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Growing of Rice Crop in North-East Gangetic plains and Nitrogenous Fertilizer Loss problem in Rice Field Crop

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Rice (*Oryza Sativa* L.) is the staple food of more than 60 per cent of world's population. It is the staple food of most of the people of South-Eastern Asia. Rice occupies a pivotal place in Indian agriculture and is the staple food for more than 70 per cent of population and a source of livelihood for about 120-150 million rural households. It accounts for about 43 per cent of total foodgrain production and 55 per cent of cereals production in the country.

History of Rice in India

India is an important centre of rice cultivation. Carbonised paddy grains were found in the excavations at Hasthinapur (Uttar Pradesh) at a site dated between 1000-750 B.C. (Choudhary and Ghose, 1953).

De Candolle (1886) and Watt (1892) thought that South India was the place where cultivated rice originated. Vavilov (1926) suggested that India and Burma should be regarded as the centre of origin of cultivated rice.

Climatic Requirements

Rice cultivation in India extends from 8 to35ºN latitude and from sea level to as high as 3000 meters. It is best suited to regions which have high humidity, prolonged sunshine and an assured supply of water. The average temperature required throughout the life period of the crop ranges from 21 to 37º C. Maximum temp which the crop can tolerate 40ºC to 42ºC.

Nutritional value of Rice

Rice is a nutritional staple food which provides instant energy as its most important component is carbohydrate (starch). Rice flour is rich in starch and is used for making various food materials. In husked rice, protein content ranges in between 7per cent to 12per cent.

Medicinal Value

The immense diversity of rice germplasm is a rich source for many rice based products and is also used for treating many health related maladies such as indigestion, diabetes, arthritis, paralysis, epilepsy and give strength to pregnant and lactating mothers. Medicinal rice varieties like Kanthi Banko (Chhattisgarh), Meher, Saraiphul & Danwar (Orissa), Atikaya & Kari Bhatta (Karnataka), are very common in India.

Crop Production Practices

In India Rice is mainly grown in two types of soils i.e., (i) uplands and (ii) low lands. The crop of rice is grown with the following methods

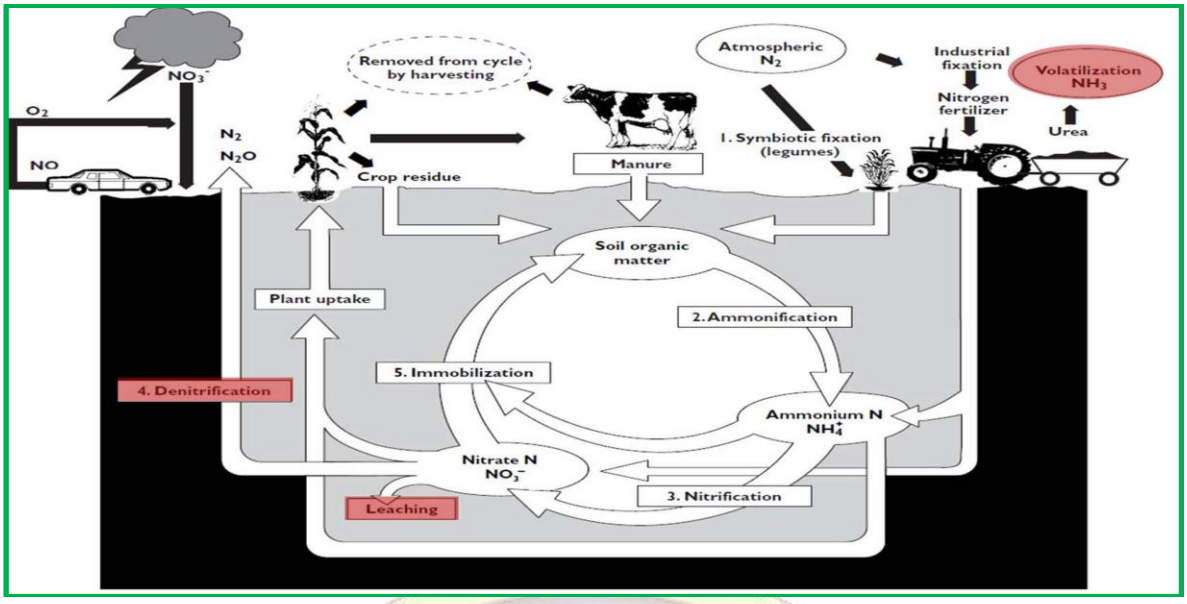
- Dry or Semi-dry upland cultivation
    - Broadcasting the seed
    - Sowing the seed behind the plough or drilling
- Wet or lowland cultivation
    - Transplanting in puddled fields.
    - Broadcasting sprouted seeds in puddled fields
    - Selection of Seeds

Before sowing the seed should be treated with fungicides which protects the seed against soil-born fungi and also give a boost to the seedlings.

Leaching of Nitrogenous Fertilizer in Rice field Crops

Nitrogen is the main limiting nutrient after carbon, hydrogen and oxygen for photosynthetic process, phyto-hormonal, proteomic changes and growth-development of plants to complete its lifecycle. Excessive and inefficient use of N fertilizer results in enhanced crop production costs and atmospheric pollution. It is involved in various critical processes, such as growth, leaf area-expansion and biomass-yield production. Excess NUE can support good plant performance and better crop out-put. Various plant molecules such as amino acids, chlorophyll, nucleic acids, ATP and phyto-hormones, that contains nitrogen as a structural part, are necessary to complete the biological processes, involving carbon and nitrogen metabolisms, photosynthesis and protein production.

High N fertilizer and flooding irrigation applied to rice on alluvial soil often result in N leaching and low recovery of applied fertilizer N from the rice fields in, which threatens ecological environment, food security, and sustainable agricultural development. This paper reported the regulating N application for rice yield and sustainable Eco-Agro development in the North-East Gangatic River basin. The results showed that reducing and postponing N application could maintain crop yields while substantially reducing N leaching losses to the environment and improving the nitrogen use efficiency. Considering the high food production, the minimum environmental threat, and the low labour input, we suggested that regulating N application is an important measure to help sustainable agricultural development in this region.



1. **Ammonia Volatilization:** In this chemical reduction process, nitrogen is lost in the gaseous form when urea or ammonium fertilizers are applied on the soil surface. Losses of nitrogen as ammonia are occurred, especially in alkaline soils. It may be represented in the following reaction:

$$\underset{\text{Nitrite}}{2HNO_2} + \underset{\text{Urea}}{CO(NH_2)_2} \rightarrow CO_2 + 3H_2O + 2N_2\uparrow$$

2. De-Nitrification Loss: The biochemical reduction of nitrate-nitrogen to gaseous compounds by microorganism is called de-nitrification. The microorganism involved are common anaerobic forms.

$$\underset{\text{Nitrates}}{2NHO_3} \xrightarrow{-2(O)} \underset{\text{Nitrites}}{2NHO_2} \xrightarrow[-H_2O]{-2(O)} \underset{\text{Nitrous oxide}}{N_2O} \xrightarrow{-(O)} \underset{\text{Elemental nitrogen}}{N_2} \xrightarrow{-(O)} \underset{\text{Nitric oxide}}{2NO}$$

3. Leaching Loss: The nitrate-nitrogen is lost in drainage or with percolating water. Nitrate-N can be leached from any soil if rainfall or irrigation moves water through the root zone.

4. Crop Removal: Substantial amounts of N are lost from the soil system through crop removal. A 250 bushel per acre corn crop, for example, removes approximately 175 pounds of N with the grain. Crop removal accounts for a majority of the N that leaves the soil system.

5. Soil Erosion and Runoff: Nitrogen can be lost from agricultural lands through soil erosion and runoff. Where soils are highly erodible, conservation tillage can reduce soil erosion and runoff, resulting in less surface low of N.

Method to increase nitrogen use efficiency

1. Minimizing Nitrogen Loss with Proper Management of Nitrogen: (a) Deep placement of N fertilizers (b) Nitrogenous fertilizers should be applied in split dose (or instalment).

2. Minimizing Nitrogen Loss with Proper Water Management: (a) For minimizing the de-nitrification loss in the field arrangement for proper drainage should be done. (b) Optimum use of irrigation water would reduce the leaching loss.

3. Weed Control. Loss of N can be minimized by removal of weeds from the field.

4. Varietal Differences in Nitrogen-use Efficiency. Rice variety IR 42 uses N more efficiently than IR 36 and IR 8. Variety like IR 42 should be used for increasing N- efficiency.