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Review: Nitrogen assimilation in crop plants and its affecting factors

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Mokhele, B., Zhan, X., Yang, G. and Zhang, X. 2012. **Review: Nitrogen assimilation in crop plants and its affecting factors**. Can. J. Plant Sci. **92**: 399–405. In this review we discuss mainly nitrogen assimilation in crop plants and factors affecting the related process. Nitrogen is a major macro-element limiting the growth and development of plants in agriculture. Both organic and inorganic forms of nitrogen are metabolized in plants; nitrate and ammonia in soil are common forms of inorganic nitrogen that can be metabolized in all plants. There are other nitrogen forms, which include amino acids, nitrite and urea, that are metabolized in plants. Metabolism normally starts with reduction of nitrate to nitrite, and the latter further reduces to form ammonium with the presence of relevant enzymes. This reaction occurs more rapidly in leaves in the presence of light. After ammonia is formed, it enters into the biosynthetic pathways of plant cells, such as reductive amination and transpiration, to produce different amino acids. Amino acids in cells take part in the synthesis of protein and other nitrogenous compounds that help in body building. Radiation, gaseous factors, the presence of metals, soil pH and amount of nitrate are some of the environmental factors affecting absorption and reduction of nitrogen in plants. This review presents a comprehensive understanding of the assimilation process by crop plants of nitrogen and recommends that favorable surrounding conditions are the prerequisites for plants to absorb and utilize nitrogen efficiently.

Key words: Nitrogen, absorption, assimilation, nitrate reductase, environmental factors

Mokhele, B., Zhan, X., Yang, G. et Zhang, X. 2012. **Assimilation de l'azote par les plantes cultivées et facteurs modifiants**. Can. J. Plant Sci. **92**: 399–405. Dans cette analyse, les auteurs parlent surtout de l'assimilation de l'azote par les plantes cultivées et des facteurs qui affectent ce processus. L'azote est un élément nutritif majeur qui limite la croissance et le développement des plantes en agriculture. Les plantes métabolisent cet élément sous sa forme organique ou minérale; les nitrates et l'ammoniaque sont des formes courantes d'azote inorganique dans le sol que métabolisent toutes les plantes. L'azote se rencontre toutefois sous d'autres formes, notamment les acides aminés, les nitrites et l'urée, que métabolisent aussi les végétaux. Habituellement, le métabolisme commence par la réduction des nitrates en nitrites, puis en ammonium en présence des enzymes pertinents. La réaction survient plus rapidement dans les feuilles quand il y a de la lumière. Après formation de l'ammoniaque, l'azote pénètre dans les voies de la biosynthèse des cellules végétales notamment l'amination réductive et la transpiration, ce qui crée différents acides aminés. Dans la cellule, les acides aminés participent à la synthèse des protéines et d'autres composés azotés qui concourent à l'expansion de l'organisme. Les rayonnements, les gaz, les métaux, le pH du sol et la concentration de nitrates figurent parmi les facteurs environnementaux qui affectent l'absorption et la réduction de l'azote par les plantes. Cet article brosse un tableau complet du processus d'assimilation de l'azote par les plantes et avance que pour absorber et assimiler efficacement l'azote, les plantes cultivées ont absolument besoin de conditions ambiantes favorables.

Mots clés: Azote, absorption, assimilation, nitrate réductase, facteurs environnementaux

Nitrogen (N) is an essential component of the proteins that build cell materials and plant tissue. Nitrogen often comes from fertilizer application, and, although the atmosphere is mostly made up of N, only legumes such as soybeans and alfalfa can convert atmospheric N_2 to plant-available forms via a symbiotic biological process involving *Rhizobium* bacteria and the plant roots. Plant-available inorganic forms of N include nitrate (NO_3^-), and nitrite (NO_2^-), as well as ammonium (NH_4^+). The concept of plant organic N nutrition relies, to a large degree, on studies of amino acids. Thus, amino acid N is in many cases used as a synonym for organic N. However, urea $(NH_2)_2CO$ is perhaps the most commonly used source of organic N applied as a fertilizer.

Nitrogen assimilation into carbon skeletons represents a physiological process of the utmost importance for plant growth and development. Inorganic N is assimilated into amino acids, namely glutamate, glutamine, and asparagine which play a pivotal role as N-transport compounds in plants (Lea and Miflin 2003).

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Abbreviations: **AM**, arbuscular mycorrhizal; **GDH**, glutamate dehydrogenase; **GOGAT**, glutamine-2-oxoglutarate amino transferase; **GS**, glutamine synthetase; **GSA**, glutamine synthetase activity; **NR**, nitrate reductase; **NRA**, nitrate reductase activity