INTRODUCTION

Rice is the most important cereal crop in India with annual production of about 53.23 million tonnes of cleaned grain out of 39.77 million hectares (1980-81). Although it accounts for 41 per cent of the total food grain, the level of productivity is as low as 1.34 tonnes per hectare. Of the several factors essential for increasing production of rice, nitrogen earns its place of prominence because this is considered to be the key to the realization of the yield potential of modern rice varieties. Experiments conducted under the All India Coordinated Rice Improvement Project on a wide variety of soil conditions in all the rice-growing tracts have shown that there is no place where the application of nitrogen has failed to give response. Moreover, it is found to be essential even for modest yields. However, the recovery and productive efficiency of applied N is often very low. Numerous nitrogen - use experiments have shown that the recovery of fertilizer N applied to the rice crop is normally seldom more than 30 to 40 per cent. Even with the best agronomic practices and strictly controlled conditions, the recovery of fertilizer N by the rice crop seldom exceeds 60 per cent. Low nitrogen-use-efficiency, the wide-spread need for nitrogen in food production, the anticipated increase in fertilizer nitrogen costs, and the foreseeable world shortage of petroleum products, call for improved practices on fertilizer use and management to conserve nitrogen.

The poor utilization of N fertilizer by rice is thought to be largely due to losses of applied N from the soil-plant system. Leaching, denitrification, run-off, seepage, and ammonia volatilization have been identified as potential N loss mechanisms. More than one such mechanism of loss may become predominant in a particular situation. Under lowland situation, among the different types of losses, leaching and denitrification are considered to be the major ones under submerged condition. This is indicative of inefficiency of N fertilizers which often frustrate strategies to increase production of rice particularly of rainfed lowlands which occupy about 50 per cent in the country (Mishra and Roy, 1980)and 50-60 per cent in monsoonal Asia (Patnaik and Rao, 1979). Although most of the research on nitrogen transformation and biological nitrogen fixation in soils has been oriented towards processes that take place in well aerated dry lands, much work is yet to be done on submerged soils and especially on the wet-land rice to develop more efficient fertilizer sources and management practices.

Among the most commonly available sources of nitrogen for rice fertilization, urea is the dominant one and will remain so in all the rice-growing countries of the world, particularly in tropical Asia, since the production of urea will constitute 85 per cent of the total manufacturing capacity by 1985 (Stangel, 1977). While the price advantage of urea makes it the most popular fertilizer for rice, it is not an ideal one. Problems with urea include rapid hygroscopicity, easy dissolution and

ready decomposition by the enzyme urease to ammonia and carbon dioxide. Losses of nitrogen from urea are reported to range from 60 to 80 per cent for rice. However, recent advances in urea technology offer an excellent opportunity to examine its effectiveness as a fertilizer for rice. Modified and new urea materials are now being evaluated in several rice producing countries in the world particularly in Asia.

A modified slow-release form of urea may hold promise to achieve real potential for increasing the effectiveness of applied N where water-logging continues for long periods - a common feature of lowland rice fields in wet season. Moreover, under such situation topdressing is either not possible or even if feasible only during early part of crop growth. Thus, it leaves further scope of utilization of slow-release forms with the added advantage of dispensing with topdressing of N in the mid season. On the basis of the results of field experiments conducted in the country and abroad, SCU has proved to be a suitable slow-release source of nitrogen for rice. But, its use is restricted mainly due to high cost. Hence, any modified form of low cost urea with high efficiency which is atleast comparable to SCU, will be most suitable. In addition to this, any effort to increase the efficiency of urea fertilizers by minimising the loss of N and increasing its availability by adopting appropriate management practice, would be of great advantage.

Use of some indigenous materials like oil cakes or lac are considered prospective sources as coating materials to

convert ordinary urea into slow-release type. Their low cost and easy availability are of added advantage. Many field experiments with lac coated urea and neemcake treated urea have shown some promise in lowland rice fields. But, informations available so far appear to be inadequate for developing any management practice which prove beneficial to the lowland rice crop. Slow-release forms of nitrogen give better crop response as compared to prilled urea. Moreover, their productive efficiency can be further increased if such materials are applied in a way that the requirements of the crop coincides with the rate of release of N. Hence, it becomes imperative to investigate the possible techniques by which this can be achieved.

Rate, timing, and method of application of N are considered to be important management practices which increase the utilization of nitrogen fertilizer. A high positive correlation between yield and application rate of N has been observed by many researchers only upto a certain level that may vary according to the variations in growing conditions and plant type. The time of fertilizer application also significantly affects the utilization rate of N, more so when application is matched with the different critical stages of crop growth. Single basal application which is common practice in lowland rice, particularly under waterlogged condition, encourages loss of applied N mainly by leaching and denitrification. Thus, use of a slow-release form of urea fertilizer appears to provide considerable scope for minimising loss of applied N by better crop utilization through prolonged supply and thus increasing its efficiency.

Greater benefit of any fertilizer management practice can be accrued if the crop duration, soil type, and season of cultivation are also taken into account in framing a proper fertilization schedule.

Hence, in the light of the above informations, an investigation was planned to achieve the following objectives :

1. To evaluate the relative efficiency of different slow-release and modified urea fertilizers in increasing the grain yield and uptake, productive efficiency, and recovery of applied N.

2. To obtain an insight into the relationship between N-source, N-management and N-efficiency of rice under lowland condition.

3. To develop appropriate management practices for different promising urea fertilizers for lowland rice to minimise loss and maximise the efficiency of nitrogen.