Irrigated Agriculture in the Ebro Valley

Enrique Playán
Where are we?

A slide show on dryfarming and irrigated agriculture
Where are we today?

- The central Ebro valley depression
- Precipitation: 250 – 400 mm
- Reference evapotranspiration of about 1,100 mm per year
- Shallow, poorly developed soils
- Salinity resulting from lake like evaporation
- Rivers and wind have modeled the landscape
Dryfarming in Monegros

- Rich agricultural tradition
- Barbecho system
- Deforestation boosted by diesel power
- Linked to the 20th century history
- Now a days:
  - Poor yields
  - Harvest only a fraction of the years
A bit of irrigation history, XIX and XX

- Regeneracionism
- Looking inside
- Water for rural development
- Strong governmental intervention
- A popular policy
PARQUE-A
REGADIOS-SI
II. - Y - ECOLOGIST
SOIS - LOS - JUDAS
DE - MONEGROS -
Y - DE - ARAGÓN.
Irrigation systems

Identifying limiting factors to sustainable Mediterranean agriculture
Sustainable Mediterranean Agriculture

- Mediterranean climate is naturally characterized by variability
- Pending issues on water quality, derived from the WFD: irrigation return flows
- Need to adjust inputs to improve energy, pollutant and economic budgets
- Soil protection: key issue in an extremely vulnerable area
  - Erosion
  - Salinity
Our best farmers are using resources rather well… what can we do for the rest?

- Part-time farmers
- Poorly educated farmers
- To what extent can technology alleviate deficits in dedication or training?
Surface irrigation

- Initial irrigation system
- The only one available
- Applied to all soils and conditions
- Successes and failures
- In clear regression
Sprinkler irrigation (1970+)

- Started as individual fields
- Continued with collective networks
- Today we are in the middle of rebuilding about half of the surface irrigated area, switching to collective sprinkler (and drip) irrigation networks
Drip irrigation

- Relevant in some areas: fruit production
- Warm climate
- Large properties: industrial
- Aggregated supply
- Associated to labor intensive crops
Collective Water Management

Specific challenges derived from collective structures
Collective water management

- Difficult access to water, surface water developments
- Large initial investments required
- Strong initial public intervention
- Mandatory “irrigation districts”
  - Not only irrigation now
  - Long tradition in overland water
  - Accounting efforts
- Districts + Basin authorities
  - Public-private interaction
  - Embryo of some WFD concepts
  - 80 years old here
Challenges for the 21st century

- Inspiring the National Irrigation Plan:
  - Improve irrigation efficiency
  - Improve irrigation structures
    - Sustainable, profitable irrigated farming
  - Protect water quality
  - Improve water management

- The Plan has been in operation for about 10 years now
  - Projects in about 1 Mha
  - Large public-private investments
  - From surface to sprinkler/drip irrigation
  - Collective networks
Two paths to improve irrigation efficiency:

- **Structures**
  - 99% of the Spanish National Irrigation Plan

- **Management**
  - 1% of the Spanish National Irrigation Plan (26 M€)
  - Advantages:
    - Bottom-up
    - Slow and endogenous
    - Much cheaper (€/m³ of conserved water)

- Need to combine both approaches for optimum results (Styles, 1999; Vidal et al., 2001)
Irrigation management principles

- Transparency
- Participation
- Traceability
- Effectiveness
- Standardization
- Certification

...These are the ingredients we used to build **Ador**, an irrigation district water management software
Ador: a tool for collective water management

And also a Trojan horse…
Ador: Derived from research projects

- Started research in 1997
- Researchers from:
  - Estación Experimental Aula Dei (CSIC)
  - Centro de Investigación y Tecnología Agroalimentaria (DGA)
- Objective:
  - A software to support daily water management activities in irrigation districts... particularly under drought!
  - Regardless of type of water distribution, irrigation system or quality of management.
- Support:
  - Research funds,
  - Government of Aragón,
  - Irrigation Districts (mainly “Riegos del Alto Aragón, RAA”)


Ador: Strength gained at the districts

- Cooperation between:
  - researchers,
  - farmers,
  - companies,
  - public administration and
  - water managers.

- Half of the Aragonese irrigated land is managed with Ador (about 180,000 ha)

- The project has boosted water management utilities nationwide

- Currently released version: 1.2.9 (free download)
Water pricing: a matrix
Water users
Cadastral plots and water uses
Water uses
A diagram of the irrigation network
Secondary network elements
Water management units
Registering and allocating water orders

<table>
<thead>
<tr>
<th>Paqador Agua: ABAIADAS TESA, GONZALO</th>
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<tbody>
<tr>
<td>U. Gestión: A-6-10</td>
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<td>Línea Hidrante: A-6-10-11</td>
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<tr>
<td>Usos-Pagador Agua: parcela</td>
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**Info U. Gestión:**
- Nombre: ABAIADAS TESA, GONZALO
- Uso: A-6-10
- Horas: 0:8:00
- Fin: 0:8:00
- m3/24h: 75000
- L/s: 868.1

**Info Línea:**
- Línea: A-6-10-11
- Descripción: Canal
- m3/24h: 20000
- L/s: 231.5

**Usos Seleccionados:**
- **Tipo Uso:** Trigo Blando
- **Cultivo:**
  - Trigo Blando
  - A-6-10-11
  - G. Abadias-1
  - G. Abadias-2
  - G. Abadias-3

**Reparto Usos:**
- Nombre: ABAIADAS TESA, GONZALO
- m3/24h: 5000
- l/s: 231.40
- Dia: 24/10/2003
- Días: 7
- Hora Inicio: 8:00
- Horas: 0
- Consumo: 20000

**Gestor Concesiones:**
- Usuario: ABAIADAS TESA, GONZALO
- Fecha Concesión: 24/10/2003
- Fecha Inicio: 0:3:00
- Fecha Fin: 25/10/2003
- m3/24h: 2000
- l/s: 231.48
- Consumo: 20000
## Registering water meter readings

### Introducir Lecturas Puntos Hidrantes

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<thead>
<tr>
<th>Línea</th>
<th>Nombre</th>
<th>Lectura Anterior</th>
<th>Fecha Lectura</th>
<th>Lectura Hidrante</th>
<th>Fecha Nueva Lectura</th>
<th>Nueva Lectura</th>
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### Options
- Eliminar Lectura
- Cerrar Sin Guardar
- Mostrar Todas Lecturas
- Cerrar
Billing for general costs: by the hectare
Billing for water use: by the m³
The educational water bill

Datos del Cliente:
Título: 
NIF: 
Dirección: 
Población: Huesca
Provincia: HUESCA

Consumo:

<table>
<thead>
<tr>
<th>Tipo Uso</th>
<th>Consumo</th>
<th>ha</th>
<th>Consumo m³/ha</th>
<th>Importe Total</th>
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<tr>
<td>Agrícola</td>
<td>48,688,00 m³</td>
<td>4.5</td>
<td>10,800</td>
<td>194,40 €</td>
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Gastos Especiales:

Gastos Especiales de Usos

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<tr>
<th>Nombre</th>
<th>Tipo</th>
<th>Ha Parcelas</th>
<th>Cantidad</th>
<th>Total</th>
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<tbody>
<tr>
<td>Gastos generales</td>
<td>Heráclio</td>
<td>11.5</td>
<td>25.00 €</td>
<td>297.50 €</td>
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<tr>
<td>Reparación acequia</td>
<td>Heráclio</td>
<td>11.5</td>
<td>5.42 €</td>
<td>62.38 €</td>
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Nota: En la columna Ha Parcelas aparece el número de hectáreas del tipo Heráclio e último de parcelas si la demanda es del tipo Fija.

Gastos Especiales de Usuarios

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<tr>
<th>Concepto</th>
<th>Cantidad</th>
<th>Precio</th>
<th>Total</th>
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<tbody>
<tr>
<td>Gasto prueba</td>
<td>5</td>
<td>12,900 €</td>
<td>64,50 €</td>
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Totales:

- Total Consumo: 194,40 €
- Total Gastos: 409,83 €
- Total Factura: 604,23 €
Drought management: water restrictions
Drought management: water restrictions

- The water restriction form has been applied to live with dramatic water shortages
- RAA: a number of severe drought years since the adoption of Ador in 2001
- Ador contributed to transparency and equity in those years, supporting farmers’ endurance of water scarcity
Irrigation District “La Campaña” (RAA): histograms of water use per crop

**Alfalfa**
- 0-4000: 18
- 4000-6000: 27
- 6000-8000: 14
- 8000-10000: 14
- 10000-15000: 17
- >15000: 10

**Corn**
- 0-4000: 11
- 4000-6000: 13
- 6000-8000: 23
- 8000-10000: 22
- 10000-15000: 25
- >15000: 6
GIS support: plot identification
GIS support: searches and queries
GIS support: supply lines and cadastral plots
Concluding remarks

The take-home message
Concluding remarks

- Participative, endogenous effort
- Institutional strengthening
- Adjusting water input to crop water requirements
- Surviving recurrent droughts
- Increased management responsibilities
- A long way to go