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**Plan d'appui scientifique à une politique de Développement durable**  
**Appui scientifique à la recherche prénormative dans le secteur alimentaire dans un contexte**  
**de développement durable**

**Gestion intégrée de l'azote en cultures arables et normes nitriques**

**Rapport d'activité final**

Ministère de l'Agriculture et des Classes Moyennes  
Centre de Recherche Agronomique de Gembloux  
Département Production Végétale  
Monsieur Marc Frankinet (Chef de Département)  
Madame Sophie Renard (Assistante)

Faculté Universitaire des Sciences Agronomiques de Gembloux  
Unité d'Hydraulique Agricole  
Madame Sylvia Dautrebande (Professeur titulaire)  
Monsieur Christophe Casse (Assistant)

## Summary

In the frame of sustainable agriculture and environmental normalisation, the Crop Production Department of CRA Gembloux has developed a research focused on the risks of enrichment of groundwater through nitrate coming from agricultural activities. Indeed, it clearly appears that an excessive nitrogen fertilisation always leads, in addition to higher costs, to high nitrogen residues in the soil at harvest, also increased by mineralisation process of crop residues in autumn, among other sources.

Our approach is to propound a tool for the management of nitrogen fertilisation of main crops in Belgium. We have chosen the software AZOBIL (INRA, Laon France) studied since 1994 in our Department essentially in cereals, sugar beet and potato crops. To validate AZOBIL we have considered the crop yield in term of quantity and quality (no yield decrease due to nitrogen management) and mineral nitrogen residues in the soil at harvest.

Field trials were conducted on main crops in Belgium, for which nitrate leaching risks are well known and increase from winter wheat to sugar beet to silage maize to potato and to vegetable crops. Results show that the use of AZOBIL does not lead to yield decrease, whatever the crop. Moreover, in most of the situations, we have measured, for AZOBIL treatment, a diminution of soil mineral nitrogen residues at harvest. In some cases, it corresponds to less nitrogen in the soil profile and in other cases, crop residues are less abundant and then less pollutant in term of enrichment of soil profile by potentially leachable nitrate in depth.

To conclude this study, the following recommendations can be propounded. Although its complexity, the nitrogen fertilisation management can be improved by a software like AZOBIL. Its use is beneficial for the environment since it leads always to a reduction of the nitrogen rate usually applied by farmers and since it does not penalize the user. Moreover, AZOBIL is easy to run and can be adapted in function of local conditions, which still allow to precise the nitrogen advice. Nevertheless the management of some elements remains difficult, like the consideration of the real contributions of manures in term of mineral nitrogen during the crop period. The close relation between mineralisation and temperature give rise to uncertainties but the regular analyses of manure to determine their nitrogen concentrations can help to give a more accurate advice. A lack of precision is also monitored when AZOBIL is used for field vegetable crops. AZOBIL were initially designed for arable main crops. More information will be soon given from INRA of Laon for vegetables. Moreover, our Department begins a new research project on this problematic. Particular attention must also be paid to the high sensitivity of vegetable crops to climatic conditions.

During this work, we have demonstrated the usefulness of the management of nitrogen fertilisation at the rotation scale. Situations for which a great excess of nitrogen in the soil is monitored can not be corrected after one year but it is necessary to consider the whole crops rotation.

The actual Walloon legislation concerning mineral nitrogen residues in the soil is not sufficiently detailed. Indeed, the Ministerial law of the Walloon Government of the 14th of March 1995 determines at 50 kg N/ha the quantity of mineral nitrogen acceptable on the first 60 centimetres of the soil profile. Our researches show that adaptations must be realised taken into account not only the crop species (f.i. spinach is different from sugar beet) but also the pattern of the soil profile (excess in the top or in the lower part of the profile) and the rotation (estimate the potential of the following crop to absorb nitrogen). In this way, the recent propositions of the Walloon Region to the European Commission in the frame of the application of the Nitrate Directive are a novelty in terms of potentially leachable nitrogen (PLN) in the soil profile. A maximum PLN (taxation level) would be annually defined in function of information on weather conditions, crops and soil texture collected in basic representative situations.