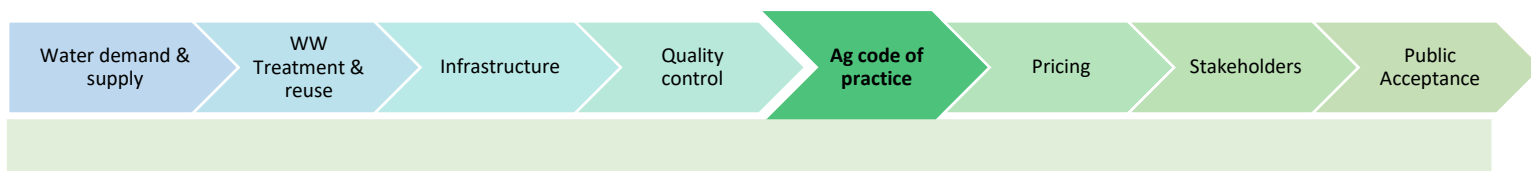




The Success Story of Israel

Fact Sheet 5 - Code of practice for agricultural irrigation



KEYS FOR SUCCESS – Lessons learned from the success stories of Cyprus and Israel

SUWANU EUROPE is a H2020 project aiming to promote the effective exchange of knowledge, experience and skills among practitioners and relevant actors on the use of reclaimed water in agriculture. This factsheet is part of a total of 17 factsheets that describe the successful reclamation practices of Israel and Cyprus in order to learn and boost implementation of solutions adapted to the European context. Our ultimate goal is to enhance acceptance and awareness to an alternative source of an increasingly scarce resource, water.

Two main challenges exist when irrigating with reclaimed water: assuring the water chemistry (e.g., salinity, nutrients) is suitable for the irrigated crops, and making sure the irrigation practice does not pose a public health risk. The concern for creating a public health risk can be split in two:

- ◆ General public – a concern regarding contracting an effluent-associated infection from consuming produce irrigated with reclaimed effluents
- ◆ Growers and agriculture workers – a concern regarding growers contracting effluent-associated infections from handling reclaimed effluents

The concern over a public health risk is often given as an added chance of illness. For example, the WHO guidance for irrigation with effluents states that irrigating fruits that are eaten raw with effluents containing up to 1,000 fecal coliforms per 100 ml would create a 2:1,000,000 chance of illness – meaning for every million people eating these fruits, two will contract a coliform infection. This is compared to a chance of 1:10,000 of contracting an illness from potable drinking water (Table 1). The Israeli regulations for reclaimed water for unrestricted irrigation allows for no more than 10 f.coli per 100 ml (as a monthly average), which translates to a 2:100,000,000 chance of illness (5,000 times lower than the chance of illness from typical drinking water).

Table 1 - Risk of illness from drinking water and from consuming fruit irrigated with reclaimed water

Water type	Chance of illness	Comments
Drinking water	0,0001:1	US EPA
Eating fruit irrigated with reclaimed water	2:1,000,000	Reclaimed water containing <1,000 f.coli/100ml

To prevent public health risks from irrigating with reclaimed effluents, a series of physical barriers are placed to distance the reclaimed effluents from food crops. The number of barriers required is set according to a combination of crop type and the quality of the water used for irrigation (Table 2). These barriers can be generally distinguished into three types:

1. Pathogen removal – e.g., media filtration with effluent turbidity <5 NTU or effluent TSS <10 mg/L; long term reservoir storage (>30/60 days for terminal/flow through reservoirs); mixing with natural water in a reservoir (up to 10% effluents/20% chlorinated effluents); disinfection (contact time ≥30 min; residual concentration > 1 mg/L); etc.
2. Physical barrier between reclaimed water and food crops – e.g., drip irrigation (the number of barriers granted depends on the distance between the fruit and the irrigated soil); soil cover; subsurface drip irrigation; etc.
3. Other barriers – e.g., heat treatment (wheat); cooking of crops not eaten raw (potatoes); fruit with inedible peel (citrus, bananas, nuts).

Table 2 - Barriers allowing irrigation by effluent quality

Unrest. Irri.	High qual Eff.	Medium qual eff.	Crop	Sand filt. /or long storage /or 10% effluent	Effluent disinfection ¹		Meets min distance req. from drip irrigation ²	UV resistant cover sheet	Shallow inserted drip line	Inedible peel	Not eaten raw
					Must	Can					
Number of barriers needed											
0	2	3	Veg. consumed raw; above ground (e.g., peper, tomato, zucchini)	+	+			+	++		
0	2	3	Veg. consumed cooked W/peel (e.g., squash, eggplants)	+		+		+	++	+	+
0	2	3	Root veg. consumed cooked (e.g., potatoes)	+		+					+
0	2	3	Citrus	+		+	++		++	+	
0	2	3	נשירים	+		+	++		++		
0	Not allowed	Not allowed	Public gardening								

¹effluent disinfection is obligatory for all vegetables eaten raw

²50m distance is considered two barriers; 25m distance is considered one barrier

³vegetables cannot be irrigated with medium quality effluents

+number of barriers provided

Crops that do not come in contact with the general public or that are grown in a manner that inherently prevents the survival of pathogenic microorganisms do not require barriers. These include for example:

- ◆ Crops meant for industrial use (e.g., cotton) and fodder.
- ◆ Crops dried in the sun for more than 60 days after ultimate irrigation (e.g., sunflower seeds, wheat, popcorn-corn)
- ◆ Groves forbidden for public access.

To prevent the contamination of water sources or resources, rules have also been placed to regulate where and how irrigation with reclaimed water can be practiced. For example:

- ◆ To avoid groundwater wells contamination, irrigation with reclaimed water is forbidden (unless a specific permit is granted) in a protective radius defined by the regulator (Figure 1).
- ◆ To avoid contamination of the National Water Carrier (NWC), irrigation with reclaimed water is forbidden in the natural preservation area surrounding the NWC.
- ◆ To avoid contamination of potable water, irrigation with reclaimed effluents underlaid by potable water infrastructure is only allowed when the reclaimed effluents meet the required disinfection demand, the infrastructure is in good condition and is not in the risk of experiencing negative pressure.
- ◆ Reclaimed effluents that do not meet the disinfection requirements can be used at a distance greater than 3m from the edge of the irrigated area, so long as it has been shown that surface runoff from the irrigated area cannot reach the area overlying the potable water infrastructure.

To protect public health, additional precautions are taken for parks and landscape irrigation using reclaimed water. For example:

- ◆ The reclaimed effluents must be suitable for unrestricted irrigation
- ◆ A visible sign must be posted to notify that the water source is non-potable reclaimed effluents
- ◆ In areas accessible to the public, reclaimed effluents can be used for irrigation only when the area is not accessible to the public (e.g., nighttime, closed) or using subsurface drip irrigation
- ◆ Properly signed water fountains must be available for public use in areas accessible to the public and irrigated with reclaimed effluent

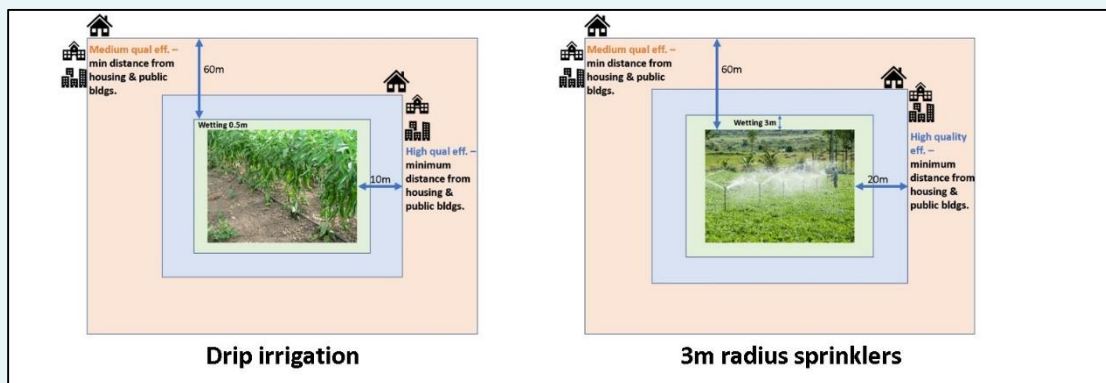


Figure 1 - Two examples of protective area based on irrigation type, effluent quality, and land use

CONTACTS:

Coordinator

Rafael Casielles (BIOAZUL SL)

Avenida Manuel Agustin Heredia nº18 1ª4 Málaga (SPAIN)

Mail | info@suwanu-europe.eu Website | www.suwanu-europe.eu

CONTACTS:

Responsible for Factsheet

Diego Berger, Ph.D. (dberger@mekorot.co.il)

Hadas Raanan Kiperwas, Ph.D. (o-hraanan@mekorot.co.il)

MEKOROT | Website | www.mekorot.co.il



THIS PROJECT HAS RECEIVED FUNDING FROM
THE EUROPEAN UNION* HORIZON 2020 RESEARCH
AND INNOVATION PROGRAMME
UNDER GRANT AGREEMENT N. 618056



Israel National Water Co.
EMS Mekorot Projects
Development & Enterprise Ltd