

# Decision making in soil based irrigation systems for high water use efficiency and minimized leaching of nutrients

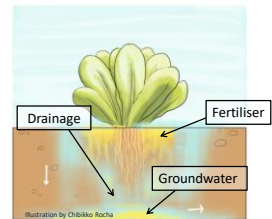
8-3-2017, Francisco D. Mondaca – PhD Candidate, Farm Technology Group



## Leaching and drainage

### The EU Water Framework Directive

- Timetable, 2027 - Reduction to zero drainage of agricultural leaching
- "Pollution from domestic, agricultural and industrial sources is, despite the progress in some fields, still a major concern, either directly through discharges (effluents) or indirectly through the spreading of nitrogen fertilisers and pesticides or through leaching" [1]

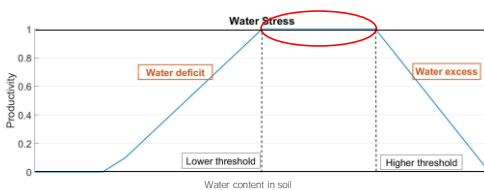


Answer: Why not use less water?

[1] European commission -DG Environment (December, 2008) Water note 12. A Common Task: Public Participation in River Basin Management Planning. Water Information Systems for Europe.



## Crop irrigation



Keep in between thresholds



## Soil Water Sensors

- Measure volumetric water content
- Help in water demand
- Accurate if calibrated



Drawback: Measure water content but not water flow  
You need the water flow to predict drainage



### Soil Water Sensors

- Know the status just at a certain point in time
- Do not know direction
- Do not know flow



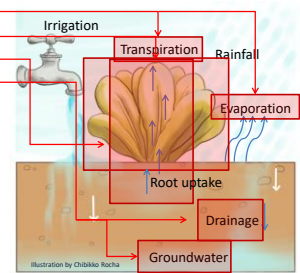
How can we know the water flow?



### Water flow model

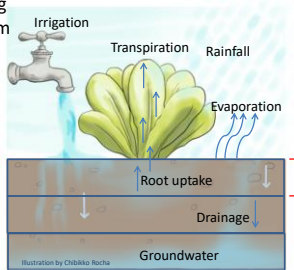
Mechanistic model combining

- Penman-Monteith
- Crop Growth model
- Plant water flow
- Spatial soil model



### Sensitivity Analysis

- Parameter sensitivity
- Increased understanding of relations in the system
- Model simplification



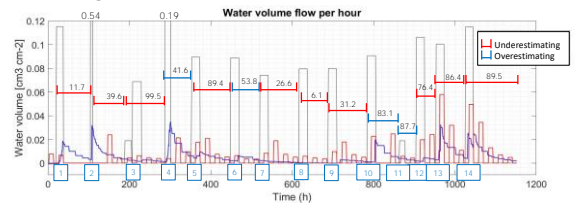
### Spatial soil model

- Thickness of layers, specially first layer
- Shape parameter  $\alpha$  – Air entry pressure
- Saturated water content and residual water content

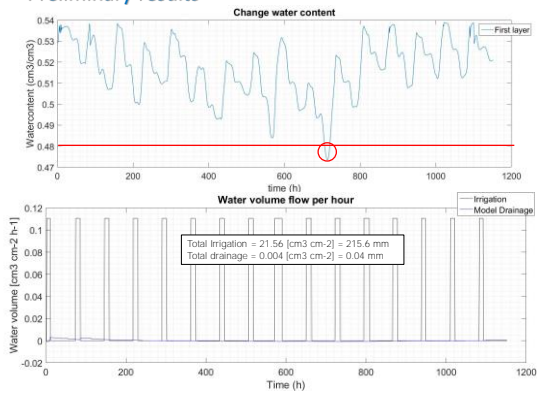


### Preliminary results

Case study for decision making. Nederland grower, soil based greenhouse



## Preliminary results



## Conclusion

- The number of irrigation events and the duration of irrigation are also important in an irrigation strategy
- Not only risk of lower yield production is important. We need to consider risk of drainage in irrigation strategies
- Grower wants easy to follow, easy to implement, efficient irrigation strategies



Thank You

