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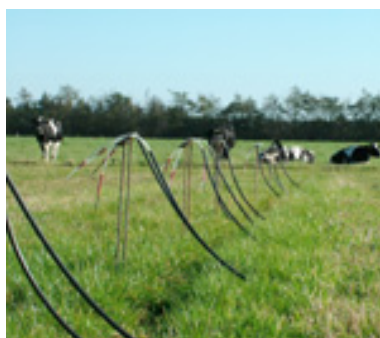
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**High yield and low N leaching with barley as a green crop for silage after grass-clover**

## High yield and low N leaching with barley as a green crop for silage after grass-clover

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Danish organic farmers experience increasing difficulties with clover soil fatigue due to continuous cultivation of clover. A solution could be to undersow barley with Italian ryegrass after ploughing of grass-clover where the barley could be used as a green crop for silage (i.e., barley harvested at the beginning of heading), and Italian ryegrass could be used for cutting in autumn.

This method offers advantages not only for the farmer but also for the environment. When grass-clover is ploughed there is a high risk of N leaching. However, new field experiments show, that with the suggested method it is possible to reduce leaching to a minimum and simultaneously achieve a high production of roughage.

### Experiments with barley as a green crop on sandy soil

The experiment was established in spring 2003 on a commercial organic farm in the southern part of Denmark. The soil was a coarse sandy soil. Two fields with grass-clover were ploughed in: one field had a 3-year history in a cereal-based crop rotation, and the other had a 5-year history in a grass-intensive rotation grazed by dairy cows.

After ploughing in the grass-clover in each field, a number of treatments were established, of which two will be mentioned here:

- 'Mature' - spring barley without undersown grass, harvested at maturity and afterwards subject to mechanical weed control in autumn
- 'Green' - spring barley harvested early as a green crop for silage and with an undersown catch crop of Italian ryegrass.

Both crops were fertilized with 0, 60 or 120 kg ammonium-N per ha in cattle slurry, injected in spring on ploughed soil. The resultant treatments are named as:

- Mature-0N
- Mature-60N
- Mature-120N
- Green-0N

## Leaching of organic N and C after cultivating grass-clover pastures

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- Green-60N
- Green-120N

Leaching 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 per ha (**Table 1**). In addition, leaching of organic nitrogen and carbon was measured (see the article of **Vinther et al.** in this DARCOFenews).



Figure 1.

To the left is a rotovated plot ('Mature-120N') and to the right a plot with Italian ryegrass ('Green-0N') just before ploughing in spring 2004. Photo: Peter Karlsen.

## High roughage yields

Yields harvested in barley (grain and straw) in 'Mature-0N' were 4300-5300 SFU (Scandinavian Feed Units) per ha, while yields in 'Green-0N' were 5000-7600 SFU per ha (**Table 2**). Yields with 'Green-0N' after 3-year grass-clover were 700 SFU higher than in 'Mature-0N', while the yield difference after 5-year grass-clover was 2300 SFU. 'Green-120N' produced in total 8200 and 10100 SFU per ha after 3 and 5-year grass-clover, respectively. Thus, it was possible to harvest relatively high yields by growing barley as a green crop for silage undersown with Italian ryegrass after grass-clover.

## Large effect on N leaching

N leaching after unfertilized barley harvested at maturity ('Mature-0N') was 174-240 kg N per ha, when the soil was kept bare by rotovating twice during autumn (**Table 3**). In the same treatments but with 120 kg N per ha ('Mature-120N') leaching was 302-316 kg N per ha. In treatments with barley as a green crop with undersown Italian ryegrass ('Green-0N' and 'Green-120N') leaching was only 7-9 kg N per ha. Thus, the 'Green' treatments reduced leaching with 166-309 kg N per ha corresponding to 95-98% (**Table 3**).

## Omit manure in barley harvested at maturity following grass-clover

A comparison of the treatments 'Mature-0N' and 'Mature-120N' shows additional leaching of on average 102 kg N per ha when 120 kg ammonium-N per ha was applied (**Table 3**). This is matched by a corresponding lack in yield increase when applying 120 kg N per ha (**Table 2**). In contrast to 'Mature' treatments, leaching from 'Green' treatments did not differ, irrespective of whether manure was applied or not (**Table 3**). This can be explained by an additional N uptake of on average 127 kg N per ha in 'Green-120N' compared with 'Green-0N' (data not shown). In 'Green' treatments the applied manure was taken up by the crop instead of being leached.

## **General validity of the results**

Results described above derive from one-year experiments and are thus influenced by the weather conditions in the period under consideration. However, the relative differences between the treatments are regarded as generally valid.

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