

Why

Subirrigation involves infiltrating water into the soil of an agricultural plot via the drainage system. The aim is to replenish the groundwater and moisten the soil around the drains. The latter can have a beneficial effect on crops, as part of their water requirements is met through capillary rise. This technique is used, for example, to allow runoff from paved surfaces, peak flows in a river or water collected in a flood basin to infiltrate agricultural land rather than being allowed to run off.

What

Instead of draining, the drainage system is used to introduce water into the plot at certain times of the year. This technique is essentially an extension of level-controlled drainage (see the level-controlled drainage fact sheet), where the drainage system is already connected to a control well and level control is possible. The desired groundwater level can be set so that water is no longer supplied once the desired level has been reached. This level can be adjusted depending on the crops.

With sub-irrigation, it is also recommended to provide ventilation, so that the water entering via the control well can spread optimally throughout the drainage system and air can escape from the pipes. This technique is also worth combining with the use of weirs in field ditches to maintain the groundwater level as effectively as possible during the summer.

As part of the Life ACLIMA project, infiltration tests involving sub-irrigation via level-controlled drainage were carried out at the Hoogstraten Research Centre. These tests were conducted at various times between September and November to study the influence of the groundwater level on the infiltration rate. In this way, the volume of water that can be infiltrated per square metre of infiltration surface area and per day was monitored at a given groundwater level in sandy soil.

An initial infiltration trial was launched in early November 2022. Approximately 80 m³ of rainwater was infiltrated over a two-week period using sub-irrigation with level-controlled drainage. The infiltration rate decreased during the experiment and fell sharply over the two-week period. Gradually, all the soil pores around the infiltration pipes became filled with water and the soil became saturated.

In a repeat trial starting in September 2023, the system was activated to actively infiltrate water into the level-controlled drainage field. In September, barely 1 m³ was infiltrated over a seven-day period. The trial was restarted in early October. Over a ten-day period, 5 m³ of water was infiltrated. These results were likely due to the high groundwater level at that time.

How

Construction

There must be a sufficient supply of clean, fresh water available to feed into the system to enable sub-irrigation.

The water supply continues as long as the water level at the source is higher than the groundwater level. Water for sub-irrigation in the level-controlled drainage system can be supplied in various ways.

- **Gravity-fed supply** can come, for example, from a watercourse situated higher than the plot. This is the ideal situation for sub-irrigation, as supplying this water requires no energy.
- The water can also be supplied via a **pump** and channelled into the drainage system via the monitoring well. Electricity is, of course, required to operate the pump; this can be sourced from solar panels, for example. A float in the monitoring well can stop the water supply once the desired water level in the plot has been reached.

At the Hoogstraten Research Centre, a level sensor (Omron) was installed in the control well of the level-controlled drainage system to ensure a continuous flow of sub-irrigation. This level sensor was then connected to a submersible pump in the basin. During the infiltration tests, this enabled a constant water column to be maintained in the control well. This entire installation was supplied by MAIS Automatisering.

Soil properties

So far, the technique has mainly been applied to sandy soils, but successful trials have also been carried out on heavier soils in the Netherlands. Heavier soils have higher capillary action, which means the desired water level can be lower, provided the plant can still access it. As heavier soils drain more slowly, the response to drainage is slower, which can cause problems during heavy rainfall.

However, soil that drains too quickly is also undesirable. If the drains are situated higher than the water table, the supplied water will flow straight through to the water table. In situations where there is a non-permeable or poorly permeable layer in the shallow subsoil (e.g. a clay layer at a depth of 1.5 m), this problem will be less of an issue.

Drain location

An existing level-controlled drainage system is often used. In this case, the depth of the drains is important: the higher the drains, the better the plants can utilise the capillary rise of the water. The distance between the drains also plays an important role in the horizontal distribution of the supplied water: the ideal distance for sub-irrigation is 4 to 6 metres. In traditional drainage systems, this distance is often several metres greater.

A key factor influencing infiltration and drainage on a plot is the plot's gradient. Due to the steep gradient of the open-field plot at the Hoogstraten Research Centre, not the entire infiltration area of the pipe network is

utilised. In this trial, a water column of 15 cm above the drain pipe was established.

Based on the results of the trials at the Hoogstraten Research Centre in 2022 and 2023, it appears that a groundwater level at the height of the drainage pipes hinders the infiltration trials. This has a significant impact because a level-controlled drainage system has relatively deep drainage pipes. We observe that as soon as the groundwater table is at the depth of the drainage pipes, the infiltration rate and infiltration volume decrease.

Secondly, in the autumn of 2023, the groundwater level was too high to achieve a good result for the infiltration test, due to the wet month of August. Most likely, the suitable time for infiltration using a level-controlled drainage system in 2023 was already in July or even June. This naturally depends on the soil type, the depth of the drainage pipes and the rainfall pattern.

Cost

Subsidy

The conversion from conventional drainage to water-level-controlled drainage is eligible for funding under the VLIF non-productive investment aid scheme (see the information sheet on water-level-controlled drainage). However, no government support is currently available for subirrigation.

Benefits

Economic

If water can be supplied by gravity, no energy is required. This can result in a net increase in yield. However, when a pump is used to supply the water, it is not certain that there will be a net increase in yield: the energy costs of the pump may offset the increased crop yield.

Furthermore, subirrigation will result in lower energy and labour requirements compared to sprinkling.

Ecological

Some ecological benefits:

- Crops experience less heat stress and associated diseases and pests
- Ideal soil moisture conditions are created for crop development

- There is better utilisation of available fresh water

Proactive infiltration is an interesting approach for replenishing groundwater levels. In years when reservoirs are already quite full by summer, such as in 2021 and 2023, growers can make an informed decision, based on the known consumption figures for their crops, to lower the water level in the reservoir through infiltration in, for example, August and September. In this way, delayed drainage and basin overflows in winter are avoided to a greater or lesser extent, and we contribute to raising the groundwater table when it is needed.

What to look out for

Legislation

The use of sub-irrigation will, of course, also affect neighbouring plots, so be sure to consult closely with the owners of these plots. It may be possible to collaborate at a regional level: this leads to better results than working on individual plots.

Useful links

- [B-Watersmart and subirrigation](#)
- [Subirrigation with treated wastewater](#)
- [Opportunities for subirrigation](#)
- [Level-controlled drainage and subirrigation](#)

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Examples

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