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*Mini Review*

# New Methods to Enhance Crop Utilize Productivity

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**Abstract**

Nitrogen (N) is the most limiting nutrient for agricultural production, but its overuse is associated with environmental pollution, rising levels of greenhouse gases, and multiple impacts on human and animal health. These effects are strongly influenced by biochemical transformations such as volatilization, leaching, runoff, denitrification and N loss. Half of the nitrogen fertilizer produced worldwide is used to grow three major crops: rice, wheat and maize, with current nitrogen recovery rates of around 30-50%. Continued increases in N fertilizer use, despite declining crop yields, may further increase the environmental and health impacts of residual N. To counteract these effects, NUE efficiency (NUE) is improved through the introduction of efficient agricultural practices, and modern breeding and biotechnology tools to develop N-efficient cultivars require immediate attention is required. Using conventional marker-assisted selection methods to map quantitative trait loci and their introgression into elite germplasm, NUE leads to the creation of superior cultivars. In addition, gene-editing techniques offer the opportunity to develop high-yielding cultivars with enhanced N utilization capacity. Some of the most reliable and least expensive methods include agricultural practices such as specific nitrogen management, fertilizers with improved use efficiency, resource conservation practices, precision farming, and Nano fertilizers, allowing farmers helps reduce the environmental loss of nitrogen. , which improves NUE. In our review, recent developments in regional and scientific soil and crop management techniques, and conventional and modern breeding techniques, to increase NUE that help reduce the associated nitrogen load and health impacts.

**Keywords:** Genetic improvement, Tissue culture, Somaclonal variation, DNA markers

## INTRODUCTION

Future food demand is expected to grow from meet the enormous challenges of feeding an increasing population, biochemical and molecular reactions, metabolism and resources. In the meantime, we need to increase agricultural production by about 60%. It is considered to be the most limiting nutrient in plant production as it affects plant allocation **(Bhutta, Zulfiqar A., 2013)** Synthetic nitrogen fertilizers are an important input to the agricultural sector, which accounts for nearly half of the nitrogen source for global food production, and are therefore essential for meeting food security for people, especially in developing countries. However, intensive and disproportionate use of N fertilizers is associated with his N loss from the soil plant system, resulting in lower NUE, higher investment costs and greater food insecurity. This nitrogen loss leads to several environmental impacts, including eutrophication, increased greenhouse gas emissions, and pollution of surface and groundwater resources. Consumption of nitrate-rich water is associated with health problems such as methemoglobinemia and cancer **(Headey DD., 2013).** Additionally, high levels of nitrates in wastewater can affect animals, leading to direct poisoning of aquatic life and livestock.

Because grains contribute significantly to the supply of protein and calories (directly through grains and indirectly through animal products), they play an important role in human and animal nutrition and food security, especially in developing countries **(Deaton A, Dreze J., 2008).** I'm here among them, maize, rice and wheat account for almost 90% of the world's cereal production and are considered the most important from a human nutrition point of view. About half of the world's population depends directly or indirectly on nitrogen fertilizers for food. Due to the growing role of synthetic nitrogen fertilizers in agriculture, the industry produces nearly 120 of reactive nitrogen per year. However, less than 40% of the applied N is taken up by plants. At the same time, the rest enter the environment through different mechanisms, resulting in different agricultural, environmental and health impacts. Therefore, given the agricultural, environmental and health implications of N loss, some innovations are needed to improve his NUE, especially for cereals **(Headey D, Chiu A, Kadiyala S., 2012)**. In this regard, the adoption/use of improved agricultural approaches such as site-specific nutrient management (SSNM), resource conservation practices, precision agriculture, and increased use of efficient fertilizers (EUEF) and Nano fertilizers will help farmers improve the environment reduces nitrogen from soil plant systems, thereby improving NUE at operational levels. **Nitrogen route in soil–plant systems**

The biogeochemical cycle of N involves diverse N pools, morphologies and environmental processes in terrestrial and aquatic ecosystems. Several forms of N exist in the soil and atmosphere (biosphere), including N2, N2O, NO-, NO2-, NO3- and NH3 (reduced forms). The N cycle includes nitrification, denitrification, mineralization, immobilization, volatilization, precipitation and fixation processes for the transfer of N from one compartment to another. The N cycle is further divided into two cycles, the external cycle and the internal cycle. The extrinsic cycle includes the processes of N contribution to the ecosystem such as rainwater N2 fixation, NH4+ and NO3–, and the use of organic and inorganic forms of N fertilizers. H. In contrast, the internal cycle includes the processes of N-transformation (shape transformation) or assimilation into the plant body, root turnover, mineralization and microbial immobilization **(Datt G, Ravallion M., 1988).** N externally applied to soil is processed in two ways by plants. H. Uptake of N by plants (as nitrate and ammonium) and assimilation of N within plants (amino acids) results in the formation of essential amino acids and other metabolites. Available N released from soil by applied fertilizers or organic N is highly sensitive to losses by soil plant systems such as denitrification, leaching, runoff and volatilization. N-optimization is therefore of great importance for economic and ecological reasons. The N cycle is driven by the fixation of atmospheric N (inert) and the generation of bioavailable (reactive) N compounds. H. Nitrates, ammonium and other oxides **(Ravallion M, Datt G., 2002).** This cycle is artificially induced by fertilizer input and fossil fuel burning. In agriculture, nitrates are mainly produced from manure, cow dung, crop residues and soil organic matter. Heterotrophic microorganisms play an important role in converting organic substrates first to ammonium and finally to nitrite by nitrifying bacteria. In native ecosystems, N comes from lightning, biological fixation, and atmospheric deposition (dry and wet deposition) **(Christiaensen L , Demery L , Kuhl J., 2011).** Denitrification is a microbial process that removes nitrate under anaerobic conditions and reduces it to nitrite, nitric oxide and nitrous oxide. The addition, removal and subsequent re-entry of N between different compartments of soil and air are presented to complete the N cycle. The amount of inorganic N in soil can be summarized by the following N-cycle dependent N-balance equation.

**Factors affecting N dynamics in soil–plant systems**

Globally, there is a large mismatch between nitrogen demand and supply in cultivated agroecosystems. Soil nitrogen deficiency limits plant growth and development. On the other hand, too much can cause water pollution (eutrophication) and global warming (greenhouse gas emissions). Efficient and precise management of nitrogen is therefore important for crop production, profitability, and minimization of environmental losses. In general, the NUE of a crop is a biological it depends on both and abiotic factors. and biological factors are also shown to vary between crops (variety differences, genotype, root development and rootstock) **(Bamji MS, Murty P., 2011).**

### Physico-chemical factors

These abiotic factors, including physical and chemical interventions, influence soil nitrogen dynamics and efficiency. These factors are either induced or it can occur naturally **(Headey D., 2013).**

Soil pH plays an important role in the dynamics of N available to plants in soil. Both high and low pH conditions adversely affect soil N availability. Under neutral pH (pH 6-7) or equilibrium conditions, the biological conversion of ammonium to nitrate is rapid and readily available to plants. However, under low pH conditions (pH < 6 > 7); significant amounts of ammonia gas can be lost. Ammonium fertilizers lower the pH of the soil and nitrate fertilizers raise it. Fertilizers such as urea are applied to the soil, H+ ions are produced by hydrolysis, resulting in a significant increase in pH and loss of N through volatilization becomes larger **(Abdul-Rahaman A, Abdulai A., 2018)**

# CONCLUSIONS

Although N is the most limiting nutrient for agricultural production, its overuse, especially in the form of synthetic N fertilizers, is associated with large losses that pollute the environment, increase the concentration of greenhouse gases, and affect human and animal health. It also has a responsible impact on health. Therefore, N utilization efficiency needs to be improved to provide enough N to meet increasing food demand and maintain a safe environment. Appropriate use of known N-efficient mechanisms and candidate genes can provide new cues for tuning genotypes that produce optimal yields and improve NUE considering projected climate change scenarios. Genetic engineering and biotechnology tools should also be incorporated into breeding programs to target specific candidate genes responsible for higher N efficiencies. Therefore, genetic engineering and molecular breeding tools (QTL/candidate genes and MAS) should be combined with modern breeding strategies to achieve genotypes with improved N recovery. By adopting some of the most recent agricultural management strategies such as site-specific nitrogen management, fertilizers with improved use efficiency, resource conservation practices, precision agriculture and nanofertilizers, farmers are able to reduce the environmental burden of nitrogen from soil and plant systems. You can reduce your losses and thereby improve your farm. Therefore, by combining multiple breeding and agronomic approaches, it is possible to improve the NUE of crops while maintaining soil fertility and balance improvements to crops with higher yields and nutritional characteristics. A holistic approach is therefore required to identify and develop cultivars with improved nitrogen uptake and translocation efficiencies to sustain cereal production under climate change scenarios.

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