Evaluation of Water Delivery Performance in Tertiary Canal
-A Case Study of Irrigation Improvement Project in Egypt-

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1. Introduction

Egypt's challenges are dealing with the less water resources by applying policies to improve the performance of the water supply system and its development. Irrigation Improvement Project **(IIP)** is one of the most important attempts in Egypt to implement more effective on-farm irrigation technologies for modifying traditional irrigation system and saving water by improving the existing delivery system in the Nile Delta with a total area of about 1.05 million ha by 2017.

This study aims to evaluate the IIP and its impact on water delivery performance by farmer's practices in their farm. This study was carried out to evaluate the improved irrigation system of tertiary canal (Meska) by comparing with other unimproved system through irrigation seasons of 2003 and 2004 in Wasat command area **(Fig.1)**. This area is located on the northern edge of the middle Delta and extends from the outskirts of the city Kafr El-Sheikh to the edge of the irrigated area bordering Lake Burullus. This area is fed from the tail reaches of the main canal (Meet Yazid). Due to its location at the tail of the feeder canal system, El-Wasat command area suffers from inadequate water supplies. This problem is exacerbated by the tendency of farmers to plant more paddy rice areas than the area that government allowed.

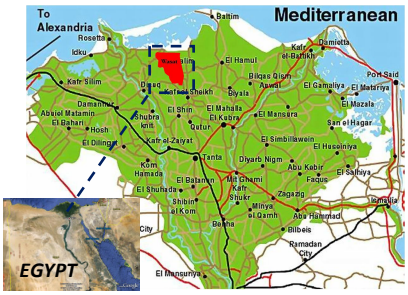

Fig. 1 Study area in the Nile Delta of Egypt

2. The Sample study area

In the sample study **(Fig.2)**, two sample branch canals Daqalt and Basis were selected for evaluation. The former is improved and the latter is unimproved branch canals. Six tertiary canals were selected on each branch canal and six fields were selected at each tertiary canal. A set of performance indicators have been employed for evaluation. This evaluation concerns on the performance of water delivery in the old lands in the Nile Delta after the introduction of some elements for the development such as; applying continuous flow in branch canal and converting from the plural lifting points to single lifting point in tertiary canal.

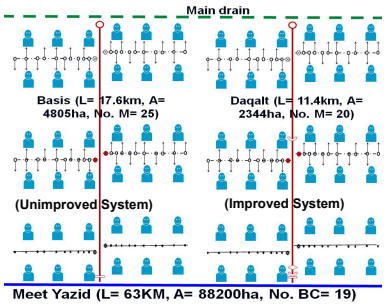

Fig. 2 The study sample in Wasat area

3. Data analysis

The data of the selected meskas and fields were collected in four sheets, which are: (i) *Calibration Sheet*: it describes the pump characteristics in lifting point, (ii) *Pump Operation Sheet:* it describes the pump operation in lifting point, (iii) *Irrigation Time Sheet*: it describes the irrigation time for selected fields in each meska, and (iv) *Cropping Pattern Sheet*: it describes the cropping pattern for selected meskas and fields.

The calculation of total amount of pumped water and total water requirement are concerned to the entire meska for improved system, while in unimproved system, they are concerned to the entire selected field. For improved meskas in Daqalt canal **(Fig.3)**, the water supply is stable in summer seasons and it is higher than winter seasons due to heavier planting ratio of paddy rice more than 50%. While the water requirement is decreasing in the following summer season and vice versa in winter season. For unimproved meskas in Basis canal **(Fig.4),** the water supply in the tail location is higher than the other locations of fields due to delivery of the water from the drainage canal through the irrigation seasons, while the water requirement is decreasing in the following irrigation seasons. However, there are clear water shortages through irrigation seasons for both branch canals.

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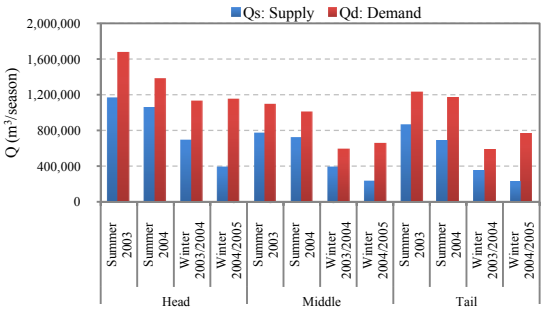

Fig. 3 Q_S and Q_d for improved meska in Daqalt canal

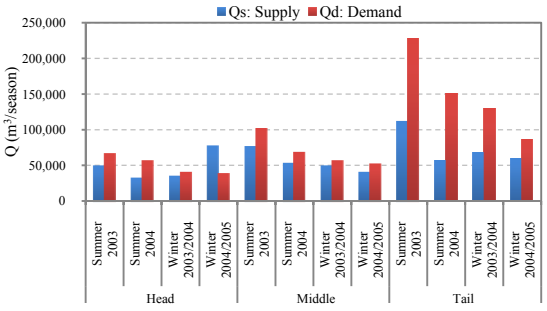

Fig. 4 Q_S and Q_d for unimproved meska in Basis canal

4. Performance assessment

4.1. Water delivery performance of system

Adequacy, efficiency, equity, and dependability of water delivery were measured by using four indicators that were proposed by Molden and Gates (1990). For tertiary canals system in both branch canals, the performance of water delivery was evaluated as "poor" in adequacy and dependability, while "good" in efficiency for both branch canals, "good" and "fair" in equity for Daqalt and Basis canals, respectively. On field level in both branch canals, the performance of water delivery was evaluated as "poor" in adequacy and dependability, "good" in efficiency, and "fair" in equity through all irrigation seasons. The results of performance indicators are the same situation between the meskas and fields in both of the branch canals. However, the performance of the improved system is almost equal and stable for all locations through irrigation seasons. The reasons for water delivery problem are; (i) the absence of crop production planning among the farmers, (ii) no water delivery plan among the fields, especially in unimproved system; and (iii) relatively small field capacity as compared with irrigation demand in the study area.

4.2. Irrigation hours per unit area

From **Fig.5**, the irrigation hours per unit area for main crops in Daqalt canal are lower than in Basis canal for all meskas locations through irrigation seasons. In summer season, the average irrigation hours to the improved field is about 40% to 70% of unimproved one, and 60% to 80% in winter season. This is due to irregular irrigation time among the farmers in improved meska and commitment of the operation schedule by water user associations (WUA) through improved meska, and improved fields by their intake.

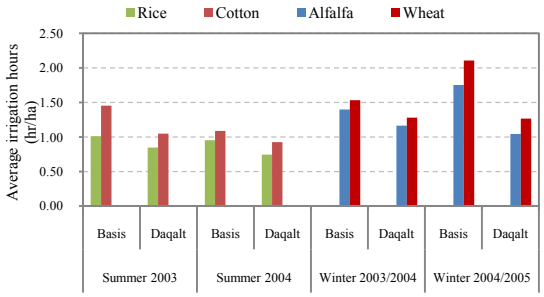

Fig. 5 Average irrigation hours per unit area for irrigation seasons

4.3. Incidence of night irrigation

Fig.6 shows cumulative hours and frequancy of night irrigation for fields in both branch canals. There is night irrigation during summer seasons that are higher than winter seasons due to heavier planting ratio of paddy rice. More fields that need to night irrigation are located at tail end and this is ordinary case because these locations faced to water deficit in most of the time during irrigation seasons in both systems. The average irrigation hours of night irrigation for improved fields are 2 hours while 3.5 hours for unimproved fields.

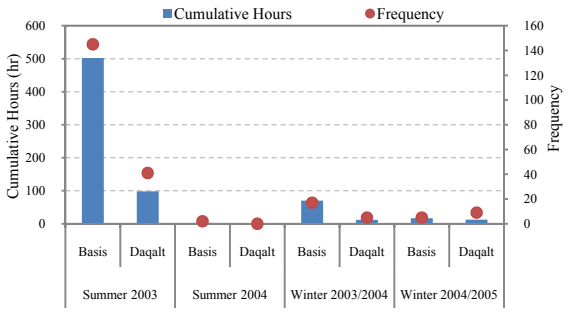

Fig. 6 Cumulative hours and frequency of night irrigation

5. Conclusions

Based on the evaluation of indicators including four performance indicators in this study, it can be concluded that IIP has a positive effect on farmers' practices in their farm. The equity of water distribution among different locations in improved system was slightly better than that in unimproved system. Frequency and hours of irrigation were less in the improved system compared to the unimproved one.

Reference

Molden, D.J., Gates, T.K., 1990. Performance measures for evaluation of irrigation water delivery systems. J. Irrig. Drain. Eng. 116 (6), 804-823.