Actions towards sustainable and safely use of treated wastewaters in agriculture: Morocco Experiences

Pr. Redouane Choukr-Allah
IAV Hassan II Agadir
8-9 October 2009, Girona, Spain

Introduction

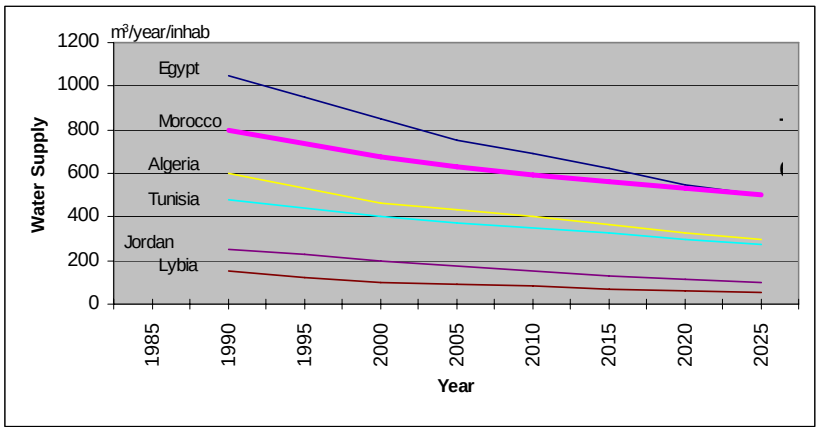
Morocco is characterized by:

- More repetitive periods of drought;
- Irregularity of the rainfalls;
- Water chronic scarcity will be reached by 2020;
- Degradation of the water resources quality.

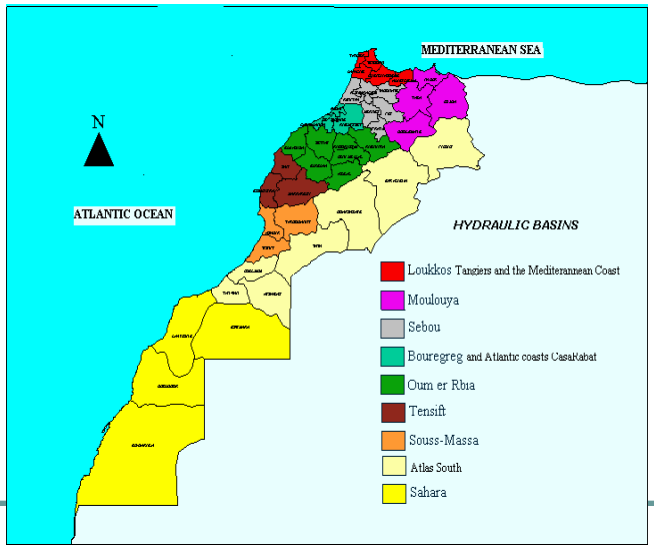
PROBLEMATIC

Scarcity of water resources and needs for protecting the environment and the natural resources are the main factors leading the Moroccan government to introduce TWW as additional water resources in the national plan of water resource management.

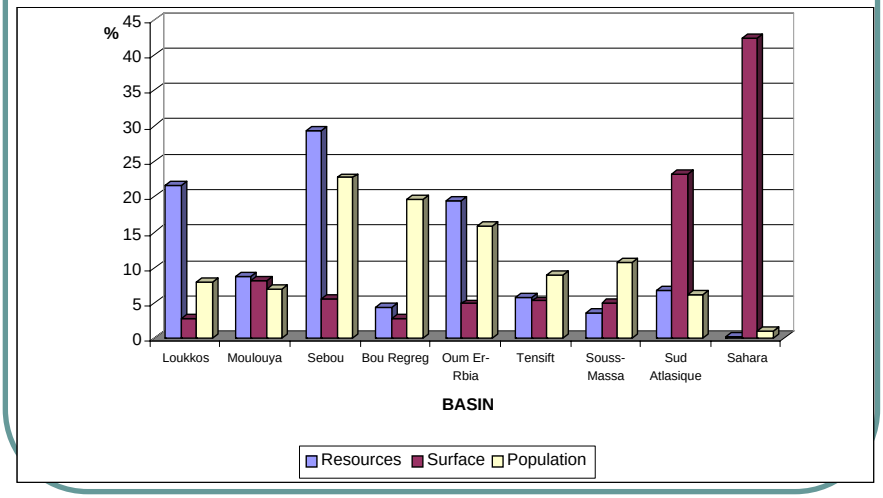
supply of available waters per capita and per year in some Mediterranean countries



Geographic Distribution of Hydraulic river basins in Morocco



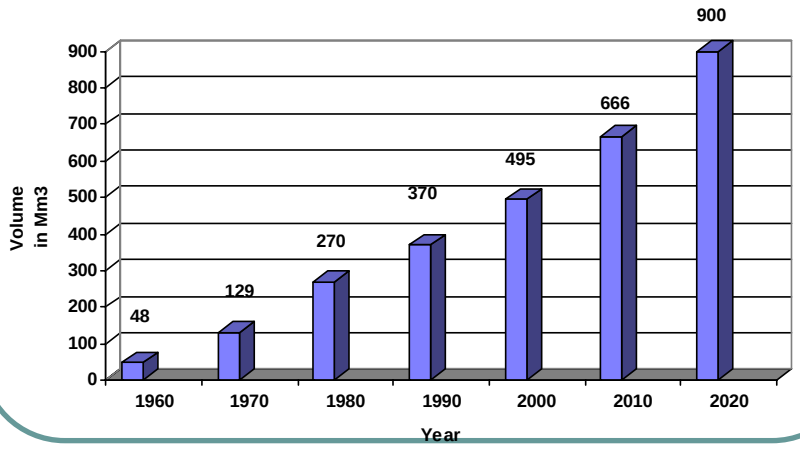
Geographic distribution of surface waters resources



Issues of Water Resources in Morocco

- The available water resources per inhabitant and per year will drop from less than 1000 m^3 to less than 500 m^3
- 23%of the dams used for potable water are threatened by urban pollution

Potential of wastewater in Morocco



Wastewater effluents cannot be totally mobilized

- 58% of this volume will be discharged on the coast
- Absence of irrigable sites downstream from the discharges in numerous centers, especially coastal cities.
- high cost of the water conveyance system to the reuse site;
- availability of conventional waters in the area.

The reuse of treated wastewater is still at the experimental level

Pilot projects:

- Ouarzazat- FAO
- Ben Sergao - ADF
- Ben Slmimane - ACDI
- Drarga - USAID

OBJECTIVES OF THESE PILOT PROJECTS

- The response of several crops to treated wastewater irrigation
- The impact of treated wastewater on the soil and ground water
- What are the Best management practices for reducing nitrogen pollution and salt accumulation under irrigated crops using treated wastewater

Irrigation systems

- Numerous irrigation systems have been tested in the pilot projects
- problems faced were not linked to the irrigation method but rather to the piloting of the irrigation
- choice of a good dripper might significantly improve the distribution of wastewaters at the level of the plot
- Drip irrigation reduce considerably the health risks

Impact of treated wastewater on the soil electrical conductivity

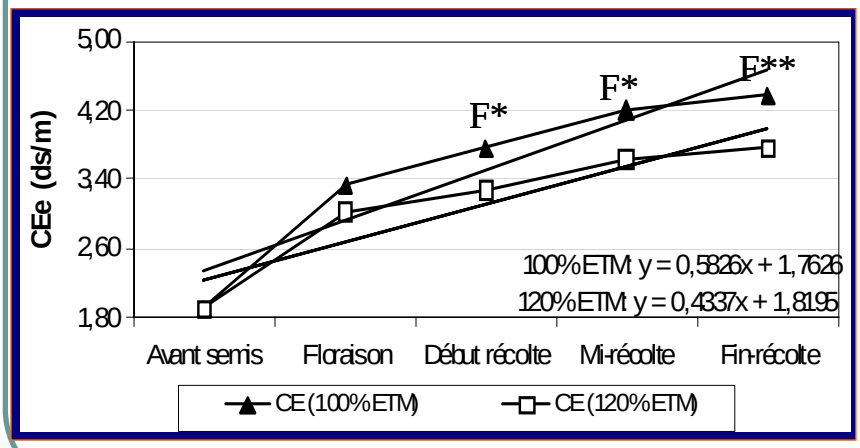


Figure : Evolution of the soil ECI

Quantity of nitrogen supplied by irrigation

Crops	N Supplied (Kg NO3/ha)	N Supplied (Kg N/ha)
Melon	2114	477
Carnation	2397	541

Quantities of Nitrogen lost

- Melon : 217 Kg N/ha
- Carnation : 287 Kg N/ha

If we integrate the other elements in the nitrogen budget

- Melon : 346 Kg N/ha
- Carnation : 343 Kg N/ha

Economic Benefit of irrigation with Treated Wastewaters

Cultivation	Net Benefit on water (1) (Dh / year/capita)	Benefit on fertilizers (2) (Dh / year/capita)	Total benefit (Dh / year/capita)
Tender Wheat	750	1492	2242
Corn	1588	3614	5202
Fodder corn	1568	3572	5140
Clover	774	1539	2313
Zucchini	677	1545	2.222
Squash	611	1216	1827
Tomato	1.553	3542	5095
Potato	940	2140	3080

Wastewater reuse strategy and planning

- National plan of reducing 90% of the pollution by the year 2030
- Implementation of strategy and policy to promote reuse
- Development of national water quality guidelines for wastewater reuse
- Promotion of reusing treated wastewater in golf courses and city landscaping

Wastewater reuse project planning

- Selection of treatment system based on the type possible reuse
- Cost-benefit analysis should include socio-economic and environmental aspects

Potential cost effective alternatives

- Stabilization ponds or lagoons,
- Sand filters,
- Land treatment systems, and
- Constructed wetlands

SAND FILTERS

Maintaining sand filter

Sewage performances: Reduction percentage

Plant	Ouarzazate		BenSergao	Drarga	BenSlimane	Marrakech	Bouznika
Processing System	Lagoon	High Out put Lagoon	Infiltration Percolation		Aerated Lagoon	Optional Lagoon	Lagoon
Period of Stay (Days)	25	21.9	-	-	30-40	30	-
DBO5 (mg/l)	81.7	65.3	98	98.5	78	97	75
DCO (mg/l)	72	65.4	92	96	79	76	71
MES (mg/l)	28	-	100	96.6	-	69	76
NTK (mg/l)	31.5	48	85	96.8	75	71	14
P total (mg/l)	48.5	54	36	95.9	41	85	-
CF /100ml	99.9	99.9	99.9	99.9	100	99.4	99.9
O. Helminthes/L	100	100	100	100	100	100	100

Source: ONEP-FAO (2001)

STRATEGIES FOR SUSTAINABLE REUSE

- Adequate and low cost treatment technology
- Crop selection
- Irrigation techniques and scheduling
- Control of nitrogen pollution and salt accumulation