© 2015 IJSRSET | Volume 1 | Issue 5 | Print ISSN : 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

Weather-Climate Forecasting System for Early Warning in Crop Protection

Bhavesh Kataria
Department of Computer Engineering and Information Technology, LDRP Institute of Technology and Research, Gandhinagar, Gujarat, India

ABSTRACT

Weather and Climate forecasting is the application of science and technology to predict the state of the atmosphere for a given location. This provide occurrence or change in severity of plant diseases. At the field scale, these systems are used by growers to make economic decisions about disease treatments for control. Often the systems ask the grower a series of questions about the susceptibility of the host crop, and incorporate current and forecast weather conditions to make a recommendation. Forecasting system provide information about plants disease which happen due to Weather and Climate changes and it happen in such a fashion that disease can occur and cause economic losses.

Keywords
FAO, phenology, Weather-Climate Forecasting System, Temperature, Solar radiation, Humidity, Cloud, Pressure, Wind, Precipitation

I. INTRODUCTION

Analysis of meteorological and climatic data allows providing near real-time information about the crop state, in quality and quantity, with the possibility of early warning on alarm/alert situations so that timely interventions can be planned and undertaken. Crop forecasting philosophy is based on various kinds of data collected from different sources: meteorological data, agrometeorological (phenology, yield), soil (water holding capacity), and remotely sensed, agricultural statistics. Based on meteorological and agronomic data, several indices are derived which are deemed to be relevant variables in determining crop yield, for instance crop water satisfaction, surplus and excess moisture, average soil moisture, etc.

Crop forecasting is the art of predicting crop yields (tons/ha) and production before the harvest actually takes place, typically a couple of months in advance. Crop forecasting relies on computer programmes that describe the plant-environment interactions in quantitative terms. Such programmes are called "**models**", and they attempt to simulate plant-weather-soil interactions. They need, therefore, information and data on the most important factors that affect crop yields - the model **inputs**. After passing "through" the model, the inputs are converted to a number of **outputs**, such as maps of crop conditions and yields.

Violent weather factors - cyclones, floods and storms - catch the attention of the public and usually receive wide media coverage. Due to their rare occurrence and unpredictable timing, they are usually extremely difficult to model. It should be stressed, however, that far more agricultural production is lost to "chronic" problems, such as local droughts, and recurrent pest attacks, than to the violent ones.
Weather data are among the most important factors that condition the inter-annual variability of crop yields. Depending on the prevailing climatic conditions, limiting factors can be either rainfall (in semi-arid areas), sunshine (in many equatorial or temperate countries). In addition, weather affects crops indirectly, through pests and diseases.

Over the last 20 years, FAO (Food and Agriculture Organization) has developed a crop forecasting "philosophy" through a number of national projects to establish national early warning systems. The FAO approach to crop forecasting philosophy is characterized by the following:

1. **Integration** of ground-based agrometeorological information with remotely-sensed (satellite) information, both at the data and at the product, or analysis, level
2. **A modular approach**, i.e. crop forecasting tools that are largely independent but can be combined, or "chained" as required by local conditions. The modularity is an essential ingredient of the sustainability of a national crop forecasting system as it facilitates maintenance, training and upgrading of forecasting systems.

II. METHODS AND MATERIAL

2.1 Weather Elements

Weather is a phrase of climate representing atmospheric condition at a given place and at a fiven instant of time as against climate, representing atmospheric condition for longer period of time over a large area. Components of weather and climate or simply weather elements include:

- Temperature
- Solar radiation
- Humidity
- Cloud
- Pressure
- Wind
- Precipitation

The influence of weather and climate on crop growth and development and final yield is complicated by complexity of interactions with crops and the environment during the crop season. The influence of weather and climate on crop productivity can be summarized as indicated below:

2.2. Weather parameters with favourable influence

i. Weather and climate are important factors to determining the success or failure of agriculture.
ii. All the agriculture operations from sowing to harvest of crops depend on the mercy of weather.
iii. Climate determines suitability of a crop to a particular region while weather plays a major role in the productivity of a crop in the region.
iv. The excess or shortage of elements of weather and climate exerts a negative influence on crop growth, development and final yield.
v. The effect of weather and climate is complex as elements of climate operate simultaneously in nature.
vi. Due to complexity of environment in which a crop is grown, it is difficult to assign an optimum value of climatic element for maximum crop productivity.

2.3 Weather parameters with negative influence

- Excessively and untimely rains.
- Scanty rains with prolonged dry spells.
- Heat and cold waves.
- Dust-storms, thunderstorms and hailstorms.
- High winds.
- Floods.

2.4 Weather variables having both positive and negative effects on crop productivity.

- Solar radiation.
- Temperature.
- Humidity.
- Wind.
- Precipitation.

2.5 Factors controlling weather and climate.

Geographical factors influencing weather and climate are referred to as climate controls. They are:

- Latitude.
- Altitude.
- Land and water bodies.
- Mountains.
- Topography.

The distance from the equator, either from south or north, largely creates variations in climate. Based on latitude, the climate has been classified as tropical, subtropical, temperate and polar climates. The height from mean sea level adds to variation in climate. Temperature and pressure decreases with increasing height from mean sea level. Based on altitude, the climate is described as mountainous and valley climates. Nearness to large

bodies of water also causes variation in climate. The climates are referred to as continental and maritime.

This system represents general of above weather parameters The assumption is that farmers access to pest and disease warnings, either directly by mobile internet/SMS, or through advisory service officers, enables improved targeting of crop protection measures which both can give increased crop yield and quality, as well as reduced pesticide use/or timely use and less production costs to farmers. The benefits for the public of a working system are reduced risks from pesticides in food and environment.

III. RESULT AND DISCUSSION

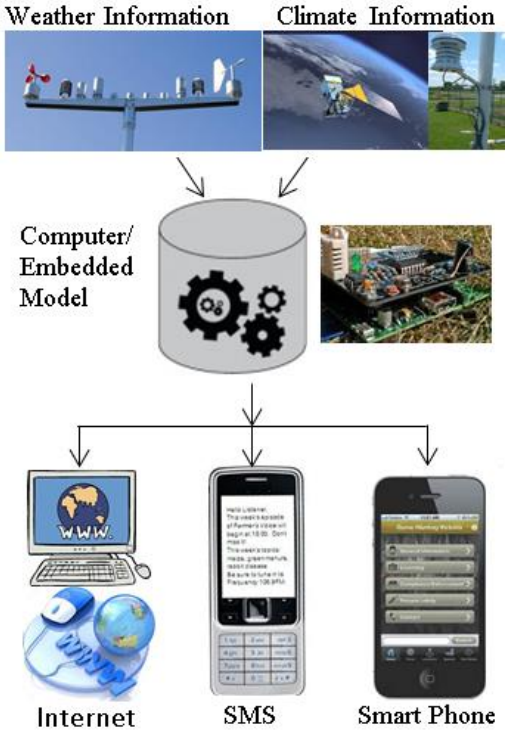

Figure 1: Weather-Climate Forecasting System

The system is a weather driven forecasting system for plant pests and diseases. This is just a general architecture. This system helps to warn Indian farmers on weather driven attacks on crops from pests and diseases. The system is computer/embedded technology based framework.

IV. CONCLUSION

Weather or Climate forecasts are made by collecting quantitative data about the current state of the atmosphere on a given place and using scientific understanding of atmospheric processes to project how the atmosphere will change. Once an all-human endeavor 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 elements which impact on cop growth.

Moreover, such a system is also implicitly addressing the climate change impacts on the pest and disease situation in crop like rice. Currently, the scientific literature is reviewed for availability of forecasting models and climate response information for the selected pests. The next steps of development in the project will be to implement selected models to operate against all weather stations of Gujarat and put the dissemination service online.

V. REFERENCES

[1] Epstein, Paul R., Climate Change and Infectious Disease: Stormy Weather Ahead?, Epidemiology, July 2002 - Volume 13 - Issue 4 - pp 373-375

[2] Applications of seasonal to interannual climate prediction in agricultural planning and operations

[3] L.A. Ogalloa, M.S. Boulahyab, T. Keanec, Agricultural and Forest Meteorology, ELSEVIER, Volume 103, Issues 1-2, 1 June 2000, Pages 159-166

[4] Francisco J. Meza, James W. Hansen, and Daniel Osgood, 2008: Economic Value of Seasonal Climate Forecasts for Agriculture: Review of Ex-Ante Assessments and Recommendations for Future Research. J. Appl. Meteor. Climatol., 47, 1269-1286.

[5] Joyce Fox Strand, Some agrometeorological aspects of pest and disease management for the 21st century, ELSEVIER, Agricultural and Forest Meteorology, Volume 103, Issues 1-2, 1 June 2000, Pages 73-82

[6] Kristie L. Ebi, Nancy D. Lewis and Carlos Corvalan, Environmental Health Perspectives, Vol. 114, No. 12 (Dec., 2006), pp. 1957-1963

[7] Andrew J. Challinor1,Frank Ewert, Steve Arnold, Elisabeth Simelton and Evan Fraser, Crops and climate change: progress, trends, and challenges in simulating impacts and informing adaptation, Oxford Journals, Journal of Experimental Botany, Volume 60, Issue 10

[8] Clima Rice project supported by the Ministry of Foreign Affairs, Norway, through the Royal Norwegian Embassy, New Delhi grids. In Euro-Par, pages 169-180, 2003.