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USING GEOGRAPHIC INFORMATION SYSTEM (GIS) FOR MAPPIN WATER REQUIREMENTS FOR SOME CROPS

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ABSTRACT

A branch canal was selected in El Sefsaf canal command area which located in Sidi Salem district in Kafr El sheikh Governorate (North Delta) for using geography information system (GIS) for mapping cropping pattern and water requirements for winter and summer crops before irrigation improvement and after improving. El Sefsaf canal is an earth branch canal located at km 51.800 on the left side of Meet Yazied main canal ; a carrier canal located on the left side of Bahr Shebeen canal at Km 96.500, the 63.00 Km long canal feeds an area of about 210,000Fed.Distributed through 19 branch canals

The length of EL-Sefsaf canal that is about 3.400Km which served a command area of about 700 Fed . design of bed width vary between 2.5 m and 1.5 m , while the design maximum water level vary between 2.80 m and 2.50 m, while the actual maximum water level vary between 1.50 m and 1.60 m.

The study was carried out during four seasons started from Nov. 2003 and finished in the end of summer season 2008. This period covered two summer seasons (summer 2004 and summer 2008) and two winter seasons (winter 2003/2004 and winter 2007/2008 **)**

Total crop water requirements in EL Sefsaf canal command area could be summarized as follows:

Summer crops: The total water requirements of Rice were 1753213.59 and 1537013.18 m^3 in 2004 and 2008 seasons respectively. While it were 1200734.54 and 549805.78 m^3 in 2004 and 2008 respectively for cotton crop. Also the total water requirements of Maize crop were 111488.49 and 19168.44 m^3 for the above mentioned seasons respectively. The highest water requirements as recorded with Rice crop. The peak demand were in July and August. Winter crops: The total water requirements of Barseem were 982490.09 and 516100.68 m^3 in 2003/2004 and 2007/2008 seasons respectively. On the other hand the total water requirements of Wheat crop were 1056627.12 and 667397.01 m^3 for the stated seasons respectively. Finally the total water requirements of Sugarbeet crop were 554260.24 m^3 in 2003/2004 season , and 68416.21 m^3 in 2007/2008 season. The peak demand were in Marsh and April.

INTRODUCTION

Engineers are frequently called upon to make, within the limited time period, estimates of probable past, present and future consumptive use, and irrigation requirements and stream depletion in river basins. Actual measurements of consumptive use under each of the various physical and climatic conditions of any large areas are time-consuming and expensive. Thus, rapid and reliable methods are needed by engineers and hydrologists for estimating consumptive use of water for areas where no measured water consumptive use data are available.

The Irrigation Improvement Sector (IIS) of the Ministry of Water Resources and Irrigation (MWRI) in Egypt is implementing many phases of the Irrigation Improvement Project (IIP). From these phases, W10 project was conducted to test new design criteria that will be implemented in IIIMP project. W10 project served 6150 Fadden supplied water from Meet Yazied canal between EL-Mofty regulator (Km 50.2) and EL-Masharqa regulator (Km 59.5) at Kafr EL-Sheikh Governorate. This sub project mainly consists of three branch canals and two sub-branched canals.

- The branch canals are:
  - Sefsaf canal (Km51.9)
  - Eliwa canal (Km 55.5)
  - El-Masharqa canal (Km 56.7)
- The two sub-branch canals are:
  - Safan canal, which branched from EL-Sefsaf canal
  - Sidi-Salem canal, which branched from EL-Masharka canal

Main differences between old design criteria implemented in IIP1 and new design criteria implemented in W10 that the current study aims to monitor and evaluate the change after irrigation improvement on branch canals level. The downstream control gates replaced by sluice gates provided with an automation system.

The overall objective of this project is to increase the agricultural production and farm income by improving the irrigation infrastructure, facilitating a more equitable water distribution and improving on-farm water management.

The water management Research Institute (WMRI) that belong to the National Water Research Center (NWRC) in Egypt is currently carrying out some of the activities of that M&E program in the W10 area for five seasons starting from May 2006. The current M&E program for canal will have two main different components. [Canals Monitoring Study (CMS), and Acceptance Assessment Study (AAS)].

From the results of research studies by engineers and other scientists formulas have been developed relating to consumptive use and climatological data. These formulas may be used to transpose observed consumptive-use data from one area to other areas where few or no data, except climatological records, are available.

Geographical information system can be defined in many different ways, which depends on what seek. It can be defined as "Computer software that links geographic information (where things are) with descriptive information (what things are). Unlike a flat paper map, where "what you see is what you get ", a GIS can present many layers of different information" (ESRI, 2002).

Alternatively, GIS is defined as: An organized collection of computer hardware, software geographic data and personal designed to GIS is used in variety of agricultural application, such as managing crop yields, monitoring crop rotation techniques, and projecting soil less for individual farms or entire agricultural regions. The following examples are just a few of the different ways people are using GIS every day in agriculture (ESRI 2000).

GIS and related technologies provide users with the means to use the "language geography" to digitally model, analyze and view the earth, its features, and phenomena.

Through this versatile and rich medium, users may communicate location-based concepts that would otherwise be difficult to convey (Buehler, 2005).

The ultimate use of GIS lies in its capability for modeling : constructing models of the real world, form digital database, and using these models to simulate the effect of a specific process over time for a given scenario. Modeling is a powerful tool for analyzing trends and identifying factors that affect them, or for displaying the possible consequences of planning decisions or projects that affect resource use and management (FAO, 2004).

Abd El-Aal (1995), reported that the cropping pattern in Egypt is somewhat adjusted to soil conditions. In the northern part of the Nile Delta, where soil salinity is somewhat higher than normal, crop rotation includes rice and cotton as the main summer crops, and wheat and clover as the main winter crops. All these crops have proved to be salt-tolerant or semi-tolerant.

Regarding to limited water resources in Egypt and tendency the farmers to planting high water consumptive crops as Rice and sugar can. Thus the aim of this study is using geography information system program (GIS) for mapping water requirement for winter and summer crops in El Sefsaf canal before and after irrigation improvement.

Many investigators studied the water requirements of rice cultivars at continuous flooding. In this respect, Nour and Mahrous (1994) record 19152 m3/ha. For Giza 176 cultivar.

Nour et al., (1996) found the figures 13333, 14976 and 14078 m^3/ha. For Giza 176, Giza 177 and Giza 178 cultivar, respectively.

Ghanem and Ebaid (2001) gave 13755 m^3/ha. for Sakha 101 cultivar.

Awad (2001) gave 12542 m^3/ha. for Giza 178 cultivar from transplanting to harvest.

Maha (2009) found that the total water applied of rice were 6546, 6300, 6340, 6420, 4244 and 3878 m3/fed. and 6797, 6551, 6593, 6617, 4490 and 4124 m3/fed. for T1: Traditional transplanting: transplanting of seedlings rice on flat soil at the hills (4-5 plants) distance of 20 x 20 cm. T2: transplanting of seedlings rice on flat soil at the hills (4-5 plants) distance of 20 cm. between rows and 15 cm. between hills. T3: transplanting of seedlings rice on flat soil at the hills (4-5 plants) distance of 20 cm. between rows and 12.5 cm. between hills. T4: transplanting of seedlings rice on flat soil at the hills (4-5 plants) distance of 20 cm. between rows and 10 cm. between hills. T5: transplanting of furrows 60 cm. wide. And T6: transplanting on beds 80 cm. wide in 2006 and 2007 seasons respectively.

Abou Zeid (1993) stated that the surface water resources are limited to Egypt share of the floe of the River Nile, together with minor amounts of rainfall and flash food. The average annual natural flow of Nile stmated at Aswan is about 84 billion m^3 , 55.5 billion m^3 is Egypt's share, 18.5 billion m^3 is Sudan's share and the remainder is allowed for evaporation.

Rosenzweig and Hillel (1994) suggested three cultivation policies as a means to achieve both the reclamation program and the supply/demand balance. The first policy maintains the present cropping pattern, including 550.000 ha of rice and 130.000 ha of sugarcane. The second policy proposes a reduction in the rice areas to 380.000 ha. The third policy reduces the rice areas to 300.000 ha, together with the complete replacement of sugarcane by sugar beet.

Steiner and Howell (1993) concluded that the most predominant approach to calculating Evapotranspiration for irrigation management involves :

- Calculation of potential Evapo-transpiration that depends only on climatic factors, and is independent of surface conditions.
- Relating actual ET of a specific crop data for given period of growth to ETp using empirically derived crop coefficient.
- Using the estimated actual ET in the water balance to determine specific irrigation needs based on irrigation efficiency, soil water holding capacity characteristics and management objectives.

Ibrahim *et al*. (1988) estimated the irrigation water requirements for Kafr El-sheikh Governorate based on the determination of consumptive use of different corps. comparison study was then done with the actual irrigation. Nowadays and according to the instructions of the country about the liberation of cropping pattern according to desires of farmers in planting what they want and when they want.

MATERIALS AND METHODS

A branch canal was selected in El Sefsaf canal command area which located in Sidi Salem district in Kafr El sheikh Governorate (North Delta) for using geography information system (GIS) for mapping cropping pattern and water requirement for winter and summer crops before and after irrigation improvement. El Sefsaf canal is an earth branch canal located at km 51.800 on the left side of Meet Yazied main canal ; a carrier canal located on the left side of Bahr Shebeen canal at Km 96.500 the 63.00 Km long canal feeds an area of about 210,000Fed. distributed Through 19 branch canals .

The EL-Sefsaf canal is about 3.400Km in length that served a command area of about 700 Fed . design bed width vary between 2.5 m and 1.5 m , while the design maximum water level vary between 2.80 m and 2.50 m . while the actual maximum water level vary between 1.50 m and 1.60 m.

The study was carried out during four seasons started from Nov. 2003 and finished in the end of summer season 2008. this period covered two summer seasons (summer 2004 and summer 2008) and two winter seasons (winter 2003/2004 and winter 2007/2008).

Climatic conditions:-

Some meteorological data during the four seasons are presented in Table (1) obtained from Sakha meteorological station located at 31° 7`latitude and 30° 52` longitude. It has an elevation about 6 meters above sea level. It represents condition and circumstance of middle northern part of the Nile Delta. These data are used to get potential evapotranspiration.

Table (1) : climatic data of Sakha meteorological station

Season	Month	Air Temp.		R.H %	Wind Velocity (Km/24hr) At 2m height	Sun shine hours
		Max.	Min.			
2003-2004	November	26.7	12.5	66.15	108	8.5
	December	21.7	8.4	67.15	113	8.5
	January	19.43	7.23	69	122.22	7.15
	February	21.24	6.80	68.89	119.67	7.8
	Mars	24.70	8.77	65.70	92.43	8.8
	April	28.53	10.93	60.02	106.90	10
	May	29.50	13.37	38.08	111.67	10.9
	June	32.33	16.17	65.32	117.20	12.1
	July	34.20	19.10	69.34	106	12.1
	August	33.53	21.67	69.95	86.73	11.7
	September	32.17	18.03	28.99	99.63	10
	October	30.20	16.31	63.93	84.05	9.4
2007-2008	November	24.83	8.03	65.52	52.87	9.4
	December	20.70	3.80	71.17	61.83	8.5
	January	18.7	5.3	67.95	59.33	7.15
	February	19.7	2.8	68.91	78.33	7.8
	March	25.76	5.96	66.9	74.13	9.2
	April	27.76	8.3	58.14	98.5	10.2
	May	29.67	10.67	57.85	108.3	11.6
	June	32.87	14.90	66.42	105.83	12.1
	July	32.97	16.20	70.05	88.03	12.3
	August	34	16.8	69.6	81.4	11.6
	September	33.7	15	62.5	608	10.5
	October	29	11.3	62.3	423.7	9.5

Evapotranspiration :-

Reference evapotranspiration calculation of (Eto) is carried out according to the FAO Penman Montieth equation using the climatic data of Sakha station table.

$$Et_0 = \frac{0.408\Delta(R_n - G) + \gamma U_2 (e_n - e_d) 900 / T_c + 273.15}{\Delta + \gamma(1 + 0.34U_2)}$$

Where :-

Et_o : reference evapotranspiration (grass) (mm/ day)

R_n : net radiation at crop surface (MJ/m^2/day)

G : soil heat flux(MJ/m^2/day)

T_c: average temperature (^oC)

U_2: wind speed at 2m height (m/s)

e_a: saturation vapour pressure (Kpa)

e_d: actual vapour pressure (Kpa)

Δ: slop of saturation vapour pressure curve at mean air temperature (Kpa/ ^oC)

γ : psychromatic constant (Kpa/ ^oC)

Water requirements :

$$\text{Crop W.R} = \frac{Et_o * Kc}{\text{Irrigation efficiency}}$$

Where :-
Et_o : reference evapotranspiration (mm/day)
Kc : the crop coefficient. Table (2).

Irrigation efficiency is 55% for surface irrigation according to cod Ministry of water Resources and Irrigation. While irrigation efficiency is 85% after irrigation improvement according to Irrigation Improvement Project.

Mapping :-

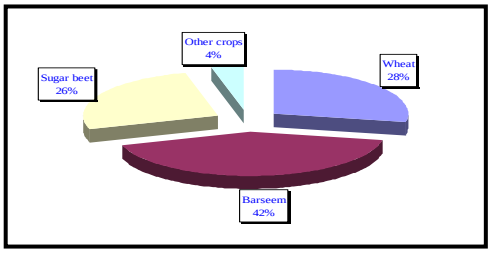
Arc View v 3.2 program ; one of the geographic information system was used for mapping cropping pattern and water requirements.

The map of study area was introduced from Google earth program and then entered and processed through arc view program.

RESULTS AND DISCUSSION

Cropping pattern :- Winter cropping patterns:- Fig.(1),(2) and Map (1),(2) show the winter cropping pattern in EL Sefsaf canal command area during 2003/2004 and 2007/2008 growing seasons. The data indicated that the winter cropping pattern was berseem , Wheat , Sugarbeet and others (Faba beans and Flax). berseem is the most favorable winter crop to many farmers since it can either be used as fadder or be sold for cash. It occupied 42 and 35.1 % of the cropping pattern in winter seasons 2003/2004 and 2007/2008 respectively.

Wheat is the second main winter crop and occupied 28 and 57.7 % of the cropping pattern in the previous winter seasons respectively. Sugarbeet is the third main crop in EL Sefsaf canal command area due to its cash value as it is sold to the sugar factories there. It occupied 26.1 and 5.1 % of the cropping pattern in the previous winter seasons respectively. The secondary winter crops (others) mainly Faba bean , Flax and some vegetables. Generally occupied less than 4 %. It can be concluded that in winter 2003/2004 the high percent was berseem (42%) , while Wheat was (57.7 %) in winter 2007/2008 due to the higher price of Wheat. It mean that the price of the crop play an important role in the cropping pattern.



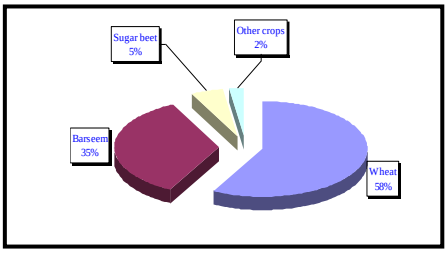
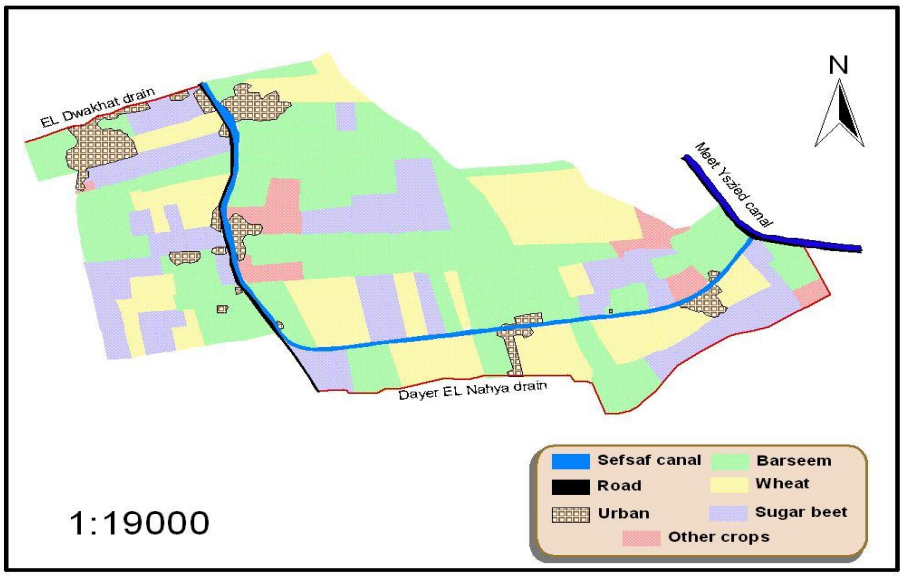
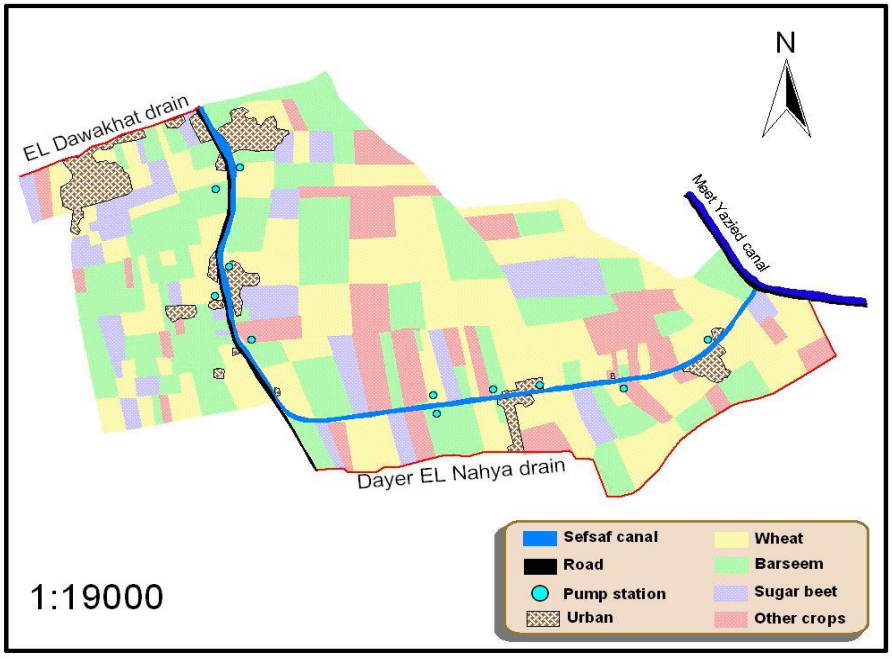


Figure (1): The distribution of cropping pattern during winter season of 2003/2004.

Figure (2) :The distribution of cropping pattern during winter season of 2007/2008.



Map (1): Cropping pattern of EL Sefsaf canal command area in winter season 2003/2004



Map (2) : Cropping pattern of EL Sefsaf canal command area in winter season 2007/2008

Summer cropping pattern

Data presented in Fig. (3)and(4) and Map (3)and(4)show the summer cropping pattern in EL Sefsaf canal command area . The data showed that the main summer crops were Rice , Cotton , and Maize. The first main summer crop was Rice and occupied 54.1 and 71 % of the cropping pattern in 2004 and 2008 seasons respectively.

Cotton was the second main crop and occupied 35 and 24 % of the cropping pattern in 2004 and 2008 seasons respectively. Maize was the third main crop and occupied 3.9 and 1 %.

The secondary summer crops (others) mainly water melon and vegetables , varied substantially between 7 and 4 % of the studied summer cropping pattern.

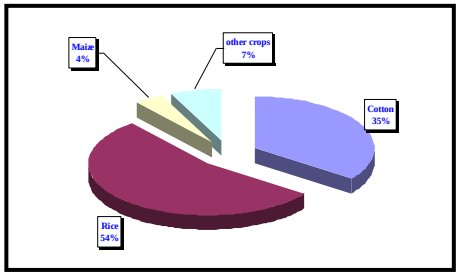


Figure (3): The percent of cropping pattern for summer season 2004.

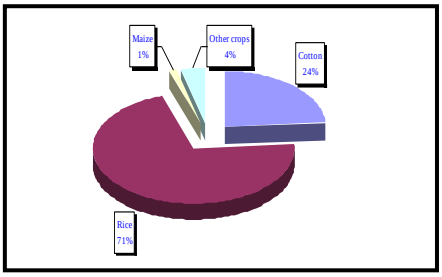
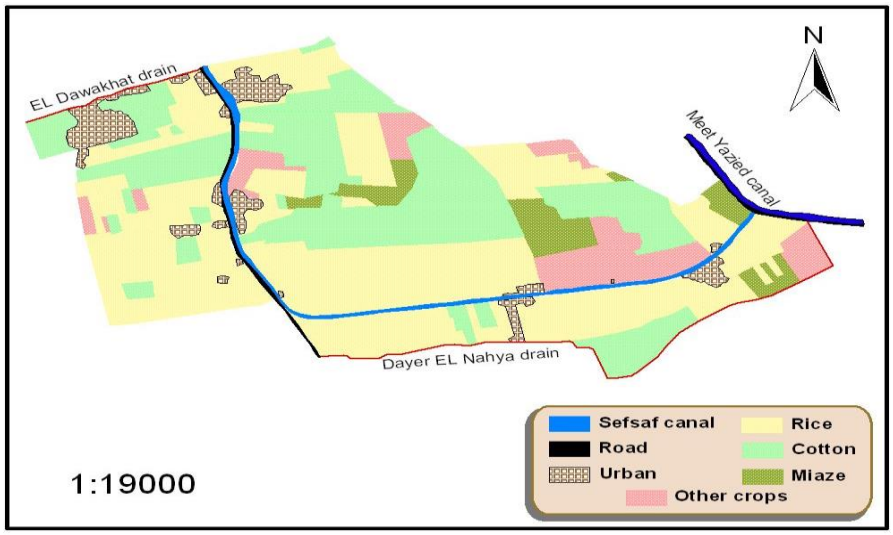
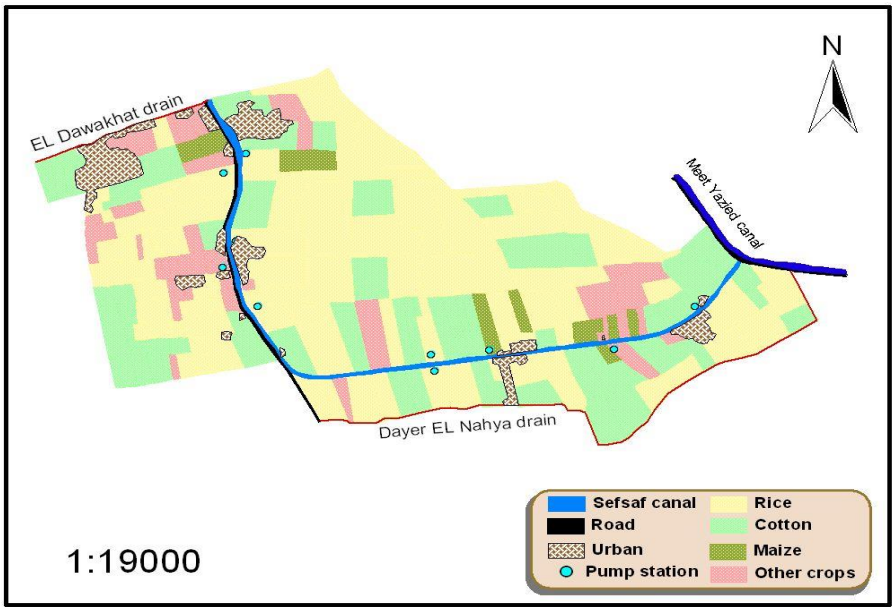


Figure (4): The percent of cropping pattern for summer season 200



Map (3) : Cropping pattern of EL Sefsaf canal command area in summer season 2004



Map (4) : Cropping pattern of EL Sefsaf canal command area in summer season 2008

Total water requirements in EL Sefsaf canal command area:
Summer crops :-

Data revealed that the highest values of water requirements during summer season was recorded with Rice crop. The water requirement was 570301.15 , 598195.28 , 518716.12 and 66001.04 m^3/area during June , July , Aug. and Sep. of 2004 respectively ; the total water requirement of Rice was 1753213.59 cubic meter. While it was 508461.03 , 511209.46 , 462081.13 and 55261.56 m^3/area for the stated months but in season 2008 respectively ; the total water requirement of Rice was 1537013.18 cubic meter. For Cotton crop it was 54627.11 , 131630.77 , 468331.91 , 337747.63 , 335583.44 and 72813.68 m^3/area. and 25022.97 , 60445.10 , 125128.08 , 150965.33 , 156357.25 and 31887.05 m^3/area during April , May , Jun , July , Aug. and Sep. of 2004 and 2008 respectively. The total water requirements was 1200734.54 cubic meters and 549805.78 cubic meters in 2004 and 2008 respectively. For Maize crop it was 13594.20 , 20182.39 , 34890.53 , 27195.33 and 15626.04 cubic meters and 2337.74 , 5324.47 , 5840.25 , 4903.33 and 2562.65 cubic meters during May , Jun , July , Aug. and Sep. for 2004 and 2008 seasons respectively.

The total crop water requirements were 111488.49 cubic meters and 19168.44 cubic meters in 2004 and 2008 respectively.

It can be concluded that the highest water requirements achieved with Rice crop during July. in the two growing seasons. Also it is noticed that the lowest water requirements was recorded during 2008 growing season due to the increase of irrigation efficiency after irrigation improvement project. Tables(2),(3) and Fig.(5) and Map (5),(6)

Table (2) : Total crop water requirements for summer season 2004 in SEFSAF canal

Month	Total Crop Water Requirements M³/Area			Total
	Rice	Cotton	Maize	
April	----	54627.11	----	54627.11
May	----	131630.77	13594.20	145224.97
Jun	570301.15	268331.91	20182.39	858815.45
July	598195.28	337747.63	34890.53	970833.44
Aug.	518716.12	335583.44	27195.33	881494.89
Sep.	66001.04	72813.68	15626.04	154440.76
Total	1753213.59	1200734.54	111488.49	**3065436.62**

Tabl (3) : Total crop water requirements for summer season 2008 in SEFSAF canal

Month	Total Crop Water Requirements M³/Area			Total
	Rice	Cotton	Maize	
April	----	25022.97	----	25022.97
May	----	60445.10	2337.74	62782.84
Jun	508461.03	125128.08	3524.47	637113.58
July	511209.46	150965.33	5840.25	668015.04
Aug.	462081.13	156357.25	4903.33	623341.71
Sep.	55261.56	31887.05	2562.65	89711.26
Total	1537013.18	549805.78	19168.44	**2105987.4**

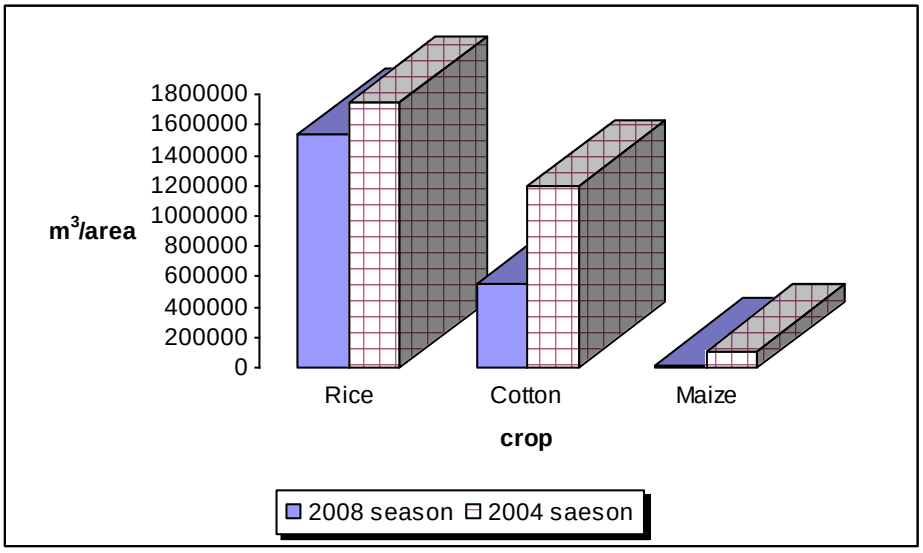
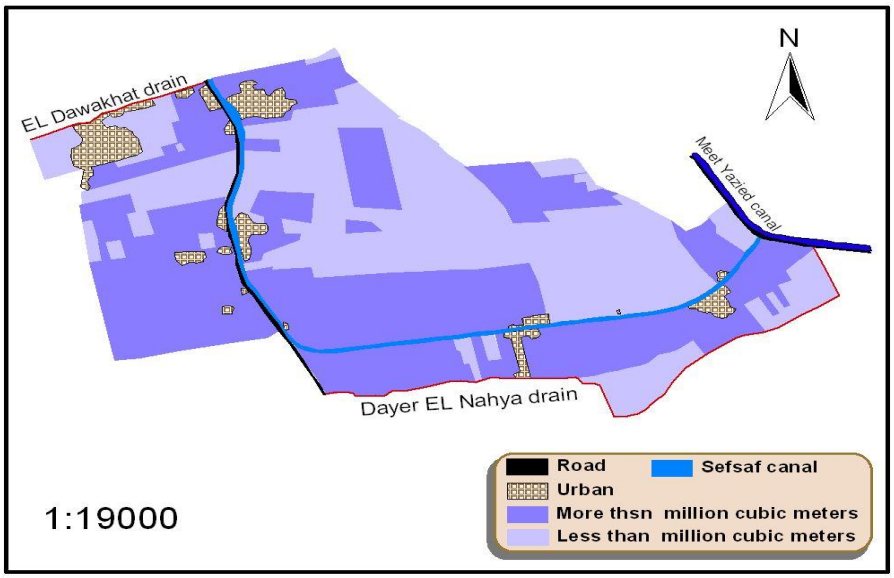
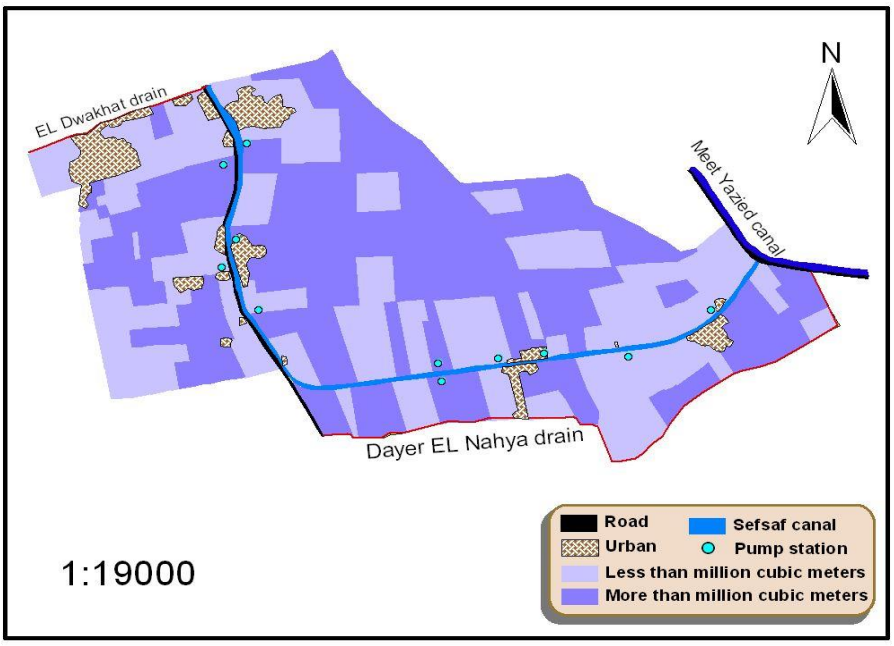


Figure (5): Difference between water requirements for each crop in 2004 and 2008 seasons before and after irrigation improvement.



Map (5) : Water requirements for EL Sefsaf canal command area for season 2004



Map (6) : Water requirements for EL Sefsaf canal command area for season 2008

Winter crops :-

The values of water requirements of Berseem crop was 59464.51 , 98467.92 , 95291.54 , 115946.35 , 171674.44 , 230994.67 and 210650.66 m^3/area. And 26443.46 , 43255.43 , 44144.24 , 57266.14 , 97472.86 , 129307.56 and 118210.99 m^3/area in Nov. , Dec. , Jan. , Feb. , Mar. , April and May in 2003/2004 and 2007/2008 seasons respectively.

The total water requirements were 892490.09 and 516100.68 cubic meters in the previous seasons respectively.

The water requirements of Wheat crop was 54855.27 , 127995.63 , 226073.01 , 334732.02 , 278815.97 and 34155.22 m^3/area. And 28798.93 , 68578.29 , 133444.83 , 227136.82 , 186531.34 and 22906.8 m^3/area in Dec. , Jan. , Feb. , Mar. , April and May in 2003/2004 and 2007/2008 seasons respectively.

The total water requirements were 1056627.12 and 667397.01 m^3 for the stated seasons respectively.

Finally the water requirements of Sugarbeet were 30668.43, 53836.91, 56909.49 , 76071.8 , 155955.77 , 172927.48 and 7890.36 m^3/area. And 3206.38 , 5560.19 , 6198.23 , 8833.4 , 20818.19 , 22758.81 and 1041.01 m^3/area in Nov. , Dec. , Jan. , Feb. , Mar. , April and May in 2003/2004 and 2007/2008 seasons respectively. Also the total water requirements were 554260.24 and 68416.21 m^3 for the above mentioned seasons respectively.

It has been noticed that the peak months of irrigation water requirements were July and August for summer crop , while it were March and April for winter crop.

On the other hand the minimum values were recorded in September and October for summer season and November and December for winter season in two growing seasons. Tables (4)and(5) and Fig.(6) and Map(7)and(8).

Table (4) : Total crop water requirements for winter season 2003/2004 in EL-SEFSAF canal

Month	Total Crop Water Requirements m^3/Area			Total
	Berseem	Wheat	Sugar beet	
Nov.	59464.51	----	30668.43	90132.94
Dec.	98467.92	54855.27	53836.91	207160.1
Jan.	95291.54	127995.63	56909.49	280196.66
Feb.	115946.35	226073.01	76071.80	418091.16
Mar.	171674.44	334732.02	155955.77	662362.23
Apr.	230994.67	278815.97	172927.48	682738.12
May	210650.66	34155.22	7890.36	252696.24
Total	982490.09	1056627.12	554260.24	**2593377.45**

Table (5) : Total crop water requirements for winter season 2007/2008 in EL-SEFSAF canal

Month	Total Crop Water Requirements M³/Area			Total
	Berseem	Wheat	Sugar beet	
Nov.	26443.46	----	3206.38	29649.84
Dec.	43255.43	28798.93	5560.19	77614.55
Jan.	44144.24	68578.29	6198.23	118920.76
Feb.	57266.14	133444.83	8833.40	199544.37
Mar.	97472.86	227136.82	20818.19	345427.87
Apr.	129307.56	186531.34	22758.81	338597.71
May	118210.99	22906.8	1041.01	142158.8
Total	516100.68	667397.01	68416.21	**1251913.9**

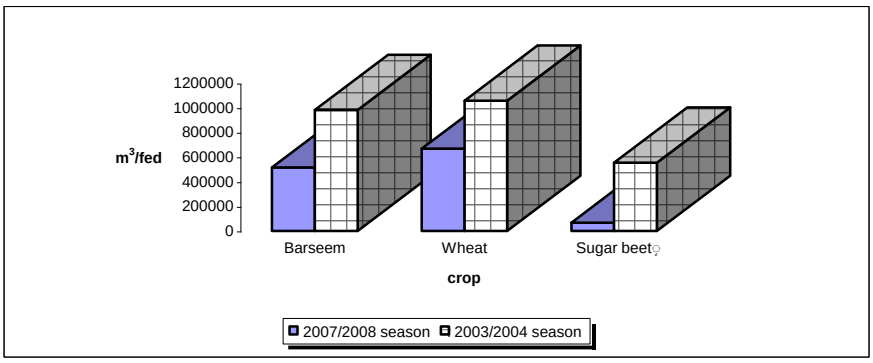
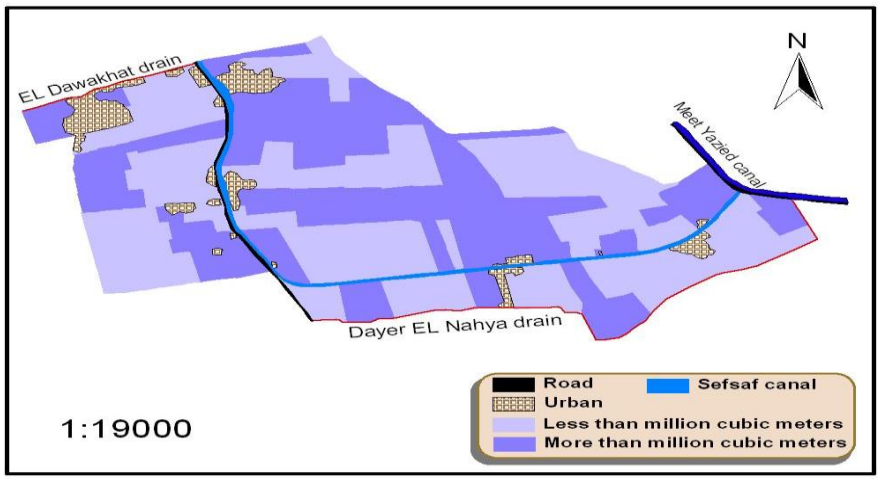
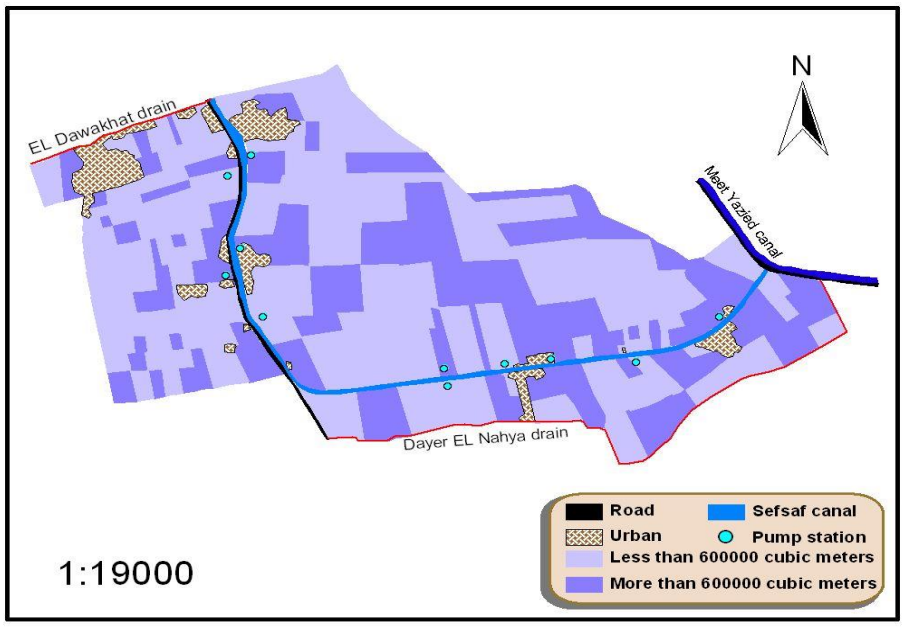


Figure (6): Difference between water requirements for each crop before and after irrigation improvement for winter seasons



Map (7) : Water requirements for EL Sefsaf canal command area for season 2003/2004



Map (8) : Water requirements for EL Sefsaf canal command area for season 2007/2008

Conclusion

1. The importance of using the geographic information systems in the agricultural field to facilitate the process of data collection or display, and know where the problems lie in order to make the right decision to solve these problems.
2. The importance of the implementation and generalization of the IIP (Irrigation Improvement project) because it greatly contributes to the provision of water and raise the efficiency of irrigation.
3. the water requirements of crops are significantly affected by climate change.
4. water needs varied from canal to another, depending on existing of crop patterns.
5. Water requirements for any canal are significantly influenced by the area of cultivated rice**.**
6. Irrigation improvement can save 31.3% of the total water requirements for summer season, while it save 51.7% of the total water requirements for winter season.

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إستخدام نظم المعلومات الجغرافية لرسم خرائط الاحتياجات المائية لبعض المحاصيل

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تم اختيار منطقة زمام ترعة الصفصاف الفرعية كمنطقة دراسة لاستخدام نظم المعلومات الجغرافية لرسم خرائط التركيب المحصولى بها و الاحتياجات المائية للموسم الشتوى و الصيفى ، قبل تنفيذ مشروع تطوير الرى و بعد تنفيذه . و تقع ترعة الصفصاف فى زمام هندسة رى سيدى سالم فى محافظة كفر الشيخ (شمال الدلتا) ، و تقع ترعة الصفصاف فى الكيلو ٥١,٨٠٠ من الجانب الأيسر لترعة ميت يزيد الرئيسية ; حيث تقع ترعة ميت يزيد على الجانب الأيسر من ترعة بحر شبين فى الكيلو ٩٦,٥٠٠ و يبلغ طول ترعة ميت يزيد حوالى ٦٣ كم تقريبا و تغذى زمام قدرة حوالى ٢١٠ ألف فدان ، من خلال ١٩ ترعة فرعية. يبلغ طول ترعة الصفصاف حوالى ٣,٤٠٠ كم حيث تخدم زمام قدره حوالى ٧٠٠ فدان. عرض القاع التصميمى لها بين ٢,٥م و ١,٥م ، و أقصى منسوب تصميمى لترعة الصفصافه هو بين ٢,٥٠م و ٢,٨٠م . بينما المنسوب الفعلى لها بين ١,٥٠م و ١,٦٠م.

تمت الدراسة خلال أربعة مواسم زراعية بدأت من نوفمبر ٢٠٠٣ و انتهت فى نهاية الموسم الصيفى ٢٠٠٨. و تمت الدراسة فى هذه الفترة على موسمين صيفيين (موسم صيفى ٢٠٠٤ و موسم صيفى ٢٠٠٨) و موسمين شتويين (موسم شتوى ٢٠٠٤/٢٠٠٣ و موسم شتوى ٢٠٠٨/٢٠٠٧).

التركيب المحصولى الشتوى:-

محصول البرسيم هو اكبر المحاصيل تفضيلا من جانب المزارعين لأنه ممكن أن يستغل فى أكثر من اتجاه حيث انه يستخدم فى تغذية الحيوانات و يباع مقابل مبلغ معين من المال. و نلاحظ من النتائج المتحصل عليها انه مساحه قدرها ٤٢% من إجمالى المساحات المنزرعة على زمام ترعة الصفصاف فى الموسم الشتوى ٢٠٠٤/٢٠٠٣ (قبل تنفيذ مشروع تطوير الرى) ، بينما نلاحظ أن مساحته المنزرعة صارت ٣٥,١% من إجمالى المساحة المنزرعة على زمام ترعة الصفصاف خلال الموسم الشتوى ٢٠٠٨/٢٠٠٧ (بعد تنفيذ مشروع تطوير الرى). القمح هو ثانى المحاصيل الشتوية الرئيسية و الذى كانت نسبة زراعته هى ٢٨% من إجمالى المساحة المنزرعة خلال الموسم الشتوى ٢٠٠٤/٢٠٠٣ (قبل تنفيذ مشروع تطوير الرى)، بينما نلاحظ انه فى الموسم الشتوى ٢٠٠٨/٢٠٠٧(بعد تنفيذ مشروع تطوير الرى) أصبحت نسبة زراعته ٥٧,٧% من إجمالى المساحة المنزرعة على زمام ترعة الصفصاف. بنجر السكر يعتبر المحصول الثالث فى المحاصيل الشتوية و الذى كانت نسبة زراعته فى الموسم الشتوى ٢٠٠٤/٢٠٠٣ هى ٢٦,١ % من إجمالى المساحة المنزرعة . بينما نلاحظ أنها نقصت الى ٥,١% من إجمالى المساحة المنزرعة فى الموسم الشتوى ٢٠٠٨/٢٠٠٧. أما المحاصيل الشتوية الثانوية و هى مثل محصول الفول البلدى و محصول الكتان و بعض الخضروات فهى عموما نسبتها من اجمالى المساحة المنزرعة تقل عن ٤%.

التركيب المحصولى الصيفى :-

تعتبر المحاصيل الصيفية الرئيسية هى الأرز و القطن و الذرة . و يعتبر الأرز هو أهم المحاصيل الصيفية و الذى تبلغ نسبة زراعته ٥٤,١% من إجمالى المساحة المنزرعة فى الموسم الشتوى ٢٠٠٤/٢٠٠٣ ، بينما نلاحظ من النتائج أن مساحته المنزرعة زادت إلى أن أصبحت ٧١% من إجمالى المساحة المنزرعة على زمام ترعة الصفصاف. القطن هو ثانى المحاصيل الصيفية الرئيسية حيث كانت نسبة زراعته هى ٣٥% فى الموسم الشتوى ٢٠٠٤/٢٠٠٣، بنما أوضحت

النتائج انه فى الموسم الشتوى ٢٠٠٨/٢٠٠٧ أصبح ٢٤% من إجمالى المساحة المنزرعة على زمام ترعة الصفصاف. أما محصول الذره فهو ثالث المحاصيل الصيفية و الذى كانت نسبة زراعته هى ٣,٩% و ١% فى الموسم الصيفي ٢٠٠٤/٢٠٠٣ و ٢٠٠٨/٢٠٠٧ على التوالى. أما المحاصيل الصيفية الثانوية مثل لب البطيخ و بعض الخضروات كانت مساحتها المنزرعة ٧% و ٤% من إجمالى المساحة المنزرعة فى الموسم الصيفى ٢٠٠٤ و الموسم الصيفي ٢٠٠٨ على التوالى.

إجمالى الاحتياجات المائية الكلية على زمام ترعة الصفصاف

المحاصيل الصيفية:-

إجمالى الاحتياجات المائية لمحصول الأرز للمساحة الكلية المنزرعة فى زمام ترعة الصفصاف هى ١٧٥٣٢١٣,٥٩ م^3 و ١٥٣٧٠١٣,١٨ م^3 خلال الموسمين الصيفيين ٢٠٠٤ و ٢٠٠٨ على التوالى. بينما كانت الاحتياجات المائية الكلية لمحصول القطن كالتالى ١٢٠٠٧٣٤,٥٤ م^3 و ٥٤٩٨٠٥,٧٨م^3 لموسم ٢٠٠٤ و ٢٠٠٨ على التوالى. أما بالنسبة لمحصول الذرة فكانت ١١١٤٨٨,٤٩ م^3 خلال موسم ٢٠٠٤ أما خلال موسم ٢٠٠٨ فهى ١٩١٦٨,٤٤ م^3 . ولقد سجلت البيانات المتحصل عليها أعلى قيمة للاحتياجات المائية و كانت لمحصول الأرز ، و كانت اقصى احتياجات مائيه خلال شهر يوليو و شهر أغسطس.

المحاصيل الشتوية :-

إجمالى الاحتياجات المائية لمحصول البرسيم للمساحة الكلية المنزرعة فى زمام ترعة الصفصاف هى ٩٨٢٤٩٠,٠٩ م^3 و ٥١٦١٠٠,٦٨ م^3 خلال الموسمين الشتويين ٢٠٠٤/٢٠٠٣ و ٢٠٠٨/٢٠٠٧ على التوالى. بينما كانت الاحتياجات المائية الكلية لمحصول القمح كالتالى ١٠٥٦٦٢٧,١٢ م^3 و ٦٦٧٣٩٧,٠١ م^3 لموسم ٢٠٠٤/٢٠٠٣ و ٢٠٠٨/٢٠٠٧ على التوالى. أما بالنسبة لمحصول بنجر السكر فكانت ٥٥٤٢٦٠,٢٤ م^3 خلال موسم ٢٠٠٤/٢٠٠٣ أما خلال موسم ٢٠٠٨/٢٠٠٧ فهى ٦٨٤١٦,٢١ م^3 . ولقد سجلت البيانات المتحصل عليها أعلى قيمة للاحتياجات المائية و كانت لمحصول القمح ، و كان أعلى شهر هو شهر مارس.

الاستنتاج

خلصت هذه الدراسة الى عدة استنتاجات :

١- اهمية استخدام نظم المعلومات الجغرافية فى المجال الزراعى لتسهيل عملية الحصول على البيانات او عرضها و معرفة اين تكمن المشاكل حتى يتسنى اتخاذ القرار الصحيح لحل هذه المشاكل.
٢- اهمية تنفيذ مشروع تطوير الرى و تعميمة لانه يساهم بقدر كبير فى توفير المياه ورفع كفاءة الرى.
٣- تتأثر الاحتياجات المائية للمحاصيل تاثرا كبيرا بتغير العوامل المناخية المحيطة.
٤- تختلف الاحتياجات المائية من ترعة الى اخرى تبعا لتغير التركيب المحصولى الموجود فى زمامها.
٥- تتاثر الاحتياجات المائية على اى ترعة تاثرا كبيرا بمساحة الارز المنزرعه عليها .
٦- تطوير الرى وفر حوالى ٣١,٣% من اجمالى الاحتياجات المائية فى الموسم الصيفى، بينما كانت النسبة ٥١,٧% من اجمالى الاحتياجات المائية فى الموسم الشتوى.