SESSION I.
Diagnosis and Challenges of Agricultural Water Management in smallholders' traditional irrigation systems in Africa

Flexible water service to improve Agricultural Water Management in small-scale irrigation schemes in Africa

Introducing the diagnostic approaches of assessing Agricultural Water Management in small-scale irrigation schemes in Africa

Fathi Lebdi

FAO/AgWA

OUTLINE

Measures of Agricultural Water Management:

Flexibility on Water Resources Management and Irrigation

Main factors for small scale irrigation systems

Indicators

Modelling of hydraulic characteristics

Measures in the field

OBJECTIVE OF HYDRAULIC WATER SERVICE

“ to meet the plant demand and satisfy the water requirements”

“ to provide the best hydraulic parameters at the entrance of the farm: discharge and water level at quaternary, when it is required “

“ to design the suitable irrigation scheme: from the main canal to the quaternary canal “

“ suitable irrigation scheme: water conveyance and dimensions, maintenance, operation and regulation devices to fit with the operation management, measurement along the system to quantify performances, to arbitrate in case of conflicts between users, and finally to perform water use efficiency”

→ link between Water Productivity and Water Use efficiency is crucial to achieve a flexible water service.

OBJECTIVE OF HYDRAULIC WATER SERVICE

Flexibility of the service is described as:

- The frequency of water delivered at farm level
- The discharge/rate delivered at farm level
- The duration of water delivery at farm level

The improvement of any of the parameters above means improvement of water flexibility service at end user level

All activities at management level are contributions to this water service at farm level and for the end user

INDICATORS OF HYDRAULIC WATER SERVICE

The **indicators** of good flexible water service is quantified by:

- the **impact** of flexibility parameters on crop productivity
  (Parameters of flexibility retained: Frequency; Flow rate; Duration)
- the **reliability** (water service is in time and in expected amount)
- the **equity** for improved social harmony (equity of water distribution),
- the **adequacy** to respond on crop water and system demand

→ Control of discharge from main to the secondary canals, at tertiary and quaternary levels.

In particular, quaternary level plays crucial role by controlling discharge and water level since it is the interface between the farm and the irrigation scheme.

OUTCOMES OF HYDRAULIC WATER SERVICE

Flexibility of water service component is a combination between sub-components:

- Level of the satisfaction of water demand (through the flexibility parameters) requested by crop water productivity
- Conditions of infrastructure and operation and regulation devices, to deliver the service with relevant efficiency
- Existing water operation rule for fixed rotation or arranged rotation to match the water distribution and farmers' behavior
- Availability of water resources to answer the demand requested

CHARACTERISTICS OF HYDRAULIC WATER SERVICE

Some of the sub-components are stochastic

- Water requirement for the water productivity level requested
- Availability of water resources

Some of the sub-components are deterministic

- Conditions of infrastructure and operation
- Water operation rule and farmer behavior

COMPUTING FLEXIBLE WATER SERVICE

None Weighted Probability to satisfy 90% (ex.) of the configuration of water demand at end user level, through Flexible water service

=

(Prob of Frequency; Flow rate; Duration, reliability**)**

x

(Prob of efficiency of infrastructure and operation and regulation devices**)**

x

(Prob of water resources availability**)**

x

(Prob of water resources availability**)**

Any improvement of the above probabilities will make the chance of best flexible water service high

COMPUTING FLEXIBLE WATER SERVICE

The modelling of hydraulic characteristics:

1. For each water demand at farm level (final node on the hydraulic network), the demand is identified by the discharge and the water level
2. Aggregation/ disaggregation along the quaternary, tertiary, secondary and the main canal

Step 1: Downstream to upstream: for different scenarios of water demand at farm level

Step 2: Addition of the discharge, and identification of the water level at the selected canal section from the discharge calibration curve for the selected canal, using like for under pressure systems:

Manning Strickler Equation; Froud calculation; flow regime identification;

Head losses evaluation, correction with the efficiency estimation, discharge and energy upstream

Step 3: Upstream to downstream, according to the rotation and to any simulation of rotations:

Step 4: for the discharge available upstream, at the gate of the main canal,

- identification of the discharge and the water level, everywhere where there is flow,
- identification of the service at farm level (discharge, water level at quaternary)

RESULTS IN PILOT AREAS

1- Water Use Efficiency according to Water Productivity requested Service

1.1- Masscote and RAP diagnosis for small scale

1.2- Measurement protocol and weirs construction

1.3- rehabilitation plan design and implementation

1.4- trainings and involvement of end users and operators

1.5- optimal flexible water designed and parameters communicated and agreed with operators, leaders (reliability and equity) and farmers (to respect the new frequency at secondary level, the new farmers groups working for the same time, the new duration and new discharge requested by water productivity team)

RESULTS:

Results of flexible water has in Uganda:

- 6 hours (instead of 4 hours) irrigation

- 18 hours irrigation (instead of 24 hours) and 6 hours free to correct the irrigation scheduling (flexibility)

- compliance with the requested discharge for optimal WP scenario, thanks to the rehabilitation plan

- the same frequency to answer the behavior of farmers and their organization

- Construction of weirs, measurements with Mobile , calibration of weirs, to answer the performances and efficiency of water conveyance and water use and to have answers for equity and for arbitration in case of water scarcity in the peak period

Indirect objective: exit reservoir built by the rehabilitation plan in Burkina Faso

Special thanks for farmers in Africa who believed and implemented our recommended practices on the field