CHAPTER - 1

INTRODUCTION

Low rice yield in the tropics has recently received much attention. The environment under which rice is normally grown, defects in the varieties used, or both are major causes of low yield. Since rice hectarage is more or less fixed, the rice yield per unit area per unit time must be increased by increasing the number of crops produced each year, a double or triple cropping system.

In Eastern India, single cropping in the monsoon season is commonly practiced. However, some rice varieties are grown during different times of the year, depending on the availability of water. Autumn rice, locally known as 'aus', is sown in May-June in uplands and consists of short duration varieties of 90 to 120 days. Winter rice or 'aman' is sown in June-July in lowlands and consists of long duration varieties of 140 to 170 days. Spring and summer rice or 'boro', sown in December-January in lowlands, are usually short duration varieties of 90 to 120 days (Ghose et al, 1956). It therefore appears that the environment throughout the year in Eastern India is not seriously limiting for double or triple rice cropping.

The 'boro' season (December-March), somewhat resembles the rice growing season of temperate region. In this period, the average daily temperature never goes below 10°C

or above 24°C. This is unlike 'aus' and 'aman' seasons, where fairly high temperature prevails. The climatic conditions that exist during the 'boro' season should be favourable for high rice yield if sufficient water is provided.

Plant breeders have now succeeded in evolving and selecting new rice varieties which have many desirable plant characters for intensive cultivation in the tropics. A few such varieties are Taichung-(Native) I, IR8-288-3, ADT-27 and local varieties like Kalimpong-1 and Dular. These high yielding, short duration and day-neutral varieties can be grown in succession throughout the year in the tropics. At the International Rice Research Institute, Manila, Philippines, (IRRI Reporter, 1966) triple cropping recorded a total production of nearly 18,000 kg per hectare - giving an average yield of 6,000 kg per hectare per crop. It shows that high yields can be obtained not only under temperate climate but also under tropical conditions. In India attempts have been made to introduce double or triple rice cropping in recent years, but full success has not yet been achieved because of a lack of basic information on the soil-plant-water relations in rice production.

To obtain crops in succession, rice must be grown in different seasons under irrigated conditions. The seasonal characteristics and water needs are therefore important factors.

Rice is considered to be a water loving plant as it thrives well under flooded conditions. However, soil saturation has been shown sufficient for good growth and yield of rice (Bhatia and Dastane, 1966). Even 30% of field capacity for a loam soil is an adequate moisture content for better growth of rice (Chang et al, 1958-33). The response of rice plant to different soil water regimes also depends on the growth stages (Matsushima, 1962). According to the International Rice Research Institute, Manila, Philippines (Ann. Rept., 1966) plots drained before the panicle primordium initiation stage, at the effective tillering stage, or during the booting stage yielded more than plots that were continuously flooded. The reverse was true when plots were drained at the panicle primordium initiation stage and at the flowering stage.

In India out of about 36.1 million hectares under rice nearly 13 million hectares have good irrigation facilities. With the introduction of new irrigation projects, more and more rice area will gradually come under irrigation. The water requirement of rice is larger than that of any other crop of a similar duration. According to Ramiah and Vachhani (1951) a rice crop of about 150 days duration will require about 75 acre-inches (1875 mm) of water including rain and irrigation. This increases considerably the cost of irrigated rice agriculture.

Water is thus costly and scarce. Large amounts of water move from soil into the roots, through the stems into the leaves and out into the atmosphere in the form of vapour by the process known as transpiration. Transpiration is mainly governed by the soil water regimes and atmospheric conditions. An understanding of the relations of water use, growth and yield of rice under different soil water regimes and climatic conditions is necessary to find a way to make rational use of water under irrigated rice agriculture without sacrificing yield.

A basic understanding of the problem, therefore, is necessary in planning the double or triple rice cropping programme for a particular region.

The present investigation was undertaken to study the water use, growth, and yield of rice as affected by the soil water regimes and atmospheric conditions operating during the different growth phases.