Research Article

ADAPTATION OF AGROMET ADVISORY BULLETIN (AAB) FOR IMPROVING AGRO-ECONOMIC STATUS OF FARMERS

Pralhad Jaybhaye[1*], P.B. Shinde[1] and R. Balasubramanian[2]
[1]*Department of Agricultural Meteorology, VNMKV, Parbhani – 431 401, INDIA*
[2]*Agricultural Meteorology Division, IMD, Pune-411 005, INDIA*
**Corresponding author's E-mail: agmetprj@gmail.com*

KEY WORDS:
GKMS, AMFU, AAB, dissemination

ARTICLE INFO
Received on:
09.02.2018
Revised on:
11.03.2018
Accepted on:
20.03.2018

ABSTRACT
The study was conducted to assess the economic impact of weather forecast-based advisories (AAB) issued to 8 districts in Marathwada region of Maharashtra state. Six years comprising 6 Kharif, Rabi and Summer seasons during 2010-2011 to 2015-2016 were taken. The main aim was to study the percentage increase or decrease in the yield and net return due to AAB. AAB adopted farmers of Marathwada region accrued a mean net benefit of 17 % in the overall yield and mean reduction by 8 % in the cost of cultivation with year to year less variation(7 % and 3%, respectively).

INTRODUCTION

Weather is one of the most important factors determining success or failure of agricultural production. It effects on every phase of growth and development of plant, furthermore it plays vital role in yield deciding factor such as disease, pest and microbe's growth and finally reflected in variation of crop yield. The minor variability in the weather during the crop season, such as delay in the monsoon, excessive rain, hail storm, flood, heavy wind, droughts, spells of heat wave or cold wave would affect the crop growth And finally, it reflects to deteriorate the quality and quantity of the yield. Global warming is now becoming a worldwide concern; the rise of temperature has been felt much more clearly after 1990. Abnormality in climate patterns, induced by accelerated warming. Higher temperatures lead to a high rate of evaporation and dry conditions in some areas of the world. Perennial crops such as fruit trees have faced very serious due to climate change. Qualities of fruits have clearly changed (Sarkar *et al*., 2017). The productivity of the mango and sweet orange not only depends on the annual mean weather condition but also depends on seasonal and weekly weather condition. It is understood that the most important weather parameter affected productivity of mango and sweet orange was due to rainfall in terms of quantum and distribution (Jaybhaye *et al*., 2016). Therefore, some adaptation techniques to mitigate the effects of global warming have been developed. Problems and practical approaches against negative impacts of global warming on fruit crops are required (Sarkar *et al*., 2017). Considering such needs India has been taken started weather service to the farmer community not only in India but also taken initiation in south Asia. The crop growth and yield qualitatively and quantitatively to be more in case of farmers who have adopted the AAS information regularly compared to the farmers who have not adopted the AAS information (Jagadeesha *et al.,* 2010).

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 and agro based rural business best suited to the anticipated climatic conditions. The objective of the weather forecasting is to advice the farmers on the actual and probable weather and its influence on the various day-to-day farming operations i.e. sowing, weeding, application time of plant protectant, irrigation scheduling, fertilizer application etc. and overall crop management (Jaybhaye *et al.,* 2014; Manjappa and Yeledalli, 2013; Rani *et al*., 2015). The transfer of technology was observed useful to development of early-maturing varieties with early seedling vigour and efficient nutrient management techniques along with integrated weed management would encourage farmers to switch over from transplanted rice to direct seeded rice culture (Dhaka and Bairwa, 2017). The Weather forecast benefits to increase agriculture production; decreases losses, risks and costs of inputs, also it improves quality of yield, increase efficiency in the use of water, labour and energy and reduce pollution with judicious use of agricultural

chemicals. Weather varies with space and time, hence, its forecast can help to minimize the farm losses through proper management of agricultural operations. The complete avoidance of all farm losses due to weather factor is not possible but it can be minimized to some extent by making adjustments through timely and accurate information of weather forecast (Vashisth *et al*., 2013).

Weather-based Agro Advisory Services provided through AAB to the AAS adopted farmers could help in proper management of different farm inputs like irrigation, pesticides and human labour by AAS adopted farmers (Rathore *et al.,* 2003). The enhance livelihood of rural farmers who were adopting agro advisory services than the not aware of Agromet advisory services (Jagadeesha *et al.,* 2010). The benefit by the farmers using agromet advisory bulletin and weather forecast for making farm level decisions by farmers from different villages have been discussed in this paper. The main aim was to study the adaptation assessment of AAB on qualitatively, the percentage increase/ decrease in the yield and net return or saving in put cost of agricultural production and livestock rearing.

MATERIALS AND METHODS

Progressive farmers have been taking keen interest in the agro-advisories and are the leading beneficiaries. It is because of weather forecast and weather based agromet advisories help in increasing the agro-economic benefit to the farmers by suggesting them the suitable management practices according to the real time weather conditions. The methodology for this study was used as suggested by Maini and Rathore (2011).

Background

The project Gramin Krushi Mausam Seva (GKMS) which are running by Agrometeorological Field Unit (AMFU) is located at Department of Agricultural Meteorology, Vasantrao Naik Marathwada Krushi Vidypeeth (VNMKV), Parbhani. The major objective of the project is to advise timely and need based crop management practices based on weather forecast to the farmers of Marathwada region of Maharashtra state. 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 (bi-weekly) from RMC, Mumbai of IMD. The weather forecasting scheme operational at National Centre for Medium Range Weather forecast for issuing location specific five days weather forecast in advance and the statistical interpretation methods are used to increase the reliability of the precipitation forecast. Now a day's location specific weather forecast is improved with high accuracy compared with real time weather. Ramakrishna (2013) reported that as with meteorological services, the quality and coverage of agricultural advisory services vary throughout the region. India leads the region in the provision of agricultural advisory services, maintaining a National Centre for Medium-Range Weather Forecasting, which provides weather forecasts at smaller spatial and temporal scales. At present, 622 District Level Agromet Advisory Bulletins are prepared twice in a week and also disseminated to 8.54 million farmers through SMS and IVR technology under Public Private Partnership mode (Reuter Market Light, Handygo, IFFCO Kisan Sanchar Limited (IKSL), Nokia, Mahindra Samriddhi, NABARD, Reliance Foundation, etc.) including Kisan Portal across the country (Anonymous, 2015). GKMS, unit VNMKV, Parbhani is the one of them; which has prepared agromet advisory bulletin (AAB) for all 8 districts independently based on the received real time weather forecast and the actual crop condition of the districts. A case study was undertaken on adaptation of AAB for improving agro-economic status of farmers for assessing the impacts of AAB. The users of AAB were selected adjoining 250km distance from VNMKV, Parbhani for the study and it lies geographically 17^0 35' to 20^0 40' N latitude and 74^0 40' to 78^0 16' E longitude having the altitude 300 to 900 meters above mean sea level covers total geographical area 64.5 lakh ha with cultivable area of 57.0 lakh ha. AAB were disseminated by AMFU, Parbhani which comes under the project GKMS funded by IMD, Ministry of Earth Sciences, Government of India.

Preparation, dissemination and feedback mechanism of the AAB

For issuing the weather based agro-advisories, a forecasting system for generating objective medium-range location- specific forecast of surface weather elements has been evolved by IMD. Location-specific weather forecasts for six parameters, *viz.*, rainfall, cloud cover, wind direction and speed, minimum and maximum temperature were further subjected to statistical and synoptic interpretation by experts and 5-days forecasts in quantitative terms were issued to the GKMS unit twice a week (on every Tuesday and Friday). These forecasts were converted into farm-level advisories by GKMS unit (AMFU)as per AAB format generated by Jaybhaye *et al*. (2014) and recommended by IMD. The prepared AAB disseminated to the farmers in vernacular language(i.e. in Marathi as well as in English (bilingual)) through mass media under multi-mode dissemination channel, awareness programme, popularization programme etc. The major crops considered during generating AAB are cotton, pigeon pea, soyabean, sorghum, maize and bajara in *kharif* season; *rabi* sorghum, wheat, gram, safflower in *rabi* season; turmeric and other vegetables as well as sugarcane (annual); banana, sweet orange, mango, pomegranate, annona (perennial or horticultural crops). It was also considered post-harvest and marketing of agriculture, livestock rearing activities during the preparation of AAB. Public awareness programmes in 'kisan melas', field visits, group meetings on fields, farmers rallies and programmes scheduled different occasions by state government and central government are regularly held at agricultural universities to educate farmers on the usage of farm advisories. The whole process of AAB

dissemination through multi-mode channel of GKMS UNIT, AMFU, Parbhani are described in Table 1. On similar line mode of AAB dissemination uniform strategic results are given by IMD that under the Public-Private Parternship (PPP) mode at present farmers are receiving the agromet advisories in SMS/IVRS (Interactive Voice Response System) directly through mobile. In addition to that with the joint collaboration with NIC/ATMA/KVK/ NABARD/ sending of agromet advisories through SMS. IMD in collaboration with AMFU located in the State Agricultural University, ICAR institutes, IITs has started sending weather forecast and agromet advisories in both regional and English languages through farmer's portal (http:// farmer.gov.in/advs/login.aspx) launched by the Ministry of Agriculture, Government of India in July 2013 to help the farming community in the country. As on today, Agromet Advisories in SMS format are being communicated to 1224810 farmers in the country through this portal (Anonymous, 2015.). The AAB are communicated to IMD for preparation of state and national composite bulletin of agrometeorological advisory and are uploaded bilingually on the IMD website (www.imdagrimet.gov.in) hastily. GKMS unit also reported periodic feedback on worthiness of AAB usefulness in economic terms. Although these studies gave an initial idea about the value of forecast, tangible conclusion could be arrived at only by carrying out the study in greater detail. The SMS system is efficient for dissemination realtime weather based agromet advisory in local language i.e. Marathi. At present, more than thirteen thousand farmers, Agricultural Officers, Print/electronic media persons and other stakeholders of the region have registered forgetting mobile weather SMS service. The registered farmers after receiving the SMS, convey weather information to other farmers of the village (Anonymous. 2016 (a); Anonymous. 2016 (b)).

Table 1. GKMS centre at AMFU, Parbhani disseminated AAB through multi-mode dissemination channel

Sl. No.	Mode of dissemination	Through GKMS, Parbhani	Through other institutes/ partners
1.	Audio	AIR- Parbhani, Aurangabad, Beed, Osmanabad and Nanded	Reliance foundation sponsored programme through AIR- Beed, Parbhani and Nanded.
2.	Doordarshan/Audio visual	All regional TV channels recurrently; through SMS/IVRS (Interactive Voice Response System); directly through mobile/ you tube	Reliance foundation through DISH TV; KVKs and State ATMA through SMS/IVRS (Interactive Voice Response System); directly through mobile/ you tube
3.	Smart phone's (Whatsapp, hike, Facebook etc.)	SMS on district wise Whatsapp/ hike/ Facebook groups	SMS through, other institutes (KVKs, ATMA etc.) NGO's and corporate companies under PPT mode (WOTR, Reliance foundation, Mahindra KisanMitra, Routers Marketing Light etc.) and personal sharing with farmers. SMS through Farmer's Portal- www.farmere.gov.in,
4.	IT	http://www.mkv.ac.in www.mkv2.mah.nic.in http://www.promkvparbhani.blogspot.in/	http://www.imdagrimet.gov.in http://www.imd.gov.in/
5.	Print	Regional News Papers,	AAB replica and Periodicals, Leaflets, Loose-leaf, folders, books. through KVKs, ATMA, State Govt. of Maharashtra etc.
6.	Personal communication	Face to face conversation at centre and during awareness programme; personal discussion through Telephonic , IT chatting and IVRS etc.	Deliberation in farmers rally, workshop, meetings, Seminars etc. by KVKs, ATMA, NGO's and corporate companies under PPT mode.

Impact assessment of AAB

Agromet impact study paradigm

There does not exact any general simulation model for the evaluation of the economic benefits of meteorological assistance to agriculture. However, the benefit can always be assessed in terms of what is apparent or possible and what can be the maximum possible benefit theoretically. The systematic its assessment involves the various stages of the study. As a first step, quantitative weather forecast generated at IMD was disseminated to AMFU in quantitative terms along with information of adverse weather, if any. Weather information was then translated into farm level action-oriented advice by the agricultural scientists at AMFU. It contained weather based advisories, including time and method of sowing, time and amount of irrigation, time and method of fertilizer/pesticide application, etc. Agriculture impacts realized included changes experienced by farmers in terms of a positive (a benefit effect) or negative (an undesired effect) effect, thereby helping them to decide on the selection of crop/variety, sowing/harvesting time, irrigation management, fertilizer management, pest/disease management and other intercultural operations. This formed the backbone of the economic impact study carried out by GKMS in collaboration with AMF units. Assessing impacts of weather forecast application in farm management sector is a stupendous task. It become seven more challenging if one is attempting to quantify the value of weather forecast-based agromet advisories. It was difficult to consider all crop and allied activates related to farming business. Hence a conscious decision was taken to undertake the study covering principal crops (cereal, pulse, oilseed, fruit, vegetable, cash etc. crops and livestock rearing measure. The study period was spread over 6 years comprising *6 Kharif* (monsoon), *Rabi* (post monsoon and winter) and Summer (premonsoon) seasons during 2010-2011 to 2015-2016.

Survey and the questionnaire

The sampling method was designed to work directly with the users of forecast and advisory information, and to meaningfully assess credible cost/loss estimates. The important issue was to develop an effective and meaningful base for assessing the impacts of cost-cutting yield and enhancing decisions. Cost-cutting measures can take a variety of forms, some of which include saving in irrigation, reducing the loss of fertilizer, reducing pesticide application, reducing livestock rearing etc. To obtain quantitative information, working relationships between AMFUs and user farmers were set up through periodic visits. Through such visits, inputs from the farmers were obtained about use and application of the AAB through a pre-devised questionnaire. Thus the sample survey was done independently as well additionally conducted by the agencies (Reliance foundation and KVKs) which provided the questionnaire and therefore, a lesser amount of bias was inevitable. This is one of the slight limitations that have been encountered during the study. The survey gave special attention to dates of sowing, planting, spraying, fertilization, irrigation, tillage and harvesting, transport, storage, operation. Emphasis was given on collecting information on the adoption of advisory by the farmers during such operations and the benefit/loss accrued by them on following/not-following the advisories related to such crucial operations. Based on the above methodology and impact assessment framework, the survey was done using Socio-economic status aspects.

Socio-economic status

The socio-economic status of the farmers was surveyed using queries related to the following in the questionnaire: (a) family structure; (b) size of land holding;(c) cropping pattern; (d) traditional methods used; (e) awareness of AAB; (f) mode of AAB receipt; (g)weather parameters required; (h) satisfaction from service (reliability, timely availability, expected benefits, frequency); (i) utility of AAB etc.

Quantity analysis of used advice given in AAB in (a) preparatory tillage, time of sowing, quantity of seed, fertilizer, pesticide(b) numbers, quantity and method of irrigation; (c) harvesting time, method, storage, processing and marketing techniques (d)utilization of human labour, implements, machinery and its maintenance management etc. to reduce input cost.

The main aim was to study the adaptation assessment of AAB on qualitatively, the percentage increase/ decrease in the yield and net return or saving in put cost of agricultural production and livestock rearing. Hence, the sample set consisted of variable farmers, because of every year increases number of responding farmers as an adopted and given feedback. However, specific economic impact was assessed to understand utility of AAB and deeply economic impact study was not able to worked on the basis of feedback; it is because of farmers are not much intent or responsive to keep such type of data. The majority farmers are not interested in knowing the economic benefit of weather forecast is serious problem (Autade *et al*., 2014).

In this study data was collected by purposive sampling techniques (provided questioner) randomly and computed statistically mean, frequency, percentage and standard deviation by computerised programme 'Statistical Product and Service Solutions (Anonymous, 2013).

RESULTS AND DISCUSSION

The observations of this study was recorded and tabulated. The data given in Table 2 elucidated that the quantitatively and qualitatively significance of AAB disseminated by GKMS centre, AMFU, Parbhani. The dada revealed that very less variability (8%) amongst year to year disseminated numbers of AAB and weather forecast received from other sources in addition to AAB was observed. Whereas, the very high variation was found in number of farmers who have received AAB and

given feedback from the farmers in numbers. It was found due to increased number of users /farmers year to year during study period because of increasing facility for dissemination of AAB through IT, SMS, multimedia, IVRS technology. Whereas, onwards 2013-14 number of farmers increased abruptly due to farmer portal SMS service. These results are similar to observations reported Anonymous (2015).

Table 2. AAB awareness and economic impact of AAB of indusial farmer during 2010-11 to 2015-16

Year	Prepared and disseminated AAB	No. of farmers received AAB in time (through the all multi-channel system)	Weather F'cast received to farmers from other sources in addition to AAB (%)	No. of farmers given feedback (through the different mode)	Net benefit in the overall yield (%)	Reduction in the cost of cultivation (%)
2010-11	84	98000	63	91	7	8
2011-12	88	157000	72	110	19	11
2012-13	82	137000	70	200	27	9
2013-14	88	180000	60	350	16	5
2014-15	80	1039792	78	5197	13	6
2015-16	102	1810209	80	20178	22	11
Mean	87	570334	71	4354	17	8
SD	8	--	8	--	7	3

Table 3. Quality and utility basis classification and usefulness of AAB in % during 2010-11 to 2015-16

Year	Excellent (%)	Very good (%)	Good (%)	Satisfactory (%)	Ordinary (%)	No. farmers reacted AAB was useful (%)
2010-11	50	15	17	8	10	93
2011-12	47	30	7	8	8	70
2012-13	15	32	38	10	5	77
2013-14	12	30	40	11	7	42
2014-15	16	30	14	23	16	50
2015-16	20	35	15	20	10	60
Mean	27	29	22	13	9	65
SD	17	7	14	7	4	19

Secondly, feedback response was found a lesser amount with vide variation in numbers among the years (Table 2); it may be due to lack of awareness for bringing up-to-date recording of AAB adaptation benefit. This result corroborates the findings of the study of Autade *et al*. (2014). Hence, a simple interactive multimedia programme/App is required to overcome such problem.

The data given in the Table 2 revealed that the farmers of Marathwada region of Maharashtra state, who adopted AAB are accrued a mean net benefit of 17 % in the overall yield and mean reduction by 8 % in the cost of cultivation with less variation (7 % and 3%, respectively) year to year. These profit was may be due to the crop management done by the farmers such as timely land preparation and sowing, adoption of recommended seed rate and suitable varieties, timely weeding, harvesting and irrigation and pesticide applications, according to AAB. These results are in conformity with the results of Vashisth *et al.* (2013), reported that the farmers who followed the agromet advisories are able to reduce the input cost up to 6% in wheat, 9.6% in carrot, 7% in rice and increases the net profit by 0.9, 3 and 4% respectively as compared to the non AAS farmers, who did not follow the weather based information. It may be due to low input cost, following weather based management practices and timely management of pests and diseases. Similar results were reported by Gill *et al. (*2010) and Jagadeesha *et al.* (2010).

Furthermore, it showed that the farmers, who followed the AAB are able to reduce the livestock rearing cost and increasing the net profit as compared to the non AAB farmers. It may be due to advice given in AAB was found useful to reduce in rearing cost of livestock by avoiding disease, injury, permanent injury or complete losses during and after aberrant weather condition or weather calamities; which was finally reflected into increase in production (*viz*., egg, meat, milk, wool and draft efficiency). However, it shows more variation individual to individual by AAB adopted farmers (Annual progress report,2015-16), AAS farmers accrued a net benefit of 10–15% in the overall yield from agriculture and a reduction by 2–5% in the cost of cultivation or input cost over the non-AAS farmers.

Earlier many workers reported that weather forecast and weather based AAB are helping increase in the economic benefit to the farmers by suggesting suitable management practices according to the real-time prevailing weather (Maini and Rathore, 2011; Vashisth *et al*., 2013). On the similar line findings of the present case study are obtained and it was observed that the 65 % farmers were reacted that the AAB was found useful to reduce production cost and increased net monitory benefit through proper management of agricultural operations. While, year to year usefulness of AAB are found significantly variable and enlighten in Table 3.Whereas,on the quality and utility basis, AAB adopted farmers given rating as excellent (27 %), very good (29 %), good (22 %), satisfactory (13 %) and ordinary (9 %)with year to year less variation (Annual progress report, 2015-16).These results are in conformity with the results of Manjappa and Yeledalli (2013), the forecasted and related advisories issued for day to day farm activities were found to be excellent in 30.6 cases, very good in 12.5 cases, good in 21.6 cases and satisfactory in 35.3 cases. It can be concluded that the weather forecast and related advisories issued from the Agromet Advisory Service Unit benefited the farming community. Similar results were reported by Patel *et al.* (1998) and Rana *et al*. (2005).

CONCLUSION

It is concluded that adaptation of agromet advisory bulletin (AAB) prepared by GKMS centre based on current weather, forecasted weather and real time field crop condition have a useful tool for enhancing the production and income through which improving agro-economic status of farmers. While, AMFUs have available huge data bank of AAB which are high potential to exploit in the interest of farming community for coping up their difficulties related to weather resilience; however it requires strong mechanism for feedback which should be develop by IMD as well as state agricultural department through financial support system. After success in district level forecast, to communicate weather based AAB on line to the farmers at district level subsequent efforts will be required to generate forecast for 7 days rather than 5 days at district level as well as thasil (Block) and village level as quick as possible.

REFERENCES

Anonymous. 2013. Statistical Package for the Social Sciences (SPSS) version Statistics 22.0 released by IBM on 13 August 2013.

Anonymous. 2015. GKMS-News. 2015. GKMS-News. Agricultural Meteorology Division India Meteorological Department, Ministry of Earth Sciences Quarterly Newsletter. Volume –3, Number-1, January-March, 2015.

Anonymous. 2016 (a). Annual progress report, GKMS, 2015-16.

Anonymous. 2016 (b). Annual progress report, GKMS 2010-11 to 2015-16.Annual report presented in RRC, VNMKV, Parbhani and ARM, IMD.

Autade, C.D., P.S. Shehrawat and S.K. Metha. 2014. The constraints associated with the use of weather forecasting advice. NASA-2014, international symposium, 16-18 october, 2014: Pp373.

Dhaka, B.L. and R.K. Bairwa. 2017. Impact of direct seeded rice technology on rice farmers' earnings: A case study. Inno.Farm., **2**(4): 205-208.

Gill, K.K., P.K. Kingra and Ritu. 2010. Economic impact analysis of agro-advisory services during kharif season in central plain agroclimatic region of Punjab. *Journal of Agrometeorology*, **12**(1): 141-143.

Jagadeesha, N., B.T. Ravindrababu, H.K. Pankajaand and M.B. Rajegowda. 2010. Adoption of agromet advisory services (AAS) for improving livelihood of rural farmers. *International Journal of Agricultural Sciences*, **6**(2): 584-586.

Jaybhaye, P.R., N.H. Deore, N. Chattopadhyay and S.V. Chandras. 2014. Studies of AAB Quality parameters to mitigate impact of climate change on Agriculture. NASA-2014, international symposium, 16-18 october, 2014: 357.

Jaybhaye, P.R., S.D. Gawali, V.K. Mohite, P.B. Shinde, and B.V. Asewar. 2016. Impact of Changing Rainfall Trend on Yield of Mango and Sweet Orange in Marathwada Region. *Indian Journal of Ecology*, **43**(1): 250-253.

Maini, Parvinder and L.S. Rathore. 2011. Economic impact assessment of the Agrometeorological Advisory Service of India. Current Science, **101**(10): 1296-1310.

Manjappa, K. and S.B. Yeledalli. 2013. Validation and assessment of economic impact of agro advisories issued based on medium range weather forecast for Uttara Kannada district of Karnataka. *Karnataka J. Agric. Sci.*, **26**(1): 36-39.

Patel, H. R., A.M. Shekh and H. Venkatesh. 1998. Status of present day weather forecasting to farmers; a case study of middle Gujarat region. *Annals Agric. Res.*, **19**(3): 285–289.

Rana, R. S., R. Prasad and S. Kumar. 2005. Reliability of medium range weather forecast in mid hill region of Himachal Pradesh. *J. Agrometeorol.*, **7**(2): 297-303.

Rani Saxena, K.C. Gupta, Mathur Prasoon. 2015. Economic impact analysis of weather based agromet advisories on crops under climate change scenario. *Journal of Progressive Agriculture*, **6**(1): 100- 102.

Rathore, L.S., K.K. Singh and A. Gupta. 2003. National Centre for Medium Range Weather Forecasting : Activities, current status and future plans. In : National Seminar on Agrometeorology in the New Millennium : Prospectives and Challenges, October 20-31, 2003, PAU, Ludhiana. Abstract/Souvenir. Pp. 141-147.

Sarkar Tanmoy, Ramkumar Dewangan, Sanjay Kumar, Sanvar Mal Choudhary and Sushanta Kumar Sarkar. 2017. Impact of global warming on fruit crops in india. *Inno. Farm.*, **2**(3): 148-153.

Vashisth Ananta, R. Singh, D.K. Das and R. Baloda. 2013. Weather Based Agromet advisories for Enhancing the Production and Income of the Farmers under Changing Climate Scenario. *International Journal of Agriculture and Food Science Technology*, **4**(9): 847-850.

How to cite this article?
Pralhad Jaybhaye, P.B. Shinde and R. Balasubramanian. 2018. Adaptation of agromet advisory bulletin (AAB) for improving agro-economic status of farmers. *Innovative Farming*, **3**(1): 24-30.