
OPTIMIZE YIELD PER DROP OF WATER

I. PAPADOPOULOS

MAIN OBJECTIVE

DEVELOPMENT
OF TOOLS AND GUIDELINES
FOR THE PROMOTION OF THE SUSTAINABLE
URBAN WASTEWATER TREATMENT
AND REUSE
IN THE AGRICULTURAL PRODUCTION
IN THE MEDITERRANEAN COUNTRIES

Presentation with emphasis on the Cyprus Imput

CYPRUS ARI


SASTAINABLE URBAN
WASTEWATER TREATMENT
AND REUSE
IN AGRICULTURE
WITHIN THE OVERALL
WATER
SUSTAINABILITY

CAUSES OF DESERTIFICATION

Inappropriate land and agricultural management practices and policies

Inappropriate management of scarce water resources aggravated by frequent droughts

GROWING WATER CRISIS

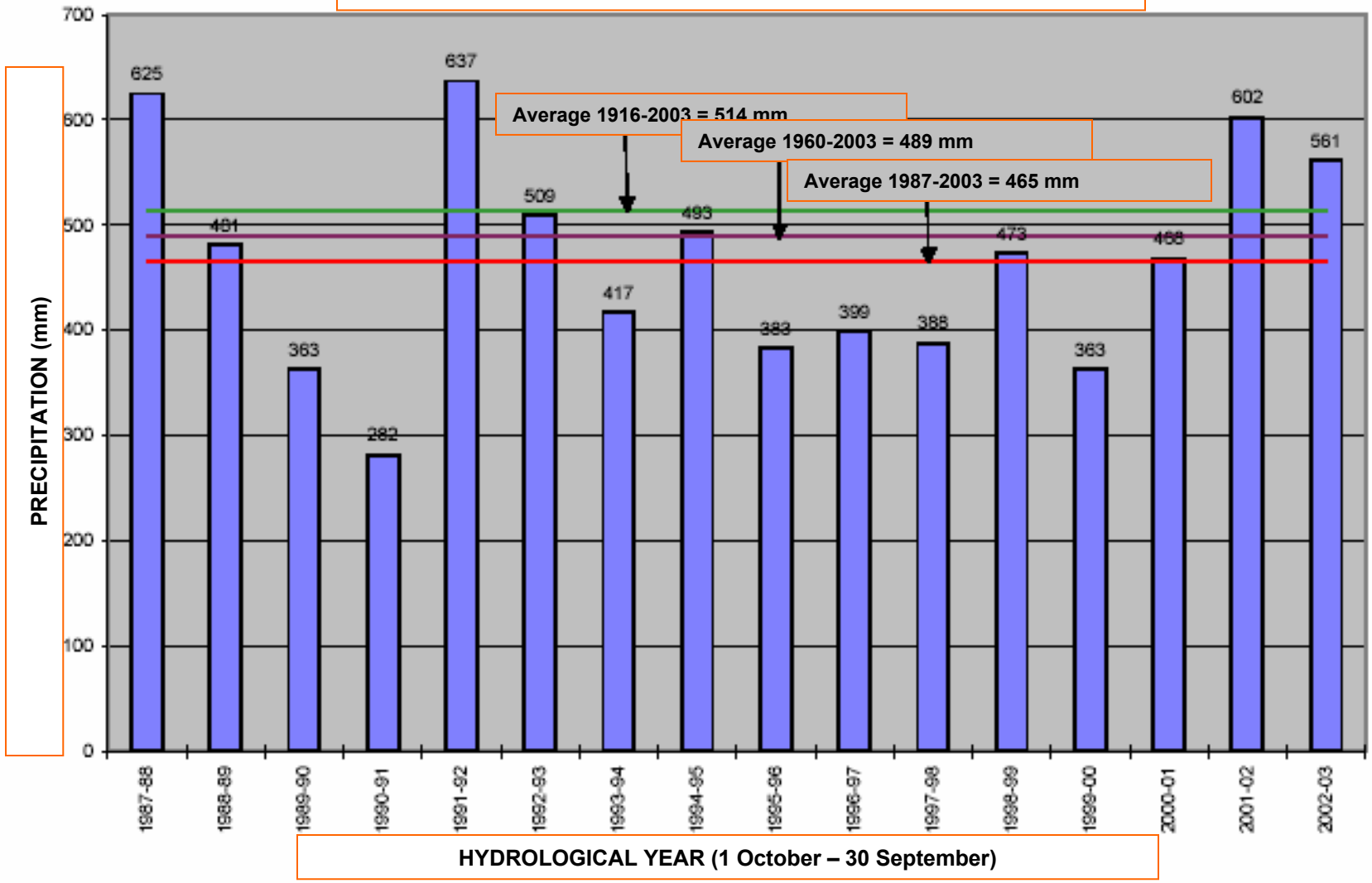
1. Variable water supply (Erratic Rainfall)
2. Decreasing of groundwater
3. Deterioration of water quality
4. Expanding irrigated agriculture
5. Rabid population growth (Domestic demand)
6. Tourism
7. Others (Industrial demand)

Strategy to cope with water scarcity

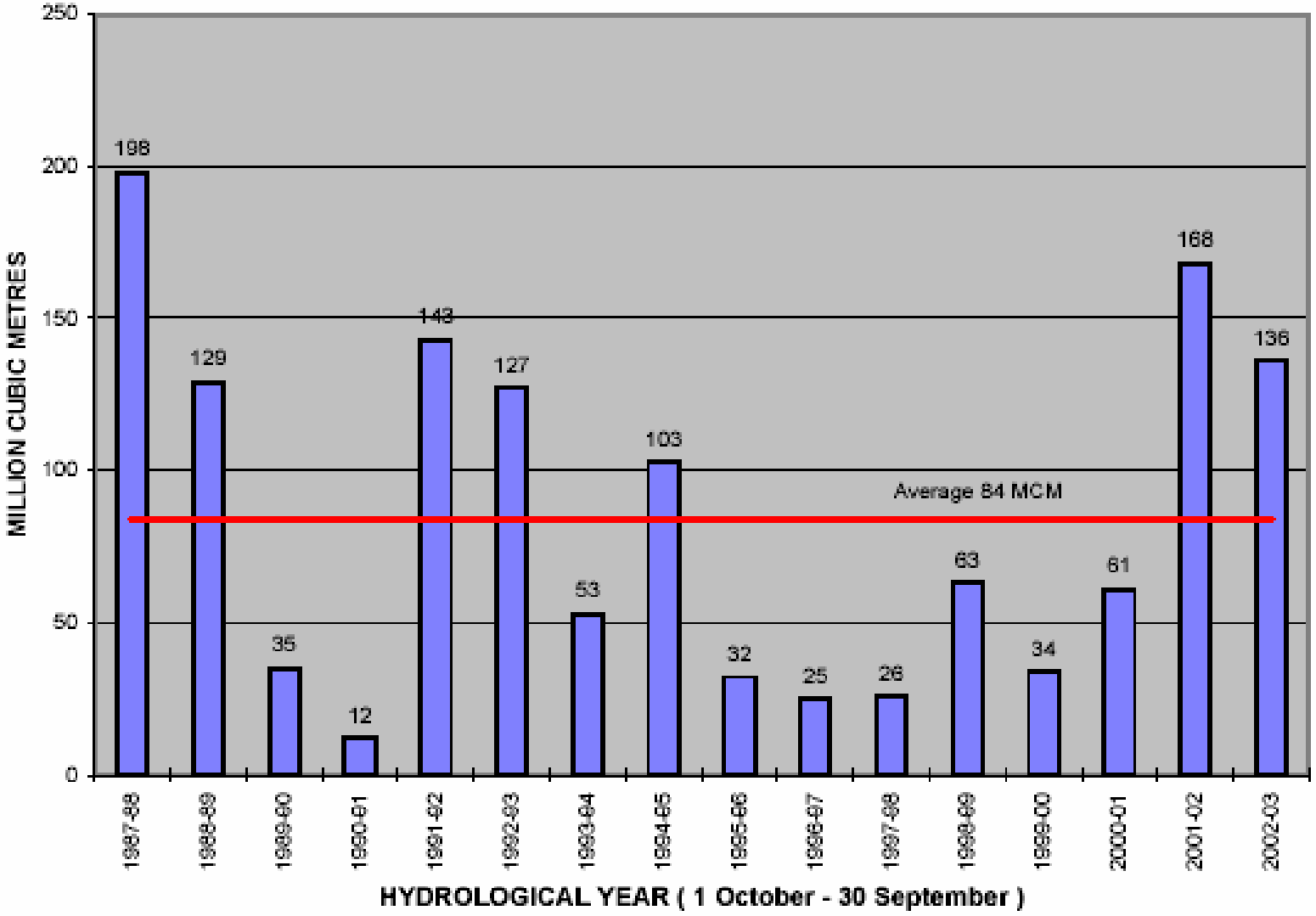
- **Increase water resources**
- **Conservation of water use**

Capacity of the 106 dams in Cyprus is 307.5 million m^3

MEAN ANNUAL PRECIPITATION OF CYPRUS
(AREA UNDER GOVERNMENT CONTROL)
1987 - 2003



INFLOW OF WATER TO THE DAMS
1987 - 2003



DESALINATION

Treatment plant at Dekelia with a capacity of 40000 m^3/day

Sea water is the most reliable, renewable water resource

Treatment plant at Larnaca Airport with a capacity of 51000 m^3/day

Treatment plant of Limassol (in operation in 200?) with 20000 m^3/day

TREATED WASTEWATER

It is an additional, reliable, renewable water source for irrigation

Guidelines and a code of Good Agricultural Practices must be developed to secure safe use of these waters

Cyprus guidelines for domestic treated WW use for irrigation

Irrigation of	BOD mg/L	SS mg/L	Faecal coli-forms/100ml	Infestinal worms/L	Treatment required
All crops (a)	(A) 10*	10*	5* 15**	Nil	Secondary and Tertiary and disinfection
Amenity areas of unlimited access and vegetables eaten cooked (b)	(A) 10* 15**	10* 15**	50* 100**	Nil	Secondary and Tertiary and disinfection
Crops for human consumption. Amenity areas of limited access.	(A) 20* 30*	30* 45**	200* 1000*	Nil	Secondary and storage >7 days and disinfection, or Tertiary and disinfection.
	(B)		200* 1000*	Nil	Stabilization-maturation ponds total retention time >30 days or Secondary and storage > 30 days
Fodder crops	(A) 20* 30**	30* 45**	1000* 5000**	Nil	Secondary and storage >7 days or Tertiary and disinfection.
	(B)		5000*	Nil	Stabilization-maturation ponds total retention time >30 days or Secondary and storage > 30 days
Industrial crops	(A) 50* 70**		3000* 10000**	Nil	Secondary and Disinfection
	(B)		3000* 10000**		Stabilization-maturation ponds total retention time >30 days or Secondary and storage > 30 days

A Mechanized methods of treatment (activated sludge e.t.c.)

B Stabilization ponds

* These values must not be exceeded in 80% of samples per month (Min. number of samples = 5).

** Maximum value allowed

(a) Irrigation of leafy vegetables, bulbs and corms eaten uncooked is not allowed

(b) Potatoes, beetroots, colocasia.

Note: Note: No substances accumulating in the edible parts of crops and proved to be toxic to humans or animals are allowed in effluent.

Strategy to cope with water scarcity

- Increase water resources
- Conservation of water

Present sources and sinks of water (Annual quantities in MCM)

Source / Econ. Sector	Surface Water	Groundwater	Recycled Water	Desalinated water	Total	%
Irrigation	82	97	4		183	**68**
Domestic	17	22		30	69	26
Industry		4			4	1
Environmental	6	7	1		14	5
TOTAL	105	130	5	30	270	100
%	39	48	2	11	100	

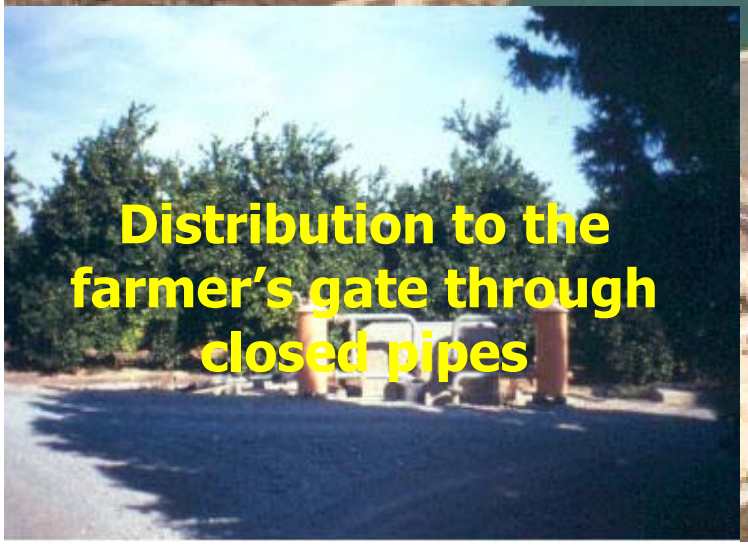
Irrigation: Includes Animal Husbandry 8 MCM
Government Schemes 100 MCM
Non-Govern. Schemes 75 MCM

Domestic Residents (Households) 54 MCM
Tourism 15 MCM

Environmental: **Landscape irrig**., i.e., Hotel & house gardens, playgrounds, parks, road isles
Ecological areas i.e., Lakes, marshes, flora & fauna of river beds

CONSERVATION OF WATER

70-80% of the water is allocated to the Agriculture

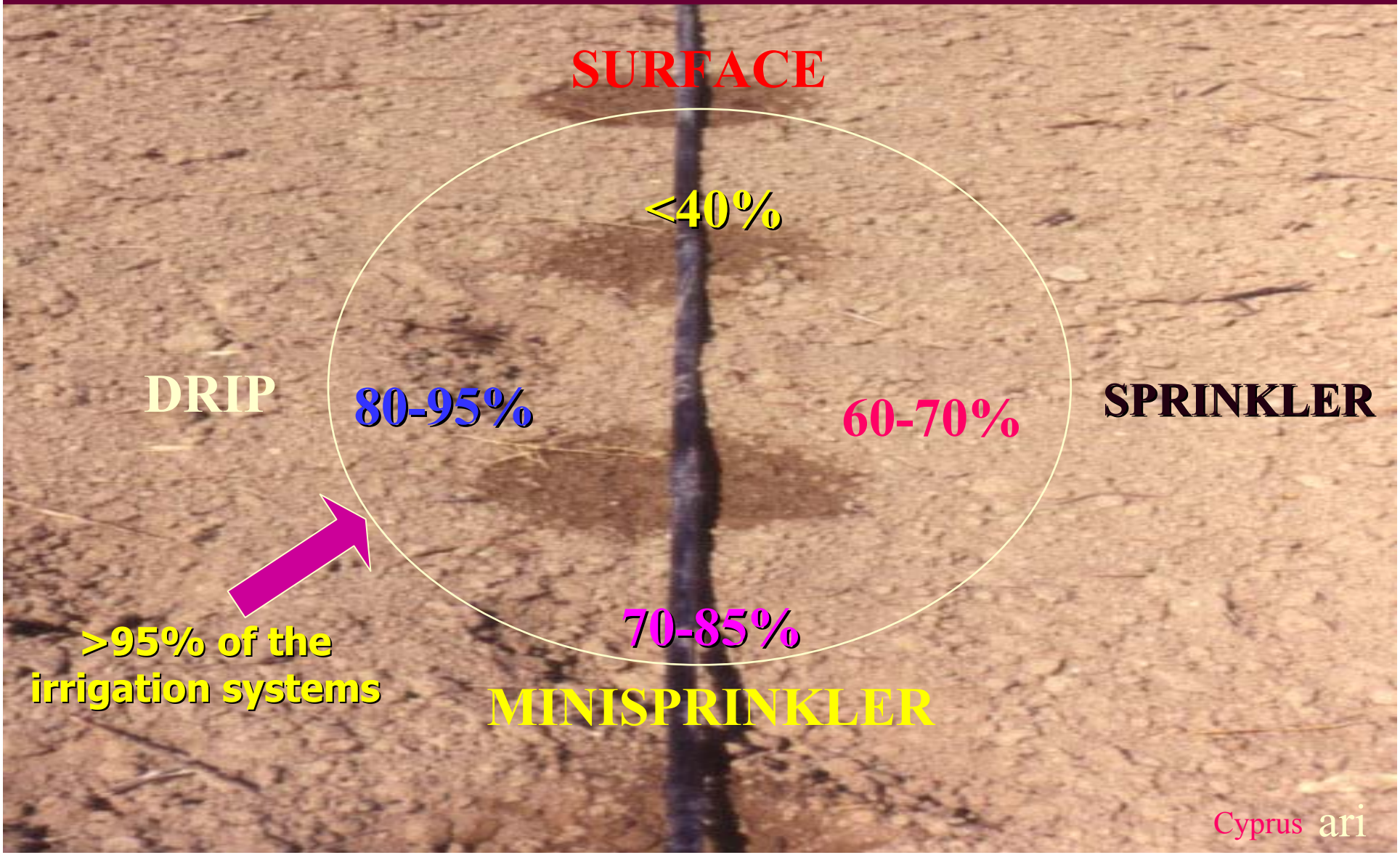


SAVE WATER AT FARMER'S LEVEL

- IRRIGATION SYSTEMS
  - SURFACE
  - SPRINKLERS
  - MICROIRRIGATION
  - SUBSURFACE
- SCHEDULING OF IRRIGATION
  - AMOUNT OF WATER
  - FREQUENCY OF APPLICATION

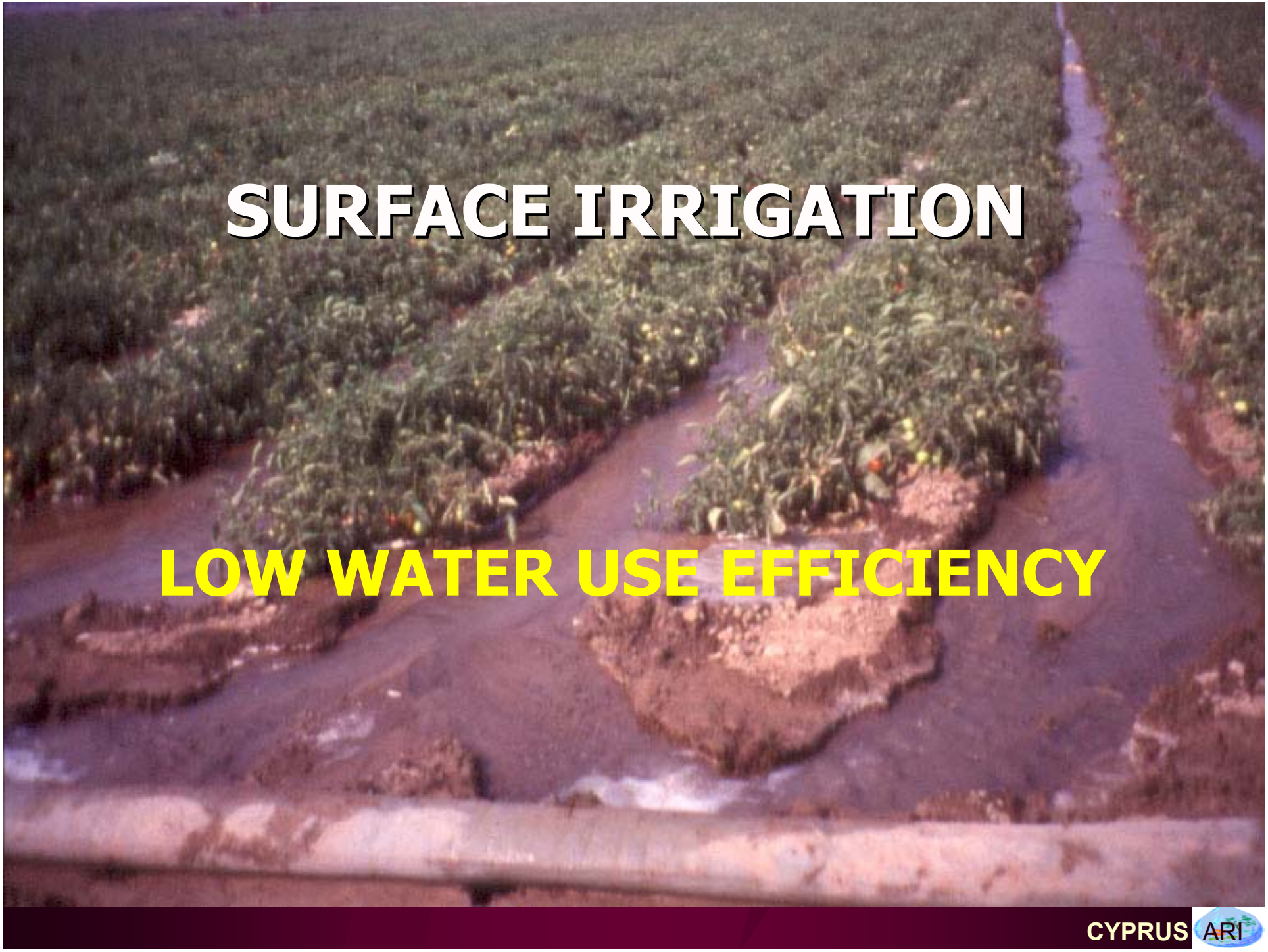
WATER MANAGEMENT IN AGRICULTURE IS A KEY FACTOR FOR CONSERVING WATER

WATER APPLICATION EFFICIENCY




High water use efficiency
Cyprus
ARI

HIGH WATER USE EFFICIENCY


SURFACE IRRIGATION
LOW WATER USE EFFICIENCY

With the lowest possible losses of water produce the optimum

Effective water use

SAVING WATER FROM AGRICULTURE (The main consumer) MEANS MORE WATER FOR OTHER SECTORS

Efficient water use

Always Remember the Environment

Cyprus ari

Strategy to cope with water scarcity

Increase water resources

Use treated wastewater for irrigation

WASTEWTER QUALITY CONSIDERATIONS

Unique in composition

1. **CHEMICAL AND PHYSICOCHEMICAL CHARACTERISTICS AND CONSIDERATIONS**

   - **Salinity**
   - **Alkalinity**
   - **Ion toxicity**
   - **Trace elements and heavy metals**

2. **BIOLOGICAL QUALITY CRITERIA**

WASTEWATER USE and ENVIRONMENT

1. Environmental Benefits

- Conservation of water resources
- Avoidance of discharge to surface waters
- Saving groundwater resources
- Possibility of soil conservation

2. Potential negative environmental Effects

- Spread of pathogens
- Introduction of chemicals and nutrients into susceptible ecosystems

AGRONOMICAL ASPECTS

- Source of nutrients (N,P,K,Mg, micro…..)
- Source of organic matter

Yield of tomato (1995)

N-Treatment gN/m3	Yield (kg/plot)	
	Farm water	Waste water
Nil	83.9d	129.8b
30	114.9c	137.4b
60	111.9c	145.1a
90	135.6b	149.0a

PLANT NUTRIENTS IN WASTEWATER

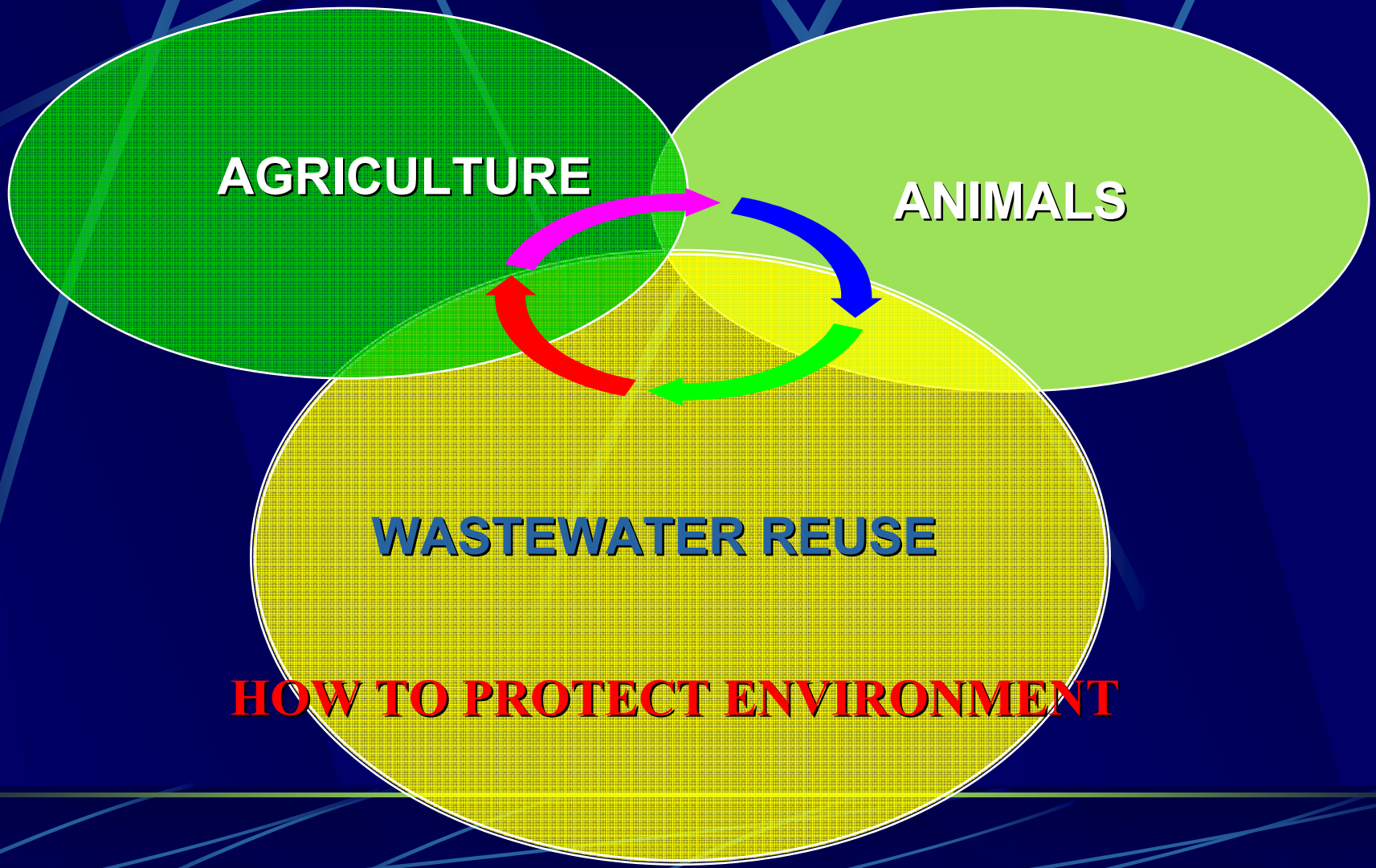
N-Treatment gN/m3	Yield (kg/plot)	
	Farm water	Waste water
Nil	80.2c	127.1a
30	106.7b	126.9a
60	118.2b	127.9a
90	125.3a	128.5a

TREATED WASTEWATER

Is a source for plant nutrients

However, the nutrients if not managed in an appropriate way, may adversely affect the environment

SOURCES OF NITRATES



HOW TO PROTECT ENVIRONMENT

Nitrates in the environment