situations to maximum possible extent.

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