CHAPTER 1

AGROMETEOROLOGY

Agrometeorology, abbreviated from Agricultural Meteorology and also referred to as Agroclimatology, has been defined in several ways. The name itself implies that it is the study of those aspects of meteorology which have direct relevance to agriculture. Agrometeorology puts the science of meteorology to the service of agriculture, in its various forms and facets, to help the sensible use of land, accelerate production of food and to avoid the irreversible abuse of land resources (Smith, 1970).

The meeting of Agrometeorologists in Moscow in 1951 (Molga, 1962) defined agrometeorology as a science investigating the meteorologic, climatologic and hydrologic conditions which are significant for agriculture owing to their interaction with the objects and processes of agriculture production.

The task of an agrometeorologist is to apply every relevant meteorological skill to help the farmer to make the most efficient use of his physical environment for improving agricultural production both in quality and quantity (Bourke, 1968).

1.1. Scope of Agrometeorology

For optimum crop growth specific climatic conditions are required. Agrometeorology thus becomes relevant to crop production because it is concerned with the interactions between meteorological and hydrological factors on the one hand and agriculture, in the widest sense including horticulture, animal husbandry and forestry, on the other. Its objective is to discover and define such effects and thus to apply knowledge of the atmosphere to practical agricultural use. The field of interest of agrometeorology extends from the soil surface layer to the depth up to which tree roots penetrate. In the atmosphere he is interested in the air layer near the ground in which crops and higher organisms grow and animals live, to the highest levels in the atmosphere through which the transport of seeds, spores, pollen and insects may take place.

1.2 Inter-disciplinary Aspects

Agrometeorology is an inter-disciplinary science in which the main scientific disciplines involved are atmospheric sciences and soil sciences which are concerned with the physical and chemical environment, and the plant sciences and animal sciences (including their pathology, entomology and parasitology, etc.) which deal with the contents of the biosphere. Though inter-disciplinary in nature, agrometeorology is now a well-defined science. It has a set approach in theory and methodology. Its subject matter links together the physical environment and biological responses under natural conditions. Using a four-stage approach, an agrometeorologist first formulates an accurate description of the physical environment and biological responses. Secondly, he interprets biological responses in terms of the physical environment. Thirdly, he makes crop and weather forecasts. His final goal is the control of physical environment of crop fields and animal houses.

1.3 Practical Utility

The science of agrometeorology has great practical utility in protection against, or avoidance of adverse climatic risks. The dangers to crops and livestock which have a meteorological content include the incidence and extent of pests and diseases; the pollution of air and soil, crop growth, animal production; all farm operations, the incidence and effects of drought; soil erosion from wind or water; incidence, frequency and extent of frost; the dangers of forest or bush fires; and losses during storage and transport.

Out of the total annual crop losses, a great proportion is due to direct weather effects such as flash floods, untimely rains, hails and storms. Losses in harvest, storage and also those due to parasites, insects and plant diseases are highly influenced by the weather. When specifically tailored weather support is readily available to the needs of agriculture, it greatly contributes towards making short term adjustments in daily agricultural operations which minimise losses resulting from adverse weather conditions and improve the yield and quality of agricultural products (Mavi, 1974). The weather support also provides guidelines for long range or seasonal planning and selection of crops most suited to anticipated climatic conditions.

Weather elements which influence agricultural operations and crop production can be forecast for different time spans; however, with an increase in time span, the accuracy of the forecast decreases (Newman, 1974). Hail, tornados and flash floods can be forecast up to 12 hours in advance; heavy rainfall, blizzards and thunderstorms up to 24 hours in advance; and wind velocity and rainfall forecasts can be made up to 36 hours in advance. Weather elements like rainfall and temperature intensity can be predicted for five days. Departures from the normal temperature and precipitation can be predicted for the coming season. Based on the forecasts of these elements, decisions can be taken in advance in agricultural operations and planning so as to make the best use of favourable weather conditions and make adjustments for adverse weather.

Other applications are through improvement in techniques based on sound interpretation of meteorological knowledge. These include irrigation; shelter from the wind or cold; shade from excessive sun; anti-frost measures including choice of site; anti-erosion measures; soil cover and mulching; plant cover using glass or plastic materials; artificial climates of growthrooms or heated structures; animal housing and management; climate control in storage and transport; and efficient use of herbicides, insecticides and fertilisers. Agrometeorological methods can be used in efficient land use planning; determining suitable crops for a region; risk analysis of climatic hazards and profit calculations in farming; production or harvest forecasts; and in adoption of farming methods and choice of farm machinery.

1.4. Future Thrust

The use of weather science has contributed considerably towards increased efficiency of agricultural operations. The increased efficiency has been due to laboratory and greenhouse studies in which biological responses have been measured under controlled conditions and later transferred to the field.

Because of its economic importance, there is a definite need to expand the sphere of agrometeorological knowledge. Greenhouse experiments, controlled climatic studies and bioclimatological models need more thrust (Russel, 1976). The other areas which need to be pursued vigorously by agrometeorologists are:

1) Identification and ecological importance of droughts;

2) Water balance analysis as an index of crop production potential.

3) Soil micro-climate; and

4) Agroclimatic classifications.

In livestock production, the thrust has to be to:

1) Stengthen the agrometeorological network to meet the special needs of livestock raising; and

2) Conduct research on the adaptation of animals to varying climatic conditions and in the design of animal shelters.

More agrometeorological research stations need to be established in typical agroclimatic regions to record data on weather and crops for preparing agrometeorological models and agroclimatic indices.

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