"Uses of Weather Forecasting Advisory Services as Disseminated by Dr. R. P. C. A. U. among the Farmers of Muzaffarpur District''

By

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DEPARTMENT OF EXTENSION EDUCATION

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Certificate

This is to certify that the work recorded in this thesis entitled **"Uses of Weather Forecasting Advisory Services as Disseminated by Dr.R.P.C.A.U. among the farmers of Muzaffarpur District"** submitted in the partial fulfilment of the requirements for the award of the degree of **MASTER OF SCIENCE (AGRICULTURE) IN EXTENSION EDUCATION** of the Faculty of Post-Graduate Studies, Dr. Rajendra Prasad Central Agricultural University, Bihar, Pusa (Samastipur) is the faithful record of *bonafide* research work carried out by **Mrs. Shweta Kumari** under my supervision and guidance.

The result of the investigations reported in this thesis work have not so far been submitted for any other degree or diploma. The assistance and help received during the course of this investigation and source of literature have been duly acknowledged.

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We, the undersigned, members of the Advisory Committee of **Mrs. Shweta Kumari,** a candidate for the award of the degree of **MASTER OF SCIENCE (AGRICULTURE) IN EXTENSION EDUCATION** have gone through the manuscript of the thesis and agree that the thesis entitled **"Uses of Weather Forecasting Advisory Services as Disseminated by Dr.R.P.C.A.U. among the farmers of Muzaffarpur District"** may be submitted by her in partial fulfilment of the requirements for the award of the degree.

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Dedicated To

MY RESPECTED PARENTS

"Whose Faith, Blessing, Sacrifice And Perpetual Affection Always Inspired Me To Attain High Ambition In Life"

✍.....*SHWETA KUMARI*

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ABSTRACT

Agriculture is the backbone of Indian economy. Compared to various other sectors of economy, agriculture is unique, whose output is largely dependent on weather conditions. The degree of success of agriculture production and its economics is determined to a significant extent by how well weather conditions corresponding to the optimal requirements of the crop are best exploited to raise the crops. Also, how effectively adverse weather conditions, which cause moisture, thermal, wind, radiation and biotic stress impeding growth and development of crop are managed to minimize their adversity. Further to this, it also depends on management aspects of preventing the crops from severe weather conditions.

Agriculture in India and entire world in mostly dependent on the persisting weather conditions. The alteration is global warming has dramatically effected agriculture and its productivity. The increase in temperature has significantly led to change in the agricultural zones and shift in the growing seasons. On the other hand the change in the rainfall pattern is the serious threat to agriculture, which turn affects the country's economy and food security. The delayed or inadequate monsoons also cause influence on the sale of agriculture inputs such as fertilizers, agrochemicals, tractors etc. So advance weather forecasting is essential for mass awakening. It is evident from experiences that yearly information of weather and appropriate advisory minimizes the production loss of farmers. Therefore, In view of the effectiveness of advisory services study has been proposed with the following specific objectives:

1. To assess the socio- economic and personal characteristics of users.
2. To explore the level of knowledge and attitude of users towards the weather forecasting information.
3. To study the extent of adoption of weather forecasting information as disseminated by R.P.C.A.U.
4. To identify the different constraints as perceived by the users related with adoption of weather forecasting information.
5. To ascertain the relationship between selected socio- economic and personal characteristics of users with the adoption level of weather forecasting information.

The study was conducted in Marwan and Saraiya block of Muzaffarpur district of Bihar. One village was selected from each block i.e. Bhagwatpur and Ballysaraiya. 30 farmers were selected from each village so total numbers of farmers were 60 for study purpose. Twelve independent variables of the study were: Age, Caste, Occupation, Education, Family type, Family size, Annual family income, Social participation, Sources of information utilized, Attitude, Farming experience, Land of size holding. The dependent variables were: Knowledge level and Extent of adoption. All the variables were measured strictly under the set rule and procedure, with scale and schedule developed for the study. An interview schedule was prepared and face to face interview was carried out with farmers. Appropriate statistical tests were used for data analysis.

This study concluded that maximum per cent of farmers were belonged to middle age group, OBC caste, farming occupation, high school education level, joint family type, medium size family, less than Rs.50, 000 annual family income. Likewise farmers had not member of any organization in social participation, often used TV and AAS bulletin as source of information, above 10 years of farming experience, marginal land holding group. It is also concluded that farmer had medium level of knowledge about weather forecasting information, medium favourable attitude towards weather forecasting information, medium level of adoption of weather forecasting information. It can be observed that “Farmers could not understand SMS on mobile due to lack of knowledge of its application” and “The farmers cannot get time to view weather forecast advisory services due to delay in media” has got first and second rank respectively while “Farmers are not able to know the economic benefits of weather forecasts” has got last rank in constraints perceived by the farmers. It is also observed that attitude and size of land holding had a positive significant association with the level of adoption of farmers towards weather forecasting information.

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CHAPTER - I

INTRODUCTION

INTRODUCTION

Agriculture is the backbone of Indian economy. Compared to various other sectors of economy, agriculture is unique, whose output is largely dependent on weather conditions. The degree of success of agriculture production and its economics is determined to a significant extent by how well weather conditions corresponding to the optimal requirements of the crop are best exploited to raise the crops. Also, how effectively adverse weather conditions, which cause moisture, thermal, wind, radiation and biotic stress impeding growth and development of crop are managed to minimize their adversity. Further to this, it also depends on management aspects of preventing the crops from severe weather conditions.

Ideally, technical progress in agriculture should reduce overall dependence on weather and climate. But the link between yield and weather or climate does not seem to be decreasing. The effects of meteorological conditions are most pronounced on high yielding varieties of crop with increased sensitivities to environmental conditions, requiring maximum optimization of water, air, thermal and nutritional conditions. The biological potential of the plants manifests itself best in favorable conditions and is severely reduced when conditions are adverse. This results in large fluctuations in annual crop yields whose scale exceeds the increase in yields from the growth in agriculture. For this reason, the information is increasing. Using information on the effect of weather and climatic factors on agricultural productivity in an educated manner can not only reduce damage, but can also make it possible to obtain additional yield without significant financial outlays. Thus, the weather forecast based agro-advisories assumes considerable importance for agricultural activities.

For effective planning and management of agricultural practices such as selection of cultivar, sowing, need-based application of fertilizer, pesticides, insecticides, efficient irrigation and harvest, weather forecasts in all temporal ranges are desirable. Weather forecast in short and medium ranges greatly contribute towards making short-term adjustments in daily agricultural operations which minimize losses resulting from adverse weather conditions and improve yield and quantity and quality of agricultural productions.

Meteorological information also plays an important role in the following operations in agriculture:

- Higher and regulated crop yields
- Lower production costs
- Environmental protection
- Better product quality
- Land management: diversification, soil conservation
- Water management: issues related to farm irrigation, urban water needs, and water conservation measures
- Combat unfavorable consequences of weather including pest and disease management
- Breeds and varieties adapted to local agro climatic conditions
- Better consideration of meteorological factors that affect animal behavior and health
- Multiple cropping systems for irrigated areas and tree based farming system for rainfed area
- Integrated pest management
- Soil and water conservation
- Watershed management
- Agro forestry systems in dry lands, sloppy areas and erosion prone areas
- Water technology

Hence, the meteorological services can help the farmers & the planners exploit the potential of good weather and minimize the impact of bad weather as there exist tremendous opportunities for applications of meteorology in both day to day and long term planning in agriculture and such applications could contribute substantially to promote sustainable agriculture and poverty alleviation and the management of agro meteorological data is the key to these applications. Weather information and advisories are assuming greater significance under the increased variety in the changing climate.

Weather forecasting

Weather forecasting is the prediction of what the atmosphere will be like in a particular place by using technology and scientific knowledge to make weather

observations. In other words, it's a way of predicting things like cloud cover, rain, snow, wind speed, and temperature before they happen.

Once a human-only endeavour based mainly upon changes in barometric pressure, current weather conditions, and sky condition, weather forecasting now relies on computer based models that take many atmospheric factors into account. Human input is still required to pick the best possible forecast model to base forecast upon, which involves pattern recognition skills, teleconnections, knowledge of model biases. In accuracy of forecasting is due to the chaotic nature of the atmosphere, the massive computational power required to solve the equation that describe the atmosphere, the error involved in measuring the initial conditions, and an incomplete understanding of atmospheric processes. Hence, forecasts become less accurate as the difference between current time and the time for which the forecast is being made (the range of the forecast) increases. The use of ensembles and model consensus help narrow the error and pick the most likely outcome.

Weather forecasting Organisation

Several organisations all-over the world measure weather elements and forecast weather condition. Accepted norms are developed for measuring, assigning values and codes for different countries. Indian Meteorological Department was established in 1875 with headquarters at Pune.

Agricultural meteorological division was started in 1932 for conducting research on crop weather relationships. A major step was taken in early forties to set up specialized meteorological observatories in a crop environment to inculcate weather consciousness among farmers and to develop farm environment climatology. This has resulted in a steady growth of observatories, which at present number about 125. Besides agromet observatories, synoptic weather stations also record data such as rainfall, temperature, radiation, low level wind, evaporation etc. The National commission on Agriculture recommended establishment of principal Agromet Observatories in each of the Agricultural Universities.

The synoptic observatories collect information on various weather elements on the basis of which daily forecast, warnings and weather reports are prepared by five regional forecasting centres situated at, Nagpur, Mumbai, Delhi and Kolkata. The Regional centres also prepare indicating the probable date of onset of monsoon,

intensity, duration, breaks in rainfall and other adverse weather phenomenon. The bulletins are broadcasted in the regional languages through radio and television along with rural programmes.

Essential requirement of weather forecast

The essentials features of weather forecasting are:

- Proper recording of data,
- Careful study of synoptic charts,
- Search for similar situation from the historical data,
- Preparation of the weather condition charts as may be possible in next 24 hours and
- Drawing quick, correct and definite conclusions regarding future weather phenomenon.

Types of weather forecasting

Based on time or duration of forecasting period, the weather forecasting can be divided into:

- Short range weather forecasts are for one to three days. These daily forecasts are useful to irrigation engineers and farmers.
- Medium range weather forecasts are for 3 to 10 days.
- Long range forecasts are for periods of more than four weeks. The long range forecasts are useful for choosing crop pattern.

Methods of weather forecasting

Persistence

Persistence forecasting is based on the concept that current weather conditions can reveal clues to tomorrow's forecast. Meteorologists who rely on this forecasting method predict that current conditions will persist, or continue unchanged. They make observations using thermometers and barometers to assess the weather and then conceive that the next few days will feature similar weather patterns. This forecasting technique works best in areas with predictable weather patterns, such as a tropical zone or an arctic region.

Synoptic

Synoptic or analogue forecasting is a method of predicting the weather based on accepted theories and principles of meteorology. This technique requires some skill and training, and incorporates weather maps, radar and satellite images. Forecasters combine these tools with information about atmospheric pressure, air flow and temperatures to come up with a forecast. Synoptic forecasting served as the primary method of predicting the weather through the 1950s and '60s. It's still used today for short term predictions.

Statistical

Statistical or climatological forecasting allows meteorologists to make predictions based on historical trends. It assumes consistent weather patterns over time. Forecasters examine historical information about average, high and low temperatures to estimate future temperature ranges. They also examine historical storm records and precipitation amounts and use those as a basis for forecasting. For example, a statistical forecaster may state that the next month will bring rain and cold temperatures because that is considered the normal condition for this area at this time of year.

Computer Modeling

Computer modeling forecasts represent the most advanced method of predicting the weather. This method relies on mathematical formulas that are designed to model atmospheric and weather conditions. By inputting current weather data, the meteorologist can calculate future conditions. Top weather-related agencies, such as the National Weather Service and National Hurricane Center, rely on this form of forecasting to maximize accuracy.

Agromet Advisory Services

The sources of weather and climate-related risks in agriculture are numerous and diverse: limited water resources, drought, desertification, land degradation, erosion, hail, flooding, early frosts and many more. Effective weather and climate information and advisory services can inform the decision-making of farmers and improve their management of related agricultural risks. Such services can help develop sustainable and economically viable agricultural systems, improve production and quality, reduce losses and risks, decrease costs, increase efficiency in the use of

water, labour and energy, conserve natural resources, and decrease pollution by agricultural chemicals or other agents that contribute to the degradation of the environment. Thus, the importance of the Agromet Advisory Services that have now been established at district levels in India.

These Services meet the real-time needs of farmers and contribute to weather-based crop and livestock management strategies and operations dedicated to enhancing crop production and food security. They can make a tremendous difference in agricultural production by assisting farmers in taking the advantage of benevolent weather and in minimizing the adverse impact of malevolent weather.

Putting the structure in place

India Meteorological Department (IMD) began regular weather services for farmers in 1945 in the form of a "Farmers' Weather Bulletin" and broadcasts through All India Radio in regional languages. In 1971, on the recommendation of the National Commission on Agriculture (NCA), it launched Agrometeorological Advisory Services (AAS), a comprehensive tool tailored to farmers' need. Then in 1975-1976, the U.S. National Aeronautics and Space Administration (NASA) conducted a Satellite Instructional & Television Experiment (SITE) with IMD and agricultural agencies that led to the production of crop specific weather-based agronomic advisories for different regions of the country. These integrated Agromet Advisory Services were further developed in 2007 and have steadily been improved since.

IMD is implementing operational agrometeorological schemes across the country under a five-tier structure:

- Top-level policy planning body in Delhi
- Execution by the National Agromet Service headquarters in Pune
- Coordination and monitoring by State Agromet Centres
- Definition of the agro-meteorological zone
- District or local level extension and training for input management advisory service

Weather services to agriculture

All agrometeorological and agroclimatological information that can be directly applied to try to improve and protect the livelihood of farmers in agricultural production may be considered to belong to agrometeorological services. This improvement or protection applies to yield quantity, quality and income while safeguarding the agricultural resource base from degradation. The Agromet Advisory Services provide a very special kind of inputs to the farmers as advisories that can make a tremendous difference to the agriculture production by taking the advantage of benevolent weather and minimize the adverse impact of malevolent weather. This has a potential to change the face of any country in terms of food security and poverty alleviation. Agrometeorological services rendered by India Meteorological Department (IMD), Ministry of Earth Sciences is a step to contribute to weather information based crop and livestock management strategies and operations dedicated to enhancing crop production and food security. IMD is operating a project "Gramin Krishi Mausam Sewa" (GKMS) with an objective to serve the farming community at different parts of the country. The following are the major activities being carried out under this project minimising the threat on the biodiversity in the agricultural system in India.

Generation of weather forecast & agromet advisory

Based on the medium range weather forecast, AAS bulletins have been prepared for 636 districts and issued on every Tuesday and Friday. State Composite bulletins and National AAS bulletins have also been issued simultaneously. Efforts are being made to prepare AAS bulletins for all the districts of the country. Efforts have also been made for preparation of accurate medium range weather forecast by value addition from Regional Meteorological Centres (RMCs) and Meteorological Centres (MCs). To help the farmers to cope with climate risks and also for effectively use seasonal to inter-annual climate forecasts, IMD in collaboration with Central Research Institute for Dryl and Agriculture, Hyderabad continued issuing AAS Bulletins based on Extended Range Weather Forecast and Monthly Weather Forecast during southwest monsoon 2017 to fulfil the needs of different users including planners at State and National levels and farmers.

Special advisories for extreme events

In a large country like India which is experiencing cyclone, floods, droughts, hailstorms as an extreme events every year, the weather may be nullified to a large extent by suitable adoptive measures dissemination through Agromet Advisory Services by aberrations of India Meteorological Department is doing yeomen's service by providing advance information including monitoring of the disaster events by using state of art instruments & technology. Such type of advisories is issued in cyclone, floods and droughts so that the farmers can minimize the crop loss. Also, IMD is having different kinds of network of observatories in India to monitor and assess the weather which are Conventional Observational Network, Automatic Weather Stations (AWS), Buoy or Ship Observations, Cyclone Detection Radars, Doppler Weather Radars and Satellites observations. Another two important issues which are being dealt are extreme weather events and climate change & variability. Around 26 Doppler weather radars were installed and also various types of satellite data is being used to provide information about extreme weather events like heavy rainfall to save the crops and also contingency planning is given to the farmers for taking appropriate crops in respect of expected climate variability during the monsoon season Synoptic Methods, Statistical Methods and Numerical Weather Prediction models developed based on these observational network can be used for generation of rainfall, temperature, thunderstorm, dust storm, clouds, cyclonic storms (their courses and stages), heavy rainfall warnings, frost warning, squall warning, heat waves, cold waves etc. Digital and image information at 10 minutes interval from Doppler weather radar is very useful in addition to many other observed data in predicting thunderstorm activity. Specialized products derived from satellites such as Normalised Difference Vegetation Index (NDVI), surface insulation, Leaf Surface Temperature (LST), Albedo, reference evapotranspiration, soil moisture, Aridity index, satellite-based rainfall etc. also play very significant role in disaster management in agriculture. Such generated agromet products are useful if they were promptly delivered to the end users to reduce disaster management risk for farmer community. Due to this information, farmers can tackle the situations under different extreme weather events and ultimately reduces the impact of bad weather. Efforts have also been made through automated advisory tools to develop a mechanism for

generation of agromet advisories along with crop and its stages by using realized data recorded at surface observatories under Network of IMD.

Dissemination of weather forecast, agromet advisories and extension activities

Dissemination of agromet advisories to the farmers through different multi-channel system of like All India Radio (AIR) and Doordarshan, private TV and radio channels, newspaper and internet, SMS and IVR (Interactive Voice Response Technology) etc. is being made on wider scale. Under PPP mode, Reliance Foundation, Reuter Market Light, IFFCO Kisan Sanchar Limited (IKSL), NOKIA-HCL, Handygo, Mahindra Samriddhi, Kisan Sanchar, National Bank for Agricultural and Rural Development (NABARD) are disseminating agromet advisories in SMS and IVR format to the farming community. In addition to that number of Agromet Field Units (AMFU) has started sending agromet advisories through SMS in collaboration with National Informatics Centre (NIC), Agricultural Technology Management Agency (ATMA), KVK, NABARD and Internet. Agromet Advisories are also being disseminated in both Regional and English languages through "Kisan SMS", a portal (http: //farmer. gov.in/advs/login.aspx) launched by the Ministry of Agriculture, Government of India. At present 21.69 million farmers are benefitted by this service directly. Weather forecast and advisories under alerts and warnings through SMS during extreme weather events are also issued which enable the farmers in planning of farming operations to minimise or control damage of crops under the adverse weather conditions.

India Meteorological Department (IMD) in collaboration with Agromet Field Units (AMFUs) disseminates weather forecast and Agromet Advisories to the farming community in the country in both regional and English languages through farmers' portal (http://farmer.gov.in/advs/login.aspx). The services helped the farmers not only in increasing the crop production but also reducing the losses due to inclement weather and other problems. In order to increase the number of farmers in the Kisan Portal, a system of registration through IMD's website has been developed by IMD and National Informatic Centre (NIC), Pune to provide weather based Agromet advisories to more number of farmers through free SMS. To avail this service, farmers are required to register their name and mobile number along with the crops.

Usefulness of Weather Forecasts for Agriculture

- **Climate-based strategic agronomic planning**

  For optimal productivity at a given location, crops and cropping practices must be such that their cardinal phased weather requirements match the temporal march of the relevant weather elements, and at the same time endemic periods of pests, diseases and hazardous weather are avoided. In such strategic planning of crops and cropping patterns, short –period climatic data, both routine and processed (such as initial and conditional probabilities), have a vital role to play.

- **Occurrences of erratic and adverse weather**

  Agronomic strategies have to be devised to cope with the effects of erratic and adverse weather on agricultural production. For example, delay in the start of crop season can be countered by using short duration varieties of crops and thicker sowings and the effects of frosts can be prevented by resorting to irrigation or lighting trash fires. Medium range weather forecasts with a validity period that enable farmers to organize and carry out appropriate cultural operations to cope with, are clearly useful.

The following kind of forecast is mainly useful in operational agrometeorology. Short and Medium Range Forecast for agriculture is useful for the following activities:

- Preparatory activities, including land preparation and preparation of plant material
- Planting or seeding or sowing; Management of crops, fruit trees and vines
- Application of fertilizer, irrigation; thinning, topping, weeding; pest and disease control; Management of grazing systems
- Harvesting, on-farm post-harvest processing
- Transport of produce; Livestock production activities (for dairy enterprises, beef systems, lamb and other livestock systems)

Justification

Climate change is the most important global environment challenge facing humanity with implications for natural ecosystem, agriculture and health.

Agriculture in India and entire world in mostly dependent on the persisting weather conditions. The alteration is global warming has dramatically effected agriculture and its productivity. The increase in temperature has significantly led to change in the agricultural zones and shift in the growing seasons. On the other hand the change in the rainfall pattern is the serious threat to agriculture, which turn affects the country's economy and food security. The delayed or inadequate monsoons also cause influence on the sale of agriculture inputs such as fertilizers, agrochemicals, tractors etc. So advance weather forecasting is essential for mass awakening.

It is evident from experiences that yearly information of weather and appropriate advisory minimizes the production loss of farmers and R P C A U, Pusa is providing weather based farmers advisory. Therefore, In view of the effectiveness of advisory the present study is planned.

From this background, this investigation was planned and conducted with the following specific objectives:

6. To assess the socio- economic and personal characteristics of users
7. To explore the level of knowledge and attitude of users towards the weather forecasting information
8. To study the extent of adoption of weather forecasting information as disseminated by R.P.C.A.U.
9. To identify the different constraints as perceived by the users related with adoption of weather forecasting information
10. To ascertain the relationship between selected socio- economic and personal characteristics of users with the adoption level of weather forecasting information

Problem of statement

Bihar is one of the most climate-sensitive states in India due to its geographical setting, hydro-meteorological uncertainties, dense rural population and high level of poverty. Agriculture contributes 21.3% of Bihar's GDP and will continue to play an important role in the economic development of the state and as a prime source of livelihood for about 90% of the population. The State Government of Bihar acknowledges that climate change is one of the major challenges of agriculture in the state, and its overall strategy is to transform agriculture and its allied sectors

into climate-resilient and vibrant production systems while developing their full potential and ensuring sustained food and nutritional security.

Increasing temperatures and variations in rainfall patterns over time, coupled with frequent mid seasonal droughts and floods are clear evidence that the climate has changed in Muzaffarpur. Farming is the chief source of livelihood in the district but the rain fed agriculture is highly vulnerable to the vagaries of climate change.

Responding to climate change through mitigation will take time and therefore adaptation becomes critical particularly where the ability to adapt is low. Negative impacts of climate change can be reduced through adaptation, which requires involvement of the local community. Government policy to promote adaptation to climate change is in place but seems not to cope with the looming food in security in Muzaffarpur district. Through government, from different institution, they provide weather forecast advisory services to reduce the loss. The government places a lot of emphasis on adaptation methods such as use of high breed seed, drought resistant crops, early and late planting, conservation farming and irrigation schemes in the area. Response to weather forecast advisory services through adaptation however, appears to be weak. It seems that there is a gap between the rate at which climate is changing and the response to reduce its impact through employment of adaptation strategies that ensure sustainable food security by Muzaffarpur farmers. In spite of this, factors that influence farmers' decisions to adapt to weather forecast advisory services in Muzaffarpur district are not known. This study seeks to investigate the uses the weather forecast advisory services among the farmers of Muzaffarpur district.

Scope of the study

It is well known that Agricultural productivity largely depends on weather. Weather forecast in temporal ranges is desirable for effective planning and management of agricultural practices. At the same time, lacking of this information to the farmers resulted in crop failure and due to this many farmers remains unemployed and their monetary returns are also not satisfactory. Hence at this juncture, weather forecast advisory services has emerged as an important venture to farmers, as it does not require very complicated technology and can be started, by only the use of weather forecast advisory services and it does not require any capital. The present study will generate the knowledge and adoption of weather forecast information. The

findings of the study would expose the fact about the uses of weather forecast information in agriculture to increase the income and employment generation of the rural population.

Limitation of the study

Though an effort were made to make the study as exhaustive systematic and complete as possible yet the study did suffer from time and resources constraints as usually happen in any research project. The investigation was carried out with the help of interview schedule and data were collected face to face situation, hence the objective would be limited only to the extent, the information received from respondents were correct and true reflection of their existing situation. Under this situation the question is constrained to some degree with the problem of objectivity.

As far as possible more appropriate method of measuring dependent and independent variables have been adopted. Some scale were available which were used with high precision but in some cases there was no alternative left for the researcher expect to develop some measuring devices. Hence, precision slightly differed in different variables. The study was restricted to the variables covered under the study, the result would have been different as researcher opted for some more variables with still better measuring instruments.

Since, the study as confined to two selected villages (Bhagwatpur) from Marwan block and (Ballysaraiya) from saraiya block of Muzaffarpur district of Bihar having different categories of farmer. The findings of the study may not be applicable beyond the preview of the investigation, unless the existing conditions are by and large, similar. The research was done with small sample because it suffers from its own limitation in generalizing the findings on large scale. The most of the study may consider as timely investigation to assess the situation. Despite all these, the present study is a successful attempt to reckon the uses of weather forecast advisory services among the farmers.

Layout of the thesis

The thesis is presented in five chapters. It opens with the introductory chapter, which deals with the need and importance, objectives, statement of problems scope and limitations of the study. The second chapter consists of review of related literature. The methodology adopted for the research is explained in the third chapter.

The findings and discussions constitute the content of the fourth chapter. Finally, the fifth chapter contains the summary and conclusion of the investigation, implications of the research and suggestions for future research. The literature consulted and cited in the body of the presentation has been enlisted in separate section after the summary and conclusion. This is followed by the relevant appendix prepared and use during the study.

CHAPTER - II

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The purpose of this chapter is to report the findings and reviews undertaken by previous investigators on different aspects of the study in the light of the objectives set forth. In accordance with the objectives of the study, the review of literature has been chronologically organized and presented under different heads as given below.

2.1 Socio- economic and personal characteristics

2.2 Knowledge level and attitude of users towards the weather forecasting information

2.3 Extent of adoption of weather forecasting information

2.4 Constraints as perceived by the users related with adoption of weather forecasting information

2.5 Relationship between selected socio- economic and personal characteristics of users with the adoption level of weather forecasting information

2.1 Socio-economic and personal characteristics

Studies pertaining to socio-economic and personal characteristics of farmers about weather forecast information were not reported more. Hence, an attempt has been made here to review the related literature initially.

Shiferaw & Holden (1998) found that age influences farmers' exposure to different farming systems, experiences and seasons. Thus, it is expected that "increasing farmers' age" affects positively perception on climate change.\

Rijks and Baradas (2000) used conventional methods of communication, such as bulletins, pamphlets, posters, postal letters, newspapers, radio, television, (mobile) phone, pagers, local announcements, village meetings, local time-bound markets and personal communication are better to reach the second group of users.

World Bank (2001) reported that gender gaps in agriculture as related to land ownership and agricultural land size , livestock, mechanical tools, farm inputs and financial and extension services such as agricultural credits and technical training in every region of the planet. Women‟s agricultural activities are also reported to be

under resourced and undercapitalized compared to men, a gap that reduces efficient investments in new technologies aimed at facilitating adaptation to climate change.

Bielders, Ramelot & Persoons (2003) reported positive association between education and farmers awareness on soil erosion. Education increases farmers' perception on climate change and thus its effect is hypothesized positively.

Tenge, Graaff de, Hella (2004) recorded that farmer who involves mainly off-farm activities may not perceive climate change because there is no or less likely to engage on farm activities. Thus, this variable can negatively associate with farmers' perception on climate change.

Schipper (2004) recorded that improved education and information are described as crucial factors to determine adaptive capacity and sustainable development. It is believed that households that at least have basic education are likely to prompt enough to respond against the changing climate and are not resistant for innovative climate change adaptation technologies.

Rathore *et al.,* (2006) studied based upon a farmer's experience with traditional weather forecasts and expected losses due to adverse weather at different stages of crop growth, the extent of his or her use of forecasts may vary at different seasons and crop-growth stages. Thus, particularly in developing countries, there could be a number of categories of farmers using forecasts and other information.

Wanjiku *et al.* (2007) studied using multinomial logit also found that gender, formal and informal training of the household head significantly influenced the choice of mechanization technology on small farms in Nyanza province of Kenya.

Hepworth and Goulden (2008) found that developing countries had especially been vulnerable to climate change because of their geographic exposure, low incomes, and great reliance on climate sensitive sectors such as smallholder agriculture.

Nhemachena and Hassan (2008) found age to have no significance in influencing the choice of an adaptation strategy to climate change.

H.S Kushwaha (2008) discussed the economic impact of National Centre for Medium Range Weather Forecasting (NCMRWF), Noida's five days location specific medium range weather forecast (MRWF) applicable for Tarai & Bhabar agro-climatic

zone of Uttarakhand, India, during rice seasons of 2004 and 2005. The paper focuses the benefits earned by farmers by better understanding the weather related information and forecast for increasing rice production over those not following the advisory on weather sensitive farm operations in the zone. The AAS farmers harvested an average of 18.0 and 19.2 q acre-1 as compared to 17.3 and 18.1 q acre-1 yield of rice crop, which was 6.8 and 8.9 per cent more than NON-AAS farmers for both the Kharif seasons of 2004 and 2005, respectively. The AAS farmers were able to reduce 7.6 and 9.0 per cent input cost as compared to NON-AAS farmers for both the year 2004 and 2005, respectively. Ultimately the AAS farmers gained 21.8 and 24.3 per cent more income than NON-AAS farmers for the year 2004-05 and 2005-06, respectively. The benefit-cost (B/C) ratio of AAS and NON AAS farmers were 1.7 & 1.8 and 1.5 & 1.6 for both the kharif seasons of 2004 and 2005, respectively indicating that farmers using the advisory on weather sensitive farm operations have been benefited significantly and required agromet advisory service to continue in future for appraisal of their economic conditions.

Gbetibouo *et al*., (2009) studied on understanding farmers Perceptions and adaptations to climate change and variability. Results showed household size, wealth, farm size, farming experience, perception of soil fertility, access to credit, extension services and off farm activities, tenure security and climate variables as significantly influencing this decision.

Lazo *et al.,* (2009) identified television, radio, the internet, and electronic devices as some of the many sources people turn to when they search for weather information.

Deressa *et al.,* (2010) observe that farmers with larger farm sizes are also wealthier farmers who can depend on savings and are therefore less likely to adopt strategies such as livestock sale and borrowing from relatives as adaptation options to climate change and variability

Chikozho (2010) explained utilisation of scientific information on climate change and variability, is predicated on well-packaged and disseminated information.

Meinzen-Dick *et al.,* (2010) founded that climate change affecting food production directly especially on rainfall dependent farms, women's response to climate change will depend on the needs, challenges and resources they can access.

Handmark (2010) founded that many Americans who use the internet on their phones are seeking weather information as well.

Geir Inge Orderud (2011) found that the most information sources for Norwegian mayors are science, the county governor‘s environmental department and the municipal environmental officer, with consultancy playing a minor role. It is noticeable that full time environmental officers have a broader climate change information network than part-time officers. Furthermore, a higher level of education helps to increased interaction with other public sector actors and hence increased knowledge of climate change.

Grotticelli (2011) reported that cable television stations, like The Weather Channel, and the internet also garnered a large proportion of source choices.

Demuth *et al.,* (2011) found that 1461 respondents to the survey, some 83.5% of respondents reported that they use three or more sources a week, while 43.6% use five or more different sources a week.

Purcell (2011) revealed that adults are most likely to download apps that provide continuous information on news, weather, sports, and finance.

Kemausuor *et al.,* (2011) reported that farmers' perception on climate change is determined by a number of factors such as access to information, extension services, education, experience, resource availability. In practice, farmers take decisions in the context of their own environment, and differences may exist between perceived and real environments.

Rav *et al.* (2011) reported that the majority of the respondents (73.33%) were found in the land holding categories of marginal farmers followed by small farmers (15.83%), medium category (5.84%) and 5.00% in the large category of farmers.

Wannasai *et al.,* (2013) suggested that adaptive capacities should be established earlier on. He suggested land size, cropping intensity, poverty incidence and literacy rate as indicators of vulnerability of this process. Farming households‟ ability to adapt to climate change likewise depends on a variety of factors including availability of resources (both state and individual) for adaptation, motivation, and information about the changing state of the environment and the links between human decisions and the environment.

The Weather Channel (2013) explained that the Weather Channel became the first major weather corporation to launch its own app aimed at consumers who sought to easily retrieve forecasts in the palm of their hand.

Bhadauria (2013) conducted a research in Baghpat district of Western Uttar Pradesh to compare the social profile of the adopters and non-adopters to observe the role of Uttar Pradesh Diversified Agricultural Support Project (UPDASP) regarding rural development in Western Uttar Pradesh funded by World Bank. He revealed that majority of the adopters 65 per cent were belonging to the other backward caste (OBC), whereas 25 per cent adopters were related to Upper caste (General Caste), only 10 per cent adopters were belonging to Schedule caste (SC).

Jianjun *et al.,* (2015) revealed the level of education, farming experience, farm size, household income, and perception of climate change impacts influence farmers' adaptation decisions.

Rajesh *et al.,* (2016) revealed that television and radio were the most preferred source of weather forecasting information ranked it as first. The second most used source of information was mobile SMS facilities of CCS HAU, Hisar and newspaper. While in case of utilization of information sources radio and television were most preferred while other sources of information for weather forecasting were not utilized by farmers. Radio was the most common medium through which pastoralists receive external climate forecast. The major sources of information to the mango growers were radio, extension workers and TV. Study reported that friends followed by neighbours and relatives were the most sought after information sources for receiving information on all practices at every stage of innovation decision process.

Rupan Raghuvanshi *et al.,* (2017) studied on farmers' awareness about climate change and adaptation practices. He found that majority of the farmers were middle-aged, females, educated up to primary & high school (about 48%), and one-fourth educated up to intermediate, were small holders, belonging to middle class, having 'medium' information seeking behaviour, and had 'medium' decision making ability. Further, they displayed 'moderately' favourable attitude towards improved farm practices, along with high' economic motivation, and 'high' scientific motivation.

2.2 Knowledge level and attitude of users towards the weather forecasting information

Knowledge level

C. Jaeger (1993) observed that 28% of participants could identify carbon dioxide (CO2), while the other 72% stated they did not know or identified the other main contributing factor for climate change is greenhouse gas.

Dunlap (1998) estimated that, only few people responded that they understood the issue very well.

Stamm *et al.,* (2000) observed that, majority (88%) level of awareness and knowledge about climate change.

Stamm, Clark & Eblacas (2000) observed that 43.8% of their participants in Seattle, Washington viewed chlorofluorocarbons (CFCs) as important in causing global warming. Additionally, 44.6% of participants considered reducing the use of aerosol spray cans as a very helpful mitigative behaviour, despite the prohibition of CFCs in aerosol sprays.

Jones *et al.,* (2000) observed that accurate forecasts of climate 3-6 months ahead of time can potentially allow farmers and others in agriculture to make decisions to reduce unwanted impacts or take advantage of expected favourable climate. However, potential benefits of climate forecasts vary considerably because of many physical, biological, economic, social and political factors.

Stedman (2004) found that 57.8% of participants believed climate change was a problem, but when ranked against other environmental issues was not a top priority.

Selvaraju *et al*., (2005) in their study indicated that knowledge level of farmers who directly related to innovativeness (r = 0.373), which could be improved through enhancing extension participation. Factor analysis indicated those farmers with higher education tended to decide them. He reported that more than 70% of the farmers perceived that the strategic decisions made before the start of the rainy season were more important than in-season tactical decisions.

Rautela (2005) discussed the indigenous technical knowledge inputs for effective disaster management practices by the people of Himalayan terrain region. He observed that during the course of their habitation the indigenous people through

experience, experimentation and accumulated knowledge devised ways of reducing their vulnerability to natural hazards. Studies showed that their understanding was fairly evolved in the areas of earthquake, landslide and drought management and had devised efficient ways of mitigating the effect of natural or climatic changes.

Qi hu *et al.* (2006) identified the accuracy of weather and climate forecasts is continuously improving and new information retrieved from climate data is adding to the understanding of climate variation, use of the forecasts and climate information by farmers in farming decisions has changed little. This lack of change may result from knowledge barriers and psychological, social and economic factors that undermine farmer motivation to use forecasts and climate information. The three major findings of the study are: the utility and value of the forecasts for farming decisions as perceived by farmers are, on average, around 3.0 on a 0–7 scale, indicating much room to improve attitudes toward the forecast value. The use of forecasts by farmers to influence decisions is likely affected by several social groups that can provide ―expert viewpoints on forecast use. A major obstacle, next to forecast accuracy, is the perceived identity and reliability of the forecast makers.

Dietz *et al*., (2007) in a study on Support for Climate Change Policy reported that two-thirds of the sample in Virginia and Michigan reported that they had some knowledge about climate change and 28.00 per cent said they knew little about climate change. Only 9.00 per cent said they had a lot of knowledge. Eight per cent of the respondents had not obtained any type of climate change information from any of the sources about which they asked.

Nyong *et al*., (2007) in their study entitled the value of indigenous knowledge in climate change mitigation adaptation strategies in the African Sahel and reported that local population in the African Sahel region had developed and implemented extensive mitigation and adaptation strategies through their indigenous knowledge systems that have enabled them to reduce their vulnerability against climate change.

King *et al*. (2008) in their study using a kaupapa Maori Based Research approach and semi-directive interviewing, an intimate understanding of local weather and climate was demonstrated by elders.

Kumar (2009) in his study on indigenous technical knowledge in agriculture published a number of indigenous technological knowledge on rain-water

management, soil and water conservation, wind erosion, tillage practices, crop and cropping systems, pests and disease management, soil fertility management, farm implements, post-harvest technology, grain or seed storage, horticultural crops, veterinary and animal husbandry, fishery, ethno-botany and agro-biodiversity, weather forecasting, fuel management, thermal efficiency, waste water management, garbage disposal and management, food-product material and ethnic food**.**

Orlove *et al.,* (2009) examined the local knowledge around inter annual variability in both the timing and seasonality of rainfall in southern Uganda. Four major components of their knowledge system are discussed: the longstanding familiarity with the seasonal patterns of precipitation and temperature, a set of local traditional climate indicators, observation of meteorological events and information about the progress of seasons elsewhere in the region. The paper examines these components and explores the connections between them as well as discussing the social context within which this knowledge is embedded.

Douglas *et al.* (2010) investigated local knowledge and perception through a survey of 60 farmers. Survey showed that majority of farmers (67%) indicated that there have been changes in weather patterns in the area.

Esa (2010) found that overall the teachers had sufficient knowledge about the environment and the depletion of natural resources.

Joslyn and Savelli (2010) found that public understood uncertainty information in deterministic weather forecasts. The participants also understood that an increase in lead time for a forecast would have more error and forecast uncertainty. Interestingly, participants were able to gauge that high wind forecasts were often overestimated with the actual wind speeds verifying much lower. Forecasts for snowfall were met with much more skepticism than a forecast for "no snow," and forecasts that call for rain are trusted more than a forecast that indicates no rain.

Ryo sakuraj *et al.,* (2011) conducted a study to explore the knowledge of japanese cherry blossom festivals and stakeholder's about global climate change. Most (92%) managers of festival-dependent businesses mentioned that global warming is occurring and affecting the flower timing of cherry trees.

Gugulethu Zuma-Netshiukhwi (2013) suggested that some short-term traditional forecasts/predictions may be successfully merged with science-based

climate predictions. The traditional knowledge and its use, reported on in this paper, is what scientists learned from farmers.

Prutsch *et al.,* (2014) explained the emergence of research and programmatic interventions on climate change in both case study countries in the recent years, knowledge gaps remain huge, partially due to the weak documentation of smallholder practices and lessons. Furthermore, while climate change research is directed towards policy makers, they are often not applicable in practice, leaving a gap between scientific results and practical advice for decision makers.

Attitude

Vogel and O'Brien (2006) studied irrespective of its nature and importance, any information is useless until and unless it is promptly delivered to the users. Reliability of forecasts, expected weather-induced risks or weather-induced losses, and farmers' attitudes towards risk will affect the use of weather forecasts.

Artikov *et al.,* (2006) recognized the provision of trustworthy and clear information can ease access and improve understanding of weather products and has been regarded as having an important influence on farmers' personal attitudes about particular forecasts as well as being important for enhancing their general forecast use.

Howden *et al*., (2007) emphasized, if farmers do not believe that climate change is occurring and/or do not perceive it to be a threat to their livelihoods, they will not likely act to adapt to or mitigate climate change. They maintain that farmer's attitudes about the impacts of climate change are key to successful adaptation and mitigation.

Kaiser *et al.,* (2010) explained the farmer with strongly expressed attitude towards increased resilience to climate risks can be expected to carve out a set of adaptation behaviours based on their disposition. Behaviours in that case are a ''transitively ordered set of means to implement different levels of attitudinal goals".

Fosu-Mensah *et al.,* (2012) examined the differences in farmers' abilities and costs of implementing farming practices can be useful to transitively rank adaptation strategies in terms of what is feasible and in what context. Such an approach can further provide insights on the practices that farmers favour or disfavour depending on the specific context and is, therefore, important to understanding farmers' attitudes

towards adaptation strategies to climate risks. To date, however, it is not well known how different adaptation strategies rank in specific-contexts based on the cost of implementation and farmers' behavioural dispositions. This has made it difficult to promote targeted interventions and partly explains why farmers might perceive climate variability but fail to engage in adaptation strategies.

Barnes and Toma (2012) recognized farmer attitudes toward climate change must be understood if climatologists, scientists, policymakers, and others are to effectively support adaptive and mitigated actions in agriculture. While many recognize that it is important to understand farmer attitudes toward responses to climate change, very little research effort has been focused on this area.

Wheeler *et al.,* (2013) studied the relationship between farmers' attitudes and adaptation to climate risks. A notable exception includes that there exists a relationship between farmers' attitudes and adaptation behaviour.

Lagerkvist *et al.,* (2015) examined farmers' attitude towards adaptation strategies to climate risks; and to identify determinants of adaptation to climate risks. For the first objective, we use a psychometric latent class Rasch model of attitude measurement. This approach has been found useful in studies related to adoption of integrated soil fertility management.

Mohammad Sadegh Allahyari *et al.,* (2016) explored farmers' attitudes towards precipitation and temperature variability and their adaptation strategies in paddy fields in a typical agricultural province in northern Iran. Primary survey data were collected from a sample of 382 paddy farmers of Rasht County in Guilan Province. Data have been analyzed using both summary statistics and bivariate analysis (Pearson, Spearman, and Eta correlation coefficients).

Jean François Regis Nisengwe (2016) studied that both risk perception and risk attitude can be used as determinants to predict whether farmers will take up adaptive measures. This study seeks to improve understanding of farmers' behaviours, especially in the face of climate risk. Logistic regression results showed that factors like access to forecast information, belonging to a cooperative, and experience with floods have a significant effect on farmers' adaptive behaviours. Risk perception and risk attitude both have an effect on adaptive behaviours but the effect was not found to be significant. Results show that policies or programs that encourage farmers to

participate in cooperatives and improve farmers' access to forecast information can lead to adaptive actions.

2.3 Extent of adoption of weather forecasting information

Studies pertaining to extent of adoption of farmers about weather forecast information were not reported more. Hence, an attempt has been made here to review the related literatures initially.

Kabwe and Donovan (2003) stated that the decision to adopt technology is usually guided by the information received from different sources as well as their own analysis of the technology. Availability of human and financial resources is also a determinant. Adopters who have been affected by a drought or experience erratic rainfalls patterns are more likely to accept conservation farming methods.

Haggblade and Tembo (2003) states that Dunavant cotton farmers who were affected by drought recorded marked increases in adoption to water conserving technologies between 2000/1 and 2002/3 of 70% with the highest in Central province.

Tenge *et al.*, (2004) found that female headship negatively influenced adoption of soil and water conservation technologies in the west Usambara highlands of Tanzania because female heads had less access to land, and other resources due to traditional social barriers.

Lal (2005) suggested that by adopting improved management practices on agricultural land (use of NT and crop residues) food security would not only been hanced but also offset fossil fuel emissions at the rate of 0.5 Pg C yr-1. Climate change is likely to strongly affect rice–wheat, rice and maize-based cropping systems that today account for more than 80 per cent of the total cereals grown on more than 100 Mha of agricultural lands in South Asia.

Knowler & Bradshaw (2007) found the higher the income, the higher the probability of adopting climate-related timing approaches. This is because the adoption of technologies requires considerable investment of financial resources.

Leutbecher and Palmer (2008) identified that forecasting adopts the idea of predicting probabilities for future weather events.

Antle (2008) defined that adaptation to climate change as the adoption of practices that are relatively less vulnerable under the changed climate.

Koru and Holden (2008) found that gender differences in adoption of different technologies between male and female headed households that expose vulnerabilities of women to climate change. Ownership and control over land was lower in female headed households in sub-Saharan African countries.

Kurukulasuriya *et al.,* (2011) found that irrigation adoption is sensitive to both temperature and precipitation, which validates it as an adaptive strategy.

Antle and Valdivia (2011) found a new version of the model TOA-MD5 has been developed to address adoption as well as climate impact assessment.

Ekpo and Nzegblue (2012) have identified various adaptation measures including irrigation, adoption of improved varieties, crop insurance, conservation tillage and livelihood diversification, depending on the nature of climate change and its effects.

Chan-Olmsted *et al.,* (2013) recognized that the adoption of new technology, like a news or weather app, would begin with deciding on how simple it is to use, if the user does not believe the product offers much utility, the new technology will not likely be successful.

Prince Maxwell Etwire *et al.,* (2013) studied to determine the factors that influence the adoption of climate related technologies introduced by research institutions. A Multinomial Logit Model was estimated using data from 320 households in Northern Ghana. The empirical results reveal that sex, age, farm size, access to formal agricultural extension, agro ecology and noticing of unpredictable temperatures were the factors influencing farmers' adoption of a climate related strategies introduced by research institutions. The empirical results imply that targeting females, increasing access to agricultural extension services and creating more awareness about changes in temperatures are important in promoting the adoption of climate related technologies introduced by research.

Denis Antonio da Cunha *et al.,* (2014) analysed the effects of climate change on irrigation adoption in Brazil. Temperature and precipitation projections for the 2010-2099 periods were employed under a number of different climate scenarios according the 4th Assessment Report of Intergovernmental Panel on Climate Change (IPCC). The results show that irrigation adoption will be affected by climate change. Given current conditions, irrigation has generally been adopted in Brazil to cope with

reduced precipitation and temperature variations. The estimated irrigation probabilities in the future scenarios were quite different across Brazilian regions. The main explanation for this pattern is the distinct climatic conditions and production structures. Considering future climate change, over the next 30 years (2010 to 2039), the irrigation probability is expected to increase in all Brazilian regions. However, this trend is reversed in the long run.

Mary Nyasimi *et al.,* (2017) studied that farmer adoption of climate-smart agricultural practices and innovation after being exposed to Farms of the Future Approach (FotF). First; they explore and assess the various CSA(Climate Smart Agriculture) technologies and practices; including institutional innovations farmers are adopting. Second; they identify and document farmer learning and dissemination pathways that can enhance adoption of CSA technologies and practices. Third; they identify existing institutions that enhance adoption of CSA practices. They use household survey data, complemented by qualitative information from focus group discussions and key informant interviews. The results show farmers are adopting a variety of CSA technologies, practices, and institutional innovations to after participating in the FotF approach with use of improved crop varieties, agroforestry, and scientific weather forecast information cited as the main practices. To minimize their risks and reduce vulnerabilities, farmers are diversifying and integrating five to 10 CSA practices in one season. Matengo pits, SACCOs, and efficient energy stoves were adopted by very few farmers due to their high initial investment costs and unsuitability to the area. Ninety-eight per cent of farmers reported that they receive agricultural information orally from a variety of sources including government extension workers, seed companies, researchers, traditional experts, neighbours, radio agricultural shows, religious groups, farmer groups, and family members. Lastly, farmers reported that the FotF approach is a useful tool that enabled them to interact with other farmers and learn new CSA practices and innovations. Suggested improvements to make on the FotF included include longer trip duration, increased number of farmer participants, and gender balance and age considerations to include youth.

Gurupreet Singh Gandhi *et al.,* (2018) studied quantify economic benefits through adopting the agromet-advisory in their day to day agricultural operations. For this purpose, two groups of farmers were selected namely, a group adopting the agro

met advisories regularly in their operation (AAS farmers) and other group of farmers not aware of agromet advisories (Non-AAS farmers).

Md. Rezaul Karim (2017) examined poverty level of small scale farmers, climate change challenges they faced and their coping strategies adopting in response to climate change impact.

2.4 Constraints as perceived by the users related with adoption of weather forecasting information

Rosenzweig and Hillel (1993) announced that, the potential for adjustment ought not to prompt lack of concern. Agrarian adjustment to environmental change isn't currently and may never flawless, and changes in how farmers work or what they deliver may cause huge interruption for individuals in country districts. To be sure, some versatile measures may have adverse effects of their own. For instance, were real moves in harvests to be made, as from grain to leafy foods generation, agriculturists may get themselves more presented to showcasing issues and credit emergency brought by higher capital and working expenses.

Vernon (1994) directed an examination on oat edit farmers recommends that data about environmental change and better access to organizations firmly enhances the cultivating house hold capacities to adjust to a dangerous atmospheric deviation. They found that family unit getting a charge out of agribusiness augmentation administrations gave by government, advances and having farming systems were among those well on the way to start environmental change adjustment measures on their homestead.

Adger and Kelly (1999) detailed that, the criticalness of atmosphere variety relies upon the level of progress and the qualities of the general public presented to it. These attributes decide the level of defencelessness of a framework. Creating nations are more helpless and have lesser versatile limits than created countries, because of: Overpopulation (with respect to current profitability, pay and normal assets), Debilitated environmental base (arrive corruption and discontinuity), Over-reliance on atmosphere delicate parts: agribusiness, ranger service, fisheries, Level of monetary riches, Inequities in access to assets and riches among gatherings, Weak socio-social (inflexibility in arrive utilize rehearses, social clashes), infrastructural, money related/advertise (dubious estimating, accessibility of credit, absence of credit), lawful

and administration structures, Technological, abilities and human asset bottlenecks, weakness conditions.

Climate change and African agriculture review report (2006) indicated that a large number felt that lack of credit or savings represented a barrier to adaptation. This was felt most acutely in Kenya and Nigeria. Lack of access to water was anticipated to be a major problem in adaptation. Lack of access to appropriate seed, lack of security of property rights and lack of market access was hardly mentioned except in Ethiopia. Scarcely any farmers saw the absence of data about the climate or long-term environmental change to be a boundary to adjustment.

David Maddison (2007) opined that, the absence of data about climate and atmosphere, absence of learning about adjustments, proportioning of key information sources including water, the absence of fitting seed, unreliable property rights and the absence of market get to. Barely any agriculturists saw absence of data about the climate or long haul environmental change to be a hindrance to adjustment. In like manner, few trusted they needed information about the fitting adjustments. In Ethiopia a fourth of respondents felt that they needed data about environmental change. A substantial number felt, nonetheless, that absence of credit or funds spoke to a hindrance to adjustment. Among adjustments rolled out because of atmosphere improvement, planting diverse assortments of a similar yield and changing dates of planting is essential all over the place.

Mutekwa (2009) observed that in Zimbabwe, extension workers lacked accurate information and knowledge on climate change and variability, which is a prerequisite tool in adaptation strategies for enhancing the agricultural production of farmers.

Stigter (2010) studied a majority (two out of three) fails because of lack of accuracy (<70% accurate considered a failure), which in turn affects the different timing of farm operations that are based on existing climate.

K. Ravi Shankar *et al.,* (2011) determined constraints faced by farmers in adopting climate forecasts, along with suggestions to overcome them. It is clear that participatory engagement to understand farmers' needs and adoption constraints is crucial to realizing the value of climate prediction. To achieve adoption of forecasts, forecasts need to be more accurate, reliable, and relevant to agricultural decisions and

better communicated. With agricultural systems becoming more susceptible to climate variability, this study helps and guides policymakers in considering the spatial reliability of climate prediction in relation to the spatial scale at which the information may be used.

Singh *et al.,* (2014) suggested that adaptation measures should be evaluated continuously, and learning should be complemented by experience gained from micro-level (households/village/community). It is at this level that a depository of farmer constraints and opportunities can be generated and tracked to quantify their vulnerabilities.

Rajesh *et al.,* (2016) reported the major constraints in using the weather forecasting information. The possible reasons as reported by the respondents for these problems are as follows: Absence of location specific weather forecasts was the major problem because the forecasts usually cover a wider area and speculation exists among farmers. Poor reliability of weather forecasts was a problem because of lack of certainty of information. Hence, farmers lack trust in the forecasts. One of the most serious constraints was that mostly weather forecasting was not timely forecast at the time of flood and drought and success rate was also very low. Constraints regarding the understand ability of weather forecasting information. It was found that belief about weather forecast was more powerful than modern weather forecasting in farmer's view was one of the most serious constraints. All the constraints can be minimized by providing guidance to the farmers and by distribution literature and training regarding technicality of weather forecasting advisory services to the farmers.

2.5 Relationship between selected socio- economic and personal characteristics of users with the adoption level of weather forecasting information

Gogai and Phukan (2000) stated that average annual income showed significant association with the extent of adoption. The highest percentage of non-adoption belonged to middle and low income group respectively.

Carlsson et al. (2006) found that high prices and age were significant barriers to their (3G+ services) adoption and diffusion.

Gbetibouo (2009) found that farmer's age was hypothesized to have a positive influence on the adoption of climate-related timing approaches. This is because older

farmers have more farming experience and are in a better position to assess the attributes of an innovation than younger farmers.

Benal *et al.,* (2010) observed that two variables *viz.,* education and innovativeness taken together explained 56.89 per cent variation (R2=0.5689) in adoption of recommended dryland agricultural technology.

Deressa *et al.,* (2010) observed a negative relationship between precipitation and adoption of climate related technologies in Ethiopia.

Singh and Varshney (2010) conducted a study and revealed that land holding of farmers have significant relationship with level of adoption. When there is unit change in land holding, there is increase in level of adoption of rice technologies.

Aker (2011) reported that a previous review of public extension systems worldwide found that they were barely functioning. She also acknowledged the high cost of obtaining information through traditional means such as radio, newspapers and travel as important significant barriers to technology adoption in the developing world.

Mandleni and Anim (2011) observed an inverse relationship between temperature and adoption of adaptation measures. This study measures farmer's perception of temperature as a binary outcome, whether they have observed unpredictable temperatures in the past decade.

CHAPTER - III

RESEARCH METHODOLOGY

RESEARCH METHODOLOGY

A research methodology is very essential for any activity that requires concrete results. The present study tried to assess the Uses of Weather Forecasting Advisory Services as Disseminated by R.P.C.A.U among the farmers of Muzaffarpur District. The study being one of the pioneer attempt, a careful endeavour has been made to outline the modus operandi for the study. In order to address the objectives of the study this chapter is organized and presented under the following subtitle:

3.1 Locale of the study

3.2 Selection of respondents

3.3 Variables and their measurements

3.4 Tools and techniques for the data collection

3.5 Plan of analysis and statistical measurement

3.1 Locale of the study:

The examination was led in Muzaffarpur District of Bihar. Muzaffarpur region, "The Land of Litchi", is situated on worldwide guide in the vicinity of 25°54' and 26°23' North scope and 84°53' and 85°45' East longitude. It possesses a territory of 3,172 square kilometers. It covers 3.4 % of the aggregate zones of the territory of Bihar. The rank of the region in contrast with different areas of Bihar as far as zone is tenth. It has a normal rise of 170 meter from mean ocean level. Muzaffarpur is encompassed by Sitamarhi, Sheohar and East Champaran region in the North, Vaishali and Saran locale in the South, Darbhanga and Samastipur area in the East and Saran and Gopalganj region in the West. The locale of Muzaffarpur involves a broad plain shaped by the alluvium brought by the Gandak, the Bagmati and different waterways which move through it. The dirt of the area is to a great extent alluvial. An exceptional element of the locale is that because of constant store of sediment, a large number of its stream beds are higher than the connecting regions. This prompts visit surges amid the blustery season especially in north-east and south-east parts of the area. The fundamental waterways of the locale are the Gandak, the Bagmati, the Burhi Bagmati and the Baya.

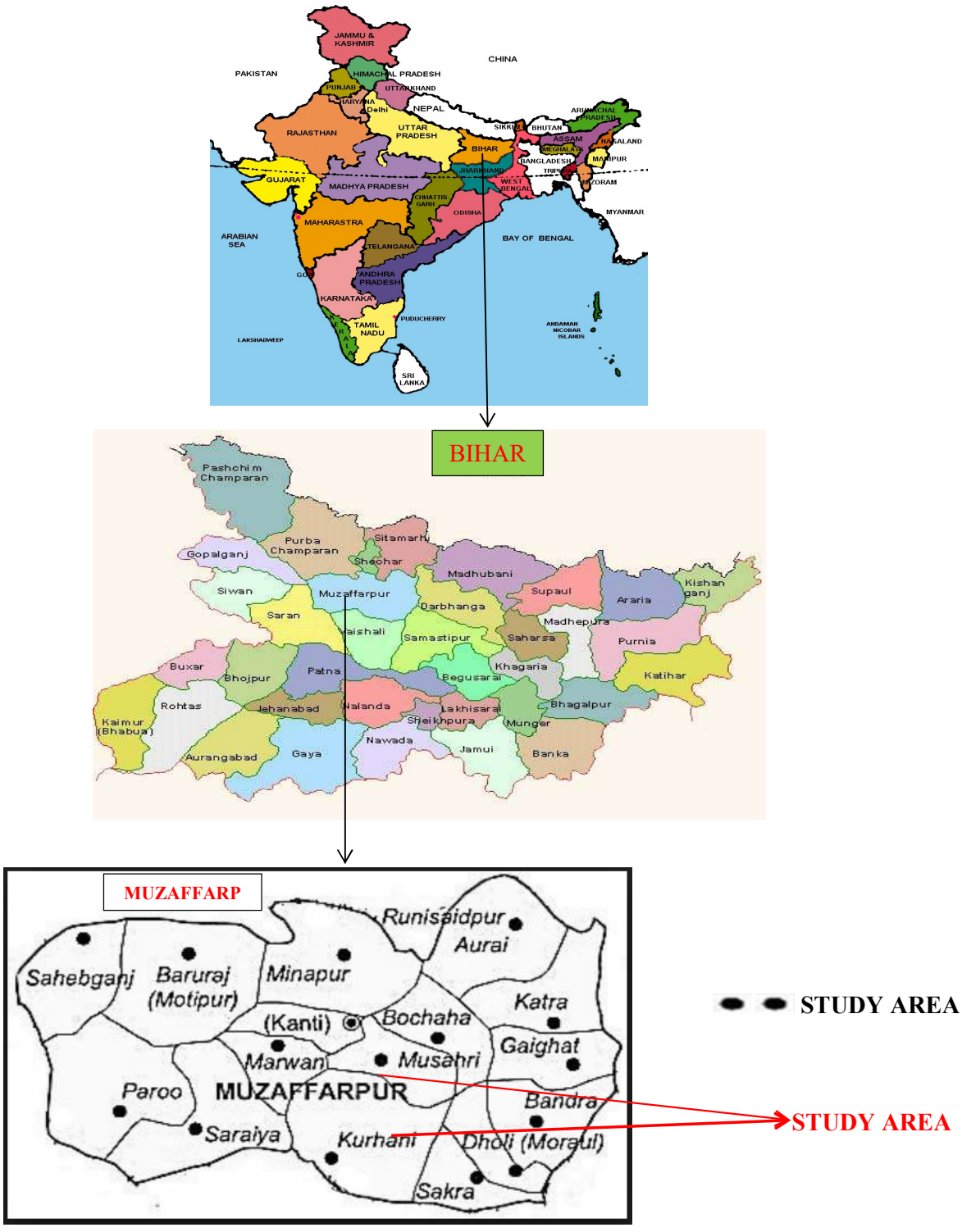

Fig. 3.1: Locale of the study

Muzaffarpur has generally a humid climate except during summer which is rather dry. The winter season starts from November to February and Summer Season from March to May. The rainy season extends from June to September, October being the transitional month. January is the coldest month when the mercury sometimes drops to 4-5°c. Dust storms and westerly wind usher in the hot weather in early April. May is the hottest month when the maximum temperature reaches up to 44°c. The monsoon season begins in the second half of June and last until September and maximum annual rainfall falls during the monsoon season. With the cessation of rains the temperature falls and the climate becomes rather pleasant. The district gets some winter rains also.

In 2011, Muzaffarpur had population of 4,801,062 of which male and female were 2,527,497 and 2,273,565 respectively. The population density in the district is 1514 per sq.km. Average literacy rate of Muzaffarpur in 2011 were 63.43 the male and female literacy were 71.28 and 54.67 respectively. The land use around Muzaffarpur is mainly agriculture and horticulture.

3.1 a Selection of district:

The state of Bihar having 38 districts. Out of these districts Muzaffarpur district was selected purposively because a project from the department of Agrometeorology of R.P.C.A.U had already been operationed from 2012 to 2017 at Muzaffarpur district. Keeping this view in my mind the district was selected for the study purpose.

3.1 b Selection of blocks:

The study was conducted in the area of Muzaffarpur district of Bihar. All together there are 16 Blocks in Muzaffarpur district. Out of which two blocks were selected for the study of the uses of Weather Forecasting Advisory Services as disseminated by R.P.C.A.U among the farmers, Saraiya and Marwan block were selected for the study purpose as about 75% people are dependent on agriculture and allied sector for their livelihood production.

3.1 c Selection of villages:

One village was selected from each block i.e. Ballysaraiya and Bhagwatpur. Therefore, total no. of villages were 2.

Ballisaraiya village

Ballisaraiya village is located in the Saraiya block of Muzaffarpur district. The village comes under Ambaratezsing Gram Panchayat. This village is situated 5 km distant from Saraiya (Muzaffarpur) KVK and 25 km from the Muzaffarpur district headquarters. A canal known as Habipurbaitarni originates from Gandak River and runs through the middle of the village and this fulfils to some extent the irrigation needs of the agricultural lands of this village. Nearly 76 per cent of the villagers are engaged in agriculture or agriculture related activities and the rest are engaged either in small-scale industries or cottage industries. A small percentage is also employed in service sector. The land of this region is quite fertile but most of the cultivated land is under rainfed having mono cropping system. The main crops are paddy, wheat, pulses, potato and mustard.

Bhagwatpur village

Bhagwatpur village is located in Marwan block of Muzaffarpur district. Gousara village Gram Panchayat governs the village. This village is situated 10 km away from Saraiya (Muzaffarpur) KVK and 25 km from the Muzaffarpur district town. A canal known as somegarhsubminor originates from Gandak River crisscrossing the agricultural field of the village and provides irrigation for the limited areas of the village. About 10 % of agricultural land of this village is located on the bank of Gandak river basin. Nearly 72% of the villagers are engaged in agriculture or agriculture related activities and the rest are engaged either in small-scale industries or cottage industries with some employed in service sector. The land of this region is quite fertile but most of the land is under rainfed condition. About 8% of the land area gets inundated every year due to flood and as a result of which the agricultural land becomes unproductive owing to sand deposition. The main crops of this village are paddy, wheat, pulses and mustard.

3.2. Selection of Respondents:

30 respondents were selected from Ballysaraiya village and same 30 respondents were selected from Bhagwatpur and these villages were adopted by R.P.C.A.U under NICRA Project under Agrometeorology department R.P.C.A.U., Pusa.

Table 3.1 Selection of respondents on the basis of villages and blocks

Name of Blocks	Name of villages	Number of respondents selected
Saraiya	BallySaraiya	30
Marwan	Bhagwatpur	30
	Total	**60**

3.3. Selection of variables and their measurement techniques.

Twelve independent variables were identified by discussion with scientists and reviews. Dependent variables were identified by considering the objectives of the study about knowledge level of farmers towards weather forecasting information and adoption of weather forecasting information.

The variables selected and the techniques employed for measurement are as below.

(A).	Independent variables	Measurements
i	Age	As per chronological order
ii	Caste	SC/ST/OBC/UR
iii	Occupation	Trivedi Scale(1963) with minor modification
iv	Education	Trivedi Scale(1963) with minor modification
v	Family type	Nuclear/ Joint family
vi	Family Size	Trivedi Scale (1963) with minor modification
vii	Annual family income	Actual income in Rupees
viii	Social Participation	Trivedi Scale (1963)
ix	Sources of Information Utilized (SIU)	Schedule developed for the study
x	Attitude towards weather forecasting	Schedule developed for the study
xi	Farming Experience	Lakshminaryana (1997)
xii	Size of land holding	Marginal/Small/Medium/Large
(B).	**Dependent variable**	**Measurements**
i	Knowledge level	Schedule developed for the study
ii	Extent of adoption	Schedule developed for the study

The details of the operational definition of each variable and as measurements procedure are discussed below:-

Independent variable

Age:

It is referred to the chronological age of the respondent. Age of the respondent was measured as the number of years completed by the respondent at the time of investigation. The respondents were categorized into three age group:

Sl. No.	Categories	Age in years
1.	Young age group	Up to 35 years
2.	Middle age group	36-50 years
3.	Old age group	Above 50 years

Caste

Caste is a social system, the membership of which is determined by birth and is endogamous in nature. In other words, it is a close class system, which clearly distinguishes the status and the role for its member in particular society. The respondents of the study were classified as follows on the basis of their caste group.

Sl. No.	Caste	Score
1.	SC (Schedule Caste)	1
2.	ST (Schedule Tribes)	2
3.	OBC (Other Backward Caste)	3
4.	General (Un Reserved)	4

Occupation

The occupation was prepared as the nature of job performed or held by the users. In this study, occupation refers to the rural occupation as stated in terms involvement such as farming and allied profession. In this study, the term occupation refers to the present occupation of the selected users for study. The occupation has been categories in the following manner.

Sl. No.	Occupation	Score
1.	Farming	1
2.	Farming+ Business	2
3.	Farming +Business +Services	3
4.	Others (Specify)	4

Education

Education is the process of teaching or learning, especially in a school or college, or the knowledge that we get from this. In this study, this variable referred to the number of years of formal education received by the respondent. The answers were collected on five educational levels and it was measured by assigning the score as indicated below developed on the basis of Trivedi scale (1963).

Sl. No.	Education level	Score
1.	Illiterate	1
2.	Can read and write only	2
3.	Up to middle school	3
4.	Up to high school	4
5.	Up to intermediate	5
6.	Graduation and above	6

Family Type

Users were categorized as either nuclear or joint family on the basis of a number of generations of members living together. The score given is as follows.

Sl. No.	Family type	Score
1.	Nuclear Family	1
2.	Joint Family	2

Family Size

It refers to the number of members living in a family. The users were asked to tell the numbers of their family members during the study. Based on the number of members told by them, the size of the family has been categorized in to 3 categories following numbers.

Sl. No.	Family Size	Score
1.	Small family (up to 4 member)	1
2.	Medium Family (5-8)	2
3.	Large Family (9 and above)	3

Annual Income

It refers to the annual income of farmer through all sources. On the basis of data collected the users were classified into four categories.

Sl. No.	Annual income in Rupees	Score
1	Up to Rs.50,000	1
2	Rs.50001 to 1,00,000	2
3	Rs.100001-1,50,000	3
4.	Above Rs.1,50,000	4

Social participation

Social participation is an important variable. Social participation refers to one's degree of participation of respondents in any social institution. Social participation was measured with help of Trivedi (1963) at IARI. The social participation was measured in research as under.

Sl. No.	Social participation	Score
1.	Not Member of any organization	1
2.	Member of one organization	2
3.	Member of more than one organization	3
4.	Office bearer of an organization	4

Source of information utilization

Source of information utilization is defined as the extent to which the farmers follow the various information related to the farm or non-farm activities from various sources. The sources were selected and listed below. The score of 4, 3, 2, and 1 was assigned for the extent of use i.e. 'Always', 'often', 'sometimes', 'never'.

Sl. No.	Categories	Always	Often	Sometimes	Never
1.	KCC				
2.	Agriculture University				
3.	Research Station				
4.	Television				
5.	AAS bulletin in printed from public notice				
6.	KVK				
7.	Any Others (Internet, Newspaper, SMS etc.)				

Attitude towards weather forecasting

State of mind is the level of constructive or contrary effect with some mental items like image, express, trademark, and individual, establishment, thought towards which individuals can contrast in changing degrees from the perspective of social brain research. It is the preparedness of people to respond in a certain way towards social object or phenomena. Further, the variable was operationalized as the positive or negative mental predisposition of respondents towards the use of weather forecasting advisory services among farmers. Thirteen statements were selected and rated on a five- point continuum 'Strongly Agree' 'Agree' 'Undecided' 'Disagree' 'and 'Strongly Disagree' with scores of 5, 4, 3, 2 and 1 respectively for positive statements and the reverse for negative statements. Respondents were asked to choose from this five - point continuum.

The attitude of respondents was further categorized under by working out mean and standard deviation.

Highly Favourable : Above (Mean + SD)

Favourable : From (Mean − SD) to (Mean + SD)

Least Favourable : Below (Mean − SD)

Farming Experience

It refers to the total number of years of experience of the individual farmer in agriculture. The procedure adopted by Lakshminaryana (1997) was used to categorize this variable.

Sl. No.	Farming experience (In years)	Score
1.	Up to 10 years	1
2.	11-20 years	2
3.	Above 20 years	3

Size of land holding

The extent of land actually possessed by the farmers was recorded. The area of land was recorded in acres. The respondents were classified into four groups as follows:

Sl. No.	Category	Size of land holding
1.	Marginal	Up to 2.5 acres
2.	Small	>2.5 to 5 acres
3.	Medium	>5 to 10 acres
4.	Large	>10 acres

Dependent variables

Knowledge level

It is operationally defined as the level of knowledge of respondents regarding uses of weather forecasting advisory services. Seventeen statements were listed. For 'correct' statements score two was given and for 'incorrect' statements score one was given. The maximum possible score was 34 and the minimum possible score was 17.

The knowledge index was computed using the following formula,

$$\textbf{Knowledge index} = \frac{\text{Obtained knowledge score}}{\text{highest obtainable score}} \times 100$$

The score thus obtained were put into the mean ± SD procedure to obtain low, medium and high categories of level of knowledge as given below.

Sl. No.	Knowledge level	Score
1.	Low	Below (Mean – SD)
2.	Medium	Between (Mean ± SD)
3.	High	Above (Mean + SD)

Extent of adoption

Adoption is a multifaceted process. Leagans (1985) well-defined adoption as a decision to create full use of an innovation as the best course of action. Adoption is not only a complex physical process but a mental process as well as symbolic and conviction of its value. The definition implies that when adopter is satisfied with the innovation he uses to adopt the innovation.

It is operationally defined as the level of adoption of respondents regarding weather forecasting advisory services. Twelve statements were listed. It was measured as full adoption, partial adoption, non-adoption. For full adoption of advisory services, 3 scores was given, for partial adoption of advisory services 2 scores was given and for non-adoption of advisory services 1 score was given. The individual score was later converted to the standardized score of adoption index with help of following formula.

$$\textbf{Adoption index} = \frac{\text{Obtained score}}{\text{Highest obtainable score}} \times 100$$

Sl. No.	Adoption level	Score
1.	Low	Below (Mean – SD)
2.	Medium	Between (Mean ± SD)
3.	High	Above (Mean + SD)

Constraints

During investigation, respondents expressed many reasons or causes were termed as constraints. Mean scores were calculated as per the constraints expressed by the respondents and they were ranked in order of magnitude. The respondents were asked to mainly nine constraints. These responses were identified and scores as follows.

Sl. No.	Response	Score
1.	More important	3
2.	Important	2
3.	Less important	1

Suggestions are the ideas put forth by the respondents based on their experience. Suggestions of the farmers regarding their problems which they are facing were obtained through questions.

Tools and techniques for data collection

A structured schedule was prepared with the help of experts in the field of agricultural extension, which included subject matter content of weather forecasting advisory services and all the items under which each of the variables selected for the study. The schedule was developed in English. Data collection was done by personal interview method with the help of the schedule. The farmers were contacted at their residence or field.

Plan of analysis and statistical measurement

The statistical tools and tests such as frequency, percentage, mean, correlation coefficient and category were used and the data were analyzed systematically to draw valid inferences.

Frequency

A frequency distribution was used to quantify the different personal and socio-economic characteristic of the farmers using weather forecasting advisory services. It was also used in the response analysis of knowledge, attitude, and adoption statement.

Percentage

The percentage was used for simple comparison. For calculating percentage, the frequency of a particular was multiplied by 100 and divided by the total number of respondents in that particular category to which cell they belong.

Arithmetic Mean

Mean or average that is taken as representative of a group of the item implies to measure the degree of variability. The mean was computed as the sum of items

divided by the number of items. The symbol used for mean X the formula for the mean used as:

$$\overline{X}=\frac{\sum X_i}{n}$$

Where,

X= Represents items averaged, i.e. = 1, 2, …..n., n= is the total numbers of items.

This measure was used to categorize the dependent and independent variables into low, medium and high categories.

Standard Deviation (SD/σ)

It is the positive square root of the mean of the squared deviations taken from airthematic mean. It is represented by the symbol.

$$\mathbf{SD}=\sqrt{\frac{1}{n}\sum(X_i-\bar{x})^2}$$

X_i = Values of random variable x

$\overline{X}$ = Mean of all the variables or Observations

n = Number of observations.

This measure was used to categorize the dependent and independent variables into low, medium and high categories.

Category

In this study respondents were classified into three categories as low, medium and high on the basis of score obtained in order to get their proper presentation.

Less than Mean – Standard deviation was considered low (up to mean – SD)

Mean – Standard deviation to Mean + Standard deviation was considered as the medium category (in between mean ± SD) and

Above Mean + Standard deviation was consider as high category (mean + SD).

Karl Pearson's coefficient of correlation

In order to study the association of independent variables with the level of adoption of weather forecast information, correlation was done. It was measured by using Karl Pearson's coefficient of correlation **(r)**.

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \cdot \Sigma y^2}}$$

Whereas,

Σxy = Sum of the product of ' x ' and ' y'

Σx^2 = Sum of the square of the variable ' x'

Σy^2 = Sum of the square of the variable ' y'

CHAPTER - IV

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

The findings of the study have been presented on the basis of analysis of data using relevant statistical tools and techniques in relation to the specific objectives of the study. The results of the study are presented under the following headings:

1. To assess the socio-economic and personal characteristics of farmers.
2. To explore the level of knowledge and attitude of users towards weather forecasting information.
3. To study the extent of adoption of weather forecasting information as disseminated by R P C A U.
4. To identify the different constraints as perceived by the users related with the adoption of weather forecasting information.
5. To ascertain the relationship between selected socio-economic and personal characteristics of users with the adoption level of weather forecasting information.

1. To assess the Socio-economic and personal characteristics of farmers

The results related with distribution of respondents according to their personal, psychological, communication and economic variable has been described here separately.

Age

Age of the respondents as a variable forms the centre of the study in social sciences researches. The age was recorded on the basis of response given in the interview schedule. On the basis of their age the respondents were classified into three categories i.e. young age group (up to 35 years), middle age group (36-50 years) and old age group (above 50 years).

Table 4.1. Distribution of farmers according to their age

Sl. No.	Age group	Farmers (n=60)	
		Frequency	Percentage
1.	Young age group (up to35 years)	20	33.33
2.	Middle age group (36-50 years)	25	41.67
3.	Old age group (Above 50 years)	15	25.0
	Total	60	100

Table 4.1 reveals that out of total respondents 41.67 per cent were belonged to middle age group followed by 33.33 per cent belonged to young age and 25.0 per cent were found in old age group.

It is evident from the table that the majority of the respondents belonged to the middle age group (41.67 per cent) whereas least number came under old age group (25.0 per cent). Usually, farmers of middle aged are enthusiastic having more responsibility and were found more efficient than the younger and older ones. The respondents in this age group were active in adoption of agriculture practices. This category of farmers were highly composite and with high economic motivation, highly innovative and with more risk bearing ability. The results were in line with the research findings reported by Rupan Raghuvanshi *et al.,* (2017).

Caste:

During the study it was conceived that caste structure is one of the important aspect of social system in our country and it is more pronounced in the state of Bihar. Traditionally the village social system has been divided into various caste groups, viz., SC, ST, OBC and UR based on their caste structure. Details of the result obtained across the caste group are presented here with table 4.2.

Table 4.2. Distribution of farmers according to their caste

Sl. No.	Caste	Farmers(n=60)	
		Frequency	Percentage
1.	SC (Schedule Caste)	3	5.0
2.	ST (Schedule Tribes)	0	0
3.	OBC (Other Backward Caste)	55	91.67
4.	General (Un Reserved)	2	3.33
	Total	60	100

The table 4.2 reveals that majority of respondent i.e. 91.67 per cent belonged to OBC group among the total selected respondents followed by 5.0 per cent from SC group and 3.33 per cent from UR group but none of the respondents were from ST group.

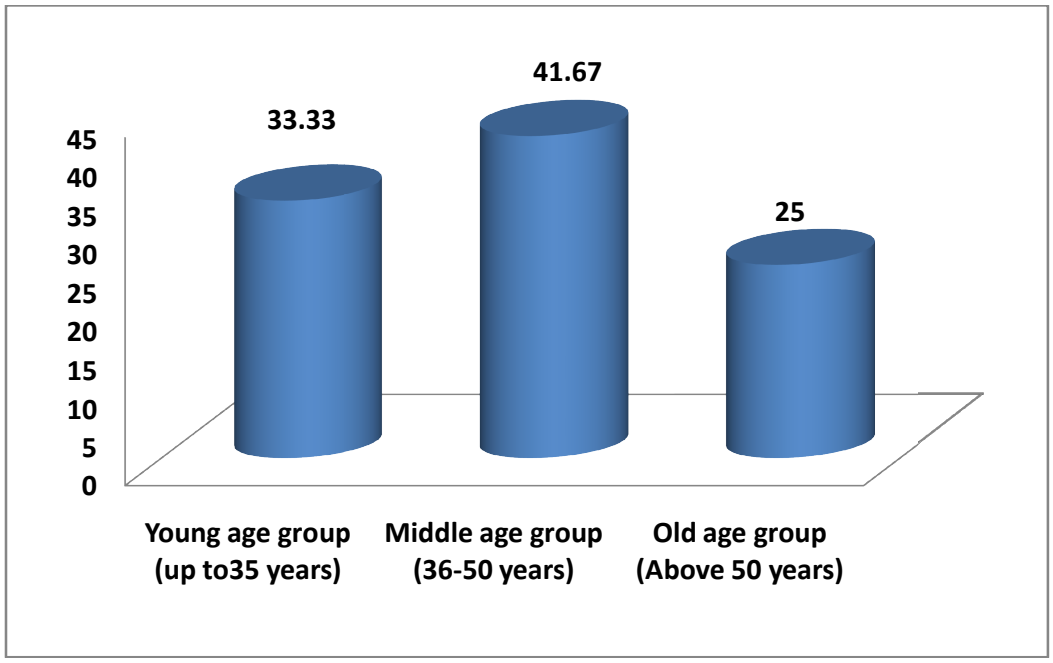

Fig. 4.1: Percentage distribution of respondents on the basis of their age

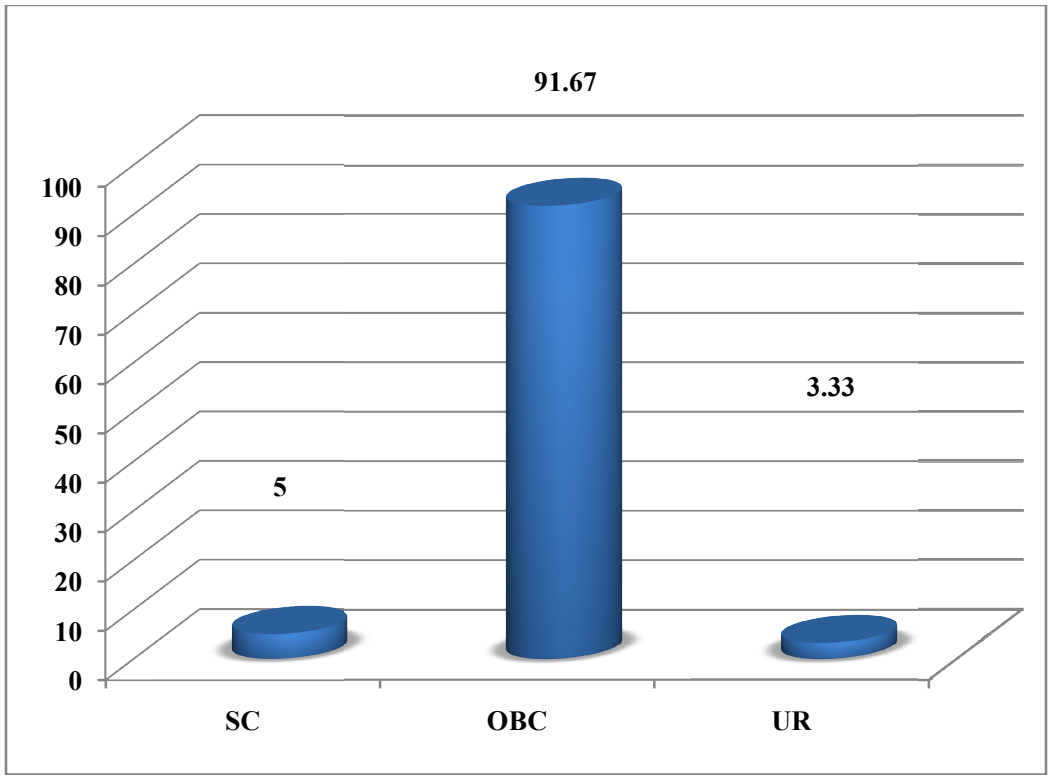

Fig. 4.2: Percentage distribution of respondents on the basis of their caste.

Occupation:

Occupation of respondents were considered as important factor which largely affect the economic condition of family, decision making process and attitude of family members towards weather forecasting information. All the respondents had been categorized into different groups on the basis of their main occupation.

Table 4.3. Distribution of farmers according to their occupation

Sl. No.	Occupation	Farmers (n=60)	
		Frequency	Percentage
1.	Farming	50	83.33
2.	Farming + Business	7	11.67
3.	Farming + Business + Services	3	5.0
4.	Other (specify)	0	0
	Total	60	100

The above table 4.3 clearly reveals that majority of respondents were from Farming only i.e. 83.33 per cent followed by farming with business (11.67 per cent) and 5.0 per cent engaged in farming with business and services.

Education

Education is another important factor that influences the knowledge of individuals. On the basis of education respondents were grouped into six categories i.e. illiterate, can read and write only, up to middle school, up to high school, up to intermediate, graduation and above.

Table 4.4 Distribution of farmers according to their education level

Sl. No.	Level of Education	Farmers (n=60)	
		Frequency	Percentage
1.	Illiterate	9	15.0
2.	Can read and write only	5	8.33
3.	Up to middle school	5	8.33
4.	Up to high school	25	41.67
5.	Up to intermediate	7	11.67
6.	Graduation and above	9	15.0
	Total	60	100

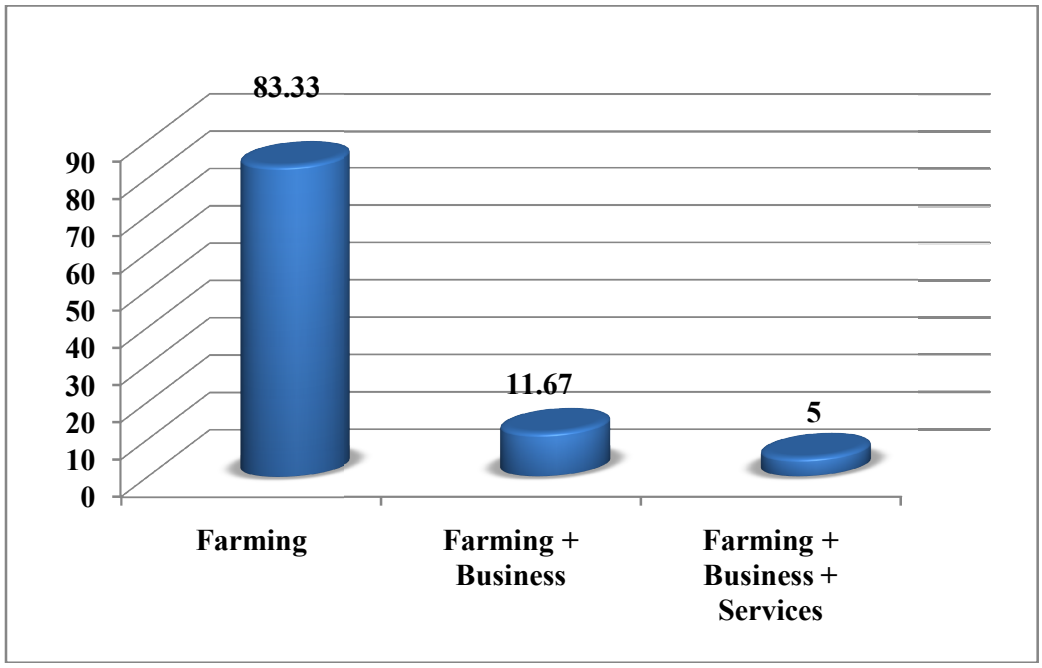

Fig. 4.3: Percentage distribution of respondents on the basis of their occupation.

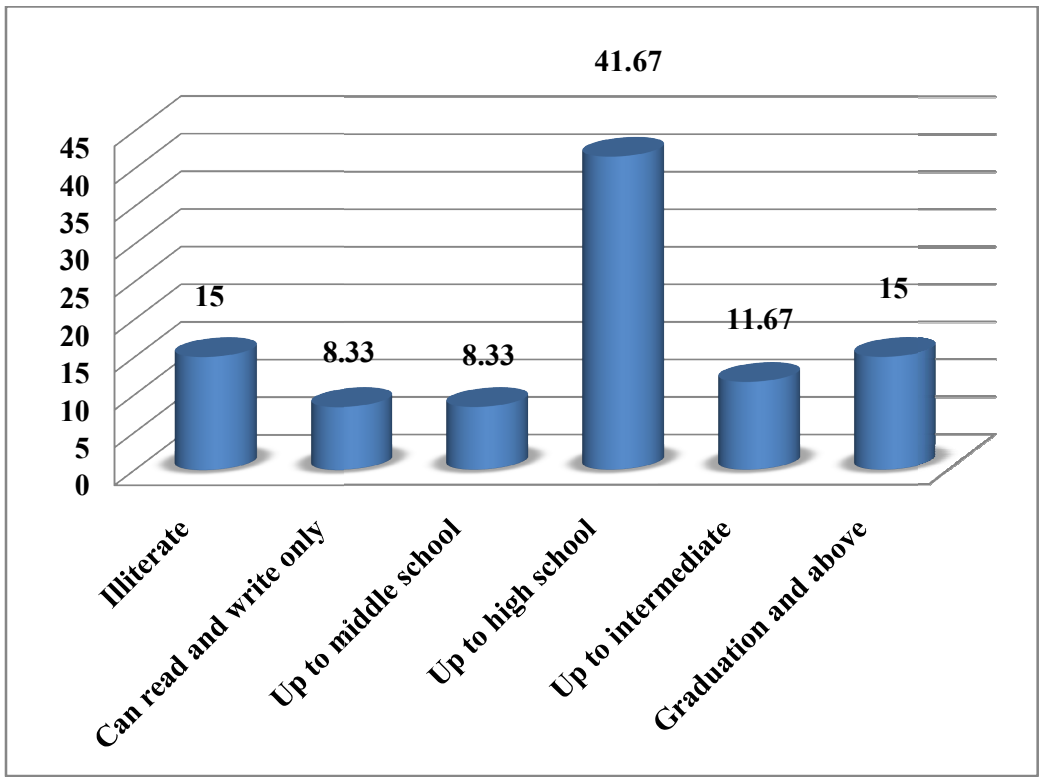

Fig. 4.4: Percentage distribution of respondents on the basis of their educational qualification.

It is clear from the data presented in table 4.4 that 41.67 per cent farmers had their education up to high school level, 15.0 per cent farmers had graduation and above, followed by 15.0 per cent farmers were found illiterate, 11.67 per cent farmers had their education up to intermediate, and 8.33 per cent farmers had up to middle school level of education and 8.33 per cent had found barely read and write group.

Family Type

Each type of the family has their respective advantages and disadvantages. However, type of family determines the progressiveness of the family in the society. It is the common phenomenon that joint families are more progressive and relatively resource rich. Moreover, the members of the joint family system are better involved in developmental activities for income generation. Distribution of the type of family of respondents were analysed and represented below.

Table 4.5. Distribution of farmers according to their family type

Sl. No.	Family Type	Farmers(n=60)	
		Frequency	Percentage
1.	Nuclear Family	27	45.0
2.	Joint Family	33	55.0
	Total	60	100

The data from the above table depicted that majority i.e. 55.0 per cent of the respondents belonged to joint family followed by 45.0 per cent who were belonged to nuclear family. It indicated that there was more social bondage among people in rural areas. But gradually, it is changing so that families are being changed from joint to nuclear family.

Family Size

It plays an important role in determining the economic behaviour of the family regarding income and expenditure on the basis of family size of farmers, the family size of the respondents were classified into three categories. The result came out through the family size are given here in table 4.6.

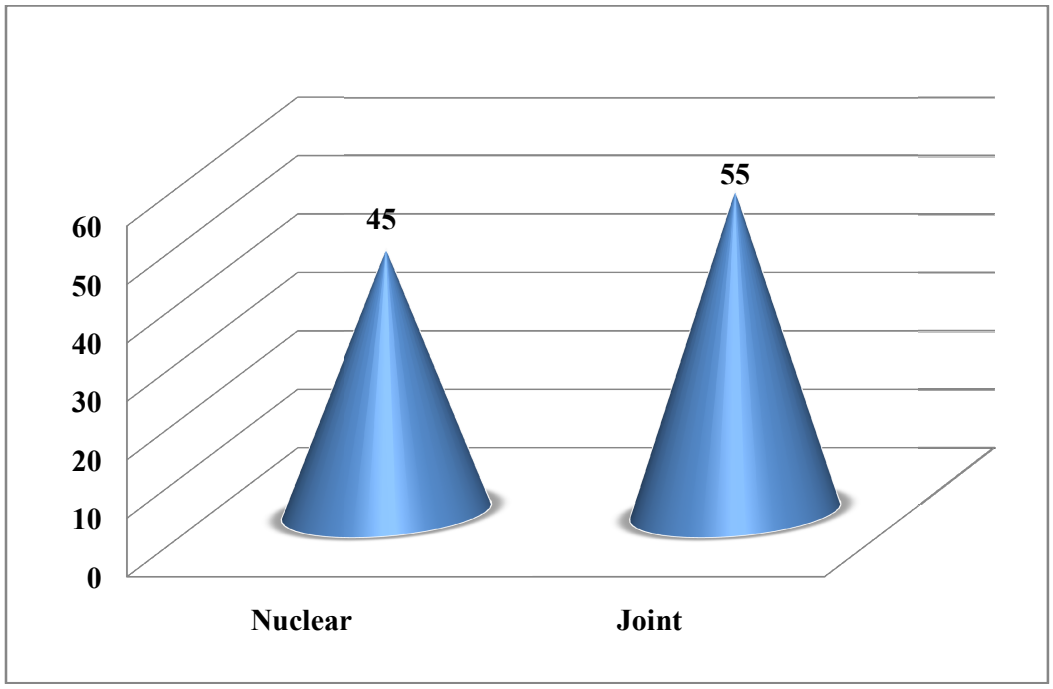

Fig. 4.5: Percentage distribution of respondents on the basis of their family type.

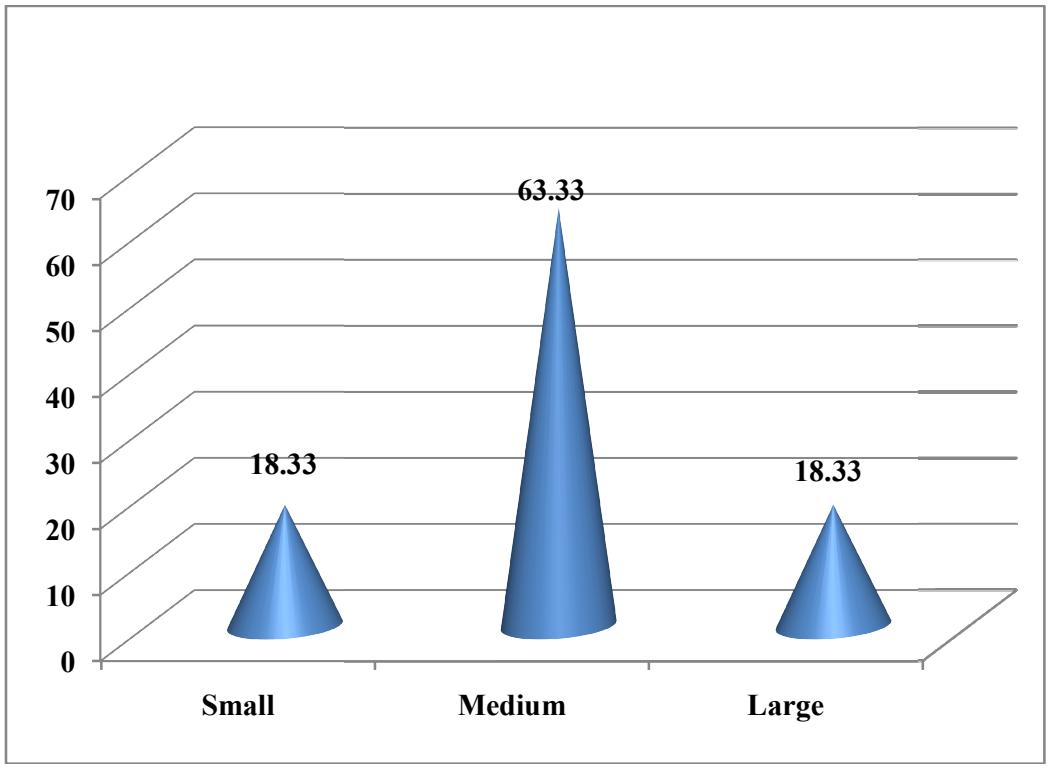

Fig. 4.6: Percentage distribution of respondents on the basis of their family size.

Table 4.6. Distribution of according to their family size

Sl. No.	Family Size	Farmers (n=60)	
		Frequency	Percentage
1.	Small (Up to 4 member)	11	18.33
2.	Medium (5-8)	38	63.33
3.	Large (9 and above)	11	18.33
	Total	60	100

The above table 4.6 clearly reveals that majority of respondents i.e. 63.33 per cent belonged to medium size among the total selected respondents followed by 18.33 per cent of the respondents belonged to large size and small size family respectively.

Annual Family Income

Average annual income greatly influences the decision making habit of an individual. The aspirations and goals of an individual are more or less ascertained on the basis of his average annual income. It influences an individual to take a decision to adopt an innovation or reject it. The study also attempted to investigate the annual income of the respondents by four categories. These were reflected in the table 4.7 after analysis.

Table 4.7. Distribution of farmers according to their annual family income

Sl. No.	Annual Income (In Rs.)	Farmers (n=60)	
		Frequency	Percentage
1.	Up to 50,000	26	43.33
2.	50,001- 1,00,000	25	41.67
3.	1,00,001-1,50,000	5	8.33
4.	Above 1,50,000	4	6.67
	Total	60	100

The result obtained from the above table revealed that majority of respondents i.e. 43.33 per cent were having annual income up to Rs.50,000 followed by 41.67 per cent had an annual income between Rs.50,001 to Rs.1,00,000, 8.33 per cent respondents had an annual income between Rs.1,00,001 to Rs.1,50,000 and 6.67 per cent respondents had an annual income above Rs.1,50,000 respectively.

Thus, it can be concluded that majority (43.33 per cent) of the respondent had an annual income less than Rs.50,000. This is attributed to the family background of the respondents.

Social participation

People with more social contact are usually exposed to latest development. The extent of social participation tells about the progressiveness and social standard of a person in the society. Persons more prone to outside world are more innovative and adopt modern technology easily. So a man with greater social participation is supposed to be more up to date and more enthusiastic about new innovations. Individual's involvement in various developmental organizations and participation in the activities not only increases knowledge but also develops interest to the changes in the practice. Social participation therefore has significant contribution in receiving and use of the information.

On the basis of extent of involvement and the position they hold in different organization, the respondents have been categorized in to four groups. The frequency and percentage distribution in different group have been shown in table 4.8.

Table 4.8. Distribution of according to their social participation

Sl. No.	Category	Farmers (n=60)	
		Frequency	Percentage
1.	Not member of any organization	40	66.67
2.	Member of one organization	19	31.67
3.	Member of more than one organization	01	1.67
4.	Office bearer of an organization	0	0
	Total	60	100

The above table clearly shows that majority of the respondents were not member of any organization i.e. 66.67 per cent followed by member of one organization i.e. 31.67 per cent while member of more than one organization were only 1.67 per cent and none of the respondents were office bearer. From the above analysis, it can be concluded that, the respondents were less aware about membership in any organization. It can be also represented by graphical.

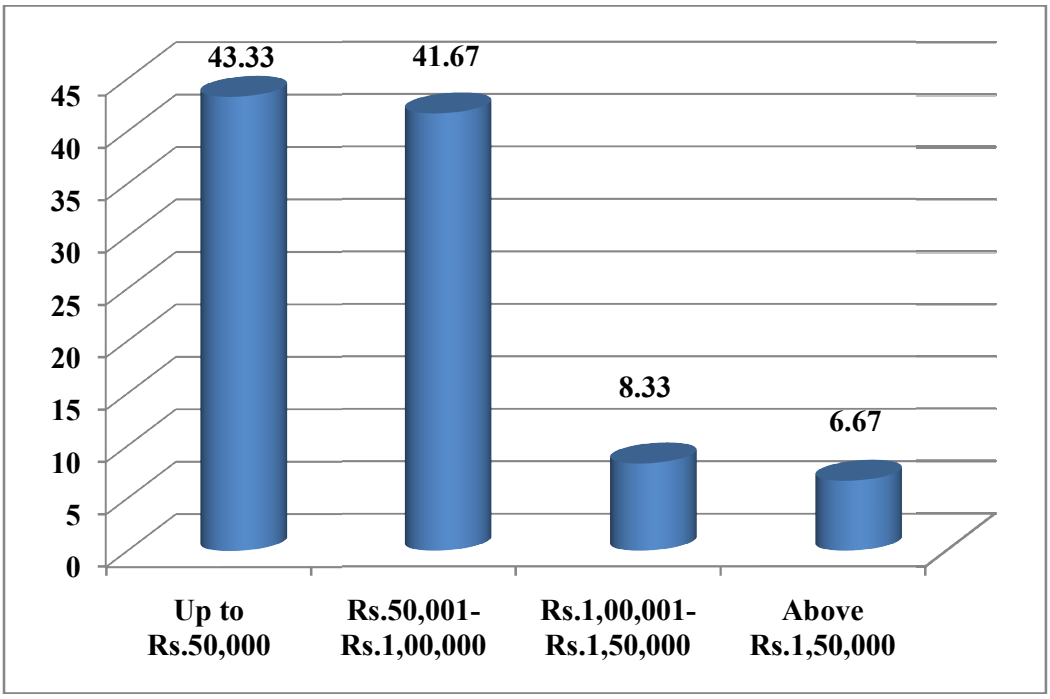

Fig. 4.7: Percentage distribution of respondents on the basis of their annual family income.

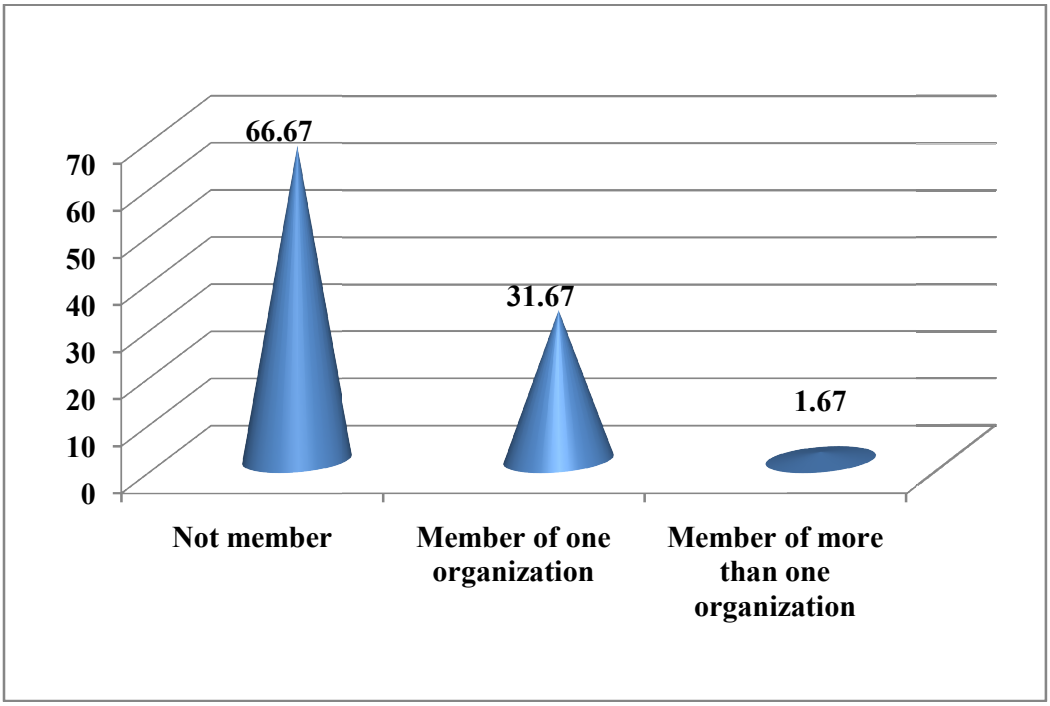

Fig. 4.8: Percentage distribution of respondents on the basis of their social Participation.

Source of information utilized

Source of information utilized is one of the most important variables that play an important role in adoption of new technology. Source of information in the present study refers out-side contact of farmers which given knowledge related with the latest technologies. As the respondent established close linkage with various information sources *viz.* personal cosmopolite and personal localite and mass media, they possess significant level of adoption.

Table 4.9. Distribution of farmers according to their source of information utilized

Sl. No.	Category	Farmers(n=60)			
		Always	Often	Sometimes	Never
		Frequency (Percentage)	Frequency (Percentage)	Frequency (Percentage)	Frequency (Percentage)
1.	KCC	1 (1.67)	0 (0)	13 (21.67)	46 (76.67)
2.	Agriculture University	2 (3.33)	3 (5.0)	41 (68.33)	14 (23.33)
3.	Research Station	0 (0)	2 (3.33)	10 (16.67)	48 (80)
4.	Television	1 (1.67)	35 (58.33)	18 (30.0)	6 (10.0)
5.	AAS bulletin in printed from public notice	5 (8.33)	35 (58.33)	18 (30.0)	2 (3.33)
6.	KVK	7 (11.67)	13 (21.67)	27 (45.0)	13 (21.67)
7.	Any Others (Internet, Newspaper, SMS etc.)	7 (11.67)	8 (13.33)	40 (66.67)	5 (8.33)

The table 4.9 shows that majority of respondents i.e. 76.67 per cent never used and 21.67 per cent of respondents were sometimes used, KCC as the source of information. In case of Agriculture University, 68.33 per cent of respondents were sometimes used while 23.33 per cent respondents were never used, Agriculture

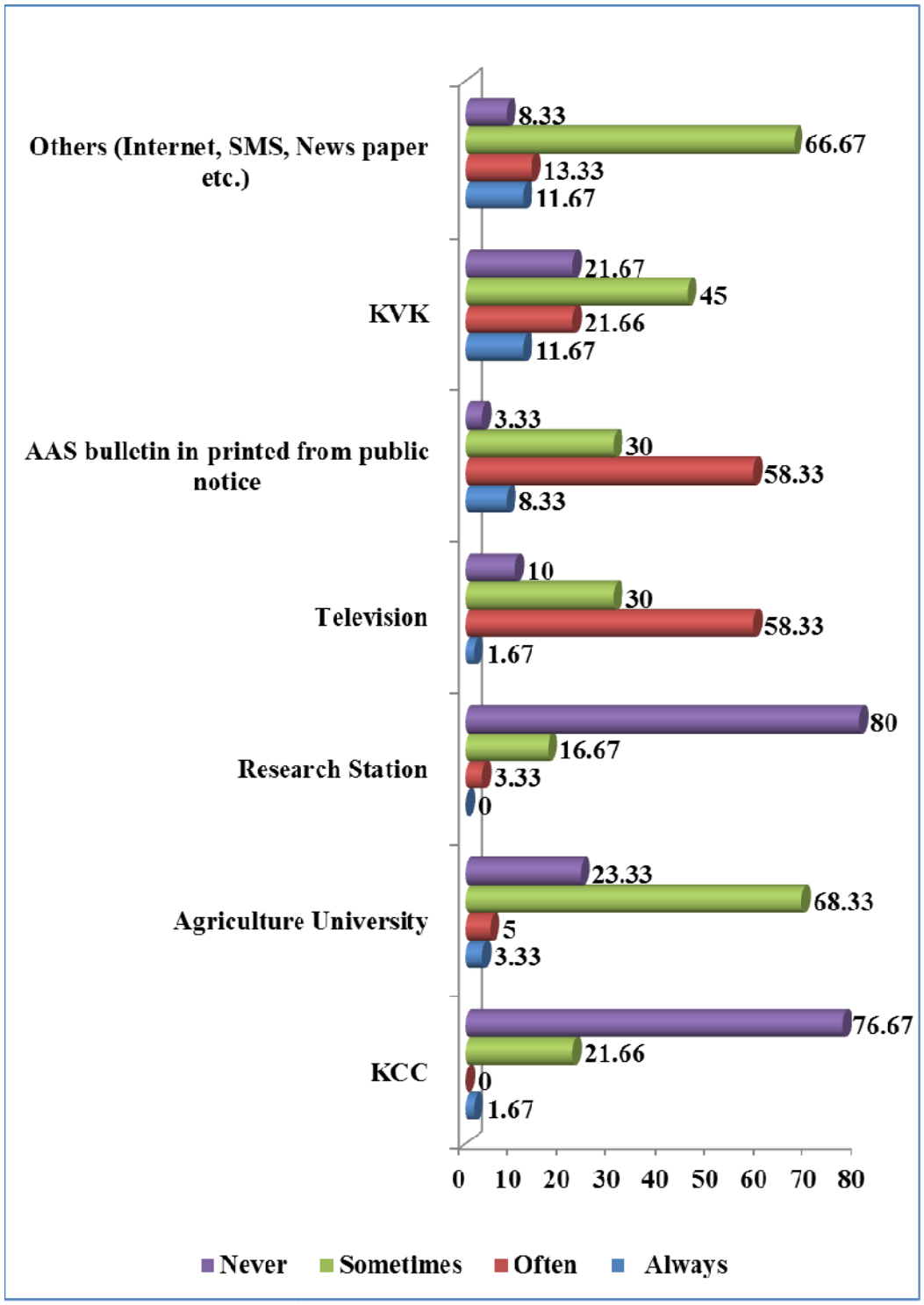

Fig. 4.9: Percentage distribution of respondents on the basis of their source of information utilized.

University as the source of information followed by 80.0 per cent respondents were never used and 16.67 per cent respondents were sometimes used, Research station as the source of information. It can be also observed that 58.33 per cent of respondents were often used and 30 per cent respondents were sometimes used, Television and AAS bulletin as the source of information followed by 45.0 per cent respondents were sometimes used and 21.67 often used, KVK as the source of information. It is also observed that 66.67 per cent of respondents sometimes used, 13.33 per cent respondents often used and 11.67 per cent of respondents always used others (Internet, SMS and Newspaper etc.) as a source of information.

Farming Experience

The table 4.10 revealed that 36.67 per cent respondents were found to have up to 10 years of farming experience followed by 33.33 per cent of respondents been having above 20 years of farming experience and 30.0 per cent respondents were found to have between 11 to 20 years of farming experience.

Table 4.10 Distribution of farmers according to their farming experience

Sl. No.	Farming Experience (In years)	Farmers (n=60)	
		Frequency	Percentage
1.	Up to 10 years	22	36.67
2.	11- 20 years	18	30.0
3.	Above 20 years	20	33.33
	Total	60	100

Thus, it can be concluded that majority 36.67 per cent respondents had 10 years of farming experience. This might be due to the fact that among the farmers selected for the study majority of them belonged to young to middle age group. Hence they have got 10 years of farming experience.

Size of land holding

Land is an important income generating asset in rural areas. Land holding possessed by respondents were measured in hectares but the respondents were categorized into marginal, small, medium and large. Farmers based on criteria of National Commission of Agriculture (MOAFW, GOI, 1976). The data thus collected was analysed and the results are given table 4.11.

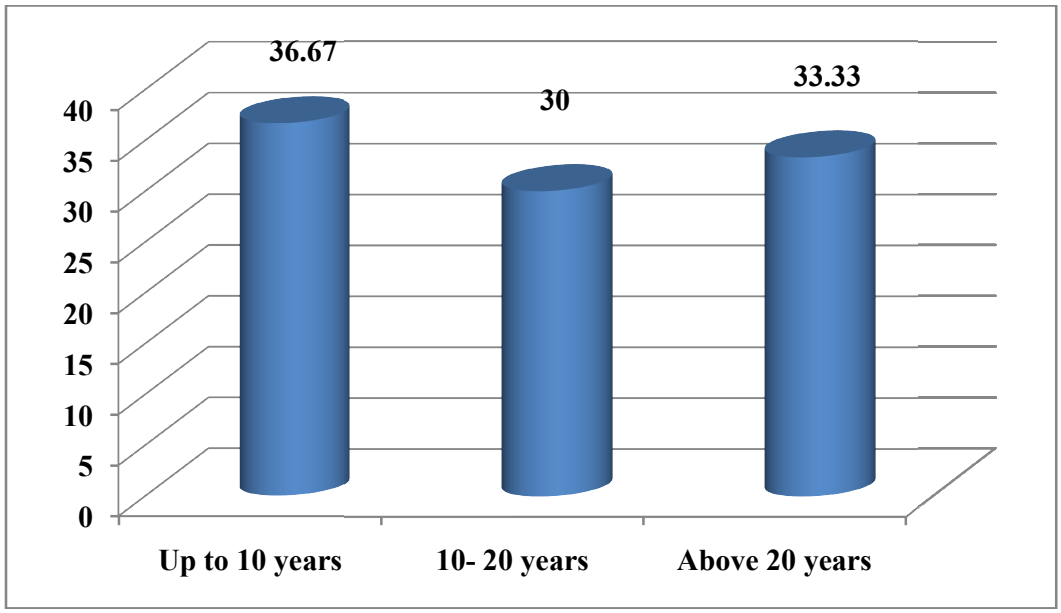

Fig. 4.10: Percentage distribution of respondents on the basis of their farming experience.

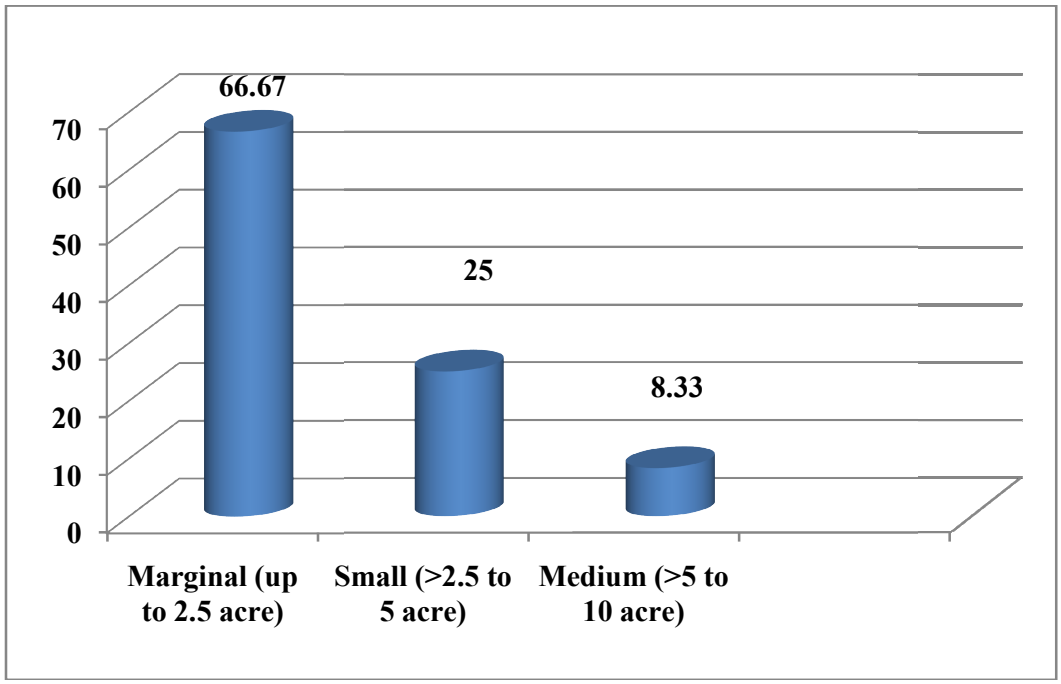

Fig. 4.11: Percentage distribution of respondents on the basis of their size of land holding.

Table 4.11. Distribution of farmer according to their size of land holding

Sl. No.	Category	Farmers (n=60)	
		Frequency	Percentage
1.	Marginal (up to 2.5 acre)	40	66.67
2.	Small (2.5 to 5 acre)	15	25.0
3.	Medium (>5 to 10 acre)	5	8.33
4.	Large (>10 acre)	0	0
	Total	60	100

It is observed from the table that, among the respondents the majority of them belonged to marginal farmers i.e. 66.67 per cent followed by small farmers (25.0 per cent), and medium farmers were 8.33 per cent. It is clear from the table that more than two- third of respondents were small and marginal farmers. None of the respondents were found under large category. This study found similar results with the findings of Rav *et al.,* (2011) where result depicted that majority of respondents were in marginal land holding category.

2. Knowledge level and attitude of users towards weather forecasting information

Knowledge level

To assess the level of knowledge on weather and weather forecast advisory services, a knowledge test was specially designed for the purpose, which constituted of 17 questions with correct answers getting score of 2 and incorrect answer getting a score of 1, the knowledge test was administrated to the samples of study, the data thus got were analysed and the results are presented in table 4.12. In order to finalize the level of knowledge scores, the scores obtained on all the 17 questions were added and the percentage was calculated using the following formula.

$$\textbf{Knowledge index} = \frac{\text{Obtained knowledge score}}{\text{highest obtainable score}} \times 100$$

The knowledge score of all the 60 respondents were put in a frequency table and their mean and S.D was computed. The frequency distribution is given in table 4.12.

Table 4.12. Overall knowledge level of the farmers about weather forecasting information

Sl. No.	Category	Farmers (n=60)	
		Frequency	Percentage
1.	Low (<29.33)	12	20.0
2.	Medium (29.33 to 33.43)	43	71.67
3.	High (>33.43)	5	8.33
	Total	60	100

Mean = 31.33, SD=2.10

It is clear from the table 4.12 that 71.67 per cent of respondents had medium level of knowledge and 20.0 per cent of respondents had low level of knowledge. Only 8.33 per cent of respondents had high level of knowledge.

Thus, the table 4.12 indicates that majority of respondents 71.67 per cent were having medium level of knowledge about weather forecasting information, as they possess few important weather forecast advisory services and using regularly.

Knowledge of various components of weather forecasting information of respondents

Level of knowledge was measured by using a knowledge test consisting of 17 questions. An attempt was made here to compute frequencies of correct answers.

The table 4.13 revealed that the overall percentage of knowledge of respondents about weather forecasting advisory services were 92.16, whereas 100 per cent respondents had knowledge about the importance and changing of monsoon time. Majority of the respondents having knowledge about weather forecasting advisory services were between 90-100 per cent regarding R.P.C.A.U bulletin, major crop, sources of weather forecast, most important climatic factor which affect crop production, maximum rainfall but in case of instruments for measuring of rainfall and temperature only 15 per cent of respondents were having knowledge.

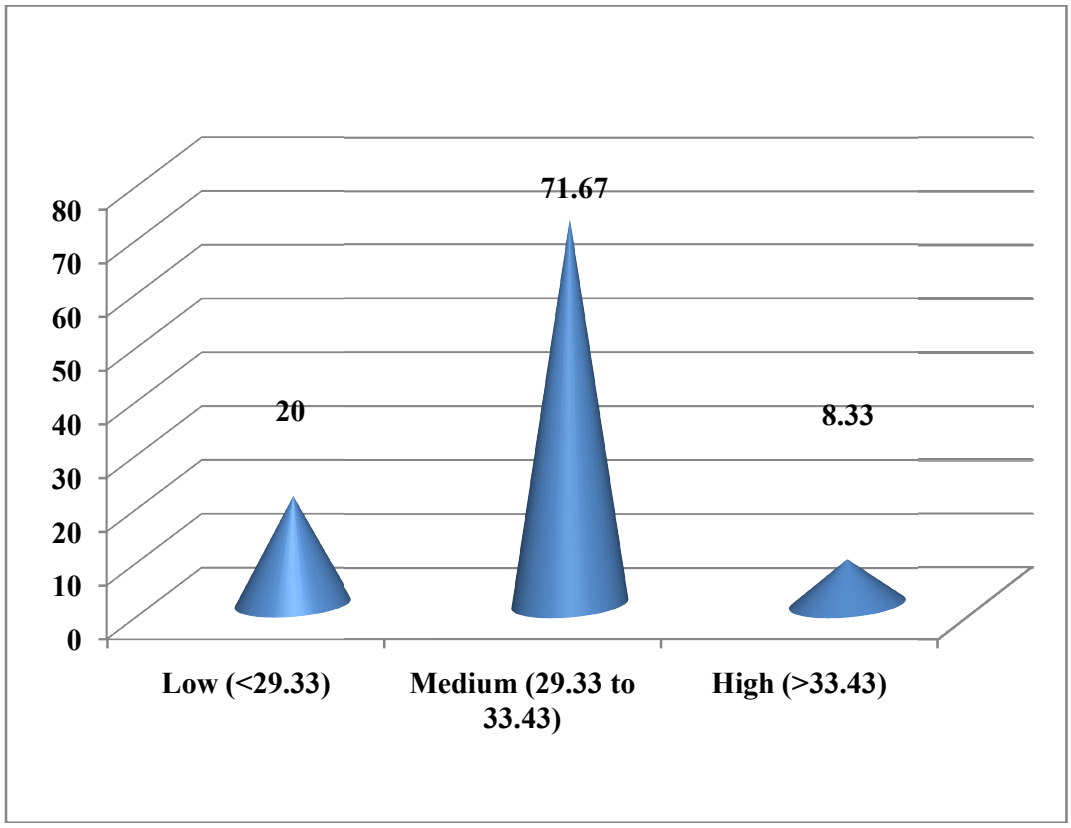

Fig. 4.12: Percentage distribution of respondents on the basis of their level of knowledge.

Table 4.13. Distribution of various components of knowledge towards weather forecasting information

Sl. No.	Components of knowledge of Weather Forecasting information	Farmers (n=60)	
		f	%
1.	Whether the weather forecasting advisory services is important for farmers?	60	100.0
2.	Are you sowing your crop and choose the varieties according to changing in climate?	48	80.0
3.	Do you have any information about the bad effect about the use of pesticides and insecticides in our environment?	37	61.67
4.	Do you know the instruments for measuring of rainfall and temperature?	9	15.0
5.	Are you aware about R.P.C.A.U Bulletin?	54	90.0
6.	Have you seen any change in monsoon timing?	60	100.0
7.	Are you are satisfied with AAS bulletin, are you willing to pay for it?	34	56.67
8.	R.P.C.A.U Bulletin provide weather forecast?	55	91.67
9.	Do you know the major crop of your area?	57	95.0
10.	Do you know the different sources of weather forecast?	56	93.33
11.	Do you know the frequency of forecast which you use?	53	88.33
12.	Do you know the coverage of forecast used by you?	51	85.0
13.	Do you know about climatic factor which affects crop production in your area?	56	93.33
14.	Do you know about the maximum rainfall which takes place in your area?	59	98.33
15.	Do you know in these months which factor is most important which affect the crop Production?	56	93.33
16.	Do you know how much percentage of weather forecasting benefit is being received by agriculture?	59	98.33
17.	Do you know in these months which factor is most important which affect the crop Production?	57	95.0
	Overall % knowledge		**92.16**

Attitude

It refers to the degree of positive and negative feelings of the respondents towards the crop weather forecasting messages received from the university. The responses were obtained on five point continuum namely “Strongly agree, Agree,

Undecided, Disagree and Strongly disagree". The scores of 5, 4, 3, 2 and 1 were given to positive statements and the scoring was reversed for negative statements.

A perusal of Table 4.14 presents the data obtained regarding attitude of farmers towards weather forecasting information.

Statements agreed by the respondents were, nearly 73.33 per cent of the respondents agreed that use of weather forecasting information is a way to increase the crop production, Weather forecasting information increasing the farmers income (56.67 %), Uses of weather forecasting information increasing farming skills (46.67%), Frequency of weather forecasting information is sufficient for agriculture (45.0%), Changing in the farming system by the use of weather forecasting information (60.0%), New technology is disseminated by the weather forecasting advisory services unit (33.33%), Weather forecasting information will provide benefit in your agriculture (70.0%), The use of weather forecasting information is essential for production of high value crop (63.33%), Weather forecasting information often save your crop from failure (68.33%), Accuracy of weather forecast information is correct (43.33%), Farmers can get timely weather forecast information (40.0%), Weather forecast information is location specific (28.33%), Language of weather forecast information is easily understood by farmers (48.33%).

Statements which undecided by respondents were, nearly 20.0 per cent of the respondents undecided that weather forecasting information increases the farmers income, Weather forecasting information changing farming skill (30.0%), frequency of weather forecasting information is sufficient for agriculture (36.67%), New technology is disseminated by the weather forecasting advisory services unit (40.0%), Accuracy of weather forecast information is correct (35.0%), Farmers can get timely weather forecast information (36.67%), Weather forecast information is location specific (40.0%), Language of weather forecast information is easily understood by farmers (21.67%).

Table 4.14. Distribution of farmers according to their attitude towards weather forecasting information

Sl. No.	Statements	Farmers (n=60)				
		Strongly agree	Agree	Un Decided	Disagree	Strongly Disagree
		Frequency (Percentage)	Frequency (Percentage)	Frequency (Percentage)	Frequency (Percentage)	Frequency (Percentage)
1.	The use of weather forecasting information is a way to increase the crop production.	14 (23.33)	44 (73.33)	1 (1.67)	1 (1.67)	0 (0)
2.	Weather forecasting information increasing the farmers income	12 (20)	34 (56.67)	12 (20.0)	2 (3.33)	0 (0)
3.	Weather forecasting information changing farmers skill	11 (18.33)	28 (46.67)	18 (30.0)	3 (5.0)	0 (0)
4.	Frequency of weather forecasting information is sufficient for agriculture	5 (8.33)	27 (45.0)	22 (36.67)	6 (10.0)	0 (0)
5.	Changing in the farming system by the use of weather forecasting information.	12 (20.0)	36 (60.0)	10 (16.67)	2 (3.33)	0 (0)
6.	New technology is disseminated by the weather forecasting advisory services unit.	2 (3.33)	20 (33.33)	24 (40.0)	11 (18.33)	3 (5.0)
7.	Weather forecasting information will provide benefit in your agriculture.	11 (18.33)	42 (70.0)	7 (11.67)	0 (0)	0 (0)
8.	The use of weather forecasting information is essential for production of high value crop.	13 (21.66)	38 (63.33)	7 (11.67)	1 (1.67)	1 (1.67)
9.	Weather forecasting information often save your crop from failure	15 (25.0)	41 (68.33)	3 (5.0)	0 (0)	1 (1.67)
10.	Accuracy of weather forecast information is correct	6 (10.0)	26 (43.33)	21 (35.0)	6 (10.0)	1 (1.67)
11.	Farmers can get timely weather forecast information	10 (16.67)	24 (40)	22 (36.67)	4 (6.67)	0 (0)
12.	Weather forecast information is location specific	5 (8.33)	17 (28.33)	24 (40.0)	8 (13.33)	6 (10.0)
13.	Language of weather forecast information is easily understood by farmers.	12 (20.0)	29 (48.33)	13 (21.67)	1 (1.67)	5 (8.33)

Table 4.15.Overall attitude of farmers towards weather forecasting information

Sl. No.	Category	Farmers (n=60)	
		f	%
1.	Least favourable (< 43.5)	11	18.33
2.	Favourable (43.5 to 53.94)	39	65.0
3.	Highly favourable (> 53.94)	10	16.67
	Total	60	100

Mean= 48.72, SD= 5.22

The overall attitude of respondents towards weather forecasting information is depicted in table 4.15. It was observed that majority 65.0 per cent of respondents had favourable attitude towards weather forecasting information followed by 18.33 per cent of respondents had least favourable attitude and 16.67 per cent of respondents had highly favourable attitude towards weather forecasting information.

Thus, it can be concluded that majority of respondents 65.0 per cent had favourable attitude towards the weather forecasting information. The possible reason might be the fact that considerable number (71.67 %) of respondents had medium level of knowledge on weather forecasting information, resulted in favourable attitude. Further majority of the respondents were literate and belonged to middle age group might influence favourable attitude.

3. To study the Extent of adoption of weather forecasting information as disseminated by R. P. C. A. U.

To measures the extent of adoption of weather forecasting information by respondents a simple schedule was prepared consisting 12 items related with adoption of advisory services. Based on the responses given by the respondents on each statement, the total score obtained, the respondents were categorized on the basis of frequency and percentage in different groups *viz.* 'full adoption', 'partial adoption', 'non adoption'.

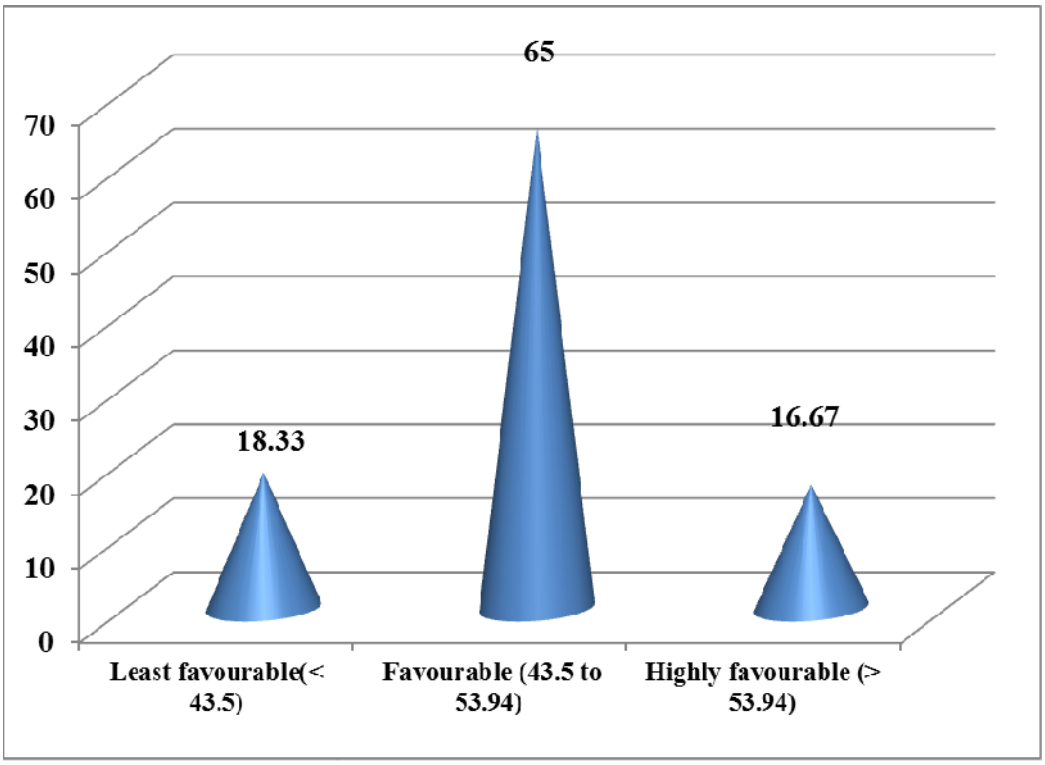

Fig. 4.13: Percentage distribution of respondents on the basis of their attitude towards weather forecasting.

Table 4.16. Distribution of farmers according to their extent of adoption of weather forecasting information

Sl. No.	Aspects of weather forecasting information	Level of adoption		
		Full adoption	**Partial Adoption**	**Non Adoption**
		f **(%)**	***f*** **(%)**	***f*** **(%)**
1.	Use of advisory services of weather forecasting information	41 (68.33)	17 (28.33)	2 (3.33)
2.	Type of crop pattern given by the advisory service of weather forecasting information.	19 (31.67)	34 (56.67)	7 (11.67)
3.	Type of crop planted according to the advisory services of weather forecasting information.	39 (65.0)	18 (30.0)	3 (5.0)
4.	Varieties of crop used according to the advisory services of weather forecasting information.	28 (46.67)	26 (43.33)	6 (10.0)
5.	Type of seed used according to the advisory services of weather forecasting information.	44 (73.33)	14 (23.33)	2 (3.33)
6.	Harvesting of crop according to the advisory services of weather forecasting information.	52 (86.67)	8 (13.33)	0 (0)
7.	Type of fertilizer required according to the advisory services of weather forecasting information.	34 (56.67)	23 (38.33)	3 (5.0)
8.	Quantity of fertilizer used according to the advisory services of weather forecasting information.	35 (58.33)	22 (36.67)	3 (5.0)
9.	Quantity of irrigation required according to the advisory services of weather forecasting information.	36 (60.0)	18 (30.0)	6 (10.0)
10.	Use of pesticides and insecticides according to the advisory services of weather forecasting information.	21 (35.0)	31 (51.67)	8 (13.33)
11.	Frequency of weather forecast used by farmer according to the advisory services of weather forecasting information.	27 (45.0)	27 (45.0)	6 (10.0)
12.	Uses of new technology by farmer given by the advisory services of weather forecasting information.	14 (23.33)	35 (58.33)	11 (18.33)
	Total	**390**	**273**	**57**
	%	**54.16**	**37.91**	**7.42**

The table 4.16 revealed that 54.16 per cent of respondents had full adoption level towards weather forecasting information followed by 37.91 per cent of respondents had partial adoption level and 7.42 per cent of respondents had not adopted different component of information related with weather forecasting information as disseminated by R.P.C.A.U., Pusa among the selected farming groups.

Table 4.17. Overall adoption of farmers towards weather forecasting information across the selected Blocks

Sl. No.	Category	Marwan		Saraiya	
		Farmers (n=30)		Farmers (n=30)	
		f	%	*f*	%
1.	Low (Mean — S.D)	2	6.67	4	13.33
2.	Medium (Mean ±S.D)	21	70.0	24	80.0
3.	High (Mean + S.D)	7	23.33	2	6.67
	Total	30	100	30	100

Mean of Marwan Block = 29.1 **Mean of Saraiya Block= 30**

SD of Marwan Block= 5.5 **SD of Saraiya Block= 4.5**

As the result in table 4.17 revealed that in Marwan block majority of the respondents had medium level of adoption i.e.70.0 per cent followed by 23.33 per cent respondents had high level of adoption and 6.67 per cent respondents had low level of adoption. Whereas in Saraiya block majority of the respondents had medium level of adoption i.e. 80.0 per cent followed by 13.33 per cent had low level of adoption and 6.67 per cent had high level of adoption.

It is evident from the table that 23.33 per cent respondents of Marwan block had high level of adoption followed by 6.67 per cent respondents of Saraiya block because as per my field visit in Marwan block I observed that farmers of Bhagwatpur village were mainly depend on farming because there farming is the main source of their livelihood and income. Whereas farmers of Bally Saraiya village of Saraiya block were not mainly depend on farming because they have other sources for their livelihood and income.

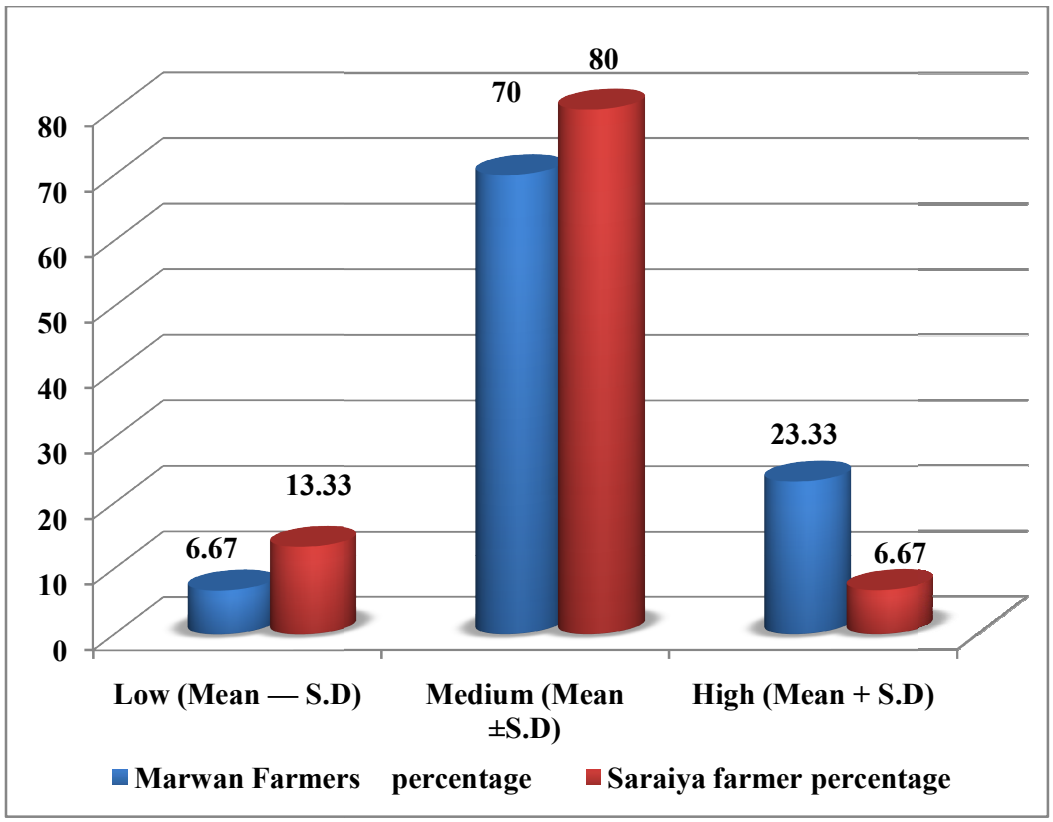

Fig. 4.14: Percentage distribution of respondents with respect to their extent of adoption across the selected Blocks

Table 4.18. Overall extent of adoption of farmers towards weather forecasting Information

Sl. No.	Category	Farmers (n=60)	
		Frequency	Percentage
1.	Low (< 24.85)	6	10.0
2.	Medium (24.85 to 34.25)	44	73.33
3.	High (> 34.25)	9	15.0
	Total	60	100

Mean =29.55, SD = 4.7

Result present in table 4.18 revealed that majority of respondents had medium level of adoption i.e. 73.33 per cent followed by high level which is 15.0 per cent and 10.0 per cent had low level of adoption.

Thus, it can be concluded that majority of respondents had medium level of adoption i.e. 73.33 per cent. The possible reason might be the fact that considerable number (83.33%) of respondents had engaged in farming occupation and this is main source of income. Hence they had medium level of adoption about the weather forecasting information. Further majority of respondents (71.67%) had medium level of knowledge might influence the medium level of adoption.

4. To identify different Constraints as perceived by the users related with the adoption of weather forecasting information

One of the objectives of the study was to find out the constraints as encountered by the users related with the adoption of weather forecasting information. During investigation, respondents expressed many reasons due to which they could not adopt the weather forecasting information. For the purpose, open-ended questions were asked to elicit respondent's perceived constraints.

The constraints expressed by the respondents were tabulated and presented in table 4.19 with frequencies and percentages were assigned based on their magnitude.

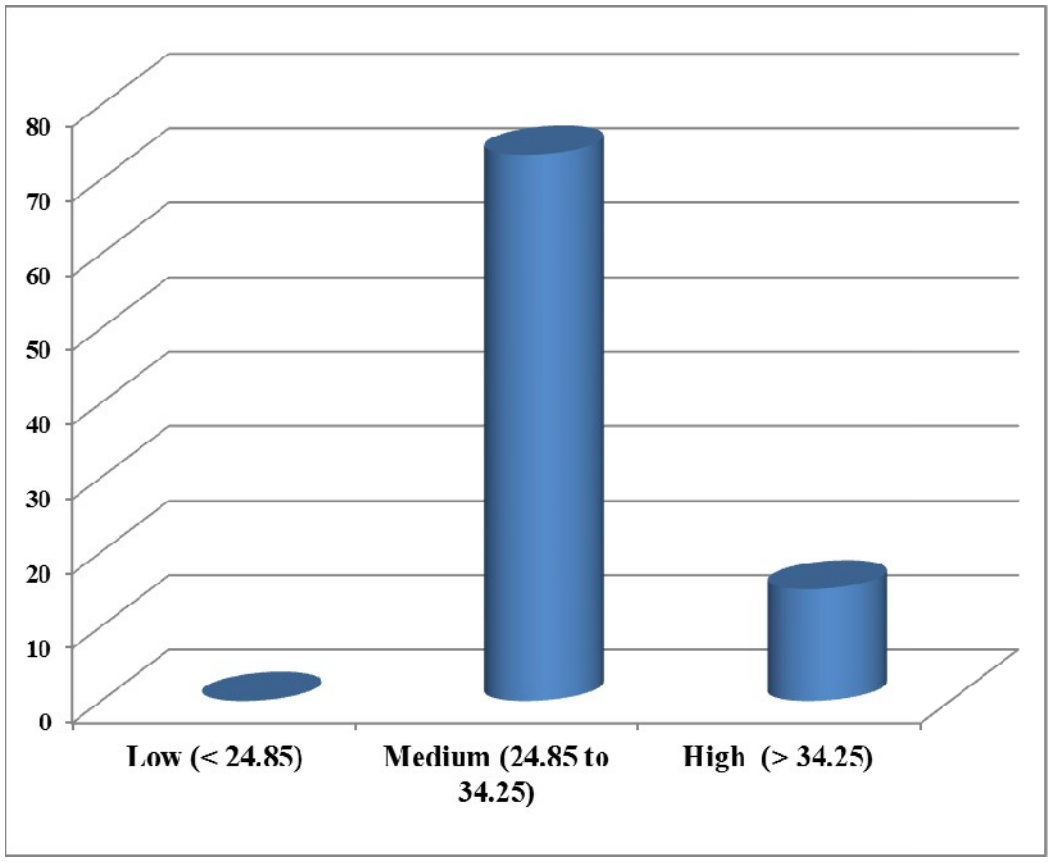

Fig. 4.15: Percentage distribution of respondents on the basis of their extent of adoption.

Table 4.19. Constraints as perceived by the users related with adoption of weather forecasting information

Sl. No.	Constraints	Degree of importance (n=60)					
		More Important		Important		Less Important	
		f	%	*f*	%	*f*	%
1.	Weather forecast information is not location specific	15	25.0	28	46.67	17	28.33
2.	Due to flexibility in weather condition information is not right at every time	14	23.33	44	73.33	2	3.33
3.	Weather forecasting is not timely forecast at the time of flood and drought	14	23.33	38	63.33	8	13.33
4.	Farmers could not understand SMS on mobile due to lack of knowledge of its application	23	38.33	34	56.67	3	5.0
5.	Belief about traditional weather forecast is more powerful than modern weather forecasting in farmer's view	8	13.33	14	23.33	38	63.33
6.	Weather forecasting an advisory service is brief hence cannot be understood by majority of farmers	12	20.0	21	35.0	27	45.0
7.	Farmers are not able to know the economic benefits of weather forecasts	0	0	16	26.67	44	73.33
8.	All farmers do not have availability of source of information	14	23.33	40	66.67	6	10.0
9.	The farmers cannot get time to view weather forecast advisory services due to delay in media	18	30.0	38	63.33	4	6.67

The data from table 4.19 indicates that, 38.33 per cent of the respondents had more important and 56.67 percent of the respondents had important constraint in "Farmers could not understand SMS on mobile due to lack of knowledge of its application" followed by 30 per cent of respondents had more important and 63.33 percent of respondents had important constraint in "The farmers cannot get time to view weather forecast advisory services due to delay in media" and 23.33 per cent of respondents had more important and 73.33 per cent of respondents had important constraint in "Due to flexibility in weather condition information is not right at every time" in adoption of weather forecasting information. It is observed that 23.33 per cent of respondents had more important and 66.67 per cent of respondents had important constraint in "All farmers do not have availability of source of information" followed by 23.33 percent of respondents had more important and 63.33 per cent of respondents had important constraints in "Weather forecasting is not timely forecast at the time of flood and drought" in adoption of weather forecasting information.

Also it is observed that, 46.67 per cent of respondents had important and 28.33 per cent of respondents had less important constraints in "Weather forecast information is not location specific" followed by 35 per cent of respondents had important and 45 per cent of respondents had less important constraint in "Weather forecasting an advisory service is brief hence cannot be understood by majority of farmers", 23.33 percent of respondents had important and 63.33 percent of respondents had less important constraint in "Belief about traditional weather forecast is more powerful than modern weather forecasting in farmer's view" and 26.67 per cent of respondents had important 73.33 percent of respondents had less important constraint in "Farmers are not able to know the economic benefits of weather forecasts" in adoption of weather forecasting information.

There are different nine constraints identified which are classified into more important, important and less important and scoring was done as 3, 2 and 1 respectively. Rank of constraints had decided on the basis of mean score. The results are presented in Table. 4.20.

Table 4.20. Constraints (in rank-wise) as perceived by users related with adoption of weather forecasting information

Sl. No.	Statement	Mean	Rank order
1.	Farmers could not understand SMS on mobile due to lack of knowledge of its application	2.33	I
2.	The farmers cannot get time to view weather forecast advisory services	2.23	II
3.	Due to flexibility in weather condition information is not right at every time	2.2	III
4.	All farmers do not have availability of source of information	2.13	IV
5.	Weather forecasting is not timely forecast at the time of flood and drought	2.1	V
6.	Weather forecast information is not location specific	1.96	VI
7.	Weather forecasting an advisory service is brief hence cannot be understood by majority of farmers	1.75	VII
8.	Belief about traditional weather forecast is more powerful than modern weather forecasting in farmer's view	1.5	VIII
9.	Farmers are not able to know the economic benefits of weather forecasts	1.26	IX

From Table 4.20 it can be revealed that Farmers could not understand SMS on mobile due to lack of knowledge of its application was considered most serious constraint by the respondents and was ranked first as per the mean score followed by The farmers cannot get time to view weather forecast advisory services was ranked second, Due to flexibility in weather condition information is not right at every time was ranked third, All farmers do not have availability of source of information was ranked fourth, Weather forecasting is not timely forecast at the time of flood and drought was ranked fifth, Weather forecast information is not location specific was ranked sixth, Weather forecasting an advisory service is brief hence cannot be understood by majority of farmers was ranked seventh, Belief about traditional weather forecast is more powerful than modern weather forecasting in farmer's view

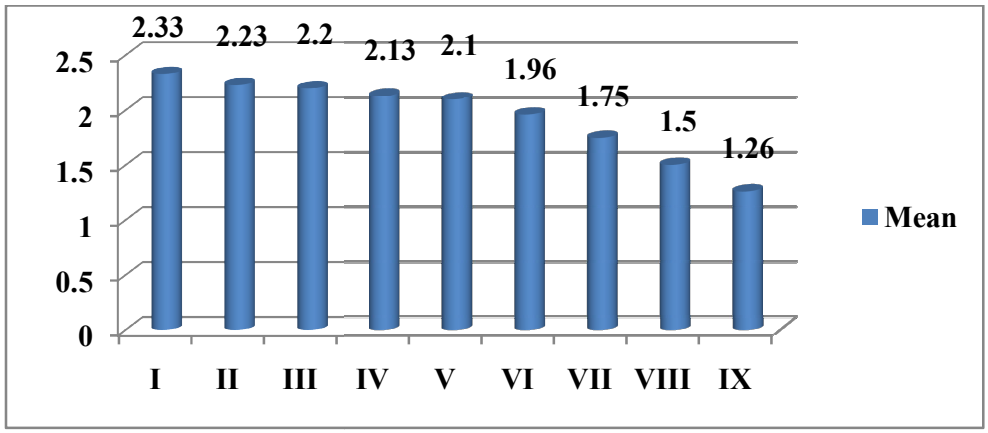

Fig. 4.16: Constraints as perceived by users related with adoption of weather forecasting information

Rank I - Farmers could not understand SMS on mobile due to lack of knowledge of its application.

Rank II - The farmers cannot get time to view weather forecast advisory services.

Rank III - Due to flexibility in weather condition information is not right at every time.

Rank IV- All farmers do not have availability of source of information.

Rank V- Weather forecasting is not timely forecast at the time of flood and drought

Rank VI- Weather forecast information is not location specific

Rank VII-Weather forecasting an advisory service is brief hence cannot be understood by majority of farmers.

Rank VIII- Belief about traditional weather forecast is more powerful than modern weather forecasting in farmer's view.

Rank IX- Farmers are not able to know the economic benefits of weather forecasts.

was ranked eighth and Farmers are not able to know the economic benefits of weather forecasts was ranked ninth.

Suggestions on improving the Adoption of weather forecasts as given by the farmers:

1. Providing Location-specific Climate Forecasts by Improving Infrastructure at Village Level. This was the major suggestion expressed by the farmers. Details were on improving infrastructure, like installing rain gauges, observatories and other weather tools at village level because the current forecasts are more regional specific and do not take account of the variability across small areas.
2. Improving Accuracy of Climate Forecasts by Frequent Updating. This was proposed because dependability of forecasts decreases with increase in lead time (forecast time).
3. Improving Extension Service in weather prediction. Improvement of such and other agrometeorological services can be done by frequent visits by extension personnel along with the use of different teaching materials and methods because rarely do extension personnel interact with farmers regarding climate prediction and other agrometeorological services on a regular basis. Also the use of different teaching materials (like display boards, bulletins) and methods (like personal contacts, informal discussion) on changing weather events was not given the deserved attention.
4. Weather Forecasts in Radio, TV, and Newspapers should be relevant to their operational needs. This should be the case because weather forecasts need to be simple, comprehensive and preferably in the local language that would provide farmers with the ability to make decisions.

5. To ascertain the relationship between selected socio-economic and personal characteristics of users with the adoption level of weather forecasting information.

The coefficient of correlation was calculated in order to find out the relationship between selected socio-economic and personal characteristics of farmer with the adoption level of weather forecasting information. The results pertaining to the correlation between selected socio-economic and personal characteristics comprising age, caste, occupation, education, family type, family size, family income,

social participation, Source of information utilized, attitude, farming experience, size of land holding and their level of adoption towards weather forecasting information is presented here in table 4.20.

Table 4.21. Correlation between the selected independent variables and level of adoption about weather forecasting information

Sl. No.	Independent variables	Value of correlation coefficient (r)
1.	Age	0.165
2.	Caste	0.092
3.	Occupation	0.182
4.	Education	0.179
5.	Family type	0.246
6.	Family size	0.248
7.	Annual family income	0.196
8.	Social participation	0.111
9.	Source of information utilized	0.166
10.	Attitude towards weather forecasting	0.609**
11.	Farming experience	0.117
12.	Size of land holding	0.303*

** Correlation is significant at the 0.01 level.

*Correlation is significant at the 0.05 level

It is evident from the table that attitude towards weather forecasting had a highly positive significant association at 0.01 level and size of land holding had a positive significant association at 0.05 level with the level of adoption of farmers towards weather forecasting information, whereas age, caste, occupation, education, family type family size, annual family income, social participation, source of information utilization and farming experience were not able to show their significant effect on adoption level of weather forecasting information.

The attitude and adoption level of farmers were found to have highly significant association towards weather forecasting information. It may be due to the reason that farmer with positive attitude have high level of adoption towards the weather forecasting information, they would have more exposure in their farming and

tried to adopt the weather forecast information with the anticipation of taking future benefits in their farming in order to reduce the losses.

Land holding had also significant association with adoption level of farmers towards weather forecasting information. It may be due to the fact the farmer who possessed large land holding were found to observed more changes in climatic conditions. They adopt weather forecasting information and utilize information in their land for higher production and for protection of crop from failure.

CHAPTER - V

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

Agriculture is the backbone of Indian economy. Compared to various other sectors of economy, agriculture is unique, whose output is largely dependent on weather conditions. The degree of success of agriculture production and its economics is determined to a significant extent by how well weather conditions corresponding to the optimal requirements of the crop are best exploited to raise the crops. Also, how effectively adverse weather conditions, which cause moisture, thermal, wind, radiation and biotic stress impeding growth and development of crop are managed to minimize their adversity. Further to this, it also depends on management aspects of preventing the crops from severe weather conditions.

Ideally, technical progress in agriculture should reduce overall dependence on weather and climate. But the link between yield and weather or climate does not seem to be decreasing. The effects of meteorological conditions are most pronounced on high yielding varieties of crop with increased sensitivities to environmental conditions, requiring maximum optimization of water, air, thermal and nutritional conditions. The biological potential of the plants manifests itself best in favorable conditions and is severely reduced when conditions are adverse. This results in large fluctuations in annual crop yields whose scale exceeds the increase in yields from the growth in agriculture. For this reason, the information is increasing. Using information on the effect of weather and climatic factors on agricultural productivity in an educated manner can not only reduce damage, but can also make it possible to obtain additional yield without significant financial outlays. Thus, the weather forecast based agro-advisories assumes considerable importance for agricultural activities.

For effective planning and management of agricultural practices such as selection of cultivar, sowing, need-based application of fertilizer, pesticides, insecticides, efficient irrigation and harvest, weather forecasts in all temporal ranges are desirable. Weather forecast in short and medium ranges greatly contribute towards making short-term adjustments in daily agricultural operations which minimize losses resulting from adverse weather conditions and improve yield and quantity and quality of agricultural productions.

Agriculture in India and entire world in mostly dependent on the persisting weather conditions. The alteration is global warming has dramatically effected agriculture and its productivity. The increase in temperature has significantly led to change in the agricultural zones and shift in the growing seasons. On the other hand the change in the rainfall pattern is the serious threat to agriculture, which turn affects the country's economy and food security. The delayed or inadequate monsoons also cause influence on the sale of agriculture inputs such as fertilizers, agrochemicals, tractors etc. So advance weather forecasting is essential for mass awakening.

Present study entitled "Uses of weather forecasting Advisory Services as Disseminated by Dr. R.P.C.A.U among the farmers of Muzaffarpur district" was undertaken with the following specific objectives:

11. To assess the socio- economic and personal characteristics of users.
12. To explore the level of knowledge and attitude of users towards the weather forecasting information.
13. To study the extent of adoption of weather forecasting information as disseminated by R.P.C.A.U.
14. To identify the different constraints as perceived by the users related with adoption of weather forecasting information.
15. To ascertain the relationship between selected socio- economic and personal characteristics of users with the adoption level of weather forecasting information.

RESEARCH METHODOLOGY

The study was conducted in Marwan and Saraiya block of Muzaffarpur district of Bihar. One village was selected from each block i.e. Bhagwatpur and Bally Saraiya. 30 respondents were selected from each village so total numbers of respondents were 60 for study purpose. Twelve independent variables of the study were: Age, Caste, Occupation, Education, Family type, Family size, Annual family income, Social participation, Sources of information utilized, Attitude, Farming experience, Land of size holding. The dependent variables were: Knowledge level and Extent of adoption. All the variables were measured strictly under the set rule and procedure, with scale and schedule developed for the study. An interview schedule was prepared and face to face interview was carried out with respondents. Appropriate statistical tests were used for data analysis.

MAJOR FINDINGS OF THE STUDY

To assess the socio- economic and personal characteristics of users

- **Age:** 41.67 per cent respondents were belonged to middle age group followed by 33.33 per cent belonged to young and 25.0 per cent respondents were found in old age group.
- **Caste:** 91.67 per cent respondents belonged to OBC group among the total selected respondents followed by 5.0 per cent from SC group and 3.33 per cent from UR group but none of the respondents were from ST group.
- **Occupation:** Majority of respondents were from Farming only i.e. 83.33 per cent followed by farming with business (11.67 per cent) and (5.0 per cent) engaged in farming with business and services.
- **Education:** 41.67 per cent farmers had their education up to high school level, 15.0 per cent farmers had graduation and above, followed by 15.0 per cent farmers were found illiterate, 11.67 per cent farmers had their education up to intermediate, and 8.33 per cent farmers had up to middle school level of education and 8.33 per cent had found barely read and write group.
- **Family Type:** 55.0 per cent of the respondents belonged to joint family followed by 45.0 per cent who were belonged to nuclear family system.
- **Family Size:** 63.33 per cent respondents belonged to medium size among the total selected respondents followed by 18.33 per cent of the respondents belonged to large size and small size respectively.
- **Annual family income:** 43.33 per cent of respondents had an income less than Rs.50,000 whereas 41.67 per cent of respondents had an income between Rs.50,001 to Rs1,00,000 lakhs followed by 8.33 per cent of the respondents had an annual income between Rs.1,00,001 to Rs.1,50,000 and 6.67percent respondents had an annual income more than 1,50,000.
- **Social participation:** 66.67 per cent of respondents were not member of any organization followed by member of one organization i.e. 31.67 per cent while member of more than one organizations were only 1.67 per cent and none of the respondents were office bearer.
- **Source of information utilized:** 76.67 per cent of respondents never used, KCC as the source of information followed by 68.33 per cent respondents sometimes used, Agriculture University as the source of information and 80

per cent respondents never used, Research station as the source of information. It is observed that 58.33 per cent respondents often used, Television and AAS bulletin as the source of information followed by 45.0 per cent respondents sometimes used, KVK as the source of information and 66.67 per cent respondents sometimes used, others (Internet, Newspaper, SMS etc.) as the source of information.

- **Farming experience:** It was found that that 36.67 per cent respondents were found to have up to 10 years of farming experience followed by 33.33 per cent of respondents been having above 20 years of farming experience and 30.0 per cent respondents were found to have between 11 to 20 years of farming experience.
- **Size of land holding:** Among the respondents the majority of them belonged to marginal farmers i.e. 66.67 per cent followed by small farmers (25.0 per cent), and medium farmers were 8.33 per cent. None of the respondents were found under large category.

To explore the level of knowledge and attitude of users towards weather forecasting information.

Knowledge level:

- With respect to knowledge level of weather forecast information 71.67 per cent of respondents had medium level of knowledge and 20.0 per cent of respondents had low level of knowledge. Only 8.33 per cent of respondents had high level of knowledge.
- With respect to knowledge of various components of weather forecasting advisory services it was found that 100 per cent respondents were aware about change of monsoon timing but with respect to the instruments for measuring of rainfall and temperature only 15.0 per cent of respondents were aware. Majority of respondents were aware about the general information on weather and weather forecasting information.
- **Attitude:** It was found that majority 65.0 per cent of respondents had favourable attitude towards weather forecasting information followed by 18.33 per cent of respondents had least favourable attitude and 16.67 per cent of respondents had highly favourable attitude towards weather forecasting information.

To study the extent of adoption of weather forecasting information as disseminated by R P C A U.

Extent of adoption:

- With respect to the extent of adoption of weather forecasting information it was found that 54.16 per cent of respondents had full adoption level towards weather forecasting information followed by 37.91 per cent of respondents had partial adoption level and 7.42 per cent of respondents had not adopted different component of information related with weather forecasting information.
- With respect to overall extent of adoption of weather forecasting information it was found that majority of respondents had medium level of adoption i.e. 73.33 per cent followed by high level which is 15.0 per cent and 10.0 per cent had low level of adoption.

Constraints as perceived by the users related with the adoption of weather forecasting information:

- In more important constraint category, 38.33 per cent of respondents had constraints in "Farmers could not understand SMS on mobile due to lack of knowledge of its application" followed by "The farmers cannot get time to view weather forecast advisory services due to delay in media" (30.0%) and "Weather forecast information is not location specific" (25.0%).
- In important constraint category, 73.33 per cent of respondents had constraint in "Due to flexibility in weather condition information is not right at every time" followed by "All farmers do not have availability of source of information" (66.67%) and "Weather forecasting is not timely forecast at the time of flood and drought" (63.33%).
- Farmers could not understand SMS on mobile due to lack of knowledge of its application was considered most serious constraint by the respondents and was ranked first as per the mean score followed by The farmers cannot get time to view weather forecast advisory services due to delay in media was ranked second, Due to flexibility in weather condition information is not right at every time was ranked third.

Relationship between selected socio-economic and personal characteristics of users with the adoption level of weather forecasting information.

- It was found that attitude towards weather forecasting had a highly positive significant association at 0.01 level, size of land holding had a positive significant association at 0.05 level with the level of adoption of farmers towards weather forecasting information, whereas age, caste, occupation, education, family type family size, annual family income, social participation, source of information utilization and farming experience were not able to show their significant effect on adoption level of weather forecasting information.

Suggestion for future research

- The present study was conducted with a sample of 60 respondents. In order to have greater generalization of findings such study should be conducted with large samples of respondents.
- Study area was very limited that should be increased in future study.
- The study revealed that farmers had more knowledge because of the influence of Agro-met Advisory Service. Hence, there is need to provide similar service to other farmers also.
- The study indicated that, farmers had medium attitude towards weather forecasting information. This is a good trend and this has to be still improved by conducting more awareness programmes and extending these services to other farmers also.
- There is a need to improve the system which creates awareness among people provides the early warning and to create awareness among people about the climate change and also provides early warning in order to avoid the ill effects in near future.
- Developmental departments need to make the suitable policy decisions in providing agricultural inputs at appropriate time in the villages. They should provide support price, insurance to all crops and subsidies has to be given to targeted farmers in order to sustain their lives under adverse climatic situation.

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APPENDIX

APPENDIX - I

RESEARCH SCHEDULE

Department of Extension Education
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Title of the research problem:-"Uses of Weather Forecasting Advisory Services as disseminated by Dr.R.P.C.A.U among the farmers of Muzaffarpur District"

Name of Farmer :

Name of Block :

Name of Village :

Name of weather forecasting Advisory services :
Distance of village from weather forecasting centre :
Mobile No. :

1. Socio -Economic and Personal Characteristics of users.

i. Age:

Sl. No.		Score
1.	Young age group(Below 35 years)	
2.	Middle age group(Between 36-50 years)	
3.	Old age group (Above 50years)	

ii. Caste:

Sl. No.		Score
1.	SC (Schedule Caste)	
2.	ST (Schedule Tribes)	
3.	OBC (Other Backward Caste)	
4.	General (Un Reserved)	

iii. Occupation:

Sl. No.		Score
1.	Farming	
2.	Farming+ Business	
3.	Farmer +Business +Services	
4.	Others (Specify)	

iv. Education Qualification (Actual)

Sl. No.		Score
1.	Illiterate	
2.	Can read and write only	
3.	Up to middle school	
4.	Up to high school	
5.	Up to intermediate	
6.	Graduation and above	

v. Family type:

Sl. No.		Score
1.	Nuclear Family	
2.	Joint Family	

vi. Family size:

Sl. No.		Score
1.	Small family (up to 4 member)	
2.	Medium Family (5-8)	
3.	Large Family (9 and above)	

vii. Family Income (annual):

Sl. No.		Score
1.	UP to Rs.50,000	
2.	Rs.50001 to 100000	
3.	Rs.100001 to 150000	
4.	Above Rs.150000	

viii. Social Participation:

Sl. No.		Score
1.	Not Member of any organization	
2.	Member of one organization	
3.	Member of more than one organization	
4.	Office bearer of an organization	

ix. Size of land holding:

Sl. No.		Score
1.	Marginal (up to 2.5 acres)	
2.	Small (> 2.5 to 5 acres)	
3.	Medium (> 5 to 10 acres)	
4.	Large (>10 acres)	

x. Farming Experiences

Sl. No.		Score
1.	Up to 10 years	
2.	11-20 years	
3.	Above 20 years	

xi. Source of information Utilized:

Sl. No.	Categories	Always	Often	Sometimes	Never
1.	KCC				
2.	Agriculture University				
3.	Research Station				
4.	Television				
5.	AAS bulletin in printed from public notice				
6.	KVK				
7.	Any Others (Internet, SMS, Newspaper etc.)				

2. Level of knowledge and attitude of users towards the weather forecasting information.

Level of knowledge:

Sl. No.	Statement	Yes/No
1.	Whether the weather forecasting advisory services is important for farmers?	
2.	Are you sowing your crop and choose the varieties according to changing in climate?	
3.	Do you have any information about the bad effect about the use of pesticides and insecticides in our environment?	
4.	Do you know the instruments for measuring of rainfall and temperature?	
	(a). If yes than write the name of one instrument.	
5.	Are you aware about R.P.C.A.U Bulletin?	
	(a). If yes, how did you come to know about the R.P.C.A.U Bulletin?	
	a) Personal contact with officials (scientist, AAS, field staff, BDO) / b) Informed by a fellow farmer or panchayat head / c) Through electronic media (Radio or Television) / d) Through mass media (News paper)	
6.	Have you seen any change in monsoon timing?	
	(a). If yes than tick any one from the following?	
	a) Come early / b) Come late / c) Go early / d) Go late	
7.	Are you are satisfied with AAS bulletin, are you willing to pay for it?	
8.	R.P.C.A.U Bulletin provide weather forecast?	
	(a) If yes than tell me R.P.C.A.U Bulletin provide weather forecast for?	
	a). Rainfall / b). Temperature / c) Wind speed / d) Wind Direction / e) Cloud Cover / f) Multiple Weather Parameter	
9.	Do you know the major crop of your area?	
	If yes then tell me what is the major crop of your area?	
	a) Rice / b) Wheat / c) Maize / d) Mustard / e) Sugarcane / f) Potato	
10	Do you know the different sources of weather forecast?	
	(a) If yes than tell me your sources of weather forecast?	
	a) KCC / b) KVK / c) Agriculture university / d) Research station / e) Television / f) AAS bulletin in printed from public notice / g) Email / h) Mobile SMS	

11	Do you know the frequency of forecast which you use?						
	If yes than tell me what is the frequency of forecast you use?						
	a) Daily	b) Bi-weekly	c) Weekly	d)Fortnightly	e) Monthly	f) Seasonally	
12	Do you know the coverage of forecast used by you?						
	(a) If yes than tell me what is the coverage of forecast used by you?						
	a) Rainfall	b)Temperature	c) Wind speed	d) Cloud cover	e) Any other		
13	Do you know about climatic factor which affects crop production in your area?						
	a) Rainfall	b)Temperature	c) Wind speed	d) Wind direction	e) Cloud cover	f) Any other	
14	Do you know about the maximum rainfall which takes place in your area?						
	a) May	b) June	c) July	d) August	e) September	f) Other	
15	Do you know in these months which factor is most important which affect the crop Production?						
	a) Good quality of seed	b) Quantity of fertilizer	c) New technology	d) Insecticide	e) Climate	f) Any other	
16	Do you know how much percentage of weather forecasting benefit is being received by agriculture?						
	a) 0-15%	b) 15-30%	c) 30-45%	d) 45-60%	e) 60-75%	f) 75-90%	
17	Do you see any change in farming according to weather agricultural advisory services?						
	(a)If yes than tell me according to weather agricultural advisory services what you have changing in farming?						
	a) Good quality of seed	b) Quantity of fertilizer	c) Varieties	d) Insecticide	e) Irrigation	f) All	

Attitude of farmers towards weather forecasting information:

Sl. No.	Statements	SA	A	UD	DA	SDA
1.	The use of weather forecasting information is a way to increase the crop production.					
2.	Weather forecasting information increasing the farmers income					
3.	Weather forecasting information changing farmers skill					
4.	Frequency of weather forecasting information is sufficient for agriculture					
5.	Changing in the farming system by the use of weather forecasting information.					
6.	New technology is disseminated by the weather forecasting advisory services unit.					

7.	Weather forecasting information will provide benefit in your agriculture.					
8.	The use of weather forecasting information is essential for production of high value crop.					
9.	Weather forecasting information often save your crop from failure					
10.	Accuracy of weather forecast information is correct					
11.	Farmers can get timely weather forecast information					
12.	Weather forecast information is location specific					
13.	Language of weather forecast information is easily understand by farmers					

SA-strongly agree **A-**Agree **UD-**Undecided **DA-**Disagree **SDA-**Strongly disagree

3. Extent of adoption of weather forecasting information as disseminated by R.P.C.A.U.

SI. No.	Aspects of weather forecasting information	Level of adoption		
		Full adoption	Partial adoption	Non Adoption
1.	Use of advisory services of weather forecasting information			
2.	Type of crop pattern given by the advisory service of weather forecasting information.			
3.	Type of crop planted according to the advisory services of weather forecasting information.			
4.	Varieties of crop used according to the advisory services of weather forecasting information.			
5.	Type of seed used according to the advisory services of weather forecasting information.			
6.	Harvesting of crop according to the advisory services of weather forecasting information.			
7.	Type of fertilizer required according to the advisory services of weather forecasting information.			
8.	Quantity of fertilizer used according to the advisory services of weather forecasting information.			
9.	Quantity of irrigation required according to the advisory services of weather forecasting information.			
10.	Use of pesticides and insecticides according to the advisory services of weather forecasting information.			
11.	Frequency of weather forecast used by farmer according to the advisory services of weather forecasting information.			
12.	Uses of new technology by farmer given by the advisory services of weather forecasting information.			

4. Identify the different constraints as perceived by the users related with adoption of forecasting information

Sl.NO.	Statement	More Important	Important	Less Important
1.	Weather forecast information is not location specific			
2.	Due to flexibility in weather condition information is not correct every time			
3.	Weather forecasting is not timely forecast at the time of flood and drought			
4.	Farmers could not understand SMS on mobile due to lack of knowledge of its application			
5.	Belief about traditional weather forecast is more powerful than modern weather forecasting in farmer's view			
6.	Weather forecasting an advisory service is brief hence cannot be understood by majority of farmers			
7.	Farmers are not able to know the economic benefits of weather forecasts			
8.	All farmers do not have availability of source of information			
9.	The farmers cannot get time to view weather forecast advisory services due to delay in media			

Please suggest the ways by which these constraints can be eliminated?

1. .....

2. .....

3. ....

4. ....

5......

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