Use of water and irrigation management models to promote productivity of major crops in Lebanon - MOA experience

Challenges and Opportunities

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ESCWA-Beirut-26/27 Aug 2019
Half of the agriculture area in Lebanon is irrigated → 113,000 Ha

Irrigation increase with the increase of the area of the property going from:

- 38% of properties less than 2 ha are irrigated
- 65% of properties more than 20 ha are irrigated

Yearly irrigation requirement → 1050 MCM (70% of water consumption)

Half of the irrigated area uses water efficient techniques.

Most areas equipped with water efficient materials are in Bekaa. (75%)
Challenges facing irrigation sector

- Poor irrigation water management
- Low efficiency in the distribution networks
- Lack of knowledge in irrigation scheduling
- Climate change: increase in the length of the irrigation period
  uneven distribution of rain
  increase in water needs due to increase in T°C
Challenges facing irrigation sector (con’t)

Irrigation needs are highly compromised since drought seasons are becoming more frequent

- Irrigation season may start earlier due to shorter winter season
- Many crops may not tolerate the new climatic conditions (adverse and drought)
- More pressure on Groundwater due to increasing demand and decreasing supply.
- Traditional cropping patterns may be affected
Actions to increase water use efficiency

Irrigation consumption is not measured is to be reduced, by:

- Improving irrigation efficiency of existing and planned irrigation schemes
- Optimizing on-farm irrigation techniques.
- The adoption of government plans for the development of the irrigation sector
- Irrigated areas are to be increased in line with government policies.
Technologies in Agriculture and Irrigation

- **computer hardware, software, electronic instrumentation, and control systems** for solving problems in agriculture, including agronomy, horticulture

- Relevant areas of technology include
  - **Artificial Intelligence**, 
  - sensors, 
  - machine vision, 
  - robotics, 
  - Networking 
  - **simulation modelling**.
Crop simulation models (CSM)

- A Crop Simulation Model (CSM) is a simulation model that describes processes of crop growth and development as a function of weather conditions, soil conditions, and crop management.

Examples of CSM
- CropSyst
- APSIM
Climate and agriculture model using remote sensing

**The WaPOR data portal**, developed by (FAO) is a tool that uses satellite data to monitor agricultural land- and water productivity throughout Africa and the Near East.
Aquacrop

- It is a FAO crop water productivity model.
- Simulates yield response of herbaceous crops to water, especially where water is a key limiting factor in crop production.
- Assess the effect of the environment and management on crop production.
- Studies interaction between Soil-Plant-Climate
Aquacrop benefits

- It has many benefits enabling its practical use:
  - Use Canopy Cover instead of Leaf Area Index
  - Needs relatively low number of parameters
  - Input data requiring explicit and intuitive parameters
  - Applicable on diverse agricultural systems
Output

- Water balance in the soil
- Deficit irrigation
- Supplemental irrigation
- Irrigation scheduling
- Water productivity
Data needed

Simulation model needing long term data:
- Climate (at least for 10 yrs: Tmin, Tmax and Rainfall)
- Crop characteristics (through experimental trials) growing stages, root development ...
- Soil characteristics: physical characteristics
  - Soil water content
  - Soil water retention

Real time calculation
- Everyday climatic data
- Everyday soil condition data (moisture and water content level)
Climate
- Weather data collected at field or from agro-meteorological stations
  - Minimum and Maximum air temperature
  - ETo
  - Rainfall
  - CO₂ concentrations

Crop
- Calibrated and validated crop characteristics from database
- Adjust cultivar specific and less conservative parameters

Soil
- Soil profile characteristics
  - Field observations
  - Default values in database
  - Pedo-transfer functions
- Characteristics of groundwater table
  - Depth below soil surface
  - Salinity
- Soil texture

Management
- Field management practices
  - Soil fertility level
  - Practices that affect the soil water balance
- Irrigation management practices
  - Irrigation method
  - Application depth and time of irrigation events
  - Salinity of the irrigation water
Challenges using Aquacrop

- Simulation model → long term climatic data → not always found and accurate in every location
- Soil data → needs experimental field data → needing instrumentation, workers and financial resources which are not always available
- Crop data → needs experimental studies over several years for each crop under specific climate and soil condition → needs financial and human resources
- Needs wide knowledge in soil, crop and water to analyze results
- Needs information of the farm → farmer registry
- Cannot be used on fruit trees (Mainly Bekaa and Akkar)
Recommendations

- We need to build a systemic information sharing system
- AQUACROP is good to be used to elaborate guidelines for irrigation water management of crops.
- Can be used on Potatoes and Wheat
- Still need more work on other field crops and vegetables in Lebanon
Recommendations (cont’d)

- Need to apply irrigation water management at irrigation schemes level and not only at farm level → enhance collaboration and communication between different parties

- Support and subsidies research studies on agriculture and irrigation.
THANK YOU!