Effective Management of On - Farm Irrigation for some Major Crops in Egypt using CropWat model

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Abstract

Eight field trials performed for main crops (wheat and maize) during successive two winter and summer seasons 2013- 2015 in two agro-climatic zones in Egypt namely, Giza (Middle Egypt) and Shandaweel (Upper Egypt).

The present study aims at improving water management in on-farm using CropWat model. Irrigation scheduling scenarios (15 treatments) in addition the control treatment have been studied. The irrigation scheduling criteria included irrigation timing (irrigation at fixed interval days) and application depths (fixed depths, mm). The control treatment define “optimal” irrigation where the irrigation intervals are at a maximum whilst avoiding any crop stress.

Results indicated that elongate the period between irrigation with adding less water amounts led to save more water but caused a substantial decrease in the productivity of the crop. On the other hand, shortening the period between irrigation with the addition of large amounts of water resulted in loss of large amounts of water without benefit. The results confirmed that the best scenario that can be applied to get higher yield out of the water unit for wheat crop are (25 days + 50 mm). This scenario led to saving irrigation water by 116 m^3/ ha at Giza ; 249 m^3/ ha at Shandaweel comparing to traditional farmer practice (control treatment).

With application this scenario at large scale, the average potential water saving of applied water in wheat cultivated area (1.3 million ha) would be about 260 $M.m^3$. This amount is sufficient to irrigate an area of wheat about 50,000 hectares of wheat..

Results added that the best scenario that can maximize the amount of water added to maize crop in the two sites under study is (12 days + 80 mm), where it led to saving irrigation applied water 549 m^3/ ha at Giza, 571 m^3/ ha at Shandaweel. The potential average applied water that can be saved at the level of the total area planted with maize

could be 0.5 BCM. This amount can be sufficient to irrigate a new agricultural area of maize 60,000 hectares.

Introduction

Irrigation in arid areas of the world provides two essential agricultural requirements: (1) a moisture supply for plant growth which also transports essential nutrients; and (2) a flow of water to leach or dilute salts in the soil. Irrigation also benefits croplands through cooling the soil and the atmosphere to create a more favourable environment for plant growth.

The method, frequency and duration of irrigations have significant effects on crop yield and farm productivity. For example, annual crops may not germinate when the surface is inundated causing a crust to form over the seed bed. After emergence, inadequate soil moisture can often reduce yields, particularly if the stress occurs during critical periods. Even though the most important objective of irrigation is to maintain the soil moisture reservoir, how this is accomplished is an important consideration. The technology of irrigation is more complex than many appreciate. It is important that the scope of irrigation science not be limited to diversion and conveyance systems, nor solely to the irrigated field, nor only to the drainage pathways. Irrigation is a system extending across many technical and non-technical disciplines. It only works efficiently and continually when all the components are integrated smoothly.
(http://www.fao.org/docrep/t0231e/t0231e03.htm).

Prediction methods for crop water requirements are used owing to the difficulty of obtaining accurate field measurements. The methods often need to be applied under climatic and agronomic conditions which are very different from those under which they were originally developed. Testing the accuracy of the methods under a new set of conditions is laborious, time-consuming and costly, and yet crop water requirement data are frequently needed at short notice for project planning (FAO 1977).

Mismatch between available water supplies and crop water requirements both, in terms of quantity and timing are a major cause of low water use efficiency in canal irrigated areas in India. FAO CROPWAT model adequately predicts the effects of water stress on yield. The applicability of the model was studied with the help of operating schedule data of a small *Noorpur* distributary of Western *Yamuna* Canal system. The expected yields of wheat under different sowing dates, during a large period of sowing followed by farmers in north Indian Plains (First week of November to third week of January), were estimated corresponding to the most probable canal operation schedule. Third week of November was found to be the optimal sowing period for wheat. This paper concludes that CROPWAT is a powerful tool to simulate different crop water need scenarios under different planting dates and thus enables the user to select most optimal sowing date to realize higher yields and water use efficiencies by matching the probable canal water supplies with crop needs. (www.irrigationtoolbox.comirrigationtoolbox.com,PDF. Dr.T.B.S. Rajput and Neelam Patel Water Technology Centre, IARI, New Delhi –110 012, India)

FAO (2002) indicated that the great challenge for the coming decades will therefore be the task of increasing food production with less water, particularly in countries with limited water and land resources. Water productivity for food production was a major issue at the Second World Water Forum convened in March 2000 by the World Water Council in The Hague, the Netherlands, where a vision of progress towards water security was presented and an action framework for achieving this was developed. One of its main targets was defined as the need to increase water productivity for food production from rainfed and irrigated agriculture by 30 percent by 2015.

The aim of the present investigation is to improve water management in on-farm using CropWat model. The study also aims to identify the best scenarios that result in saving irrigation water without clear deficiency in crop productivity or **more crop per drop**.

Materials and Methods

In the present study CROPWAT4 (Windows4.3, Derek et al. 1998) was used under different agro-climatic zones of Middle Egypt (represented by Giza site) and Upper Egypt (represented by Shandaweel site).

CROPWAT for windows is a program that uses the FAO (1992) Penman-Monteith methods for calculating reference crop evapotranspiration. These estimates are used in crop water requirements and irrigation scheduling calculations. The methods supersede the older FAO 24 procedures published in 1977 which are no longer recommended as they overestimate evapotranspiration. This model has been used to simulate yield reduction percentage as a result of the decrease in evapotranspiration. The basic calculation procedure in this empirical model is:

$$(Ya / Ym) = Ky\,(1 - ETa / ETm)$$

Where: Ya = actual harvested yield

Ym = maximum harvested yield

Ky = yield response factor

ETa = actual evapotranspiration

ETm = maximum evapotranspiration

The relationship between crop yield and water supply can be determined when crop water requirements and crop water deficits on the one hand and maximum and actual crop yield on the other can be quantified. Water deficits in crops, and the resulting water stress on the plant, have an effect on crop evapotranspiration and crop yield. Water stress in the plant can be quantified by the rate of actual evapotranspiration (Eta) in relation to the rate of maximum evapotranspiration (Etm). When crop water requirements are fully met from available water supply then Eta = Etm; when water supply is insufficient, Eta < Etm. To evaluate the effect of plant water stress on yield decrease through the quantification of relative evapotranspiration (Eta/Etm), an analysis of research results shows that it is possible to determine relative yield losses if information is available on actual yield (Ya) in relation to maximum yield (Ym) under different water supply regimes. Where economic conditions do not restrict production, and in a constraint-free environment, Ya = Ym when full water requirements are met; when full water requirements are not met available water supply, Ya < Ym (FAO 1979).

Field trials:

Eight field trials were carried out through 2013 to 2015 at Giza (Lat. 30.03, Long. 31.13 and Elev. 19 m) and Shandaweel (Lat. 30.03, Long. 31.13 and Elev. 19 m) sites to collect all necessary data for the model.

Climatic data

Average monthly weather data during two successive seasons for wheat (2013/ 14 and 2014/ 15) and maize (2014 and 2015) were collected from (Egyptian Meteorological Authority "EMA" and Central Laboratory for Agricultural Climate "CLAC"). Weather data included maximum and minimum temperature, relative humidity, wind speed and actual sunshine hours. Figs. 1 – 4 shows values of reference evapotranspiration (ETo) calculated by CropWat of the two sites under study.

Fig. 1: References evapotranspiration (ETo) during 1st winter season (2013/ 14) at Giza and Shandawee sites

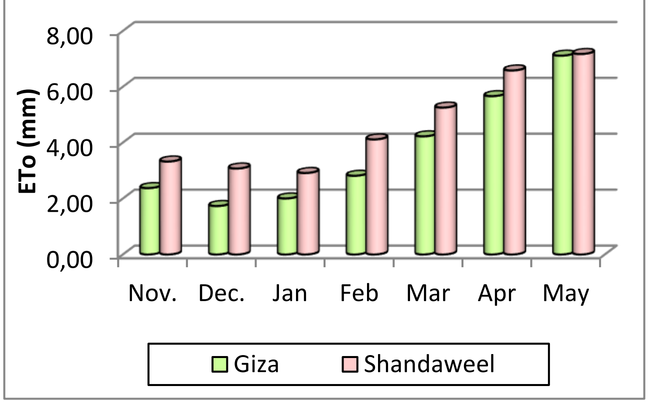


Fig. 2: References evapotranspiration (ETo) during 2nd winter season (2014/ 15) at Giza and Shandawee sites

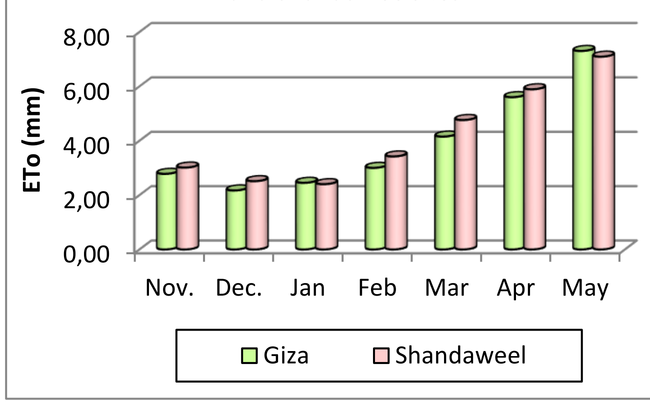


Fig. 3: References evapotranspiration (ETo) during 1st summer season (2014) at Giza and Shandawee sites

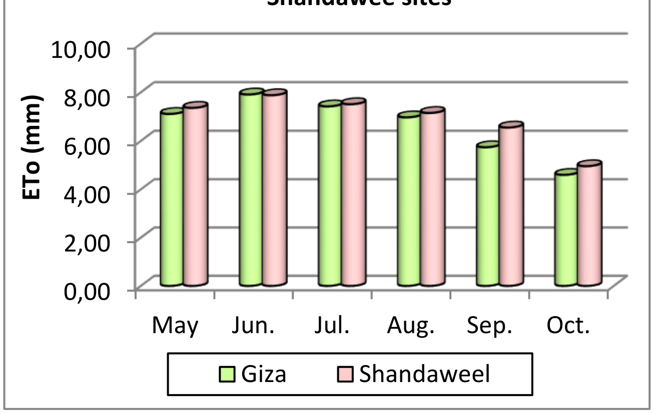
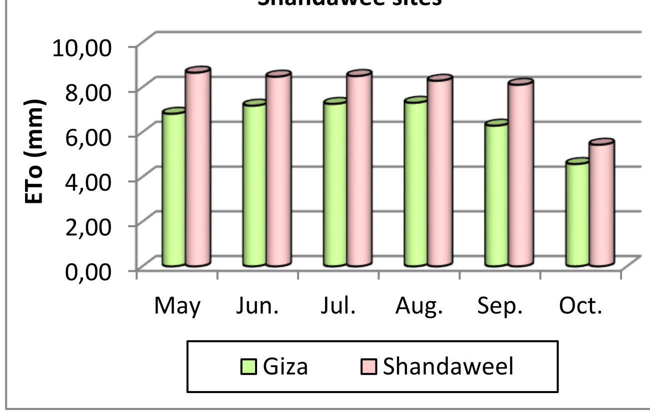


Fig. 4: References evapotranspiration (ETo) during 2nd summer season (2015) at Giza and Shandawee sites



Tested crops and sowing date:

Wheat and maize were selected in this study because they are major crops in Egypt and the national production is insufficient, so annual high rates are imported.

Wheat crop (Giza168 CV.) was sown on 26th Nov. at Giza and 28th Nov. at Shandaweel. Harvest date was on 30th April in both sites.

Maize crop (SC10 CV.) was sown on 15th May in the two sites and harvest date was on 16th September at Giza and 9th September at Shandaweel.

Simulations

To achieve the research objectives, 15 irrigation scheduling scenarios in addition the control treatment have been proposed and studied. The irrigation scheduling criteria included **irrigation timing** (irrigation at fixed interval days) and **application depths** (fixed depths, mm).

- **Control treatment** (this treatment define “optimal” irrigation where the irrigation intervals are at a maximum whilst avoiding any crop stress):
    - ❖ Application timing: irrigation when 100 % of readily available moisture occurs
    - ❖ Application depth: refill to 100 % of readily available moisture

- **The 15 irrigation scheduling scenario are:**

I- For wheat crop:

1- 20 days + 40 mm
2- 20 days + 50 mm
3- 20 days + 60 mm
4- 20 days + 70 mm
5- 20 days + 80 mm
6- 25 days + 40 mm
7- 25 days + 50 mm
8- 25 days + 60 mm
9- 25 days + 70 mm
10- 25 days + 80 mm
11- 30 days + 40 mm
12- 30 days + 50 mm
13- 30 days + 60 mm
14- 30 days + 70 mm
15- 30 days + 80 mm

II- For maize crop:

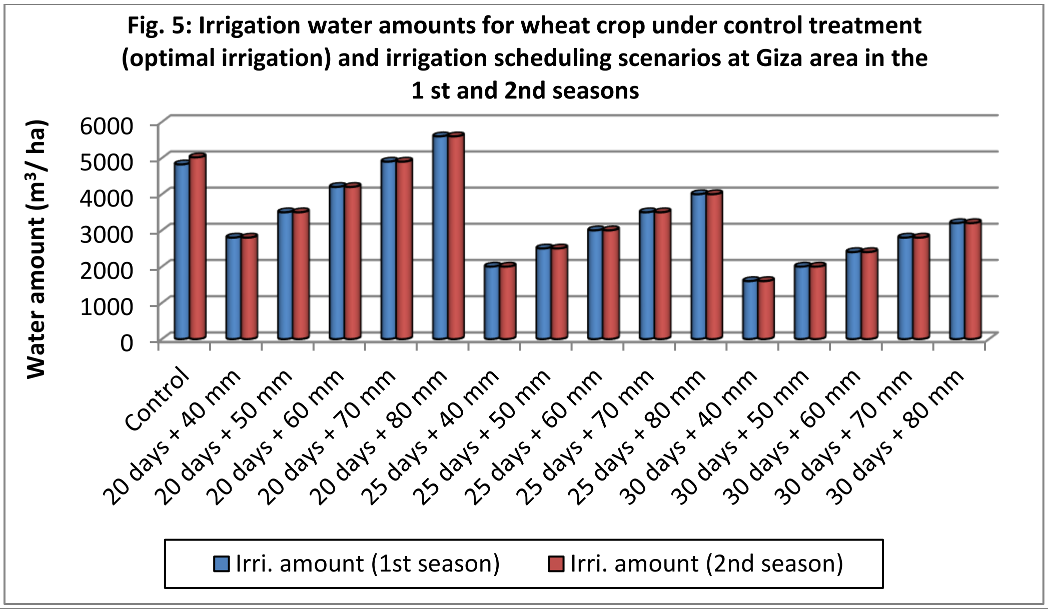
1- 8 days + 50 mm
2- 8 days + 60 mm
3- 8 days + 70 mm
4- 8 days + 80 mm
5- 8 days + 90 mm
6- 12 days + 50 mm
7- 12 days + 60 mm
8- 12 days + 70 mm
9- 12 days + 80 mm
10- 12 days + 90 mm
11- 16 days + 50 mm
12- 16 days + 60 mm
13- 16 days + 70 mm
14- 16 days + 80 mm
15- 16 days + 90 mm

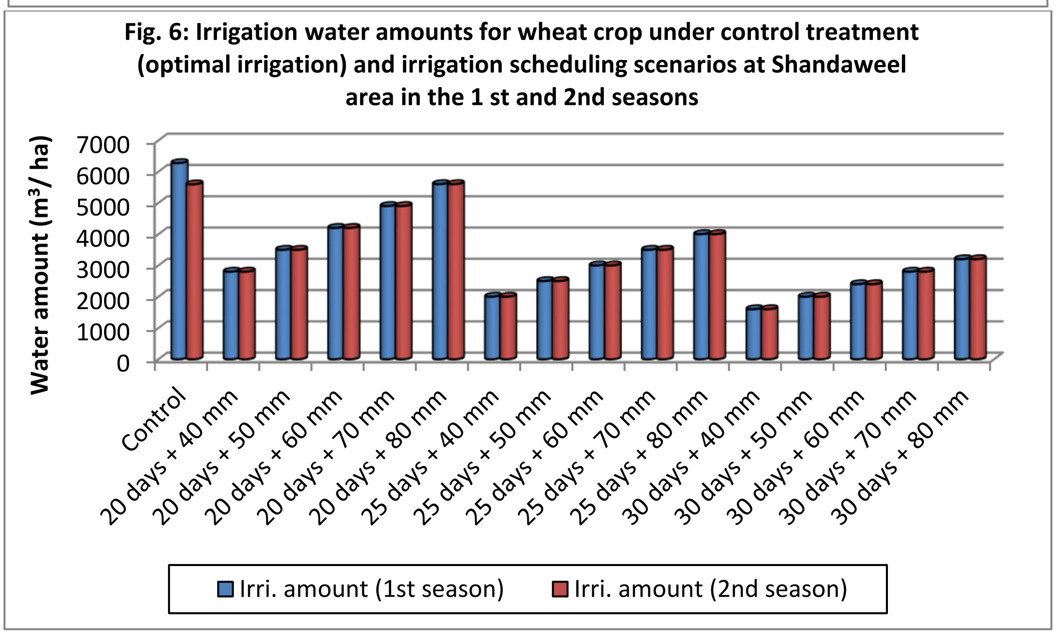
Results and discussion

I. Simulation of irrigation scheduling scenarios on wheat crop

I. 1. Irrigation water amounts for wheat

Results as recorded in Figs. 5 – 6 indicate water amounts for control treatment and the 15 irrigation scenarios under study. Water amount for wheat crop with the control treatment at Giza area was 4824 m^3/ ha in the 1st season and 5019 m^3/ ha in the 2nd season. However, the amounts at Shandaweel area were 6273 and 5594 m^3/ ha in the respective two seasons. On the other hand, the amounts for the 15 scenarios ranged from 1600 – 5600 m^3/ ha.





I. 2. Water consumptive use for wheat

Water consumption for control treatment in the 1st and 2nd seasons were 3859 and 4015 m^3/ ha at Giza ; 5018 and 4475 m^3/ ha at Shandaweel. As for irrigation scenarios, water consumption ranged between 3361 to 4015 m^3/ ha at Giza and between 3941 to 5018 m^3/ ha at Shandaweel. The highest water consumption was found for the scenarios of 20 days + 50mm, 20 days + 60mm, 20 days + 70mm, 20 days + 80mm, 25 days + 60mm, 25 days + 70mm, 25 days + 80mm, 30 days + 80mm at Giza and with the scenarios of 20 days + 60mm, 20 days + 70mm, 20 days + 80mm, 25 days + 80mm at Shandaweel. While, the lowest one was registered for 30 days + 40mm in both areas (see Figs. 7 – 8).

Results clearly show that seasonal water consumption was increased for short irrigation intervals with any irrigation depth. However, under long intervals it was increased with the large irrigation depths. In addition water consumption was increased in the 2nd season as compared with the 1st season at Giza, while, at Shandaweel it takes opposite trend. This may be due to increasing wind speed and low relative humidity and then increase reference evapotranspiration in the second season at Giza. While, in Shandaweel, the large increase in wind speed in the first season resulted in increasing reference evapotranspiration and then increasing water consumption. Generally, seasonal water consumptive use superior at Shandaweel as compared with Giza by 30 and 11 % in the first and second seasons, respectively.

Fig. 7: Water consumption (ET) for wheat crop under control treatment (optimal irrigation) and irrigation scheduling scenarios at Giza area in the two seasons of 2013/ 14 and 2014/ 15

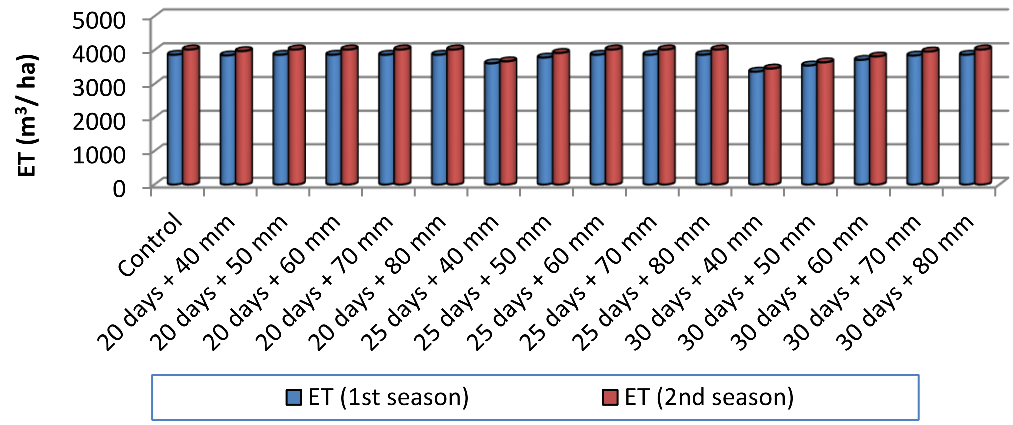
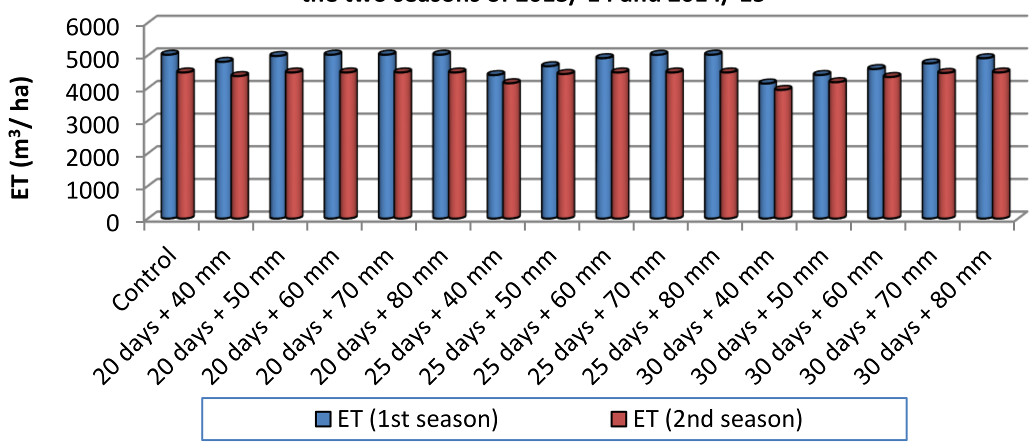


Fig. 8: Water consumption (ET) for wheat crop under control treatment (optimal irrigation) and irrigation scheduling scenarios at Shandaweel area in the two seasons of 2013/ 14 and 2014/ 15



I. 3. Yield reduction for wheat crop under irrigation scenarios

As a result of reducing amount of irrigation water, the water used by crop was less than actually needed, with pronounced effect on the simulated yield reduction percentage. Results as presented in Figs 9 – 10 indicated that the largest yield reduction at Giza area was 7.7 and 8.4 % occurred in the scenario 30 days + 40 mm in the 1st and 2nd seasons respectively. However, at Shandaweel the same scenario registered yield reduction of 10.5 and 6 % in the respective two seasons. This yield reduction is caused by lower water availability or the supply of water does not match the demand.

Fig. 9: Wheat yield reduction (YR) under irrigation scheduling scenarios at Giza area in the two seasons of 2013/ 14 and 2014/ 15

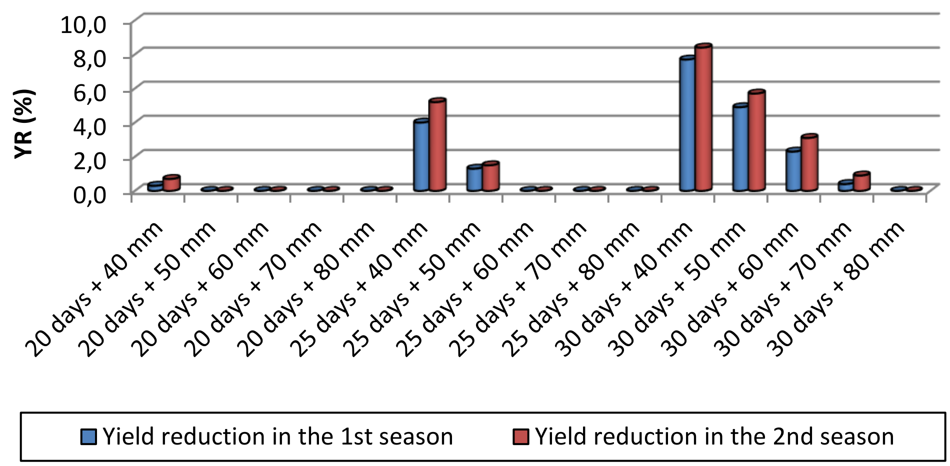
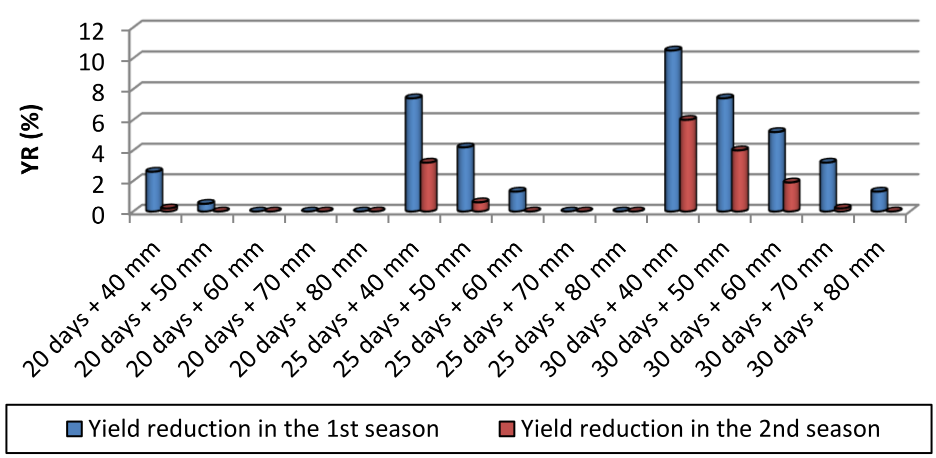


Fig. 10: Wheat yield reduction (YR) under irrigation scheduling scenarios at Shandaweel area in the two seasons of 2013/ 14 and 2014/ 15



In this connection, FAO 2002 indicated that water stress affects crop growth and productivity in many ways. Most of the responses have a negative effect on production but crops have different and often complex mechanisms to react to shortages of water. Several crops and genotypes have developed different degrees of drought tolerance, drought resistance or compensatory growth to deal with periods of stress. The highest crop productivity is achieved for high-yielding varieties with optimal water supply and high soil fertility levels, but under conditions of limited water supply crops will adapt to water stress and can produce well with less water.

I. 4. Amount of water saving for wheat crop under irrigation scenarios

Results as recorded in Figs. 11 – 12 indicated that seven irrigation scheduling scenarios resulted in saving irrigation water at Giza and Shandaweel sites in the two seasons (except Shandaweel in the 1st season). These are 20 days + 40 mm, 25 days + 40 mm, 25 days + 50 mm, 30 days + 40 mm, 30 days + 50 mm, 30 days + 60 mm and 30 days +70 mm. Regarding Shandaweel in the 1st season, all irrigation scheduling scenarios resulted in saving water. The average amount of saving water in the two seasons ranged between 42 – 663 m^3/ ha at Giza; 24 – 885 m^3/ ha at Shandaweel.

Fig. 11: Amount of water saving under irrigation scheduling scenarios (non-optimal irrigation) compared to control treatment (optimal irrigation) at Giza area in the two seasons of 2013/ 14 and 2014/ 15

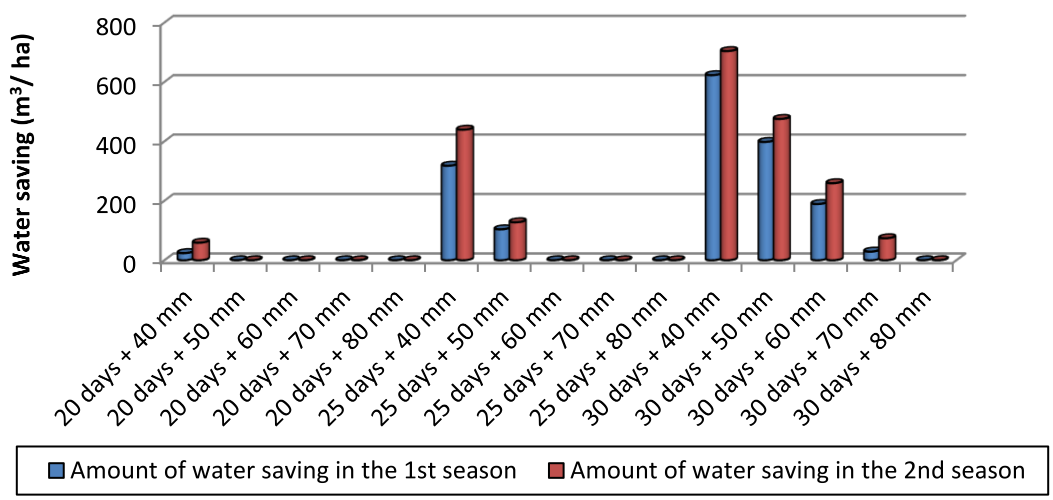
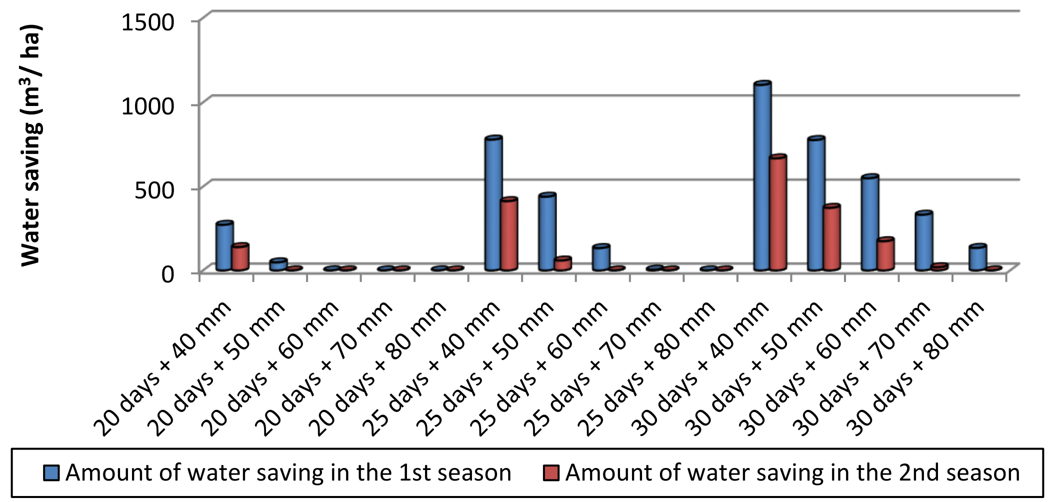


Fig. 12: Amount of water saving under irrigation scheduling scenarios (non-optimal irrigation) compared to control treatment (optimal irrigation) at Shandaweel area in the two seasons of 2013/ 14 and 2014/ 15



Generally, it could be concluded that elongate the period between irrigation with the adding of a few water amounts led to save more of water but caused a substantial decrease in the productivity of the crop. On the other hand, shortening the period between irrigation with the addition of large amounts of water resulted in loss of large amounts of water without benefit. The best scenario can be applied to get the highest benefit from the amount of irrigation water added to wheat crop is (25 days + 50 mm). This scenario can save the amount of irrigation water up to 116 m^3/ ha at Giza (yield reduction less than 2%); 249 m^3/ ha at Shandaweel (yield reduction about 2%).

If we assume that the average saving of irrigation water in the two sites is about 183 m^3/ ha, the savings at the level of the total area planted with wheat (1413750 hectares according to agricultural statistics 2013/2014) will be 258716250 m^3. This amount of water is sufficient to irrigate an area of wheat about 49317 hectares in the old lands (flood irrigation) or 52393 hectares in the new lands (sprinkler irrigation).

II. Simulation of irrigation scheduling scenarios on maize crop

II. 1. Irrigation water amounts for maize

Irrigation water amount for maize with the control treatment at Giza area was 9018 m^3/ ha in the 1st season and 9023 m^3/ ha in the 2nd season. The amounts at Shandaweel were

8679 and 9898 m^3/ ha in the respective two seasons. On the other hand, the amounts for the 15 scenarios ranged from 3500 – 12600 m^3/ ha (see Figs. 13 – 14).

Fig. 13: Irrigation water amounts for maize crop under control treatment (optimal irrigation) and irrigation scheduling scenarios at Giza area in the 1 st and 2nd seasons

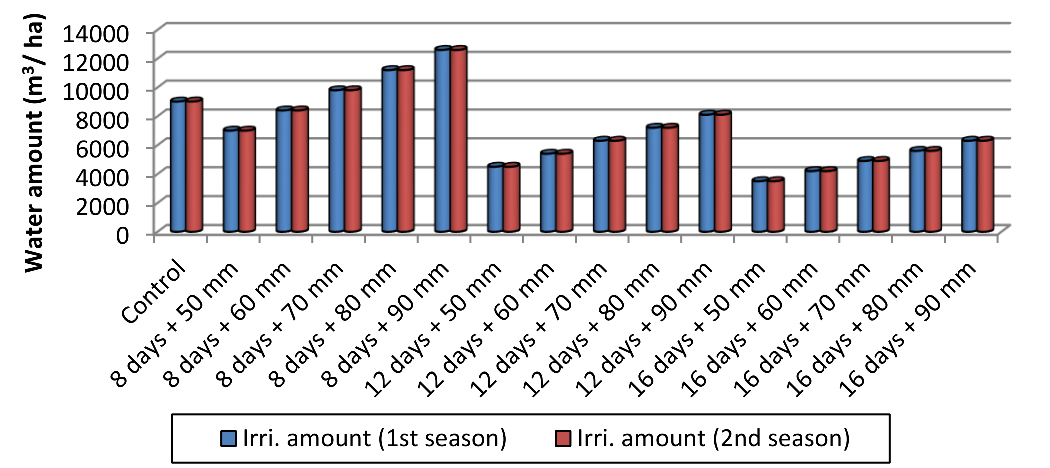
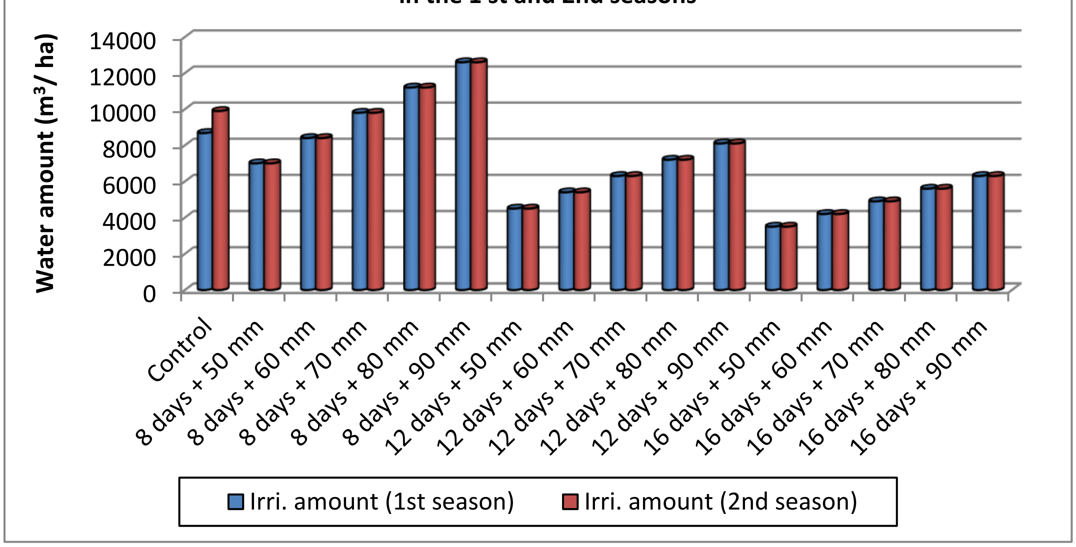


Fig. 14: Irrigation water amounts for maize crop under control treatment (optimal irrigation) and irrigation scheduling scenarios at Shandaweel area in the 1 st and 2nd seasons



II. 2. Water consumptive use for maize

Results as presented in Figs. 15 – 16 illustrated that maize water consumption for control treatment in the 1st and 2nd seasons were 7214 and 7218 m^3/ ha at Giza; 6943 and 7918 m^3/ ha at Shandaweel. Regarding irrigation scenarios, water consumption ranged between 4637 to 7218 m^3/ ha at Giza and between 4812 to 7918 m^3/ ha at Shandaweel. Results added that seasonal water consumption was increased for short irrigation intervals (irrigation each 8 days) with all irrigation depths under study. However, under long intervals (irrigation each 16 days) it was increased with the large irrigation depth (90 mm).

On the other hand, results indicate that water consumption at Giza is almost identical in the first and second season. While at Shandaweel, it is high in second season compared to the first season due to the high temperature, low relative humidity and increasing wind speed and this led to increased reference evapotranspiration and water consumption increased accordingly

Fig. 15: Water consumption (ET) for maize crop under control treatment (optimal irrigation) and irrigation scheduling scenarios at Giza area in the two seasons of 2014 and 2015

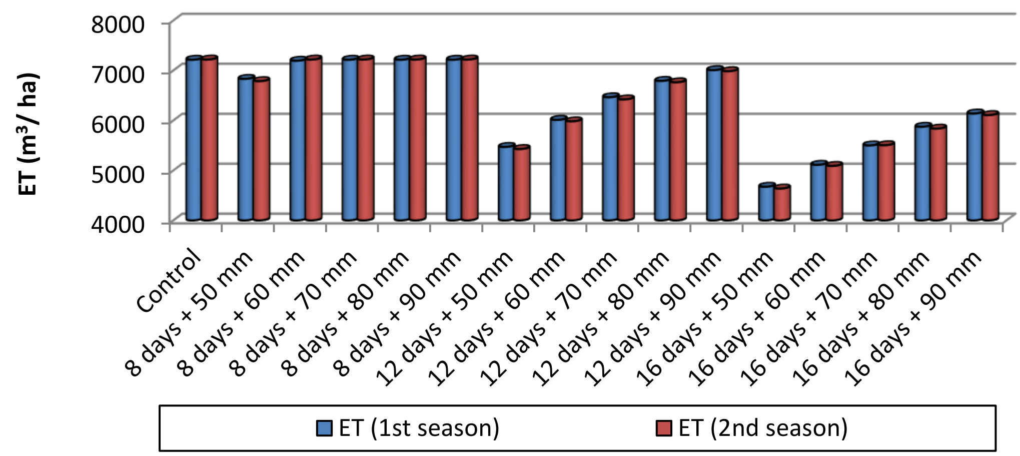
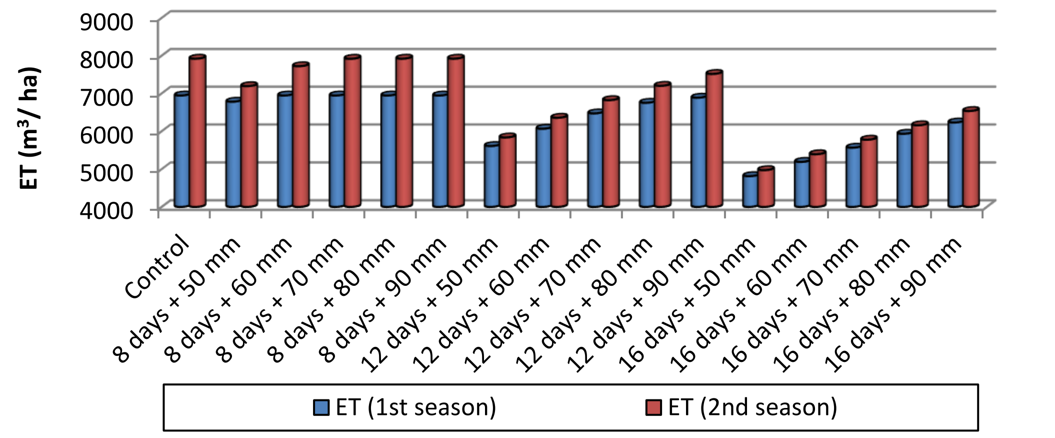


Fig. 16: Water consumption (ET) for maize crop under control treatment (optimal irrigation) and irrigation scheduling scenarios at Shandaweel area in the two seasons of 2014 and 2015



II. 3. Yield reduction for maize crop under irrigation scenarios

Results as shown in Figs. 17 - 18 show that the reduction of maize productivity caused by low irrigation water depth especially under long intervals conditions. Reduction in soil moisture resulted in reduction in evapotranspiration that directly influence the crop yield. The results added that the highest yield reduction happened with the scenarios 12 day + 50 mm, 16 days + 50 mm, 16 days + 60 mm and 16 days + 70 mm where the average decrease in productivity reached about 30 - 45% in the two areas.

Fig. 17: Maize yield reduction (YR) under irrigation scheduling scenarios at Giza area in the two seasons of 2014 and 2015

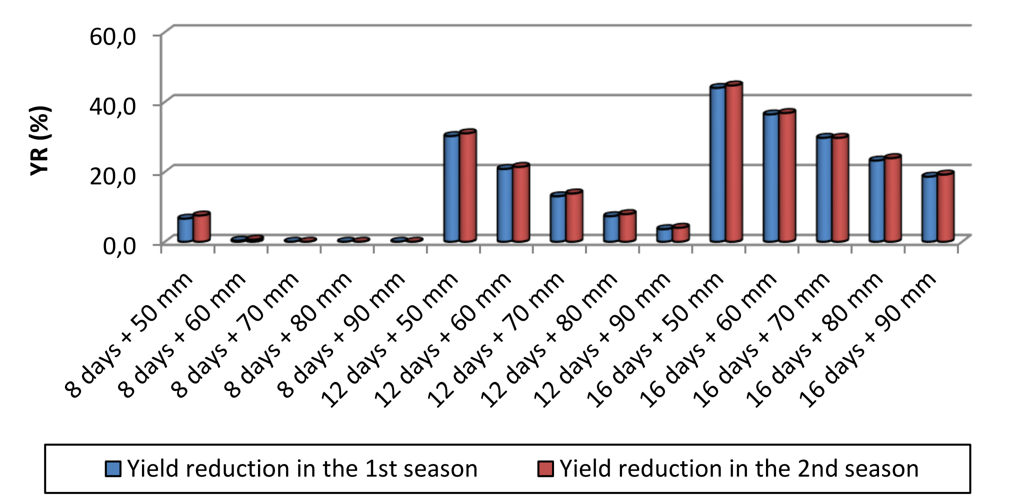
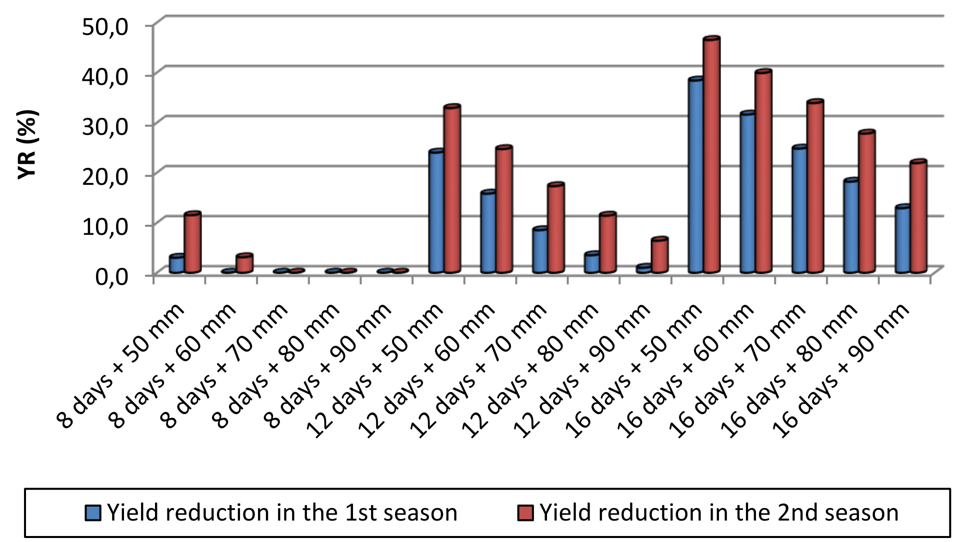


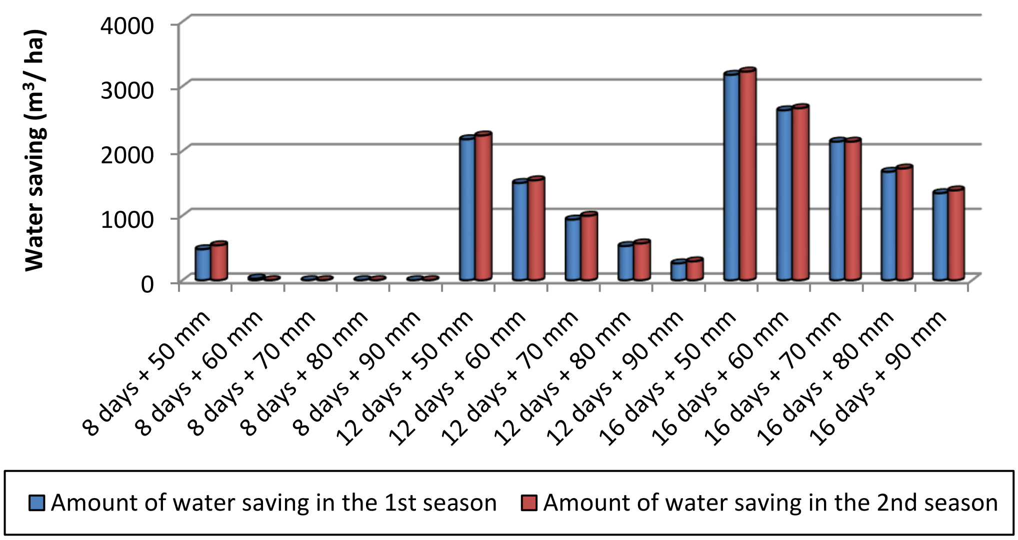
Fig. 18: Maize yield reduction (YR) under irrigation scheduling scenarios at Shandaweel area in the two seasons of 2014 and 2015

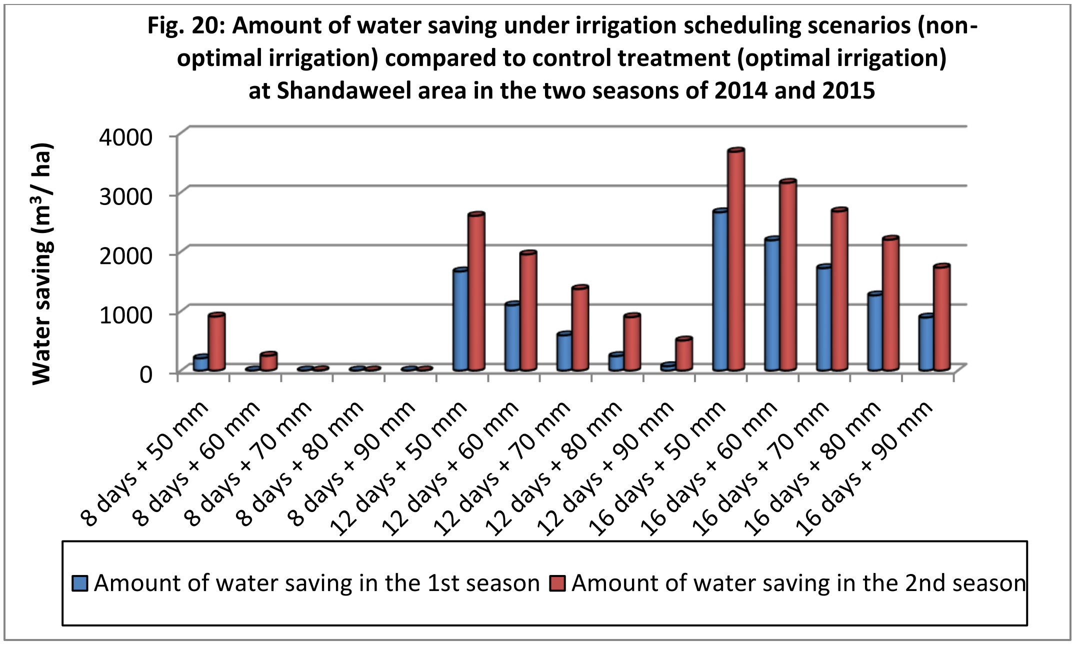


II. 4. Amount of water saving for maize crop under irrigation scenarios

All irrigation scenarios led to saving irrigation water at Giza and Shandaweel sites in the two seasons (except Shandaweel in the 1st season). Saving irrigation water around between 1 – 3227 m^3/ ha at Giza; 1 – 3684 m^3/ ha at Shandaweel (see Figs. 19 – 20).

Fig. 19: Amount of water saving under irrigation scheduling scenarios (non-optimal irrigation) compared to control treatment (optimal irrigation) at Giza area in the two seasons of 2014 and 2015





From the previous maize results it could be concluded that the best scenario that can maximize the amount of water added to maize crop in the two sites under study is (12 days + 80 mm), where it led to saving irrigation water 549 m^3/ at Giza, 571 m^3/ ha at Shandaweel (yield reduction around 7.5 % in the two sites).

If we assume that the average savings of irrigation water in the two sites is about 560 m^3/ ha, the savings at the level of the total area planted with maize (910638 hectares according to agricultural statistics 2014) will be 509957280 m^3. This amount can planted a new agricultural area of maize 59332 hectares in old lands (flood irrigation) or 63043 hectares in new lands (sprinkler irrigation).

Conclusion

Reducing irrigation depth with the long intervals causing sever yield reduction. At the same time, reduce irrigation depth with reducing the intervals between irrigations may not significantly affect the productivity of the crop. Current research aims to study many irrigation scheduling scenarios to reach the best scenarios that maximize the use of the amount of water applied to some main crops in Egypt (wheat and maize).

The results showed that the best scenarios for wheat and maize crops are (25 days + 50 mm) and (12 days + 90 mm), respectively.

These scenarios have led the conservation of natural resources and also saving irrigation water amounts without significant reduction in crop productivity. Such amounts of water can add new agricultural areas of these crops to reduce the gap between production and consumption.

Acknowledgement

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References

Derek, C.; M. Smith and K. El-Askari (1998). "CropWat for Windows". Model for crop water requirements calculation using Penman Monteith method. FAO.

FAO **(Food and Agriculture Organization),** 1977. Guidelines for predicting crop water requirements. Authors, Doorenbos J & Pruitt WO, Irrigation and Drainage Paper 24. Rome, Italy.

FAO **(Food and Agriculture Organization),** 1979. Yield response to water. Authors, Doorenbos J & Kassam AH. Irrigation and Drainage Paper 33. Rome, Italy.

FAO **(Food and Agriculture Organization)**, 1992. CROPWAT, a computer program for irrigation planning and management. Author, Smith M. Irrigation and Drainage Paper 46, Rome, Italy.

FAO **(Food and Agriculture Organization)**, 2002. Water Reports (No. 22). Deficit irrigation practices . ISSN 1020-1203.

www *Irrigationtoolbox.com/ReferenceDocuments/TechnicalPapers/IA/…/036.p…* by TBS Rajput - Cited by 1 - Related articles. *Irrigated Areas using FAO CROPWAT Model*. ***Dr.T.B.S. Rajput and Neelam Patel***.*Water Technology Centre*, *IARI*, *New Delhi –110 012*, *India*. *ABSTRACT*.

الملخص العربى

الادارة الفعالة للرى الحقلى لبعض المحاصيل الرئيسية فى مصر باستخدام نموذج CropWat

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***المركز الدولى للبحوث الزراعية فى المناطق الجافة (ايكاردا) – مصر

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اقيمت 8 تجارب حقلية خلال الفترة 2013-2015 فى منطقتى الجيزة وشندويل لتمثل مناطق مناخية مختلفة فى مصر وذلك بهدف تحسين ادارة الرى الحقلى لبعض المحاصيل الرئيسية فى مصر (القمح والذرة الشامية) . يهدف البحث أيضا الى اختيار أفضل السيناريوهات التى تحقق أقصى استفادة من كمية المياه المضافة للمحاصيل أو بمعنى اخر أفضل محصول بأقل كمية مياه مضافة.

وقد استخدم فى البحث نموذج كروب وات واقترحت عدد من السيناريوهات (15 سيناريو بالإضافة الى معاملة الكنترول) لجدولة الرى من خلال فترات رى فاصلة وكميات مياه مضافة فى كل رية.

وأوضحت النتائج أن أفضل سيناريو لمحصول القمح هو ان تكون فترة الرى الفاصلة 25 يوم وكمية المياه المضافة فى كل رية 50 مم. هذا السيناريو حقق توفير فى مياه الرى حوالى 116 م^3/ هكتار فى الجيزة ، 249 م^3/ هكتار فى شندويل. واذا تم الحساب على اساس المساحة الكلية المنزرعة بالقمح سوف يصل التوفير فى مياه رى هذا المحصول الى ما يزيد عن 0.25 مليار متر مكعب (258716250 م^3). هذه الكمية من المياه تكفى لزراعة مساحات جديدة من القمح تصل الى حوالى 49317 هكتار فى الأراضى القديمة (رى يالغمر) أو 52393 هكتار فى الأراضى الجديدة (رى بالرش).

هذا وقد أضافت النتائج أن أفضل سيناريو لجدولة رى محصول الذرة الشامية هو الرى كل 12 يوم واضافة 80 مم من المياه فى كل رية. هذا السيناريو حقق توفير فى مياه الرى بلغ 549 م^3/ هكتار فى الجيزة ، 571 م^3/ هكتار فى شندويل. واذا تم الحساب على اساس المساحة الكلية المنزرعة بالذرة الشامية فى مصر فان متوسط التوفير فى مياه رى هذا المحصول سوف يصل الى حوالى 0.5 مليار متر مكعب (509957280 م^3). هذه الكمية من المياه يمكنها أن تضيف مساحة زراعية جديدة من الذرة الشامية تصل الى حوالى 59332 هكتار فى الأراضى القديمة (رى يالغمر) أو 63043 هكتار فى الأراضى الجديدة (رى بالرش).