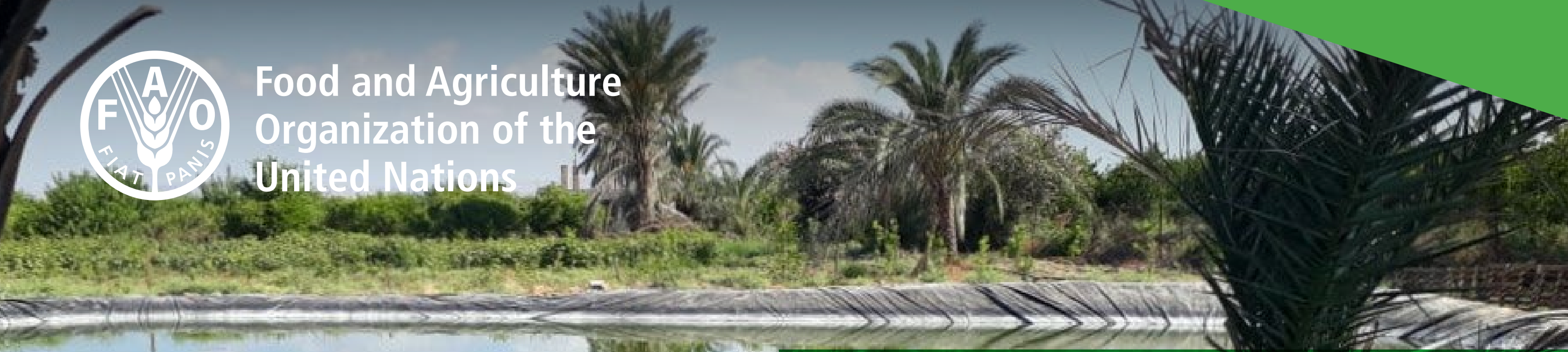


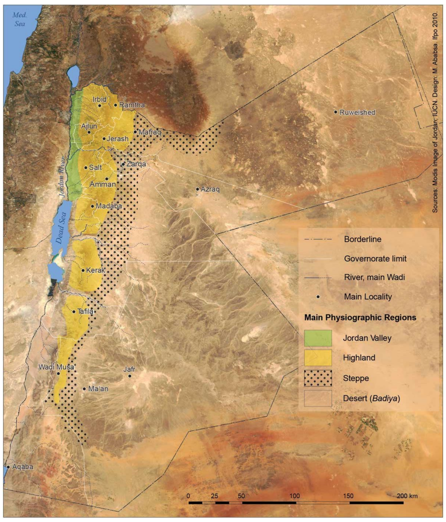
Boost your crop water productivity in selected farming systems: assess and adapt

Water productivity baseline assessment *in Jordan*

Setting the context - Jordan's geography and climate

Jordan is one of the most water scarce countries in the world. Jordan covers an area of about 89 000 km² with a mostly Mediterranean climate (arid to semi-arid), with three main climatic and geographic zones: the highlands, Jordan Valley, and the eastern desert. The highlands (600–1 500 MASL) extend from the northern to the southern part of the country and separate the Jordan Valley from the desert. The northern and central parts of the highlands are characterized by a hot dry summer and a cold wet winter, receiving the highest amounts of precipitation in the country (300–600 mm per year). The Jordan Valley (200–400 MBSL) extends along the western part of the country and is the most fertile area in Jordan. The climate is arid with a hot dry summer, a warm winter and an average precipitation of less than 200 mm per year. The eastern desert (0–900 MASL) covers around 80 percent of the country and receives an average precipitation of less than 150 mm per year. Agriculture consumes around 52 percent of the water withdrawn in the country. While the demand on water is continuously increasing and exceeding the available supply, it is necessary to add always more value to any drop of water. This could be achieved through assessing and improving water productivity.

Figure 1. Jordan main physiographic regions



Source: Al-Bilbisi (2013). https://books.openedition.org/ifpo/docannexe/image/4859/img-2.jpg

Water productivity (WP)

- WP is broadly defined as the ratio of the outputs obtained from crops to the amount of water used to produce those outputs. WP can be expressed in biophysical terms (for example, yields in kg per m³), economical terms (for example, dollars per m³) or social terms (for example, employment per m³). The amount of water used can be expressed in terms of the amount of water supplied, or consumed as evapotranspiration or transpiration.

Studying WP – why it is important

- In water scarcity situations such as in Jordan, WP provides a measure of the efficiency of water usage in agriculture.
- WP allows assessing the benefits produced from water and allows evaluating the impact of interventions on the value of water.
- WP helps identify the best allocation for agricultural water among different agricultural uses.
- Enhancing WP especially in poorer countries and those with limited water resources can help produce more food and more income per unit of water.

WP baseline assessment - objectives

- Providing a comprehensive review for WP studies conducted in Jordan and about the methods used to assess it in order to establish a reference point or benchmark for future analyses and projects;
- Studying the status of WP for crops and cultivated areas in Jordan and understanding what is still needed to further assess WP in Jordan;
- Identifying the opportunities to enhance WP, identifying the available options (interventions) to improve WP, and identifying the challenges and factors that affect WP.

Methods used to conduct the WP baseline assessment

- Collecting and analyzing all available works and data related to WP for crops and cultivated areas in Jordan. An extensive literature review was used (around 25 documents).

Main results of the WP baseline assessment

Interventions improved WP

In the past 20 years, agricultural productivity in Jordan has increased, despite the sector's major water resource constraints, due to several interventions such as:

- Converting from surface irrigation to drip irrigation (around 85 percent of the irrigated lands are currently under drip irrigation).
- Growing crops in controlled environments (large plastic tunnels).
- Allocating specific water amounts to different crops and farms.
- Converting the secondary open canal schemes into pressurized pipes.
- Introducing new, more adapted varieties.
- Establishing water users associations for farmers.

WP works

- Studies related to WP for crops and cultivated areas in Jordan are limited.
- Most studies related to WP focused on the Jordan Valley while only a few studies have been conducted in the highlands and deserts.
- Most studies presented individual or few crops and locations while fewer studies addressed several crops and locations.
- The crop water productivity in Jordan was dominantly assessed as economic water productivity (either $ per m^3 or JD per m^3), while much less as bio-physical water productivity (kg per m^3).
- Studies in Jordan also considered the impact of several factors on WP such as deficit irrigation, fertilizer application, irrigation system types and performance, water quality, soil quality, drought impact, location, and growing season.

Current WP status in Jordan

- The Jordan Valley, which represents the largest irrigated area of the country, has a weighted average WP of 0.85 JD per m^3, followed by the cultivated areas of the highlands with a WP of 0.36 JD per m^3. The desert area, instead, has the arid agriculture with the lowest WP value.
- Within the Jordan Valley there are WP differences among the southern, central and northern zones, with the highest values in the center of the Valley (around 1.1 JD per m^3) and the lowest value in the northern part (around 0.79 JD per m^3). This variability is mostly due to the type of crops cultivated in these three zones. Citrus is dominant in the north Jordan Valley while vegetables, some grown under plastic tunnels, are dominant in the center and south Jordan Valley. Citrus has an average WP of around 0.7 JD per m^3 while winter vegetables have an average WP of around 1.3 JD per m^3.

The sources of uncertainties in WP

The compilation of studies and the collected data allowed for the estimation of WP of different crops and in different locations in Jordan which are summarized above. The studies, however, are subject to a number of uncertainties, such as:

- Lack of data on the actual water consumed. WP studies, therefore, have used either the estimated (theoretical) water requirements, or the allocated or delivered water, with or without adjustment for rainfall.
- Lack of data on crop management and on the actual yield amounts.
- The economic crop water productivity ($ per m^3) assessment adds several confounding effects (e.g., market price variability, variable costs of production, currency devaluation, etc.)
- The economic WP assessment is also affected by the kind of costs considered. Some cases consider both variable and fixed costs while other cases consider only the variable costs.
- The limited availability of biophysical WP prevents a more robust relationship between crop yields and field management practices, and therefore to identify the types of interventions that can increase WP and that are under the control of the farmers.

Despite several constrains (e.g. economic, water and land), there are opportunities to increase WP through:

- Adopting good farming practices. For example, improving the performance of the irrigation systems and scheduling. The studies showed that the irrigation systems in the Jordan Valley have low performance.
- Growing high value crops. There are some promising crops with high economic WP values, such as strawberries, Brussels sprouts, ginger, celery, leek, and broccoli, but they are still grown on a small scale.
- Other interventions are also helpful (for example, using advanced technologies, modifying crop patterns, re-allocating water, etc..) but need high level planning and regulations.

What is needed?

- Developing a standardized approach for assessing crop water productivity, accounting for the sources of variability. WP would be normalized for some sources of variability (e.g., climate and market prices).
- Paying more focus on the bio-physical water productivity (kg per m^3) as it is the driving force to enhance the economic WP.

CAPACITY BUILDING NEEDS

- Dissemination of the concept and the importance of water productivity, including the tools and the methodology of assessing WP.
- Small-scale and large-scale interventions to improve WP including technical, policies and regulations.
- Improving farmers' skills to adopt good farming practices.

Figure 2: Large plastic tunnels

Figure 3. Pressurized pies of the secondary collective network

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Al-Bilbisi. H. Topography and Morphology In : Atlas of Jordan : History, Territories and Society [en ligne]. Beyrouth : Presses de l'Ifpo, 2013 (généré le 04 juin 2022). Disponible sur Internet : <http://books.openedition.org/ifpo/4859>. ISBN : 9782351594384. DOI : https://doi.org/10.4000/books.ifpo.4859.

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