Factsheet
Agriculture

Requirements for water reuse in agriculture

Challenges

Water reuse for agricultural irrigation has to consider preservation of human health, soil, groundwater and plants. To this purposes the relevant hygienic (mainly indicator organisms) and chemical requirements (mainly salinity, nutrients, heavy metals and organic compounds) need to be classified and assessed.

An irrigation with treated wastewater therefore should always be demand-oriented in order to prevent contamination of ground water. In contrast to the availability of wastewater all year round, there is only seasonal need for irrigation water. Therefore, a short or long term water storage in a reservoir or alike becomes necessary. Another possibility for storage is the groundwater enrichment with treated wastewater and subsequent extraction for agricultural irrigation (see separate factsheet about groundwater enrichment).

Selected precautionary approach for the agricultural sector

The quality parameters were selected in order to meet the requirements for the irrigation of plants of middle to high salt and boron tolerance (e.g. sugar beets or some varieties of cereals). At low concentration boron is essential for plant growth but it can be toxic at higher concentration. In addition, the respective hygienic quality requirements were defined to ensure that the treated wastewater can be used for irrigation of non-food crops (e. g. fibre and energy plants).

Furthermore, the international and EU hygienic requirements were defined that the water is suitable for the irrigation of food crop that is being processed, as well as for food crop that is suitable for being eaten raw. There are some irrigation limitations though (see below).

Important regulations/laws/guidelines

Germany

So far there are no explicit laws or directives in Germany or the EU that regulate the water reuse of treated wastewater for agricultural purposes. In Germany a lot

Figure 1: Irrigation of a potato field (Source: AnRo0002, Wikimedia Commons)

of aspects are regulated in the following laws, regulations or standards (table 1):

Table 1: Relevant guidelines and standards for Germany

Surface water directive (Environmental quality standard)
Water resources act
Drinking water directive
Waste water directive
Groundwater directive
De minimis thresholds – groundwater
DIN 19684-10 „Analysis and assessment of water for irrigation measures“ (Analysis of irrigation water, effects on plants and soil)
DIN 19650 „Irrigation – hygienic aspects of irrigation water“ (Definition of suitability classes)
Recommendations of the Thuringian Regional Institute for Agriculture (Thüringer Landesanstalt für Landwirtschaft) „Irrigation quality – hygienic and chemical aspects“

EU and international

On an international level different approaches for the minimization of the health risk and a multitude of different national rules have been established. These follow mainly the policy documents of the World Health Order (WHO), the Food and Agriculture Organization of the United Nations (FAO) as well as the Australian guidelines and those of the U.S. Environmental Protection Agency (US-EPA). EU guidelines that are relevant for single aspects of water reuse for agricultural purposes as well as internationally relevant standards are given in table 2:

Table 2: Relevant guidelines and standards for the EU and internationally

Relevant guidelines for the EU
Water Framework Directive 2000/60/EC
Surface water directive (2008/105/EG) with environmental quality standards
JRC-Draft: European Commission – Joint Research: Development of minimum quality requirements for water reuse in agricultural irrigation and aquifer recharge Draft V.3.3. (June 2017)
Urban Waste Water Treatment Directive 91/271/EEC
Groundwater Directive 2006/118/EC
International guidelines and standards
FAO: FAO (1985). Water Quality for Agriculture. FAO Irrigation and Drainage Paper 29, rev. 1. Food and Agriculture Organization of the United Nations, Rome, Italy.
WHO: World Health Organization (2006) Guidelines for the Safe Use of Wastewater, Excreta and Greywater. Geneva, Switzerland.
US EPA: US EPA (2012) Guidelines for Water Reuse 2012. Report EPA/600/R-12/618.
Australia: NWQMS (2006) Australian Guidelines for Water Recycling, National Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1).

- The EU water framework directive aims at the protection of surface- and groundwater. The chemical and ecological state of surface water, or the chemical state of groundwater should not be negatively affected. This has to be ensured when using treated wastewater for irrigation.
- The EU groundwater directive requests that leaching of dangerous substances into the groundwater is avoided, resp. minimized.
- The EU Urban Waste Water Treatment Directive implies that wastewater has to be reused whenever possible while restricting environmental pollution to a minimum.

Definition of quality requirements

The quality requirements for water reuse in agriculture were compiled from the guidelines and standards mentioned above. In the JRC-draft of the European Commission, quality classes for treated wastewater are defined as a combination between hygienic parameters and approved irrigation techniques (JRC 2017). That means for MULTI-ReUse that as long as those requirements are met, treated wastewater can be used for the irrigation of non-food crops without any restriction. The irrigation of food crops is possible too, but only via drip irrigation. In case of food crops suitable for being eaten raw without peeling only underground drip irrigation is allowed. This is a good compromise between risk- and cost minimization for water treatment. Table 3 shows hygienic quality requirements for agricultural irrigation compiled for MULTI ReUse.

Table 3: Derived hygienic quality requirements for water reuse for agricultural purposes

Parameter	Value	Source
Germany		
Escherichia coli	2,000–20,000 kbE/100 ml	TLL
Enterococci	400–4,000 kbE/ 100 ml	TLL
Salmonellae	0 kbE/1,000 ml	TLL
Parasites (infectious phase)	0 infectious phase/1,000 ml	DIN 19650
European Union and internationally		
Escherichia coli	1,000 kbE/100 ml	JRC, various national regulations
Intestinal nematodes	1 egg/10 L	WHO, various national regulations

For water reuse in Germany, only organic micro pollutants that could be found in the effluents of different local wastewater treatment plants have been included into the list of quality criteria. Demand-driven agricultural irrigation minimizes the risk of substances being leached to the groundwater, but the risk can't be eliminated entirely. According to the German precautionary principle, a pollution or deterioration of groundwater quality has to be avoided. Here, environmental standards, threshold values of the groundwater directive as well as the de minimis thresholds defined by LAWA ("Länderarbeitsgemeinschaft Wasser" = working group on water resources of the authorities of the German federal states) have to be complied with.

The list of requirements for water reuse in agriculture in Germany as well as for the EU and internationally can be downloaded from the MULTI-ReUse website as a table (https://water-multi-reuse.org/wp-content/uploads/2018/03/Tabellen_Factsheet_Landwirtschaft.pdf)

Conclusion

Water reuse for agricultural purposes is not regulated by German or EU law yet. However, there are some recommendations (e. g. US-EPA, FAO, WHO) and legal guidelines (e. g. water framework directive, groundwater and urban waste water treatment directive), where relevant aspects for water reuse for agricultural purposes are defined. A European regulation is going to be released soon to standardize the quality requirements.

Water reuse for agricultural purposes is getting more and more important because of rising water demand due to agricultural intensification and climate change effects. It is assumed that treated wastewater will increasingly be considered an important resource in arid and semi-arid developing and industrialized countries in order to safeguard agricultural yields. In addition, competitive pressure regarding water abstractions will rise between agriculture, industry and drinking water production. Water reuse can release that pressure on water resources. The MULTI-ReUse quality criteria contribute to that.

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Short description of the MULTI-ReUse project

Treated wastewater is an important part of the water cycle. It usually is fed into rivers, something that is acceptable from an environmental point of view but for the use in agriculture or industry the water often is unsuitable. MULTI-ReUse closes this gap by developing and implementing of new procedures for the reuse of service water. The aim of MULTI-ReUse therefore is the development, demonstration and evaluation of a modular water treatment system, in order to offer service water in different qualities and quantities for the different purposes and to competitive prices.

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