

Farmers' perception and economic impact assessment of agromet advisory services in rainfed regions of Karnataka and Andhra Pradesh

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ABSTRACT

All India Coordinated Research Project on Agrometeorology (AICRPAM) of ICAR has started the micro-level Agromet Advisory Service (AAS) through its 25 cooperative centers across the country. Micro-level advisory based on weather forecast is the newer dimension of the AAS in the country. Studies on economic impact of these micro-level advisories are uncommon. Therefore, the present study was conducted using the field survey to assess the farmer's perception and economic impact of micro-level AAS in Vijayapura and Anantapur centers on pilot basis. Two groups i.e. AAS and non-AAS farmers, consisting of 40 farmers in each group were selected through multi-stage stratified random sampling technique. The probit regression model was employed to assess the factors influencing willingness to pay (WTP) for AAS. Majority of farmers (65%) rated micro-level AAS as 'very good' on scale of 'very poor' to 'very good'. Majority of non-AAS farmers were aware about micro-level AAS but lagged in adopting the service. It needs further detailed investigation of underlying causes of not adopting the service. Farming experience, education, land holding size and income were found to be most important factors influencing the farmer's willingness for pay-based services. Results of economic impact revealed that there was 12 to 33 per cent increase in profit for AAS farmers as compared to non-AAS farmers.

Key words: Agromet Advisory Service, weather forecast, descriptive statistics, probit regression model, economic impact

Agriculture in India depends on weather and climatic conditions. Weather through various atmospheric factors plays a significant role in reaping good agricultural output (Bal and Minhas, 2017). Variable and uncertain weather is a pervasive fact that farmers have to cope up with it and this has bearing on the livelihoods of farmers. Lack of timely and reliable agrometeorological information is a serious limitation for effective farm planning operations (Prasad Rao and Manikandan, 2008). Weather forecasts are essential for taking decisions regarding crop choice, crop variety, sowing/harvesting dates, and judicious management of agricultural operations such as seedbed preparations, ploughing, irrigation, scheduling and application of fertilizers, pesticide, herbicide and harvesting. In addition, timely weather information enables the farmers to plan their farm operations in way that not only minimize the cost and crop losses but also help in maximizing yield gains. Agriculturally relevant forecast is not only useful for efficient management of farm inputs but also leads to precise impact assessment (Gadgil, 1989). Hence, improved weather based Agromet Advisory

Service (AAS) greatly helps farmers to take advantage of favourable weather and mitigate the impacts of external weather situation. Agromet advisory services are vital tool which provide the valuable information for all types of agricultural operations associated with raising agricultural crops. Weather forecast and weather based agromet advisories help in increasing the economic benefit to the farmers with appropriate crop management practices (Ramachandrappa, 2018). The application of agromet advisory bulletin, based on real time weather forecast is a useful tool for enhancing the production and income of farmers (Ananta Vashisth, 2013).

The India Meteorological Department (IMD) has adopted AAS at district level since 2008. The district level AAS is provided to farmers to make use of medium range weather forecast information provided by National Centre for Medium Range Weather Forecasting (NCMRWF) and IMD. However, validity of such services disseminated to district level has some restrictions, particularly in view of

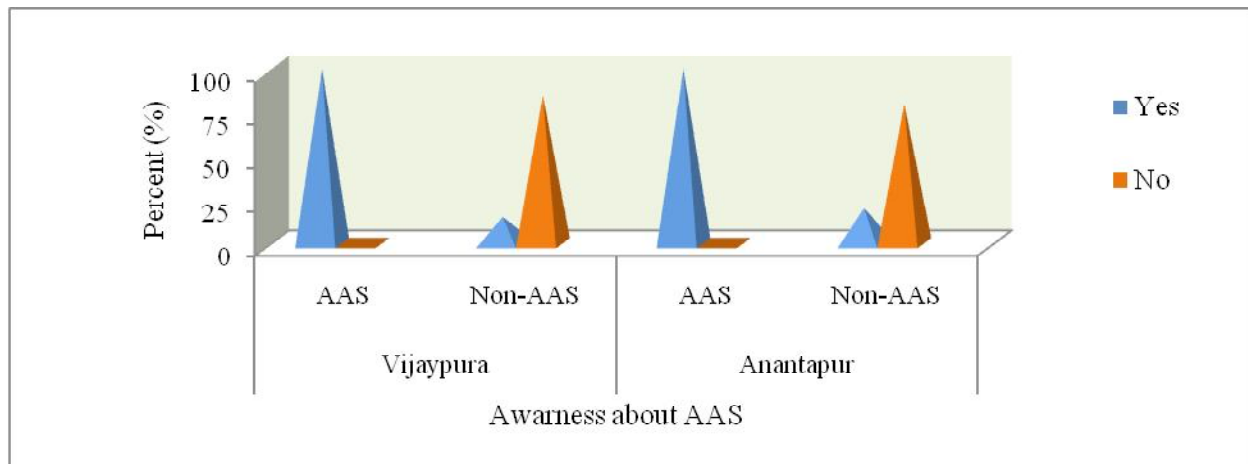


Fig. 1: Awareness about AAS services in study area

large variability in terms of crops, varieties and spatial weather anomalies at this level. Considering the variability of weather, climate and soil, the Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad pioneered in starting flagship research programme of the Indian Council of Agricultural Research (ICAR) named “National Innovations in Climate Resilient Agriculture (NICRA)”. As part of this project, the All India Coordinated Research Project on Agrometeorology (AICRPAM) took up a pilot project during 2010 to develop and disseminate micro-level AAS through its 25 cooperating centers spread across the country towards enabling capacity building of farmers for climate resilience (Vijayakumar *et al.*, 2017). The features of micro-level AAS include preparation and dissemination of weather advisories twice a week to farmers based on the forecasted weather data of IMD in consultation with KVK Subject Matter Specialists (SMS) and Field Information Facilitators (FIF) at village level. The Micro-level advisory based on weather forecast is the newer dimension of the agromet advisory services in the country. Studies on economic impact of these micro-level advisories are uncommon. Therefore, this study was conducted through field survey to assess the farmer’s perception and economic impact of micro-level AAS in AICRPAM centers located at Vijayapura and Anantapur on pilot basis.

MATERIALS AND METHODS

The present study was based on primary data collected from farmers through a proper and pre-tested schedule. The multi-stage stratified random sampling technique was employed for selection of respondents. Districts to which AICRPAM centers were catering the first-stage of sampling unit and taluka within the district became the second stage of sampling unit. Villages within taluka were became third

stage of sampling unit. Villages within taluka were divided into two groups viz., villages with AAS adoption and villages without AAS adoption for comparative study. The ultimate selection units i.e. farmers were divided into 3 groups (strata) based on size of land holding (small, medium and large). Out of 25 AICRPAM centers located across the country, Vijayapura and Anantapur centers were selected for present study. In Vijayapura centre, two villages namely Honawad as adopted and Aheri as non-adopted village were chosen for the study. In Anantapur centre, Pampanur as adopted and Papanpally as non-adopted village were chosen for the study. For the purpose of assessing the economic impact of agromet advisory service, 20 farmers each from AAS adopted and AAS non-adopted village were selected. The total sample size for present study was 80 out of which 40 are AAS adopters and 40 are AAS non-adopters. Further, care was also taken for selection of villages to ensure the similar socio-economic condition and resource base in the villages for comparison purpose.

The descriptive statistics like frequency, percentage and tabular analysis were employed to assess the farmer’s awareness, perception and economic impact of AAS services. The crop yields information both under *kharif* and *rabi* season along with input usage of both AAS and non-AAS farmers was collected and compiled for the study. Probit regression model was employed to assess the factors responsible for willingness to pay for AAS service.

Probit regression model

In this study, we aimed to estimate the farmers willingness to pay (*WTP*) for AAS and factors affecting the decision of farmer. The probit regression model is a statistical probability model with two categories (yes/no) in the

dependent variable and it is based on the cumulative normal probability distribution. In the binary probit model, willingness to pay was taken as 'one', while unwillingness to pay as 'zero'. The independent variables considered in the study were age of the farmers, family size, education, farming experience, land holding size, income and gender of the farmers.

Probit regression model was presented as follows;

$$WTP = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + e_i$$

Where,

b_0 = Intercept, X_1 = Age of the sample farmers in (years), X_2 = Size of the family in (numbers), X_3 = Dummy variable for education level (educated=1, not educated=2), X_4 = Farming experience (years), X_5 = Land holding size (ha), X_6 = Level of income in percentage, X_7 = Dummy variable for gender (male=1, female=2), e_i = Error term

RESULTS AND DISCUSSION

Socio-economic characteristic of AAS and non-AAS farmers

The socio-economic characteristics of the farm households are assumed to have differential impact on a farmers' perception about agromet advisory service and his/her capacity to adopt it (Table 1). The results revealed that 50% of AAS farmers are in old aged groups while 45% of non-AAS farmers are in the middle aged groups. 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. They also perceived larger climatic variability and its impact on crop yields as compared to younger farmers. The results are in line with findings of Preethi *et al.* (2013) and Dhanya and Ramachandran (2016). The education of farmers has important implication on technology adoption and its usage. The higher level of education among farmers help in access to more advanced technology and information. Nearly one-third of AAS farmers were illiterates while more than half of the non-AAS farmers were illiterates. More than half of AAS farmers possessed higher secondary education while only one-third of non-AAS farmers possessed higher secondary education. Only five per cent of non-AAS farmers attained graduation while 10% of AAS farmers attained graduation in the study area. The results are in line with findings of Dhamodaran and Vasanth Kumar (2001). Farming experience was higher in case of AAS farmers (52.5%) as compared to that of non-AAS farmers (45%). AAS farmers had marginally

less access to irrigation water (17.5%) in comparison to non-AAS farmers (22.5%). Thus, farmers with agromet advisory services judiciously conserve and utilized water for critical life saving irrigations as compared to non-AAS farmers. Agriculture was the main source of income for more than 50% of both AAS and non-AAS farmers in the study area. Less than half of farmers in both categories were engaged in off-farm employment for alternative source of income. In both AAS as well as non-AAS group female participation in agricultural activities was low as compared to male participation.

Awareness about AAS service in study area

The results of farmer's awareness about agromet advisory services in two AICRPAM centers i.e. Vijayapura and Anantapur are shown in Fig. 1. The interesting observation was that even majority of non-AAS farmers (80-85%) in both the centers had awareness about the service but lagged in the adoption of the service. Only 15-20% of non-AAS farmers were not aware about the service. Among two centers, the awareness was higher in Vijayapura compared to Anantapur centre. Awareness about agromet advisory service was hundred percent in AAS adopted villages of the both centers. The non-AAS farmers received information from various mass media like radio, television and from fellow friends in the village however they are not following agromet advisories issued by AICRPAM centers since more than 50% of non-AAS farmers are illiterate and not able to read and write.

Sources of AAS Information to farmers

The agromet advisories were disseminated to farmers through various modes of communication like radio, television, mobile phones, newspaper and AAS bulletin in printed form/public notice (Table 2). Among the different modes of communications, nearly 85% of farmers accessed the AAS advisories through mobile phones followed by printed AAS bulletins (70%). However, the information received through personal contact was limited to 20-25% of farmers. The results are in line with findings of Ramachandrappa *et al.* (2018).

AAS farmer's perception towards agromet advisory service in study centers

The results on farmers' perception about agromet advisory service revealed that 65% of farmers rated the service as 'very good' on the scale of very poor to very good (Table 3). Majority of farmers (>90%) agreed on essentiality of AAS and felt that advisories based on predicted rainfall

Table 1: Socio-economic characteristics of farm households in study area

S.No.	Particulars	Category	AAS Farmers (n=40)		Non-AAS Farmers (n=40)	
			<i>f</i>	%	<i>f</i>	%
1.	Age	Young (<35)	06	15	14	35
		Middle (36-45)	14	35	18	45
		Old (>46)	20	50	08	20
2.	Education	Illiterate	07	15	21	52.5
		Primary	20	50	11	27.5
		Higher secondary	09	25	06	15
		Graduation	04	10	02	05
3.	Gender	Male	35	87.5	27	67.5
		Female	05	12.5	13	32.5
4.	Family size	Small (up to 5)	17	42.5	09	22.5
		Medium (6 to 8)	18	45	18	45
		Large (>9)	05	12.5	13	32.5
5.	Family type	Nuclear family	28	70	24	60
		Joint family	12	30	16	40
6.	Farming experience	Low (up to 15 years)	07	17.5	11	27.5
		Middle (16-25 years)	12	30.5	18	45
		High (>25 years)	21	52.5	11	27.5
7.	Social participation	Yes	08	20	06	15
		No	32	80	34	85
8.	Land holding (ha)	Marginal & small	06	15	15	37.5
		Medium	16	40	17	42.5
		Large	18	45	08	20
9.	Access to irrigation	Yes	07	17.5	09	22.5
		No	33	82.5	31	77.5
10.	Farmers income	Less than 50,000	10	25	13	32.5
		50,000 -100,000	13	32.5	07	17.5
		Above 100,000	17	42.5	20	50
11.	Off-farm occupation	Yes	18	45	16	40
		No	22	55	24	60

Source: Field survey data.

event is very much useful in their farming activities followed by advisories based on the temperature. These results are in conformity with studies of Vernon (1994) and Maddison (2006). Majority (85%) of farmers perceived that AAS was essential and it helps to reduce the cost of cultivation in agricultural production followed by managing pest and diseases (75%) during cropping season. More than 80% of farmers opined that real time agromet advisory service was helpful in sowing stage since dissemination of AAS services prior to cropping season with useful weather information particularly information on timely rainfall, temperature and

humidity helps farmers to plan their farm activities particularly land preparation and sowing activities timely and accurately. More than 75% of farmers perceived that micro-level AAS disseminated through AICRPAM centers was accurate, timely available and more than 80% of farmers opined that bi-weekly forecast information was good as it helps to take short term decision on farming activities. Further, farmers willingness to pay for AAS indicates that less than half (40-45%) of farmers presently willing for pay based services. Findings from study also indicated that more than 85% of AAS farmers were satisfied with micro-level AAS.

Table 2: Source of AAS information to farmers

S.No.	Particulars	Vijayapura centre (%)	Anantapur centre (%)
1.	Radio	10	15
2.	TV	25	35
3.	Mobile	85	85
4.	News paper	60	45
5.	AAS bulletin	70	70
6.	Personal contact	20	25

Source: Field survey data.

Factors determining farmer's willingness-to-pay (WTP) for AAS service

Analysis of factors affecting WTP for the AAS service through probit regression model showed that farming experience, land holding size and income level were the important factors in Vijayapura centre (Table 4). Land holding size and income level positively affected WTP for the services as evident from significant positive coefficient (slope) of regression model, whereas farming experience showed significant negative response. The land holding size and income level demonstrating one to one relationship which denotes that higher the size of land holding and income level of the farmers, higher will be the WTP for service while experience of the farmers shows reciprocal relationship which indicate that higher the experience of the farmers, lower will be his willing to pay for the service because farmer use his own experience in farming rather than paying to the service.

At Anantapur centre, farming experience and education level determined willingness to pay for AAS services. Regression coefficient for level of education was positive and significant whereas farming experience was significantly negative at $p < 0.05$. The positive relation of education level implied that higher the education level and knowledge of farmers, higher will be his WTP for the service. At present 85% of AAS farmers satisfied with advisory service disseminated by AICRPAM centre but most of them were not willing to pay for the services since most of them cultivated rainfed crops with poor and limited farm resources.

Economic impact of AAS on crop productivity and economics of cropping system

The economic impact studies indicated that there were considerable benefits to farmers who adopted and regularly follow the agromet advisory services over non-

adopted farmers. The percent gain in income due to AAS was ranging from 12 to 33 per cent (Table 5). The net returns realized by AAS farmers was more as compared to non-AAS farmers which was mainly attributed to timely adoption of farm advisories disseminated by AICRPAM centers. Further, better crop management practices based on advisories such as timely sowing, selection of improved crop cultivar, timely application of fertilizer, pest and disease management, life saving irrigation and harvesting which helps them to reduce the cost of production over non-AAS farmers. The high returns and reduced cost of different crops under AAS category was also evident from the benefit cost ratios arrived from the results. The yield of maize, groundnut, *rabi* sorghum and castor+redgram crop increased to the tune of 3, 1.5, 1 and 2+0.5 q ha⁻¹ respectively for AAS adopted farmers as compared to non-AAS farmers in study area. The increase in crop yields in case of AAS farmers was also due to judicious use of farm inputs based on the real time agromet advisories. Chaudhari *et al.* (2010) reported that the per cent increase in yield due to adoption of agromet advisory bulletins prepared based on medium range weather forecast by NCMRWF was 13-15 q ha⁻¹ in rice, 10 q ha⁻¹ in mango and cashew nut in high rainfall zone of Konkan in Maharashtra. Ananta Vashisth *et al.* (2013) reported that weather based crop management practices which includes timely land preparation and sowing, adoption of recommended seed rate and suitable crop cultivars, timely weeding, *in-situ* moisture conservation measures like furrow between paired rows of redgram to conserve rainwater and maintain the soil moisture, pesticide application, irrigation and harvesting which helped in realizing higher yield of finger millet and groundnut cropping system. Rajegowda *et al.* (2008) reported that in the Eastern dry zone of Karnataka the farmers who adopted the agromet advisories have realized an average economic benefit of 31.4, 24.7, 16.2 and 20.6 % in finger millet, redgram, field bean and tomato, respectively.

CONCLUSION

The present study revealed that micro-level agromet advisory service played an important role in improving the agricultural production and farm income. The farmer's perception towards agromet advisory services issued by AICRPAM centers was very good and positive among AAS farmers. At present, farmer's willingness to pay for AAS was low since most of farmers want to use advisory service at free of cost due to their farm resource constraints. There were considerable economic benefits to farmers who adopted farm advisories issued by AICRPAM centers regularly as

Table 3: AAS farmer's perception towards agro-met advisory service in study centers

S.No.	Farmers perception	Vijayapura centre		Anantapur centre	
		<i>f</i>	%	<i>f</i>	%
1.	Perception about AAS				
	Very poor	01	05.00	02	10.00
	Poor	04	20.00	05	25.00
	Good	02	10.00	00	00.00
	Very good	13	65.00	13	65.00
2.	Necessity of AAS				
	Yes	19	95.00	18	90.00
	No	05	05.00	02	10.00
3.	For which weather parameter AAS is essential				
	Rainfall	17	85.00	18	90.00
	Temperature	13	65.00	14	70.00
	RH	07	35.00	08	40.00
	Wind velocity	03	15.00	04	20.00
4.	Benefit of AAS				
	Yes	17	85.00	16	80.00
	No	03	15.00	04	20.00
5.	Which way you are benefited from AAS				
	Reducing cost during sowing	18	90.00	17	85.00
	Managing pest and disease	15	75.00	15	75.00
	Avoid post harvest losses	07	35.00	09	45.00
	Reducing irrigation charges	13	65.00	14	70.00
6.	At what stage of crop AAS is essential				
	Sowing stage	17	85.00	16	80.00
	Flowering stage	08	40.00	06	30.00
	Fruit formation stage	11	55.00	14	70.00
	Harvesting stage	13	65.00	12	60.00
7.	Quality of AAS information disseminated				
	Good	15	75.00	16	80.00
	Average	03	15.00	03	15.00
	Poor	02	10.00	01	5.00
8.	Frequency of forecasting				
	Daily	03	15.00	3	15.00
	Weekly	01	5.00	01	5.00
	Bi-weekly	16	80.00	16	80.00
	Monthly	00	00.00	00	00.00
9.	Willingness for pay based services				
	Yes	09	45	08	40
	No	10	50	11	55
	Undecided	01	05	01	05
10.	Overall satisfaction about AAS				
	Yes	17	85.00	18	90.00
	No	03	15.00	02	10.00

Source: Field survey data.

Table 4: Probit model for determining farmers WTP in Vijayapura and Anantapur centre

Variable	Vijayapura centre			Anantapur centre		
	Estimated co-efficient	Std Error	t-ratio	Estimated co-efficient	Std Error	t-ratio
Constant	1.760	1.060	1.660	-2.6800	2.3480	-1.1413
Age	0.055	0.032	1.718	0.0030	0.0350	0.0857
Gender	0.022	0.1712	0.127	-0.0123	0.0165	-0.7432
Family size	0.002	0.002	1.285	0.0575	0.2814	0.2043
Farming experience	-0.047	0.022	-2.136**	-0.1740	0.0538	-3.2342**
Education level	0.012	0.016	0.743	0.0002	0.0001	2.0596**
Land holding size	0.448	0.132	3.385**	0.2525	0.0615	0.4198
Income level	0.218	0.094	2.319**	0.2520	0.6017	0.4188

Note: Vijayapura - **Significant at 0.05% level, df= 7, p-value = 0.000, Chi-squared = 126.35

Anantapur - **Significant at 0.05% level, df=7, p-value = 0.0000, chi-square= 75.674

Table 5: Impact of AAS on crop productivity and economics of cropping systems

Crops	AAS farmers				Non-AAS farmers				Additional income to AAS farmers	% change over non- AAS
	COC ¹ ha ⁻¹	Yields (q ha ⁻¹)	Returns ¹ ha ⁻¹	B:C ratio	COC ¹ ha ⁻¹	Yields (q ha ⁻¹)	Returns ¹ ha ⁻¹	B:C ratio		
Maize	17535	25	17865	1.99	21192	28	13400	1.80	4465	33
Rabi Sorghum	8696	8	10125	2.12	10154	9	9046	1.89	1079	12
Sunflower	13535	8.8	15625	2.08	14632	8	12268	1.85	3357	27
Bajra	8330	10	10220	2.22	8110	9	8740	2.07	1480	17
Groundnut	18922	10	25778	2.36	20135	8.5	21245	2.15	4533	21
Castor + Redgram	17635	8+2.5	19765	2.09	18420	6+3	16130	1.95	3635	23

Source: Field survey data.

compared to non-adopted farmers. Higher crop yields and net returns of AAS farmers as compared to non-AAS farmers were attributed to timely adoption of AAS and better crop management practices like timely sowing, selection of improved crop cultivars, life saving irrigation and management of pest and disease under climatic variability conditions.

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