

Effectiveness of Weather Based Agromet Advisories on Economics of Farmers in Gaya District of Bihar

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2021/v11i830453

Editor(s):

(1)Dr. Wen-Cheng Liu, National United University, Taiwan.

Reviewers:

(1) Hardev Choudhary, National Innovation Foundation, India.

(2) Rewendra Kumar Sahu, ICAR-NIBSM, India.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/74054>

Original Research Article

Received 29 June 2021

Accepted 09 September 2021

Published 20 September 2021

ABSTRACT

Present study was conducted during *Summer* and *Kharif* 2020 across villages of Gaya district under the South Alluvial zone of Bihar to assess the usefulness of Agro-met Advisory Services (AAS) and to quantify the economic gain of farmers through adoption of advisory in their day-to-day farming practices. To achieve this, two groups of farmers were formed namely, a group adopting the agro-met advisories (AAS farmers) and other group not aware of agro-met advisories (non-AAS farmers). A total of 80 farmers (including AAS and Non AAS) were identified. The agro-met advisory were circulated among AAS farmers for *Summer* and *Kharif* season of 2020 and care was taken for proper implementation of advisories by this group. Expenditure incurred & crop situation of both the group of farmers were compared at every stage from land preparation to harvest and crop growth and yields were monitored regularly among them. Significant results were reported for crop growth and yield among the AAS farmers compared to non-AAS. AAS farmers

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have obtained a net income of Rs. 45188 and Rs. 37273 while, non AAS farmers obtained a net income of Rs. 26225 and Rs. 28510 for green gram and rice respectively. The AAS farmers reported 41.96 and 23.5 per cent of additional benefit in green gram and rice, respectively. The gain in additional benefit was due to management of crop according to agro-met advisory bulletins. Therefore, adoption of agro-met advisory bulletin based on past, current and future weather forecast is an effective tool for enhancing the net productivity and income.

Keywords: Weather forecasting; AAS bulletin; Green gram; Rice and Economics.

1. INTRODUCTION

Monsoon in India is a true gamble for Agriculture. The unawareness of farmers regarding future behaviour of monsoon possesses great difficulties in making their decisions from day-to-day agricultural operations. Weather and climatic information plays a major role before and during the cropping season and if information on weather is provided in advance can be helpful in inspiring the farmer to plan their own resources in order to gain the maximum benefits. The National Centre for Medium Range Weather Forecasting (NCMRWF) under the Ministry of Earth Sciences (MoES), Government of India (GOI) in collaboration with India Meteorological Department (IMD), Indian Council of Agricultural Research and State Agricultural Universities had been providing Agrometeorological Advisory Services (AAS) at the scale of agroclimatic zone to the farming community based on location-specific medium-range weather forecast (MRWF) [1]. Since 2007, the entire framework of AAS, developed and successfully demonstrated by NCMRWF, has been relocated at IMD under MoES for extending the service (in operational mode) to districts under these agro-climatic zones. It is now called as Integrated Agrometeorological Advisory Service of MoES. IMD releases block-level AAS based on block-level MRWF since 2015 which is currently operating in selected Krishi Vigyan Kendras (KVKs) in India including KVK, Gaya. To improve his coverage, IMD is planning to provide block-level AAS to 6500 blocks (660 districts) all over India through District Agromet Units (DAMUs) [2]. At the block-level AAS, the Agromet Expert (AE) of DAMU has to prepare Agro advisory (AA) for each block every Tuesday and Friday based on the block level MRF. Thus, the AAS set up exhibits a multi-institutional, multidisciplinary synergy to render an operational service for the farming community. The AAS service rendered by IMD, MoES is a mechanism to implement relevant meteorological information by helping the farmers for efficient management of natural resources, with the aim of qualitative &

quantitative improvement of agriculture production (Latif et al., 2017). It becomes more and more vital to supply climatological information conjoined with seasonal climate forecasts before the start of the cropping season in order to adapt the agricultural system to enhanced weather variability. The major goal of AAS is to help the farmers in adapting the prevailing weather conditions in order to optimize the resource conservation and uses and to minimize the loss due to abrupt weather conditions [3]. The timely and skillful weather forecasts offer the famers a great potential to reduce vulnerability to weather vagaries [4-5]. The weather forecasting at national level and bi-weekly agro-advisory services at regional level has been critical in modalizing the farmers to adjust their farm activities in favour of optimum production [6]. The complete crop failure or crop loss can be reduced by adopting proper crop management in time by releasing timely and accurate weather forecasts. Weather forecast also advices for selection of suitable crops or suitable varieties according to the anticipated climatic conditions. It also advice the farmers on actual and expected weather conditions and its impact on the day-to-day farming operations from land preparation to grain storage and overall crop management practices. Weather forecast helps to improve water use efficiency and quality of yield by reducing losses, risks, cost of inputs, labour and pollution with efficient and judicious use of agricultural chemicals. Rathore et al. [7] disserted the weather forecasting scheme functional at National Centre for Medium Range Weather Forecast for issuing location specific weather forecast five days in advance. In general, it is difficult to assess the economic benefit of any advisory service given to take measures against catastrophes or life-threatening situations, but it is possible to assess the economic benefit of the agrometeorological services [8]. This can be done when scientific methods applied for weather-based advisories have a direct relationship with the traditional knowledge of the farmers [9]. From a farmer's perspective, the forecast value increases if the

weather and climate forecasts are capable of influencing their decisions on key farm management operations [10-12]. Thus, it becomes essential to relate with the requirements of farmers [4-5], understand their needs and to give the forecast in appropriate spatial and temporal range [13] [4-5] [14-15]. This ultimately helps in increasing the reliability of the forecast and thus in better adoption of the weather-based advisory [15]. Therefore, present study was aimed to assess the benefit gained by the farmers using appropriate agro-met advisory bulletin & weather forecast for making decisions of farming from different villages of Gaya, Bihar.

2. MATERIALS AND METHODS

The experiment site is located in the South Alluvial zone of Bihar among four agro climatic zones (Fig. 1) which lies between $24^{\circ} 5'$ to $25^{\circ} 10'$ N latitudes, $84^{\circ} 4'$ to $85^{\circ} 5'$ E longitudes and the 101 to 108 m of altitude above MSL with an average annual rainfall of 1055 mm. The Southwest (SW) monsoon season is vital for crop production in this region and highly helpful to the small and marginal farmers under rainfed conditions. The DAMU (Gramin Krishi Mausam Sewa) is running from Krishi Vigyan Kendra, Manpur, and Gaya to serve the local farming community. Progressive farmers takes keen interest in the AAS provided by the DAMU, Gaya,

Bihar and are the flagship beneficiaries of the services. Weather forecast on rainfall, wind speed, wind direction, cloud cover and with maximum and minimum temperature and humidity are being received on every Tuesday and Friday from IMD, New Delhi. After receiving of forecast the experts' opinion from different disciplines is obtained. According to experts' opinion the agro advisories are being prepared on every Tuesday and Friday in Hindi and English then sent to IMD for preparation of national bulletins and also uploaded on the IMD website in both languages. The real time bulletins are regularly circulated among the farmers and also sent to local newspapers for regular publication through phone/e-mail/SMS/social media (whatsapp, Facebook). The AAS bulletins are also sent to, Bihar Agricultural University, AMFU, KVK Gaya, NGOs, ATMA, State Agriculture offices, District Agriculture offices, Block level Offices, JEEVIKA etc. through e-mail. The weather forecast based agro-advisory bulletin have a summary of previous weeks' weather, deviation of weather from the normal value, weather forecast information for the next five days, based on which crop management practices and warning are given to the farmers well in advance regarding weather variability including pest/disease problems. Therefore, farmers can decide their crop management options, application of nutrients and strategies to overcome the weather vagaries.



Fig. 1. Agro-climatic zones of Bihar

The investigation was conducted with 40 AAS farmers selected purposively from two blocks (Gaya town & Manpur) through Simple Random Sampling technique. The same number of non-AAS farmers was selected randomly from the respective blocks. Thus, the sample size selected for the study was 80 comprising of 40 members from both the categories. Therefore, to assess the economic benefit of the farmers through adoption of AAS, 20 users each from AAS and non AAS categories were selected for green gram and rice growers, respectively. The data collected with a semi structured interview or by personal interview either at home or at farm pre-scheduled earlier. The collected data are then classified, tabulated and analyzed through appropriate statistical tools for meaningful interpretation of results. The adoption level and information of the respondents was collected on scale point of Always, Sometimes, and Never were analyzed with score value, 2, 1, 0 respectively to reveal the result.

3. RESULTS AND DISCUSSION

The economic benefit obtained by farmers following the advisories has been evaluated for Summer and Kharif seasons of 2020. Total cost of cultivation, crop yield and net returns for green gram during summer and rice during Kharif 2020 by AAS and non AAS farmers are presented in Table 1 and Table 2 respectively.

The results from the table revealed that the cost of cultivation of green gram in case of AAS farmers was more as compared to non-AAS Farmers, but the farmers were getting higher grain yield (25.8%) and net return as compared

to non-AAS Farmers. The increased cost of cultivation was due to effective adoption of agro-advisory by AAS farmers.

From Table 1 (b) it is observed that the total cost of production, gross return, net returns and B: C ratio were 24232 Rs./ha, 69420 Rs./ ha, 45188 Rs./ ha and 2.86, respectively in case of AAS farmers and 22855 Rs./ ha, 49080 Rs./ha, 26225 Rs./ha and 2.15 in case of non-AAS farmers for green gram crop. From this, it is observed that the AAS farmers are getting more benefit than non-AAS farmers under green gram cultivation.

The higher net return and B:C ratio in case of AAS farmers as compared to non AAS farmers was due to adoption of recommended practices given by experts in different aspects. The higher co-efficient of variation (4.23%) indicates that there is more variation in getting net returns of farmers belonging to non-AAS category.

Total cost of cultivation, crop yield and net returns for Transplanted rice grown by the AAS and non AAS farmers during *Kharif* season are presented in Table 2.

The cost of cultivation of transplanted rice in case of AAS Farmers was more as compared to non-AAS Farmers, but the farmers were getting higher yield (12.4%) as compared Non AAS Farmers. In transplanted rice crop the total cost of cultivation, gross return, net returns and B: C ratio were 35821 Rs./ ha, 73094 Rs./ ha, 37273 Rs/ha and 2.04, respectively in case of AAS farmers while in case of non-AAS it was 30410 Rs / ha, 58920 Rs./ ha, 28510 Rs /ha and 1.94 respectively.

Table 1 (a). Economics (Rs/ha) of green gram as influenced by AAS & Non AAS farmers during summer season (2020)

Particulars	AAS Farmers	Non AAS Farmers
Land preparation	3000	3000
Seed	3000	3000
Seed Treatment	250	-
Fertilizers	2400	1600
Pesticides	780	1130
Herbicides	1200	-
Irrigation	1320	2640
Miscellaneous	500	500
Labour Cost	11782	10985
Total Cost of Cultivation	24232	22855
Grain Yield (q/ha)	12.4	9.2
Straw Yield (q/ha)	4.6	3.1

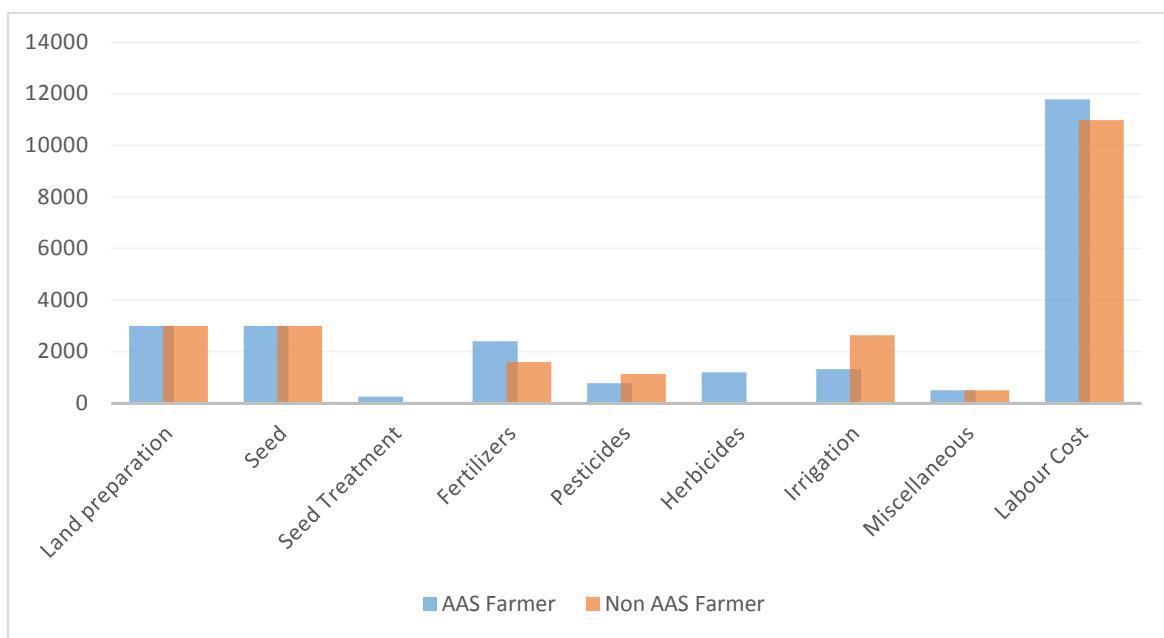


Fig. 2. Cost of cultivation (Rs/ha) with AAS and non AAS farmers of green gram

Table 1 (b). Economics (Rs/ha) of green gram cultivation

Type	Cost of cultivation	Gross return	Net return	B:C ratio
AAS Farmers	24232	69420	45188	2.86
Non AAS Farmers	22855	49080	26225	2.15

Table 1 (c). Extent of variation in net return in green gram among respondents (n=40)

Category of farmer	Mean	Standard Error	Standard Deviation	CV %
AAS Farmers	45188.35	218.70	978.08	2.65
Non AAS Farmers	26225.25	230.61	1031.33	4.23

Table 2 (a). Economics (Rs/ha) of Transplanted rice as influenced by AAS during Kharif season (2020-21)

Particulars	AAS Farmer	Non AAS Farmer
Land preparation	6000	6000
Seed	840	840
Seed Treatment	50	-
Fertilizers	5510	4730
Pesticides	1160	1500
Herbicides	1350	705
Irrigation	4500	1320
Machine cost	4355	4355
Labour Cost	12056	10960
Grain Yield (q/ha)	39.6	34.7
Straw Yield (q/ha)	37.1	34

Table 2 (b). Economics (Rs/ha) of Transplanted Rice

Type	Cost of cultivation	Gross return	Net return	B:C ratio
AAS Farmers	35821	73094	37273	2.04
Non AAS Farmers	30410	58920	28510	1.94

Table 2 (c). Extent of variation in net return in transplanted rice among respondent (n=40)

Category of farmer	Mean	Standard Error	Standard Deviation	CV %
AAS Farmers	37273.10	183.67	821.40	2.12
Non AAS Farmers	28510.25	249.45	1115.57	2.60

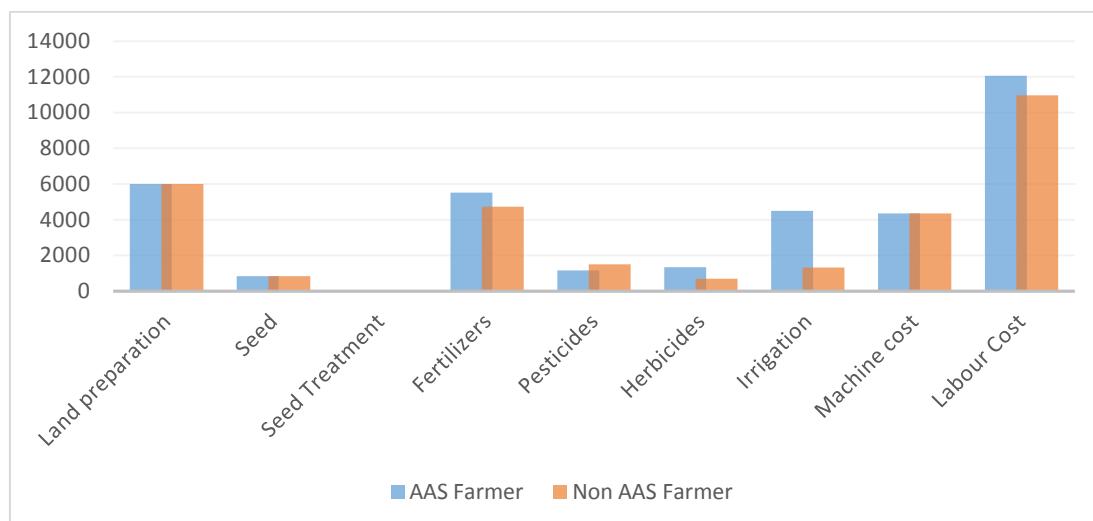


Fig. 3. Cost of cultivation (Rs/ha) with AAS and non AAS farmers of rice cultivation

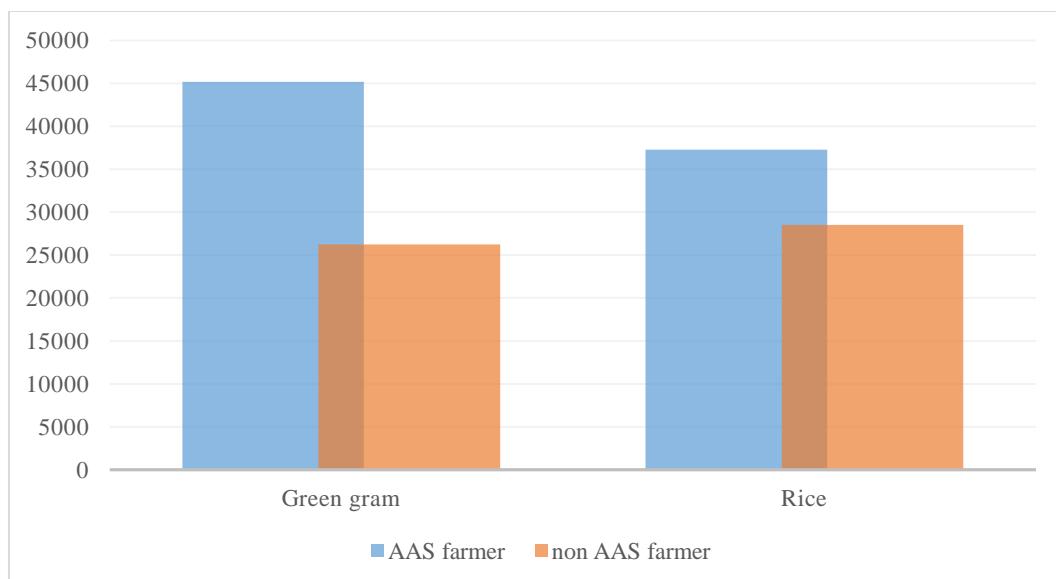


Fig. 4. Net Return (Rs/ha) of green gram gram and rice crop

Table. 3. Distribution of respondents according to their Extent of adoption of agro-met advisory services (n=80)

Sl. no	Extent of Adoption Category	Respondents	
		Frequency	percentage
1	Low (Mean – SD)	12	15.00
2	Medium (Mean ± SD)	45	56.25
3	High (Mean + SD)	23	28.75

The higher net return and B:C ratio in case of AAS farmers as compared to non AAS farmers was due to adoption of recommended practices given by experts in different aspects. The higher co-efficient of variation (2.60%) indicates that there is more variation in getting net returns of farmers belonging to non-AAS category. Through critical evaluation of the study revealed that, the yield and net benefit per unit area was more in case of AAS farmers due to the advisories issued by the DAMU unit for crop production strategies right from land preparation to harvesting and post-harvest procedures to derive maximum benefit of the benevolent weather and to mitigate the impact of malevolent weather for enhanced productivity of all crops. Bi-weekly forecast given to the AAS farmers helped them to avoid the malevolent effects of weather events like heavy rain, dry spell, high wind speed which influence the growth of the crops. Most of the AAS farmers have realized higher additional benefit of 41.96% and 23.5% in green gram and rice respectively. Ray et al. [16] also reported an additional benefit of 41.2% and 20.8% by AAS farmers in green gram and rice respectively. Singh et al. [17] and Venkataraman [3] suggested the need for Agromet advisories and input requirements for Agromet advice on field operations, crop prospects and avoidance of pest and disease under adverse environment condition is essential. Rana et al. [18] reported an additional benefit Rs. 1885/-, Rs. 1410/- and Rs. 1620/- per hectare for maize, wheat and rice, respectively. Similar conclusion was also found according to Anonymous [19] for Rs. 330/- and Rs. 3750/- per hectare for Maize and Wheat, respectively. Rajegowda et al. [20] reported an average additional benefit of 31.4%, 24.7% and 16.2% in finger millet, redgram, field bean respectively, in eastern dry zone of Karnataka. Chaudhari et al. [21] reported a per cent increase in yield for 13-15 q/ha in rice in high rainfall zone of Konkan in Maharashtra. Kushwha et al. [22] reported 3.5 to 6.1% more yield of wheat and 5.5 to 9.8% more yield of rice by AAS farmers in Tarai and Bhabar agro climatic zone of Uttarakhand during Rabi seasons of 2004-08. Ravindrababu et al. [23] observed an average saving of 16.82% in manures and fertilizers, about 16.15% in weeding, about 17.43% in plant protection, 23.77% in irrigation and the overall saving during crop growing season is 6.61% by AAS farmers. Tripathi et al. [24] found that higher grain yield and water use efficiency of finger millet in combination of soil mulch with 60% soil moisture depletion level (SMDL) give 23.48 q/ha and 6.21

kg/hamm as compared with combination of soil mulch with 50% SMDL.

The respondents were classified based on mean and standard deviation as low, medium and high. From the above table it is inferred that majority of the respondents (56.25%) had medium level of adoption of agro advisory services followed by high level (28.75 %). Therefore, it can be concluded that agro advisory services were very effective, situation specific and need based for the respondents.

4. CONCLUSION

The AAS of MoES has helped in bringing out substantial awareness among farmers about adoption of weather-based advisories, their timely availability and quality of service. It has also helped in encouraging the adoption and use of modern agricultural production technologies and practices, in promoting weather-based irrigation management, pest/ disease management, etc., along with greater use of post-harvest technologies and commercial marketing of commodities [25]. The economic impact studies indicated that there was considerable benefit to farmers who adopted the advisories made from GKMS Unit Gaya. Hence, it can be concluded that the weather forecast and related advisories issued from the Agro-met Advisory Service Unit benefitted the farming community.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:

The peer review history for this paper can be accessed here:
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