SEMINAR REPORT

WEATHER SERVICE TO FARMERS

By

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AGM 591: Masters' Seminar (0+1)

DEPARTMENT OF AGRICULTURAL METEOROLOGY

COLLEGE OF HORTICULTURE

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DECLARATION

I, **Vinu K.S** (2018-11-113) hereby declare that the seminar entitled **"Weather service to farmers"** has been prepared by me, after going through various references cited at the end and has not been copied from any of my fellow students.

Vellanikkara
25/01/2020

Vinu K. S
(2018-11-113)

CERTIFICATE

This is to certify that the seminar report entitled **"Weather service to farmers"** has been solely prepared by **Vinu K.S (2018-11-113)**, under my guidance and has not been copied from seminar reports of any seniors, juniors or fellow students.

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CERTIFICATE

Certified that the seminar report entitled **"Weather service to farmers"** is a record of the seminar presented by **Vinu. K.S (2018-11-113)** on 07-11-2019 and is submitted for partial fulfillment of requirement of the course AGM 591.

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1. Introduction

Agriculture in India is a gambling with monsoon. Under such circumstances, the farmers are unaware of the future behavior of monsoon for making decisions in their day to day agricultural operations. Weather and climatic information plays a major role before and during the cropping season and if the information on weather is provided in advance can be helpful in inspiring the farmer to organize and activate their own resources in order to reap the benefits. The National Centre for Medium Range Weather Forecasting (NCMRWF) Department (IMD), Indian Council of Agricultural Research and State Agricultural Universities had been providing Agrometeorological Advisory Services (AAS) at the scale of agro climatic zone to the farming community based on location-specific medium-range weather forecast (MRWF)

The losses in crop can be reduced by doing proper crop management in time by timely and accurate weather forecasts. Weather forecast also provides guidelines for selection of crops best suited to the anticipated climatic conditions. The objective of the weather forecasting is to advice the farmers on the actual and expected weather and its impact on the various day-to-day farming operations i.e. sowing, weeding, time of pesticides spray, irrigation scheduling, fertilizer application etc. and overall crop management. Weather forecast helps to increase agriculture production, reduce losses, risks, reduce costs of inputs, improve quality of yield, increase efficiency in the use of water, labour and energy and reduce pollution with judicious use of agricultural chemicals.

Crop production is under the control of climate and weather, and both are beyond human control and hence crop production under open condition carries high risks Risk is defined as the quantum of physical and economical crop production losses with events of probability in occurrence Type of crop production risks, Inherited risks, Transferable risks, crop management Risk that can be minimized through technology introduction,

2. Weather Forecasting

Forecasting is the process of making predictions of the future based on past and present data and most commonly by analysis of trends. Weather forecasting is the application of science and technology to predict the conditions of the atmosphere for a given location and time (Wikipedia). Weather forecasting is defined as "prediction of the state of the atmosphere for a given location applying the principles of physics, supplemented by a variety of statistical and empirical techniques and by technology." In addition to predictions of atmospheric phenomena themselves, weather forecasting includes predictions of changes on Earth's surface caused by atmospheric conditions. Weather forecasts are important because they are issued to protect life and property, to save crops and to tell us what to expect in our atmospheric environment.

3. What is ITK?

According to Louise Greneirs (1998) Indigenous Technical Knowledge is the unique, traditional and local knowledge existing within and developed around specific conditions of men and women indigenous to a particular geographical area. By the definition given by Mapara in 2009, Indigenous Technical Knowledge is a body of knowledge, or bodies of knowledge, of the indigenous people of particular geographical areas that they have survived on for a very long time". It is the basis for local level decision making in agriculture, health care, food preparation, education, natural-resource management, and a host of other activities in rural communities. Indigenous technical knowledge is the information base for a society, which facilitates communication and decision making. Indigenous information systems are dynamic, and are continually influenced by internal creativity and experimentation as well as by contact with external systems.

Indigenous technical knowledge is the knowledge that people in a given community has developed over time, and continues to develop. It covers a wide spectrum-soil, water and farm equipment, farm power, post-harvest preservation and management; agro-forestry; bio-diversity conservation and also exploitation; animal rearing and health care; animal products preservation and ethics foods and homestead management.

3.1. Sources of Indigenous Technical Knowledge

- Farmers and the community members especially elders are the best sources of Indigenous technical knowledge. But, since Indigenous technical knowledge is unevenly distributed in communities. It is important to find out who knows what to tap the right sources; otherwise, data will not truly reflect the Indigenous Technical Knowledge in the community.
- Folk-lore, songs, poetry, and theatre can reveal a great deal about people's values, history and practices. These are often recited from generations and not written down, hence need to be recorded
- Although Indigenous Technical Knowledge is mostly transmitted by word of mouth, yet some indigenous forms of community keeping to exist. These include writings, paintings, and carvings, and many other forms
- People working with communities such as extension personnel can be a valuable source of Indigenous Technical Knowledge. Other resource persons are local school headmaster, credit co operative society officials, village milk co-operative members, men and women labourers, and village Panchayat Sarpanch.
- Secondary sources include published and unpublished documents, databases, videos, photographs, museums and exhibits.

3.2. Weather prediction during ancient times

The art of weather forecasting began with early civilizations using reoccurring astronomical and meteorological events to help them monitor seasonal changes in the weather. Around 650 B.C., the Babylonians tried to predict short-term weather changes based on the appearance of clouds and optical phenomena such as haloes. By 300 B.C., Chinese astronomers had developed a calendar that divided the year into 24 festivals, each festival associated with a different type of weather. Around 340 B.C., the Greek philosopher Aristotle wrote *Meteorologica*, a philosophical treatise that included theories about the formation of rain, clouds, hail, wind, thunder, lightning, and hurricanes. In addition, topics such as astronomy, geography, and chemistry were also addressed. Aristotle made some remarkably acute

observations concerning the weather, along with some significant errors, and his four-volume text was considered by many to be the authority on weather theory for almost 2000 years. Although many of Aristotle's claims were erroneous, it was not until about the 17th century that many of his ideas were overthrown.

For thousands of years, India has been using astrology, study of clouds, and examination of winds and observations of nature for forecasting of rain. Upanishads contain discussion about the cloud formation and rain. Chanakya (Kautilya) described in detail the rainfall and its measurements, prediction of rainfall in 3rd century. In *Brihat Samhita*, Varahamihira (505 – 587 AD) had mentioned the science of forecasting rain and its measurement in the unit of *adhaka*. One *adhaka* is equal to 1.6cm. Parashara's technique of rain forecast is based on the positions of the sun and the moon. The classical hindu astrological almanac known as *Panchang* had been prepared for public use from *Vedang Jyotish* period (1400 – 1300 BC). The book published yearly gives information on daily basis and extensively used by the astrologers for making astrological calculations and the farmers to start the farming activity based on the prediction of rainfall (Sivaprakasam and Kanakasabhai, 2009) Weather forecasting through ITKs is largely based on biotic and abiotic methods. Abiotic indicators include those based on observations, theoretical calculations and planetary configurations. Common biotic indicators include birds, insects and trees

4. ITK based weather prediction

Red eastern sky at night indicates fair weather and red western sky indicates an approaching storm or adverse weather:

Plate 1: Red sky

Appearance of sky in red colour is mainly due to the phenomenon of mie scattering. Scattering is a general physical process where some forms of radiation, such as light, sound, or moving particles, are forced to deviate from a straight trajectory due to localized non-uniformities in the medium through which they pass. Mie scattering occurs when the wavelength of the radiation is almost equal to the size of the obstructing particle. Longer wavelengths are mainly scattered by mie scattering. It occurs mostly in the lower portions of the atmosphere where larger particles are more abundant, and dominates when cloud conditions are overcast. During sunset, sun will be positioned in the west. So if there is an overcast condition, then scattering will be more in the western sky. So western sky will appear red during night. This can indicate a storm approaching or heavy rainfall. If overcast condition does not persist in the western sky, the light from sun can travel much distance through the atmosphere. So the light will scatter fully when it reach east without much big obstruction. Thus the red eastern sky indicates fair weather.

Roaring sea can lead to rain:

Roaring of sea occurs due to the increased wind velocity which pushes the waves. It increases the evaporation from sea also. Along with the evaporated water, salt particles also reaches the atmosphere. These salt particles act as the condensation nuclei in the clouds to produce rain. The more the roaring, the greater is the possibility of rain occurrence.

Plate 2: Roaring sea

Halo around moon

Circles found around moon which appear as bigger size circles is termed as halo and circles which appear as smaller circles is termed as corona. Formation of halo around moon indicate low rainfall. The major reason for halo around moon is the presence of cirrus type of clouds around it. Cirrus clouds are non-rain producing clouds. With the appearance of small circles or corona around moon, we can expect more rainfall within another two days

Plate 3: Halo around moon

Plate 4: Corona around moon

4.1Insect indicators

Ants move out of its tunnel and shift their eggs to safer place

Due to change in relative humidity ants move out of its tunnel and shift food and eggs to safer place (Acharya, 2011). In a study conducted by Department of Agricultural Meteorology, KAU in the year 2016 at Vellanikkara, it was found that rain occurred after four hours of shifting of ants from their tunnels.

Plate 5. Ants move out of its tunnel and shift their eggs to safer place

Dragon fly flying low

Due to the pressure of increased relative humidity in the upper atmosphere, dragon flies are pushed down to lower atmosphere which indicates upcoming rain. A study conducted by Department of Agricultural Meteorology, KAU in the year 2016 at Palakkad showed the occurrence of rain during evening when dragon fly was found flying in the lower atmosphere during morning

Plate 6: Dragon fly flying low

Appearance of black and white termites/ rain flies:

Plate 7: black and white termite

White termite indicate low rainfall Black termite indicate heavy rainfall

There is lack of validation studies in the case of various indigenous technical knowledge. More validation studies of indigenous technical knowledge are to be carried out to know how far these are true. Indigenous knowledge is passed from generation to generation by word. It is seldom documented. This can lead to its loss due to the death of elder people in the community. So there is a need of documentation of this precious knowledge

4. Types of weather forecast

Now casting

This type of weather forecasting is issued for less than 12 hours closely related to local weather phenomena like thunderstorms dust storms, cyclones and cold and heat waves now casting is also useful for outdoor functions

Short Range Forecasting (SRF)

It comprises forecast and warning of weather elements hazardous to agriculture which is valid for 36 hour and an outlook for the subsequent 2 days. The short-range forecast includes cloud spread, rainfall distribution heavy rainfall warning, maximum and minimum temperatures, heat and cold waves, low-pressure areas, cyclone warning. Hail or thunderstorm dust storm, snow. Frost and likelihood of maximum wind speed. The short- range forecast is issued twice a day on the basis of synoptic conditions though the short range forecast

is useful in weather based agricultural operations, the reaction time to the farmers is too short for preventive measures against adverse weather. The, forecasting in the medium and long range is important.

Medium Range Forecasting (MRF)

Medium range forecasting valid for 3 to 10 days it is a forecast and warning of weather elements hazardous to agriculture which is valid for 3 to 10 days. This forecast includes cloud amount. Rainfall, maximum and minimum temperatures, average wind speed. Wind direction and weekly cumulative rainfall. The medium-range weather forecast is a challenging one to weather scientists, as it involves enormous numerical computations requiring expertise in weather science The National Centre for Medium Range Weather Forecasting (NCMRWF) was established in New Delhi by the Government of India during 1988, to develop only medium-range weather forecasting for 3 to 10 days ahead and disseminate the same in time. This is a part of the programme for developing agrometeorological advisory services across the country based On medium-range weather forecasting. (Rao, 2015)

Long Range Forecasting (LRF)

It is a forecast for more than 10 days or a month or a season The India Meteorological Department revived issuing the long-range weather forecast in 1988 on total monsoon rainfall of the country by the end of May. These forecasts can be used for predicting likely trends in food grains production of India before the beginning of the kharif season, as food grains production depends mostly on the distribution and amount of monsoon rain across the country. The cultivable cropped area depends on mansoon rain and its distribution. These forecasts can hold the food grain prices can check through buffer stock operation.

Climate/Agro climate Forecast

It requires past meteorological data for a good number of years (say 30-50 years). The trends in rainfall its variability and the probability of distribution of rainfall over a

season can be determined weekly by using the historical data of rainfall for a given location. This information useful to crop planners and farmers, as crop growth periods can be adjusted under rained conditions depending upon rainfall probabilities. The climate trends will also help in understanding the impact of climate variability on agricultural production over a period of time. The periods of water surplus and deficit could be worked out for a particular location on the basis of past meteorological data (rainfall and evaporation) through the water balance procedure. This information can be used for irrigation scheduling during dry spells and for providing drainage in excess rainfall or water surplus periods. Analogous technique can be tested for daily rainfall forecasting during the mansoon in the humid tropics location-wise wherever long series of daily rainfall data are available are mansoon in stable , like in Kerala. These technique can be used by the end of July to predict rainfall during august and September.

5. Method of weather forecasting

1) Synoptic weather forecasting

(2) Numerical methods

(3) Statistical methods

Synoptic weather forecasting

It is the traditional approach in weather prediction. This primary method continued to be in use until the late 1950s. Here it would be in the fitness of things that the meaning of the word “synoptic’ should be made clear to the reader. Synoptic” means that the observation of different weather elements refers to a specific time of observation. Thus, a weather map that depicts atmospheric conditions at a given time is a synoptic chart to a meteorologist. In order to have an average view of the changing pattern of weather, a modern meteorological center prepares a series of synoptic charts every day. Such synoptic charts form the very basis of weather forecasts. As stated earlier, the task of preparing synoptic charts on a regular basis involves huge collection and analysis of observational data obtained from thousands of weather stations.

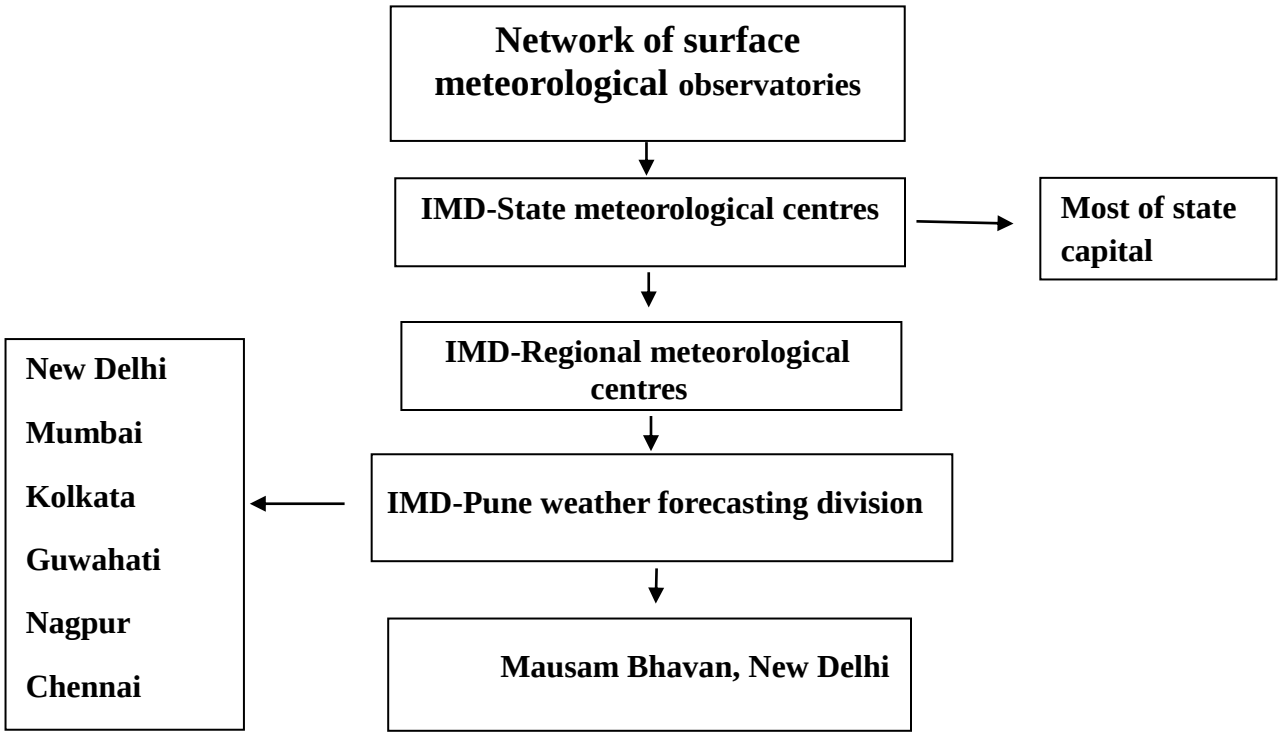
Numerical methods

More recently it has been realized that other methods can more accurately predict the future weather than was possible by the traditional synoptic approach. The numerical method involves a lot of mathematics. Modern weather forecasting is now using the techniques of Numerical Weather Prediction (NWP). This method is based on the fact that gases of the atmosphere follow a number of physical principles. If the current conditions of the atmosphere are known, these physical laws may be used to forecast the future weather. Since the late 1940s there has been a steady growth as regards the use of mathematical models in weather forecasting. These procedures have been made possible because of advancement in the formulation of mathematical models. A series of mathematical equations is used to develop theoretical models of the general circulation of the atmosphere. These equations are also used to specify changes in the atmosphere as the time passes on. For these equations certain weather elements like air movements, temperatures, humidity, evaporation at the ground, clouds, rain, snow and interactions of air with ground and oceans are taken into account.

Statistical methods

Statistical methods are used along with the numerical weather prediction. This method often supplements the numerical method. Statistical methods use the past records of weather data on the assumption that future will be a repetition of the past weather. The main purpose of studying the past weather data is to find out those aspects of the weather that are good indicators of the future events. After establishing these relationships, correct data can be safely used to predict the future conditions. Only overall weather can be predicted in this way. It is particularly of use in projecting only one aspect of the weather at a time. For example, it is of great value in predicting the maximum temperature for a day at a particular place. The procedure is to compile statistical data relating temperature to wind velocity and direction, amount of cloudiness, humidity, and to the specific season of the year. Thereafter these data are depicted on charts. These charts provide an estimate of the maximum temperature for the day from the data of the current conditions. Statistical methods are of great value in long-range weather forecasts. The National Weather Service prepares monthly and weekly weather outlooks. In fact these are not weather forecasts in the strict sense of the term.

Creation of weather forecast



6. Tools of weather forecasting for agriculture

Crop weather calendar

In order to provide the farmer with an efficient weather service, it is essential that the weather forecaster should be familiar with the crops that are grown in a particular agro climatic zone. The type of forewarning to be given, depending upon the state and stages of the crop, should also be known. In case of farmers, they should become familiar with weather bulletins and learn how to interpret them. To meet the above requirement detailed information collected from the agricultural department has been condensed by the IMD and presented in a pictorial form known as crop weather calendar. The crop weather calendar consists of three parts viz crop husbandry Climate requirements and weather warnings. The important crop phases like sowing, germination, transplantation in the case of rice), tillering, elongation. flowering, grain formation and harvest are indicated under crop husbandry against the standard agrometeorological weeks in the lower part of the calendar The normal monthly rainfall and number of rainy days are depicted in the middle of the calendar with weather requirements, and

the uppermost portion of the calendar indicates the nature weather warnings to be issued in different crop periods. These crop Weather calendars help the weather forecaster to see at a glance the type of weather warning that are to be issued, for a particular district in n given weather situation during a particular phase of the crop. They are of equal interest to the farmers for better crop management. However, they fail to produce the desired results, since they are not used as hand tools in practice and became obsolete with fast-changing crop varieties. Also, the crop weather calendars prepared district-wise may not be of much use at the micro-level. Hence, the crop weather calendars are to be prepared at the village panchayat level by the agrometeorological field units (AMFUS), established in different agro climatic zones, through research and development activities taken up for major crops and varieties. They help in improving the quality of agro advisory services based on medium range weather forecasting.

CROP WEATHER CALENDAR

State : Kerala | **District: Thrissur** | **Crop: Rice** | **Variety : Kanchana** | **Duration : Short duration (105-110)** | **Season: Kharif : Virippu**

Climate normals	Months	May		June					July				August				
	Standard week/Normal	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
	Tmax (°C)	33.3	33	32	30.6	29.6	29.6	29.4	29.6	29.1	28.8	29.1	29.3	29.3	29.5	29.9	29.9
	Tmin (°C)	24.8	24.7	24.2	23.5	23.3	23.2	23.1	23	22.9	22.9	23	23.1	23.1	23.2	23.3	23.4
	Mean T (°C)	29.0	28.8	28.1	27.0	26.4	26.4	26.2	26.3	26	25.8	26.0	26.2	26.2	26.3	26.6	26.6
	RH1 (%)	88	89	91	93	94	94	94	94	95	95	95	94	95	94	94	94
	RH2 (%)	63	65	69	76	80	79	79	78	80	81	79	78	78	76	74	74
	Mean RH (%)	75.5	77	80	84.5	87	86.5	86.5	86	87.5	88	87	86	86.5	85	84	84
	WS (km/h)	3.8	3.8	3.8	3.7	3.8	3.7	3.5	3.5	3.4	3.4	3.4	3.4	3.2	3.4	3.6	3.4
	SHR (Hours)	6.2	6.1	5.1	3.4	2.7	2.9	2.7	3.1	2.5	2.1	2.6	3.0	3.2	3.8	4.6	4.6
	Evap (mm)	31.5	29.6	25.9	21.2	19.7	20.8	20.2	20.5	19.9	18.1	19.3	20.3	20.7	21.9	23	23.5
	Rainfall (mm)	40.8	51	90.9	148.4	181.7	168.8	171.2	137.8	154.7	157.1	131.4	126.2	106	103.4	76.4	76.1
	Rainy day	2.0	2.0	3.2	4.9	6.0	5.5	5.5	5.4	5.5	5.5	5.2	5.0	5.0	4.6	3.9	3.4

Phenophases and duration days	Sowing	Transplanting	Active tillering	Panicle initiation	Booting	50% flowering	Physiological maturity
		18-21	25-27	10-12	14-16	3-5	25-30

Weather required for optimum yield in Rice (Kanchana)							
Tmax(°C)	33-35	30-34	29-30	29-30	23-29	28-31	28-30
Tmin(°C)	24-27	23-26	22-23	23-24	22-29	22-23	22-23
RF(mm)	26.8	29-353	1316-2100	170-2402	185-502	32-182	62-465
RH1(%)	86-92	85-93	93-94	89-91	94-96	91-96	92-96
RHII(%)	53-64	52-79	82-84	69-71	77-85	67-80	70-74
WS(km/hr)	3-6	2-6	5-7	5-6	2-6	2-7	2-6
SSH(hrs)	2-10	3-7	2-4	5-7	1-4	1-4	3-5
EVP(mm)	3-5	3-6	3-4	4-5	2-3	2-4	2-4

Weather Calendar for Pest and Disease in rice		
SHEATH BLIGHT	Sheath blight (Tmax : 28 – 32 °c and RH : 85 – 100 %)	LEAF FOLDER
	Leaf folder (Tmax : 33 – 35° c and RH : 90%)	

Plate 8: Crop weather calendar

Crop Weather Diagram

It gives season-wise information on crop husbandry (tillage to harvest), actual weather and normal weather month or week-wise, and information on pest and disease incidence. It may help in understanding favorable weather conditions that are responsible for better crop yields and vice versa if they are prepared continuously for a number of years. Using the crop weather diagrams, attempts can be made for obtaining better crop yields through agronomic manipulations, and one can also predict crop yield qualitatively on the basis of weather conditions. It is also possible to select a suitable variety for a given location based on crop weather diagrams. The main difference between crop weather diagram and crop weather calendar is that the former indicates the current state information on crops and weather, while the latter indicates the mean state of information on crops and weather including forewarning and the period's during which they are to be issued. The crop weather diagrams can be a tool to assess the crop condition and its yield in relation weather, while the crop weather calendar is a tool for a weather forecaster for providing efficient weather service. Of course, the mean state of crop weather diagrams should be a basis improving the quality of crop weather calendars. Both are handy and useful in agro advisory, which helps to improve crop yields through better agronomic practices. As an example, the crop weather diagram of cashew grown in the west coast is depicted in. It can be used in understanding the reproductive phase of different varieties and their variations from one season to another, if prepared every year.

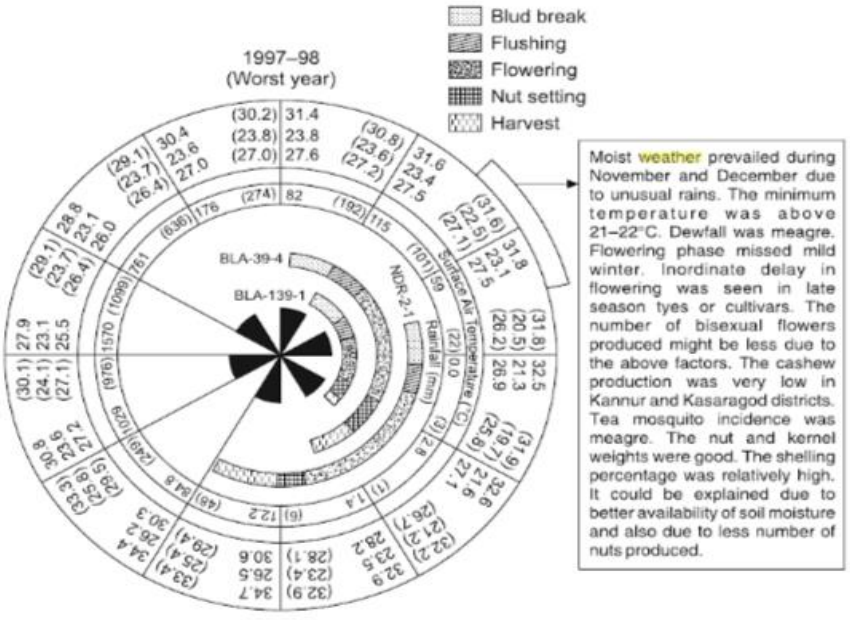


Plate 9: Crop weather diagram

7. Genesis of weather forecast in India

- In the year 1875, India Meteorological Department was established to bring all meteorological work in the country under a central authority
- Mr. H. F. Blanford was appointed as Meteorological Reporter to the Government of India.
- Sir John Eliot was appointed as Director General of Observatories in May 1889 at Calcutta headquarter
- The headquarter of IMD was later shifted to Shimla, then to Poona (now Pune) and finally to New-Delhi.
- In view of the importance of forewarning of monsoon seasonal rainfall for the agricultural economy of the country, Blanford initiated the system of Long Range Forecasting (LRF).
- The system of LRF of monsoon forewarning improved through several evolutionary phases by eminent pioneers like Sir John Eliot and Sir Gilbert Walker (Directors-General of Observatories)
- Sir Gilbert Walker has identified a phenomena of linking monsoon with global meteorological situations and discovered Southern Oscillation phenomenon.
- IMD has continuously improved into new areas of application and service, and steadily built upon its infra-structure in its history of 139 years.
- First weather service viz., Farmers Weather Bulletin was issued by the India Meteorological Department in collaboration with All India Radio on daily basis (afternoon) and broadcasted in 26 regional languages
- The main limitations are the forecast issued for a large scale and does not meet the requirements of crop cultural operations at block level
- There was no advisory given to crop planning and agricultural operations
- To overcome this problem, IMD has introduced Agricultural Meteorological Advisory Services to prepare special weather charts on small area on weekly, monthly and seasonal basis
- Based on the crop stage and rainfall data ‘Agrometeorological Advisory Bulletin’ was issued for a week or twice a week

8. What is Agromet-advisory..?

Farm decisions taken in response to changing weather. Farm decisions include agronomical, pest and disease, water and input managements. This agro-met advisory taken in response to past, current and future weather change. Basic considerations to prepare weather based agro advisories are weather sensitive crops, their weather sensitive stages and weather sensitive farm operations.

8.1. Why, When and Where

Why agro-met advisory is required?

- To reduce crop losses, To sustain the crop productivity
- To increase input efficiency when it is mostly useful?
- During flood and drought weather codes (malevolent weather situation)

When it is mostly useful?

- During flood and drought weather codes (malevolent weather situation)

Where it is required?

- Monsoon dominant regions and also where the weather system is unstable always

For whom it is required?

- Farmers Farm based industries Livestock feed makers
- Government for taking policy decision Agricultural marketing

Broad Activities of Agro met Advisories

- Sowing/ transplanting of Kharif crops based on onset of monsoon
- Sowing of Rabi crops using residual soil moisture
- Fertilizer application based on wind condition
- Delay in fertilizer application based on intensity of rain
- Prediction of occurrence of pest and disease based on weather
- Propyl active measures at appropriate time to eradicate pest and diseases
- Weeding/ thinning at regular interval

- Irrigation at critical stage of a crop
- Quantity & timing of irrigation based on meteorological threshold.
- Advisories for timely harvest of crops
- Advisories are delivered to the end users without any delay
- Interactive tuning of advisories with the farmers / managers as frequently as possible
- It is disseminated in English and local languages
- Future plan of AAS dissemination
- Department of Information Technology is planning to develop ICT facilities for the
- benefit of the citizens, especially those in rural & remote areas
- It is also planned to provide AAS link to Village Knowledge Centers at Taluka level
- (Started)
- IMD is exploring to tie up with different public and private organizations to use
- Interactive voice response (IVR) and Short Message Service (SMS) technology (Started) Mass communication mode of agro advisories and their effectiveness
- While analyzing the economic impact of Agromet advisory service, it is found that farmers, who followed the agromet advisories are able to reduce the input cost and increase the net profit. Thus the application of agromet advisory bulletin based on present and forecasted weather is an efficient tool for enhancing the agricultural production and farmer's income

9. AMFUs- Agro meteorological field units

The information regarding forecasted weather and the farm management practices to take in advance are providing in the form of Agromet advisory service (AAS) to the farmers through Agrometeorological Field Units (AMFUs). AMFUs undergoing *via* a chain of processes *viz*. field visits, observing the stage and state of crop, problem identification, receiving weather forecast from IMD and discussion with Agromet advisory board (Jaybhaye *et al.,* 2018). Then, agro advisory bulletins are prepared based on medium range forecast and crop stages; and are disseminated to the farming community through different channels (Gandhi *et al.,* 2018).

Through this bulletins, advices like fertilizer application, occurrence of pest and diseases, irrigation needs, time of harvesting etc. are provided to the farmers to give awareness about the future weather changes (Chhabra *et al*., 2018)

AMFUs in Kerala

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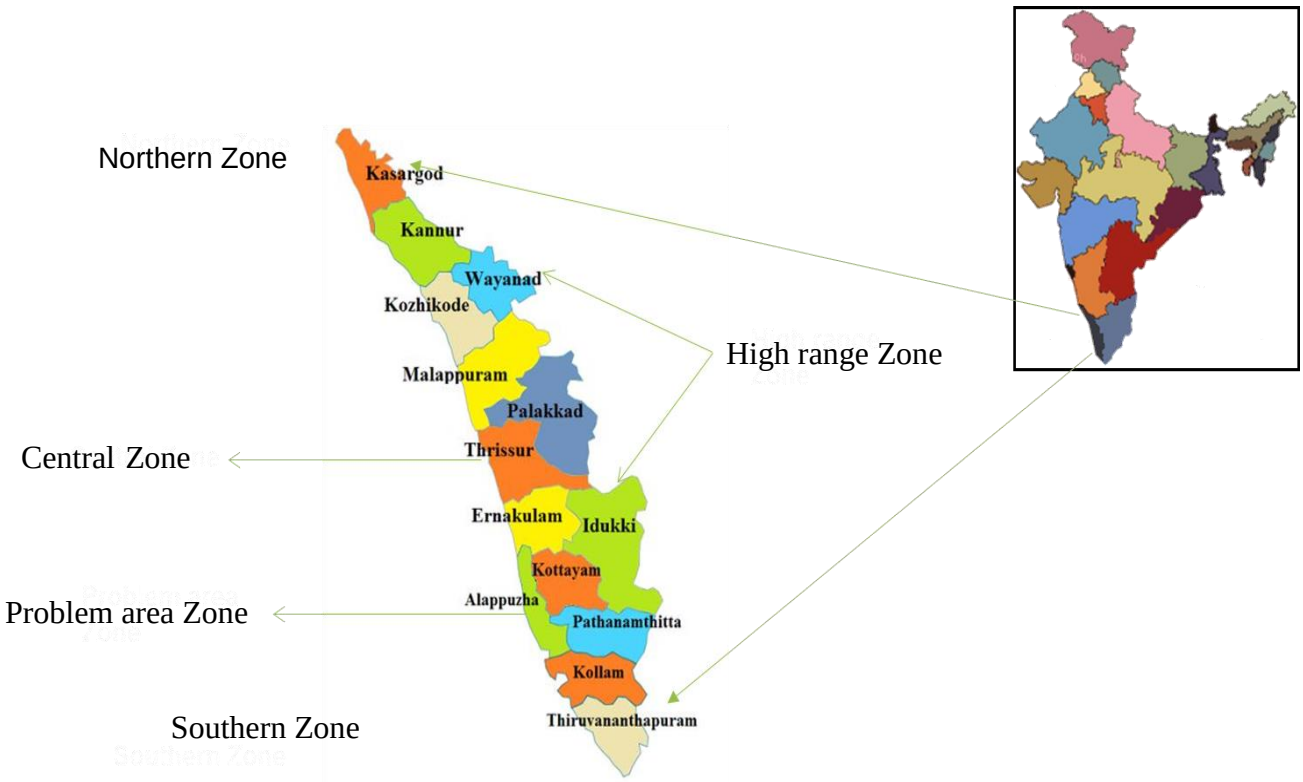


Plate 10: AMFUs in Kerala

Plate 11: Agromet advisory bulletin in Malayalam

കേരള കാർഷിക സർവ്വകലാശാല
കാർഷിക കാലാവസ്ഥാ ശാസ്ത്രപഠന വിഭാഗം
ഹോർട്ടികൾച്ചർ കോളേജ്, വെള്ളാനിക്കര
Email: cohagmet@kau.in & kauagmet@yahoo.co.in
കാർഷിക നിർദ്ദേശക ബുള്ളറ്റിൻ

തൃശ്ശൂർ ജില്ല

[illegible]

19.06.2018

കഴിഞ്ഞ ആഴ്ചയിലെ അന്തരീക്ഷസ്ഥിതി [illegible]

അടുത്ത 5 ദിവസത്തെക്കുള്ള കാലാവസ്ഥാ പ്രവചനം:

കാലാവസ്ഥാ ഘടകങ്ങൾ	20.06.2018	21.06.2018	22.06.2018	23.06.2018	24.06.2018
മഴ (മില്ലീമീറ്റർ)	45	60	38	45	42
ഉയർന്ന താപനില (°C)	30	30	30	30	30
കുറഞ്ഞ താപനില (°C)	23	23	23	23	23
മേഘവ്യാപ്തി (ഒക്ട)	8	8	8	8	8
കൂടിയ അന്തരീക്ഷ ആർദ്രത (%)	95	95	95	95	95
കുറഞ്ഞ അന്തരീക്ഷ ആർദ്രത (%)	85	85	85	85	85
കാറ്റിന്റെ വേഗത (കിലോമീറ്റർ/മണിക്കൂർ)	014	014	014	014	014
കാറ്റിന്റെ ദിശ (ഡിഗ്രി)	250	250	250	250	250
[illegible]					

കാർഷിക നിർദ്ദേശങ്ങൾ

[illegible]

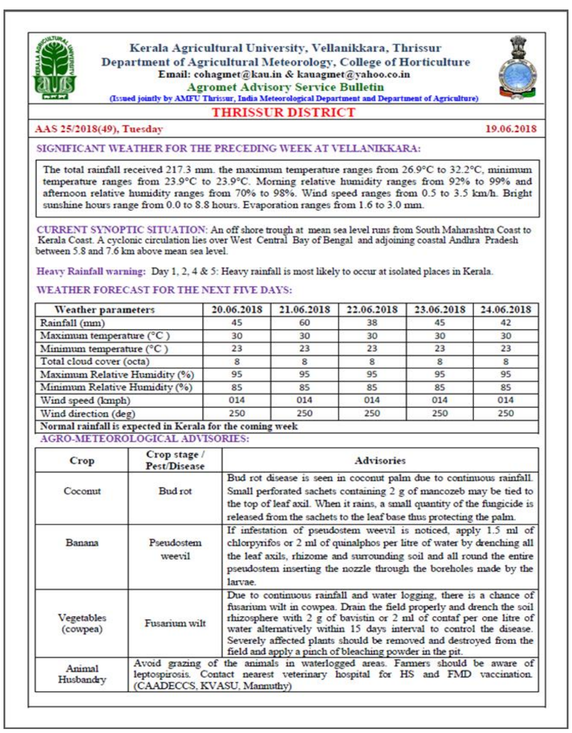
കഴിഞ്ഞ ആഴ്ചയിലെ

അന്തരീക്ഷ സ്ഥിതി

കാലാവസ്ഥാ പ്രവചനം

കാർഷിക നിർദ്ദേശങ്ങൾ

Plate 12: Agromet advisory bulletin in English



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Agromet Advisory Service Bulletin
(Issued jointly by AMFU Thrissur, India Meteorological Department and Department of Agriculture)

THRISSUR DISTRICT

AAS 25/2018(49), Tuesday 19.06.2018

SIGNIFICANT WEATHER FOR THE PRECEDING WEEK AT VELLANIKKARA:

The total rainfall received 217.3 mm. the maximum temperature ranges from 26.9°C to 32.2°C, minimum temperature ranges from 23.9°C to 23.9°C. Morning relative humidity ranges from 92% to 99% and afternoon relative humidity ranges from 70% to 98%. Wind speed ranges from 0.5 to 3.5 km/h. Bright sunshine hours range from 0.0 to 8.8 hours. Evaporation ranges from 1.6 to 3.0 mm.

CURRENT SYNOPTIC SITUATION: An off shore trough at mean sea level runs from South Maharashtra Coast to Kerala Coast. A cyclonic circulation lies over West Central Bay of Bengal and adjoining coastal Andhra Pradesh between 5.8 and 7.6 km above mean sea level.

Heavy Rainfall warning: Day 1, 2, 4 & 5: Heavy rainfall is most likely to occur at isolated places in Kerala.

WEATHER FORECAST FOR THE NEXT FIVE DAYS:

Weather parameters	20.06.2018	21.06.2018	22.06.2018	23.06.2018	24.06.2018
Rainfall (mm)	45	60	38	45	42
Maximum temperature (°C)	30	30	30	30	30
Minimum temperature (°C)	23	23	23	23	23
Total cloud cover (octa)	8	8	8	8	8
Maximum Relative Humidity (%)	95	95	95	95	95
Minimum Relative Humidity (%)	85	85	85	85	85
Wind speed (kmph)	014	014	014	014	014
Wind direction (deg)	250	250	250	250	250
Normal rainfall is expected in Kerala for the coming week					

AGRO-METEOROLOGICAL ADVISORIES:

Crop	Crop stage / Pest/Disease	Advisories
Coconut	Bud rot	Bud rot disease is seen in coconut palm due to continuous rainfall. Small perforated sachets containing 2 g of mancozeb may be tied to the top of leaf axil. When it rains, a small quantity of the fungicide is released from the sachets to the leaf base thus protecting the palm.
Banana	Pseudostem weevil	If infestation of pseudostem weevil is noticed, apply 1.5 ml of chlorpyrifos or 2 ml of quinalphos per litre of water by drenching all the leaf axils, rhizome and surrounding soil and all round the entire pseudostem inserting the nozzle through the boreholes made by the larvae.
Vegetables (cowpea)	Fusarium wilt	Due to continuous rainfall and water logging, there is a chance of fusarium wilt in cowpea. Drain the field properly and drench the soil rhizosphere with 2 g of bavistin or 2 ml of contaf per one litre of water alternatively within 15 days interval to control the disease. Severely affected plants should be removed and destroyed from the field and apply a pinch of bleaching powder in the pit.
Animal Husbandry	Avoid grazing of the animals in waterlogged areas. Farmers should be aware of leptospirosis. Contact nearest veterinary hospital for HS and FMD vaccination. (CAADECCS, KVASU, Mannuthy)	

Past weather data

Weather forecast

Agromet advisory

10. Dissemination of Agromet advisory Bulletin

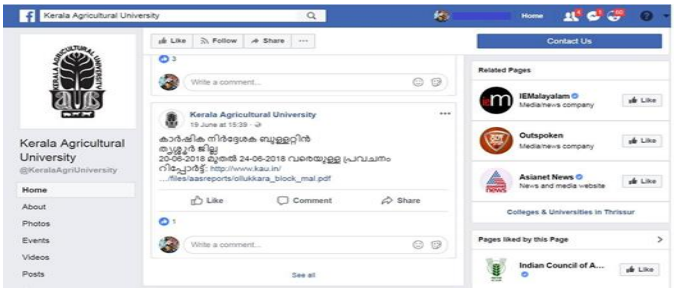
This bulletin should reach the farmers & stake holders these are the measure of dissemination of Agromet Advisory Bulletin

Plate 13: Display at Krishibhavan

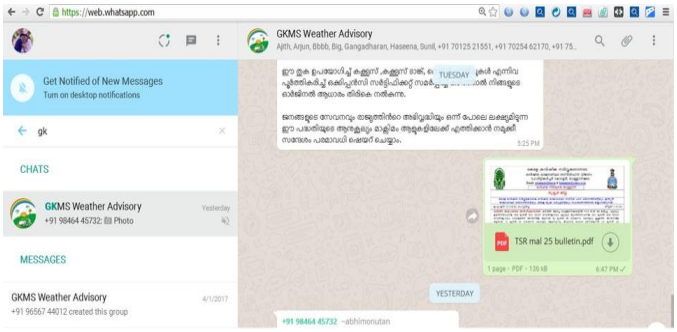
Plate 14: Direct Delivery

15. Facebook and WhatsApp

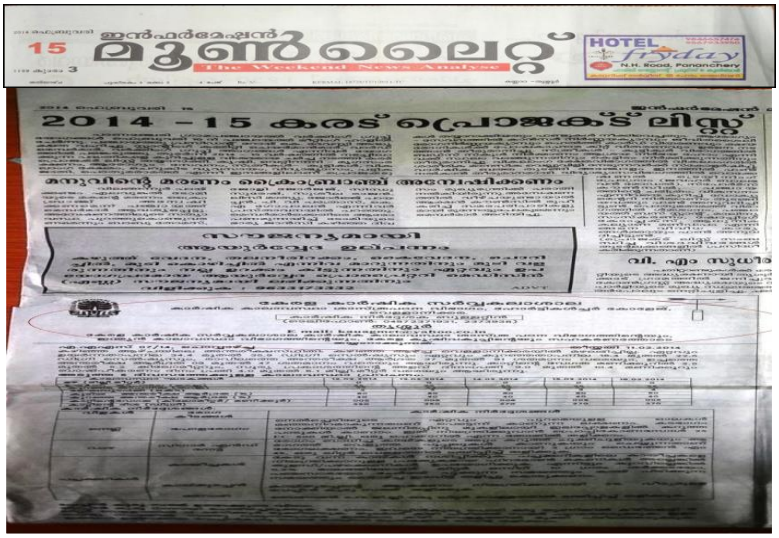
Agromet Advisories through Facebook – “Kerala Agricultural University” Facebook page



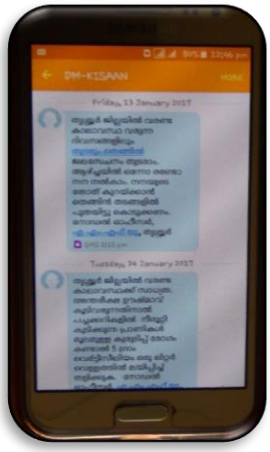
Agromet Advisories through WhatsApp group –“GKMS Weather Advisory”



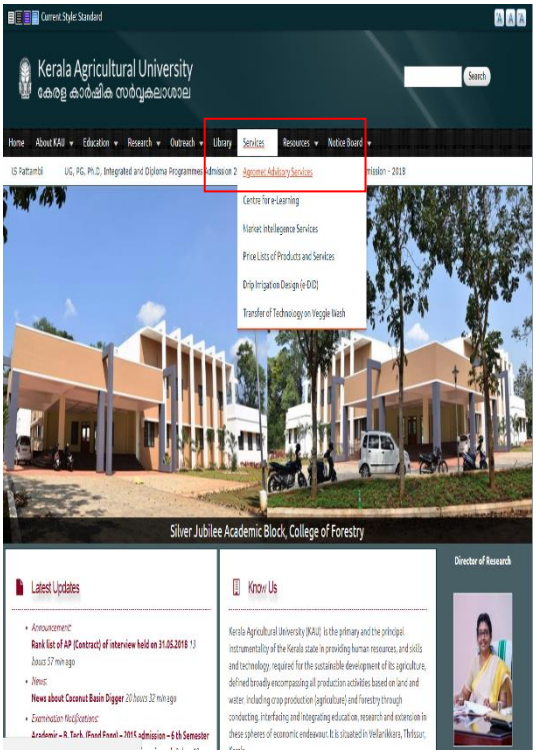
16. Print Media

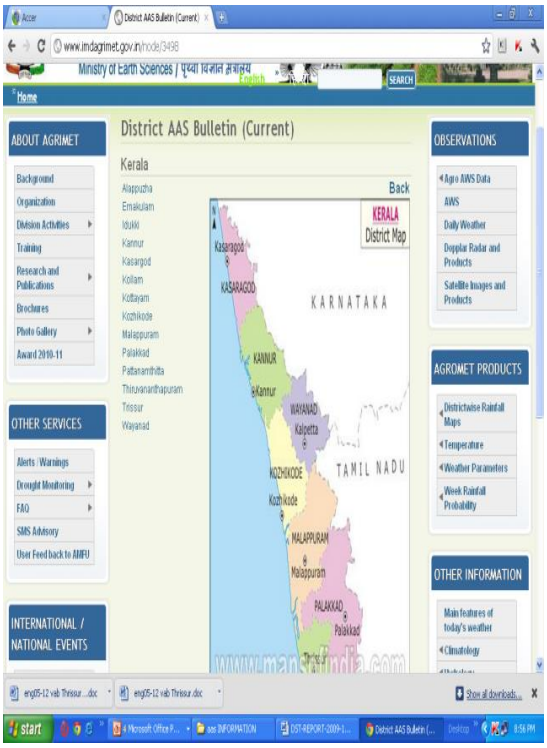


17.Group SMS through mKissan



18.Website,KAU, IMD





- *Via* Email: Krishibhavan, Agrl officers, ADA, KVK, ATMA and KAU officials and AMFU

11. Case study and economic impact of Agromet advisory bulletin

Rice variety : Vellakkoli (3 Acres)

Place : Tanur

Farmer : Mr. Kunjali

We can discuss on case study& economic impact of Agromet advisory service. The study was done in Tanur based on information collected from Mr. Kunjali who follows AAS issued from dept. of Agrl. Meteorology he cultivate vellakkoli Varity in 3 acres

Date	**Crop Stage**	**Forecast (IMD**	**AAS**	**Actual /Observed**	**Action taken by farmer**	**Loss/Profit**	**Remarks**
02/11/2018	Panicle Initiation	3,11,1,10,6	For Leaf folder and.Stem borer, use tricho cards	Light rainfall	No action taken	Loss 1000/acre	-3000/-
09/11/2018	Panicle emergence	1,1,0,6,0	For Leaf folder and.Stem borer, use tricho cards	Very Light rainfall	Use the cards 2CC/acre	Profit 500/acre	+1500/-
			Because of light rainfall, apply fertilizer	Very Light rainfall	Applied cow dung with poultry manure	Profit 400/acre	+1200/-
16/11/2018	Heading Stage	0,2,0,6,11	Rice armyworm, Spray Chlorantranilipro le, free the field from weeds	Moderate rainfall	No action taken	No loss	-

23/11/2018	Heading Stage	6,22,20,1,0	Rice armyworm, free the field from weeds	Light rainfall	He followed the advisory	Profit 500/acre	+1500/-
			Due to moderate rainfall forecast, don't apply fertilizer	Light rainfall	He followed the advisory	Loss 500/acr	-1500/-
01/12/2018	Flowering Stage	12,2,0,0,0	Brown spot, Blast, Bacterial leaf Blight, Spray pseudomonas	Very Light rainfall	Action taken by spraying that pesticide 1Kg/3acr (75/-)	Profit 200/acre	+600/- -75/-
			Because of light rainfall, apply fertilizer	Very Light rainfall	Applied cow dung with poultry manure	Profit 500/acre	+1500/- Cow dung and poultry manure from his own cattle shed
08/12/2018	Milky Stage	3,0,1,0,2	Sheath blight, Rice bug, apply neem based pesticides	Very Light rainfall	Action taken 2ml/acre	Profit 200/acre	+600/- -180/-

15/12/ 2018	Ripening /Maturity	1,0,0,0,0	Rice Bug, apply neem based pesticides	Very Light rainfall	No action taken	No loss	-
22/12/ 2018	Harvesting	0,1,0,2,5	Best time for harvesting.	No rain	He harvested the paddy before getting rain	Profit 400/acre	+1200/- Labour charge for harvesting

During 2nd Nov. the crop stage is P.I the IMD forecasted that there is a chance of light RF Upcoming 5dys based on that we gave AAB to farmers to use trichocard against stem borer and leaf folder so as per the forecast light RF was observed but the farmer was not following the advisory so he expressed a loss of 1000rs. After 1week based on IMD forecast of light RF advisories are given to use trichocards to manage the probability of stem borer and leaf folder attack he followed the advisory he used 2cc/acre and he got a profit a 500/acre. During 23rd Nov. the crop stage is heading stage IMD forecasted a moderate RF So in the advisory it was mentioned don't apply fertilizer during this stage he follow the advisory but only light RF is observed so he expressed a loss of 500/ acre.

So we have explain 3 condition the farmers expressed a loss due to not following the advisory Farmer expressed a profit due to following the advisory, and the farmers expressed a loss due to following the advisory

12. Conclusion

Agromet advisory service is an effective communication media for transfer of technology for climate change as well as forecasted information. Agromet advisory bulletin is economically useful to farmers for avoiding the losses of crop yield due to abnormal weather condition. It has also helped in encouraging the adoption and use of modern agricultural production technologies and practices, in promoting weather-based irrigation management, pest and disease management. Etc...Along with greater use of post-harvest technologies and commercial marketing of commodities.

13. Discussion

1. Why medium range weather forecasting is used for Agromet advisory preparation..?

The lead time of Medium range weather forecasts is 3-5 days because farmers sufficient time to take proper decision in their farm operation

2. What is the main difference in crop weather calendar and diagram..?

The main different between crop weather diagram and crop weather calendar is that the former indicates the current state of information on crops and weather, while the latter indicates the mean state of information on crops and weather including forewarning and the periods during which they are to be issued. The crop weather diagram can be tool to assess the crop production and its yield in relation to weather while the crop weather calendar is a tool for a weather forecaster for providing efficient weather service.

3. Wheather there is a proper weather forecasting during the time of flood..?

Yes, we have given red alert but people didn't took proper action

4. Which are all the five selected panchayath in Thrissur district where Agro Advisory Bulletin are issued..?

In thrissur district selected panchayath are Panancherry, Ollukkara, Madakkathara, Puthur, and Nadathara

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KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF HORTICULTURE, VELLANIKKARA
Department of Agricultural Meteorology
AGM 591: Masters' Seminar

Name	: Vinu K. S	Venue	: Seminar hall
Admission No.	: 2018-11-113	Date	: 07-11-2019
Major Advisor	: Dr. P. Shajeesh Jan	Time	: 10:45 a.m.

Weather service to farmers

Abstract

Weather is the most important factor that determines the success or failure of agricultural production. It has profound influence on growth, development and yield of crop, on the incidence of pests and diseases, on water needs and on fertilizer requirements. All physiological functions of crop, crop duration, the quality and quantity of crop produce are dependent on the prevailing weather conditions. The negative influence of bad weather will result in total failure of the crop. Significance of weather service is to supply useful information to the farmers to accomplish sustainable agriculture using minimum resources over change in weather parameters around the world.

There are mainly three types of crop production risks such as inheritable, transferable and crop management risks, which can be minimized by better and accurate forecasting of weather parameters. The future weather can be predicted using the local knowledge that people gained through experience and inheritance. This is known as Indigenous Technical Knowledge (ITK) based weather forecasting. In addition, there are different methods of weather forecasting *viz*. synoptic, statistical and numerical (Rao, 2015). Now-casting, short range, medium range, long range and climate (agro-climate) forecasts are different types of forecasts given according to the lead time. Medium range weather forecasts gain agricultural importance because farmers get sufficient time to take proper decision in their farm operations. The dissemination of forecasts will be through the centers of India Meteorological Department (IMD) focusing the farmers and stake holders. Crop weather diagram and crop weather calendar are the two weather forecasting tools in agriculture. Crop weather calendar is the pictorial

representation of detailed information on crop husbandry, climatic requirements and weather warnings, whereas, crop weather diagram gives season-wise information on crop husbandry from sowing to harvesting.

The information regarding forecasted weather and the farm management practices to take in advance are provided in the form of Agromet Advisory Service (AAS) to the farmers through Agrometeorological Field Units (AMFUs). AMFUs undergo *via* a chain of processes *viz*. field visits, observing the stage and state of crop, problem identification, receiving weather forecast from IMD and discussion with Agromet advisory board (Jaybhaye *et al.,* 2018). Then, agro advisory bulletins are prepared based on medium range forecast and crop stages and are disseminated to the farming community through different channels (Gandhi *et al.,* 2018). Through these bulletins, advices like fertilizer application, occurrence of pest and diseases, irrigation needs, time of harvesting *etc.* are provided to the farmers to give awareness about the future weather changes (Chhabra and Kumar., 2018).

Thus, analyzing the economic impact of Agromet advisory service, it is found that farmers, who followed the Agromet advisories are able to reduce the input cost and increase the net profit. Thus, the application of Agromet advisory bulletin based on present and forecasted weather is an efficient tool for enhancing the agricultural production and farmer's income.

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