Economic Assessment of Weather Based Agromet Advisories in Keonjhar District, Odisha

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ABSTRACT

Present study was conducted during Summer 2014-15 and 2015-16 and in Kharif 2014 and 2015 at village of Keonjhar district which comes under the North Central Plateau zone of Odisha to know the effectiveness and usefulness of Agro Advisory Services (AAS) and quantify the economic benefits through adopting the agromet advisory in their day to day agricultural operations. For this purpose, two groups of farmers were selected namely, a group adopting the agro met advisories regularly in their operation (AAS farmers) and other group of farmers not aware of agromet advisories (Non-AAS farmers). 20 farmers (both AAS and Non AAS) were identified and AAS information was issued to only 10 farmers during summer and Kharif season and care was taken to implement the advisories by this group. Crop situation of these farmers was compared with nearby fields having the same crops where forecast is not adopted in non AAS farmers. Further expenditure incurred by the farmers from land preparation till the harvest at every stage has been worked out and crop growth and yields were monitored regularly in the farmer's field belonging to both the groups. The crop growth and yield was observed to be good and high in case of farmers who have adopted the AAS information regularly compared to the farmers who have not adopted the AAS information. The net income of AAS farmer's was about Rs. 22425 in case of Green Gram , Rs. 29395 in case of Rice crop and Rs 33002 in Maize over non AAS farmers whose income was Rs.13195 , Rs 23256 and Rs 21502, respectively. The farmers who have adopted the Agromet Advisories in their day to day operation have realized an additional benefit of 41.2 %, 20.8% and 34.8 %, in Green gram, Rice and Maize crops, respectively. This profit was due to the crop management done by the farmers according to agromet advisory bulletins. Thus, the application of agromet advisory bulletin, based on current and forecast weather is a useful tool for enhancing the production and income.

***Key words** : Weather forecasting, AAS bulletin, green gram, Rice , Maize and economics*

1. Introduction

Agriculture in India is a gambling with monsoon. Under such circumstances, the farmers are unaware of the future behaviour of monsoon for making decisions in their day to day agricultural operations. Weather and climatic information plays a major role before and during the cropping season and if the information on weather is provided in advance can be helpful in inspiring the farmer to organize and activate their own resources in order to reap the benefits.

The National Centre for Medium Range Weather Forecasting (NCMRWF) under the Ministry of Earth Sciences (MoES), Government of India 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) (Singh, 1999). 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 the Integrated Agrometeorological Advisory Service of MoES. Thus, the AAS set up exhibits a multi-institutional, multidisciplinary synergy to render an operational service for use of the farming community.

The Agro-meteorological Advisory Service (AAS) rendered by India Meteorological Department (IMD), Ministry of Earth Sciences (MoES) is a mechanism to apply relevant meteorological information to help the farmer make the most efficient use of natural resources, with the aim of improving agricultural production; both in quantity and quality. It becomes more and more important to supply climatological information blended with seasonal climate forecasts before the start of the cropping season in order to adapt the agricultural system to increased weather variability. The major objective of AAS is to help the farmers in capitalizing prevailing weather conditions in order to optimize the resource use and to minimize the loss due to harsh / aberrant weather conditions (Venkataraman, 2004). Agriculturally relevant forecast is not only useful for efficient management of farm inputs but also leads to precise impact assessment (Gadgil, 1989). The emerging ability to provide timely, skillful weather forecasts offers the potential to reduce human vulnerability to weather vagaries (Hansen, 2002). The weather forecasting at national level and bi-weekly agro-advisory services at regional level has been critical in instrumentalising the farmers to adjust their production plans in favour of optimum production. However, a people centric group dynamic approach is still lacking (Sharma *et. al*, 2008).

The losses in crop can be reduced by doing proper crop management in time by timely and accurate weather forecasts. Weather forecast also provides guidelines for selection of crops best suited to the anticipated climatic conditions. The objective of the weather forecasting is to advice the farmers on the actual and expected weather and its impact on the various day-to-day farming operations i.e. sowing, weeding, time of pesticides spray, irrigation scheduling, fertilizer application etc. and overall crop management. Weather forecast helps to increase agriculture production, reduce losses, risks, reduce costs of inputs, improve quality of yield, increase efficiency in the use of water, labour and energy and reduce pollution with judicious use of agricultural chemicals. Rathore *et al* (2001) discussed the weather forecasting scheme operational at National Centre for Medium Range Weather Forecast for issuing location specific weather forecast five days in advance. Damrath *et al.* (2001) reported that the statistical interpretation methods are used to increase the reliability of the precipitation forecast. 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 (Nicholls, 1996). This can be done if the scientific methods to be used for weather-based advisories have a direct relationship with the traditional knowledge of the farmers (Palt and Gwata, 2002).

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 (Everingham *et al*, 2002; Gadgil *et al*, 2002; Ingram *et al*, 2002). Thus, it becomes essential to relate with the requirements of farmers (Hansen, 2002), understand their needs and give the forecast in appropriate spatial and temporal range (Hammer *et al*, 2001; Hansen, 2002; Nicholls, 1991; Nicholls, 2000). This ultimately helps in increasing the reliability of the forecast and thus in better adoption of the weather-based advisory (Nicholls, 2000). The benefit by the farmers using agromet advisory bulletin and weather forecast for making farm-level decisions by farmers from different village have been discussed in this paper.

2. Materials and Methods

The experiment station is located between 21^0 01' N and $22^0$10' N latitudes and between $85^0$11' E longitude. The elevation varies between 480 m to 596 m above mean sea level in North Central Plateau zone of Odisha state. The state comprises of ten agro climatic zones (Fig. 1). The geographical location of the study area lies in the North Central Plateau zone with an altitude ranging from 450 to 600 m above mean sea level having average annual rainfall of 1487.7 mm. This region includes two districts Keonjhar and Mayurbhanj.

Figure 1. Agro climatic Zones of Odisha

The Southwest (SW) monsoon season is more important for crop production in this region and it is highly helpful to the small and marginal farmers

The Integrated Agromet Advisory Services (Gramin Krishi Mausam Sewa) located in the Regional Research and Technology Transfer Station, Keonjhar coming under the North Central Plateau Zone has been serving the farming community in Keonjhar and Mayurbhanj districts. Progressive farmers have been taking keen interest in the agro-advisories and are the foremost beneficiaries. The major objective of this programme is to advise timely and need-based crop management practices. Weather forecast on rainfall, maximum and minimum temperature, wind speed, wind direction, cloud cover, maximum and minimum humidity are being received on every Tuesday and Friday from IMD, New Delhi. Once the forecast is received, the experts' opinion from different disciplines is obtained. Based on the advice, the agro advisories are being prepared on every Tuesday and Friday in Odiya as well as in English. These advisories are sent to IMD for preparation of national bulletins and are uploaded on the IMD website in both Odiya and English. Bulletins are regularly communicated to the farmers on real time basis through telephone/ E-mail/SMS. Agro-met advisory bulletins are also sent by E-mail to local Odiya newspapers for publication and uploaded at the websites in both Odiya and English. The bulletins are also sent to, KVK Mayurbhanj, KVK Keonjhar, NGOs, ATMA, State Agriculture offices, DPME, District Agriculture offices, Block level Offices, Krishi Darsan, Annadata, ETV odiya, Different local Newspapers and All India Radio etc. through E-mail messages. The weather forecast based agro-advisory bulletin contains a summary of previous weeks' weather, deviation of weather from the normal value, weather forecast information for the next five days, crop management, which is based on weather forecast and giving warning to the farmers well in advance, regarding rainfall variation, its amount and other weather variables including pest/disease problems. Thus, farmers can decide on crop management options, application of nutrients and strategies to overcome other problems.

2.1 Objective

Weather forecast and weather based agromet advisories help in increasing the economic benefit to the farmers by suggesting them the suitable management practices according to the weather conditions. The present study was conducted to study the effectiveness, extent of applicability and adaptation of the agromet advisory services (AAS) in enhancing the economic return and net benefit

of the farmers.

A study was, therefore, undertaken on adaptation of agromet advisory bulletin and economic impact of agromet advisory services for green gram during *Summer* 2014-15 and 2015-16 and for rice and maize during *Kharif* 2014 and 2015.

2.2 Methodology

The present study was conducted by Integrated Agromet Advisory Services (Gramin Krishi Mausam Sewa) located in the Regional Research and Technology Transfer Station, Keonjhar.in year 2015-16. A total 60 numbers of beneficiary farmers i.e., users of agromet advisory services (AAS) were selected purposively from two blocks. Simple Random Sampling technique was followed to select respondents. The same number of non-beneficiary farmers i.e., non-users of agromet advisory services (non AAS) were selected randomly from the respective blocks. The sample size selected for the study was 120 comprising 60 numbers from both the categories. For this study to assess the economic benefit of the farmers due to adoption of agromet advisory services, users of agromet advisory services (AAS) and non-users of agromet advisory services (non AAS) of 20 number each were selected for green gram, maize and rice crop growers.

The data were collected with a semi structured interview schedule pre tested earlier. The data were collected by personal interview either at home or at farm. The data so collected were classified, tabulated and analyzed in order to make the findings meaningful. Appropriate statistics tools were employed to reveal the results. To study the adoption level of the respondents, information 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 *Kharif* seasons for the period 2014 and 2015 and summer season of 2014-15 and 2015-16. Total cost of cultivation, crop yield and net returns for Green gram grown by the AAS and non AAS farmers during *Summer* season are presented in Table 1 and for Rice and Maize grown by the AAS and non AAS farmers during *Kharif* season are presented in Table 2 and 3 respectively.

It is revealed from the above table that the cost of cultivation of Green gram in case AAS Farmers was more as compared to Non AAS Farmers, but the farmers were getting higher grain yield (25%) as compared Non AAS Farmers. The total cost of cultivation although was found to be slightly greater in the case of AAS farmers who have effectively adopted the ago-advisory compared to non AAS farmers, their net returns were greater than the non AAS farmers. From Table 2 it is observed that the total cost of production, Grain yield, net returns and B: C ratio were 17175 Rs./ ha, 39600 Rs./ ha and 22425 Rs./ ha and 2.31, respectively in case of AAS farmers and 16505 Rs./ ha, 29700 Rs./ha and 13195 Rs./ha and 1.8 in case of non-AAS farmers for green gram crop. From this, it is observed that the AAS farmers have realised good benefit than non-AAS farmers.

Table 1. Economics of Green gram as influenced by AAS during *Summer* season (2014-15 and 2015-16) Cost **(Rs ha^{-1})**

Particulars	AAS Farmers	Non AAS Farmers
Seed	750	750
FYM	1800	1800
Seed treatment	500	-
Fertilizers and micronutrients	2170	3000
Pesticides	1000	1500
Weedicide	450	450
Human labour	6655	6055
Machine labour	2000	2000
Bullock labour	450	450
Irrigation	1000	500
Spraying of 2% Urea solution at pre& post flowering	400	-
Grain yield (q/ha)	12.0 (*25*)	9.0

(Figure in parenthesis indicates percent increase over control)

Table 2. Economics of Green gram cultivation (Rs. ha^{-1})

Type	Cost of cultivation	Gross return	Net return	B:C ratio
AAS Farmers	17175	39600	22425	2.31
Non AAS Farmers	16505	29700	13195	1.80

Table 3. Extent of variation in net return in green gram among respondents

(n=40)

Category of farmer	Mean	Standard Error	Standard Deviation	CV %	t value	P vale
AAS Farmers	22425.75	130.398	583.15	2.60	48.442 *	0.00002
Non AAS Farmers	13195.65	125.179	559.81	4.242		

t- table value 2.02 , * indicates significance of value at P =0.05

It is observed from the above table that net return and B:C ratio was more in case of AAS Farmers as compared with non AAS farmers in case of Green gram . The net return (Rs ha $^{-1}$) in case AAS Farmers was significantly higher as Non AAS Farmers in green gram cultivation and this might be due to adoption of recommended practices given by experts in

different aspects . The co-efficient of variation was 4.24 percent in case of Non AAS Farmers which was higher than variation in AAS farmers.

Total cost of cultivation, crop yield and net returns for direct seeded rice grown by the AAS and non AAS farmers during *Summer* season are presented in Table 3.

Table 4. Economics of Direct seeded rice as influenced by AAS during *Kharif* season (2014 and 2015) (Rs ha^{-1})

Particulars	AAS Farmers	Non AAS Farmers
Seed	1500	1333
FYM	3000	3000
Fertilizers and micronutrients	3675	3011
Pesticides	800	1000
Weedicide	1400	800
Human labour	11830	10900
Machine labour	5400	4400
Irrigation	1000	-
Miscellaneous	1000	1500
Total cost of cultivation	29605	25944
Grain yield (q/ha)	40.0 (17.5)	33.0
Straw yield (q/ha)	40.0	40.0

Figure in parenthesis indicates per cent increase over control

The cost of cultivation of Direct seeded rice in case AAS Farmers was more as compared to Non AAS Farmers, but the farmers were getting higher yield (17.5%) as compared Non AAS Farmers. In direct seeded Rice crop the total cost of cultivation, main product, by product; net returns and B: C ratio were 29605 Rs./ ha, 56000 Rs./ ha, 3000 Rs./ ha, 29395 Rs/ha and 1.99, respectively in case of AAS farmers and 25944 Rs / ha, 46200 Rs./ ha , 3000 Rs./ ha, 23256 Rs /ha and 1.89 in case of non-AAS .

Table 5. Economics of Direct seeded rice (Rs ha^{-1})

Type	Cost of cultivation	Gross return	Net return	B:C ratio
AAS Farmers	29605	59000	29395	1.99
Non AAS Farmers	25944	49200	23256	1.89

Table 6. Extent of variation in net return in direct seed rice among respondents (n=40)

Category of farmer	Mean	Standard Error	Standard Deviation	CV %	t value	P value
AAS Farmers	29395.25	143.2432	640.6031	2.179	30.391*	0.0000291
Non AAS Farmers	23255.9	127.3146	569.3681	2.448		

t-table value 2.028,, * indicates significance of value at P =0.05

It is concluded from the above table that net return and B:C ratio was more in case of AAS Farmers as compared with non AAS farmers in case of direct seed rice..The net return (Rs ha $^{-1}$) in case AAS Farmers was significantly higher as Non AAS Farmers in maize cultivation and this might be due to adoption of recommended practices given by experts in different aspects. The co-efficient of variation was 2. 448 per cent in case of Non AAS Farmers which was higher than variation in AAS farmers. Even here also the yield and other returns were lower in case of non-AAS farmers compared to the AAS farmers.

Total cost of cultivation, crop yield and net returns for maize crop grown by the AAS and non AAS farmers during *Summer* season are presented in Table 7.

Table 7. Economics of Maize as influenced by AAS during *Kharif* season (2014 and 2015) (Rs ha^{-1})

Particulars	AAS Farmers	Non AAS Farmers
Seed	600	600
FYM	3000	3000
Fertilizers	3348	3348
Micronutrients	200	-
Pesticides	700	300
Weedicide	600	600
Human labour	14350	13950
Machine labour	3200	3200
Irrigation	500	-
Miscellaneous	500	500
Total cost of cultivation	26998	25498
Grain yield(q.ha)	60.0 (21.6)	(47.0)

Figure in parenthesis indicates per cent increase over control

Similar, results were obtained in case of Maize crop where the total cost of cultivation, main product, net returns and B: C ratio were 26998 Rs./ ha, 60,000 Rs./ ha, 33002 Rs./ ha and 2.2, respectively in case of AAS farmers and 25498 Rs / ha, 47000 Rs./ ac and 21502 Rs./ ac and 1.84 in case of non-AAS The cost of cultivation of maize in case AAS Farmers was more as compared to Non AAS Farmers, but the farmers were getting more grain yield (21.6%) as compared Non AAS Farmers.

Table 8. Economics of Maize (Rs ha^{-1})

Type	Cost of cultivation	Gross return	Net return	B:C ratio
AAS Farmers	26998	60,000	33002	2.2
Non AAS Farmers	25498	47,000	21502	1.84

Table 9. Extent of variation in net return in Maize among respondents (n=40)

Category of farmer	Mean	Standard Error	Standard Deviation	CV %	t value	P value
AAS Farmers	33002.9	271.810	1215.574	3.683	28.55 *	0.00002
Non AAS Farmers	21502.4	268.6057	1201.241	5.586		

t table value -2.02, * indicates significance of value at P =0.05

It is concluded from the above table that net return and B: C ratio was more in case of AAS Farmers as compared with non AAS farmers in case of maize cultivation in the study area .The net return (Rs ha $^{-1}$) in case AAS Farmers was significantly higher as Non AAS Farmers in maize cultivation and this might be due to adoption of recommended practices like INM and IPM etc. The co-efficient of variation was 5.58 percent in case of Non AAS Farmers which was higher than variation in AAS farmers

The 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 by the AAS unit for crop production strategies like ploughing, sowing, pest and disease management, harvesting, threshing 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 to avoid the adverse 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 41.2%, 20.8% and 34.85%, in Green gram, Rice and Maize crops respectively. Similar observations were also reported by Singh *et al.* (2004) and Venkataraman (2004). The economic benefit of the advisories for different Agromet field units that ranged between Rs. 330/- and 3750/- and 1410/- to 1885/-per hectare for maize, wheat and rice crop, respectively (Rana *et al.*, 2005). Rajegowda *et al.* (2008) reported that the farmers who have adopted the agromet advisories have realized an average additional benefit of 31.4, 24.7, 16.2 and 20.6% in finger millet, redgram, field bean and tomato, respectively, in eastern dry zone of Karnataka. Chaudhari *et al.* (2010) reported that the per cent increase in yield due to adoption of agro advisory bulletins prepared based on medium range weather forecast by NCMRWF was 13-15 q/ha in rice, 10 q/ha in mango and cashewnut in high rainfall zone of Konkan in Maharashtra. Kushwha *et al.*(2010) reported that in Tarai and Bhabar agro climatic zone of Uttarkhand, the AAS farmers have harvested 3.5 to 6.1% more yield of wheat and 5.5 to 9.8% more yield of rice than non AAS farmers during four rabi seasons of 2004-08.

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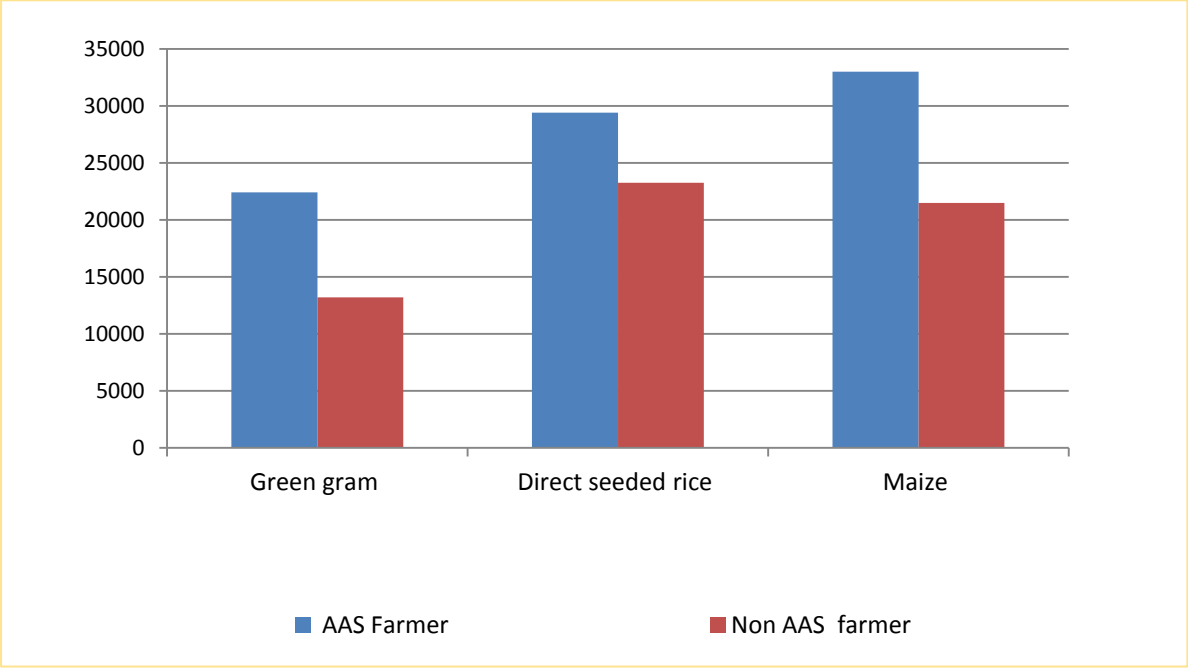

Figure 2: Net Return (Rs ha^{-1})

Table. 10 : Distribution of respondents according to their Extent of adoption of agro advisory services (n=120)

Sl no	Extent of Adoption	Respondents	
	Category	Frequency	percentage
1	Low(Mean – SD)	23	19.16
2	Medium (Mean ± SD)	65	54.16
3	High (Mean + SD)	32	26.60

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 (54.16%) had medium level of adoption of agro advisory services followed by high level (26.60 %). It can be concluded that agro advisory services were very effective, situation specific and need based for the respondents.

4. Conclusions

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. The economic impact studies indicated that there was considerable benefit to farmers who adopted the advisories made from GKMS Unit Keonjhar. Hence, it can be concluded that the weather forecast and related advisories issued from the Agromet Advisory Service Unit benefitted the farming community.

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