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# EFFECT OF USING AGRICULTURAL DRAINAG WATER IRRIGATION ON YIELD AND YIELD COMPONENTS OF SOME WHEAT GENOTYPES (*Triticuim aesativum* L.)

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## ABSTRACT

Water sacristy in Egypt is considered an important barrier for agricultural development. This study was conducted to investigate the behavior of seven wheat genotypes under sex of agricultural wastewater irrigation. The important results recorded as follows: The highest values of maturity date , plant height and total yield / plot were achieved at 60% of waste water irrigation , while the lowest at 100 % during the two studied seasons .Whereas the heading date achieved highest value at 40 % in the 2nd season only. Data also cleared that grain yield / plant, number of kernels / spike, 1000 – kernel weight as well as H.I % came in the first rank during the two studied seasons. Spike length was insignificantly affected at all treatments except at 100 % of waste water irrigation. Data also pointed out that Line III was the earliest in heading and maturity date during two investigated seasons. While both of Line I and Sids 14 genotypes were the latest in the 1st season only. The maximum number of spike / m2, spike length, number of kernels / spike and total yield / plant achieved from line I cultivar during the two studied seasons. The heaviest 1000 – kernel weight was taken of Line III during the two studied seasons. Data also cleared that Sakha 95 was the highest of harvest index in the 1st season and Line III in the 2nd season. Data also illustrated pointed out that, the interactions hadn't significant at 5 % for heading date, plant height , number of spikes, grain yield / plant and spike length during the 1st and 2nd season but maturity date was significant in the second season only. Number of kernel and 1000 – kernel weight were significantly affected during the two seasons. Giza 171 cultivar showed superiority of number of kernels at 30 % of waste water irrigation while Line I achieved superiority at 30 % also of waste water irrigation. The highest grain yield values when used 50% waste water irrigation where obtoinalby Line I, Misr 3 and Sakha 95 while used 100% waste water irrigation the genotypes the Sakha 95, Sids 14 and Line II grain the highest grain yield good can be recommended as good genetic materials for wheat breeding programmers.

**Key Words:** *Triticum aestivum,* Wheat genotypes, Grain yield, Waste water irrigation, Wheat breeding.

# INTRODUCTION

Wheat is one of the most important crops in Egypt and world wide. The aims of wheat breeders are produce high yielding genotypes and increase wheat production be cause, there is between wheat production (10 millon tons) and wheat consumption (18 millon tons), which caused by overpopulation in Egypt. It's surely to remember that the choice wheat variety is considered an important factor for achievement high grain yield to reduce gap between production and consumption. **Elbatrawy *et al.*, (2023)** found that Sakha 95 cultivar gave highest grain yield compared with others. **Peter Omara (2020) and Das *et al.*, (2021)** detected that there are differences between wheat cultivars in grain yield productivity.

So, we most increasing the wheat area production horizontally, by expand in new lands. Water is on important Factor for expand area as growing wheat.

The main resources of water irrigation in Egypt is Nile river which contributes with more than 95 % of water used in agriculture. Egypt's stake of it represents about 55 billion $m^3$ annually, it doesn't insufficient to achievement sustainable development. It's important to clear that, water quantity per capita was fallen by 500 $m^3$ under level poverty (2023) because of increases in population. Thus, Egypt is suffering from water shortage. it's important to mention that depending upon waste water for a long time causes dangerous to soil and plant because it may contain high concentration of salts and heavy metals like cadmium, copper, zinc, lead and mercury (**Taha *et al.*, 2012; Barreto *et al.*, 2013 and Kumar *et al.*, 2013)** led to lower plant biomass and yield consequently hinders 189, Horizontal or Vertical expansion. Some farmers believe that dilution of waste water reduces its toxicity. Also wheat genotypes are varied in their performance and surviving ability with waste water irrigation **(Shokoofekh *et al.*, 2020)**. Accordingly this study was carried out to determine the effect of different dilutions on untreated wastewater irrigation of wheat genotypes.

# MATERIALS AND METHODS

Two field experiments were carried out at Etay El-Baroud Experimental station, El – Behiera Governorate to study the effect of six water mixing ratio irrigation as follows:

1. Zero agricultural wastewater ( 100 % fresh water )
2. 30 % agricultural waste water + 70% fresh water
3. 40 % agricultural waste water +60 % fresh water
4. 50 % agricultural waste water +50 % fresh water
5. 60 % agricultural waste water + 40 % fresh water
6. 100 % agricultural waste water + zero fresh water

on seven wheat genotypes i.e., ( Sakha 95 , Giza 171 , Misr 3 , line I , Sids 14 , Line II and Line III) were defferd on growth , yield and yield components.The pedigree of all genotypes were listed in the Table (1).

**Table (1): The name, pedigree and selection history of the genotypes under studied.**

| Wheat genotypes | Pedigree and selection history |
|---|---|
| Sakha 95 | PASTOR//SITE/MO/3/CHEN/AEGILOPS SQUARROSA (TAUS) // BCN /4/ WBLL1<br>(CMSA01Y00158S-040P0Y-040M-030ZTM-040SY-26M-0Y-0SY-0S). |
| Giza 171 | Sakha 93 /Gemmieza 9.<br>GZ2003 –101-1GZ - 4GZ –1GZ - 2GZ - 0GZ. |
| Misr 3 | Rohf 07*2/Kiriti<br>CGSS 05 B00123T-099T-0PY-099M-099NJ-6WGY-0B-0BGY-0GZ. |
| Line I | QUA/U/5/FRET2*2/4/SNI/TRAP#1/3KAUZ*2/TRAP//KAUZ<br>CMSS06B00109S-0Y-099ZTM-099NJ-13WGY-0B-0SH. |
| Sids 14 | BOW ''S'' /VEE ''S'' //TSI/3/BANI SUEFI.<br>SD293-1SD-2SD-4SD-0SD. |
| Line II | Aj863//7C/ERA/2BUC/S887.17-301 |
| Line III | TUKURU/PASTOR<br>CMSS99MOO728-040M-030Y-030M-31Y-3M-0Y |

Soil samples were randomly collected from 0 – 30 cm before planting to determine the chemical and physical properties and listed in Table (2) as follows:

**Table (2). Some physical and chemical properties of the used field experimental soil.**

| Soil Characteristics | | 2021/2022 | 2022/2023 |
|---|---|---|---|
| Physical properties | Sand % | 20.29 | 18.07 |
| | Silt % | 25.10 | 23.83 |
| | Clay % | 54.60 | 59.01 |
| | Texture | Clay | Clay |
| Chemical properties | Soil (PH) 1 : 2.5 | 8.11 | 8.12 |
| | *EC (ds $m^{-1}$) | 2.11 | 1.40 |
| | Total $CaCO_3$ (%) | 5.66 | 5.72 |
| Nutrient properties | Total Carbon (%) | 1.20 | 1.25 |
| | Organic Matter (%) | 2.12 | 2.16 |
| | Available N (mg $kg^{-1}$) | 51.85 | 52.04 |
| | Available P (mg $kg^{-1}$) | 11.08 | 10.07 |
| | Available K (mg $kg^{-1}$) | 159.5 | 152.03 |

Preceding summer crop was soybean during two studied season. Two ploughs were done and soil prepared as recommended.

**Table (3). Fresh and agricultural waste water analysis.**

| | PH | EC ds/m | Ca | Mg | Meq/Na | K | Co3 | Hco3 | Meq/ICL | So4 |
|---|---|---|---|---|---|---|---|---|---|---|
| Fresh water | 6.4 | 0.30 | 1.1 | 1 | 1.9 | 0.2 | 0.3 | 2.3 | 0.7 | 0.72 |
| agricultural Waste water | 6.9 | 0.68 | 1.7 | 1.7 | 3.75 | 0.54 | 0.7 | 3.7 | 1.7 | 1.68 |

A split plot arrangement in RCB design with 3 replications was used, the mixing of irrigation water treatments were randomly allotted in main plots while, the seven genotypes were randomly distributed in the sub plots. A plot size was 2.4 x 3 m. Each plot contains of 12 rows with 20 cm apart between rows. 75 kg N / faddan was added in two doses the first at 21 days after sowing dates and second doses after 21 days later while , 31 kg P2O5 / faddan was added during soil preparation. The sowing date was 20 November during the two investigated season. The seeding rate 60 kg / faddan. The waste water irrigation was added according to the following equation:

Bernoulli equation is used to calculate the irrigation discharge (Q) through the siphon tube with a 4-inch diameter:

Q=A*V

$$A = \frac{\pi D^2}{4}$$

Where A is the cross section of the siphon tube and D is the inner diameter of it.

$$A = \sqrt{2gh}$$

Where h is the head difference (m) between the inlet and outlet (here it was 1.3 m)

G is the gravity (m/s2)

$$Q = A \times \sqrt{2gh}$$

To calculate irrigation flow over a weir, use the weir equation for a standard rectangular weir:

Q = C x L x H^(1.5)

where Q is the flow rate, C is the discharge coefficient, L is the weir length, and H is the head (height of water over the weir crest).These formula according to **Yunus, (2010)**.

The drainage channel in depth was 3 m approximately. All agriculture practices were done according recommendation

The following parameters were:

1 – Number of days from sowing to heading
2 – Number of days from sowing to physiological maturity
3 – Number of spike / m2
4 – Number of kernels / spike
5 – Total yield / plot
6 – Grain yield / plot

7 – Harvest Index %

Statistical analysis:

Data were subjected to two analysis of variance according to **Gomez and Gomez (1984)** then means were compared using Least Significant Differences (LSD) at 5 % level of probability.

# RESULTS AND DISCUSSION

**1. Effect of wastewater irrigation:**

Results presented in Table (4) pointed out that, yield and yield components of wheat were significantly affected by waste irrigation during the two investigated seasons. It's important to clear that the longest period of days to heading was recorded at both of 50 and 60 % of water mixing ratios irrigation. While the shortest period were (93.48 and 82.67 days) given when plants irrigated by 100% waste irrigation. Data also pointed out that, the longest period of maturity date were noticed at fresh water irrigation in the $1^{st}$ and $2^{nd}$ season, while usede 30,40, 50 and 60% waste irrigation were insignificantly effected of maturity date compared to fresh water in the second season . These findings may be due to exhibition plants to high concentrations of salts and heavy metals in waste water irrigation.

Results illustrated in the same Table detected that, plant height character was significantly influenced by overall treatments during the two investigated season. It's important to say that the tallest plants were 109.83 and 108.21 cm) noticed at 60 % of waste irrigation and relatively decreased by 2 % , in first season and relatively increased by 3.7% compared with check treatments in the first and second season, respectively. On the other hand, at 100% waste irrigation gave shortest plant (104.21 and 100.98 cm) during the first and second season respectively. The results may be attributed to the undiluted irrigation and high quantity of waste water irrigation had negatively impacts and damage causes cell membrane and lowering in cell division and elongation. Findings in the present work are in agreement with those obtained by **Namait Allah *et al.*, (2008); Islam *et al.*, (2015); Mojid, *et al.*, (2016); Abd Elraouf and Ragab (2017); Shoofekh *et al.*, (2020) and Modhi *et al.*, (2025)**.

Results presented in Table (4) also indicated that, number of spike/$m^2$ was significantly affected by waste irrigation treatments in the first season while in the highest value was noticed at 60 % and significantly equaled with 30 and 40 % in the same season. These results may be attributed to abundance of undiluted wastewater irrigation induced a disturbance in tillering process resulted from high concentrations of the heavy metals especially Na+ and k+. Similar results were obtained by **Choukr – Allah *et al.*, (2003; Islam *et al.;* (2015), Mojid, *et al.;*, (2016) and Shoofekh *et al.*, (2020)**.

**Table (4). Effect of water mixing ratios on all studied traits in the two growing seasons 2022/2023 and 2023/2024.**

| Factor | Heading date | Physiological maturity date | Plant height (cm) | Number of spikes $m^2$ | Total Yield/Plot | Grain yield/ Plot. | Spike length (cm) | Number of kernels / spike | 1000-Kernel/weight (g) | Harvest index. % |
|---|---|---|---|---|---|---|---|---|---|---|
| **Season 1** | | | | | | | | | | |
| Irrigation | | | | | | | | | | |
| 1 | 94.67 b | 131.00 a | 112.35 a | 363.33 bc | 13.90 b | 4.68 ab | 12.69 a | 68.49 bc | 51.20 a | 33.81 a |
| 2 | 93.81 cd | 129.90 ab | 108.34 ab | 388.33 ab | 14.42 ab | 4.77 a | 12.52 a | 69.74 bc | 49.37 b | 33.46 a |
| 3 | 94.38 bc | 129.00 bc | 107.49 ab | 398.10 ab | 12.53 c | 4.17 b | 12.58 a | 71.04 ab | 49.91 b | 33.20 a |
| 4 | 94.90 ab | 129.95 ab | 109.10 ab | 373.81 b | 13.58 bc | 4.73 a | 12.27 a | 67.04 c | 52.62 a | 34.81 a |
| 5 | 95.62 a | 131.05 a | 109.83 a | 445.48 a | 15.21 a | 4.19 b | 12.61 a | 74.23 a | 50.87 ab | 27.43 b |
| 6 | 93.48 d | 128.38 c | 104.21 b | 303.33 c | 9.94 d | 2.04c | 9.38 b | 53.16 d | 46.80 c | 20.77 c |
| F test | ** | ** | ns | * | ** | ** | ** | ** | ** | ** |
| LSD 5% | 0.83 | 1.40 | 5.41 | 64.87 | 1.24 | 0.526 | 0.569 | 3.9 | 2.409 | 2.566 |
| **Season 2** | | | | | | | | | | |
| Irrigation | | | | | | | | | | |
| 1 | 88.86 ab | 134.67 a | 104.51 bc | 293.57 a | 11.13 b | 3.94 b | 12.19 a | 65.33 b | 50.73 ab | 35.80 a |
| 2 | 86.33 bc | 132.57 a | 106.20 ab | 285.71 a | 11.52 b | 3.81 bc | 12.02 a | 66.58 b | 48.90 bc | 33.30 b |
| 3 | 89.52 a | 134.67 a | 105.14 bc | 274.52 ab | 10.92 b | 3.71 bc | 12.08 a | 67.88 ab | 49.44 bc | 33.99 ab |
| 4 | 86.76 abc | 133.10 a | 103.04 cd | 286.43 a | 10.69 b | 3.61 c | 11.77 a | 63.88 b | 52.15 a | 33.84 ab |
| 5 | 85.71 cd | 132.86 a | 108.21 a | 293.57 a | 12.75 a | 4.41 a | 12.11 a | 71.07 a | 50.40 ab | 34.66 ab |
| 6 | 82.67 d | 127.52 b | 100.98 d | 243.81 b | 9.35 c | 2.37 d | 9.80 b | 54.05 c | 47.14 c | 25.46 c |
| | | | | | | | | | | |
| F test | ** | ** | ** | ns | ** | ** | ** | ** | * | ** |
| LSD 5% | 3.107 | 2.164 | 2.961 | 33.088 | 0.895 | 0.241 | 0.574 | 4.040 | 2.409 | 1.999 |

Results also pointed out that the total yield /plot was significantly affected by all treatments during the two studied seasons. Generally the highest values of total yield were achieved (15.21 and 12.75 kg) at 60% wastewater irrigation during two season, respectively . While the lowest values were (9.94 and 9.35 kg) at completely wastewater during the two investigated seasons respectively . On the other side, grain yield/plant achieved highest value at 30 and 50% wastewater irrigation and fresh water in the first season and at only 60% in the second season. The lowest values were achieved at completely wastewater irrigation in the all seasons. Generally the high reduction may be due to plant exhibition to high stress of salts and heavy metals in wastewater. Similar findings are in agreement with **Islam *et al.*, (2015); Sun *et al.*, (2016); Shookofekh *et al.*, (2020) and Modhi *et al.*, (2025)**.

Results also pointed out that spike length character was insignificantly affected by fresh water and waste water treatments While, at 100% waste water irrigation gave the lowest values (9.38 and 9.80 cm) in the two studied seasons respectively. These findings are in agreement with **Sun *et al.*, (2016) Janda *et al.*, (2016) and Shokoofekh *et al.*, (2020)**.

Results also indicated that, number of kernels/spike showed significant at 5% level during the two investigated seasons. The date clear that, at 60% waste irrigation achieved superiorly number of kernels/spike. Whereas at 100% waste water gave was the lowest numbers during the two studied seasons.

Results also indicated that, 1000-kernal weight was significantly differed by all treatments through two seasons. In general where wheat irrigated with 50% water mixture the 1000-kernal weight take highest values. (52.62 and 52.15 gm.), while at irrigation with completely water waste gave the heavey kernel (46.8 and 47.14 gm.) in the two season, respectively. These findings may be attributed to the negative impact of photosyntitec activity thus a reduction in grain filling. These results are in accordance with **Namait Allah *et al.*, (2008); Islam *et al.*, (2015); Sun *et al.*, (2016); Shokoofekh *et al.*, (2020) and Modhi *et al.*, (2025).**

Results listed in Table (4) also pointed out that harvest index significantly varied by irrigation treatments during two seasons.
Using fresh water achieved superiority during two seasons while complete waste water irrigation gave lowest values during two seasons. It's important to say that harvest index significantly equaled at 0, 30, 40 and 50 in the first seasons and at o, 30, 40, 50 and second season.

**2. Effect of wheat genotypes:**

Results lasted in Table (5) pointed out that Line III was the earliest of both of days to heading and days to maturity during two seasons. While Line I was the latest. On the other side, Line I and Sids 14 cultivars were insignificantly equaled in the 1st season. The similar results were obtained by **El Hag (2017); Abdel-Hamid *et al.*, (2019) and Abdel Rady *et al.*, (2020).**

**Table (5). Differences between wheat genotypes for all studied traits in the two growing seasons 2022/2023 and 2023/2024.**

| Factor | Heading date | Physiological maturity date | Plant height (cm) | Number of spikes $m^2$ | Total Yield/Plot | Grain yield/Plot. (g) | Spike length (cm) | Number of grains/ spike | 1000-Kernel/weight (g) | Harvest index.% |
|---|---|---|---|---|---|---|---|---|---|---|
| **Season 1** | | | | | | | | | | |
| Cultivars | | | | | | | | | | |
| 1 | 95.61 ab | 127.94 d | 111.09 ab | 380.28 bc | 13.79 ab | 4.60 a | 11.81 b | 67.89 bc | 46.46 e | 32.87 a |
| 2 | 94.00 bc | 132.06 a | 109.67 abc | 344.72 d | 13.31 bc | 3.99 bc | 12.19 b | 70.33 ab | 52.47 ab | 29.50 c |
| 3 | 94.78 bc | 130.50 bc | 103.75 d | 365.83 cd | 12.61 c | 3.89 c | 11.63 b | 64.72 cd | 48.44 d | 30.43 bc |
| 4 | 97.50 a | 131.06 ab | 112.76 a | 421.94 a | 13.09 bc | 4.27 ab | 12.86 a | 72.05 a | 49.71 cd | 32.22 ab |
| 5 | 97.06 a | 131.44 ab | 108.11 bc | 392.22 abc | 13.03 bc | 3.91 c | 11.80 b | 66.24 cd | 49.45 d | 29.86 c |
| 6 | 93.39 c | 129.50 c | 105.79 cd | 401.11 ab | 14.52 a | 4.34 a | 11.66 b | 65.66 cd | 51.13 bc | 29.55 c |
| 7 | 89.00 d | 126.67 d | 108.71bc | 345.00 d | 12.50 c | 3.68 c | 12.10 b | 64.11 d | 53.25 a | 29.66 c |
| F test | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| LSD 5% | 2.06 | 1.51 | 3.92 | 35.32 | 1.00 | 0.339 | 0.575 | 3.62 | 1.603 | 2.121 |
| **Season 2** | | | | | | | | | | |
| Cultivars | | | | | | | | | | |
| 1 | 88.61 b | 132.72 c | 104.13 bc | 279.17 ab | 11.07 bc | 3.66 b | 11.48 bc | 65.12 bc | 46.13 e | 33.08 ab |
| 2 | 87.17 b | 135.22 b | 103.09 bc | 220.28 c | 10.07 d | 3.31 c | 11.82 b | 67.89 ab | 52.13 ab | 32.95 ab |
| 3 | 86.94 b | 132.17 c | 103.13 bc | 313.33 a | 11.17 b | 3.66 b | 11.22 c | 62.28 c | 48.10 d | 32.53 ab |
| 4 | 93.11 a | 137.06 a | 110.92 a | 301.11 a | 12.12 a | 3.93 a | 12.52 a | 69.61 a | 49.38 cd | 32.25 ab |
| 5 | 87.17 b | 132.00 c | 105.31 b | 294.72 a | 11.58 ab | 3.69 ab | 11.50 bc | 63.81 c | 49.11 d | 31.70 b |
| 6 | 84.22 c | 130.44 d | 102.29 c | 297.78 a | 10.96 bc | 3.70 ab | 11.31 bc | 63.22 c | 50.80 bc | 33.57 a |
| 7 | 79.28 d | 128.33 e | 103.87 bc | 250.83 bc | 10.46 cd | 3.56 bc | 11.75 bc | 61.67 c | 52.91 a | 33.80 a |
| F test | ** | ** | ** | ** | ** | ** | ** | ** | ** | ns |
| LSD 5% | 2.413 | 1.224 | 2.721 | 38.573 | 0.679 | 0.247 | 0.576 | 3.622 | 1.603 | 1.653 |

Rsults also cleared that plant height was significantly varied for all cultivars the Line I was the tallest while line II cultivars was the shortest during two seasons. These results may be due to the genetic variation between varieties. Same findings were reported by **Islam *et al.*, (2015), Kisk *et al.*, (2019), Abbas *et al.*, (2023), Ayman and Koubisy (2023) and Modhi *et al.*, (2025)**.

As presented in Table (5) number of spikes /$m^2$ character was significantly defriend among all studied characters. It can be easily say that Line I significantly surpassed on others in the first season. Whereas Misr 3, Line I , Sids 14 and line II were equaled and surpassed sakha 95 and line III in the secand season. The same findings were reported by **Islam *et al.*, (2015); Kisk *et al.*, (2019); Ayman and Koubisy (2023) and Modhi *et al.*, (2025)**.

As listed in the same Table results indicated that grain yield / plot showed significant differences through the two investigated seasons. It can be easily sure that Sakha 95 and Line II achieved highest values (4.60 and 4.34 kg) flowed by Line I (4.20 kg) in the first season. While Line I significantly surpassed in the second season, flowed by Giza 171. On the other hand, lines III came in the final rank. The same findings were reported by, **Namait Allah *et al.*, (2008); Islam *et al.*, (2015);Ali *et al.*, (2016); Kisk *et al.*, (2019) and Modhi *et al.*, (2025).**

Results presented in Table (4) pointed out that both of spike length and number of kernel / spike reached to significant differences during the two investigated seasons. It's important to clear that Line I cultivar had highest numbers of previous two traits (12.86 cm and 72.05) in the first season and (12.52 cm and 69.61) in the second season for spike length and number of kernels / spike respectively. Also, all cultivars and lines showed non-significant except Line I during the two investigated seasons. similar findings were reported by **Kisk *et al.*, (2019) and Abdel Rady *et al.*, (2020).**

As listed in Table (5), the seven cultivars were showed significantly differences in both of 1000 – kernel weight and harvest index through the two investigated seasons. It's important to remember that Line III cultivar achieved superiority in 1000 – kernel weight, whereas Sakha 95 cultivar gave lowest values during the 1st and 2nd season. Similar results were obtained by **El Hag (2017); Kisk *et al.*, (2019) and Modhi *et al.*, (2025)**.

Results also cleared that Sakha 95 came in the first rank followed by Line I. While, Sids 14, Line II and Line III hadn't significant in harvest index in the 1st season. On the other hand, Line II, Line III genotype gave the maximum average followed by others, except Sids 14 came in final rank during the second season.

3. Effect of the interactions between wastewater irrigation and wheat genotypes: -

Results in Table (6 and 7) pointed out that heading date, plant height, number of spike / m2, grain yield / plant and spike length were insignificantly affected by the interaction between irrigation with waste water and the different cultivars during the two investigated seasons. On the other side, number of kernel / spike and 1000 – kernel weight had significant differences by wastewater irrigation treatments and the seven cultivars interactions during the two seasons.

Its imported coined that Giza 171 cultivar showed latest period of maturity date under 50% waste Irrigation while line III showed earliest period of heading and maturity date under completely was to Irrigation.

Date also cleared that highest number of spike/m2 obtained by the genotypes line 1 for two seasons, when used 50 and 100 % waste water, this date dues to increase of number of tillers/plant.

Total yield /plot in Table (6) indicated that highly total yield were obtained in cultivar Sakha 95 and genotype line I , (14.00 and 10.67) and (14.33 and 12.27 kg) for two genotypes and two seasons respectively

The highest values were ( 86.33 and 83 .17 ) of number of kernels / spike through the first and second season respectively achieved by Misr 3 cultivar with used 30% of wastewater irrigation . It's could be easily say that Misr 3 also gave highest averages (56.68 and 56.21 gm.) of 1000 – kernel weight with 50% waste water irrigation during the $1^{st}$ and $2^{nd}$ season respectively.

The results indicated the highest grain yield values under 100% fresh water were (5.14 and (3.94) and (4.97 and (4.45 gm) for Sakha 95 and Misr 3 cultivars in two year respectively. While its low value for line 3. on the other hand the values when used 50% was water + 50% fresh water were obtained by line I genotypes . However, using 100% waste water irrigation the genotypes the Sakha 95, Misr 3 ,Sids 14 and line II gain the highest grain yield.

Results presented in Table (6) detected that heading date was insignificantly affected by the all characters under study were except no of kernels/spike and 1000 kernel weight and harvest index were significantly differences. It's important to coined that Giza 171 cultivar showed latest period of maturity date under 50 % waste irrigation. While Line II showed earliest period of heading and maturity date under completely waste water irrigation.

Results illustrated in the same Table indicated pointed out Sakha 95 cultivar significantly surpassed for harvest index under completely fresh weight in the second season while highest harvest index under waste water were obtained by genotypes the gentians Line I , Line II and Sakha 95 (25.1 and 28.55) , (22.28 and 27.56) and (22.26 and 23.15)% for two seasons the genotypes line I and line II and respectively.

**Table (6). Effect of the interactions between water mixing ratios and wheat genotypes in for heading date , physiological maturity , plant height , Number of spikesm$^2$ and total yield /plot two seasons 2022/2023 and 2023/2024.**

| | | Heading date | | Physiological maturity date | | Plant height (cm) | | Number of spikes m$^2$ | | Total Yield/Plot | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Factor | | Season 1 | Season 2 | Season 1 | Season 2 | Season 1 | Season 2 | Season 1 | Season 2 | Season 1 | Season 2 |
| Irr | Cvs. | | | | | | | | | | |
| 1 | 1 | 97.33 | 91.00 | 129.33 | 134.67 | 117.97 | 104.53 | 340.00 | 365.00 | 14.80 | 9.93 |
| | 2 | 95.67 | 85.67 | 134.33 | 134.33 | 112.30 | 102.63 | 345.00 | 215.00 | 15.60 | 8.87 |
| | 3 | 96.33 | 92.00 | 131.33 | 136.00 | 114.50 | 107.30 | 328.33 | 390.00 | 12.60 | 13.13 |
| | 4 | 97.00 | 94.33 | 133.33 | 138.33 | 118.67 | 106.30 | 411.67 | 265.00 | 14.53 | 11.53 |
| | 5 | 96.33 | 91.67 | 133.00 | 135.67 | 110.73 | 106.53 | 368.33 | 301.67 | 13.13 | 12.47 |
| | 6 | 91.67 | 85.67 | 129.00 | 133.00 | 106.20 | 102.97 | 428.33 | 273.33 | 15.13 | 11.27 |
| | 7 | 88.33 | 81.67 | 126.67 | 130.67 | 106.10 | 101.30 | 321.67 | 245.00 | 11.53 | 10.73 |
| 2 | 1 | 94.33 | 92.67 | 127.33 | 133.67 | 111.53 | 106.43 | 436.67 | 251.67 | 14.33 | 10.80 |
| | 2 | 91.67 | 86.33 | 131.67 | 134.67 | 109.53 | 101.17 | 345.00 | 243.33 | 14.27 | 10.80 |
| | 3 | 95.00 | 84.67 | 131.33 | 131.67 | 101.60 | 101.83 | 376.67 | 223.33 | 13.67 | 11.33 |
| | 4 | 97.33 | 92.00 | 130.33 | 136.67 | 107.63 | 114.30 | 411.67 | 363.33 | 13.53 | 13.47 |
| | 5 | 95.33 | 86.33 | 131.00 | 133.00 | 106.84 | 105.07 | 406.67 | 326.67 | 13.27 | 11.60 |
| | 6 | 94.33 | 84.00 | 130.00 | 129.00 | 109.53 | 104.30 | 390.00 | 326.67 | 16.87 | 11.27 |
| | 7 | 88.67 | 78.33 | 127.67 | 129.33 | 111.73 | 110.27 | 351.67 | 265.00 | 15.00 | 11.37 |
| 3 | 1 | 95.33 | 87.00 | 125.33 | 134.67 | 111.30 | 107.10 | 405.00 | 213.33 | 13.67 | 11.53 |
| | 2 | 93.33 | 90.33 | 131.67 | 138.00 | 109.97 | 106.63 | 411.67 | 210.00 | 12.67 | 10.33 |
| | 3 | 93.33 | 89.67 | 129.00 | 133.67 | 101.30 | 103.20 | 361.67 | 355.00 | 11.40 | 10.27 |
| | 4 | 97.67 | 94.67 | 131.00 | 137.67 | 113.87 | 114.73 | 468.33 | 283.33 | 13.00 | 11.67 |
| | 5 | 97.33 | 92.33 | 130.00 | 134.33 | 106.63 | 102.83 | 410.00 | 286.67 | 11.87 | 11.47 |
| | 6 | 94.67 | 90.33 | 130.33 | 134.33 | 100.40 | 100.87 | 396.67 | 345.00 | 14.00 | 11.20 |
| | 7 | 89.00 | 82.33 | 125.67 | 130.00 | 108.97 | 100.63 | 333.33 | 228.33 | 11.13 | 10.00 |
| 4 | 1 | 95.67 | 87.67 | 129.00 | 133.67 | 111.33 | 100.83 | 351.67 | 308.33 | 14.00 | 10.67 |
| | 2 | 94.67 | 89.67 | 133.33 | 139.00 | 107.30 | 102.20 | 301.67 | 183.33 | 12.93 | 9.90 |
| | 3 | 95.00 | 86.33 | 130.67 | 131.33 | 103.50 | 101.53 | 381.67 | 323.33 | 14.47 | 10.93 |
| | 4 | 98.00 | 94.33 | 130.33 | 138.33 | 117.33 | 106.27 | 436.67 | 361.67 | 14.33 | 12.27 |
| | 5 | 97.67 | 86.00 | 132.00 | 131.00 | 111.83 | 106.73 | 393.33 | 300.00 | 12.73 | 11.40 |
| | 6 | 93.33 | 84.33 | 128.00 | 130.67 | 106.40 | 101.97 | 411.67 | 313.33 | 14.67 | 9.93 |
| | 7 | 90.00 | 79.00 | 126.33 | 127.67 | 106.00 | 101.73 | 340.00 | 215.00 | 11.93 | 9.73 |
| 5 | 1 | 97.00 | 88.33 | 129.67 | 131.67 | 111.30 | 106.07 | 438.33 | 315.00 | 16.00 | 13.80 |
| | 2 | 94.67 | 88.00 | 131.00 | 137.00 | 113.53 | 106.97 | 391.67 | 236.67 | 14.33 | 11.67 |
| | 3 | 94.33 | 87.67 | 131.67 | 132.00 | 102.73 | 105.87 | 456.67 | 330.00 | 13.60 | 11.87 |
| | 4 | 99.00 | 93.67 | 132.33 | 138.33 | 114.53 | 115.20 | 470.00 | 291.67 | 15.13 | 14.73 |
| | 5 | 100.33 | 82.00 | 133.00 | 130.67 | 108.40 | 108.30 | 470.00 | 298.33 | 16.33 | 12.33 |
| | 6 | 94.33 | 81.67 | 131.33 | 132.00 | 108.00 | 105.20 | 458.33 | 280.00 | 16.20 | 13.00 |
| | 7 | 89.67 | 78.67 | 128.33 | 128.33 | 110.30 | 109.87 | 433.33 | 303.33 | 14.87 | 11.87 |
| 6 | 1 | 94.00 | 85.00 | 127.00 | 128.00 | 103.09 | 99.83 | 310.00 | 221.67 | 9.93 | 9.67 |
| | 2 | 94.00 | 83.00 | 130.33 | 128.33 | 105.40 | 98.97 | 273.33 | 233.33 | 10.07 | 8.87 |
| | 3 | 94.67 | 81.33 | 129.00 | 128.33 | 98.87 | 99.07 | 290.00 | 258.33 | 9.93 | 9.47 |
| | 4 | 96.00 | 89.67 | 129.00 | 133.00 | 104.53 | 108.73 | 333.33 | 241.67 | 8.00 | 9.07 |
| | 5 | 95.33 | 84.67 | 129.67 | 127.33 | 104.19 | 102.40 | 305.00 | 255.00 | 10.87 | 10.23 |
| | 6 | 92.00 | 79.33 | 128.33 | 123.67 | 104.20 | 98.43 | 321.67 | 248.33 | 10.27 | 9.07 |
| | 7 | 88.33 | 75.67 | 125.33 | 124.00 | 109.17 | 99.43 | 290.00 | 248.33 | 10.53 | 9.07 |
| F test | | ns | ns | ns | * | ns | ns | ns | ns | ns | * |
| LSD 5% | | 4.222 | 4.947 | 3.098 | 2.510 | 8.042 | 5.578 | 72.225 | 79.059 | 2.067 | 1.392 |

**Table (7). Effect of the interactions between water mixing ratios and wheat genotypes in grain yield , spike length, number of grains/spike , 1000 kernel/weight (g) and harvest index % two seasons 2022/2023 and 2023/2024.**

| Factors | | Grain yield/Plot | | Spike length (cm) | | Number of grains/ spike | | 1000-Kernel / weight (g) | | Harvest index % | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Irr | Cvs. | Season 1 | Season 2 | Season 1 | Season 2 | Season 1 | Season 2 | Season 1 | Season 2 | Season 1 | Season 2 |
| | 1 | 5.14 | 3.94 | 11.63 | 11.13 | 74.99 | 71.83 | 47.73 | 47.26 | 34.75 | 39.88 |
| | 2 | 5.01 | 3.76 | 12.82 | 12.32 | 64.66 | 61.50 | 54.35 | 53.88 | 32.11 | 42.51 |
| | 3 | 4.97 | 4.45 | 13.03 | 12.53 | 71.66 | 68.50 | 46.17 | 45.70 | 39.56 | 33.85 |
| 1 | 4 | 4.73 | 3.65 | 13.52 | 13.02 | 68.49 | 65.33 | 51.18 | 50.71 | 32.58 | 31.83 |
| | 5 | 3.91 | 4.16 | 13.30 | 12.80 | 71.83 | 68.67 | 48.89 | 48.42 | 29.92 | 33.49 |
| | 6 | 5.01 | 3.95 | 12.37 | 11.87 | 60.83 | 57.67 | 59.16 | 58.69 | 33.20 | 35.10 |
| | 7 | 3.96 | 3.65 | 12.13 | 11.63 | 66.99 | 63.83 | 50.92 | 50.45 | 34.56 | 33.96 |
| | 1 | 5.34 | 3.50 | 12.50 | 12.00 | 74.56 | 71.40 | 41.47 | 41.00 | 37.31 | 32.50 |
| | 2 | 4.97 | 3.80 | 12.77 | 12.27 | 68.99 | 65.83 | 53.40 | 52.93 | 35.37 | 35.86 |
| | 3 | 4.36 | 3.73 | 12.30 | 11.80 | 67.66 | 64.50 | 47.93 | 47.46 | 31.91 | 32.97 |
| 2 | 4 | 4.59 | 4.38 | 13.07 | 12.57 | 72.99 | 69.83 | 52.70 | 52.23 | 34.02 | 32.47 |
| | 5 | 4.20 | 3.88 | 12.43 | 11.93 | 72.16 | 69.00 | 45.89 | 45.42 | 31.60 | 33.68 |
| | 6 | 5.21 | 3.70 | 11.87 | 11.37 | 71.49 | 68.33 | 52.10 | 51.63 | 30.97 | 32.92 |
| | 7 | 4.69 | 3.71 | 12.71 | 12.21 | 60.33 | 57.17 | 52.14 | 51.67 | 33.08 | 32.69 |
| | 1 | 4.57 | 4.16 | 12.39 | 11.89 | 72.66 | 69.50 | 45.39 | 44.92 | 33.46 | 36.10 |
| | 2 | 4.37 | 3.35 | 12.52 | 12.02 | 86.33 | 83.17 | 49.89 | 49.42 | 34.19 | 32.41 |
| | 3 | 3.66 | 3.46 | 12.70 | 12.20 | 65.16 | 62.00 | 48.57 | 48.10 | 32.07 | 33.97 |
| 3 | 4 | 4.69 | 3.84 | 13.83 | 13.33 | 74.33 | 71.17 | 49.36 | 48.89 | 36.13 | 32.94 |
| | 5 | 3.99 | 3.75 | 11.53 | 11.03 | 71.66 | 68.50 | 48.75 | 48.28 | 33.22 | 32.69 |
| | 6 | 4.39 | 3.91 | 13.15 | 12.65 | 66.83 | 63.67 | 52.65 | 52.18 | 31.46 | 34.92 |
| | 7 | 3.55 | 3.49 | 11.92 | 11.42 | 60.33 | 57.17 | 54.78 | 54.31 | 31.88 | 34.87 |
| | 1 | 5.47 | 3.52 | 12.63 | 12.13 | 66.99 | 63.83 | 48.38 | 47.91 | 39.05 | 33.14 |
| | 2 | 4.12 | 3.08 | 12.73 | 12.23 | 65.66 | 62.50 | 56.68 | 56.21 | 31.87 | 31.06 |
| | 3 | 4.91 | 3.62 | 11.44 | 10.94 | 57.66 | 54.50 | 51.17 | 50.70 | 33.99 | 33.09 |
| 4 | 4 | 5.12 | 4.20 | 12.50 | 12.00 | 78.66 | 75.50 | 49.90 | 49.43 | 35.74 | 34.25 |
| | 5 | 4.86 | 3.69 | 11.97 | 11.47 | 61.66 | 58.50 | 53.33 | 52.86 | 38.03 | 32.42 |
| | 6 | 4.74 | 3.42 | 11.43 | 10.93 | 74.16 | 71.00 | 53.14 | 52.67 | 32.48 | 34.59 |
| | 7 | 3.86 | 3.74 | 13.17 | 12.67 | 64.49 | 61.33 | 55.71 | 55.24 | 32.54 | 38.33 |
| | 1 | 4.86 | 4.64 | 12.29 | 11.79 | 62.16 | 59.00 | 47.81 | 47.34 | 30.37 | 33.71 |
| | 2 | 3.64 | 3.83 | 12.63 | 12.13 | 82.66 | 79.50 | 50.91 | 50.44 | 25.20 | 32.79 |
| | 3 | 3.67 | 4.29 | 11.32 | 10.82 | 73.83 | 70.67 | 51.83 | 51.36 | 26.91 | 36.15 |
| 5 | 4 | 4.52 | 4.92 | 14.29 | 13.79 | 86.16 | 83.00 | 48.37 | 47.90 | 29.69 | 33.45 |
| | 5 | 4.32 | 4.06 | 12.43 | 11.93 | 67.66 | 64.50 | 53.25 | 52.78 | 26.42 | 32.82 |
| | 6 | 4.41 | 4.72 | 12.49 | 11.99 | 69.99 | 66.83 | 47.29 | 46.82 | 26.88 | 36.35 |
| | 7 | 3.95 | 4.44 | 12.83 | 12.33 | 77.16 | 74.00 | 56.62 | 56.15 | 26.56 | 37.34 |
| | 1 | 2.25 | 2.23 | 9.43 | 9.97 | 56.00 | 55.17 | 48.00 | 48.34 | 22.26 | 23.15 |
| | 2 | 1.81 | 2.04 | 9.67 | 9.97 | 53.66 | 54.83 | 49.56 | 49.90 | 18.28 | 23.06 |
| | 3 | 1.80 | 2.38 | 8.99 | 9.05 | 52.33 | 53.50 | 44.95 | 45.29 | 18.14 | 25.18 |
| 6 | 4 | 1.98 | 2.58 | 9.97 | 10.43 | 51.66 | 52.83 | 46.77 | 47.11 | 25.15 | 28.55 |
| | 5 | 2.16 | 2.57 | 9.12 | 9.85 | 52.50 | 53.67 | 46.57 | 46.91 | 19.95 | 25.10 |
| | 6 | 2.29 | 2.48 | 8.65 | 9.05 | 50.65 | 51.83 | 42.46 | 42.80 | 22.28 | 27.56 |
| | 7 | 2.03 | 2.31 | 9.85 | 10.25 | 55.33 | 56.50 | 49.31 | 49.65 | 19.32 | 25.59 |
| F test | | ns | ns | ns | ns | ** | ** | ** | ** | ns | ** |
| LSD 5% | | 0.694 | 0.508 | 1.179 | 1.181 | 7.408 | 7.425 | 3.286 | 3.286 | 4.349 | 3.388 |

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# تأثير الرى بماء مخلوط ماء صرف زراعى على المحصول ومكوناتة على بعض التراكيب الوراثية للقمح

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تعتبر مشكلة نقص المياه فى مصر عائقاً هاما أمام التنمية الزراعية. وقد أجريت هذه الدراسة بمحطة البحوث الزراعية بايتاى البارود خلال الموسمين الزراعيين 2022 / 2023 و2023 / 2024 وذلك لدراسة سلوك سبعة أصناف وسلالات من القمح تحت تأثير الرى بماء مخلوط بماء صرف. وكانت أهم النتائج على النحو التالى: كانت أعلى القيم لعدد الأيام حتى النضج وارتفاع النبات والمحصول الكلى للقطعة عند الرى بماء مخلوط ماء صرف زراعى بنسبة 60% (40% ماء رى : 60% ماء صرف زراعى) وكانت اقل القيم عند الرى بماء صرف بنسبة 100% خلال موسمي الدراسة. فى حين كانت أعلى قيمة لعدد الأيام حتى التزهير عند الرى بماء مخلوط ماء صرف بنسبة 40% فى الموسم الثانى. كما أوضحت البيانات أن كلا من محصول الحبوب للقطعة التجريبية وعدد حبوب السنبلة ووزن 1000 حبة ودليل الحصاد كانت الأعلى خلال موسمى الدراسة عند الرى بمخلوط مياة صرف زراعى بنسبة 50% ( 1:1 ماء رى : ماء صرف زراعى). كما تأثر طول السنبلة معنوياً تحت كل نسب خلط المياه ما عدا الرى بماء صرف بنسبة 100%. كما أشارت البيانات ان السلالة رقم 3 كانت الأبكر فى صفتى عدد الأيام حتى التزهير والنضج فى الموسمين. بينما الصنفين سلالة 1 وسدس 14 كانت أكثر التراكيب الوراثية تأخيرا فى الموسم الأول. وكان سلالة 1 أفضل التراكيب الوراثية خلال الموسمين فى صفات عدد السنابل فى المتر المربع وطول السنبلة وعدد حبوب السنبلة والمحصول الكلى للقطعة. كما كانت السلالة رقم 3 الأفضل فى وزن 1000 حبة خلال الموسمين. وأظهرت البيانات أن صنف سخا 95 كان الأعلى فى دليل الحصاد فى الموسم الأول والسلالة رقم 3 فى الموسم الثانى. كما أشارت البيانات الى أن التفاعلات لم تكن معنوية

عند مستوى 5% لعدد الأيام حتى التزهير وارتفاع النبات وعدد السنابل ومحصول الحبوب للقطعة وطول السنبلة خلال الموسمين بينما عدد الأيام حتى النضج كان معنويا فى الموسم الثانى فقط. وكان عدد حبوب السنبلة ووزن 1000 حبة معنوى خلال الموسمين. كما أظهر الصنف جيزة 171 تفوقا فى عدد الحبوب للسنبلة عند الرى بماء مخلوط ماء صرف زراعى بنسبة 30% بينما حقق الصنف سلالة 1 تفوقاً أيضا عند الرى بماء مخلوط ماء صرف بنسبة 30%(70% ماء رى : 30% ماء صرف زراعى). وكانت أفضل التراكيب الوراثية عند الخلط بـ50% ماء صرف هو والصنف سخا 95 ومصر 3 السلالة رقم 1 وعند استخدام 100% ماء صرف كانت أفضل التراكيب الوراثية هى الصنف سخا 95 وسدس 14 ، سلالة 2 ويمكن الاستفادة لها فى برنامج التربية لإنتاج الأصناف الحديثة .