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Micro level weather based agromet-advisories and economic impact assessment of cotton crop for Sirsa district, Haryana

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Abstract

Agro advisory services based on weather forecast helps in improve the income of farmers by suggesting timely suitable operation to increase the production. Study was carried out on comparison and estimation of benefits to micro level users *i.e.* agromet-advisory services (AAS) and Non-AAS farmers of Farwain Kalan village in Sirsa district of Haryana. Continuous and subsequently collected the information after issue the AAB and adoption of agromet advisory advised which have been followed by farmers and the impact of agromet-advisory services for cotton was critically evaluated. Further, assessing the impacts of AAS to consider a total of 117 agromet advisories bulletins (AAB) were disseminated to selected farmers' in respective seasons. In the case study results indicates that agromet advisories followed by adopter farmer as compared to non-adopter farmer can reduce the cost of cultivation also help in increase the net profit for the cotton crop cultivation. Results indicates that B:C (Benefit Cost ratio) was higher who follow AAS (1.71) than Non-AAS (1.33) for the year 2017. The economic impact assessment of AAB for cotton, shown that B:C ratio of AAS adopted farmers were 1.51 higher as compared to the non-AAS farmers 1.06 in the crop season 2018. The higher B:C ratio obtained in 2017 as compared to 2018 crop season. On the based results the application of micro level agromet advisory services is a useful tool for enhancing the production with effective and higher earnings to the farmers.

Keywords: Economic impact assessment, AAS, B:C ratio, cotton, AAS farmers

Introduction

Agro met advisory based on prevailing weather condition help in increase the production of farmers' by providing timely weather based management approaches. Weather based agromet advisory services provides the valuable information regarding crop cultivation, land preparation, sowing, irrigation, spray and harvest (Sridhara *et al.*, 2014) ^[5]. Weather plays an important role in the success and failure of agriculture crop production. Weather forecast help in reducing the lose by making timely decision. Medium range weather forecast for three to ten days can help to advanced or delayed in the farm operation. Weather forecast based on crop production not only useful in effective farm management inputs but also play a role in precise impact assessment (Chattopadhyay and Chandras, 2018) ^[1]. Seeley (1994) ^[3] studied that forecast effect significantly on agribusiness community, if weather forecast can be 50-60 percent realized under western countries conditions. Weather forecast help among farmer in taking decision of selection of cultivar, sowing and harvesting interval, irrigation scheduling, irrigation interval, chemical spray, mitigation and adaption against extreme weather event such as low/high temperature, cold/ heat wave frost condition heavy rainfall at critical stages, effective nutrient

management by fertilizer application; and also feed, shelter management and health for livestock (Khan *et al.*, 2019) ^[2]. ICAR (Indian Council of Agricultural Research) have a network project under NICRA (National Initiative on Climate Resilient Agriculture) lunched in February, 2011. The main objective of this project is to enhance resilience of Indian agriculture against climate change and climate vulnerability by strategic research and technology demonstration. Research mandates of project on adaptation and mitigation technology in crop production, livestock, natural resource management and fisheries. AICRPAM-NICRA Project running under the department of Agril. Meteorology, CCS HAU, Hisar has started micro-level AAS (Agromet Advisory Services) on pilot basis at village Farwain Kalan in Sirsa District. The Sirsa district located in western zone of Haryana. The major crops grown are cotton, rice, wheat, mustard, short duration pulses, horticultural fruit crop, vegetable crops also rearing of livestock are the main activities in the district. Small and marginal farmers for the crop production depend upon South-west monsoon season during the *Kharif* season in the Sirsa district. That's why it is important to study the micro level based agro advisories on weather forecast and economic impact assessment of cotton crop for Sirsa district.

Martials and Methods

Weather data observed at the Meteorological Observatory (Lat: 29°25’N; Long: 74°10’E, Alt: 202 m amsl) of ICAR-Central Cotton Research Institute-Regional Station, Sirsa (Haryana) were compared with the forecasted data of the respective weather elements. Validation of forecasted weather data was done on seasons *viz.*, winter season (January to February) pre-monsoon (March to May), South West monsoon (June to September) and post monsoon (October to December). The quantitative verification

analysis for season-wise of the forecast during year 2017 and 2018 were carried out for rainfall, maximum and minimum temperature, morning and evening relative humidity by calculating the error structure for Sirsa district of Haryana. National Centre for Medium Range Weather Forecasting (NCMRWF) (Table 1) initially defined error structure to categorize on correct, usable or unusable based on the percent deviation in the forecast values as compared to observed values as presented by Singh *et al.* (1999) [4].

Table 1: Different error structures for forecast verification analysis of weather parameters

Error structures	Rainfall	Maximum Temp	Minimum Temp	RHmax	RHmin
Correct	Diff. ≤ 25% of obs.	Diff. ≤ 1.0 °C	Diff. ≤ 1.0 °C	Diff ≤ 10%	Diff ≤ 10%
Usable	25% of Obs. < Diff. ≤ 50% of Obs.	1.0 °C < Diff. ≤ 2.0 °C	1.0 °C < Diff. ≤ 2.0 °C	10% < Diff ≤ 20%	10% < Diff ≤ 20%
Unusable	Diff. > 50% of obs.	Diff. > 2.0 °C	Diff. > 2.0 °C	Diff > 20%	Diff > 20%

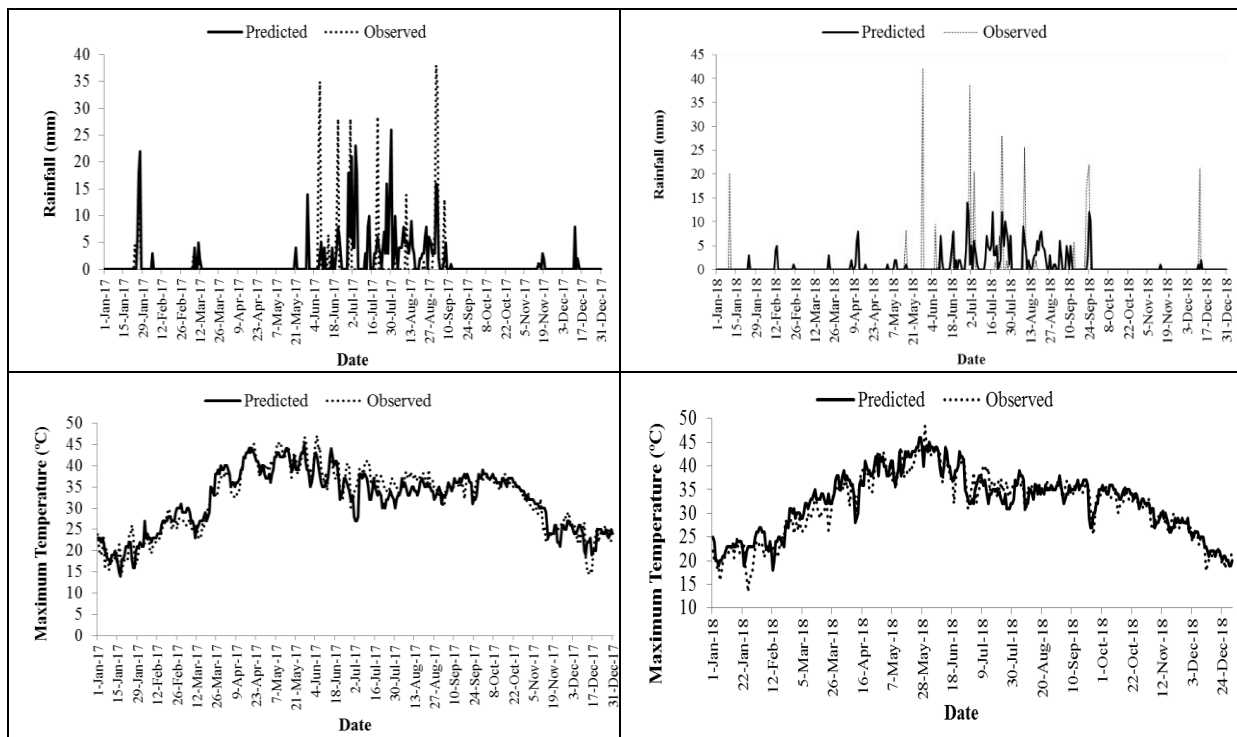
The district level weather based agro advisory bulletins were prepared based on the biweekly medium range weather forecast input provided by IMD (MoES) every Tuesday and Friday. These bulletins were made available through KVK Sirsa and webpages. For, further improvement in local weather forecast and related crop specific agro advisory bulletins the block level weather forecast was considered for developing the AAB every time. A survey was conducted by selecting eight farmers from Farwain Kalan, Sirsa district (Lat: 29°36’N Long: 75°06’E). It was adopted under AICRPAM-NICRA project. All the selected farmers’ were receiving the forecast and related agro advisories regularly and adopting the forecast based agro advisories (AAS farmers’). Similarly, another same set of farmers’ who were non-adopters of forecast based agro advisories were also considered as check farmers for comparison (non AAS farmers’). Feedback collected from farmers’ on the basis

who follow the agromet advisory and who does not follows. Later the gross returns and Benefit cost ratio (B:C) were compared to assess the economic impact of adopted versus non-adopted farmers of weather based agro advisories services.

Results and Discussion

Verification and analysis of forecasted events at Sirsa

The basic requirement for the weather based agro advisories to the farmers is the accurate weather forecast. Daily met data collected from Agrimet Observatory of ICAR-CICR, Sirsa was used for the comparison (Fig. 1) and forecast verification analysis with medium range district wise weather forecast received from IMD during year 2017 and 2018. Quantitative verification analysis was carried out using various error structures as shown in the Table 2.



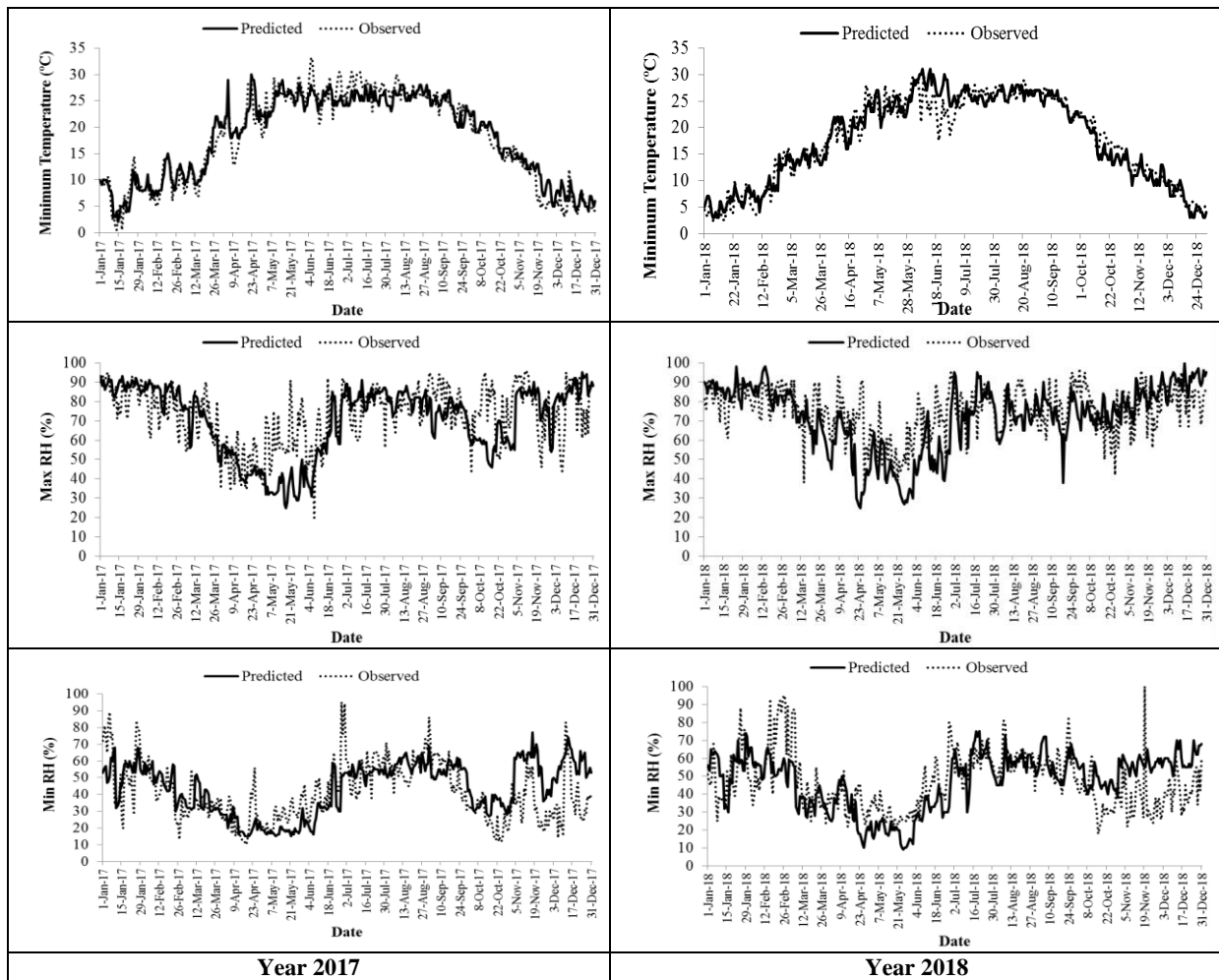


Fig 1: Comparison of predicted and observed daily weather during year 2017 and 2018 in Sirsa

Table 2: Quantitative analysis (%) of weather parameters using different error structures

Weather parameters	Season	Error structure					
		Year 2017			Year 2018		
		Correct	Usable	Unusable	Correct	Usable	Unusable
Rainfall Season	Pre Monsoon	98.9	0	1.2	98.8	0	1.2
	Monsoon	80.8	4.1	15.1	82.4	4.1	13.5
	Post Monsoon	97.7	1.1	1.1	100	0	0
	Winter	98.2	0	1.8	100	0	0
	Annual	94.1	1.3	4.6	95.3	1	3.7
T _{max}	Pre Monsoon	44.6	28.3	27.2	37	14.1	48.9
	Monsoon	37.7	18.9	43.4	50.8	22.1	27.1
	Post Monsoon	60.9	20.7	18.5	65.2	22.8	12
	Winter	47.5	20.3	32.2	39	27.1	33.9
	Annual	46.9	21.9	31.2	49	21.1	29.9
T _{min}	Pre Monsoon	46.7	26.1	27.2	46.7	28.3	25
	Monsoon	47.5	19.7	32.8	54.1	19.7	26.2
	Post Monsoon	51.1	22.8	26.1	47.8	28.3	23.9
	Winter	50.9	25.4	23.7	49.2	25.4	25.4
	Annual	48.8	23	28.2	49.9	24.9	25.2
RH _{morning}	Pre Monsoon	44.6	29.4	26.1	47.8	29.4	22.8
	Monsoon	68	21.3	10.7	51.6	29.5	18.9
	Post Monsoon	45.7	28.3	26.1	60.9	33.7	5.4
	Winter	74.6	17	8.5	79.7	18.6	1.7
	Annual	57.5	24.4	18.1	57.5	28.8	13.7
RH _{evening}	Pre Monsoon	66.3	27.2	6.5	55.4	33.7	10.9
	Monsoon	57.4	38.5	4.1	65.6	28.7	5.7
	Post Monsoon	35.9	23.9	40.2	25	39.1	35.9
	Winter	52.5	33.9	13.6	37.3	33.9	28.8
	Annual	53.4	31.2	15.3	48.2	33.4	18.4

Rainfall: Highest correct rainfall forecast was observed in pre-monsoon and lowest was observed in monsoon season i.e. 98.9% and 80.3%, respectively during year 2017. Annual correct rainfall events were 94.1% and unusable events were 1.3%. Both post monsoon and winter monsoon was observed 100% correct rainfall forecast, whereas during pre monsoon and monsoon season were 98.8% and 82.4% respectively during year 2018. During comparison of both years, rainfall forecast were found more correct for monsoon and post-monsoon during 2018.

Maximum temperature: During the period of 2017 maximum correct weather forecast event was observed in post-monsoon (60.9%) then winter season (47.5%), after that pre-monsoon season (44.6%) and least correct events observed in monsoon seasons (37.7%). In case of annual weather forecast was observed 46.9%, 21.9% and 31.2% was correct, usable and unusable respectively. Maximum correct weather forecast was observed in the post monsoon season (65.2%) followed by monsoon season (50.8%) and then winter season (39%) during the period of 2018. The annual weather forecast was observed 49.9%, 24.9% and 25.2% under correct, usable and unusable error structures, respectively. During comparison of both years, maximum temperature forecast were found more correct for monsoon and post-monsoon during 2018.

Minimum temperature: During the period of 2017, minimum correct weather forecast event was observed in post-monsoon (51.1%) then winter season (50.9%), after that monsoon season (47.5%) and least correct events observed in pre-monsoon seasons (46.7%). The annual weather forecast was observed 48.8%, 23.0% and 28.2% under correct, usable and unusable error structures, respectively. Whereas during the period of 2018 weather forecast verification for minimum temperature indicates that maximum correction was observed in monsoon than winter seasons after that post-monsoon and lowest accuracy was found in pre-monsoon season was 54.1%, 49.2%, 47.8% and 46.7% respectively. In case of annual weather forecast was observed 49.2%, 25.4% and 25.2% was correct, usable and unusable respectively.

Morning relative humidity: During year 2017, the highest correct event forecast was observed during winter seasons followed by monsoon and post-monsoon was 74.6%, 68.0% and 45.7% respectively. In case of annual maximum relative humidity forecast events was 57.5% and 24.4% for correct and usable event respectively. While during year 2018, the correctness of forecast events during winter season was highest with 79.7% correct values followed by post monsoon (60.9%) and monsoon (51.6%), whereas the least correct events (47.8%) were observed during pre-monsoon season. In case of annual maximum relative humidity forecast events, 57.5% was correct and the usable events were 28.8% while 13.7% were unusable.

Evening relative humidity: For the period of 2017 correct event, usable event and unusable events of weather forecast for the annual minimum relative humidity was 53.4%, 31.2% and 15.3%, respectively; and for the seasonal highest correct event weather forecast was observed on pre-

monsoon followed by monsoon season than in winter season and least in post-monsoon season was 66.3%, 57.4%, 52.5%, and 35.9%, respectively.

The usable percentage was relatively high during post monsoon season (40.2 percent). For the period of 2018 correct event, usable event and unusable event weather forecast for the annual minimum relative humidity were 48.2%, 33.4% and 18.4%, respectively. Seasonal highest correct event of weather forecast was observed during monsoon followed by pre-monsoon season followed by winter season and least in post-monsoon season viz., 65.6%, 55.4%, 37.3%, and 25.0%, respectively. The usable percentage was relatively high during post monsoon season (39.1%).

Dissemination of weather based Agro Advisories to micro level

A total 55 and 62 agro-advisory bulletins were prepared during cotton season 2017 (9th May to 10th November) and 2018 (1st May to 13th November), respectively. All AAS bulletins were made available to the farmers' of domain village through Field Information Facilitators (FIF) appointed in the AICRPAM-NICRA adopted village Farwain Kalan, Sirsa, mobile calls and messages (Table 3).

Table 3: Dissemination of AAS bulletins during cotton season 2017 and 2018

Project Station	AICRPAM-NICRA Farwain Kalan, Sirsa
2017	55
2018	62

Economic impact assessment of micro-level Agromet Advisory services (AAS)

Cotton crop during year 2017: Evaluation of AAS bulletins was shown in Table 4. Benefit: Cost ratio (B:C ratio) was calculated between AAS adopter and Non-AAS adopter farmers of Sirsa district presented in Table 6. B:C ratio was higher for the AAS adopter (1.71) farmers than that of Non-AAS adopter farmers (1.33). Farmers who received and follows AAS was expenditure of Rs. 58570 ha⁻¹ and Rs. 4480 lower than the Non-AAS farmers. Utilization of weather based forecast by farmer got net profit of Rs. 41350 ha⁻¹, which is Rs. 20283 more than the Non-AAS farmers. AAS bulletins prepared on weather forecast based on farm operation was received by farmer who follow the advisory though mobile-SMS followed the bulletins. The farmer who follows AAS bulletins got higher profit due to better weather based management practices.

Proper drainage on time helps the farmer to save their crop then those who not follow the AAS bulletins. Rainfall occurrence on 7th June, 8th June and 27th June at the time of vegetative phase of cotton crop was 22 mm, 35 mm, and 28 mm respectively cause loss in the field. The farmer follow weather based advisory managed their field operation then that of who did not follow the AAS bulletins. Another extreme event was observed on 17th July, 8th Aug. and 5th Sept. during flowering and boll formation phases. During this period AAS farmers were followed agro advisories and saved expenditure on irrigation and spray.

Cotton crop during year 2018: Evaluation of AAS bulletins was presented in Table 5. B:C ratio was calculated

between AAS adopter and Non-AAS adopter farmers of Sirsa district presented in Table 6 indicated that B:C ratio was higher for the AAS adopter (1.51) farmers than that of Non-AAS adopter farmers (1.06). Farmer who received and follows AAS was expenditure of Rs. 89644 ha⁻¹ and Rs. 5922 lower than the Non-AAS farmers. Utilization of weather based forecast by farmer got net profit of Rs. 86807 ha⁻¹, which is Rs. 37898 more than the Non-AAS farmers.

Farmers were faced losses due to occurrence of 28, 48.3, 13.6 and 37 mm rainfall on dated 12th June, 26th June, 13th July and 18th Sept. during vegetative phase, square formation phase, flowering and boll formation phases of cotton, respectively were managed better by AAS farmers. Another light rainfall spell suggested in the AAS bulletins was also better utilized by the AAS farmers as they withhold irrigation by following the advisory.

Table 4: Evaluation of AAS bulletins for cotton crop during *kharif* 2017

Date of issue of advisory	Crop condition/ Crop stage	Forecast, IMD	Agromet Advisory issued	Actual weather condition	Action taken by farmers	Remarks (Loss/Profit/other)	No. of irrigation saved	Pesticide/Chemical saved
05-05-17	Sowing/ Field preparation	Dry weather may prevail in coming days.	Keeping in view of dry weather in next two days farmers are advised for sowing of American cotton crop with seed treatment.	Dry weather.	Field prepared and sowing started. AAS followed.	Good <i>Vattar</i> /tilth condition so surety of germination.	Nil	Nil
19-05-17	Sowing (germination complete)	Possibility of variable weather and light rain/thundershowers at isolated places.	Due to possibility of variable weather withhold the sowing of cotton, if possible. Do intercultural operation in timely sown crop during dry days.	Dry weather.	Intercultural operations carried out by farmers.	Intercultural operation to remove weeds and conserve moisture.	1	Nil
02-06-17	Vegetative stage / 1 st Irrigation	Possibility of dry weather and slightly increase the day temperature during period.	Due to possibility of dry weather, farmers are advised to apply light irrigation in sown crop at short interval during morning and evening hours.	Dry weather was mainly observed.	Irrigation applied	AAS followed by farmers.	NIL	NIL
06-06-17	Vegetative stage/ Intercultural operation/weeding	Possibility of Dust storm/Thunderstorm accompanied with squall at isolated places Possibility of light rain at one or two places.	Due to possibility of light rain farmers are advised to withhold the spraying insecticide next 2-3 days.	Rainfall: 57 mm.	As per advisory.	AAS followed by farmers.	1	1
16-06-17	Vegetative stage /Hoing/weeding	Possibility of light to moderate rain may occur.	Farmers are advised to do the hoeing in cotton crops for conserving the moisture and withhold spray and irrigation next 2-3 days.	Rainfall: 10.2 mm.	No application of irrigation and chemicals.	AAS followed by farmers.	1	1
27-06-17	Vegetative stage/start of square formation/ Hoing and drain out excess water	Possibility of variable weather and light to moderate rain with moderate winds in the region during the period.	Farmers are advice to drain out the excess rain water in the cotton crop, in case of moderate to heavy rain from 27 th June.	Rainfall: 28 mm.	No irrigation given. Drained out excess water from field.	AAS followed by farmers.	1	NIL
17-07-17	Square formation complete/ Flowering start	Light to moderate rain/thundershowers likely.	Due to possibility of rain farmers are advice to withhold intercultural / hoeing operations in cotton crops for next two to three days.	Rainfall: 28 mm.	Drained out excess water from field. Hoing done.	AAS followed by farmers.	1	NIL
08-08-17	Flowering/ Withhold irrigation and pest management	Possibility of variable weather and light to moderate rain	The possibility of rain farmers are advised to withhold the irrigation in cotton next 2-3 days.	Rainfall 14.0 mm.	No irrigation applied.	AAS followed by farmers.	1	NIL
05-09-17	50% boll formation/Disease management	Possibility of variable and light to moderate rain/ thundershowers likely at isolated places.	The possibility of rain farmers are advised to withhold the irrigation and pesticide spray.	Rainfall: 13.0 mm.	No irrigation. Pesticides spray done.	AAS followed by farmers.	1	NIL
26-09-17	Boll formation/ disease management	Possibility of variable and dry weather during the	Picking the cotton after rise the sun and evaporate the dew. Due to possibility of	Dry weather.	Pesticide applied.	AAS followed by farmers.	NIL	1

		period.	favourable weather or after rain the infestation of Boll rot disease may occur in cotton, for control of Boll rot spray 2 gram copper-oxychloride or 2 gram Bavistin per liter water per acre.					
06-10-17	Boll opening/ disease management	Dry weather may prevail in coming days.	Due to favourable weather condition, infestation of myrothecium leaf spot, Bacterial blight in cotton than spray of 800 gram copper-oxychloride mixed with 250 liter water per acre when weather remain clear.	Dry weather	Apply pesticides.	AAS followed by farmers.	NIL	1
03-11-17	Picking	Possibility of dry weather during the period. Shallow fog/smog may occur in the morning hours.	Complete the picking of cotton crop thereafter wheat crop may be sown in the field timely.	Dry weather.	Picking done.	AAS followed by farmers.	NIL	NIL
10-11-17	Picking/ harvesting	Possibility of light rain at one or two places.	Complete the picking of cotton crop thereafter wheat crop may be sown in the field timely.	Dry weather.	Picking done.	AAS followed by farmers.	NIL	NIL

Table 5: Evaluation of AAS bulletins for cotton crop during *kharif* 2018

Date of issue of advisory	Crop condition/ Crop stage	Forecast, IMD	Agromet Advisory issued	Actual weather condition	Action taken by farmers	Remarks (Loss/Profit/ other)	No. of irrigation saved	Pesticide/Chemical saved
04-05-18	Sowing/ Field preparation	Dry weather may prevail in coming days.	Due to possibility of variable weather and light rain, farmers are advice to withhold the sowing of cotton crop.	Dry weather	Field prepared and sowing started.	Good <i>Vattar</i> /tilth condition so insure germination.	Nil	Nil
08-05-18	Sowing (done)	Possibility of variable weather and light rain/thundershowers with moderate dusty winds.	Keeping the view of variable weather do sowing of cotton crop.	Dry weather	AAS not followed	<i>Vattar</i> sustained	Nil	Nil
15-05-18	Sowing (germination start)	Possibility of variable weather and scattered light rain/ thundershowers with moderate dusty winds at isolated places during the period.	Due to possibility of variable weather do intercultural operations.	Rainfall: 8.2 mm.	AAS followed	No application of irrigation and chemicals.	1	1
18-05-18	Sowing (germination complete)	Possibility of variable weather and scattered light rain with squall likely at isolated places	Due to possibility of variable weather do intercultural operation in timely sown crop.	Dry weather was observed.	Intercultural operations carried out by farmers.	Intercultural operation done	1	1
01-06-18	Vegetative stage / 1 st Irrigation	Possibility of dry, hot and variable weather during the period.	Possibility of dry weather, farmers are advice to apply light irrigation in the field	Dry weather	Irrigation applied	AAS followed by farmers.	NIL	NIL
08-06-18	Vegetative stage/Hoeing/weeding	Possibility of Dust storm with squall at isolated places from 9 th June to 11 th June.	Farmers are advice to do the hoeing and weeding, conserving moisture and removing the weeds respectively. Withhold spray and irrigation next 2-3 days.	Rainfall: 2.6 mm.	Saved irrigation & chemical	AAS followed by farmers.	1	1
12-06-18	Vegetative stage/start of square formation/ Hoeing and drain out excess water	Possibility of dry, hot weather and dusty winds upto 15 th June thereafter light to moderate rain at isolated places with winds.	Drain out the excess rain water in the cotton crop as per requirement.	Rainfall: 28 mm.	Hoeing done.	AAS followed by farmers.	-	-
26-06-18	Vegetative stage/start of	Possibility of variable weather and light to moderate rain with	Drain out the excess rain water in the cotton	Rainfall: 48.3 mm.	No irrigation.	AAS followed by	1	NIL

	square formation/ Hoeing and drain out excess water	moderate winds in the region during the period. Light rains may occur.	crop, in case of moderate to heavy rain and winds from 1 th June.		Drained out excess water from field.	farmers.		
17-07-18	Square formation complete/ Flowering start/ Pest management	Light to moderate rain/thundershowers likely at a few places during the period. Light rains with winds may occur.	Possibilities of rainfall, farmers are advice to withhold intercultural / hoeing operations next two to three days. Due to humid weather and favorable temperature infestation of Jassid than spray University recommended insecticides, when weather remains clear.	Rainfall: 8.8 mm.	No irrigation. Drained out excess water from field. Hoeing done.	AAS followed by farmers.	1	NIL
21-07-18	50% Flowering/ Drain out excess water, Hoeing and Pest management	Possibility of light to moderate rain/thundershowers likely at a few places during the period.	Possibilities of rain farmers are advice to withhold intercultural/hoeing operations in cotton crops for next two to three days. Due to humid weather and favourable temperature infestation of Jassid in cotton crop than spray University recommended insecticides, when weather remains clear	Rainfall: 8.8 mm.	No applicatio n of irrigation and chemicals.	AAS followed by farmers.	1	1
07-08-18	Flowering/ Withhold irrigation and pest management	Possibility of variable weather and light to moderate rain / thundershower at many isolated places up to 10 August thereafter variable weather. Light rains may occur.	The possibility of rain farmers are advised to withhold the irrigation in cotton next 2-3 days.	Rainfall 13.6 mm.	No irrigation applied.	AAS followed by farmers.	1	NIL
21-09-18	Boll formation/ Disease management	Dry weather may prevail in coming days. Chances of light to moderate rainfall after 21 st Sept.	Possibility of variable weather farmer are requested keep the changing weather in mind while picking cotton, If necessary, drain excess water from the field. Stop irrigation and chemical spray till 25th September.	Rainfall 37.0 mm.	No Irrigation & Pesticide applied.	AAS followed by farmers.	1	1
12-10-18	50% boll opening/Picking, disease management	Dry weather may prevail in coming days.	Possibility of dry weather farmers are advice for picking the cotton.	Dry weather was observed.	Picking done.	AAS followed by farmers.	Nil	Nil
13-11-18	Picking/ harvesting	Possibility of light rain at one or two places.	Possibility of variable weather farmer are requested to complete the picking of cotton crop.	Dry weather	Picking/ harvesting done.	AAS followed by farmers.	NIL	NIL

Khanet *al.* (2019) ^[2] and Chattopadhyay and Chandras,
(2018) ^[1] also stated that the farmers follow the weather

based advisory services have found an average additional
benefit in yield and economically benefitted.

Table 6: Economic impact assessment of AAS bulletins for cotton crop

Particulars	2017		2018	
	AAS adopter farmers	Non AAS farmers	AAS adopter farmers	Non AAS farmers
B:C ratio	1.71	1.33	1.51	1.06

Total saving of Rs. 20283 ha⁻¹ during 2017, whereas Rs. 37898 ha⁻¹ during 2018 of the adopted farmers over the non-aas farmers.

Conclusion

An agromet advisory service is the provisions of weather information, which help to boost enhance the resilience of crop cultivation against climate change and disasters. Farm management practices were significantly affected by weather based forecasting of agromet advisory services. Medium range weather forecasts are useful tool to manage farm operation. In the find is was found that cotton yield level was increased by reducing cost of cultivation, also results of increased in the net return of the farmer who follow weather based agro met advisory. Hence, the AAS bulletins have positive impact on farmers'. The higher B:C ratio obtained in 2017 as compared to 2018 crop season. On the based results the application of micro level agromet advisory services help for increasing the production with effective and higher income to the farmers.

References

1. Chattopadhyay N, Chandras S. Agrometeorological advisory services for sustainable development in Indian agriculture. Biodiversity. Int J. 2018;2(1):13-18.
2. Khan N, Kumar A, Singh CB, Husan K, Dubey V. Weather based agro-met advisory for sustaining maize yield in central plain zone of Uttar Pradesh. Int. J Chem. Studi. 2019;7(4):263-268.
3. Seeley MW. The future of serving agriculture with weather/climate information and forecasting: Some indications and observations. Agri for Meteorol. 1994;69:47-59.
4. Singh SV, Rathore LS, Trivedi HKN. Verification of medium range weather forecasts. Guide for Agrometeorological advisory services. National Centre for Medium Range Weather Forecasting. Department of Science and Technology, Government of India Publication, India; c1999. p. 73-81.
5. Sridhara S, Gopakkali P, Somashekarappa PR, Pradeep S, Agnihotri G. Validation, usability and assessment of economic impact of agro advisories for southern transitional zone of Karnataka. J Agrometeorology. 2014;16(SI-I):214-218.