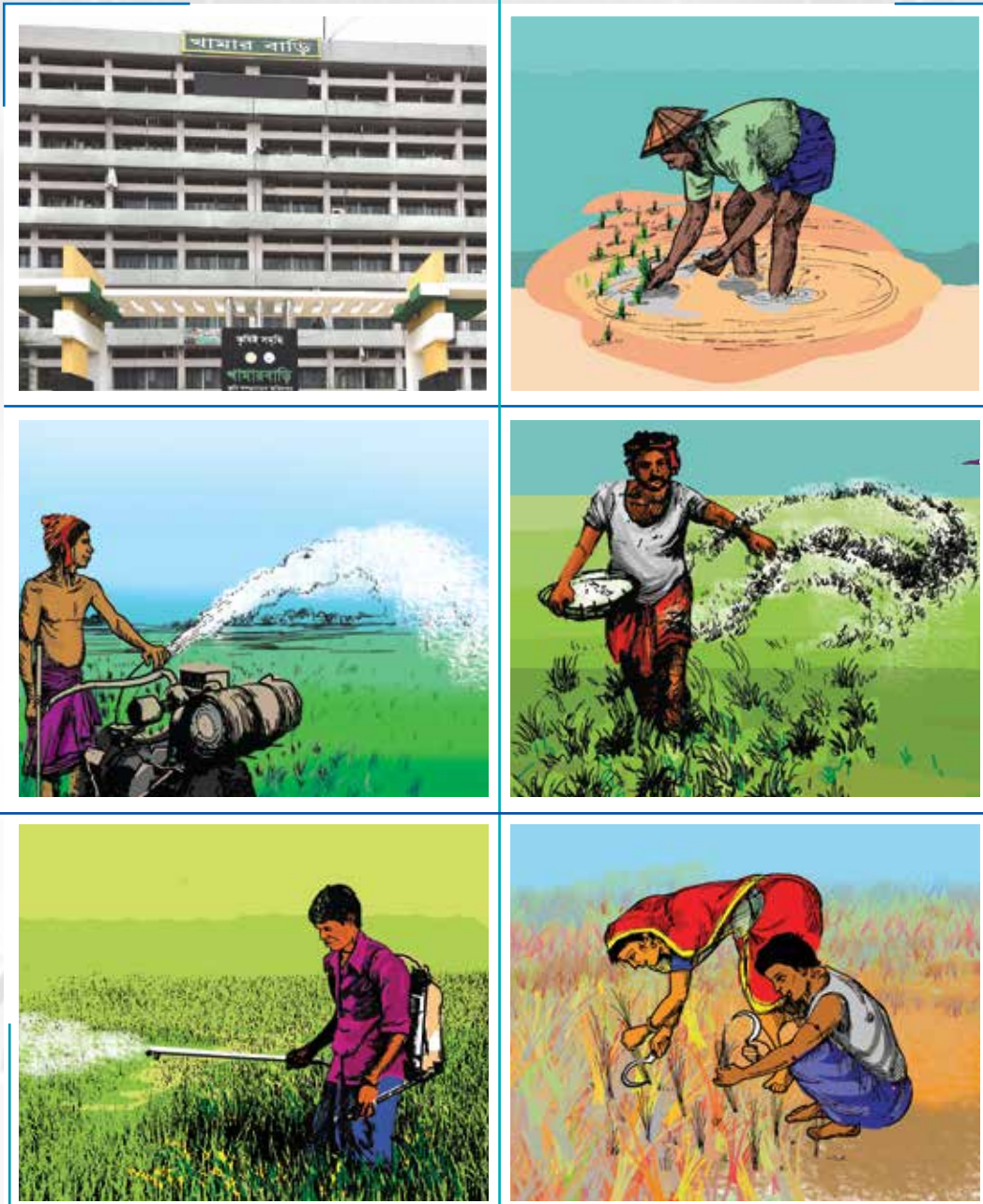




# Farmer's Training Manual on Agricultural Climate Services



**Government of The People's Republic of Bangladesh**  
Agrometeorological Information Systems Development Project  
(Component-C of BWCSR)  
Department Agricultural Extension  
Khamarbari, Farmgate, Dhaka-1215



THE WORLD BANK



### **Overall Coordination**

**Dr. Mazharul Aziz**, Project Director, Agrometeorological Information Systems Development Project, Department of Agricultural Extension (DAE) , Khamarbari, Farmgate, Dhaka-1215.

### **Technical Coordination**

**Professor Dr. H.M.M. Tariq Hossain**, Department of Agronomy, Sher-e-Bangla Agricultural University, Dhaka.

### **Content Development**

**Dr. G Srinivasan**, Chief Scientist – Climate Applications, RIMES

**Mitesh Vishwas Sawant**, Project Officer, RIMES

**Dr. Jothiganesh Shanmugasundaram**, Team Leader - Climate Application, RIMES

**Raihanul Haque Khan**, Bangladesh Country Programme Lead, RIMES

**Dr. Anshul Agarwal**, Team Leader-Hydrology, RIMES

**Asif Uddin Bin Noor**, Research Assistant, RIMES

**Syed Mahmud Hasan**, Practical Action Consulting Bangladesh Ltd.

### **Implementation Coordinator**

**Professor Dr. Moin Us Salam**, Consultant – Agrometeorology, Dhaka, Bangladesh.

### **Editorial Committee**

**Professor Dr. H.M.M. Tariq Hossain**, Department of Agronomy, SAU, Dhaka.

**Dr. M. Sahab Uddin**, Additional Director, Planning, Project Implementation and ICT Wing, DAE

**Professor Dr. Md. Shahidul Islam**, Chairman, Department of Agronomy, SAU

**Professor Dr. S. M. Mizanur Rahman**, Chairman, Department of Entomology, SAU

**Professor Dr. Mohammad Humayun Kabir**, Chairman, Department of Horticulture, SAU

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# PREFACE



Agriculture is one of the highly sensitive development sectors prone to climate variability and extremes, such as droughts and floods. In the past, good seeds, fertilizer and proper land preparation (irrigation) as well as cultivation process were sufficient for farmers to maximize producing their crops. Nowadays, those are not anymore enough. Farmers need to know how to deal with climate variability which affects their crop productivity. A majority of the Bangladesh population is still dependent on agriculture as their livelihood option. Most of the farming community practicing agriculture are not fully aware of the modern technologies of agriculture and often adopt age old wisdom as a guideline for growing crops. However, they very well know that agriculture in Bangladesh is highly dependent on the monsoon arrival and its seasonal activity. Over the years they have developed some thumb rules based on the field experiences. The farming communities have relied on various indicators to predict the nature of the coming crop year, if it would be good or bad and when to sow their crops in the current season.

Weather forecasts and climate information can assist farmers to take appropriate remedial measures to avoid or reduce economic losses against stresses as well as take advantage of favorable conditions. Forecasts of weather and climate, monitoring and early warning products on drought, floods or other calamities when translated into agro meteorological advisory services could increase the preparedness of farming community. Climate information services will be one of the tools to meet the challenges of the future particularly with reference to extreme events. The provision of need based climate information to farmers can support the management of agricultural resources (land, water and genetic resources). Better understanding of the climate in a location provides opportunities to design various measures to reduce its impacts on natural resources as such, greater professional knowledge on agricultural climate services is needed to the farmers.

The number and quality of technical and professional personnel in agricultural meteorology are very important since the effectiveness of extension services and their ability to meet farmers' needs and expectations is determined by the competence and qualifications of its staff. Therefore, this training manual is specifically designed for one day training programme for the farmers in Bangladesh . This manual seeks to increase awareness and understanding of agro-meteorological services and their relevance to build climate-smart approaches to support sustainable productivity in Bangladesh. In this regard, an Mou entitled "Developing Agricultural Climate Services Training Module" was signed with Sher-e-Bangla Agricultural University and "Agrometeorological Information Systems Development Project, Component-C of Bangladesh Weather and Climate Services Regional Project, implemented by Department of Agricultural Extension (DAE), Government of the People's Republic of Bangladesh funded by the World Bank. The module was developed by department of agronomy, Sher-e-Bangla Agricultural University with implementation support from Practical Action Consulting Bangladesh Ltd. and technical support from Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES).

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Professor Dr. Md. Shahidul Islam  
Chairman  
Department of Agronomy  
Sher-e-Bangla Agricultural University  
Dhaka 1207, Bangladesh.

# Table of Contents

|  |           |
|--|-----------|
| <b>Background &amp; brief strategies for organizing the training.....</b>                | <b>05</b> |
| <b>Five Purposes of the Training .....</b>   | <b>06</b> |
| <b>Topics of the Training Programme.....</b>   | <b>06</b> |
| <b>Details of the topics to be shared with the farmers.....</b>                          | <b>07</b> |
| <b>1. Observation of weather parameters.....</b>   | <b>08</b> |
| <b>2. Weather forecasting - Types and it's usage.....</b>                                | <b>08</b> |
| <b>3. Sensitivities of crop, livestock, poultry and fishery to weather.....</b>          | <b>08</b> |
| <b>4. Weather based forecast and warning of pests and diseases and its management ..</b> | <b>09</b> |
| <b>5. Crop production planning.....</b>  | <b>10</b> |
| <b>6. Soil and water conservation.....</b>   | <b>10</b> |
| <b>7. Warning signals of BMD.....</b>  | <b>10</b> |
| <b>8. Extreme Events.....</b>  | <b>12</b> |
| <b>9. Contingent crop plan based on weather.....</b>                                     | <b>12</b> |
| <b>10. Animal husbandry.....</b>   | <b>13</b> |
| <b>11. Agro met Advisory Services - its role and working area.....</b>                   | <b>13</b> |
| <b>12. Dissemination.....</b>  | <b>14</b> |
| <b>13. Visit to nearby union parishad .....</b>  | <b>14</b> |
| <b>14. Farmer's queries and answer by experts: some examples.....</b>                    | <b>15</b> |



# One Day Training Manual for Farmers in Bangladesh

## Background & brief strategies for organising the training programme

Agriculture is one of the highly sensitive development sectors prone to climate variability and extremes, such as droughts and floods. In the past, good seeds, fertilizer and proper land preparation, irrigation as well as cultivation process would be sufficient for farmers to maximize their crop production. Nowadays, those are not enough in changed climate. Farmers need to know how to deal with weather and climate information including climate variability that affects their crop production. Climate products are difficult to understand, especially among the farmers, who are expected to apply the information directly to undertake their farming activities such as ploughing, planting and cultivating. Thus, there is a need to organize Farmer Training Programme to address the above issues.

Climate variability in recent past in Bangladesh cause concern in the agricultural sector and also make the farming more challenging in the country. Under such anomalies of weather and climate, more scientific, accurate and to claim specific information is needed for proper farm management including risk management and to further develop their adaptive capacity with improved planning and better management decisions. In order to make the farmers more knowledgeable about the importance of climate and its impact on the agricultural crops and its management it is proposed to organize one day Farmer's Training Programme in different upazilas (sub-districts) in Bangladesh. The training programme is designed in such a way that the farmers become more self-reliant in dealing with weather and climate issues that affect agricultural production on their farms and to increase the interaction between the farmers and the Agro-meteorological service providing agencies in the country.

Farmer Training Programme is of one-day duration in which the first half of the day lectures/presentations will be given by ToT received DAE officials and in second half of the day, the discussion will be carried out on the existing knowledge of farmers on weather and climate information use in agriculture. Important discussion between resource persons and user community will be made on use of weather data and weather forecasting in Agro-met Advisory Service (AAS), extreme events, dissemination of agro met advisories. As a part of the training programme, a visit will be arranged to nearby union parishad. DAE officials will answer to the farmers' queries on different aspects.



## Training activity encompasses five purposes as follows

- Improving farmers' climate knowledge and their ability to anticipate climatic events in their farming activities.
- Assisting farmers to observe climatic parameters and using the information in their farming activities and strategy.
- Helping farmers to understand the forecasted information in their decision making.
- Farmers will learn easily how to use climatic information.
- Trained farmers will disseminate their knowledge to the neighboring farmers.



## Topics of the training programme

1. Weather observations
2. Weather forecasting - Types and its usage (Simplistic form)
3. Sensitivities of crop, livestock, poultry and fishery to weather
4. Weather Based forecast & warning of pests and diseases and its management
5. Crop production planning
6. Soil & water conservation
7. Warning signals of Bangladesh Meteorological Department
8. Extreme events
9. Contingency & adaptation plan
10. Animal husbandry
11. Agro met advisory services - its role and working area
12. Dissemination
13. Union parishd visit
14. Farmer's queries and answer by experts
15. Farmer's feedback and suggestions

## Details of the topics to be shared with the farmers

### 1. Observation of weather parameters

Different weather observations are taken in meteorological observatories. These informations helps to carry out studies on crop weather relationship, irrigation scheduling, impact of weather on pest and disease development and generation of weather-based forecast and warning models and also for their use in framing activities. Following weather observations are recorded in a Meteorological Observatory:

1. Rainfall
2. Maximum & minimum temperature
3. Relative humidity
4. Wind speed and wind direction
5. Bright sunshine hours
6. Soil moisture
7. Soil temperature
8. Solar Radiation
9. Cloud

Under AMISDP project rain gauges and weather display boards are installed at union parishad. Deliberation will be made on the functionalities of the same in understandable way.

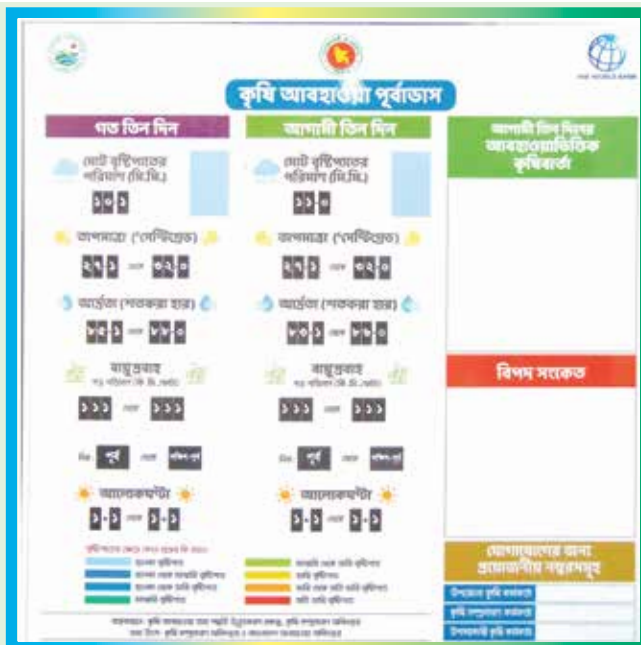


Figure 1: Weather display board



Figure 2: Automatic rain gauge



## 2. Weather forecasting - Types and it's usages

Discussion will be carried out regarding the importance of weather forecasting in agriculture. It has been mentioned that accurate weather forecasting at different scales is necessary for need based application and optimum use of applied input for achieving higher productivity. Discussion will be made on techniques to use weather forecast and its proper utilization by farmers for successful farming operations. It will be explained about irrigation water management considering the relation to weather forecasting and the methods to use weather forecasting to reduce risk. Messages will be conveyed to the farmers that the increasing efficiency of irrigation may help to increase agricultural production. Further, farmers will be advised that the farm activities should be done in accordance with the forecasted weather situations and agro met advisories in order to save the crop from adverse weather condition and also to increase the yield from the crop by minimizing cost of production and ultimately get higher net returns.

## 3. Sensitivities of crop, livestock, poultry and fishery to weather

Crop development at different phenophases depends on various thresholds of weather parameters. Any major deviations of the weather parameters particularly rainfall and temperature retard the smooth growth of plant. Similar effects on livestock, poultry and fishery are also observed. Detail discussion will be made on this subject.

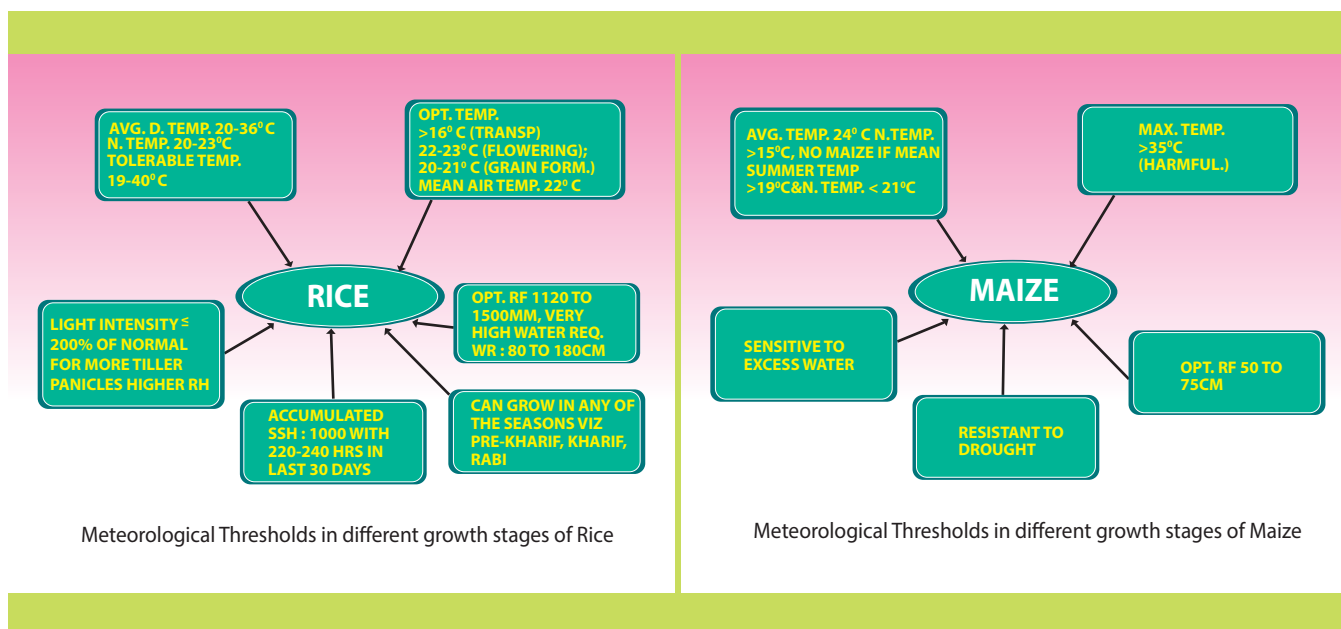


Figure 3: Development of rice and maize with their different phenophases

#### 4. Weather based forecast & warning of pests and diseases and its management

Pest management practices are combined with weather information and production practices to achieve economical, long-term solutions. Weather forecast and monitoring of pests complement the efforts of meaningful agriculture to optimize the time and dose of application of pesticides traditional knowledge of insect control, their management and favourable weather conditions for outbreak of insect and diseases will be shared with the farmers. Pests & diseases forecasting or warning systems are facilitate growers as it encourages judicious and need based use of pesticides. This not only saves the money and energy of the growers but also avoids the environmental pollution. Weather forecast and monitoring of pests complement the efforts of precision agriculture to optimize the time and dose of application of pesticides. Farmers will be advised that they should be aware of unfavorable weather conditions and take quick decision for field crops management. Farmers should apply the insecticides, pesticides or any other plant protection measures in favourable weather condition.



**Stem borer in Paddy**



**Blast in Paddy**



**Fall Armyworm in Maize**



**Seed rot in Maize**



**Aphid in Wheat**



**Blast in Wheat**

Figure 4: Pest and diseases of different crops

## **5. Crop production planning**

Farmers will be informed about the different crop rotations with the cost involved in package of practices as well as agricultural operations to be carried out during the crop growing period i.e. Kharif & Rabi seasons in perspectives of unfavourable weather. It will be also mentioned that with improved practices along with their benefits accrued over the traditional practices in vogue as well as cost benefit ratio of different crop rotations (cereals, oil seeds, pulses and vegetable crops) being followed in the region. Moreover, it will be discussed regarding growing of short duration and more profitable vegetables, which can be grown easily keeping in view the prevailing weather conditions in the region.

## **6. Soil and water conservation**

Different methods of water and soil conservations, efficient rain water management and different practices for rain water harvesting in dry farming area will be explained to the farmers. The technologies of soil moisture conservation through mulching using ferns and sprinkler irrigation will be discussed. Information will be given to the farmers to store the rain water, the use of mulch in the field to conserve the soil moisture during rabi season and plastic mulch in winter season to maintain the soil temperature for proper growth and development of the growing crops. It will be explained that rooftop rain water harvesting is the technique through which rain water is captured from the roof catchments and stored in reservoirs. The objective of rooftop rain water harvesting is to make water available for vegetable crops during water stress condition for future use will be discussed. It will be also added that capturing and storing rain water is particularly important in dry land, hilly, urban and coastal areas for future use.

## **7. Warning signal in Bangladesh**

### **Classification of Cyclones:**

The following are the classification of the cyclone according to the intensity and velocity of wind.

- (a) Depression: Wind speed 31 miles/hr. or 50 km/hr.
- (b) Deep depression: Wind speed 32-38 miles/hr. or 51-61 km/hr.
- (c) Cyclone: Wind speed 39-54 miles/hr. or 62-88 km/hr.
- (d) Severe Cyclone: Wind speed 55-73 miles/hr. or 89-117 km/hr.
- (e) Cyclone with hurricane: Wind speed 74 miles/hr. or 118 km/hr. or more.

**Table 1: Signals of Maritime Ports in Bangladesh**

## Signals for Maritime Ports

| Signals                         | Meanings  |
|---------------------------------|---|
| Distant Cautionary Signal No. I | I) There is a region of squally weather (wind speed of 61 km/hour) in the distant sea where a storm may form.   |
| Distant Warning Signal No. II   | II) A storm (wind speed of 62-88 km/hour) has formed in the distant deep sea. Ships may fall into danger if they leave harbour,   |
| Local Cautionary Signal No. III | III) The port is threatened by squally weather (wind speed of 40-50 km/hour).   |
| Local Warning Signal No. IV     | IV) The port is threatened by a storm (wind speed of 51-61 km/hour) but it doesn't appear that the danger is as yet sufficiently great to justify extreme precautionary measures.   |
| Danger Signal No. V             | V) The port will experience severe weather from a storm of slight or moderate intensity (wind speed of 62-88 km/hour) that is expected to cross the coast to the south of Chottogram port or Cox's Bazar port and to the east of Mongla port.           |
| Danger Signal No. VI            | VI) The port will experience severe weather from a storm of slight or moderate intensity (wind speed of 62-88 km/hour) that is expected to cross the coast to the north of the port of Chottogram or Cox's Bazar and to the west of the port of Mongla. |
| Danger Signal No. VII           | VII) The port will experience severe weather from a storm of light or moderate intensity (wind speed of 62-88 km/hour) that is expected to cross over or near the port.   |
| Great Danger Signal No. VIII    | VIII) The port will experience severe weather from a storm of great intensity (wind speed of 89 km/hour or more) that is expected to cross the coast to the south of the port of Chottogram or Cox's Bazar and to the east of the port of Mongla.       |
| Great Danger Signal No. IX      | IX) The port will experience severe weather from a storm of great intensity (wind speed of 89 km/hour or more) that is expected to cross the coast to the north of the port of Chottogram or Cox's Bazar and to the west of the port of Mongla.         |
| Great Danger Signal No. X       | X) The port will experience severe weather from a storm of great intensity (wind speed of 89 km/hour or more) that is expected to cross over or near the port.  |

## Signals for River Ports

| Signals                         | Meanings   |
|---------------------------------|--|
| Failure of Communication No. XI | XI) Communications with the Storm Warning Centre have broken down and local officers consider that a devastating cyclone is following.   |
| Cautionary Signal No. I         | I) The area is threatened by squally winds (wind speed of 60 km/hour) of transient nature. This signal is also hoisted during nor'westers.   |
| Warning Signal No. II           | II) A storm (wind speed of 61 km/hour) or a nor'wester (wind speed 61 kms/hour or more) is likely to strike the area (Vessels of 65 feet and under in length are to seek shelter immediately). |
| Danger Signal No. III           | III) A storm (wind speed of 62-88 km/hour or more) is likely to strike the area soon (all vessels will seek shelter immediately).  |
| Great Danger Signal No. IV      | IV) A violent storm (wind speed of 89 km/hour or more) will strike the area soon (all Vessels will take shelter immediately).  |

(Source: BMD)

### 8. Extreme Events

It will be informed that rain fed agriculture is vulnerable to adverse climate, flood, drought and cyclone that directly damage the crop. Scarcity of surface water, decreasing ground water level would affect together the agriculture, fisheries and other livelihood options. In addition to that it will be discussed that change in precipitation patterns is responsible for short-term crop failures and long-term production declines. It will be suggested precautionary measure for frost injury for winter season in vegetable crops and application of growth regulator in fruit and vegetables.

### 9. Contingent crop plan based on weather

It will be advised that farmers should adopt crop contingency plans whenever they face the eventuality like drought, break in South West monsoon that causes the mid-season drought and improved technologies in order to mitigate the impact of global warming. Contingency plan in adverse weather situations will be addressed to the farmers and measures to be taken to minimize the runoff water during less rainfall season. For following the contingent plan there would be sudden requirement of seed of recommended crop and to overcome this problem, farmers should themselves, store some additional seed of probable crops that they may require in the event of monsoon anomalies/ drought etc. Contingent measures to be taken after the flash flood of July and August in the case of rice and other crops will be explained. If the flash flood occurs in late August, then short duration pulses like green gram, black gram and cowpea can be grown in place of rice.

## **10. Animal husbandry**

Discussion will be done regarding the climatic information. Deliberations will be made on the impact of climatic forecast and climate variability on poultry and animal husbandry sector. It will be mentioned that high temperature will adversely affect the sector and which may result in reduced food intake by the animals and birds and ultimately resulted in reduced meat and egg production. Besides it will be highlighted that the adverse effects would also result in incidence of new diseases.

Further detailed impact of climatic behaviour on fisheries sector will be explained to the farmers. It will be anticipated that adverse climatic phenomenon is likely to impede sustainability of our capture fisheries which is even now under great pressure due to over exploitation and environmental decline. In general, that more frequent weather events in the changed scenario would affect production in aquaculture.

## **11. Agromet Advisory Services - its role and working area**

During the course of the programme farmers will be made knowledgeable on the role of weather information in different farm management practices like cultivar selection, choosing time for sowing/harvesting operations, irrigation scheduling, optimal water use, mitigation from adverse weather events such as low temperature, heavy rainfall at critical crop stages, fertilizer application, pesticide/fungicide spraying schedules, feed, health and shelter management for livestock. Farmers will be informed about the different components of Agro-met Advisory Service (AAS) i.e. its structure, function and working modes to meet farmer's need in real time to minimize the impact of adverse weather on crops and to make use of favourable weather to boost agricultural production. In addition to that, farmers will also be apprised on AAS which provides advisories that contains several aspects like planning of kharif crop depending on onset of monsoon, sowing of rabi crop depending on residual moisture condition of soil, fertilizer application depending on time and amount of rainfall, preventive measure of disease and pest depending on weather condition.

Discussion will also be made on the importance of different weather parameters in agriculture and horticultural crops growth. It has been mentioned that among the four major elements necessary for crop production (seed, soil, water and weather & climate), it is only possible to modify the first three components i.e. seed, soil and water but not the weather. Thus, it is very important to know whether the prevailing and weather forecast could modify intercultural operations to save the crops from adversed weather conditions.

## 12. Dissemination

Farmers are being informed that AMISDP is using the print and electronic media to obtain information related to climate & weather. Use of text SMS service to their mobiles for better crop production is practiced. Soon IVR service will be provided to them. Community Radio for farmers for disseminating the pest & disease forecast for major crop will be functioning soon. Kiosk & Weather display boards (Shown in Figure No.-1) are also used in dissemination of weather information and advisories. Agromet display boards provide agrometeorological forecast and advisory services for the farmers twice in a week. Agromet division of BMD provides agromet forecast for the farmer with the support from Department of Agricultural Extension advisories are displayed in the weather board. Weather boards are already installed in 4051 Union Parishad. DAE officials are provided with training to manage the information according to the District Agromet Bulletin. These boards help the farmers for decision support system for regular agricultural practices.



Figure 5: Kiosk installed in different Upazillas under the AMISD Project

## 13. Visit to nearby Union Parishad

As a part of the programme, farmers will visit nearby union parishad to observe installed equipments and their functionalities.



Figure 6: Weather Display Board



Figure 7: Automatic Rain gauge

## 14. Farmer's queries and answer by experts: some examples

| Queries   | Answer  |
|---|---|
| Why the yield decreases in summer rice?   | The flowering stage coincides with high temperature of 40°C, fertilization is hampered which results in low grain filling and ultimately low yield.   |
| What contingent measures to be taken after the flash flood of July and August in case of rice and another crop? | In the case of rice, emergency seedbed should be raised and the sowing in main field can be done with short duration varieties. But if the flash flood occurs in late August, then short duration pulses can be grown in place of rice. |
| What are the agronomic measures for rice in case of early season drought?                                       | In case of early season drought, when the rice seedlings are old in seed bed, closure spacing, more organic fertilizer dose, more seedlings/hill can be taken up to get optimum yield.  |
| How far the weather forecasting is very accurate with respect to rainfall in the Rangpur district?              | The weather forecasting with regard to rainfall is almost accurate, regarding short range forecast.   |
| What will be the impact of weather report on different crops?   | The impact of weather report in different crops is massive. The weather report can decide the operational activities of all crops. It can minimize the cost for inputs and labour.  |
| How potato crop is affected by weather?   | The Potato crop is highly sensitive to the temperature as it decides the tuber formation stage in potato. The foggy weather plays important role in affecting the early & late blight disease in potato.                                |
| What are the different measures to adopt in extreme weather conditions in Potato?                               | The different measures to be adopted during the extreme weather conditions in Potato are mulching for soil moisture conservation with dead leaves, water hyacinth or rice straws.   |
| Why rainfall in different parts of hilly areas is not uniform?  | Rainfall in different parts of the hilly areas is not uniform due to the natural and undulating topography. There is less amount of rainfall, where rain-shadow prevails.   |
| In how many days advance you will give us the forecast?   | Forecast will be given 5 days in advance at present with reasonable skill.  |
| You are giving forecast to entire district; will it be applicable to all parts?                                 | Presently the forecast is given for the whole district . This may not be appropriately suitable to all the parts of the district. Efforts are made to give weather forecasting block wise for more accuracy.                            |



| Queries  | Answer  |
|--|---|
| What is rain shadow area?  | Rain shadow areas are place which do not receive adequate rain.   |
| What is the favorable condition of late blight of potato and what are the preventive measures?   | Cloudy and foggy weather, light rain, low temperature. To prevent the attack of late blight, spraying of Mancozeb (2 gm /lt of water) and Blitox (4 gm/lit of water) alternately at 10-12 days interval by completely wetting the leaves are necessary. If attacked by late blight spray the mixture of Metalaxyl 8% and Mancozeb 64% @ 1 to 1 ½ gm per litre of water alternately at 12-15 days interval by completely wetting the leaves. In severe cases of attack spray Cymoxanil + Mancozeb, 2.5 gm /lit or Dimethomorph @ 2 gm/lit of water. If late blight can find in field then irrigation should be withheld. |
| What is the cause of low production of coconut in dry weather condition?   | Dry weather condition proper variety selection is very much necessary. Deficiency of some plant nutrient in the soil, shady condition and deficiency of water found to be the main cause of low production of coconut in this dry region. The speaker also told about the recommended fertilizer dose and other management practices for coconut.   |
| What is the ideal time for cultivation of gladiolus and how long it will be cultivated? When we have to take initiative for gladiolus? | Gladiolus is a winter flowering crop. The ideal time for planting is mid-September to mid-October. As the cool climatic condition (15°C -20°C) favors flowering and warm condition favors growth and development of plants, farmers can plant the corms from 10-15 <sup>th</sup> of September considering the rainfall. To cultivate gladiolus, we have to take initiative from April to May as the corms are not available here and to collect the corms at least 1-1.5 months is required.  |
| How late blight can be forecasted in tomato?   | Cloudy weather for 7 days.<br>Measurable rain (0.1-0.5 mm) for two consecutive days<br>Five-day moving RH > 85% > 50 hrs<br>Five days moving congenial temperature (7.2-26.6°C) for > 100 hrs. If above conditions prevail for five consecutive days, blight would appear in tomato within 7-10 days  |
| How can you get information about weather forecasting relating to agriculture?   | You can get information about agriculture related weather forecasting from Sub-Assistant Agriculture Officer as well as the Weather Board installed in union parishds. In this case, you cannot change your mobile number which one is provided by the Upazilla Agriculture Officer, and this number is in the project database. So, if you change your mobile number, then you should inform the Upazilla Agriculture Office.  |



**Government of The People's Republic of Bangladesh**

Agrometeorological Information Systems Development Project

Room no-728, 6<sup>th</sup> Floor, Middle Building,

Department of Agricultural Extension, Khamarbari, Farmgate, Dhaka-1215

Telephone: +880 2 55028422 | Email: pdamisd@dae.gov.bd

Website: [www.bamis.gov.bd](http://www.bamis.gov.bd)

