WAGENINGEN
UNIVERSITY & RESEARCH

# Leek production in conventional and organic arable-vegetable rotations in the Netherlands

Janjo de Haan, Marie Wesselink & Harry Verstegen

## Background

- Leek is an important vegetable grown on the leaching sensitive sandy soils in the South East of the Netherlands.
- Leek is supposed to have high nitrogen leaching because of the shallow rooting, late harvest and high nitrogen requirement.

## Objective

Improving sustainability of conventional and organic leek production within a rotation of arable and vegetable crops:

- Maintaining crop yield.
- Improving nitrogen efficiency and reducing risk on nitrogen losses.

## Strategy

Leek was grown in 3 farming systems with same crop rotation (potato – fresh peas – leek – spring barley – carrot – silage maize) on a sandy soil at experimental farm Vredepeel.

- Conventional, fertilization with pig and cow slurry and chemical fertilizer (STANDARD).
- Conventional, fertilization with processed animal manure and chemical fertilizer (low organic matter input, LOW).
- Organic, fertilization with farmyard manure, cow slurry and Vinasse (ORGANIC).

Leek was planted after grass-clover green manure crop sown in year before (July). Planting density leek: 148.000 plants/ha: 75 cm x 9 cm. Organic manure was applied before planting. Chemical fertilizer and Vinasse were applied based on soil-N testing in August & September. Groundwater depth was around 80-100 cm, organic matter content was around 4%. Data are presented from 2011-2016.

**Table 1.** **Fertilization strategy of the leek in the three farming systems.**

| | STANDARD | LOW | ORGANIC |
|---|---|---|---|
| Organic manure | Cow slurry | Processed animal manure | Cow slurry |
| Application method | Row | Row | Full-field |
| N in organic manure (kg/ha) | 183 | 155 | 99 |
| N chemical fertilizer (kg/ha) | 140 | 129 | 119 (Vinasse) |
| N input fertilizer total (kg/ha) | 364 | 283 | 218 |
| N available (kg/ha) | 270 | 274 | 144 |


**Figure 1.** **Application of mineral concentrate and slurry (left) and Vinasse (right).**

## Results

*Conventional*

- Crop yield in STANDARD higher than in LOW, especially for leek.
- Leaching risk in STANDARD higher than in LOW.
- Leaching risk of leek is higher than of total rotation but nitrate concentrations in groundwater after leek relative low. Nitrogen surplus in leek has not reached groundwater level yet.
- Incorporation of grass-clover should be done in time. Still the grass-clover is a limited source of N for leek.

**Table 2.** **Crop yield, nitrogen surplus, mineral nitrogen stock in the soil in November and nitrate concentration in groundwater of the Conventional systems (Data 2011-2016).**

| | Target | STANDARD | | LOW | |
|---|---|---|---|---|---|
| | | Leek | Rotation | Leek | Rotation |
| Crop yield (ton/ha) | >35 | 39.6 | | 34.2 | |
| N surplus (kg/ha) | <50 | 165 | 102 | 156 | 89 |
| N min soil November (0-90 cm, kg/ha) | >45 | 78 | 42 | 72 | 35 |
| Nitrate concentration groundwater (mg/l) | <50 | 50 | 68 | 35 | 57 |

*Organic*

- Crop yields are close to target but lower than conventional because of leaf diseases and N-shortage.
- Leaching risk is high, but nitrate concentrations in groundwater are low in crop rotation: a lot of nitrogen is still organically bound.
- Vinasse needs to be applied timely because of slow release. The N-input needed is therefore difficult to predict.
- Organic matter content in the soil is increasing in ORGANIC.

**Table 3.** **Crop yield, nitrogen surplus, mineral nitrogen stock in the soil in November and nitrate concentration in groundwater of the Organic system (Data 2011-2016).**

| | Target | ORGANIC | |
|---|---|---|---|
| | | Leek | Rotation |
| Crop yield (ton/ha) | >35 | 31.9 | |
| N surplus (kg/ha) | <50 | 110 | 100 |
| N min soil November (0-90 cm, kg/ha) | >45 | 84 | 84 |
| Nitrate concentration groundwater (mg/l) | <50 | 56 | 33 |

## Conclusions

- Optimizing crop yield and minimizing nitrate leaching is a dilemma in conventional (leek) production.
- The organic system gives despite the relative low yield good results on nitrate leaching. Nitrogen is still accumulating in the soil.

## Acknowledgements

This research is part of the project Soil Quality on Sandy Soils, financed through the Public Private Partnership Beter Bodembeheer by the Ministry of LNV and the ZLTO and LLTB.

**Wageningen University & Research | Field Crops**
P.O. Box 430 | 8200 AK | Lelystad
Contact | ***janjo.dehaan@wur.nl***
T | + 31 (0)320 291 211 M | +31 (0)6 51 513 285
***www.wur.eu/fieldcrops***

Janjo de Haan

BETER
BODEMBEHEER