Controlled drainage: For all your water goals?

J. van Bakel [1], E. van Boekel [1], O. Clevering [2], G.-J. Noij [1]

[1] Centre for Water and Climate, [2] Applied Plant Research, Wageningen University and Research Centre. email: jan.vanbakel@wur.nl

Conventional drainage had been widely used in the Netherlands to improve the hydrological conditions for agricultural purposes. In this case, drains are placed above water level, and drainage water goes directly into the ditches. Due to the lowering of the groundwater level, nitrogen losses to the surface water will increase, since nitrate losses due to denitrification are reduced. However, phosphorus losses to the surface water will decrease, since P-rich surface layers become drier. Besides a higher risk on nitrogen losses, conventional drainage also can result in higher peak loads.

Deep controlled drainage has opportunities to reduce the negative effects of conventional drainage. Deep controlled drainage is a system of underwater drains where drain water will flow into a collector drain and subsequently into a sink. With the so-called 'Systeem van Iersel', the water level can be controlled using a pipe in the sink.

Prior to upcoming field work, a model analysis had been carried out. In this analysis, two reference situations (with and without pipe drains) were simulated with the models SWAP and ANIMO. Regional groundwater dynamics was simulated with SIMGRO.

The model analysis lead to the following conclusions:

- Compared with an undrained reference situation, conventional drainage results in a considerable lowering of the groundwater level, an increase of N-losses and a decrease of P-losses to the surface water. Deep controlled drainage results in a slight decrease of N-losses and a considerable decrease of P-losses.
- Changing from conventional drainage in the reference situation to controlled drainage results in a decrease of the N-losses to surface water, due to the higher groundwater level (more denitrification), but also to an increase of P-losses.
- Deep controlled drainage results in a decrease of N-losses and a slight increase of P-losses to surface water, when compared to conventional drainage.

Fieldwork is necessary to corroborate the model results.

Deep controlled drainage has good prospects for combined water quantity and quality goals. However, the effects of (deep) controlled drainage on N- and P-losses to surface water are in some scenarios conflicting. A decrease of N-losses goes hand-in-hand with an increase of P-losses, and vice-versa.

The choice of a drainage system (conventional or [deep] controlled) will depend on the regional water quantity and quality aims.