INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE (ICID)
Water secure world free of poverty and hunger through sustainable rural development

ICID Young Professionals e-Forum (IYPeF)

On-farm irrigation efficiency for small scale farming

Background Note for Discussion
15 February - 2 March 2018

Introduction

Concerns about scarcity of water have focused attention on irrigation, the largest water user sector worldwide, which is widely seen as a low-value, wasteful and ''inefficient'' user of water and in times of scarcity we all have a responsibility to use water wisely, efficiently and productively.

The concept of efficiency in irrigation evolved some 70 years ago, following extensive field work in the 1940s, measuring the quantities of water applied to fields compared to the actual evapotranspiration requirement. Israelsen in (1950) defined irrigation efficiency as the ratio of the irrigation water consumed by crops in an irrigated farm to the water diverted from a river or other natural water source. This basic approach to irrigation accounting remained fundamentally unchanged for over 40 years.

A significant change in thinking was endorsed by series of papers, Willardson et al. (1994), Allen et al. (1996, 1997). Willardson and Allen (1998) suggested that the ''classical'' efficiency term was outmoded and, the general thrust of these papers was to divide water diverted to irrigation schemes into the following components:

(a) The consumed fraction (essentially ET), comprising:

- Beneficial consumption (for the purpose intended or other beneficial use such as environmental purposes).
- Non-beneficial consumption such as weeds or resulting from capillary rise during a fallow period).

(b) The non-consumed fraction, comprising:

- Recoverable flows (water flowing to drains and back into the river system for possible diversion downstream, and percolation to freshwater aquifers).
- Non-recoverable flows (percolations to saline aquifers, outflow to drains that have no downstream diversions or direct outflow to the ocean).

This set of ideas adds importance to Israelsen's original concept: first it focuses attention on what is really a 'loss' (non-beneficial ET, and the non-recoverable component of the non-consumed fraction) and action that should be taken to reduce these components in order to improve water use efficiency.

The table below shows some default irrigation system efficiency values:

Irrigation system	Losses				Default system efficiency (net to gross ratio)	
	Non-beneficial spray evaporation and wind drift (%)	In-field conveyance Losses (%)	Filter and minor Losses (%)	Total Losses (%)	Min (%)	Max (%)
Drip (surface and subsurface)	0	0	5	5	90	95
Microspray	10	0	5	15	80	85
Centre Pivot, Linear move	8	0	2	10	80	90
Centre Pivot LEPA	0	0	5	5	85	95
Flood: Piped supply	0	0	5	5	80	95
Flood: Lined canal supplied	0	5	5	10	70	90
Flood: Earth canal supplied	8	0	2	10	75	90
Sprinkler permanent	8	0	2	10	75	90
Sprinkler movable	10	5	2	17	70	83
Traveling gun	15	5	2	22	65	78

By Felix Reinders / ICID News article

From above, the impact of irrigation technologies on consumption, therefore, needs to be quantified- what changes occur in water consumption when areas are converted from traditional techniques to hi-tech drip and sprinkler?

This leads us into the issue of water productivity. If hi-tech irrigation allows the same or higher quantity of (say) grain to be produced while water deliveries are reduced, then there is an apparent increase in bio-physical water productivity (bio-physical water productivity [WP]) when expressed in kg·m−3 delivered. If the water delivered remains constant and the area irrigated increases, then again there is an apparent increase in bio-physical WP. But, if our concern is water saving, we need to measure production per unit of water consumed expressed in kg·m−3 consumed. This figure, especially for field crops (grains, fibre, forage, sugarcane) is widely reported in the literature to be “conservative” – in other words for a given crop and given agro-climatic conditions, the relationship between water consumed and crop production is linear. The important implication of this relationship is that if yield per unit area increases, then it is likely that water consumption also increases.

Objectives

The e-discussion on the topic “On-farm irrigation efficiency for small scale farming” has the following objectives:

1. Bring young professionals (YPs) in contact with the experts in the field;
2. Expose YPs to new accounting terms and allow a clearer definition of the issues and options faced in irrigated agriculture;

3. Highlight the views of YPs in Irrigation and Drainage regarding on-farm irrigation systems and their efficiency in use; and
4. Discuss the issues of water productivity and water saving

Expected outcomes

It is intended that the IYPeF e-discussion will explore answers to the following questions:

1. What activities should be taken up by YPs to increase the awareness of farmers to minimize water wastage leading to low water use efficiency (WUE)?
2. How the on-farm irrigation system efficiency is rated in a farming system and what appropriate measures can be suggested to improve it?
3. How to encourage use of modern irrigation technology as a basic solution to improve WUE?
4. How to improve the productivity of water?

Discussion mentor

- Er. Felix B. Reinders, President, International Commission on Irrigation and Drainage (ICID), South Africa, as discussion mentor.

Discussion coordinator

- Mr. Rafat N. Abdul Ghani, Water Engineer, General Authority for Operation of Irrigation and Drainage projects, Ministry of Water Resources, Iraq, as discussion coordinator.

Reference

Does improved irrigation technology save water? (Chris Perry, FAO Consultant); A discussion paper of FAO on irrigation and sustainable water resources management in the Near East and North Africa, published in 2017.

Efficient Irrigation; Inefficient Communication; Flawed Recommendations' by Chris Perry (UK), published in Irrigation and Drainage Journal, Volume 56, Issue 4, October 2007.

ICID News article titled 'Improve Performance of Irrigation by Applying A Water Balance", VPH Felix Reinders (South Africa), published in ICID News 2017 (First Quarter).

❖❖❖❖❖