Innovagri 2015

Introduction to round table

Irrigation and energy - indicators and rational use

Pour mieux affirmer ses missions, le Cemagref devient Irstea

www.irstea.fr

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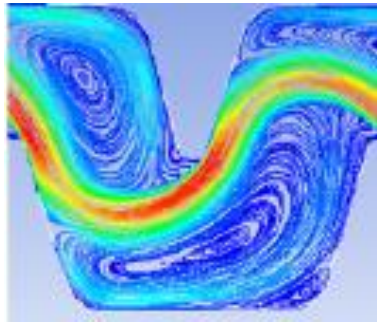
Who we are ?

IRSTEA-UMR G-EAU IN MONTPELLIER (FRANCE)

- Irrigation equipment and practices performance
- Activity: Research, R&D and Testing
- Objectives
  - Validation and improvement of irrigation performance
  - Maintain the highest water use efficiency ….
    …in order to optimize productivity
- Technologies addressed
  - Sprinkler irrigation: Efficiency, Treated waste water reuse
  - Drip irrigation :Drivers of ageing,
  - Canal regulation: real time management
    ➔ In all cases fluid mechanics approaches
  - Irrigation scheduling: Pilote crop model
  - Soil transfer measurement: large spectrum tensiometer
  - Laboratories: Irrigation equipment testing, Soil & water, Experimental Canal
  - High level equipment: PIV, PTV, Rheology, Microscopy



Water and Energy

IS IT POSSIBLE TO SAVE BOTH OF THEM?

- Most of the time focus on water management: do more with less
  - Improve efficiency of transport, delivery, application and productivity
  - Energy considered in a cost management perspective more than efficiency
- Modernization policies
  - Subsidize massively (up to 90% in Algeria, Tunisia and Morocco) conversion from traditional low energy surface irrigation techniques to pressurized
  - Gain in water use efficiency is often reported two folds
  - But energy consumption is multiplied by 3 (Daccache et al. 2014)
- Lot of ideas are circulating on energy but less figures
  - Energy requirement and irrigation technology
  - Redesign based on hydraulics and not only investment cost
    - Redimensioning a pivot supply pipe: 160 to 200mm, 600m long, reimbursed in 6 years (pump 55 to 33kw, pressure 7.4 to 4bar)
    - Putting a VFD: cost return <5years for 25% less energy

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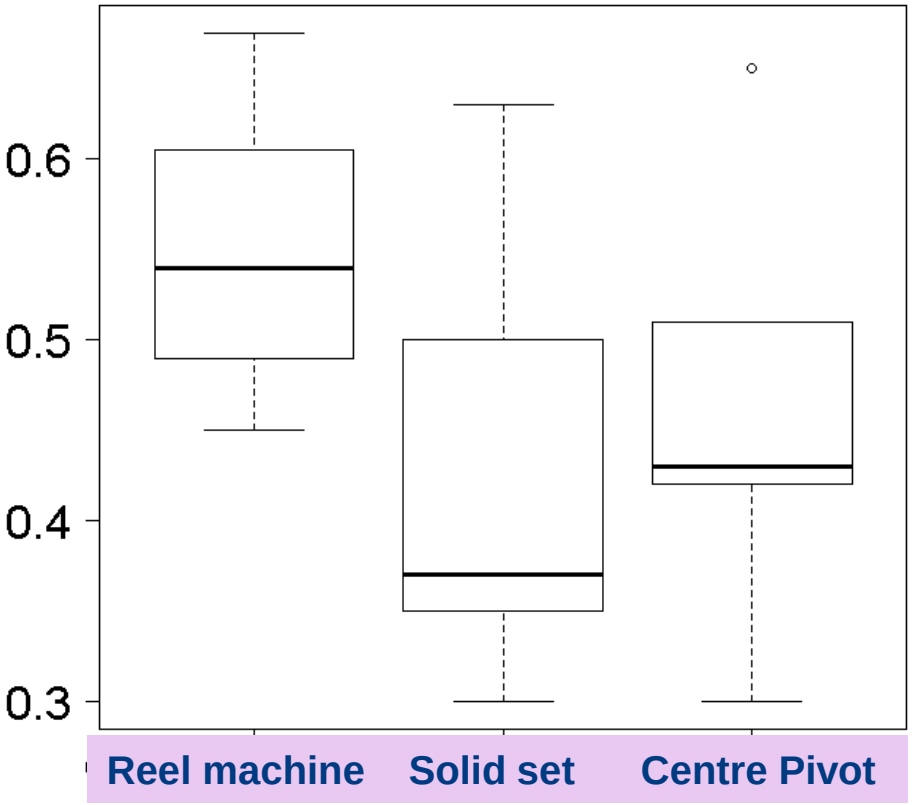
Consumption per m^3 over one year, 50 plots corn and fruits, South Ouest of France (2003)

kWh /m^3 Electric&Diesel private pumping



Measurement drip: 0.2 to 0.7kwh/m^3

Comparison Electric/Diesel 11 Reel machine (4 diesel)

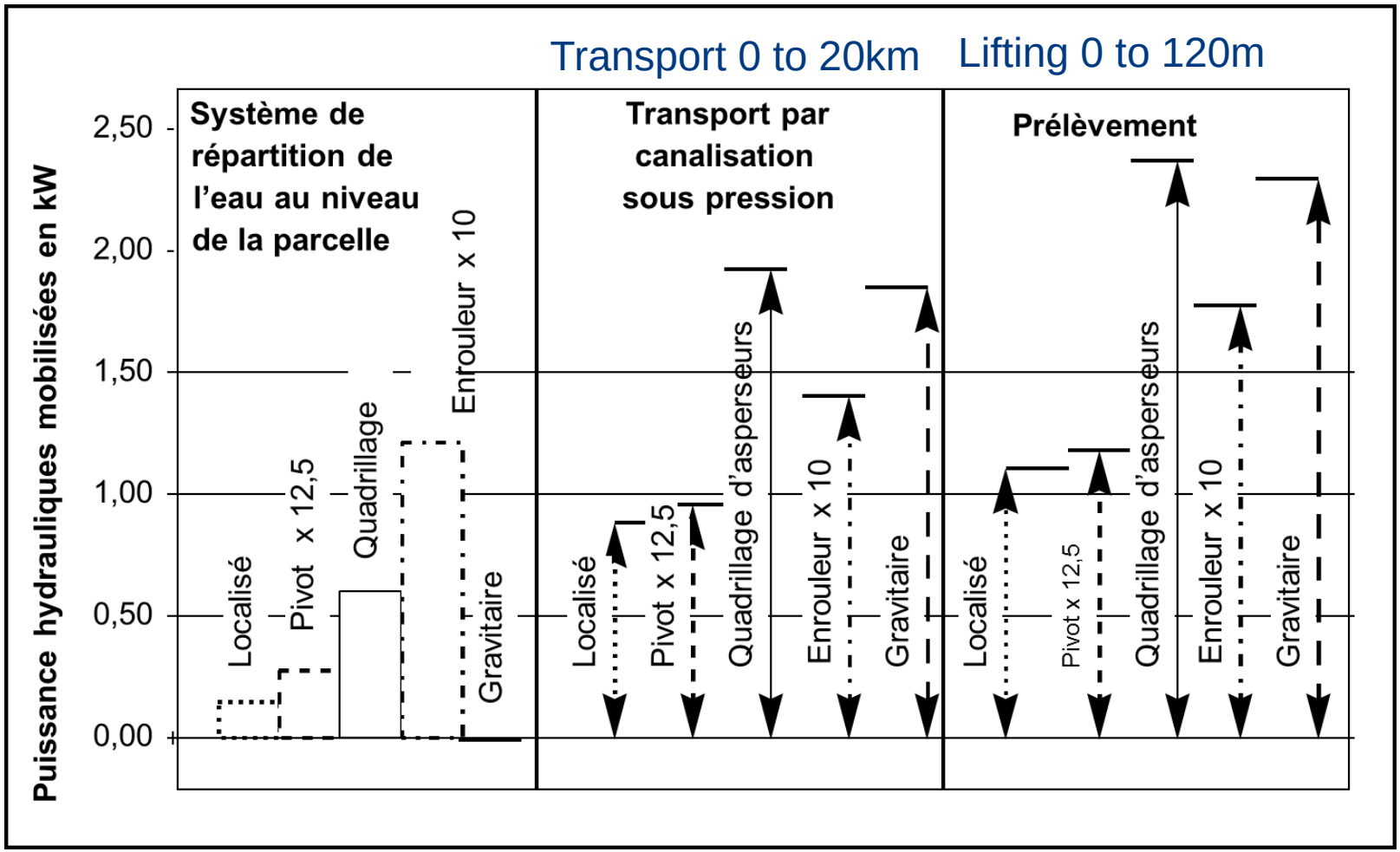
kWh /m^3

énergie	moyenne	écartype
électrique	0.55	0.07
gasoil	1.49	0.18

Coût énergie €/ha - canon-enrouleur 2400 m^3/ha

énergie	coût kWh en €	moyenne	écartype
électrique	0.06	79	11
	0.08	106	14
	0.10	132	18
gasoil	0.10	392	44

To be compared with transportation and lifting requirements (base India, Egypt, Morocco, France)



EDEN Project, Evaluating energy consumption of field irrigation systems

- Proposing a diagnosis method and Selecting the best indicator
- Based on pumping to plant analysis
  - Simple diagnosis: enquiry
    - Installed power (P required and pump yield)
    - Used energy: Q and P at emitter (includes transport energy losses)
  - Diagnosis overs several hours
    - P = Q x H, 3 to 4 reference conditions
  - Monitoring over a longer period
    - E = V x H, average over a period (a season)
- **Reel machines: 1.29 to 1.72 kwh/m^3, or 2 to 4wh/m^3/m**
- **Fixed grid of sprinklers: 0.3 to 0.7kwh/m^3, from 5 wh/m^3/m**
- **Centre pivot: 0.3 to 0.72kwh/m^3, from 0.5 wh/m^3/m**
- **Drip irrigation: 0.2 to 0.7kwh/m^3, from 0.4 wh/m^3/m**

Energy and irrigation

- Many possible indicators:
  - What are the most pertinent? Energy or Cost ?
- Many possible spatial scale to identify energy use:
  - From pump to soil, from resource to soil?
  - Need for approaching the system in its environment and infrastructure
  - Network compared to individual pumping
- Open the perspectives e.g. with LCA
  - Energy for operating the system
  - Energy for installing and manufacturing
    - ➔ The price of saved water is paid in energy
    - ➔ Conversion from surface to drip irrigation
- What about producing energy locally…

Sun'Agri

Agrovolatique, is it a perspective?
Energy production that doesn't compete with food production

Optimizing enerdy and crop production

- **Yield are maintained (salads, wheat)**
- **Atmospheric conditions (Tair, RH, U) unchanged except Rg**
- **Significant decrease of ET (-20 à -30%) and canopy temperature reduction**