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Naushad Khan

Department of Agronomy,
C.S. Azad University of
Agriculture & Technology,
Kanpur, Uttar Pradesh, India

Ajay Kumar

Department of Agronomy,
C.S. Azad University of
Agriculture & Technology,
Kanpur, Uttar Pradesh, India

CB Singh

Department of Agronomy,
C.S. Azad University of
Agriculture & Technology,
Kanpur, Uttar Pradesh, India

Karam Hushan

Department of Agronomy,
C.S. Azad University of
Agriculture & Technology,
Kanpur, Uttar Pradesh, India

Vijay Dubey

Department of Agronomy,
C.S. Azad University of
Agriculture & Technology,
Kanpur, Uttar Pradesh, India

Correspondence**Naushad Khan**

Department of Agronomy,
C.S. Azad University of
Agriculture & Technology,
Kanpur, Uttar Pradesh, India

Weather based agro-met advisory for sustaining maize yield in central plain zone of Uttar Pradesh

Naushad Khan, Ajay Kumar, CB Singh, Karam Hushan and Vijay Dubey

Abstract

Weather plays a dominant role in year to year fluctuation in crop production, both in rainfed or irrigation agriculture, weather information plays a major role during crop season and if provided in advance can be helpful in inspiring the farmer to organize and activate their own resources in order to reap the maximum benefits. Farm losses can be minimized to a considerable amount by making adjustments of agricultural operations through accurate weather forecasts. National Innovation on Climate Resilient Agriculture (NICRA) Project running under the Department of Agronomy, C.S Azad University of Agriculture and Technology, Kanpur adopted two villages, 30 farmers in each village have been selected for providing weather based agro-met advisory (AAS) to the door step of farmers by SRF and FIF of the project. The program was implemented in the period 2014-15 in village Saibasus and Daleep Nagar under the district in Kanpur Dehat, Uttar Pradesh. The results indicated that agro-met advisory (AAS) adopted farmers were able to reduce their input cost by utilization of AAS bulletins in real time. By the use of AAS bulletins they were able to manipulate the cultural practices, irrigation scheduling and fertilizers scheduling, weedicides and pesticides application as per expected weather conditions prevailed during crop period. In quantitative terms, it was observed that the AAS adopted farmers were able to reduce their input cost by 17 and 9 per-cent under the village Daleep Nagar and Saibasus, respectively as compared to non AAS farmers. It is also observed that the AAS farmers yield was increased by almost 5.0% and 14.0% of village Daleep Nagar and Saibasus, respectively as compared to non AAS farmers.

Keywords: Agro-met advisory, maize, weather, yield

Introduction

Climate is one of the most influential natural resource beyond the control of man. Suitable weather factors contribute to optimal crop growth, development and yield. They also play a major role in the incidence and spread of pests and diseases. Even on a climatological basis, weather factors show spatial variations in an area at a given time, temporal variations at a given place, and year-to-year variations for a given place and time. Agriculture is most vulnerable to weather and climate in the world even after the advent of new technologies. Climate variability and change are unequivocal and their impacts on agriculture perceived to be very high. Agriculture plays a vital role in India's economy. Nearly 54.6% of Indian population is engaged in agriculture and allied activities and it contributes about 14% to the country's Gross income. The average size of land holding has been continuously decreasing on account of increasing number of land holdings in India. From an average of 1.41 hectares in 1995-96, size of land holding went down to 1.15 hectares in 2010-11, a decrease of 18%. With rapid increase in population and urbanization, the availability of arable land dwindled considerably from 0.48 ha in 1950 to 0.15 ha in 2005 and is likely to be further reduced to 0.08 ha by 2020 (Mall *et al.*, 2006) ^[1].

Growing uncertainties of weather and climate pose a major threat to food security of the country and thus warrant for providing agro-met advisories to farmers for taking appropriate decisions in agricultural risk management. Droughts cause a huge loss of food grains. In the recent past one or the other part of the country was affected by drought, excessive rain, flood, cyclone, frost, heat and cold waves. These extreme events severely impact agricultural production and disturb the livelihoods of small and marginal farmers (Srinivasa Rao *et al.*, 2016) ^[2]. Even though age old experience and knowledge inherited by the farmers help them in coping with extreme weather events, the increasing frequency of rapid change in weather/climate making them ineffective for tackling the extreme weather related problems in agriculture. Many of the farmers depend on indigenous knowledge for predicting weather and

plan their crops and their management. The advent of forecasting technologies and decision making skills have not yet spread among small and marginal farmers who constitute major part of farming community in the country.

Weather information helps the farmers in cultivars selection, choosing windows for sowing/harvesting operations, irrigation scheduling and optimal water use, mitigation from adverse weather events such as frost, low temperature, heavy rainfall at critical crop stages, nutrient management through fertilizer application, plant protection measures such as

pesticide/fungicide spraying schedules, feed, health and shelter management for livestock.

Materials and Methods

AICRPAM-NICRA Project running under the department of Agronomy, CSAU, Kanpur have initiated micro-level AAS on pilot basis at two villages namely Saibasur & Daleep nagar under Kanpur Dehat District, since past two years. The conceptual diagram of block-level AAS developed by AICRPAM-NICRA is presented in Fig. 1. Such advisories are now designated as micro-level AAS.



Fig 1: Conceptual diagram of block-level AAS

Implementation process

KVK– Daleep nagar was selected, which is located in Shivrajpur Block, Kanpur Dehat for issuing meteorological agro-met advisory to the farmers. With the help of KVK scientists two villages were identified viz. Daleep Nagar and Saibasur. From each village 30 farmers (10 marginal, 10 small, and 10 rich land holders) were selected for providing the agro-met advisories as per the forecast issued by IMD at block level. The agro-met advisories were prepared based on the input received from multidisciplinary team of experts in the KVK and Agro-meteorologist of AICRPAM center. The preparation of block level agro-met advisories starts with collection of block level forecast data issued by IMD from its web site www.imd.gov.in, by the Agro-meteorologist of AICRPAM and provided the same to the Subject Matter Specialists (SMS) of KVK as the first step. For collection and compilation of crop information and farmers queries another novel concept of appointing "Field Information Facilitator (FIF)" was introduced. The FIF serves as the interface between the farmers and Scientists/SMS of AICRPAM and KVK. Further, FIF collects crop information (prevailing local weather conditions, crops and their growth stage, vigour, incidence of pests and diseases etc) and disseminates advisories to the farmers. Generally, a young and progressive farmer in the concerned village is identified for this purpose with the help of peer feedback received from FIF and the block level forecast, micro-level advisories were prepared. Thus, the Agro-meteorologist of the AICRPAM center

develops the agro-met advisory bulletins with the help of SMS at KVK using the field level crop information blended with weather forecasts and communicated to the FIFs by email who pass on the bulletins to farmers. The micro-level AAS is generated in KVK and is disseminated by multiple communication modes, viz., mobile text as well as voice SMS, display at public places and through personal contact etc. The feedbacks obtained from the farmers were further evaluated for improving as well as expanding services for the benefit of farming community.

Results

Impacts of agro-met advisory services

The result revealed that economic benefit obtained by the farmers who adopted the agro-met advisory services (AAS farmers) and those farmers who have not adopted the advisories were comparatively less benefited. The expenditure incurred for raising the crop, in both the situations have been documented in each stage. Regular observations were made on the situation and constantly compared with nearby fields having the same crops where forecasts have not been adopted by non AAS farmers. Further, economic impact was also assessed based on the input incurred during all cultural operation from sowing to harvest. The benefit cost (B:C) ratio of the farmers who followed and not followed the AAS is compared at each NICRA Village. The examples of the same are discussed below (Table 1 & 2).

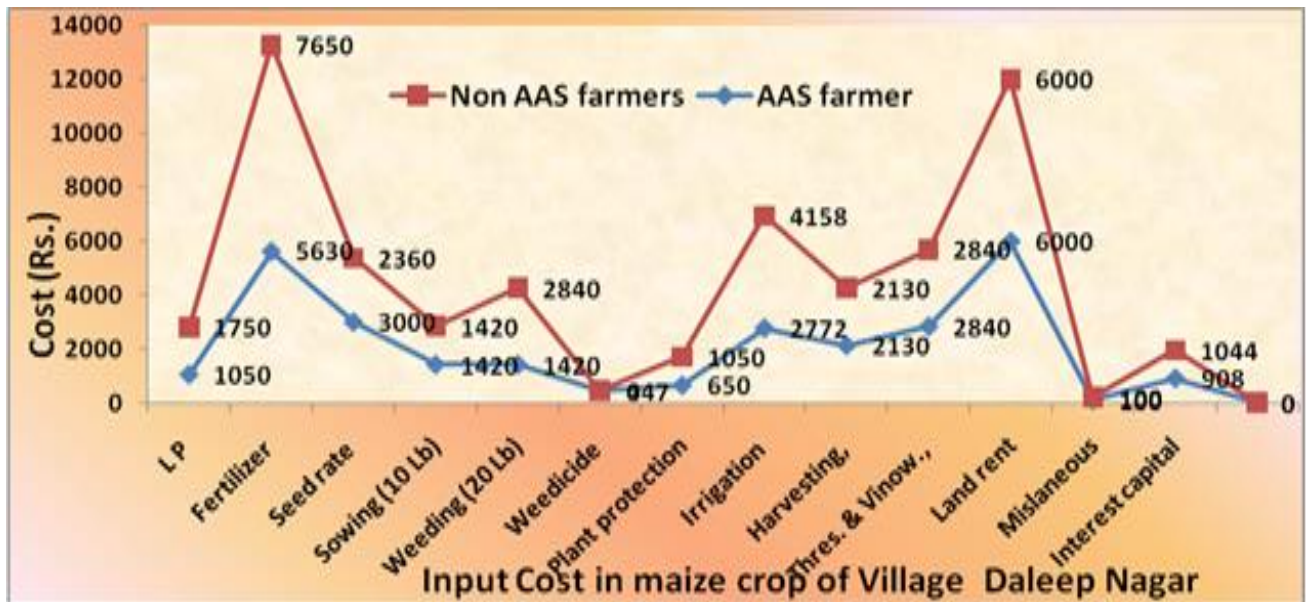


Fig 1: The comparison of input cost analysis between AAS and non AAS growers of maize crop at Village Daleep Nagar

Table 1: The comparison of input cost analysis between AAS and non AAS growers of maize crop at Village Daleep Nagar

Inputs	Cost (Rs)		Saved money (Rs) of AAS farmers
	AAS farmer	Non AAS farmers	
Land Preparation	1050.00	1750.00	700.00
Fertilizer (N:P:K) 120:60:60	5630.00	7650.00	2020.00
FYM 10t/ha	-	-	-
Seed rate (20 kg @ Rs 150/kg)	3000	2360	-640.00
Sowing (10 Labours)	1420.00	1420.00	0
Weeding (20 Labours)	1420.00	2840.00	1420.00
Weedicide (Atrazine) 1.5 kg/ha @ Rs 298/kg	447.00	-	-447.00
Plant protection	650.00	1050.00	400.00
Irrigation 8hr/ha for 2, One Irrigation @ Rs 120/hr + 6 Labours @Rs 142/ Labours	2772.00	4158.00	1386.00
Harvesting, 15 Labours @ Rs 142/ Labours	2130.00	2130.00	0
Threshing and Vinowing, 20 Labours	2840.00	2840.00	0
Land rent	6000.00	6000.00	0
Mislaneous	100.00	100.00	0
Total	27459	32298	4839.00
Interest of working capital	908.00	1044.00	136.00
Total	28367.00	33342.00	4975.00

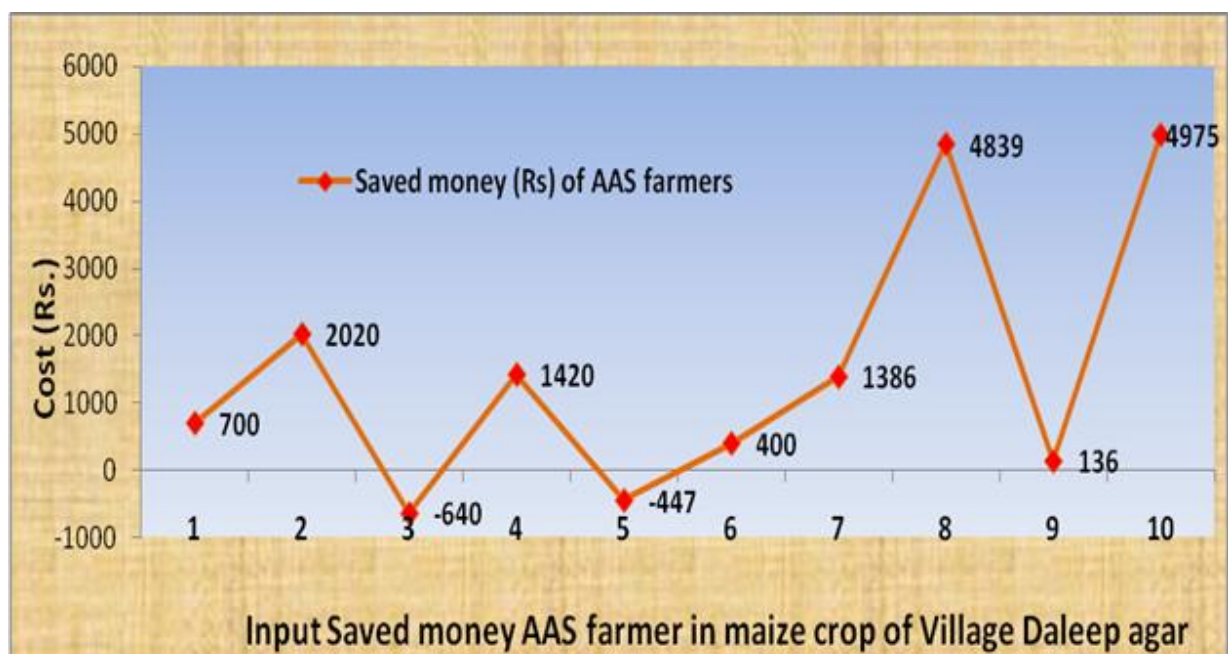


Fig 2: The comparison of input cost analysis between Saved money (Rs) of AAS farmers growers of maize crop at village Daleep Nagar

Table 2: The comparison of input cost analysis between AAS and non AAS growers of maize crop at village Saibusu

Inputs	Cost (Rs)		Saved money (Rs) of AAS farmers
	AAS farmer	Non AAS farmers	
Land Preparation	1050.00	1750.00	700.00
Fertilizer (N:P:K) 120:60:60	5630.00	7650.00	2020.00
FYM 10t/ha @ Rs 300/t	3000.00	0	-3000.00
Seed rate (20 kg @ Rs 150/kg)	3000.00	3000	0.00
Sowing (10 Lb)	1420.00	1420.00	0.00
Weeding (20 Lb)	1420.00	2840.00	1420.00
Weedicide (Atrazine) 1.5 kg/ha @ Rs 298/kg	447.00	0	-447.00
Plant protection (Quinolphos @ Rs 276/lt)	552.00	1104.00	552.00
Irrigation 8hr/ha for 2, One Irrigation @ Rs 120/hr + 6 Lb @Rs 142/Lb	2772.00	4158.00	1386.00
Harvesting, 15Lb @ Rs 142/lb	2130.00	2130.00	0.00
Threshing and Vinowing, 20 Lb	2840.00	2840.00	0.00
Land rent	6000.00	6000.00	0.00
Mislaneous	100.00	100.00	0.00
Total	30361.00	32992.00	2631.00
Interest of working capital	872.00	980.00	108.00
Total	31233.00	33972.00	2739.00

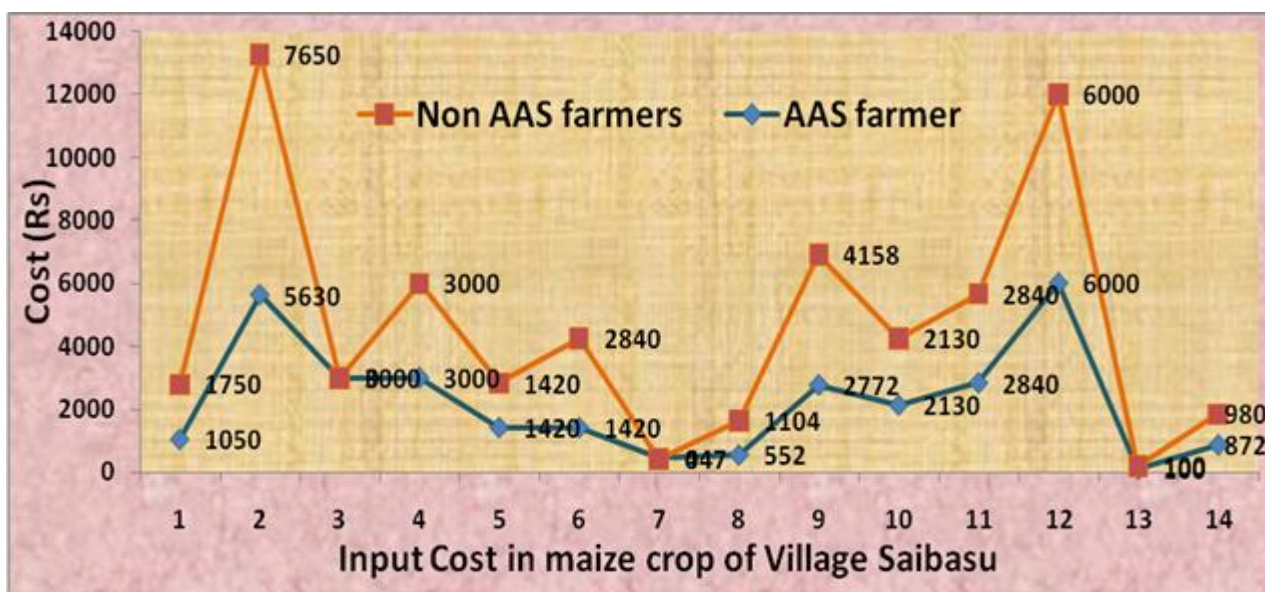


Fig 3: The comparison of input cost analysis between AAS and non AAS growers of maize crop at village Saibusu

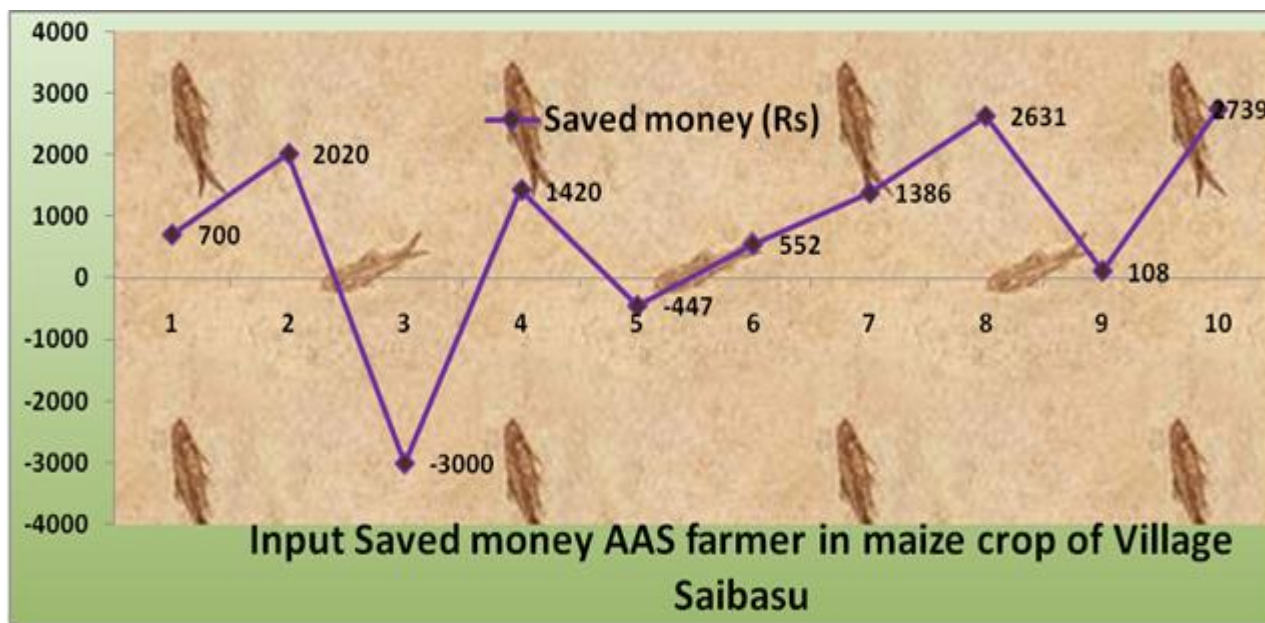


Fig 4: The comparison of input cost analysis between Saved money (Rs) of AAS farmers growers of maize crop at village Saibusu

Cost reduction

It was indicated that application of agro-met advisory services, based on current and forecasted weather have been proved as a useful tool for enhancing the production and income of the AAS farmers. The AAS farmers received weather forecast based agro-advisories, including optimum use of inputs for different farm operations. Due to judicious and timely utilization of inputs, production cost for the AAS farmers was reduced. The increased yield levels and reduced cost of cultivation led to increased net returns. The effectiveness of AAS can only be accessed through economic gain with each or seasonal aggregate of advisories. The impact of AAS in terms of cost reductions at different villages adopted by AICRPAM centers are as under:

- The farmers belonging to adopted villages Saibas and Daleep Nagar of Kanpur dehat district were provided AAS for judicious use of fertilizer application in Maize crops. The farmers saved a minimum Rs 2020.00 ha⁻¹ by adopting the AAS.
- At Kanpur, maize growing farmers of two villages (Saibas and Daleep Nagar under KVK, Daleep Nagar)

in Kanpur Dehat district were provided timely AAS during *kharif* season. The farmers of these villages were able to save the labour charge and cost of irrigation by following the AAS. The savings in the input cost after following AAS was found Rs. 1386.00 ha⁻¹.

The farmers belonging to the adopted villages (Saibas and Daleep Nagar) of Kanpur center were provided with agro-met advisory to stop spraying of pesticides in maize crops. The farmers of these villages saved a minimum of Rs. 552.00 by lesser input cost and labour charges due to adoption of the AAS.

Farm productivity

The agro-met advisory services through various channels have resulted significant increase in farm productivity, resulted in higher availability of food and income. Ad helped the farmers not only in increasing their productions but also reducing their losses due to changing weather patterns and others problems also.

Table 3: Details of AAS issued for the farmers of Saibas and Daleep Nagar

Farmers name	Crop	Area	Forecast	Advisory followed	Benefit
Bramha (Daleep Nagar)	Zaid Moong & Urd	0.23 & 0.34	Light to moderate rain on 15,16&18 June	Stop harvesting and harvested crop should be kept at safer place, stop irrigation, conserve moisture and spraying of pesticides	Save up Rs.2000/-per quintal from quality seed in zaid urd and save up Rs.550/q from moong seed.
Raj Kishor Tiwari (Daleep Nagar)	Zaid Moong & Urd	0.28 & 0.30	Light to moderate rain 27-29 June	Stop harvesting and harvested crop should be kept at safer place, stop irrigation, conserve moisture and spraying of pesticides	Save up Rs.2000/-per quintal from quality seed in zaid urd and save up Rs.550/q from moong seed.
Santosh Kumar (Saibas)	Maize paddy Sorghum (Fodder)	2.19 1.08 0.06	Light to moderate rain 14 - 16 July	Stop irrigation and spraying of insecticide, stop sowing of urd & moong, top dressed 40 kg/ha Urea to take benefit of rain moisture in fodder field at proper moisture and plantation of paddy	Saved labour and seed cost of pulses Rs. 1500/ha, cost of pesticide Rs. 350/ha & tube well charges for irrigation amounting to 1500/ha.
Sushil Tiwari (Saibas)	Maize Paddy Sorghum (Fodder)	0.86 0.68 0.53	Light to moderate rain 12- 14 August	Advise to farmers for skip irrigation, drain out excess rain water and avoid spraying of insecticide	Saved on labour, cost of pests spraying Rs.670/ha the insecticide & irrigation, fuel charges amounting Rs.1500/ha.
Ramakant Shukla (Saibas)	Maize Til	1.19 0.15	Light to moderate rain 18 -19 September	Avoid irrigation, drain out excess water and stop spraying of insecticide	Saved Rs.1500/ha. from irrigation through labour charges and spraying the insecticide of Rs.670/ha.

Contribution of agro-met advisories for climate resilience

Realizing the importance of agro-met advisories in combating the weather related risks including extremes, it has been included as one of the climate resilient technology in climate resilient villages in India (Srinivasarao *et al*, 2016) [2]. It was found to be a high impact adaptation strategy contributing to words climate resilience. Further, it also contributed for input cost reduction, improved income and risk minimization in agriculture.

Cost: Benefit ratio

In quantitative terms, it is seen that the AAS farmers of Daleep Nagar were able to reduce the cost of cultivation by

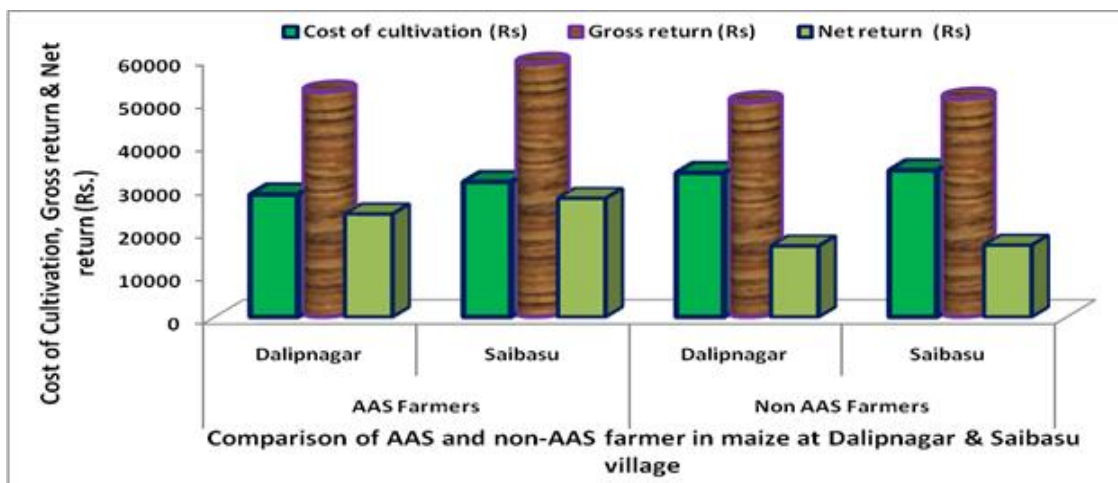
17% as compared to non AAS farmers and also AAS farmers of Saibas village reduced their cost of cultivation 9.0 % than non AAS farmers of the same village (Table 1 & 2). This showed that the right selection of timely land preparation, fertilizer use, plant protection measure, irrigation and timely sowing reduced input cast and benefited the AAS farmers. The farmers were also award through training programmes organized under NICRA project about timely agronomical practices as per predicted weather conditions. It was also observed that due to adoption of advisory services, the crop yield increased by almost 5.0% and 14.0% in Daleep Nagar and Saibas village, respectively (Table 4 & 5).

Table 4: Comparison of BC ratio of AAS and non-AAS farmer due to maize at Daleep Nagar village

S. No.	Status of the farmers	Cost of cultivation (Rs)	Gross return (Rs)	Net return (Rs)	C:B ratio
1	AAS Farmers	28367.00	52200.00	23833.00	1:1.84
2	Non AAS Farmers	33342.00	49760.00	16418.00	1:1.49

Table 5: Comparison of BC ratio of AAS and non-AAS farmer due to maize at Saibasuvillage

S. No.	Status of the farmers	Cost of cultivation (Rs)	Gross return (Rs)	Net return (Rs)	C:B ratio
1	AAS Farmers	31233.00	58690.00	27457.00	1:1.88
2	Non AAS Farmers	33972.00	50578.00	16606.00	1:1.49

**Fig 5:** Comparison of Cost of cultivation (Rs), Gross return (Rs) & Net return (Rs) due AAS and non-AAS farmer due to maize at Daleep Nagar & Saibasuvillage

Conclusions

The micro level agro-met advisories developed with the help of subject matter specialists of the KVK and disseminated back to the farmers. It was observed from the above analysis and discussions that these micro level agro-met advisories are very well working in the farmers fields. The assessment of benefit - cost ratio (B:C ratio) of field crops was found higher in AAS farmers as compared to non AAS farmers. With this confidence, there is need to expand these services to all over Uttar Pradesh for improving the farmers' resilience towards economic stability and crop sustainability and ability to withstand against rising extreme events foreseen by the Intergovernmental Panel on Climate Change.

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