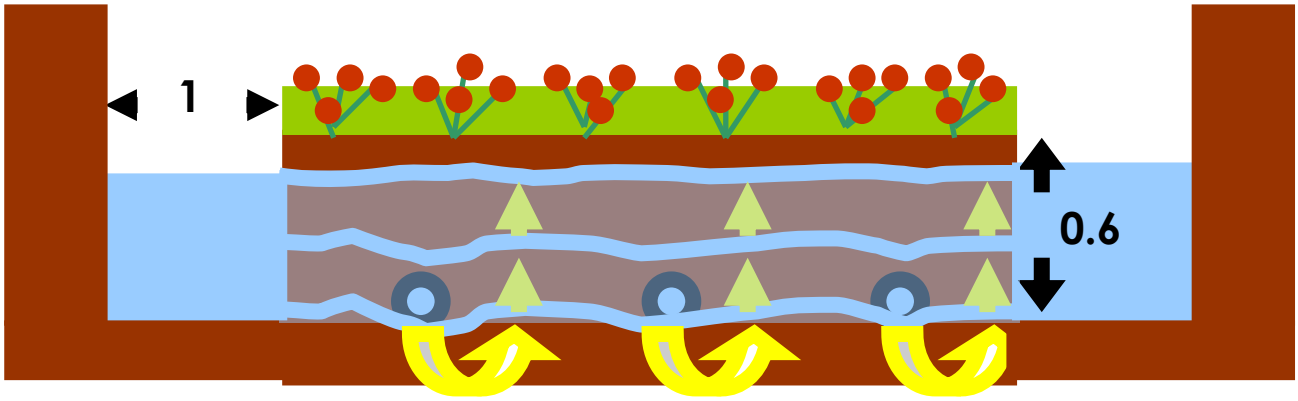
Water Table Management (WTM) Field Tour

Nutrient losses from agricultural can have adverse impacts on environmental and human health. Tile drainage has been recognised as a pathway for nitrogen loss. Furthermore, it is now generally accepted that phosphorus losses from tile drainage represent a significant fraction of the total phosphorus transport from fields to water bodies. Water table management is a water conservation technique that uses a control structure and an external water source to keep a constant water level in the soil profile. It can be used to lower drought stress in dry periods and to reduce tile drainage volumes in wet periods.



An experimental site was set up to study the effect of water table management on nutrient losses. From 1993 to 2000, the main focus was nitrogen, while phosphorus losses were more closely studied between 2001 and 2006.

Field description

- See layout diagram
- Area: 4,2 ha
- A plastic barrier of 1.5 m deep separates all plots. The plots are tile drained individually.
- Drains end-up in two buildings where flow is measured (with tipping buckets) and water is sampled automatically.

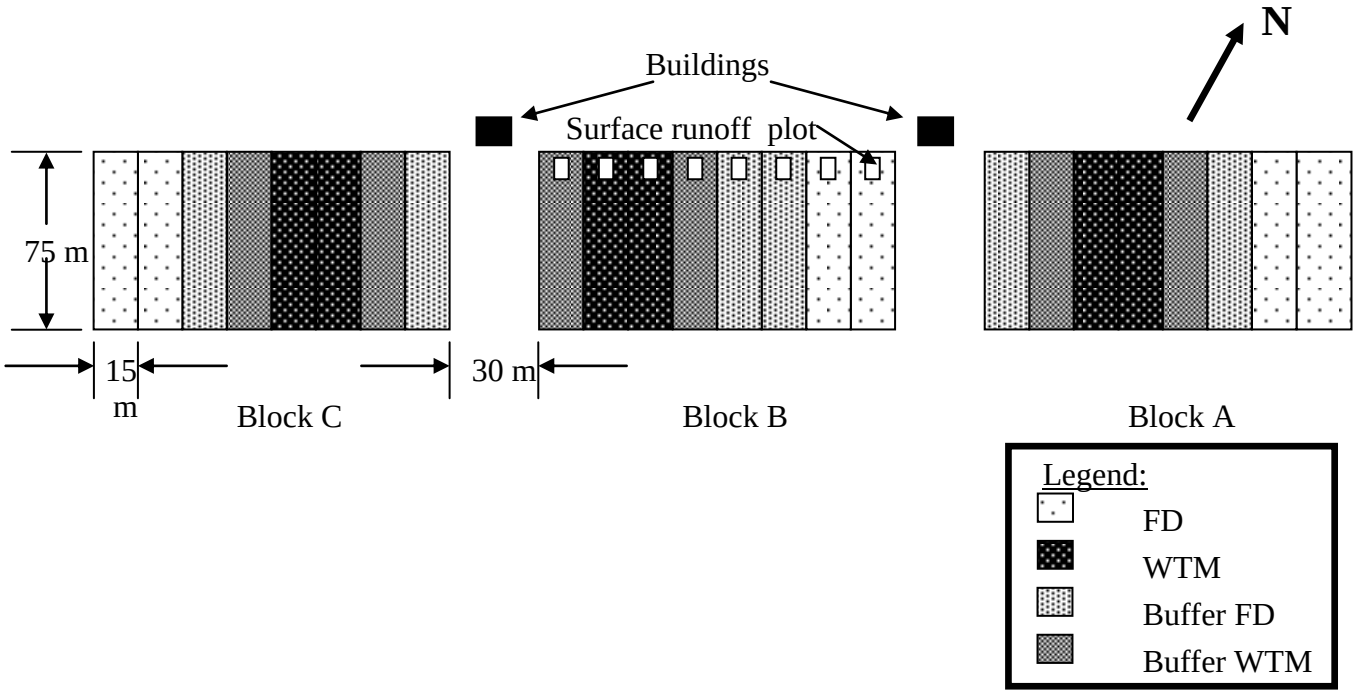
Monitoring and testing (2001-2006)

- Rainfall
- Water table depth
- Subsurface drainage and surface runoff flows (surface runoff only in 2001-2002)
- Water sampling and analysis
    - Dissolved P (organic and inorganic/orthophosphates)
    - Total P (organic and inorganic; for runoff samples)
- Yield sampling (fresh and dry weight of stalks and cobs, weight of dry grain)

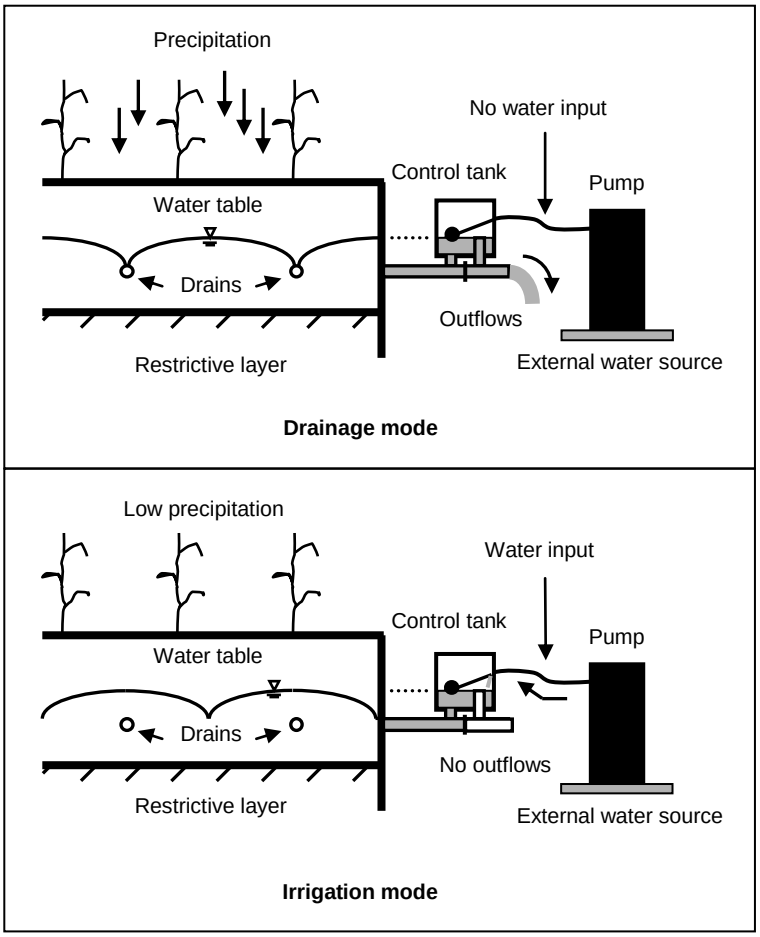
Results and conclusions

In most years, WTM has proved successful at maintaining a constant water table throughout the growing season. This resulted in significant yield increases in dry years (30% for 2001-2002).

Nitrate concentrations and loads in tile drainage were reduced by using WTM. This was shown to be the result of increased denitrification rates.



Layout of the field, and location of plots under water table management (WTM) and conventional free drainage (FD)



On the contrary, phosphorus concentrations and loads were found to be higher in plots with WTM than in plots with conventional free drainage. This was partly due to higher flows at the end of the growing season. This problem was greatly reduced with a closer management of the system. Higher phosphorus concentrations are thought to be caused by low redox conditions in the anaerobic soil profile. Research is currently underway to study this hypothesis.

At this point, while WTM can be considered as a technique to increase crop yields in dry years and to reduce nitrate losses from tile drains, it seems to lead to increased phosphorus losses to the environment. Current research will help to understand the exact cause of this situation and to identify possible modifications to eliminate it. New research at the site includes an analysis of the effect of WTM on pesticide losses and on crop growth.

The dual function of a water table management (WTM) system: controlled drainage and subirrigation

SOME PAPERS & THESIS WORK DONE AT ST. EMMANUEL SITE

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