Assiut J. Agric. Sci., (48) No. (1-1) 2017 (374-393) *ISSN: 1110-0486*
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Effect of Different Dates and Irrigation Regimes on Growth, Yield and Consumptive Use of Some Wheat Varieties Under Sohag Governorate Conditions

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Received on: 15/11/2016 **Accepted for publication on:** 12/12/2016

Abstract

Field experiments were conducted at Shandaweel Agricultural Research Station, during the three winter successive seasons (2012/2013, 2013/2014 and 2014/2015) to find out the effect of different dates and irrigation regimes on growth, yield and consumptive use of three wheat varieties under Sohag governorate conditions. Three bread wheat cultivars (Shandaweel-1, Giza-168 and Sids-12) were cultivated in two different sowing dates (20th November and 5h December) under three irrigation intervals treatments of 21, 28 and 35 days. The experiment was laid out in a split – split plot design with three replications.

The results revealed significant differences among studied cultivars and irrigation treatments in most studied traits in all seasons. The second sowing date 5th December produced the best results of the growth components, grain yield and water use efficiency through the years of this study. The irrigation at 21 days gave the best values of grain yield values (18.234, 16.609 and 17.198 ardab/fed) for the three winter seasons 2012/13, 2013/14 and 2014/15. The average water consumptive use by wheat plants were 2094.48 for I_1, 1883.46 for I_2 and 1564.15 for I_3 m^3/fed. at the first sowing date (20th Nov.) while it was 2123.93 for I_1, 1811.49 for I_2, and 1606.19 for I_3 m^3 /fed for the second sowing date (5th Dec.). The irrigation water use efficiency was higher with using the irrigation treatment every 35 days. It was 0.53, 0.54, and 0.61 kgm^{-3} for the first sowing date (20th November) and it was 0.64, 0.68, and 0.68 kgm^{-3} for the second sowing date (5th December) by using the irrigation interval treatment at 21, 28, and 35 days, respectively.

Shandaweel 1 produced the highest values of grain yield and water use efficiency at the two sowing dates and the irrigation regimes. Also the results of the second sowing date (5th December) for Shandaweel 1 were higher than these of first sowing date.

Keywords: *Wheat, Irrigation regimes, Irrigation dates.*

Introduction

Oriented agricultural research is mostly directed to alleviate the problem of food shortage with our limited water resources.

Wheat *triticum asetivum* is the main food crop in Egypt. As in the most of world there is a gap between production and consumption. In Egypt, wheat is commonly known as the king of cereal crops used as a major food crop. Its cultivated area reached about 2.9 million feddan (fed = 0.42 hectare) with an average production of 18.1 ardab per feddan of grains (ardab = 150 kg) (FAO 2008).

However, this local production doesn't meet the consumption owing to the increased population with a limited cultivated area and water resources (El-Shaer *et al.* 1997 and Eid *et al*. 1999*)*.

Khater *et al.,* (1997) found that, spikes/m³, 1000 grain weight, straw and grain yield/fed were significantly decreased with decreasing available soil moisture content.

EL Kalla *et al.,* (1994) found the same result and add the plant height. Rayan *et al*., (1999) indicated that seasonal wheat water consumptive use at Shandaweel region (Upper Egypt) was veiled between 1883 and1930 m³/fed.

Khalil*. et al.,* (2006) found that the irrigation treatment at 1.2 evaporation pan coefficient recorded the highest amount of water consumed .more than the other two treatment water consumptive uses by wheat were 1582m³/fed 1796.9m³/fed and 2215.9m³/fed for irrigation treatment at 0.8, 1, 1.2 evaporation pan coefficient . The irrigation at 0.8 evaporation pan coefficient gave the highest value of water use efficiency.

With respect to crop productivity as a function for the soil moisture availability during the growing season, Mohamed and Tammam (1999), Sidrak (2003) and Moussa and Abdel-Maksoud (2004) reported that the number of spikess/m^2, 1000-grain weight, straw and grain yields decreased due to the irrigation at the high soil moisture depletion.

El-Marsafawy (2000) and Rayan *et al.* (2000) found that the highest values of grain yield were obtained when wheat crop irrigated at 1.0 evaporation pan coefficient (EPC) compared with 1.4.

El-Sabbagh *et al*, (2002) in Egypt and Metin-Sezen and Attila-Yazar (2006) in the arid Southeast Anatolia of Turkey, recorded that short irrigation intervals (7, 14 and 21 days) increased the plant height, spikes length, number of spikess/m^2, number and weight of grain/spikes, 1000- grain weight, harvest index and straw and grain yields compared with prolonged irrigation intervals (35 days).

The main objective of this study is to determine the best irrigation regimes by using different irrigation intervals under two different sowing dates for wheat production.

Materials and Methods

A field experiment was carried out at Shandaweel Agricultural Research Station, ARC, Egypt, during the winter of 2012/2013, 2013/2014, and 2014/2015 growth seasons to study the effect of different dates and irrigation regimes on growth, yield and consumptive use for three wheat varieties under Sohag governorate conditions. The experiment was laid out in a split – split plot design with three replications. The plot area was 42.0 m^2 (6 x 7 m).

The main plots were devoted to sowing dates of S1 = first sowing date (20th November) S2 = second sowing date (5th December); the sub plots were assigned to the irrigation regime as intervals of I1= 21 days, I2= 28 days, and I3= 35 days, and the sub_ sub plots were assigned to three wheat cultivars including V1 = Shandaweel 1, V2 = Giza 168 and V3 = Sides 12.

Wheat seeds of the three cultivars were broadcasted at a rate of 60 kg/fed (144kg / ha), the recommended levels of basic fertilizers (NPK) were applied. All experimental plots were fertilized using nitrogen fertilizer, that was applied in the form of urea (46.5% N), super phosphate (15%P_2O_5), and potassium sulphate (48 % K_2 O), at the level of 70 kg N /fed, 15 kg P_2O_5 /fed, and 24 kg K_2O/fed, respectivly.

The nitrogen and potassium fertilizers were divided and added into equal doses, the first one with the first irrigation and the second was added with the second irrigation However, the phosphate fertilizer was added before planting.

Meteorological data used in calculating the potential water consumptive use were collected from Sohag 623970 station (latitude of 26^0:6, longitude of 37^o:7 and elevation of 70 m) during the growth seasons (Table 1).

Table 1. The meteorological data at Sohag 623970 Station during 2012/2013, 2013/ 2014 and 2014 /2015 seasons.

Season	2012/2013 season							
Month	**T max(C^0)**	**T min(C^0)**	**WS 2m(km/ day)**	**RH (%)**	**RF (mm)**	**SS (hours)**	**SR (MJ/m^2/day)**	**E p (mm)**
Nov.	28.1	6.7	113.7	54.8	0.0	9.3	16.5	3.20
Dec.	21.4	7.6	159.9	65.0	0.0	9.0	14.9	2.73
Jan.	21.3	12.1	123.8	60.0	1.0	9.0	15.7	2.53
Feb.	24.0	14.0	164.2	48.0	0.0	9.8	18.9	3.75
Mar.	29.7	20.1	169.9	35.0	0.0	9.8	21.7	5.23
Apr.	29.9	13.0	168.5	34.0	0.0	10.1	24.3	5.94
May	37.8	17.6	159.9	30.0	0.0	11.3	26.9	7.17
Mean	27.5	11.6	151.4	46.7	Total1.0	9.8		4.43
2013/2014 season								
Nov,	28.4	13.2	132.5	59.0	0.0	9.3	16.5	3.32
Dec.	21.6	7.6	216.0	58.0	0.0	9.0	14.9	3.07
Jan.	22.5	6.3	152.6	58.0	0.0	8.9	15.6	2.91
Feb.	23.8	7.6	216.0	52.0	0.0	9.8	18.9	4.11
Mar.	27.4	12.3	210.2	45.0	9.2	9.8	21.7	5.25
Apr.	32.8	15.8	190.1	37.0	0.0	10.1	24.3	6.58
May	34.7	19.8	172.8	36.0	0.4	11.3	26.9	7.17
Mean	27.3	11.8	184.3	49.3	Total 9.6	9.7		4.63
2014/2015season								
Nov.	26.4	11.9	95.0	43.0	1.5	9.3	16.5	3.01
Dec.	22.8	8.5	103.7	48.0	0.7	9.0	14.9	2.51
Jan.	19.5	5.5	95.0	43.0	0.6	8.9	15.6	2.40
Feb.	22.8	8.1	112.3	33.0	0.4	9.8	18.9	3.42
Mar.	27.7	12.3	129.6	29.0	0.7	98	21.7	4.76
Apr.	30.1	13.0	146.9	21.0	0.5	10.1	24.3	5.89
May	35.8	19.4	146.9	17.0	0.0	11.3	26.9	7.09
Mean	26.4	11.2	118.5	33.4	Total4.4	9.7		4.15

T max and T min = maximum and minimum temperatures, °C ; WS= wind speed (Km/day) ; RF = rain fall, mm ; SS = actual sun shine, hours , SR = solar radiation, MJ/m^2/day, Ep= Evaporation pan ,mm

Some soil physical and chemical properties were measured as (Table 2) follow: Particle size distribution according to Gee and Bauder (1986).

Table 2. Some physical and chemical properties of the soil.

Particle-size distribution Soil fraction	Content (%)
Coarse sand	7.80
Fine sand	16.20
Silt	38.20
Clay	37.80
Textural class	Clay loam
Soil chemical analyses	**Content**
Organic matter	1.22%
Available N (K Cl-extract)	17.20 mg kg^{-1}
Available P (Na HCO3 extract)	10.00 mg kg^{-1}
Available K (N H4 - a acetate extract)	178 mg kg^{-1}
pH (1:2.5, soil: water suspension)	7.9
ECe	0.9 dSm^{-1}

Available N was determined according to Bremner and Mulvaney (1982). Available P was determined according to Olsen *et al*., (1954). Available K was determined according to Hesse, (1972). The EC was estimated according to Richards (1954) and soil pH was determined according to McLean (1982).

Field capacity and wilting point were determined according to Cassel and Nielsen (1986). Available water was calculated from the difference between field capacity and wilting point. Bulk density was determined according to Blake and Hartge (1986), (Table3).

Table 3. Soil moisture constants (% by weight) and bulk density (mg m^{-3}) of the soil site at Shandaweel Agricultural Research Station.

Depth (cm)	Field capacity (%)	Wilting point (%)	Available water (%)	Bulk density (Mg m^{-3})
00-15	32.20	13.77	18.43	1.15
15-30	31.78	13.18	18.60	1.20
30-45	29.73	12.40	17.33	1.22
45-60	29.19	11.18	17.39	1.28

The field capacity, wilting point and available soil moisture of the experimental field were determined and were 30.69 %, 12.63%, and18.06 % respectively. The soil was clay loam in texture with bulk density of 1.22 Mg m^{-3} (Tabl2&3). Soil samples were taken from each 15 cm depth up to 60 cm from the surface.

Growth, Yield and some Yield Attributes Esteimation

At harvest, the plants of each entire sub- sub -plot were sampled in order to determine some wheat parameters such as:

1. Total yield (ton/fed).
2. Grain yield (keg /fed.).
3. Straw yield (ton/fed).
4. Seeds index (1000 grain weight).
5. 5 spike grain weight (gm).

All obtained data were subjected to the statistical analysis of

variance and the treatment means were compered for significant differences using the LSD at *p=0.05 and p=0.01*. The MSTAT_C (version 2.10) computer program was used to perform all the analysis of variance in an agreement with the procedure outlined by Steel and Torrie (1982).

Water Relations

1-Actual water consumptive use 'WCU'

Water consumptive use was determined via soil samples from the sub.sub plots just before each irrigation and 48 h later besides at harvest, in 15cm segments along the 60 cm depth of the soil. The WCU was calculated according to Israelsen and Hansen (1962) as follows:

$$WCU = (Q2 - Q1) * ERZD * Bd * 42$$

Where:

CU = actual consumptive use (m^3/fed)

ERZD = effective root zoon depth. (m)

Bd = bulk density of soil (Mg m^{-3})

Q_2 = the soil moisture two days after irrigation (% w/w).

Q_1 = the soil moisture before next irrigation (% w/w).

2- Water use efficiency (WUE)

Water use efficiency in the present work, refers to the amount of wheat grains (kg) produced due to one m^3 of consumed water which, estimated according to Vites (1965) as follow

$$WUE = \frac{Grain\ yield\ (kg/fed)}{Consumptive\ use\ (m3/fed)}$$

Results and Discussion

1. Growth and Yield Parameters

1.1 Grain weight of 5 spikes (g):

1.1.1 Effect of sowing date (A): Table 4-a and 4-b showed that delaying sowing date by two weeks increased the grain weight of 5 spikes in the three seasons. The grain weight of 5 spikes of were 12.509, 13.256, and15.460 g was produced by the late sowing date (S2) at the 5th of December and 11.982, 12.595 and 14.480 g from S1 at the 20th of November during the three growing seasons i.e., 2012/13, 2013/14, and2014/15, respectively. Delaying the cultivation date by 15 days increased the three season's average grain weight of 5 spikes from 13.014 to 13.742 g (5.55%).

1.1.2 Effect of irrigation regime (B): Table 4-a and 4-b also revealed that, the irrigation treatments significantly increased the grain weight of 5 spikes. The highest values for grain weight of 5 spikes was given by the irrigation at 21 days interval (I1) during the three growth seasons. The grain weight of 5 spikes were as 13.994, 14.580 and 17.974 g (I1), 11.740, 12.778 and 14.279 (I2), 11.003, 11.419 and 12.657 g (I3) during the three growing seasons, 2012/13, 2013/14, and 2014/15, respectively. Grain weight of 5 spikes was increased by 32.6% and10.6% by shortening the irrigation interval from 35 day to 21 and 28 days, respectively.

1.1.3 Effect of wheat cultivars (C): Wheat cultivars showed highly significant differences in the grain weight of 5 spikes, as shown in Table 4-a and 4-b. Wheat cultivar Shandaweel-1(V1) gave the best results of grain weight of 12.840, 13.686 and 15.60 gm/5 spikes during 2012/13, 2013/14, and 2014/15 seasons, respectively. Shandaweel-1 variety and Sides-12 produced grain weight of

14.042 and 13.223 gm/5 spikes compared to 12.872 gm/5-spikes from Giza 168. The increase in Shandaweel-1 was 9.089 % over Giza168. The grain weight of 5 spikes of Shandaweel-1 increased gradually from 2012 through 2015 and was better than the other two varieties.

1.1.4 A x B Interaction: The interaction between sowing date and irrigation treatments produced significant differences in the grain weight of 5-spikes through the three seasons. The highest values of the grain weight of 5spikes were produced form the interaction between the second sowing date and irrigation at 21 days interval (S2*I1).

1.1.5 A x C Interaction: Shandaweel-1 with the second sowing date produced the best interaction during the three growing seasons. The highest values for grain weight of 5spikes of that interaction were 13.193, 14.070 and 16.128 gm/5 spikes grain, through 2012/13, 2013/14, and2014/15 seasons, respectively.

1.1.6 B x C Interaction: Highly significant differences were resulted from the irrigation interval of 21 days (I1) and Shandaweel-1. The highest values for grain weight of 5-spikes were 14.897, 16.008, and 19.308 gm/5-spikes during 2012/13, 2013/14, and 2014/15 seasons, respectively.

1.1.7 A x B x C Interaction: Shandaweel-1irrigated every 21 days which cultivated on the 5th of Dec. produced high significant values of grain weight of 5spikes.

The obtained results showed a steady increase in the average of the grain weight of 5 spikes through the three seasons. The decrease in the Max temperature during 2014/15 than 2012/13 increased the grain weight of 5 spikes by 22.24%.

Table-4-a. Grain weight of 5 spikes (g) during three years for the three verities, three irrigation regimes and two swing dates.

Seasons	V1	V2	V3	I1	I2	I3	S1	S2	Mean
2012/13	12.840	11.675	12.222	13.994	11.740	11.003	11.982	12.509	12.246
2013/14	13.686	12.404	12.687	14.580	12.778	11.419	12.595	13.256	12.926
2014/15	15.601	14.538	14.772	17.974	14.279	12.657	14.480	15.460	14.970
Mean	14.042	12.872	13.227	15.516	12.932	11.693	13.019	13.742	13.380
% ±	9.089	0.000	2.755	32.7	10.6	0.000	0.000	5.551	

Where: (A) FACTOR s1, and S2 =Sowing on 20th November, and 5th December. (B)FACTOR I1, I2andI3 =Irrigation regime 21, 28 and35days.(C) FACTOR, V1, V2 andV3 = wheat cultivars I.e., Shandaweel-1, GIza-168 and SIds-

1.2 Seed index (g/1000 grains):

1.2.1 Effect of sowing date (A): Results in Table 5-a and 5-b indicated that, delaying the cultivation date by two weeks did not reduce the seed index significantly but it produced 1.34% increase in the seed index

1.2.2 Effect of irrigation regime (B): The results in Table 5-a and 5-b showed that the irrigation regimes significantly affected on the seed index in the three studied seasons, where the best results of seed index were obtained from the irrigation (I1) at 21days interval with values of 46.125, 43.386, and 45.655

gm/1000 grains, for 2012/13, 2013/14 and 2014/15 seasons, respectively. Seed index was increased by 14.943% and 7.125% by shortening the irrigation interval from 35 day to 21 and 28 days, respectively.

1.2.3 Effect of wheat cultivars (C): Data in Table 5-a and 5-b indicated that the seed index was significantly affected by wheat cultivars. The highest values of 44.108, 41.939, and 43.439 gm/1000 grains, were gained from Shandaweel-1 cultivar (V1) during 2012/13, 2013/14 and 2014/15 seasons, respectively. The seed index of Shandaweel-1 of 4.27% was higher than Seds-12 and 3.64% higher than Giza-168.

1.2.4 A x B Interaction: The interaction between sowing date and irrigation treatments produced significant differences in the seed index through the three seasons. The highest values of seed index were produced form the interaction between the second sowing date with irrigation at 21 days interval (S2*I1) namely, 46.85, 43.84, and 46.08 gm/1000grin , from 2012/13, 2013/14 and 2014/15 seasons, respectively.

1.2.5 A x C Interaction: Data in Table 5-a and 5-b revealed no significant effects were found on seed index values due to the interaction between sowing date and wheat cultivars.

1.2.6 B x C Interaction: The interaction between irrigation regime and wheat cultivars had a significant effect on seed index. The highest values of seed index were produced from irrigating Shandaweel-1 wheat cultivar (V1) every 21 days (I1) with value of 47.480, 43.863, and 46.762 gm/1000 grin, respectively, through 2012/13, 2013/14 and 2014/15 seasons, respectively.

1.2.7 A x B x C Interaction: The highest values of seed index were optioned from the interaction of the second sowing date at 5th December of Shandaweel-1 irrigated every 21 days interval with value of 48.340, 44.387 and 47.317 g/1000 grains, during 2012/13, 2013/14 and 2014/15, respectively.

Table-5-a. Seed Index (g/1000grains) during three years for the three verities, three irrigation regimes and two swing dates.

Sea-	V1	V2	V3	I1	I2	I3	S1	S2	Mean
2012/1	44.108	42.235	41.708	46.125	42.922	39.003	42.281	43.086	42.684
2013/1	41.939	40.873	40.868	43.386	41.260	39.034	41.051	41.402	41.227
2014/1	43.439	41.953	41.610	45.655	41.790	39.557	42.043	42.625	42.334
Mean	43.162	41.687	41.395	45.055	41.991	39.198	41.792	42.371	42.081
% ±	4.268	0.705	0.000	14.943	7.125	0.000	0.000	53.929	

Where: (A) FACTOR S1, and S2 =Sowing on 20th November, and 5th December. (B)FACTOR I1, I2 and I3 =Irrigation regime 21,28 and 35days. (C) FACTOR, V1, V2 andV3 = wheat cultivars I.e., Shandaweel-1, GIza-168 and SIds-12

1.3 Total biological yield (ton/fed):

1.3.1 Effect of sowing date (A): Data in Table 6-a and 6-b, revealed that the total biological yield was significantly effected by sowing date. The best values of the total biological yield of 7.389, 6.092 and 5.852 ton/fed resulted from the sec-

ond sowing date at 5th December in. Total biological yield increased by 7.98 % with the second sowing (date 5th December) over the first sowing date (20th November).

1.3.2 Effect of irrigation regime (B): Data recorded in Table 6-a and 6-b indicated that the total biological yield was significantly increased by shortening the irrigation intervals with values, of 5.563, 6.190, and 6.865 ton/fed for 35, 28 and 21 days irrigation interval, respectively. Irrigation every 21days gave the highest values of the total biological yield of 7.897, 6.331 and 5.852 ton/fed through the three seasons i.e., 2012/13, 2013/14 and 2014/15. Total biological yield significantly increased with decreasing the irrigation interval from 35 days by one and two weeks by 11.270% and 23.405%

1.3.3 Effect of wheat cultivars(C): Data in Table 6-a and 6-b shown that, Shandaweel-1 produced significant higher yield than the other two cultivar. Total biological yield of wheat cultivars Shandaweel1 and Giza168 was increased by 4.698 % and 0.421 % Sids12, respectively, compared of Sids12.

1.3.4 Effect of A x B interaction: The total biological yield values were significantly affected by the interactions between sowing date and irrigation regime, where the sowing date on 5th of Dec. with irrigation every 21 treatment recorded the highest values of total biological yield 8.709 and 6.628 ton/ fed) in both the first and second seasons (2012/13 and 2013/14), respectively. The interaction of the first sowing date with irrigation treatment interval21 days had the highest value of total biological yield (6.460 ton /fed) in the last season 2014/15.

1.3.5 Effect of A x C interaction: The total biological yield of Shandaweel-1 sown on the 5th of Dec. as an average of three years was better than the other two wheat cultivars and sowing dates.

1.3.6 Effect of B x C interaction: Shandaweel-1 wheat cultivar with irrigation at 21 days significantly affected the total biological. The biological yield obtained from interaction between the irrigation intervals at 21 days with Shandaweel-1 were 8.254, 6.512 and 6.549 ton /fed, during 2012/13, 2013/14 and2014/15 seasons, respectively.

1.3.7 Effect A x B x C interaction: The triple interaction of sowing date with irrigation regime and wheat cultivars showed significant effects on total biological yield. Shandaweel-1, irrigated every 21 days which sown on the 5th of Dec. produced the highest significant value of total biological yield of 8.893 ton/fed.

The total biological yield was reduced from 2012/13 to 2014/15, growth seasons by 18.83%, due to temperature reduction by about on degree. In contrast, the grain weight of 5 spikes showed a steady increase in the average of the grain weight of the 5spikes through the three seasons and that was supposed to be due to the decrease in the Max temperature during 2014/15 than 2012/13. The cold weather enhances the grain filling which overcomes the vegetative growth and hay ratio.

Table-6-a. Total biological yield (ton/fed) during three years for the three verities, three irrigation regimes and two swing dates.

Sea-	V1	V2	V3	I1	I2	I3	S1	S2	MEA
2012/1	7.014	6.770	6.809	7.884	6.838	5.871	6.340	7.389	6.865
2013/1	6.190	5.791	5.949	6.331	5.928	5.671	5.862	6.092	5.977
2014/1	5.962	5.822	5.547	6.381	5.803	5.147	5.701	5.852	5.777
Mean	6.389	6.128	6.102	6.865	6.190	5.563	5.968	6.444	6.206
% ±	4.698	0.421	0.000	23.405	11.270	000	0.000	7.980	

Where: (A) FACTOR s1, and S2 =Sowing on 20th November, and 5th December. (B)FACTOR I1, I2andI3 =Irrigation regime 21, 28 and 35days. (C) FACTOR, V1, V2 andV3 = wheat cultivars I.e., Shandaweel-1, GIza-168 and SIds-1

1.4 Grain yield (kg /fed).

Data in Table 7-a and 7-b, present the results of grain yield.

1.4.1 Effect of sowing date (A): Delaying the sowing date 15 days from 20th November to 5th December caused 17.477% increase in wheat grain yield. This increase was significant. The best values for grain yield were 2314.8, 2467.9 and 2474.7 kg /fed., that were recorded for the second sowing date 5th December and 1841.8, 2181.4 and 2154.6 kg /fed., for the 20th of Nov. during the three respective seasons 2012/13, 2013/14 and2014/15. The average grain yield produced from the late sowing date was 2419.2 kg/fed (5760 kg/ha).

1.4.2 Effect of irrigation regime (B): The grain yield was significantly affected by the irrigation regime interval. Grain yield values were increased by using irrigation treatment interval of 21days which gave the highest values for grain yield of 2735.2, 2491.4 and 2579.7 kg/fed for 2012/13, 2013/14 and 2014/15 seasons, respectively. The grain yield increased due to increasing the soil moisture. These results are in agreement with those reported by Khail *et al*, (2005) and El-Marsafawy (2000). Increasing the irrigation interval by one and two weeks reduced the grain yield by 15.5% and 24.4%, respectively. Therefor 21days irrigation interval would be the best irrigation schedule for max grain weight. Metin-Sezen and Attila-Yazar (2006) in the arid Southeast Anatolia of Turkey, recorded that shortening the irrigation intervals (7, 14 and 21 days) increased the grain yield, compared with prolonged irrigation intervals (35 days).Decreasing the irrigation interval by two or one week increased the grain yield significantly by 32.957% and 12.367%. There for, using 21days interval, would be the best irrigation scheduling for highs grain yield in Sohag.

1.4.3 Effect of wheat cultivars (C): The highest values of grain yield of 2160.4, 2455.4 and 2332.7 kg/fed were gained from Shandaweel-1, through 2012/13, 2013/14 and 2014/15, seasons, respectively. The grain yield of the three variety namely Shandaweel-1, Giza168, and Sides-12 were 2316.2, 2242.4, and 2159.0 kg/fed respectively. The increase in the grain yield of Shandaweel1 was 7.278% compared to Sides-12.

1.4.4 Effect of A x B interaction: The grain yield values were significantly affected by the interactions between sowing date and irrigation regime. The highest values of

grain yield of 3150.3, 2656.31 and 2676.8 kg/ fed were produced by sowing wheat on 5th Dec, and irrigating it every 21 days. During the growing seasons of 2012/13, 2013/14 and 2014/15, respectively. The lowest grain yield was resulted from interval of 35 days and 20th of Nov. date.

1.4.5 Effect of A x C interaction: The highest grain yield was produced when wheat cultivar of Shandaweel-1 (V1) was sown in the late sowing date of 5th December (S2), in the first 2012/13 and second 2013/14 seasons (2475.2 and 2576.2 kg/fed), respectively. However, Giza186 sown on the 5th of Dec. had the best value of grain yield in the last season 2014/15 with value of 2570.7 kg/fed. This result may be due to the interaction between genetic coefficients with the weather condition.

1.4.6 Effect of B x C interaction: Irrigation at 21 days with Shandaweel-1 wheat cultivar recorded the best values of grain yield i.e. 2861.7, 2573.0, and 2638.5 kg/fed through 2012/13, 2013/14 and 2014/15 seasons, respectively.

1.4.7 Effect of A x B x C interaction: The highest result for grain yield of 3290.6, was obtained by Shandaweel-1(V1) irrigated every 21 days (I1) at the second sowing 5th December (S2) date. The grain yield increased in the second and third year by 11.86 and 11.37% respectively.

Table-7-a. Grain yield (kg /fed) during three years for the three verities, three irrigation regimes and two swing dates.

Seasons	V1	V2	V3	I1	I2	I3	S1	S2	Mean
2012/13	2160.472	2102.117	1972.461	2722.372	1976.728	1535.950	1841.807	2314.893	2078.35
2013/14	2455.422	2266.983	2251.711	2456.872	2301.544	2215.700	2181.485	2467.926	2324.71
2014/15	2332.778	2358.222	2253.089	2580.167	2279.533	2084.389	2154.615	2474.778	2314.70
Mean	2316.22	2242.44	2159.09	2586.47	2185.94	1945.35	2059.30	2419.20	2239.25
% ±	7.278	3.861	0.000	32.957	12.367	0.000	0.000	17.477	

Where: (A) FACTOR s1, and S2 =Sowing on 20th November, and 5th December. (B)FACTOR I1, I2andI3 =Irrigation regime 21, 28 and35days.(C) FACTOR, V1, V2 andV3 = wheat cultivars I.e., Shandaweel-1, GIza-168 and SIds-12

1.5 Straw yield (ton/fed)

Data in Tables 8-a, and 8-b includes the results of the wheat straw, yield.

1.5.1 Effect of sowing Date: The straw yield produced from sowing dates of 20th of Nov. and 5th of Dec. were 4.492, and 4.989 tons/fed. in 2012, 30657 and 3.624 tons/fed. in 2014 , and 30367 and 30537 tons/fed. in 2015. The straw yield values were higher with the late sowing while the straw yield was going down growing with seasons from 2012/13, to 2014/15 growth seasons while the grains yield had an increasing trend.

1.5.2 Effect of irrigation regime: Data recorded in Table 8-a and 8-b indicated that the straw yield was significantly affected by the irrigation regime interval. Straw yield values were increased by reducing the irrigation interval to 21days which gave the highest values for straw yield of 5.148, 3.839 and 3.802 tons/fed in the three respective seasons i.e. 2012/13, 2013/14 and 2014/15. Metin-Sezen and Attila-Yazar (2006 reported similar results.

1.5.3 Effect of wheat cultivars: The straw yield values produced from Shandaweel-1 cultivar were significantly higher than the other two cultivars with values of 4.835, 3.735 and 3.626 ton/fed, through 2012/13,

2013/14 and 2014/15 seasons, respectively.

1.5.4 Effect of A x b interaction: The interaction between the second sowing date and irrigation treatment interval 21 days recoded the highest values of straw yield (5.533 and 3.967 ton/ fed) in both the first and second seasons (2012/13 and 2013/14), respectively, the interaction of the first sowing date with irrigation treatment interval 21 days recorded the highest value of total yield (3.971 ton /fed) in the last season 2014/15.

1.5.5 Effect of A x C interaction: Results in Table 8-a and 8-b indicated that the values of straw yield were significantly affected by the interaction between the sowing date and wheat cultivars.

1.5.6 Effect of B x C interaction: Data illustrated in table 8-a and 8-b showed a significant effect on the straw yield due to the interaction between the irrigation regimes and wheat cultivars. The interaction between the irrigation treatment interval 21 days (I1) and wheat cultivar Shandaweel 1(V1) had the highest values of straw yield (5.353, 3.939 and 3.917 ton /fed) in (2012/13, 2013/14 and2014/15) seasons, respectively.

1.5.7 Effect of A x B x C interaction: The triple interaction showed that Sids-12 sown on 5 Dec. with the irrigation regime every 21 produced significant higher straw yields through the first and second seasons, while Shandweel-1 produced the highest straw yield when sown on the 20th of Nov. and irrigated every 28 days.

Table-8-a. Straw yield (ton/fed) during three years for the three verities, three irrigation regimes and two swing dates.

Sea-	V1	V2	V3	I1	I2	I3	S1	S2	Mean
2012/1	4.835	4.662	4.724	5.148	4.741	4.332	4.492	4.989	4.741
02013/	3.735	3.522	3.664	3.839	3.629	3.454	3.657	3.624	3.641
2014/1	3.626	3.451	3.279	3.802	3.514	3.041	3.537	3.367	3.452
Mean	4.065	3.878	3.889	4.263	3.961	3.609	3.895	3.993	3.944
% ±	4.831	0.009	0.284	18.121	9.763	0.000	0.000	2.525	

Where: (A) FACTOR s1, and S2 =Sowing on 20th November, and 5th December. (B)FACTOR I1, I2 and I3 = Irrigation regime 21, 28 and35days.(C) FACTOR, V1,V2 andV3 = wheat cultivars I.e., Shandaweel-1, GIza-168 and SIds-12

2. Water Relations

2.1 Actual water consumptive use (WCU, m^3/fed).

Evapotranspiration is the combination of two processes, evaporation and transpiration. Evaporation is the direct evaporation of water from the soil surface and/or from the plant surface. Transpiration is the flow of water vapor from the interior of the plant to the atmosphere (Jones *et al*, 1984). Results in Table 9-a and 9-b showed that the seasonal water consumptive use (ETa) was increased as Etc with the increased number of irrigations and the soil moisture was more available for extraction by plant roots and as well as soil surface evaporation where the value of the ETc for irrigation treatment 21 day heights than the 28, and 35 days irrigation treatment. Water consumptive use was reduced by 6.64m^3 in 2014/15 season compared to 2012/13 and 2013/14 seasons. due to the change in the T^0 Max by 1.1C^0 in

2014/15 season compared by 2012/13 and 2013/14 seasons, the EP also changed in these seasons by 4.43, 4.63, 4.12 %

2.1.1 Factor (A): Effect of sowing date (A), the WCU maximum value was predicted by the first sowing date S1 in all studied seasons, With respect to sowing date, The WCU in 2012/13, 2013/14 and 2014/15 for S1(1908, 1857 and 1778 m^3/fed)for 2012/13, respectively, in same respective WCU results for S2 were (1855, 1879, and 1777 m^3/fed). These results indicate that ETa values with early sowing date, whereas delaying sowing date decreased WCU values. Due to shortage growth season under delayed sowing date caused in minimize develop roots growth as well as decrease water uptake by plant. These results were pointed out by (Hussein *et al,*. 1990) who reported that sowing wheat at late November in (20^{th} and 28^{th}) generally increases crop CU values when compared by swing at December. Delaying the sowing date by 15days to 5^{th} December reduced the water consumptive use.

2.1.2 Factor (B): Effect of irrigation regime(B). The highest WCU values were predicted by I1, water consumptive use was increased as ETc with the increased number of irrigations and the soil moisture was more available for extraction by plant roots and as well as soil surface evaporation where the value of the ETc for irrigation treatment 21 day heights than the 28, and 35days irrigation treatment. The WCU value in the first season 2012/13 was (2194, 1874, and 1620 m^3/fed) for irrigation treatment I1, I2 and I3, respectively. The same respective in 2013/14 and 2014/15 WCU value were (2104, 1912 and1588m^3/fed) in succession. Irrigation every 28 days and 21 days increased the consumptive use more than the irrigation interval 35days by 16.6%and 33.1%.

2.1.3 Factor (C): Effect of wheat cultivars(C), The data in Table 9-a and 9-b showed that the wheat cultivar Giza168, V2 recorded the highest value for WCU in these study, and the least value was given by seidss12. The cultivar Giza168 used water 5.3% more than Sides12 while Shandaweel1 used 1.4% water more than Sides12 ,that is due to the genetic fraction of each variety .

2.1.4 A x B Interaction: The interaction between sowing date and irrigation regimes, as shown in Table 9-a and 9-b pointed out that, the WUC gave different results, while, the interaction between sowing date and irrigation treatment interval 35 days (I3) gave the minimum value of WCU.

2.1.5 A x C Interaction: The interaction S2*V2 recorded the highest WCU value in most results.

2.1.6 B x C Interaction: The interaction between irrigation regime and wheat cultivars as shown in Table 9-a and 9-b pointed out that the WCU value was increased by short irrigation to 21days interval (I1) with wheat cultivar Giza168 (V2).

2.1.7 A x B x C Interaction: The general interaction of these studied treatment (S1*I1*V2, S1*I1V1, and S1*I1V2) recorded the highest WCU value in 2012/13, 2013/14 and 2014/15. While, the WCU was (2445, 2156, and 2124 m^3/fed), respectively.

Table-9-a Actual (measured) water consumptions during three years for the three verities, three irrigation regimes and two swing dates

Sea-	V1	V2	V3	I1	I2	I3	S1	S2	Mean
2012/1	1877	1968	1844	2194	1874	1620	1908	1885	1896
2013/1	1857	1908	1839	2104	1915	1839	1857	1879	1868
2014/1	1763	1830	1739	2030	1778	1525	1778	1777	1778
Mean	1832	1902	1807	2109	1848	1585	1848	1847	1847
% ±	1.383	5.238	0.000	33.100	16.578	0.000	0.036	0.000	

Where: (A) FACTOR s1, and S2 =Sowing on 20th November, and 5th December (B) FACTOR I1, I2andI3 =Irrigation regime 21, 28 and35days.(C) FACTOR, V1, V2 andV3 = wheat cultivars, Shandaweel-1, GIza-168 and SIds-12

2.2 Water use efficiency (WUE):

Table 10-a and 10-b shows the results for WUE witch indicated that:

2.2.1 Factor (A): The second sowing date of 5th December (S2), recorded the best WUE value through the three seasons. The WUE values was 0.963, and 1.256 kg of wheat /m^3 for S1 and S2 in the first season 2012/13, respectively, while in the successive seasons 2013/14 and 2014/15 the WUE value for S1 and S2 were 1.200, and 1.323 kg/m^3, 1.217, and 1.409 kg/m^3, respectively .

2.2.2 Factor (B): Irrigation every 21 day interval (I1) in the first season (2012/13) was the best. However, WUE values increased with irrigation at 35 days interval (I3) in 2013/14 and 2014/15. These are due to the decrease in the applied water consumed (I3). These results matched with those reported by El-Marsafawy (2000) She found that the highest WUE value for wheat was achieved as irrigation practiced according at 1.0 EPC.

2.2.3 Factor (C): Shandaweel-1(V1) gave the best values for WUE in all growth seasons.

2.2.4 A x B Interaction: The maximum WUE was given by the interaction of the second sowing date with the irrigation at 21 days interval (S2*I1) only in the first season (2012/13), but the interaction between the second sowing date and the irrigation at 35 days interval (S2*I3) recorded the highest WUE value in 2013/14 and 2014/15 as shown in Table 5.

2.2.5 A x C Interaction: The interaction between wheat cultivar Shandaweel 1and second sowing date 5th December (S2*V1) gave the best WUE values for all seasons.

2.2.6 B x C Interaction: WUE values increased with using irrigation treatment of 35 days interval with wheat cultivar Shandaweel1 (I3 *V1).

2.2.7 The effect of the triple interaction (A*B*C): The highest WUE was with sowing wheat cultivar Shandaweel 1 (V1), in 5th December (S2), using irrigation treatment interval of 35 days (I3).

Table -9-a. Actual Water use efficiency (WUE) during three years for the three verities, three irrigation regimes and two swing dates

Sea-	V1	V2	V3	I1	I2	I3	S1	S2	Mean
2012/1	1.145	1.065	1.117	1.251	1.126	0.951	0.964	1.255	1.110
2013/1	1.340	1.196	1.250	1.183	1.221	1.382	1.201	1.323	1.262
2014/1	1.332	1.302	1.307	1.272	1.289	1.380	1.219	1.409	1.314
Mean	1.272	1.188	1.225	1.235	1.212	1.238	1.128	1.329	1.229
% ±	7.099	0.000	3.086	1.925	0.000	2.118	0.000	17.819	

Where: (A) FACTOR s1, and S2 =Sowing on 20th November, and 5th December, (B)FACTOR I1, I2andI3 =Irrigation regime 21, 28 and35days. (C) FACTOR, V1, V2 andV3 = wheat cultivars, Shandaweel-1, GIza-168 and SIds-12

Table -4-b. Effect of different sowing dates and irrigation regimes on grain weight /5 spikes (g) of some wheat varieties under Sohag governorate conditions

Sowing date (A)	Irrigatio regime (B)	Grain weight /5 spikes(g)											
		2012/13 season				2013/14 season				2014/15 season			
		Varieties (C)			Mean	Varieties (C)			Mean	Varieties (C)			Mean
		V1	V2	V3		V1	V2	V3		V1	V2	V3	
S1	I1	13.970	12.673	12.990	13.211	14.967	13.000	13.600	13.856	17.880	16.077	16.400	16.786
	I2	12.017	11.517	11.670	11.734	12.843	12.450	12.633	12.642	14.300	13.753	14.190	14.081
	I3	11.473	10.917	10.613	11.001	12.093	11.293	10.477	11.288	13.040	12.850	11.830	12.573
Mean		12.487	11.702	11.758	11.982	13.301	12.248	12.237	12.595	15.073	14.227	14.140	14.480
S2	I1	15.823	13.267	15.243	14.778	17.050	13.597	15.267	15.304	20.737	17.660	19.090	19.162
	I2	12.610	10.577	12.050	11.746	13.173	12.573	12.993	12.913	14.730	14.017	14.687	14.478
	I3	11.147	11.100	10.767	11.004	11.987	11.510	11.153	11.550	12.917	12.870	12.437	12.741
Mean		13.193	11.648	12.687	12.509	14.070	12.560	13.138	13.256	16.128	14.849	15.404	15.460
B*C	I1	14.897	12.970	14.117	13.994	16.008	13.298	14.433	14.580	19.308	16.868	17.745	17.974
	I2	12.313	11.047	11.860	11.740	13.008	12.512	12.813	12.778	14.515	13.885	14.438	14.279
	I3	11.310	11.008	10.690	11.003	12.040	11.402	10.815	11.419	12.978	12.860	12.133	12.657
Mean(C)		12.840	11.675	12.222		13.686	12.404	12.687		15.601	14.538	14.772	

Where: (A) FACTOR s1, and S2 =Sowing on 20th November, and 5th December. (B)FACTOR I1, I2 and I3 =Irrigation regime 21,28 and 35days.

(C) FACTOR,V1,V2 andV3 = wheat cultivars I.e., Shandaweel-1, GIza-168 and SIds-12

LSD at 0.5 level for:

A	0.04	0.45	0.42
B	0.35	0.18	0.29
AB	0.40	0.34	0.31
C	0.45	0.22	0.37
AC	0.50	0.43	0.40
BC	0.61	0.53	0.49
ABC	0.87	0.75	0.69

Table -5-b. Effect of different sowing dates and irrigation regimes on seeds index (g/1000 grain) of some wheat varieties under Sohag governorate conditions.

Sowing date (A)	Irrigation regime (B)	Seed index											
		2012/13 season				2013/14 season				2014/15 season			
		Varieties (C)			Mean	Varieties (C)			Mean	Varieties (C)			Mean
		V1	V2	V3		V1	V2	V3		V1	V2	V3	
S1	I1	46.620	45.167	44.413	45.400	43.340	43.147	42.303	42.930	46.207	45.570	43.923	45.233
	I2	43.710	41.753	42.903	42.789	41.617	40.897	41.097	41.203	42.293	41.213	41.313	41.607
	I	41.110	39.643	35.210	38.654	40.523	38.600	37.940	39.021	41.150	39.657	37.057	39.288
Mean		43.813	42.188	40.842	42.281	41.827	40.881	40.447	41.051	43.217	42.147	40.764	42.043
S2	I1	48.340	44.700	47.510	46.850	44.387	42.800	44.337	43.841	47.317	44.073	46.840	46.077
	I2	44.133	42.033	43.000	43.056	41.840	40.910	41.200	41.317	42.900	41.253	41.767	41.973
	I	40.733	40.113	37.210	39.352	39.927	38.883	38.333	39.048	40.767	39.950	38.760	39.826
Mean		44.402	42.282	42.573	43.086	42.051	40.864	41.290	41.402	43.661	41.759	42.456	42.625
B*C	I1	47.480	44.933	45.962	46.125	43.863	42.973	43.320	43.386	46.762	44.822	45.382	45.655
	I2	43.922	41.893	42.952	42.922	41.728	40.903	41.148	41.260	42.597	41.233	41.540	41.790
	I	40.922	39.878	36.210	39.003	40.225	38.742	38.137	39.034	40.958	39.803	37.908	39.557
Mean(C)		44.108	42.235	41.708		41.939	40.873	40.868		43.439	41.953	41.610	

Where: (A) FACTOR s1, and S2 =Sowing on 20th November, and 5th December. (B)FACTOR I1, I2 and I3 =Irrigation regime 21,28 and35days.
(C) FACTOR,V1,V2 andV3 = wheat cultivars I.e., Shandaweel-1, GIza-168 and SIds-12

LSD at 0.5 level for:

A	2.57N.S	0.90N.S	4.21N.S
B	1.42	0.70	1.21
AB	1.07	0.57	1.91
C	1.80	0.88	1.53
AC	1.35N.S	0.72N.S	1.41N.S
BC	1.66	0.88	2.95
ABC	2.35	1.25	4.18

Table -6-b. effect of different sowing dates and irrigation regimes on total biological yield (1000kg/fed) of some wheat varieties under Sohag governorate conditions.

Sowing date (A)	Irrigation regime (B)	Total biological yield(1000kg/fed)											
		2012/13 season				2013/14 season				2014/15 season			
		Varieties (C)			Mean	Varieties (C)			Mean	Varieties (C)			Mean
		V1	V2	V3		V1	V2	V3		V1	V2	V3	
S1	I1	7.615	6.430	7.129	7.058	6.426	5.521	6.156	6.034	6.669	6.442	6.269	6.460
	I2	6.195	6.116	5.834	6.048	5.915	6.030	5.809	5.918	6.490	5.782	5.250	5.841
	I3	6.228	5.750	5.761	5.913	5.647	5.626	5.625	5.633	4.989	4.802	4.618	4.803
Mean		6.679	6.099	6.241	6.340	5.996	5.726	5.863	5.862	6.049	5.675	5.379	5.701
S2	I1	8.893	8.571	8.664	8.709	6.599	6.646	6.638	6.628	6.429	6.488	5.991	6.302
	I2	7.486	7.580	7.818	7.628	6.203	5.575	6.035	5.938	5.682	5.868	5.744	5.765
	I3	5.669	6.170	5.646	5.828	6.348	5.349	5.431	5.709	5.514	5.548	5.409	5.490
Mean		7.349	7.441	7.376	7.389	6.384	5.857	6.035	6.092	5.875	5.968	5.715	5.852
B*C	I1	8.254	7.501	7.897	7.884	6.512	6.083	6.397	6.331	6.549	6.465	6.130	6.381
	I2	6.841	6.848	6.826	6.838	6.059	5.802	5.922	5.928	6.086	5.825	5.497	5.803
	I3	5.949	5.960	5.703	5.871	5.998	5.488	5.528	5.671	5.252	5.175	5.014	5.147
Mean (C)		7.014	6.770	6.809		6.190	5.791	5.949		5.962	5.822	5.547	

Where: (A) FACTOR S1, and S2 =Sowing on 20th November, and 5th December. (B)FACTOR I1,I2andI3 =Irrigation regime 21,28 and35days.
(C) FACTOR,V1,V2 andV3 = wheat cultivars I.e., Shandaweel-1, GIza-168 and SIds-12.

LSD at 0.5 level for:

A	0.09	0.01	0.09
B	0.18	0.03	0.08
AB	0.26	0.04	0.12
C	0.08	0.06	0.05
AC	0.11	0.08	0.07
BC	0.14	0.10	0.09
ABC	0.20	0.14	0.12

Table-7-b. Effect of different sowing dates and irrigation regimes on grain yield (kg/fed) of some wheat varieties under Sohag governorate conditions

Sowing Date (A)	Irrigation regime (B)	Grain yield (kg/fed)											
		2012/13 season				2013/14 season				2014/15 season			
		Varieties (C)			Mean	Varieties (C)			Mean	Varieties (C)			Mean
		V1	V2	V3		V1	V2	V3		V1	V2	V3	
S1	I1	2432.867	2217.867	2232.667	2294.467	2483.600	2483.600	2060.700	2257.433	2566.667	2397.333	2486.667	2483.556
	I2	1793.333	1849.500	1799.233	1814.022	2255.133	1897.933	2100.833	2084.633	2326.667	2040.000	2015.533	2127.040
	I3	1311.000	1567.567	1372.233	1416.933	2265.233	2200.967	2140.967	2202.389	1870.000	2000.000	1688.667	1852.800
Mean		1845.733	1878.311	1801.378	1841.807	2334.656	2108.967	2100.833	2181.485	2254.444	2145.778	2063.622	2154.615
S2	I1	3290.600	3122.967	3037.267	3150.278	2662.433	2664.467	2642.033	2656.311	2710.333	2753.333	2566.667	2676.778
	I2	2534.033	2275.467	1608.800	2139.433	2588.267	2438.333	2528.767	2518.456	2172.000	2592.000	2531.000	2431.667
	I3	1601.000	1579.333	1784.567	1654.967	2477.867	2172.200	2036.967	2229.011	2351.000	2366.667	2230.000	2315.889
Mean		2475.211	2325.922	2143.544	2314.893	2576.189	2425.000	2402.589	2467.926	2411.111	2570.667	2442.556	2474.778
B*C	I1	2861.733	2670.417	2634.967	2722.372	2573.017	2446.233	2351.367	2456.872	2638.500	2575.333	2526.667	2580.167
	I2	2163.683	2062.483	1704.017	1976.728	2421.700	2168.133	2314.800	2301.544	2249.333	2316.000	2273.267	2279.533
	I3	1456.000	1573.450	1578.400	1535.950	2371.550	2186.583	2088.967	2215.700	2110.500	2183.333	1959.333	2084.389
Mean		2160.472	2102.117	1972.461		2455.422	2266.983	2251.711		2332.778	2358.222	2253.089	

Where: (A) FACTOR s1, and S2 =Sowing on 20th November, and 5th December. (B)FACTOR I1, I2 andI3 =Irrigation regime 21,28 and35days.

(C) FACTOR,V1,V2 andV3 = wheat cultivars I.e., Shandaweel-1, GIza-168 and SIds-12

LSD at 0.5 level for:

A	341.14	28.16	101.64
B	258.48	19.44	111.33
C	191.81	17.57	70.47
AB	365.55	27.49	157.44
AC	271.26	24.85	99.66
BC	332.22	30.44	122.06
ABC	469.83	43.05	172.62

Table -8-b. Effect of different sowing dates and irrigation regimes on straw yield (100kg/fed) of some wheat varieties under Sohag governorate conditions

Sowing date (A)	Irrigatio regime (B)	Straw yield (100kg/fed)											
		2012/13 season				2013/14 season				2014/15 season			
		Varieties (C)			Mean	Varieties (C)			Mean	Varieties (C)			Mean
		V1	V2	V3		V1	V2	V3		V1	V2	V3	
S1	I1	5.182	4.212	4.897	4.764	3.942	3.293	3.901	3.712	4.102	4.013	3.797	3.971
	I2	4.369	4.250	4.047	4.222	3.660	4.125	3.708	3.831	4.129	3.709	3.234	3.691
	I3	4.917	4.182	4.372	4.490	3.382	3.425	3.481	3.429	3.119	2.802	2.926	2.949
Mean		4.822	4.215	4.439	4.492	3.661	3.615	3.697	3.657	3.783	3.508	3.319	3.537
S2	I1	5.525	5.448	5.627	5.533	3.937	3.981	3.983	3.967	3.732	3.728	3.438	3.632
	I2	4.952	5.288	5.543	5.261	3.625	3.136	3.520	3.427	3.510	3.276	3.223	3.336
	I3	4.068	4.591	3.861	4.173	3.867	3.173	3.394	3.478	3.163	3.181	3.055	3.133
Mean		4.848	5.109	5.010	4.989	3.809	3.430	3.632	3.624	3.468	3.395	3.239	3.367
B*C	I1	5.353	4.830	5.262	5.148	3.939	3.637	3.942	3.839	3.917	3.870	3.618	3.802
	I2	4.660	4.769	4.795	4.741	3.642	3.631	3.614	3.629	3.819	3.492	3.229	3.514
	I3	4.493	4.386	4.117	4.332	3.624	3.299	3.437	3.454	3.141	2.991	2.991	3.041
Mean(C)		4.835	4.662	4.724		3.735	3.522	3.664		3.626	3.451	3.279	3.452

Where: (A) FACTOR s1, and S2 =Sowing on 20th November, and 5th December. (B)FACTOR I1, I2 andI3 =Irrigation regime 21, 28 and35days.

(C) FACTOR,V1,V2 andV3 = wheat cultivars I.e., Shandaweel-1, GIza-168 and SIds-12

LSD at 0.5 level for:

A	0.07	0.02	0.06
B	0.15	0.03	0.04
AB	0.21	0.04	0.06
C	0.07	0.04	0.03
AC	0.10	0.06	0.04
BC	0.12	0.08	0.05
ABC	0.17	0.11	0.07

Table-9-b. Seasonal water consumptive use (m^3/fed) of wheat cultivars i.e., Shandaweel-1, Giza-168 and Sids-12 as affected by water regime and sowing date at Shandaweel region in the three seasons (2012/2013, 2013/2014 and 2014/2015).

Sowing Date (A)	Irrigation regime (B)	Water consumptive use (m^3/fed)											
		2012/2013			MEAN	2013/2014			MEAN	2014/2015			MEAN
		V1	G168	V3		V1	G168	V3		V1	G168	V3	
S1	I1	2134	2445	2026	2202	2156	2053	1990	2066	2026	2124	1896	2015
	I2	1984	1917	1868	1923	1911	1931	1903	1915	1839	1817	1781	1812
	I3	1647	1561	1589	1599	1672	1579	1514	1588	1567	1483	1465	1505
MEAN		1922	1974	1844	1908	1913	1854	1802	1857	1811	1807	1714	1778
S2	I1	2202	2218	2139	2186	2145	2145	2135	2142	2053	2060	2018	2044
	I2	1730	1933	1813	1825	1723	1995	1880	1866	1631	1855	1744	1743
	I3	1567	1734	1627	1643	1535	1744	1612	1630	1465	1642	1530	1546
MEAN		1833	1962	1860	1885	1801	1961	1876	1879	1716	1853	1764	1777
(B*C)	I1	2168	2332	2083	2194	2151	2099	2063	2104	2039	2092	1957	2030
	I2	1857	1925	1841	1874	1817	1963	1892	1890	1735	1836	1762	1778
	I3	1607	1648	1608	1620	1604	1662	1563	1609	1516	1563	1497	1525
MEAN(C)		1877	1968	1844	1896	1857	1908	1839	1867	1763	1830	1739	1777

Where: (A) FACTOR s1, and S2 =sowing on 20th November, and 5th December. (B)FACTOR I1,I2andI3 =Irrigation regime 21,28 and35days.
(C) FACTOR,V1,V2 andV3 = wheat cultivars i.e., Shandaweel-1, Giza-168 and Sids-12

Table -10-b. Seasonal Water use efficiency (WUE)of wheat cultivars i.e., Shandaweel-1, Giza-168 and Sids-12 as affected by water regime and sowing date at Shandaweel region in the three seasons (2012/2013, 2013/2014 and 2014/2015).

Sowing` Date(A)	Irrigation regime (B)	WUE (kg grain/m^3)											
		2012/2013			MEAN	2013/2014			MEAN	2014/2015			MEAN
		V1	V2	V3		V1	V2	V3		V1	V2	V3	
S1	I1	1.140	0.907	1.102	1.050	1.152	1.085	1.133	1.123	1.267	1.144	1.303	1.238
	I2	0.921	0.973	0.956	0.950	1.180	0.986	1.104	1.090	1.284	1.141	1.132	1.186
	I3	0.796	1.004	0.874	0.891	1.355	1.394	1.416	1.388	1.193	1.349	1.155	1.232
Mean		0.952	0.962	0.977	0.964	1.229	1.155	1.218	1.201	1.248	1.211	1.197	1.219
S2	I1	1.529	1.408	1.420	1.452	1.241	1.242	1.244	1.242	1.314	1.340	1.265	1.306
	I2	1.465	1.186	1.255	1.302	1.496	1.222	1.338	1.352	1.332	1.397	1.446	1.392
	I3	1.022	0.911	1.097	1.010	1.616	1.247	1.264	1.376	1.605	1.441	1.539	1.528
Mean		1.339	1.168	1.257	1.255	1.451	1.237	1.282	1.323	1.417	1.393	1.416	1.409
B*C	I1	1.335	1.158	1.261	1.251	1.197	1.164	1.188	1.183	1.290	1.242	1.284	1.272
	I2	1.193	1.080	1.106	1.126	1.338	1.104	1.221	1.221	1.308	1.269	1.289	1.289
	I3	.909	0.958	0.985	0.951	1.486	1.321	1.340	1.382	1.399	1.395	1.347	1.380
Mean(C)		1.145	1.065	1.117		1.340	1.196	1.250		1.332	1.302	1.307	

Where: (A) FACTOR s1, and S2 =sowing on 20th November, and 5th December. (B)FACTOR I1,I2 and I3 =Irrigation regime 21,28 and35days.(C) FACTOR,V1,V2 andV3 = wheat cultivars i.e., Shandaweel-1, Giza-168 and Sids-12.

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تاثير مواعيد الزراعه و فترات الرى المختلفه على النمو والمحصول والاستهلاك المائى لبعض اصناف القمح تحت ظروف محافظة سوهاج

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الملخص

أجريت هذه التجربة بمحطة البحوث والتجارب الزراعية بجزيرة شندويل – محافظة سوهاج خلال ثلاث مواسم شتوية متتالية ٢٠١٢/٢٠١٣ م ، ٢٠١٣/٢٠١٤م و٢٠١٤/٢٠١٥ لدراسة تاثير موعدى الزراعه ٢٠ نوفمبر و٥ ديسمبر ومعاملات الرى المختلفة باستخدام فترات الرى كل (٢١ يوما ،٢٨ يوما ٣٥ يوما) على النمو والمحصول والآستهلاك المائى لثلاثه من اصناف قمح الخبز (شندويل ١، جيزه ١٦٨ ، وسدس ١٢) وذلك تحت ظروف محافظة سوهاج. تم زراعة التجربة بطريقة القطع المنشقة مرتين بحيث كانت معاملات مواعيد الزراعه فى القطع الرئيسية و معاملات الرى فى القطع المنشقة من الرئيسية والاصناف وزعت فى ثلاث مكررات على القطع المنشقة مرتين.

كانت اهم النتائج كما يلى: وجود فروق معنوية بين مواعيد الزراعة ومعاملات الرى و الأصناف المختلفة فقد اثرت هذه المعاملات على (معظم) صفات النمو والمحصول لنباتات القمح الناميه.فقد أعطي موعد الزراعه الثانى٥ ديسمبر افضل النتائج فى معظم صفات النمو المدروسة والمحصول والكفاءة الأستعمالية لوحدة المياه. كما انتجت معاملة الرى كل ٢١ يوما افضل النتائج لمحصول الحبوب (١٨,٢٣٤ ،١٦,٦٠٩، ١٧,١٩٨ اردب /فدان) على التوالى خلال مواسم الدراسه الثلاث ٢٠١٢/٢٠١٣ و٢٠١٣/٢٠١٤ و ٢٠١٤/٢٠١٥ على التوالى وقد كانت معاملة الرى ٢١ يوما هى الاعلى فى الاستهلاك المائى مقارنة بباقى المعاملات ٢٨ يوم و٣٥ يوم حيث كان متوسط البخر نتح لمعاملات الرى المختلفة (٢١ ،٢٨، ٣٥ يوما) فى الموعد الاول ٢٠ نوفمبر هى (٢٠٩٤,٤٨ ، ١٨٨٣,٤٦ ،١٥٤٩,٩٤ متر^{٣}/ فدان) على التوالى و (٢١٢٣,٩٣ ، ١٨١١,٤٩ ، ١٦٠٦,١٩ متر^{٣} /فدان) على التوالى فى الموعد الثانى ٥ ديسمبر ، كما ارتفع معدل الكفاءة الاستعماليه للوحده من ماء الرى (كجم حبوب/ متر^{٣}) بزيادة طول فترة الرى الى رى كل ٣٥ يوم وايضا ارتفع معدل الكفاءة الاستعمالية لماء الرى فى الموعد الثانى عنه فى الموعد الاول للزراعة حيث بلغت متوسطات الكفاءة الاستعمالية لماء الرى (٠,٥٣ ،٠,٥٤ ، ٠,٦١ كجم/م^{٣}) فى الموعد الاول وكانت ٠,٦٤ ، ٠,٦٨ ، ٠,٦٨ كجم/م^{٣} فى الموعد الثانى وذلك باستخدام معاملات الرى كل(٢١ ، ٢٨ ، ٣٥ يوما) على الترتيب.

كما اعطى الصنف شندويل ١ اعلى انتاجية من محصول الحبوب فى جميع مواعيد الزراعة و قد اعطى اعلى محصول وافضل كفاءة استعمالية للماء للوحدة من المياه فى الوعد الثانى.