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EFFECT OF WATER DEFICIT ON GROWTH AND PRODUCTIVITY OF SOME RICE GENOTYPES

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ABSTRACT

Two field experiments were conducted during the two consecutive rice growing seasons 2020 and 2021 at the experimental farm of Sakha Agric. Res. Station, Kafr Elsheikh, Egypt to study effect of four irrigation intervals *i.e.*1- irrigation every 3 days (control) (I_1), 2- Irrigation every six days (I_2), 3- Irrigation every nine days (I_3) and 4- Irrigation every twelve days (I_4) on growth , yield and yield attributes of three rice genotypes *i.e.*, 1- Giza 178 as inbred rice cultivar, 2- Egypt hybrid 1 and 3- Egypt hybrid 2 . The experimental design was split plot with four replications.

The obtained results showed that prolonging irrigation intervals from 3 to 9 or 12 days significantly reduced flag leaf area (cm), stomata conduces ,transpiration rate , CO_2 net assimilation rate, plant height (cm) ,number of panicles m^{-2} , panicle length (cm), number of branches/panicle , number of filled grains /panicle,1000 grain weight(g) , grain yield (t ha^{1}), biomass yield (t ha^{1}) and harvest index in both seasons. On the other hand, leaf temperature increased with increasing irrigation intervals from 3 to 9 or 12 days in both seasons.

Regarding genotypes variation results indicated that Giza 178 rice variety significantly exceeded Egypt hybrid 1 and Egypt hybrid 2 in flag leaf area, leaf temperature , transpiration rate, Co_2 net assimilation rate, plant height, number of panicles m^{-2}, panicle length, ,1000 grain weight, grain yield, biomass yield t and harvest index in both seasons .

The interaction effect among irrigation intervals and rice genotypes was significant on all studied traits except number of filled grains /panicle in both seasons.

At irrigation every 12 days Giza 178 rice variety gave the highest grain yield as compared with Egypt hybrid 1 and Egypt hybrid 2 in both seasons-

Key Word: Rice, irrigation interval, genotypes, growth, yield and yield components.

INTRODUCTION

Rice is one of the most important cereal crops cultivated worldwide and constitutes a primary source of human food as it accounts for one-fifth of the total caloric intake by the global human population and provides food for about half of the global population **(Fantao *et al*. 2018**

and Zhang *et al* .2021).Rice, being a gluten-free, fat-free, cholesterol-free food, and naturally low in sodium content, has become a highly beneficial commodity as a part of a healthy diet for the growing population of people suffering from celiac disease, coronary artery disease, heart disease, blood pressure, etc**.(Sahebi *et al*.2018)**. Rice, requires plenty of water compared to several other cereal crops **(Gewaily *et al*.2021).**

Nowadays, Egypt face problem in amounts of irrigation water, thus the first important step of Egyptian strategy is increasing rice productivity from unit area with the lowest irrigation water quantity and decreased rice areas to saving the irrigation water. Saving irrigation water is necessary to face the shortage of water in the future. Such saving of irrigation water in rice culture is likely to be achieved by increasing irrigation intervals and using drought tolerant rice genotypes.

Stomata closing, leaf area, maintaining photosynthetic rates, accumulation of organic acids, changes in carbohydrate metabolism and rate of respiration were reduced under water stress **(Abd Allah, 2010). El- Hawary (2000) ,Panthuwan *et al.*(2002), Kumar *et al*. (2016) Gaballah,(2018)and Adhikari *et al*.,(2019)**, stated that the traits include plant height, days to flowering, delay in flowering, grain yield panicle^{-1}, biomass/biological yield, harvest index, number of panicles m^{-2}, panicle length, panicle excretion, spikelet fertility, total number of spikelets, panicle length, 1000-grain weight and grain yield of rice significantly decreased with increasing irrigation intervals or water stress. **Mohamed *et al*.,(2019).** showed that filled grains and grain yield were significantly reduced under drought stress.

According to varietal variation **El- Hawary(2000)**found that rice varieties significantly differed in number of panicles m^{-2}, panicle length, panicle weight , panicle length, 1000-grain weight and grain yield. Also he reported that Giza 178 rice variety exceeded other studied varieties in all mentioned studied traits. **Zaman *et al.* (2018)** revealed that 1000-grain weight and grain yield showed significant differences among rice genotypes. Djissa and Chencherica had the highest number of tillers and yield . **Gaballah,(2018)** and **Adhikari *et al*.,(2019).** revealed that the analysis of variance for all characters studied (number of panicles/ plant, 100-grain weight, sterility %, grain yield/ fed. and harvest index) indicated highly significant differences among parents, crosses, parents vs. crosses.

MATERIALS AND METHODS

Two field experiments were conducted during the two consecutive rice growing seasons 2020 and 2021 at the Experimental Farm of Sakha Agricultural Research Station, Kafr Elsheikh, Egypt. The experiments were conducted to study the effect of different irrigation intervals on promising hybrid rice genotypes and Giza 178 variety. The experiments treatments were as follows:

Irrigation treatments: Four irrigation treatments were studied *i.e.*1- irrigation every three days (control) (I_1), 2- Irrigation every six days (I_2), 3- Irrigation every nine days (I_3) and 4- Irrigation every twelve days (I_4).

Rice genotypes: Three different rice genotypes used *i.e.*,1- Giza 178 as inbred rice cultivar,2- Egypt hybrid 1 and 3- Egypt hybrid 2

The experimental design was split plot with four replications. The main plots were assigned to irrigation intervals while the sub plots were assigned to rice genotypes**.**

Data recorded:

At 90 from sowing the following traits were measurements:

1- Flag leaf area (cm), 2-Leaf temperature,

3-Stomata conduces, 4-Transpiration rate, 5-CO_2 net assimilation rate**.**

At harvest the following data were measured:

6- Plant height (cm) , 7- Number of panicles m^2.

Ten panicles were collected randomly to estimate the following characters,8-Panicle length(cm),9- Panicle weight (g),10-Number of filled grains panicle^{-1}, 11-1000-grain weight (g).The crop of central 5 m^2 of each plot was harvested separately at full maturity, dried, threshed, then grain and straw yields were recorded and each of them was converted into t ha^{-1} grain yield was modified at 14% moisture content.

12- Grain yield t ha^1 13- Biomass yield (t ha^1) and 15- Harvest index

The evaluation of stomata, diffusive conductance and the CO_2 rates and water vapor exchange are important parameters for estimating carbon (C) and water content of plants. A portable porometer "steady-state porometer, LICOR, LI-1600, Lincoln, NE, USA" is designated for assessing the steady-state CO_2 and H_2O exchange degrees of leaves. The entire porometer comprises an open gas exchange in its system that displays the variations in concentrations levels of CO_2 and H_2O incoming and exit a cuvette that is fixed on or around leaves. Data of leaf diffusive resistance (LDR) was determined through the equation: LDR (s cm^{-1} ((DRad × DRab) / (DRad + DRab). Here, DRad and DRab exemplify the diffusive resistance of the adaxial and abaxial surfaces, correspondingly **(Schulze *et al*., 1982)**. Stomatal conductance (SC) was measured in the fully expanded flag leaf. Net photosynthetic rate (NPR, A) used for the *gs* models was estimated as follows: A =Amax × f (PAR), PAR in this equation was obtained from the on-site PAR measurements at which the measurements took location) in the morning, round noon and afternoon). Where, PAR is the photo-synthetically active radiation (μmol $m^{-2}s^{-1}$). CO_2 concentration (CO_2) was calculated. Leaf transpiration rate (LTR) was dignified directly on the same leaf. It signifies the sum of the rates for the adaxial and abaxial surfaces. Leaf temperature (LT) was determined by the thermocouple of the steady-state porometer pressed against the adaxial and abaxial surfaces of the leaf, and the leaf-to- air temperature gradient (TL-TA) was measured by using the atmospheric temperature. The cuvette temperature was measured using Linearized thermistor at the ambient air temperature and the humidity around the leaf. This device might also be utilized to calculate the response of CO_2 curves in the field. Adaxial and abbatial diffusive resistances were determined on the upper fully expanded leaf with a steady-state porometer was collected during the measurement. The physical and chemical analysis of soil at the experimental site in both 2020 and 2021 seasons according **Cottenie *et al*. (1982)** are shown in Table(1).

Table (1): Physical and chemical properties of the soil at the experimental site during 2020 and 2021 seasons.

Character								
	Chemical analysis				Physical characteristics			
Seasons	N (Available ppm)	P (Available ppm)	K (Available ppm)	Soil pH	Sand %	Silt %	Clay	Soil texture
2020	18	22.5	325	8.75	18.12	36.10	45.87	Clay
2021	16	24.7	342	7.88	20.30	38.50	41.20	Clay

The previous crop was barely (*Hordeum Vulgare* L.) in the two seasons. Seeds at the rate of 24kg ha^{-1} for promising hybrid genotypes and at the level of 144 kg ha^{-1} for Giza 178 were soaked in water for 24 hr, and then incubated for 48 hr to accelerate early germination. Pre-germinated seeds were uniformly broadcasted in the nursery on 8^{th} and 5^{th} May of the two seasons, respectively. The permanent field was well prepared, *i.e.* plowed twice followed by well dry leveled. Basal application of phosphorus and potassium fertilizers was applied to all plots and incorporated well into the soil during land preparation at the rate of 36kg P_2O_5 and 60 kg K_2O per hectare using single super phosphate fertilizer (15%P_2O_5) and potassium sulfate (48% K_2O), respectively. Seedlings were carefully uprooted from the nursery at 30 days after sowing and distributed in the plots. Seedlings were manually transplanted in 20x20 cm space between rows and hills, with seedling $hill^{-1}$ .Nitrogen fertilizer was applied at the rate of 165kg N ha^{-1} in the form of urea (46.5% N). Urea was added in two equal splits as basal application, and top dressed at 35 and 70 days after transplanting. All other agronomic practices were done as recommended.

The data of the studied agronomic traits were collected and subjected to analysis of variance according to **Steel *et al.* (1997)** to sort out significant differences among treatments. Differences among means were compared using LSD at 5% probability level.

RESULTS AND DISCUSSION

Average flag leaf area (cm), leaf temperature, stomata conduces, transpiration rate , CO_2 net assimilation rate, plant height (cm), number of panicles m^{-2}, Panicle length (cm), Number of branches/panicle , number of filled grains /panicle ,1000 grain weight , grain yield (t ha^{-1}), biomass yield (t ha^{-1})and harvest index of some rice genotypes as affected irrigation intervals and their interactions in 2020 and 2021 season are presented in Tables 2 - 7.

Results presented in Tables 2-4 indicated that irrigation intervals significantly affected all studied traits in both seasons.

Prolonging irrigation intervals from 3 to 12 days flag leaf area (cm) by 26.48 and 25.46% , stomata conduces by 17.03 and 27.47 %, transpiration rate by 24.52 and 21.66% , CO_2 net assimilation rate by16.99 and 16.52 % , plant height (cm) by 15.10 and 14.99 %, number of panicles/ m^{-2} by 21.39 and 22.93 % , panicle length (cm) by27.71 and 25.44% , number of branches/panicle by 10.22 and 8.94 % , number of filled grains /panicle by 19.14 and 23.44 % ,1000 grain weight by 14.85 and 20.06 % , grain yield (t ha^{-1}) by 25.51 and 21.63 %, Biomass yield (t ha^{-1}) by 13.13 and 10.13 % and harvest index by 14.14 and 12.85 % in 2020 and 2021 seasons , respectively . on the other hand , leaf temperature increased by 36.38 and 36.23 % with increasing irrigation intervals from 3 to12 days in 2020 and 2021 seasons , respectively.

The reduction in stomata conduces and transpiration rate caused by prolonging irrigation intervals may be attributed to plant attempts to loss water by decreasing transpiration. These results are in harmony with those obtained by (**Schulze *et al*., 1982).**

The reduction in plant height due to prolonging irrigation intervals may be attributed to the reducing cell size and cell division, which may affect the plant height under drought condition. However, the reduction in number of effective tillers $hill^{-1}$ could be attributed to less ability of tiller nodes to produce more tillers under water stress. A similar trend was found by **Sarvestani *et al*., (2008).** The reduction in biomass yield as affected by prolonging the irrigation intervals may be due to the decrease in dry matter production, plant height and number of effective tillers $hill^{-1}$. However, the reduction in grain yield as affected by prolonging the irrigation intervals may be attributed to the reduction in net assimilation rate lead to depressed dry matter production, panicle weight, number of panicles m^{-2}, number of filled grains $panicle^{-1}$ and 1000-grain weight. A similar trend was found by **El-Hawary (2000) ,El-Refaee *et al*. (2012) and Gewaily *et al*. (2019), Zaman *et al*. (2018)**.who reported that drought stress caused several constructional and functional disruptions in reproductive organs, leading to malfunction of fertilization or premature abortion of the seed. Early senescence, shortens the grain fillness period, photosynthesis reduction and enhanced soluble sugars remobilization from grains to other vegetative parts are observed when water stress happens at the reproductive stage. The sugars or carbohydrate remobilizations strongly depend on source activity and sink strength which vary with genotypes.

Results recorded in Tables 2-4 revealed that significant differences were obtained among tested genotypes in all studied traits in both seasons. The obtained results showed that Giza 178 rice variety significantly exceeded other tested genotypes and gave the highest values of flag leaf area (32.96 and 32.20 cm), leaf temperature (26.45 and 26.41), transpiration rate(19.75 and 23.40) , CO_2 net assimilation rate (3.617 and 4.657), plant height (98.08 and 98.46 cm), number of tillers m^{-2} (591.99 and 595.69), Panicle length (22.39 and 22.38 cm), ,1000 grain weight (24.79 and 25.00g) , grain yield (10.67 and 10.64 t ha^{1}), biomass yield (23.83 and 23.09 t ha^{-1})and harvest index (44.78 and 46.09 %) in 2020 and 2021 seasons , respectively. In this connection, Egypt hybrid 2 gave the highest values of number of branches $panicle^{1}$ (9.21 and 9.24)and number of filling grains (126.16 and 131.23) , on the other hand, it gave the lowest values in grain yield (9.81 and 9.99 t ha^{-1}) and biomass yield (22.16 and 22.69 t ha^{-1})as compared with other studied genotypes 2020 and 2021 seasons , respectively. Egypt hybrid 1 gave the highest values of stomatal conduces (0.747and 0.638) as compared with other studied genotypes 2020 and 2021 seasons, respectively. Also , Egypt hybrid 1surpassed Egypt hybrid 2 in flag leaf area (cm), leaf temperature, transpiration rate , net assimilation rate, plant height (cm), number of tillers m^{-2}, panicle length (cm), ,1000 grain weight , grain yield (t ha^{-1}) and biomass yield (t ha^{1}) in both seasons.

The superiority of Giza 178 rice variety in grain yield than other rice hybrid studied due to its ability to give the highest values of flag leaf area , leaf temperature, transpiration rate , net assimilation rate , number of panicles m^{-2} , panicle length, ,1000 grain weight which lead to raising grain yield . these results are in agreement with those obtained with **El-Hawary(2000), Gaballah,(2018) and Adhikari *et al*.,(2019).**

Results recorded in Tables 5-7 revealed that the interaction between irrigation intervals and rice genotypes had a significant effect were on all studied traits except number of filled grains / panicle in both seasons.

The obtained results showed that at all irrigation intervals Giza 178 rice variety significantly surpassed the other tested rice genotypes in flag leaf area (cm), leaf temperature, transpiration rate , plant height (cm), number of panicles m^{-2}, panicle length (cm), ,1000 grain weight , grain yield (t ha^{-1}) and harvest index in both seasons . While Egypt hybrid 1 gave the highest values of stomatal conduces and CO_2 net assimilation rate, but Egypt hybrid 2 gave the highest values of heading date and number of filled grains /panicle at all irrigation intervals in both seasons.

Table (2): Effect of irrigation intervals on flag leaf area (cm^2), leaf temperature (ċ), stomatal conduces, transpiration rate and CO_2 net assimilation of some rice genotypes in 2020 and 2021 seasons

Treatment	Flag leaf area (cm^2)		Leaf temperature (ċ)		Stomatal conduces		Transpiration rate		CO_2 net assimilation	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Irrigation interval(I)										
I_1	36.10	36.21	19.05	19.32	0.787	0.768	20.43	23.22	4.250	4.872
I_2	32.23	32.52	21.33	22.16	0.698	0.621	18.73	22.51	3.953	4.527
I_3	28.91	29.35	23.61	22.95	0.655	0.594	17.14	20.07	3.734	4.336
I_4	26.54	26.99	25.98	26.32	0.653	0.557	15.42	18.19	3.528	4.067
L S D at 0.05	0.415	0.321	0.205	0.218	0.072	0.065	1.438	1.258	0.039	0.040
Genotype (G)										
Giza 178	32.96	33.20	26.45	26.41	0.728	0.619	19.75	23.40	3.617	4.657
hybrid 1	31.47	32.03	22.73	23.11	0.747	0.638	18.21	21.61	3.517	4.513
hybrid 2	28.42	28.58	18.31	18.54	0.676	0.574	15.83	17.98	3.353	4.182
L S D at 0.05	0.339	0.250	0.157	0.153	0.063	0.059	1.050	1.037	0.034	0.047
L S D at 0.05 (I x G)	0.377	0.286	0.183	0.184	0.066	0.063	1.245	1.148	0.037	0.053

I1= Continuous flooding, I2= irrigation every 6 days, I3= irrigation every 9 days and I4= irrigation every 12 days

Table (3): Effect of irrigation intervals on plant height (cm), number of panicles m^{-2}, panicle length (cm), number of branches/panicle, number of filled grains /panicle and 1000-grain weight of some rice genotypes during 2020 and 2021 seasons

Treatment	Plant height (cm)		Number of tillers m^{-2}		Panicle length (cm)		Number of branches/panicle		Number of filled grains /panicle		1000-grain weight	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Irrigation interval(I)												
I_1	103.71	103.76	589.52	607.47	24.94	24.41	9.49	9.51	132.64	141.98	24.64	25.87
I_2	96.97	96.77	585.67	590.32	21.16	23.04	9.01	9.17	121.92	130.01	23.37	24.42
I_3	92.29	92.88	536.68	543.69	19.67	19.79	8.83	8.86	115.26	120.19	22.17	22.80
I_4	88.05	88.26	463.40	468.16	18.03	18.20	8.52	8.66	107.25	108.70	20.98	20.68
L S D at 0.05	0.847	0.849	1. 785	0.849	0.296	0.312	1.02	0.97	1.05	1.22	1.94	1.17
Genotype (G)												
Giza 178	98.08	98.46	591.99	595.69	22.39	22.38	8.59	8.69	110.94	117.48	24.79	25.00
hybrid 1	95.97	96.32	562.77	565.88	21.38	21.70	9.09	9.03	120.70	126.95	23.39	23.24
hybrid 2	91.71	91.47	476.67	495.67	19.30	20.11	9.21	9.42	126.16	131.23	20.19	22.09
L S D at 0.05	1.211	0.627	1.933	0.627	0.238	0.251	0.77	0.67	0.89	0.79	1.132	1.127
L S D at 0.05 (I x G)	1.467	1.470	2.988	3.270	0.513	0.583	N.S	N.S	1.46	1.37	2.185	2.032

I1= Continuous flooding, I2= irrigation every 6 days, I3= irrigation every 9 days and I4= irrigation every 12 days

Table (4): Effect of irrigation intervals on grain yield (t ha^{1}) , biomass yield (t ha^{1})and harvest index (%)of different genotypes during 2020 and 2021 seasons.

Treatment	Grain yield (t ha^{1})		Biomass yield (t ha^{1})		HI (%)	
	2020	2021	2020	2021	2020	2021
Irrigation interval(I)						
I_1	11.81	11.79	24.91	24.37	47.39	48.40
I_2	10.60	10.54	23.60	23.19	44.84	45.44
I_3	9.50	9.54	22.37	22.48	42.25	42.43
I_4	8.80	9.24	21.64	21.92	40.69	42.18
L S D at 0.05	1.21	0.986	1.04	0.921	1.072	1.026
Genotype (G)						
Giza 178	10.67	10.64	23.83	23.09	44.78	46.09
hybrid 1	10.01	10.20	23.40	23.19	42.76	43.99
hybrid 2	9.81	9.99	22.16	22.69	44.25	44.03
L S D at 0.05	1.05	0.697	1.02	0.783	1.022	1.014
L S D at 0.05 (I x G)	1.42	1.048	1.22	1.15	1.53	1.41

I1= Continuous flooding, I2= irrigation every 6 days, I3= irrigation every 9 days and I4= irrigation every 12 days

Table (5): Average of flag leaf area (cm^2), leaf temperature (ċ),stomatal conduces, transpiration rate and CO_2 net assimilation of some rice genotypes as affect by interaction between irrigation intervals and genotypes in 2020and 2021 seasons.

Genotype	2020				2021			
	I1	I2	I3	I4	I1	I2	I3	I4
Flag leaf area (cm^2)								
Giza 178	37.34	34.38	31.63	28.48	37.43	34.35	32.01	28.99
hybrid 1	36.27	32.62	29.63	27.36	36.81	33.11	30.13	28.07
hybrid 2	34.71	29.68	25.48	23.79	34.38	30.09	25.92	23.92
Leaf temperature (ċ)								
Giza 178	23.12	24.53	27.73	30.40	22.69	24.36	27.92	30.67
hybrid 1	18.12	21.85	24.04	26.90	19.24	24.21	21.80	27.20
hybrid 2	15.91	17.62	19.07	20.63	16.03	17.92	19.13	21.08
Stomatal conduces								
Giza 178	0.792	0.738	0.705	0.669	0.676	0.621	0.602	0.578
hybrid 1	0.822	0.762	0.715	0.687	0.694	0.647	0.622	0.589
hybrid 2	0.748	0.698	0.655	0.604	0.634	0.594	0.559	0.507
Transpiration rate								
Giza 178	21.97	21.21	19.12	16.70	25.49	25.68	22.56	19.57
hybrid 1	19.92	18.79	18.21	15.93	23.76	22.72	21.05	18.90
hybrid 2	19.40	16.18	14.08	13.64	20.12	19.12	16.59	16.09
Co2 net assimilation								
Giza 178	4.277	3.973	3.803	3.617	4.927	4.530	4.393	4.203
hybrid 1	4.433	4.113	3.863	3.707	5.067	4.720	4.540	4.300
hybrid 2	4.040	3.773	3.537	3.263	4.623	4.330	4.073	3.700

I1= Continuous **flooding, I2= irrigation every 6 days, I3= irrigation every 9 days and I4= irrigation every 12 days**

Table (6): Average of plant height, number of panicles m^{-2}, panicle length (cm), and number of filled grains /panicle and 1000-grain weight as affect by the interaction between irrigation intervals and genotypes during 2020and 2021 seasons.

Genotype	2020				2021			
plant height								
	I1	I2	I3	I4	I1	I2	I3	I4
Giza 178	106.04	99.17	95.57	91.56	106.59	98.27	96.22	92.78
hybrid 1	104.27	97.47	92.23	89.91	104.37	97.58	92.89	90.43
hybrid 2	100.82	94.27	89.08	81.67	100.33	94.44	89.54	81.58
number of panicles m^{-2}								
Giza 178	640.50	625.17	586.90	515.40	645.57	629.17	588.63	519.40
hybrid 1	611.33	592.50	553.57	493.67	616.73	595.50	555.87	495.40
hybrid 2	516.73	539.33	469.57	381.13	560.10	546.57	486.57	389.13
Panicle length (cm)								
Giza 178	25.27	23.35	21.58	19.34	25.24	23.16	21.59	19.55
hybrid 1	24.64	22.18	20.13	18.59	24.82	22.33	20.31	18.93
hybrid 2	23.58	20.16	17.31	16.16	23.18	23.62	17.48	16.13
Number of filled grains /panicle								
Giza 178	124.62	113.54	107.36	98.24	134.68	122.63	110.98	101.64
hybrid 1	134.62	123.56	118.74	105.86	143.65	132.52	121.96	109.67
hybrid 2	138.67	128.67	119.67	117.64	147.62	134.87	127.63	114.78
1000-grain weight								
Giza 178	26.84	25.29	24.13	22.90	26.83	26.29	24.88	22.00
hybrid 1	25.07	24.21	22.91	21.37	25.94	24.43	22.54	20.05
hybrid 2	22.01	20.61	19.47	18.67	24.84	22.54	20.98	20.00

I1= Continuous flooding, I2= irrigation every 6 days, I3= irrigation every 9 days and I4= irrigation every 12 days

Table (7): Effect of interaction between irrigation intervals and genotypes on grain yield (t ha^{-1}) ,biomass (t ha^{-1}) and harvest index (%) during 2020 and 2021 seasons.

Genotypes	2020 season				2021season			
Grain yield (t ha^{1})								
	I1	I2	I3	I4	I1	I2	I3	I4
Giza 178	12.88	10.84	9.74	9.22	12.17	11.07	9.97	9.35
hybrid 1	11.36	10.52	9.47	8.67	11.82	10.32	9.43	9.24
hybrid 2	11.18	10.39	9.14	8.52	11.39	10.22	9.21	9.14
Biomass yield (t ha^{1})								
Giza 178	25.87	24.39	22.96	22.18	24.98	23.24	22.46	21.67
hybrid 1	25.03	23.55	22.87	22.15	24.45	23.84	22.63	21.55
hybrid 2	23.84	22.86	21.27	20.68	23.67	22.49	22.34	21.52
Harvest index (%)								
Giza 178	49.79	44.44	42.42	41.76	48.72	47.65	41.67	42.29
hybrid 1	45.39	44.67	41.41	39.14	48.34	43.29	41.23	41.08
hybrid 2	46.90	45.45	42.92	41.20	48.12	45.44	42.43	42.18

I1= Continuous flooding, I2= irrigation every 6 days, I3= irrigation every 9 days and I4= irrigation every 12 days

At irrigation every 12 days Giza 178 rice variety gave the highest grain yield 9.22 and 9.35 t ha^{1} followed by Egypt hybrid 1 which gave 8.67 and 9.24 t ha^{-1} , on the contrary , Egypt hybrid 2 gave the lowest grain yield 8.52 and 9.14 t ha^{-1} in 2020 and 2021 seasons , respectively.

Generally it could recommended that Giza 178 rice variety may be considered the most tolerant to water deficit than Egypt hybrid1 and Egypt hybrid2 , whereas it gave the highest grain yield and yield components under prolonging irrigation intervals i.e. irrigation every 9 or 12 days which led to saving irrigation water.

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تاثير نقص المياه على نمو وإنتاجية بعض التراكيب الوراثية فى الارز

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أجريت تجربتان حقليتان خلال موسمي زراعة الأرز المتتاليين 2020 و 2021 في المزرعة البحثية لمحطة البحوث الزراعية بسخا كفر الشيخ ، مصر لدراسة تأثير أربع فترات ري ، 1– الرى كل ثلاثة ايام (الكنترول) (I_1)، 2– الري كل ستة أيام (I_2)، 3– الري كل تسعة أيام (I_3) ، 4– الري كل اثني عشر. أيام (I_4) على صفات النمو والمحصول والإنتاجية لثلاثة طرز وراثية من الأرز ، 1– جيزة 178 كصنف أرز ، 2– هجين مصر 1 و 3– هجين مصر 2. تم اتباع تصميم الاحصائي قطع منشقة مرة واحدة في أربع مكررات.

أظهرت اهم النتائج المتحصل عليها أن إطالة فترات الري من 3 إلى 9 أو 12 يومًا أدى إلى انخفاض مساحة ورقة العلم (سم) ، ومقاومة الثغور ، ومعدل النتح ، ومعدل صافى التمثيل لثاني أكسيد الكربون ، وارتفاع النبات (سم) ، وعدد االداليات م–2 وطول الدالية (سم) ، وعدد الأفرع / الدالية ، وعدد الحبوب الممتلئة / الدالية ، ووزن 1000 حبة ، ومحصول الحبوب (طن /هكتار) ، محصول البيولوجي (طن /هكتار) ، ودليل الحصاد في كلا الموسمين. وعلى العكس زادت درجة حرارة الأوراق بزيادة فترات الري من 3 إلى 9 أو 12 يومًا في كلا الموسمين. فيما يتعلق بنتائج التباين في الطرز الوراثية أوضحت النتايج أن صنف الأرز جيزة 178 زاد معنوياً عن هجين مصر 1 وهجين مصر 2 في مساحة ورقة العلم ودرجة حرارة الورقة ومعدل النتح ومعدل صافى التمثيل لثاني أكسيد الكربون وارتفاع النبات وعدد الداليات م 2 وطول الدالية 1000 وزن الحبوب ، محصول الحبوب ، محصول البيولوجي ودليل الحصاد فيما عدا عدد فروع الدالية في كلا الموسمين.

كان تأثير التفاعل بين فترات الري والتراكيب الوراثية للأرز معنويا على جميع الصفات المدروسة في كلا الموسمين. أعطى صنف أرز جيزة 178 أعلى إنتاج للحبوب مقارنة بالهجين المصري 1 ومصر الهجين عند الري كل 12 يومًا ، 2 في كلا الموسمين.

توصى الدراسة ان زراعة الصنف جيزة 178 تحت ظروف نقص ماء الرى اعطى اعلى محصول للحبوب فى منطقة سخا كفر الشيخ – مصر