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Significance and Importance of Weather Forecasting in Agriculture

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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. Weather forecasters use all kinds of tools to achieve this goal. We have instruments called barometers to measure air pressure, radar to measure the location and speed of clouds, thermometers to measure temperature and computer models to process data accumulated from these instruments. The main ways the weather can be forecast include looking at current weather conditions, tracking the motion of air and clouds in the sky, finding previous weather patterns that resemble current ones, examining changes in air pressure and running computer models.

Significance of weather forecasting: Weather forecasting can help agricultural activities in the following ways

- Planning for necessary inputs during the season Timely land preparation to take advantage of earliest rain for timely sowing.
- Selection of crops and cultivars.
- Efficient use of fertilizers. Predicting pests and diseases incidence for timely action.
- Timing of weeds, pests and disease control.
- Planning for mitigation adverse effects of weather hazards.
- Adjustments in crop harvest timing to reduce the losses at harvest.

Forecast requirements during different seasons: To a large extent, crop production in our country depends on rainfall vagaries. Long range forecasts needed for kharif and rabi are:

Kharif:

- Onset and withdrawal of monsoon.
- Breaks in monsoon rainfall, and
- Occurrence of heavy rainfall.

Rabi:

- Rainfall and cold waves during winter.
- Onset of heat waves and strong winds in spring, and
- Hail storms at commencement of summer.

Essentials of weather forecasting: Essential 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 chart as may be possible in next 24 hours, and Drawing quick, correct levels and definite conclusions regarding future weather phenomenon.

Elements included in weather forecasting: From another side, the elements of agricultural weather forecasts vary from place to place and from season to season, but they should refer to all weather elements, which affect farm planning and/or operations, and they ideally would include:

Sky coverage by clouds, Precipitation, Temperature (maximum, minimum and dew point), Relative humidity, Wind Speed and direction.

Extreme events (heat and cold waves fog, frost, hail, thunderstorms, wind squalls and gales, low pressure areas, different intensities of depressions, cyclones, tornados). Bright hours of sunshine, Solar radiation, Dew, Leaf wetness, Pan evaporation, Soil moisture stress conditions and supplementary irrigation for rainfed crops. Advice for irrigation timing and quantity in terms of pan evaporation Specific information about the evolution of meteorological variables into the canopy layer in some specific cases Micro-climate inside crops in specific cases.

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

- Now-casting (NC)
- Very short range weather forecasting
- Short range weather forecasting
- Medium range weather forecasting
- Extended range weather forecasting
- Long range weather forecasting

Now-casting (NC): Current weather variables and 0-6 hour's description of forecasted weather variables. A relatively complete set of variables can be produced (air temperature and relative humidity, wind speed and direction, solar radiation, precipitation amount and type, cloud). Prerequisite is the operational continuity and the availability of an efficient broadcasting systems (e.g. very intense showers affecting a given territory must be followed with continuity in provision of information for final users). Accuracy is very high and potential usefulness is low.

Very short range weather forecasting: Up to 12 hours description of weather variables. A relatively complete set of variables can be produced (air temperature and relative humidity, wind speed and direction, solar radiation, precipitation amount and type, cloud). Prerequisite is the availability of an efficient broadcasting systems (e.g. frost information must be broadcasted to farmers that can activate irrigation facilities or fires or other systems of protection). Accuracy is very high and potential usefulness is moderate.

Short range weather forecasting: Short range weather forecasts are for a period of 12 hours to 72 hours. These daily forecasts are useful to irrigation engineers and farmers. A relatively complete set of variables can be produced (air temperature and relative humidity, wind speed and direction, solar radiation, precipitation amount and type, cloud). In SRF the attention is centred on meso scale features of different meteorological fields. SRF can be broadcasted by a wide set of media (newspapers, radio, TV, web, etc.) and can represent a fundamental information for farmers. Accuracy and potential usefulness are high.

Medium range weather forecasting: Medium range weather forecasts are for periods of 3 to 10 days. A relatively complete set of variables can be produced (air temperature and relative humidity, wind speed and direction, solar radiation, precipitation amount and type, cloud). In MRF the attention is centred on synoptic features of different meteorological fields. MRF can

be broadcasted by a wide set of media (newspapers, radio, TV, web etc.) and can represent a fundamental information for farmers. Accuracy is high or moderate until 5 days; lower after and potential usefulness is very high.

Extended range weather forecasting: Extended range weather forecasts are for periods of 10 to 30 days. Forecast is usually restricted to Temperature and precipitation.

Long range weather forecasting: The long range weather forecasts are issued thrice in year. Validity period of long range weather forecast is 10 to 30 days. The long range forecasts are useful for choosing cropping patterns.

Agriculture Application:

Agricultural applications of short range weather forecasting:

- Determine depth of sowing for optimal seedling emergence.
- Decide whether to sow or not.
- Plan irrigation based on expected rainfall.
- Ensure maximum efficiency of spraying. Decide to harvest or not to harvest.
- Management of labour and equipment.
- Plan for animal feed requirement.
- Livestock protection from cold and heat.

Agricultural Applications of long range weather forecasting:

- Crop Planning – Marginal crops Vs Normal Crops
- Choose crop varieties to suit the expected weather
- Determine expected crop yield
- Plan area to be cultivated to get the required crop produce

Methods of weather forecasting: The nature of modern weather forecasting is not only highly complex but also highly quantitative. The various methods used in forecasting the weather are as follows:

Synoptic weather forecasting: The first method is the traditional approach in weather prediction. This primary method continued to be in use until the late 1950s. 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 meteorological centre prepares a series of synoptic charts every day. This method is useful for short range forecasts.

Numerical Weather Prediction (NWP): Uses the power of computers to make a forecast. Complex computer programs, also known as forecast models, run on supercomputers and provide predictions on many atmospheric variables such as temperature, pressure, wind, and rainfall. A forecaster examines how the features predicted by the computer will interact to produce the day's weather. The NWP method is flawed in that the equations used by the models to simulate the atmosphere are not precise. If the initial state is not completely known, the computer's prediction of how that initial state will evolve will not be entirely accurate. In this technique the behaviour of atmosphere is represented by equations based on physical laws governing air movement, air pressure and other information. This technique is found suitable for medium range forecasts.

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.

Usefulness of weather forecasts: Occurrences of erratic weather are beyond human control. It is possible, however, to adapt to or mitigate the effects of adverse weather, if a forecast of the expected weather can be obtained in time. The proverbs and local lore show, however, that farmers have been keen to know in advance the likely weather situations for crop operations from time immemorial. Agronomic strategies to cope with changing weather are available. For example, delays in the start of crop season can be countered by using shortduration varieties or crops and thicker sowings. Once the crop season starts, however, the resources and technology get committed and the only option left then is to adopt crop-cultural practices to minimize the effects of mid-seasonal hazardous weather phenomena, while relying on advance notice of their occurrence. For example, resorting to irrigation or lighting trash fires can prevent the effects of frosts. Thus, medium-range weather forecasts with a validity period that enables farmers to organize and carry out appropriate cultural operations to cope with or take advantage of the forecasted weather are clearly useful. The rapid advances in information technology and its spread to rural areas provide better opportunities to meet the rising demand among farmers for timely and accurate weather forecasts.

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