

Agrometeorological Advisory Service: A Key to Enhance the Farmers' Income in Red and Lateritic Zone of Purulia District of West Bengal

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Authors' contributions

This work was carried out in collaboration among all authors. Author ST designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author FHR managed the analyses of the study and edited the whole draft of manuscript. Authors SR, MKB, VP and all other authors managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Weather and climate affect the production of an agricultural system as it influences growth and development of crops before and during the cropping season. The Agro-meteorological Advisory Service (AAS) rendered by India Meteorological Department implemented through establishment of District Agromet Unit (DAMU) in different Krishi Vigyan Kendras across the country mainly aims to enhance the farmers' income by proper utilization of inputs and adopting suitable management practices according to the weather condition. The present study was undertaken to know the usefulness of AAS and assessing the economic benefit through its adoption in day to day farming operation by the farmers. The study was conducted at *Jambad* village of Purulia district under Red

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and Lateritic Zone of West Bengal for *Kharif* rice, groundnut and mustard crop which are predominantly grown in the region during 2019 *Kharif* and 2019-20 *Rabi* season. A group of farmers following AAS regularly provided through DAMU were selected randomly from the target village and farmers not following the same were also identified for the study. The economic impact and usefulness of block level AAS has been assessed through analysing the data collected from the selected farmers using suitable statistical technique. The result showed from the study that most of the cases forecasted data is well matched with actual data and hence those farmers who have adopted AAS timely in their farming operation realized more net income as compared to non AAS farmers having the same crop grown in the target village. Thus it can be concluded from the study that AAS is an effective tool for minimizing the crop losses caused due to aberrant weather and played a significant role in enhancing the production and farmers' income.

Keywords: AAS; DAMU; weather forecast; crops; economic impact.

1. INTRODUCTION

Weather and climate information plays very crucial role before and during cropping season as it influences crop growth and development from its sowing to harvesting. The agricultural production could be severely affected due increase in temperature [1], changes in rainfall pattern [2] and variation in frequency and intensity of occurrence of extreme weather events like cyclone, flood and drought [3,4]. Variability of climate also possess serious risk to small holder farmers particularly in dry land region [5]. The estimated yield loss on cereal crop yield due to both historical and future climate change in different region indicate that the yield loss can be up to -35% for rice, - 20% for wheat, - 50% for sorghum, - 13% for barley and - 60% for maize depending upon location, future climate change scenario and projected year [6]. Accurate and timely weather forecast along with relevant farm management options in the form of advisories will help to improve decision making ability of the farmers [7]. Farmers can minimize the losses caused by malevolent weather through adopting proper management strategy which ultimately helps to increase their income [8]. Agromet Advisory Service (AAS) aims to advice the farming community to adopt suitable management practices in their farming operation like sowing, selection of variety, Irrigation scheduling, fertilizer application, plant protection measures etc based on forecasted weather and to provide information on actual weather condition. The Agromet Advisory Bulletin (AAB) also contains possible risk mitigation measure for major crops as well as livestock of a district. To extend the benefit of AAS of India Meteorological Department (IMD) is venturing into providing Agromet Advisory Services at the block level across the country in

collaboration with Indian Council of Agricultural Research through Krishi Vigyan Kendras (KVK) under Gramin Krishi Mausam Sewa (GKMS) Scheme experimentally from 2018. District Agromet Units (DAMUs) are being set up in each identified district having KVKs to address the objectives at block level. The basic goal of establishment of DAMU includes to deliver crop and location specific AAS to block or village level farming community through improvising the existing district level AAS. District Agromet Units will be act as nodal centre of the district to cater the needs of agriculture service and extend it to allied areas like livestock for the benefit of the farmers. The prime objective of the present study was to assess the effectiveness and adaptation of block level AAS provided through DAMU among the village level farmers and its economic impact to enhance the income of farming community of Purulia district under Red and lateritic zone of West Bengal.

2. MATERIALS AND METHODS

The District Agromet Unit located at Kalyan Krishi Vigyan Kendra (KVK) Purulia serves as a nodal center of AAS for the farming community of the district. The study was conducted at *Jambad* village, Purulia II block of Purulia district, West Bengal, India (23.21°N, 86.57°E). The village is about 25 km away and well connected by roads from KVK Purulia. The study area represents red and lateritic agro climatic zone of West Bengal, situated in sub humid and sub-tropical part of Chhotonagpur plateau. The average annual rainfall of the district varies 1300-1400 mm, which is erratic in nature and mostly confined to 4 months of south west monsoon season. The wide temperature range of this region varies from 6°-47°C, characterized by hot summer and moderate winters. Soil is mainly acidic in nature,

having low water holding capacity and deficiency in organic matter and nutrients are responsible for poor yield in this region.

2.1 Collection of Weather Data and Village Level Crop Data

Weather forecast data on rainfall, maximum and minimum temperature, cloud cover, wind speed and direction, maximum and minimum relative humidity from IMD website and real time crop data from the identified villages were being collected every Tuesday and Friday for the period of June 2019 to March 2020. Realized weather data of area under study were also collected from IMD and state meteorological observatories for the said period. After obtaining the forecast data and realized past weather data Agromet Advisory Bulletins (AAB) were prepared in consultation with the expert panel associated with DAMU Purulia.

2.2 Dissemination of Weather Based AAB

The weather based agromet advisory bulletin prepared in both English and Bengali language for the farming community of the target village and were disseminated regularly through different means viz. local newspaper, mobile SMS, district Agriculture Technology Management Agency offices, input dealers, village level agriculture offices, IMD websites and other extension personnel during the study period, i.e. from June 2019 to March 2020. The block specific weather forecast on above said parameters for next five days and past three days realized weather data (from IMD stations) along with crop, soil and disease-pest related data were also collected to prepare the bulletins. Translation of weather and climatic information into village level farm advisories using existing research knowledge with application of medium range forecast were done by the engaged scientific personnel in DAMU. Weather based AAS helps to enhance the farmers' income by suggesting them suitable management strategy to alleviate the adverse impact of forecasted weather [9]. The present study was undertaken on adaptation of AAS and its economic impact on major crops grown by the farmers following AAS during *kharif* 2019 and *rabi* 2019-20.

2.3 Data Collection Method

The data were collected with a semi structured personal interview schedule through developing some questionnaire. Collected data from the

selected farmers were classified, tabulated and analyzed in order to make the outcome significant. Appropriate statistical tools were employed to justify the results. The economic impact of the present study has been assessed through the monetary benefit achieved by the farmers using AAS as compared to the non AAS users. A group of farmers following the AAS from the target village were selected randomly and farmers who are not following the same were also identified for the study.

3. RESULTS AND DISCUSSION

Advisories based on medium range weather forecast help farmers in adopting suitable management strategies to weather sensitive farm operations such as selection of cultivar for a given agro climatic zone, sowing or transplanting window, fertilizer and Irrigation scheduling, taking proper plant protection measures, date of harvesting the crop etc. It is revealed from Table 1 that the farmers followed the given advisory for *kharif* rice grown in 2019 experienced more profit through savings of inputs at various stages of the crop. Forecasted data of AAB were well matched with the actual data in most of the times except one case where farmers were not able to save their input due difference in actual and forecast data. A similar result was observed on adaptation of agromet advisory bulletin and economic impact of AAS for wheat, carrot and rice crop among the users of AAS and non-user of AAS from different villages of NCR. The result showed that the farmers who followed the agromet advisories were able to reduce the input cost upto 6% in wheat, 9.6% in carrot and 7% in rice and increases the net profit by 0.9, 3 and 4% in wheat, carrot and rice crop respectively as compared to the non AAS farmers [10].

In case of Groundnut crop results showed in Table 2 that the AAS following farmers were able to incur a huge profit only through adopting the advisories given to them. More income of AAS users have been noticed over non AAS users due to timely adoption of proper management strategy as per the weather condition. In case of Mustard crop grown in 2019-20 as presented in Table 3, farmers were encountered more income only through changing the sowing window which leads to less pest load on the crop and resulted more yield. The result revealed from the present study that farmers were able to experienced more profit (Fig. 1) by following the AAS during different stages of crop growth. Similar study was conducted on usefulness of AAS to the farmers

of Anand district of Gujrat and the result revealed that it helps to increase the farm income of 79.09% of the beneficiary as compared to non AAS user in different crops of the same region [11]. National Centre for Agricultural Economics

and Policy Research (NCAP) conducted a study in 1996 to assess the economic impact of weather forecast-based advisories and shows that there is 10-25% economic benefit obtained by the farmers due to adoption of AAS.

Table 1. Economic impact of AAS in *kharif* rice at Purulia district of West Bengal

Date of issuance of forecast	Forecast given	Advisory given	Action taken by the farmer	Type of saving/benefit	Benefit in term of cost
25th June, 2019 (<i>Kharif</i> rice)	No rainfall for next few days and moderately high temperature with mainly cloudy condition	Due to delayed monsoon, sowing of rice seeds in nursery is not recommended	Around 60% farmers were followed the advisory	Savings of input cost associated to nursery bed preparation of <i>kharif</i> rice	Save of Rs. 2800 -3000 ha ⁻¹ in terms of monetary value
13 th August, 2019 (<i>Kharif</i> rice)	Heavy Rainfall: (Forecast=72 mm, Actual=39 mm) High humidity and cloudy sky	Postpone spraying plant protection chemicals	Around 50% farmers did not sprayed chemicals	The cost of chemical was saved	Rs. 1000 - 1200 ha ⁻¹ profit in terms of monetary value
17 th September, 2019 (<i>Kharif</i> rice)	Very light Rainfall: (Forecast= 4.0 mm, Actual= 2.00 mm.), High humidity and partly cloudy sky	Weather is congenial for disease (Brown spot of rice) and Pest (stem borer) outbreak and application of chemical is advised	40% percent of the farmers adopted the given advisory	Disease and pest infestation reduced and approx. yield increase of 0.15 t ha ⁻¹ .	Profit of Rs. 1800 -2000 ha ⁻¹ .
1 st October, 2019 (<i>Kharif</i> rice)	Light Rainfall: (Forecast= 17 mm, Actual= 0.2 mm.)	Application of fertilizer as topdressing	Around 30% of the farmers adopted the given advisory	The benefit has not been noticed as forecast did not match well with the actual data	Probable loss of Rs. 700 – 800 ha ⁻¹

Table 2. Economic impact of AAS in groundnut crop at Purulia district of West Bengal

Date of issuance of forecast	Forecast given	Advisory given	Action taken by the farmer	Type of saving/benefit	Benefit in term of cost (Rs per ha)
3 rd September, 2019	High relative humidity and mainly cloudy sky	Use preventative measures to control tikka disease	Many farmers adopted the advice	Severity of the disease was comparatively less due to precautions taken	Profit of Rs 1500 -1700 ha ⁻¹ in terms of monetary value
24 th September, 2019	Heavy rainfall (Forecast= 56 mm, Actual= 101 mm.)	Make proper drainage channel to avoid water logging in the field	A lot of farmers used precautionary measures	Saving of the crop from damages due to water stagnation	Farmers using advisory made a profit of Rs.10000-12000 ha ⁻¹

Table 3. Economic impact of AAS in mustard crop at Purulia district of West Bengal

Date of issuance of forecast	Forecast given	Advisory given	Action taken by the farmer	Type of saving/ benefit	Benefit in term of cost (Rs per ha)
18 th October, 2019	Good soil moisture condition and ideal temperature for germination of seeds	Sowing of mustard is recommended as per the optimum weather condition	Many farmers adopted the advice	Severity of Aphid attack was very less and farmers get about 30% increased yield	Profit of Rs. 1000-1200 ha ⁻¹ in terms of monetary value
31 th December 2019	Medium rainfall (Forecast= 10 mm, Actual= 18 mm.)	Postpone irrigation	A lot of farmers used followed the advisory	Saving of Irrigation cost	Profit of Rs. 400 ha ⁻¹

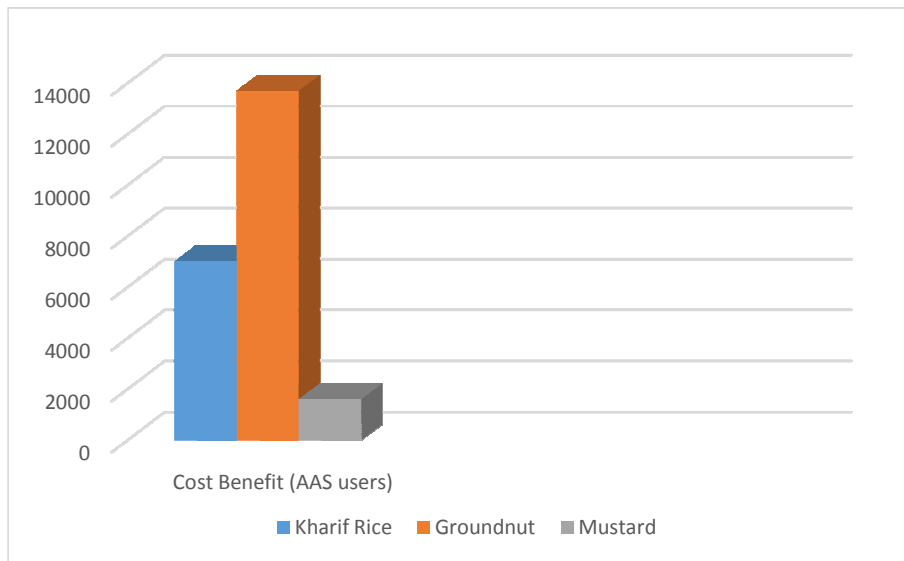


Fig. 1. Economics for different crops of AAS user farmers of Purulia district of West Bengal

In 2009 National Council of Applied Economic Research (NCAER) estimated the economic benefit of these service at Rs. 50,000 crores per year is extrapolated to rise to Rs. 2,11,000 crores if the entire farming community of the country would have been applied AAS to their agricultural activity. As per the study of NCAER during 2015 presently only 24% farmers are aware about AAS and it has the potential of generating net income benefit up to Rs. 3.3 lakh-crores on 22 major crops of the country when AAS would be utilized by all the farming households.

4. CONCLUSION

It can be concluded from the study that implementation of Agro-Met Advisory service through establishment of DAMU in red and lateritic zone of West Bengal is potentially very

useful for farmers for avoiding the losses of crop yield due to abnormal weather condition. The application of agro met advisory bulletin based on current and forecasted weather is a prospective tool for enhancing the production and farm income through judicious and timely utilization of inputs.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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