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## **Nitrogen leaching following cultivation of grazed grass-clover on coarse sandy soil**

### **Background and objectives**

When grass-clover is ploughed there is a high risk of nitrogen leaching. The objective of this study was to measure the effectiveness of an early catch crop in reducing nitrogen leaching from coarse sandy soil. Barley as a green crop for silage was undersown with Italian ryegrass in spring and harvested at the beginning of early heading, and the Italian ryegrass was subsequently used for roughage production in autumn.

### **Material and methods**

Experiments were established in spring 2003 on a commercial organic farm with a coarse sandy soil. Two fields with grass-clover were ploughed. One field, a 3-year-old grass-clover, had formed part of a crop rotation dominated by cereals, and the other, a 5-year-old grass-clover, was part of a grass-intensive rotation grazed by dairy cows. After ploughing the grass-clover, the following treatments were established in each of the two fields: 1) spring barley, harvested at maturity and subjected to mechanical weed control in autumn ("Mature") and 2) spring barley harvested early as a green crop for silage with an undersown catch crop of Italian ryegrass ("Green"), which was mowed twice in autumn. The treatments were fertilized with 0, 60 or 120 kg ammonium-N ha<sup>-1</sup> in cattle slurry, injected in the spring following ploughing. The resultant treatments are called: Mature-0N, Mature-60N, Mature-120N, Green-0N, Green-60N and Green-120N. Leaching of nitrogen (nitrate and total-N) was measured from May 2003 to May 2004 by means of ceramic suction cups installed in treatments fertilized with 0 or 120 kg ammonium-N ha<sup>-1</sup>.

### **Results and conclusions**

Nitrate leaching after Mature-0N was 174 and 240 kg N ha<sup>-1</sup> in 3-year-old and the 5-year-old grass-clover, respectively, when the soil was kept bare by rotovating twice during autumn. In Mature-120N leaching was 302 and 316 kg N ha<sup>-1</sup>. In Green-0N and Green-120N leaching was only 7-9 kg N ha<sup>-1</sup>. This means that the "Green" treatments reduced leaching by 166-309 kg N ha<sup>-1</sup>, corresponding to 95-98%. In addition to nitrate leaching, 10 and 30 kg N ha<sup>-1</sup> was leached as other N-containing compounds with the highest amount from Mature-0N and Mature-120N after the 5-year-old grass-clover.

Yields harvested in Mature-0N were 3.4 and 3.9 Mg dry matter ha<sup>-1</sup>, and yields harvested in Green-0N were 6.4 and 9.7 Mg dry matter ha<sup>-1</sup>. A comparison of the treatments Mature-0N and Manure-120N showed additional nitrate leaching of on average 102 kg N ha<sup>-1</sup> when 120 kg ammonium-N ha<sup>-1</sup> was applied. This is matched by a corresponding lack in yield increase when applying 120 kg N ha<sup>-1</sup>. In contrast to "Mature" treatments, leaching from "Green" treatments did not differ, irrespective of whether manure was applied or not. This can be explained by an additional N uptake of on average 127 kg N ha<sup>-1</sup> in Green-120N compared with Green-0N. So in the "Green" treatments most of the manure N was taken up by the ryegrass instead of being leached.

The experiments showed that barley used as a green crop for silage undersown with Italian ryegrass could reduce leaching to a minimum. This offers advantages not only for the environment but also for farmers, as a high production of roughage was possible. Besides, the increasing difficulties with clover soil fatigue experienced by Danish organic farmers could be avoided.