# INTRODUCTION

Rice is the most important cereal food crop in India, being extensively cultivated under widely varying soil and climatic conditions. Its annual production is about 53.3 million tonnes of clean rice from an area of 39.7 million hectares (1980-81). Although rice accounts for 41 per cent of the total food grain out put in the country, the level of productivity is as low as 1.34 tonnes per hectare which is far below the level demonstrated in experimental plots and National Demonstrations. Of the various factors affecting the desired level of production in rice, low efficiency of nitrogen is an important one. Numerous nitrogen response experiments in India and elsewhere have shown that the recovery of fertilizer nitrogen applied to the rice crop is seldom more than 30 to 40 per cent. This poor utilization of nitrogen fertilizers by lowland rice is considered to be largely due to losses of N from soil plant system. For efficient nitrogen use, it is imperative to understand transformation processes of this nutrient element in lowland rice soils.

Nitrogen applied to the soil plant system may partly get absorbed by the plants and the rest is lost through processes such as denitrification, leaching, run off and

ammonia volatilization. Certain conditions peculiar to lowland rice cultivation facilitate loss of N through the above processes. These include frequently fluctuating hydraulic head in the form of flood water which helps to leach the soluble ammonium out of reach of plant roots, particularly in light textured soils with low cation exchange capacity; and alternate wet and dry conditions, which, through fluctuations in redox potential, favour denitrification losses. In addition, some nitrogen may interact with organic and inorganic soil fractions and be removed from the pool of available N. Thus, a major part of the nitrogen applied to lowland rice soils is either lost or fixed by the soil colloids leaving a very little portion available for crop use. This low nitrogen recovery of rice is a major deterrent to the use of required quantities of fertilizer nitrogen for the modern rice varieties, particularly so in light textured soils because of the added problem of high leaching losses. This often results in poor performance of the crop. So it was considered desirable to investigate the possibility of developing a more efficient fertilizer management practice to minimize the leaching loss of N and thereby increasing the efficiency of applied nitrogen.

Among the commonly available sources of N, urea has become the principal source of nitrogen fertilizer for rice in India, and is going to be so in the years to come mainly

because of its price advantage and also because of the non-availability of sulfur for manufacturing other forms of nitrogen fertilizers. Though the losses of N from urea under submerged rice field are reported to range from 60 to 80 per cent due to its rapid dissolution, various experimental evidences clearly indicate that there is considerable scope for improving its utilization efficiency by proper time, form and method of application.

Considerable success has been attained in this respect by applying urea fertilizers in splits coinciding with the different growth stages of the crop. However, the gain achieved is often vitiated due to the fact that nitrogen splits are generally applied at fixed intervals rather at critical stages of crop growth when the requirement is relatively greater. Besides, the cation exchange capacity of the soil, which is one of the important characteristics in retention or loss of the nutrients, is seldom taken into consideration while deciding the quantity as well as number of splits. This defeats the purpose of feeding the crop when it is actually needed. All these have resulted in poor performance of the crop. Therefore, a cardinal principle in nitrogen fertilization would be to apply in accordance with the cation exchange capacity and requirement of the crop particularly at the critical growth stages.

In addition to split application, two basic approaches - deep placement and slow release forms - are evaluated recently in agronomic research to increase nitrogen fertilizer efficiency for rice. Data available from different parts of the country on the efficiency of slow release and coated fertilizers brighten the prospect of use of urea in its modified forms. Some of these fertilizers have an added advantage of dispensing with top dressing of nitrogen at later growth stages of the crop, which was not feasible under conditions where water depths vary from 20 to 70 cm during the growing period.

From what has been mentioned in the foregoing paragraphs, it is apparent that sufficient data are available to suggest split application of urea at critical stages of crop growth so as to synchronise with periods of most efficient utilization by the crop, deep placement of N in the active rooting zone of the rice plant much below the oxidized zone at the sub-surface and the use of coated and controlled release fertilizer N materials for increasing fertilizer N use efficiency of rice. However, the response of rice to these practices varies considerably from site to site because of the diversity of the climate and soil conditions. Further, the associated cultural and management practices like variety, season, water management, weed control and other factors will also

greatly affect the N use efficiency of rice. Therefore, the present day need for detailed studies to find out the suitable nitrogen management practice for lowland rice under existing soil, climate, and cultural conditions can not be underestimated. Keeping this in view, experiments were planned to study the mechanism of nitrogen loss with special reference to leaching and to find out a proper time, form and method of urea application for minimising these losses, with the ultimate objective of increasing N use efficiency of lowland rice.