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# **WORKING SESSION 2: Irrigation with poorer quality water: management options and technical solutions**

**ANIMATOR:** Willy van Tongeren (TNO)

**SECRETARY:** Ockie van Niekerk (OA, South Africa)

**PARTICIPANTS:** Everybody present

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 689687



# Goal of the working session



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- Identification of current situation and bottlenecks related to the **Quality Irrigation water**
- **Discuss solutions**
  - From growers out of other regions
  - How increase adoption of available tools
- **What are the remaining bottlenecks/ gaps**  
-> **Needs for Innovation ?? (also towards WP4)**

**Starting discussion on the hand of outcome surveys**

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# To evaluate practical value of solutions, consider

- Effectiveness
- Ease - of use (“farmer-friendliness”)
- Robustness
- Sustainability
- Availability of relevant background information
- Costs, Return on investment
- Context: crop type, farming system, climate limits
- Suitability to different types of growers
- Existing applications in agriculture/horticulture (growers review, TRL level)
- Anything else? Suggestions?



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# Preliminary results from survey



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## GENERAL OBSERVATIONS - ATTITUDES

- Growers are generally aware that tools/technologies are available
- Growers reluctant to use newer technologies, "why change a winning team?"
  - Comment: They will if they perceive a benefit.
- Reviews/feedback from other growers/research stations play an important role
- Concern for cost of implementing new technologies
  - Comment : Some growers expressed an interest, but were concerned of cost
- Once they have a system, innovations are usually not investment priorities
- In general, a new technology should be:
  - Reliable
  - Cheap
  - User friendly

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# Main questions irt Irrigation water



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- **(Awareness of) : What is the quality of your water source ?**
  - Relevant parameters (related to demand !)
  - Variations in quality
  - **Others? (monitoring, ....)**
- **(Awareness of) : What are the requirements for irrigation**
  - Relevant parameters (physical, microbial,.. , crop depending
  - Allowed variations
- **Solutions to fill the gap between source quality and demand**
  - Management options (change sources, mix sources, monitoring,...
  - Water treatment
  - Storage, buffering
- **Availability (Quantity)**

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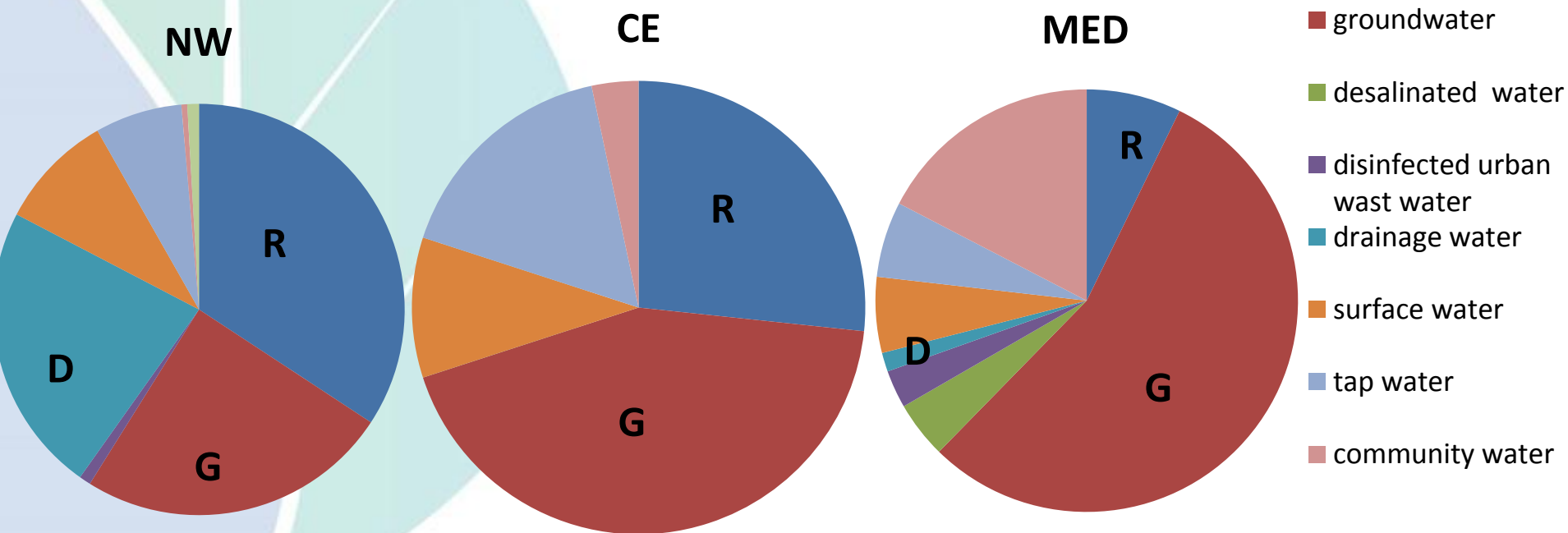


# Preliminary results from survey



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## GENERAL OBSERVATIONS – sources per region



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# Relevant parameters



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General: pH, EC, hardness, ....

Ions: Ca, Mg, Na, Cl, P, Fe, Nitrates, Carbonates...

Organics: toxic chemicals, crop protection agents, ..

Micro biological: Pathogens, Algae (bloom in buffers)

**Add on**

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# GETTING STARTED



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- Order of discussion

- 1) Sources and storage

- a) Problems + importance per region
- b) Solutions + level of adoption per region
- c) Bottlenecks: technology needed, and reason why it's not adopted

- 2) Water quality

- a) Problems + importance per region
- b) Solutions + level of adoption per region
- c) Bottlenecks: technology needed, and reason why it's not adopted

- 3) Treatment

- a) Problems + importance per region
- b) Solutions + level of adoption per region
- c) Bottlenecks: technology needed, and reason why it's not adopted

- 4) Other problems

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# Short: Quantity related issues



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- Availability of sources
- Storage
- Use of ground water (deeper and undeeep layers)
- Permits
- Mixing

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# Preliminary results from survey

## GENERAL OBSERVATIONS - PRACTICES

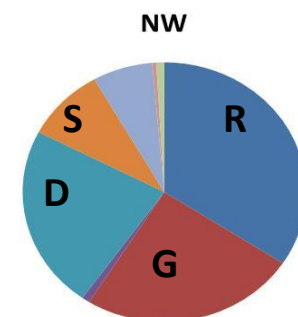


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- **Sources**

- **North-West**

- Rainwater, often lack of space for storage
    - Mix of Rain and Ground water (and Surface water, Canals (Navarra))
    - Drainage water recycle after disinfection -> **WS 1**



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# Preliminary results from survey

## GENERAL OBSERVATIONS - PRACTICES

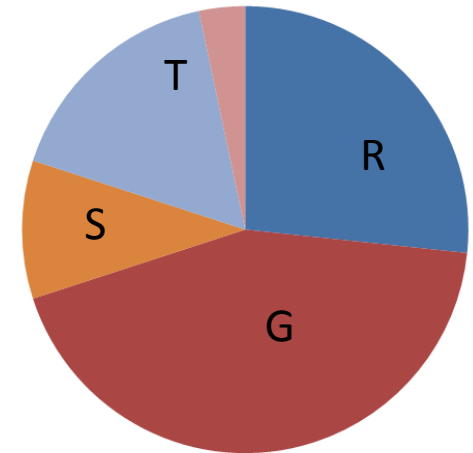


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- **Sources**

- **Central-East**

- Most groundwater,
    - Limited rainwater (high costs for storage),
    - Mix of groundwater, surface water and occasionally tap water
    - Permits for withdrawal and storage



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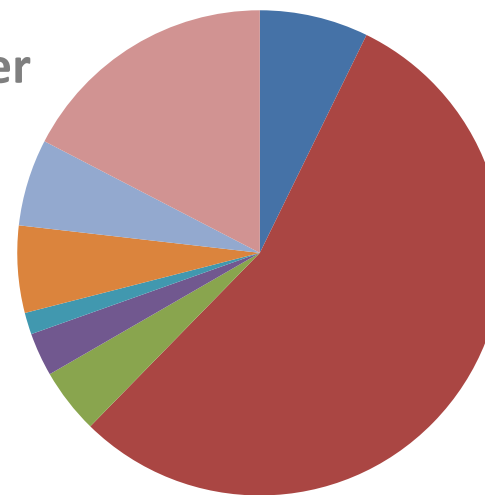
# Preliminary results from survey

## GENERAL OBSERVATIONS - PRACTICES



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- rainwater
- groundwater
- desalinated water
- disinfected urban waste water
- drainage water
- surface water
- tap water
- community water



- Sources Mediterranean
  - Ground water
  - Surface water (river) via Irrigation community, channel, ditch system
  - Treated Urban Water (Almeria)
  - Mix of groundwater and surface water
  - Desalinated sea water (expensive)
  - Storage dams (S.A.)

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# Discussion Sources and Storage



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- **Bottlenecks in summary**

- Costs for storage
- Permits for withdrawal and storage (SI)
- Discussion on water and participatory rights (Dolores Roca)
- Env. limitations; Need for infiltration rainwater (before or after use)
- Limited room
- Algae in storage tanks
- ??????

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# Discussion sources and storage

- **Bottlenecks:** previous sheet
- **Solutions (also from other region ?)**
  - Storage in ground layers
  - ??
  - 
  -
- **Gaps**
  - Costs ?



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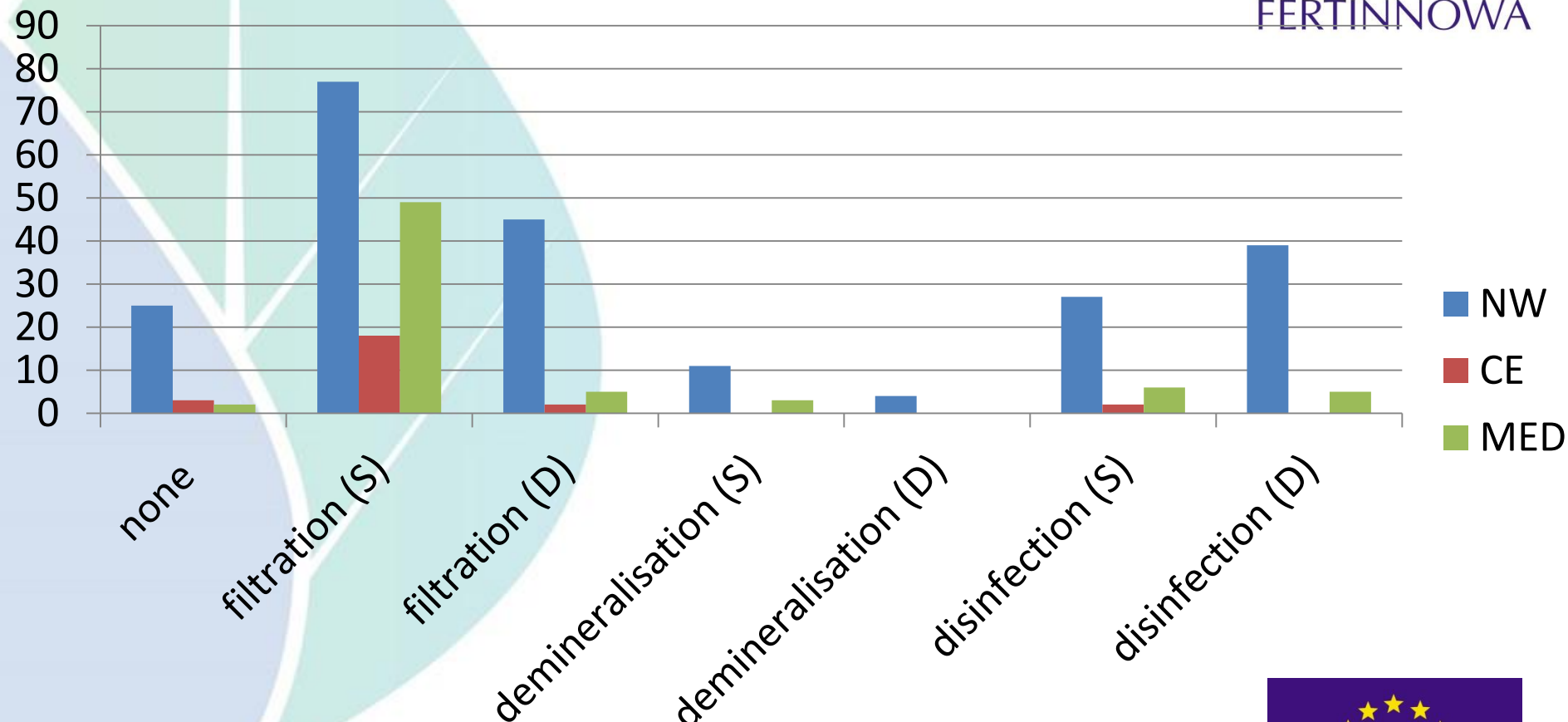


# Preliminary results from survey

## Treatment



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# Survey: Parameters



Parameter	NW	CE	Med	Remarks
pH	X		X	
Fe	X	X		
Salinity	X		X	Na, Cl, nutrients
Hardness	X			Ca, Mg, Carbonates
Organics	X			
Pathogens/ Micro-organism	X		X	Algae
Sediments		X		

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# Preliminary results from survey

## Treatment



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### – North-West

- Bio-filtration/ slow sand filtration, chlorine, UV (for recirculation systems)
- Disinfection to prevent algae bloom (peroxide, bleach)
- Strained filters and sand filtration (Navarra)
- Desalination: (Na, Cl, Ca, Mg, ..) : RO, Distillation, ED ( also irt Drain water)
- Iron removal (Fe): Aeration/ sand-filtration
- Organics (crop prot. Agents +) : coagulation/flocculation, oxidation, adsorption
- pH management: regulation, dosing acid or caustic
- Ca, Mg, carbonates (clogging drip systems) *Apriel*
- Mixing

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# Preliminary results from survey

## Treatment



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### – Central-East

- Iron in groundwater: De-ironing
- Sediments in water (reuse in ornamental production, SI): Filtration

### – Mediterranean

- Salinity groundwater
- Pathogens from rainwater
- Algae in storage
- Ca, Mg Carbonate (softening)
- pH
- Nutrients

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# Treatment in Summary



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- Particles removal
- Disinfection
- Demineralisation
- Destruction (Oxidation)
- Combined treatment

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# Treatment Technologies

## (Particle )Filtration



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sieve band screen ( particles)	
Drumfiltration (particles)	
disc filtration (particles)	
SAF filtration (particles)	
Cloth filtration (particles)	
microfiltration	
Other type of filtration ?	

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# Treatment options

## Disinfection and oxidation of materials



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slow sand filtration (dynamic /static)	
UV low/ high pressure	
chlorination (hypochlorite), ( TNO: peroxyte )	
dioxychloration (ClO <sub>2</sub> )	
Chloration Cl <sub>2</sub> (g)	
thermodisinfection	
ozonation	
oxidation of crop protection agents	
Oxidation using Fenton's reagent (H <sub>2</sub> O <sub>2</sub> /Fes)	
specific treatment to remove root exsudate?	
AOP (Advanced oxydation processes)	
PerAcetic Acid (icw H <sub>2</sub> O <sub>2</sub> )	
Photocatalysis (using catalysts like TiO <sub>2</sub> )	
Cupper/Silver ionisation	

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# Treatment Technologies

## Demineralisation +



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pH change: moerl filter, ect	
electrolysis	
distillation	
removal of iron	
denitrification	
dephosphatation	
Ion exchange	
adsorption	
<b><u>Other Physical chemical treatment</u></b>	
Coagulation/ Flocculation	
capacitive dionisation	
Electr coagulation	
Airlift for more oxygen in the water	
Photocatalysis (using catalysts like TiO2 to reduce pathogens and chemicals)	
Ultra Sound	
<b><u>Biological treatment</u></b>	
Aerobic	
Anaerobic	
Biofilters	

earch



# Treatment Technologies

## Filtration for demineralisation



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reverse osmosis (salts)	
forward osmosis	
nanofiltration	
Ultrafiltration (big molecules)	
microfiltration	
Membrane distillation	
Electrodialysis (salts)	
Other type of filtration ?	

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# Discussion Treatment



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- Bottlenecks
  - 
  -
- Solutions (also from other region ?)
  - 
  -
- Gaps
  -

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# Discussion Treatment



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# Discussion Treatment



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- Bottlenecks
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- For each situation (crop type and cropping), identify the best approach considering:

- Effectiveness
- Farmer-friendliness
- Robustness
- Cost/return on investment
- Sustainability
- etc.



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# WORKING SESSION 2: DISCUSSION PART

**Report of exchanges between participants**  
**Overview of raised issues and proposed solutions**

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# Feedback

- **Availability (Alicante)**
  - Community water EC 1,1 mS/cm
  - Availability Dry
  - Transfer – political
  - Well water – EC 2,5 mS/cm



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# Feedback

- **CE (Poland) Fe**
  - Replace dripper lines
- **Storage**
  - CaSO<sub>4</sub>
  - H<sub>2</sub>O<sub>2</sub>
  - Fish (Poland)
- **EC**
  - Mulching
  - Sub-surface drip
  - Salt tolerant crops



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