Weather-based Agro advisory services: Impact on cotton yield, economics, and perception of farmers in rainfed areas of the Kurnool District, Andhra Pradesh, India

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ABSTRACT

The District Agro Met Unit (DAMU) at KVK, Banavasi provides weather-based agro advisories to the farmers of this region. During 2018-2020, forty Front Line Demonstrations (FLDs) were organised in Krishi Vignan Kendra's adopted villages, and the feedback survey of the same was conducted to study the impact of weather-based agro advisory services on yield and economics of cotton as well as farmer's perception towards its usage. The results revealed that 13.63% average yield increase was recorded in demonstrated fields compared to the farmers' own practice. The average cost of cultivation reduced to Rs 7,383/- ha^{-1} in demonstration plots when compared to farmers' practice. The average benefit cost ratio in demonstration and farmers practice was of 3.22 and 2.38 respectively. The farmers saved their cultivation cost an average of 20.5% in plant protection, 26.8% in seed cost, 25.7% in irrigation, 11.3% in manure and fertilizers, and 17.4 % in harvesting. The majority of the farmers followed advisories sent through WhatsApp (75%) during kharif season, and 86.7 % of farmers used the advisory for sowing operations followed by spraying of plant protection chemicals (63.3 %). Ninety eight percent of farmers expressed overall satisfaction with the timely weather-based agro advisories by the KVK Banavasi.

Key words: Cotton, Weather based agro advisories, Perception, District Agro Met Units, Economics

Introduction

Agriculture in India is monsoon dependent, and each cropping season, the custom-tailored weather forecast advisories to the farming community must be given to initiate suitable measures to increase the production and to minimize the impact of unfavorable weather on agriculture. Agricultural production depends upon many factors, of which weather is that the major factor. The farmers anticipate for advisories based on monsoon forecast for making day to day agricultural operations decisions. Weather varies with time and space, hence medium range forecast can help to curtail the farm losses through proper management of agricultural operations (Nirwar *et al.*, 2019). In India, "Indian Meteorological Department (IMD)"started weather services to the farmers in 1945, and later "Agromet Advisory Services (AAS)" in 1976 to avoid failure of crop due to aberrated weather conditions. The Central and

(*Scientist- Soil Science)

State governments are concentrating more on weather-based agro advisory schemes to enhance the farmer's livelihoods. Agro-meteorological data, such as weather forecasts, information on the condition of the soil, and agro-advisories, are crucial inputs for efficient farm management. Farmers can lower the chance of failure if a reliable weather forecast is supplied. Farmers can plan ahead for crop cultivars, the timing of fertilizer application, weed control, and pest and disease control (Rathore *et al.,* 2008). Human vulnerability to weather vagaries may be reduced by the ability to produce timely, accurate weather forecasts (Hansen, 2002). As a result, any weather forecast has enormous advantages for precise crop management that outweigh the drawbacks of weather vagaries.

Indian Meteorological Department has initiated the Gramin Krishi Mausam Sewa (GKMS) programme at 130 centres with Agromet Field Units (AMFUs) at district level in all states. Such units were established by the State Agricultural Universities at their Research Stations and Colleges. Besides these units, IMD had also started block/mandal wise agromet advisory services in collaboration with ICAR through District AgroMet Units (DAMU) all over India at Krishi Vigyan Kendras (KVKs). Each AMFU and DAMU is led by an Agromet Scientist as technical officer to prepare "weather-based agro advisory" at district and block levels. In Andhra Pradesh, nine DAMUs were established in addition to existing five AMFUs in 2018. Agromet Advisory Bulletins are prepared on every Tuesday and Friday at district and block level with the help of Agro-DSS software for major crops (Agriculture and Horticulture), Animal Husbandry, Fisheries, etc. The bulletin is released inEnglish and in regional languages, and disseminated through farmer WhatsApp groups, m-Kissan portal, Annapurna Krishi Prasara Seva (AKPS) portal, Print and Electronic media, E-mail through State Agriculture Department, Research Stations, GKMS and Web portals, Short Message Services (SMS), Non-Governmental organizations' (NGOs) like Reliance Foundation Information Services, FPOs, etc. Farmers use these services to make decisions and carry out timely cultivation techniques, which facilitates a rise in crop output and a decrease in crop losses as a result of unfavourable weather. With this backdrop, a study was conducted to analyse the knowledge acquired, and level of impact of weather-based agro advisory services among the farmers in Kurnool district of Andhra Pradesh.

Materials and Methods

Area of Study

Kurnool District lies between the northern latitudes of 14^0 54' and 16^0 18' and eastern longitudes of 76^0 58' and 79^0 34', and the altitude of the district is 100 m above the mean sea level. The district ranks 10th in state's population (40,53,463 people accounting for 4.63 % of the total population of the state as per 2011 population census). In area it occupies the 3rd place with 17658 Sq. km which account for 6.41 % of the total area of the state. Kurnool District comprises three Revenue Divisions and 54 Revenue Mandals. Kurnool district falls under Scarce Rainfall Zone with an average annual rainfall of 670.6 mm (normal). Major rainfall is received from the South-West monsoon (455.1 mm), and remaining during the North-East monsoon (149.6 mm), winter (4.7 mm) and summer (61.2 mm). In the last 20 years (2001-02 to 2020-21), the Kurnool district received more than the normal rainfall only in eight years (Fig. 1.) and in that three years received excess rainfall i.e. 2007-08, 2010-11 and 2020-21 (Source: CPO, JDA, Kurnool). The DAMU, established at KVK Banavasi, Kurnool District, has produced 1092 bulletins containing appropriate advisory information / advisory to farmers based on weather forecast, observed weather, location and crop, etc., and disseminated to the farmers during 2018-2020.

Selection of villages for Front Line Demonstrations

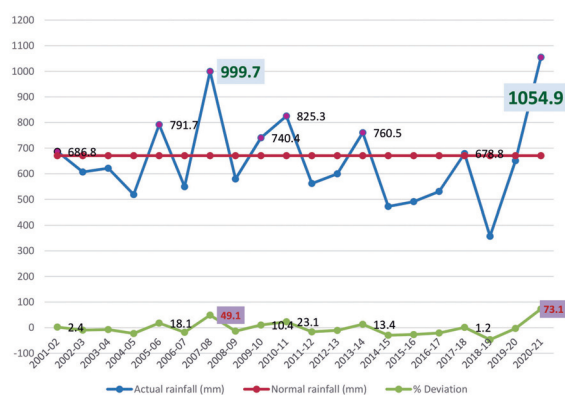Cotton is the major growing crop in Kurnool district.

Fig. 1. Actual rainfall pattern of Kurnool district (2001-21)

Front Line Demonstrations and the survey was conducted among the Bt cotton growing farmers of Kurnool district. The survey aimedat studying the yield and economic impact of cotton through Agromet advisory services at farmer's fields, and also on the knowledge of weather-based agro advisories. In addition, the spread of awareness about DAMU and its help in farm operations was also captured to find out the advisories contribution for the enhanced livelihood of farmers during the abnormal weather conditions. Forty FLDs were conducted in total during 2018-20 at Hanupuram, Venkatagiri and Kalugotla villages. The data was collected both from the demonstrations and from farmers practice regarding yield and economics. The input costs and output prices of the commodity prevailing during the study were taken into an account for calculating the net returns and benefit-cost ratio.

Survey and Data Collection Method

The total sample for the study was 150 from Hanupuram, Venkatagiri and Kalugotla villages, and the categories of farmers include marginal, small and medium. Among the sample, 120 were beneficiaries of FLDs who were associated with AAS (Agro-met Advisory Services) and 30 were not associated with AAS. To gather information on farmers' perceptions of climate change, their adaptation to it, and their characteristics, a simple, clear structured questionnaire in Telugu and English was created. It had 24 optional items. The schedule was originally designed in Telugu to aid respondents in understanding the surveys and providing accurate, concise responses. The information gathered from the respondents was collated and statistically analysed. To better comprehend farmers' perceptions of climate change and their responses to it, the data were presented in frequency and percentage. The different personal, social, psychological, and economic traits of the farmers were measured using a frequency distribution. It had also been used to the study of knowledge and adoption claims in the answer. Wherever required, the percentage was employed to compare multiple groups simply.

Results and Discussion

Analysis of the survey data showed that 75% of farmers got their Agromet advisories from Whats App, while the remaining 25% got them from television, 7% from newspapers, 5% from their

neighbours' farmers, and 3% from SMS (Fig. 2.). And in terms of the use and application of the advisories, 65% of farmers used them to plant protection measures to their crops, 20% used them for irrigation, 10% chose the best time to sow their crops, and 5% chose the type of crop to be cultivated during the kharif season (Figure 3). Results also demonstrated that farmers who complied with cotton agromet advisories were able to enhance net profit (Rs. 88,758 ha⁻¹) and decrease input costs (Rs. 7383 ha⁻¹) compared to non-AAS farmers (Rs. 66,175 ha⁻¹) who did not heed weather-based advice. AAS farmers have higher net returns than non-AAS farmers due to lower cultivation costs, methods for weather-based management, and prompt management of pests and illnesses. The farmers used crop techniques like timely weeding, harvesting, irrigation, and pesticide applications. They also reduced pesticide overuse and avoided pesticide spraying when rain was predicted in accordance with agromet advisory bulletins. As a result, the benefit-cost ratio of AAS farmers was higher (3.22) than that of non-AAS farmers (2.38) (Table 1).

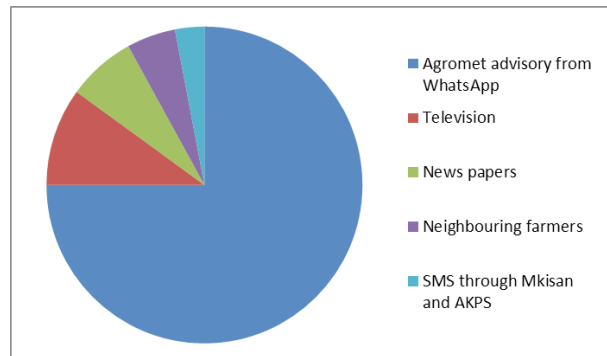The study also revealed that the information gathered through agro-advisory service was very

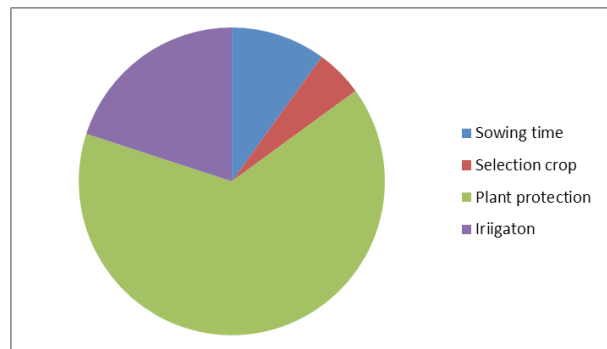**Fig. 2.** Source of weather based agro advisories

Fig. 3. Agro advisories for agriculture operations utilized by the farmers during the *Kharif*, 2020

Table 1. Economic impact analysis of AAS on Bt Cotton during Kharif seasons of 2018, 2019 and 2020

Particulars	2018			2019			2020		
	AAS	Non AAS	% change	AAS	Non AAS	% change	AAS	Non AAS	% change
Land preparation	5500	6200	11.29	5700	5700	0	5900	6200	4.84
Seed	2050	2800	26.79	2050	2800	26.79	2050	2800	26.79
Seed treatment	4750	5200	8.65	4500	4500	0	4500	4750	5.26
Fertilizer	6500	7500	13.33	7500	8300	9.64	6500	7300	10.96
Insecticides	3500	4300	18.60	3100	4100	24.39	3500	4300	18.60
Weeding	3200	3800	15.79	3500	4300	18.60	3200	3800	15.79
Irrigation	4800	6800	29.41	4500	5500	18.18	4800	6800	29.41
Harvesting	9500	11500	17.39	9500	11500	17.39	9500	11500	17.39
Cost of cultivation (Rs ha^{-1})	39800	48100	17.26	40350	46700	13.60	39950	47450	15.81
Yield (kg ha^{-1})	2150	1975	8.86	2250	1950	15.38	2625	2250	16.67
Gross Returns (Rs ha^{-1})	118250	108625	8.86	123750	107250	15.38	144375	123750	16.67
Net Returns (Rs ha^{-1})	78450	61675	27.20	83400	60550	37.74	104425	76300	36.86
BC Ratio	2.97	2.31	28.42	3.07	2.30	33.54	3.61	2.61	38.57

useful to the farmers. It was observed that farmers who followed AAS have on average % change of 20.5% in plant protection, 26.8% in seed cost, 25.7 % in irrigation, 11.3% in manure and fertilizers and 17.4 % in harvesting. When compared to AAS farmers, non-AAS farmers' yield and other returns were lower. Similar observations were also reported by Singh *et al.* (2004), Venkataraman (2004) and Nirwal *et al.* (2019). The data on operation-wise usability of advisories (Table 2) reveals that the majority of the farmers were using the agro advisories during sowing operations (86.7%) followed by spraying operations (63.3%) and about 56.7% of the respondents were using the advisories for harvesting and drying operations. This is in accordance with Ray *et al.* (2017). A total of 26 weather-based agro advisories were sent during *kharif* 2020 related to cotton crop (Table 3). Among them, majority beneficiary farmers

Table 2. Operation wise usability of weather based agro advisories at in cotton by the beneficiary farmers

Sl.No.	Purpose	No. of farmers	Percentage
1	Land Preparation	120	80
2	Seed treatment	10	6.7
3	Sowing	130	86.7
4	Weeding	60	40.0
5	Fertilizer application	65	43.3
6	Spraying of PPC	95	63.3
7	Irrigation	28	18.7
8	Harvesting	85	56.7
9	Drying of produce	70	46.7

Source: Field Survey Data

(93.3%) adopted the advisory on spraying of plant protection chemicals followed by basal application of Phosphate fertilizers, 78.7% farmers followed deep summer ploughing and 73.7% farmers used sticky traps to control sucking pests based on advisories. Only 10% of farmers were aware on the drought/heavy rainfall management. This results also supported by Kumar *et al.* (2022) and Vijayabhinandana *et al.* (2022).

The results on farmers' perception about weather-based agro advisory service in cotton crop revealed that a total of 98% farmers are receiving advisories and remaining 2% answered as irregular and not receiving (Table 4). Majority of farmers (89%) agreed the necessity about biweekly forecast and Agromet Advisory Bulletin and 87 % ranked as very good about biweekly forecast and Agromet Advisory Bulletin. These results are in conformity with studies of Vernon (1994) and Maddison (2006) About 87% respondents followed weather forecast based on agromet advisory bulletin for their farm, and among them 88% are following in *kharif* and 12% in summer. About 83% farmers ranked as highly useful about weather-based advisories and majority of farmers (> 85%) mostly follow the advisories related to rainfall followed by temperature, RH and wind velocity. The total of 57% of the farmers benefited following agro met advisories in reducing sowing cost, management of pest and diseases. The farmers could minimize the costs during whole crop duration/season with the advisories which otherwise was not possible without following the advisories and no updates on weather condi-

Table 3. Advisory wise Usability by the beneficiary farmers in cotton

Sl. No	Weather based Agro Advisories in cotton	No. of farmers	Percentage
1	Deep summer ploughing	118	78.7
2	Seed rate@ 0.75 -1.0 kg/acre	110	73.3
3	Spacing @ 90 cmx45cm	55	36.7
4	STBF fertilizers application	40	26.7
5	Integrated Nutrient management	87	58.0
6	Basal application of SSP @ 150 kg/ac	120	80.0
7	Application of urea + MOP in splits @ 35 kg + 10 kg @ 20, 40, 60, 80 DAS	115	76.7
8	Application of $ZnSo_4$@ 20 kg/ac once in 3 years.	90	60.0
9	Sowing of cotton only in black soils not in red soils.	20	13.3
10	Integrated Pest management	95	63.3
11	Jowar/Bajra as border crop	85	56.7
12	Greengram/ Black gram as trapcrops	55	36.7
13	Redgram/jowar/korra as intercrops	65	43.3
14	Non Bt sowing in borders	60	40.0
15	Stem application for sucking pest management	40	26.7
16	sticky traps usage for sucking pests	110	73.3
17	pheromone traps usage for PBW@4/ac @ 45 DAS	65	43.3
18	Spraying of chemicals like Profenophos, Choloropyriphos, Quinalphos, Thiodicarb to control PBW	140	93.3
19	Spraying of $MgSo_4$ @ 2 kg/ac @ 45, 75 DAS	95	63.3
20	Spraying of Borax @ 200gm/ac @ 60, 90 DAS	75	50.0
21	Dry spell management – spraying DAP/Urea/kNo_3/13-0-45 or Heavy Rainfall management	15	10.0
22	Use of biofertilziers like azatobactor, azospirillum, PSB, VAM etc.	52	34.7
23	Avoiding summer cotton	65	43.3
24	Root rot control by drenching with COC@ 3 gm/lit	70	46.7
25	Management of black arm by application of CoC 3g+ streptocycline 0.1g/l of water	40	26.7
26	Management of leaf spots by application of Mancozeb 2.5 g/l of water	90	60.0

Source: Field Survey Data

tions. Similar findings were reported by Dupdal *et al.* (2021). The farmers were asked to disseminate the scheme and service benefits with other stakeholders who are not in contact with DAMU, KVK, Banavasi. For this, the major farmers of the district replied positively to share about the information services to others by WhatsApp messages mode (55%), followed by in word or mouth (25%) and displaying in the Rythu Bharosa Kendras (20%). The farmers also replied that 42% farmers were able to get economic benefits of Rs 10,000 to 20,000 ha^{-1} and 18 % farmers > Rs 2,50,000 ha^{-1} in cotton crop by following weather-based agro advisories. The majority of the farmers (98%) expressed overall satisfaction with the timely weather-based agro advisories.

Conclusion

Farmers that have chosen the Agromet Advisories Services disseminated from the DAMU Unit of Kurnool district have reaped significant benefits, according to the current perception levels of farmers toward weather-based agro advisories.. It has conjointly helped not only in encouraging the acquisition and use of recent agricultural production technologies and practices, but in utilizing weather-based irrigation management, pest/disease management, along with greater use of post-harvest technologies and industrial promoting of commodities. Thus ,the implementation of the Agromet Advisory Bulletin based on current technology weather forecasts is a beneficial mode for doubling the production of crop and income of farmers.

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Table 4. Cotton growing Farmer's perception towards agro-met advisory service

S. No.	Particulars	Category	Farmers' perception (%)
1	Do you receive biweekly forecast and Agromet Advisory Bulletin?	Yes	98
		No	2
2	Necessity about biweekly forecast and Agromet Advisory Bulletin	Yes	89
		No	11
3	Perception about biweekly forecast and Agromet Advisory Bulletin	Very poor	
		Poor	5
		Good	8
		Very Good	87
4	Do you follow weather based agromet advisory bulletin for your farm	Yes	87
		No	13
5	Season of crop for which advisory used in cotton crop	Kharif	88
		Rabi	0
		Summer	12
6	How relevant or useful are the weather based advisories	Highly useful	83
		Partially useful	12
		Not useful	5
6	For which weather parameter weather based agromet advisory is essential	Rainfall	88
		Temperature	10
		RH	1
		Wind Velocity	1
7	Which way you are benefited from weather based agromet advisories	Reducing cost during sowing	57
		Managing pest and disease	23
		Reducing irrigation charges	15
		Avoid post-harvest losses	5
8	How do you share about the GKMS scheme benefits to others (you can select more than one)	By WhatsApp groups or WhatsApp	55
		By personal discussions	25
		Displaying in the Rythu Baraosa Kendras (RBKs)	20
9	Economic benefit received on following advisory bulletins (For Farm operations the Advisory found useful for: Approximate Savings done on advisory keeping in notice (Rs./ha)	Not yet calculated	30
		<10,000	10
		10,000-20000	42
		>25,000	18
10	Overall satisfaction about AAS	Yes	98
		No	2

Source: Field Survey Data

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