

Nutrient legislation versus fertilisation practices in potato fields in Flanders

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In order to implement the EU Nitrate Directive and the EU Water Framework directive, the Manure Decree was issued in Flanders, the Northern part of Belgium. The objective of this decree is to reduce water pollution by nitrates and phosphates from agricultural origin and to prevent future pollution. Flanders has a long tradition in livestock breeding and in the application of manure produced by the livestock, which has resulted in intensive nitrate leaching and in poor water quality. In the Manure Decree several measures in relation to fertilisation, like fertilisation norms/standards are set out. The fertilisation standards limit the amount of nitrogen and phosphate which can be applied, based on the soil type and crop. Also, Flanders has translated the norm of 50 mg NO₃-N/l in the surface and groundwater in a limit for residual nitrate in the soil. At the end of the growing season (between October 1st and November 15th) the residual nitrate (in kg NO₃-N/ha) (0-90 cm) is determined. Limits are set based on soil type and crop.

In this paper the area of tension between nutrient legislation on one hand and fertilisation practices in potato on the other hand will be illustrated based on field research and practical examples. The focus will be on the importance of adequate crop and parcel specific fertilisation advices for N and P and the optimal use of manure in fertilisation practices .

For potato, a maximum of 65 kg P₂O₅/ha.year and a total of 190-210 kg effective N/ha.year (sandy soil-other soils) can applied. For N only 170 kg/ha.year can applied as manure. As a consequence of these strict regulations and in order to maximise the potato yield with respect for the environment, it is of great importance to fertilise judiciously based on a soil analysis.

An optimal P-fertilisation is crop specific and parcel specific. The Soil Service of Belgium (SSB, spin-off of the KULeuven) formulates each year thousands of fertilization recommendations based on soil analyses. Soil samples are taken in the ploughing layer (0-23 cm) in order to determine the overall soil fertility (pH, C, P, K, Mg, Ca). Liming and fertilization recommendations are then calculated by the BEMEX expert system [1,2]. The majority of potato parcels in Flanders has a rather high to very high phosphorus content. On average a phosphorus fertilisation advice of 40-70 kg P₂O₅/ha is given for these potato parcels [3].

In relation to nitrogen, potatoes have a high nitrogen need but a low uptake efficiency. This low uptake efficiency in combination with high nitrogen fertilisation often results in high residual nitrate in potato fields at the end of the growing season. In 2012 the residual nitrate exceeded the limit in more than 60% of the sampled potato parcels. In order to control this residual nitrate in potato parcels an adequate nitrogen fertilisation is primordial. In Flanders many nitrogen fertilisation advices are calculated based on the N-INDEX [2,4]. The N-INDEX is defined as the amount of nitrogen that will be available to the crop during the growing season. It comprises not only the amount of mineral nitrogen available at time of sampling but also the amount of mineral nitrogen to be delivered by mineralisation of organic matter, crop residu, green manure, organic fertiliser, etc. Figure 1 shows the average mineral N content (0-90 cm) in potato parcels at the beginning of the growing season.

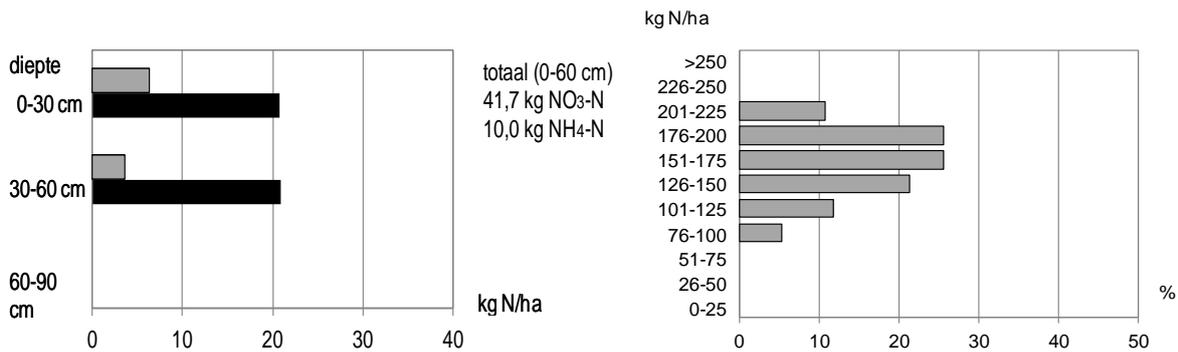


Figure 1: A. Average mineral N content in the soil (0-60 cm) on parcels with organic fertilisation and green manure (sampled between 1/1/2008 and 15/3/2008), B. Distribution of the corresponding N-fertilisation advices for potato.

Finally, as the application of animal manure is a definite part of fertilisation management in Flanders, it is very important to apply the animal manure as optimal as possible. Most farmers calculate the amount to be used based on average compositions. However manure analyses show a wide variety in nitrogen content. For example, 20 tonnes of pig slurry contains 180-220 kg N on average, but analyses carried out at the Soil Service of Belgium show that the N-content can vary between 40 and more than 300 kg N per 20 tonnes. The importance of a manure analysis and its impact on the applied amount of N and P and on the residual nitrate will be illustrated.

[1] Geypens, M., Boon, W., De Wijngaert, K., 1989. BEMEX: program and manual (programma en handleiding). Internal publication of the Soil Service of Belgium.

[2] Vandendriessche, H., Bries, J., Geypens, M., 1996. Experience with fertilizer expert systems for balanced fertilizer recommendations. *Commun. Soil Sci. Plant Anal.* 25 (5-8), 1199-1209.

[3] Maes S., Elsen A., Tits M., Boon W., Deckers S., Bries J., Vogels N., Vandendriessche H., 2012. *Wegwijs in de bodemvruchtbaarheid van de Belgische akkerbouw- en weilandpercelen (2008-2011)*. Bodemkundige Dienst van België, 198 pp.

[4] Geypens, M., Vandendriessche, H., Bries, J., Hendrickx, G. 1994. Experience with a nitrogen-index expert-system – a powerful tool in nitrogen recommendation. *Commun. Soil Sci. Plant Anal.* 25 (9-10), 1223-1238.