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Performance of Some Hybrid Rice Combinations Under Different Irrigation Intervals and Sowing Dates

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ABSTRACT

Two field experiments were conducted at the farm of Sakha Agricultural Research Station – Sakha, Kafr- El sheikh governorate, Egypt during 2014 and 2015 seasons to study the performance of some hybrid rice combinations to different dates of sowing and various irrigation intervals. Three hybrid rice combinations, namely; SK-2034H (H1), SK-2046H (H2) and SK-2151H (H3) were used under three dates of sowing (May, 1, May, 15 and May, 30) with three irrigation intervals i.e. every 4 days, every 8 days and every 12 days. A split-split plot design with four replications was used. The three dates of sowing were allocated in the main plots and the three irrigation intervals were devoted in sub-plots, while sub- sub were received the three varieties. The studied characters were light penetrations, leaf area index (LAI), chlorophyll content, crop growth rate, plant height, root depth, number of panicles /m^2, 1000-grain weight, panicle length, number of spikelets / m^2 *1000, spikelets-leaf area ratio, number of grains/ panicle, grain yield (t/ha) and straw yield (t/ha). The main results indicated that May first followed by May,15 caused an increase in all the previous characters except light penetration and plant height at maximum tillering and late booting. As for irrigation intervals, either irrigation every 4 days or every 8 days were the best for all the studied characters except light penetration and rood depth which reached to the maximum value under irrigation every 12 days. Results also revealed that the hybrid SK-2034 H (H1) surpassed the other two studied hybrids in most of the studied characters and produced the greatest grain yield moreover saved reasonable amount of irrigation water (984,3 m^3/ha) under 8 days intervals. So it can be concluded that cultivate the hybrid SK-2034 H (H1) hybrid through the first two weeks of May and irrigate it every 8 days intervals was the best combination to get higher yield and save of irrigation water without significant reduction in the yield.

Keywords : Normal soil, Rice crop, sowing dates, hybrid and unbraid rice Physiological characters and yield.

INTRODUCTION

Rice is the most important crop in Egypt. So, many research papers were presented to study the effect of sowing dates on rice production. The variation in rice production could be attributable to different climates when other conditions are suitable for optimal growing season for an already growing cultivars for a long period has been determined by changing planting dates with a certain important time for sowing of rice, Abou khalifa (2005). Irrigation water interval also is to use alternate irrigations during rice growing seasons. Continuous saturation methods save about 20.09% of water with yield reduction of 3.98%, El-Refaee (2002). Knowledge of the effect of water stress on the physiology of rice plants is essential to an understanding of resistance survival mechanisms and breeding for water stress resistance. Rice genotypes showed significant variations in physiological response to water deficit, which is known to retard phonological development and reduce growth of rice, Lilley and Fukai (1994) and Nour *et al.*, (1994). On the contrary, Prasad *et al.*, (1990), Marazi *et al.*, (1993), they found that the grain yield of rice was significantly affected by irrigation regimes. However, Mahrous and Aly (1986), El-Bershamgy *et al.*, (1988) and Awad (2001) reported that the grain yield tended to decrease insignificantly at 8-day irrigation intervals. The present study was carried out to understand the physiological performance of three hybrid rice cultivars grown in three sowing dates under different water irrigation intervals and their interactions.

MATERIALS AND METHODS

Two field experiment were conducted at Sakha Agricultural Research Station farm Sakha - kafr El sheikh, Egypt in both 2014 and 2015 rice growth season to study the performance of some hybrid rice under three irrigation intervals and different dates of sowing. Names of hybrids, hybrid combinations and types of the studied hybrid combinations are shown in Table 1.

Three Irrigation intervals were used namely; every 4 days, every 8 days and 12 days. Seedling age was 28 days which transplanted using spaces 20 × 20cm between hills and rows for all rice varieties.

Table (1). Names, Origin and hybrid combinations of the materials studied

No. of hybrids	Hybrid combinations (parentage)	Types
SK-2034H (H1)	IR69625/Giza178	Ind.× Ind./Jap.
SK-2046H (H2)	IR69625/Giza181	Ind.× Ind.
SK-2151H (H3)	IR69625/Giza179	Ind.× Ind./Jap.
H : Hybrid	**I : Indica**	**J : Japonica**

All cultural practices were applied as recommended for all rice varieties. The sub-sub plot size was 15m^2 (3×5). Combined analysis of dates of sowing was used with split plot design. Irrigation intervals were allocated in main plots, while, the sub-plots received the three tested rice hybrids with four replications. Two ditchers were established among the irrigation treatments to avoid the lateral movement of irrigation water. Nitrogen fertilizer was used in the form of urea (46.5%N) at the rate of 165 kg N/ha as three equal doses; 1/3 was applied and incorporated in the dry soil before flooding, the second was added at mid tellering the third dose was added at panicle initiation stage for each rice hybrid. Phosphorus fertilizer as form of single super phosphate (15% P2O5) at the rate of 35.7 P2O5/ha and potassium sulphate (48% K2O) at the rate of 57 K2O/ha were applied during land preparation. Zinc sulphate was applied in the nursery before broadcast the pigmented seeds (after soaking and incubated the seeds). The weeds were chemically controlled using Saturn 50% 4 to 7 days after transplanting as recommended of Rice Research and Training center (RRTC). All the previous steps were

applied for the three dates of sowing. The studied characters were light penetrations, leaf area index (LAI), chlorophyll content, crop growth rate, plant height, root depth, number of panicles /m^2, 1000-grain weight, panicle length, number of spikelets / m^2 *1000, spikelets-leaf area ratio, number of grains/ panicle, grain yield (t/ha) and straw yield (t/ha).

A. Growth characters:

1. **Leaf area index (LAI):** Leaf area (blade area) was measured by portable leaf area meter (Model LI-3000A). LAI at 60 days after transplanting (DAT) was calculated by using the following formula:

$$LAI = \frac{\text{Leaf area of fixed number of hills}}{\text{Ground area occupied by these hills}}$$

2- **Chlorophyll content (SPAD value):** At complete heading, the chlorophyll content was estimated using chlorophyll meter 5 SPAD-502 Minolta Camera Co. Ltd., Japan, (Futuhara et al., 1979). Ten leaves were randomly taken from each plot to determine chlorophyll content at 60 days after transplanting (DAT).

3- CGR values for the crop during the sampling intervals have been computed by using the formulae of Brown (1984) and Radford (1967).

$$CGR = \frac{W_2 - W_1}{(t_2 - t_1)} \quad g\ m^{-2}\ d^{1}$$

Where, W_1 and W_2 are the total dry matter production in grams at the time t_1 and t_2 respectively.

B-Yield and its attributes:

1- **Number of panicles/hill:** Number of panicles at harvest was counted in five hills, and then the average number per $hill^{-1}$ was computed.

2-**Number of filled grains per panicle:** Number of filled grains per panicle was counted from the 10 selected panicles from each plot, and then the average number per panicle was computed.

3- **Weight of 1000-grain (g):** Thousands of rough grains were counted from each sub plot after harvesting and weighted .

4- **Straw and grain yield (t /ha):** Guarded ten square meters from the center of each plot were manually harvested, then gathered in bundles and left in the field for three days to dry. The air-dried bundles were weighted and the total weight of both grain and straw were recorded. Then the weight of grain and straw was separated. The air dried bundles were mechanically threshed and grains weight per 10 m^2 was recorded. The difference between the total weight of grain + straw and subtract the weight of grain from total weight of both grain and straw to get the weight of straw in 10 m^2. The moisture content was estimated using portable moisture meter. The weight of grains was adjusted to 14% moisture content according to Yoshida (1981). The weight of grain yield were computed to tons per hectare.

Total water used (m^3/ha) for Sk-2034 (H1), Sk-2046 (H2) and Sk-2151 (H3) was determined under for irrigation every 4 days, every 8 days and 12 days.

Data collected were subjected to statistical analysis of variance according to Gomez and Gomez (1984) using IRRISTAT computer program.

RESULTS AND DISCUSSION

I- Growth characters :

Data of the growth characters namely; light penetrations, leaf area index (LAI), chlorophyll content, crop growth rate, plant height and root depth are presented in Tables (2, 3 and 4).

Light penetrations, leaf area index and chlorophyll content of some rice hybrid varieties as influenced by different date of sowing and irrigation intervals are presented in Table (1).

Data indicated that light penetrations, leaf area index and chlorophyll content gradually decreased with late of sowing up to May, 30. The late sowing cause a decrease in plant canopy such as number of tillers, number and area of leaves as well as the content of chlorophyll. These findings were in agreement with their obtained by Abou khalifa (2010) and Metwally *et al*., (2012).

Data in the same table also revealed that, LAI and chlorophyll content reached to the maximum values under irrigation every 4 days and 8 days without significant difference between them decreased with increase the intervals of irrigation up to 12 days interval, while, the light penetration perform the opposite trend under 12 days. It might be due to the reduction in plant canopy under 12 days interval. These results were similar with the obtained by Abou khalifa (2010).

Table (2): Light penetration, leaf area index and chlorophyll content of some hybrid rice varieties as affected by irrigation intervals under different sowing dates

Characters	Light penetration (Lux)		Leaf area index		Chlorophyll content (SPAD)	
Treatments	2014	2015	2014	2015	2014	2015
Sowing dates (S)						
May 1st	1603	1673	6.89	6.78	32.41	30.60
May 15th	1870	1956	6.54	6.39	25.45	24.92
May 30th	1989	2034	5.49	5.88	20.91	19.56
LSD at 5 %	196	187	0.72	0.44	0.87	0.80
Irrigation						
Intervals (I)	710	738	7.13	6.88	28.71	27.68
Every 4 days	1381	1491	6.71	6.60	27.53	27.03
Every 8 days	3372	3430	5.10	5.57	19.67	19.28
Every 12 days	135.4	136.9	1.05	0.67	1.10	0.62
LSD at 5 %						
Rice hybrids (H)						
H1	1774	1840	7.00	6.81	29.45	28.00
H2	1879	1964	6.03	6.08	22.03	21.54
H3	1806	1856	5.90	6.18	25.63	24.33
LSD at 5 %	55	67	0.60	0.39	3.80	3.29
Interaction						
S x I	ns	ns	ns	ns	ns	ns
S x H	ns	ns	ns	ns	ns	ns
I x H	ns	ns	ns	ns	ns	ns
S x I X H	ns	ns	ns	ns	ns	ns

Data in Table (3): showed that, first of May sowing date gave the highest CGR in the three growth period i.e. (60-75), (75-90) and (90-105) DAS while end of May sowing date gave the lowest values of CGR in both

season. It can be easily noticed that the highest CGR was recorded in the second period (75 – 90 DAS) under the three sowing dates followed by the first period (60 – 75 DAS), while, the last period (90 – 105 DAS) gave the least. The increase in the CGR in the second period (75 – 90 DAS) could be attributed to the increase in the dry matter accumulated through this period due to the of the increase in the synthesis photo as a result to increase the leaf area index.

Irrigation interval every 4 days gave the highest value of CGR at the three growth stages and then gradually decreased by lengthening irrigation intervals up to 12 days interval. It can be observed that there was any significant difference between the CGR under both irrigation every 4 days and every 8 days except the second period (75 – 90 DAS) in 2014 season and the third period (90 – 105) in 2015 season. The SK-2034H (H1) hybrid rice variety gave the highest CGR in the three periods followed by H3 variety, while, H2 variety gave the least. These results are in harmony with those obtained by Gorgy (1988) and Abou khalifa (2010).

Table (3): Crop growth rate at three growth stage of some hybrid rice varieties as affected by irrigation intervals under different dates of sowing during 2014 and 2015 seasons.

Characters	CGR during (60-75) DAS		CGR during (75-90) DAS		CGR during (90-105) DAS	
Treatments	2014	2015	2014	2015	2014	2015
Sowing dates (S)						
May 1st	16.11	17.92	28.69	30.25	13.35	13.75
May 15th	14.15	15.37	26.87	28.36	10.12	9.64
May 30th	14.00	14.46	24.08	27.39	9.86	8.62
LSD at 5 %	1.56	1.73	2.32	1.51	2.18	4.66
Irrigation Intervals (I)						
Every 4 days	18.18	19.89	27.16	30.65	12.81	10.73
Every 8 days	16.91	18.43	26.43	29.68	11.34	9.13
Every 12 days	11.76	13.57	26.22	25.36	9.35	8.64
LSD at 5 %	2.06	1.94	0.41	2.88	1.41	1.05
Rice hybrids (H)						
SK-2034H	14.60	19.55	25.44	30.83	13.15	12.17
SK-2046H	19.80	22.21	25.16	24.81	18.34	16.73
SK-2151H	14.21	13.80	27.25	30.70	10.93	9.77
LSD at 5 %	0.41	0.39	0.70	0.82	0.60	0.44
Interaction						
S x I	ns	ns	ns	ns	ns	ns
S x H	ns	ns	ns	ns	ns	ns
I x H	ns	ns	ns	ns	ns	ns
S x I X H	ns	ns	ns	ns	ns	ns

CGR = Crop growth rate **DAS = days after sowing**

Plant height and root depth of some hybrid rice varieties as affected by different date of sowing and irrigation intervals at different stages are presented in Table (4).

Table (4): Plant height (cm) and root depth (cm) at three stages of some hybrid rice varieties as affected by different irrigation intervals and various sowing dates during 2014 and 2015 seasons

Characters	Maximum telliring				Late booting				At harvest			
	Plant height(cm)		Root depth (cm)		Plant height(cm)		Root depth (cm)		Plant height(cm)		Root depth (cm)	
Treatments	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Sowing dates (S)												
May 1st	72.63	70.34	36.28	36.25	105	103.2	33.13	33.34	109.7	107.2	25.23	25.28
May 15th	74.46	72.65	34.71	34.45	107	105.2	31.16	31.57	107.6	105.4	23.41	23.77
May 30th	74.83	72.73	36.28	36.42	108	105.4	32.64	33.36	103.5	101.3	24.67	25.39
LSD at 5%	1.60	1.10	0.95	0.91	1.43	0.95	1.02	0.85	2.96	2.81	0.93	0.85
Irrigation Intervals (I)												
Every 4 days	76.44	74.20	33.00	34.05	109.2	106.3	30.22	31.17	111.2	108.3	22.67	23.40
Every 8 days	74.51	71.83	35.02	35.76	106.1	104.2	32.48	32.81	108.3	106.2	24.63	24.83
Every 12 days	72.44	70.09	37.24	37.42	105	103.1	34.09	34.39	104.1	102.3	26.26	26.51
LSD at 5 %	2.15	1.91	2.11	1.87	2.05	1.81	1.90	1.67	3.32	2.91	1.77	1.58
Rice hybrids (H)												
SK-2034H (H1)	76.19	73.46	36.32	37.40	107.9	105.1	33.18	34.23	113.1	111.2	25.34	26.23
SK-2046H (H2)	70.64	68.69	32.56	33.06	103	101	29.81	30.39	111	105	23.16	23.24
SK-2151H (H3)	72.36	70.11	34.31	34.64	105	102	31.81	31.78	107	100	24.87	25.09
LSD at 5 %	1.81	1.27	1.33	1.52	1.71	1.11	1.28	1.34	4.74	4.70	1.16	1.33
Interaction												
S x I	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
S x H	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
I x H	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
S x I X H	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

Data demonstrated that, cultivated rice at May, 30 or May, 15 produced the highest plant height at maximum tilliring without significant differences between them, while root depth reached to its value under May, 1 and May 30 without any significant difference between them. The data in the same table

revealed that, at the late booting sowing rice at May, 15 or May, 30 gave nearly the same tall of plants, while, root depth was the highest when rice sown at May, 1 without a significant difference with cultivated rice at May, 30. The unstable of previous data might be due to the estimating both tall of plants or its root depth at early stages of rice which the tall of plant or depth of roots were not reached to its maximum and fixed. Moreover, at harvest stage when both the height of plants or depth of roots reached to its maximum values the data indicated that sowing rice at may first gave the highest values in both plant height and root depth. It means that sowing the tested rice hybrids at may first is the best. As for the effect of irrigation intervals data in Table 4 indicated that irrigation every 4 days caused an increase in plant height at all the studied stages of rice, while irrigation every 12 days caused an increase in root depth under all the stage of rice under study. These results were hold true in the two studies seasons. It can be also found that H1 hybrid produced the greatest plant height and root depth at all the studied stages followed by H3 hybrid while H2 hybrid gave the least. These data are in agreement with those reported by El-kallawy (2002), Abou khalifa (2010), Ashouri (2012) and Bunnag and Ppngthai (2013).

Table (5) presented the data of number of panicles /m^2, 1000-grain weight and panicle length as affected by irrigation intervals and various sowing dates.

Data demonstrated that the previous characters were increased and reached to maximum values when the tested rice varieties cultivated on May first without any significant difference with the second data of sowing (May, 15). On contrast the third data of sowing (May, 30) produced the lowest values of all the previously mentioned characters. These data are in agreement with those reported by Fang *et al*., (2001), Hefeina (2007), Abed El-hamed (2009) and Metwally *et al*., (2012).

Data in the same table revealed that both irrigation every 4 days and 8 days caused an increase in the previous traits without any significant difference between them, while irrigation every 12 days caused a significant reductions in all the previous characters under study. These results were hold true in the two studied seasons. These results were similar with the obtained by Abou khalifa (2010) Ashouri (2012) Kumar *et al*., (2014)

As for the varietal differences, data in the same table indicated that both H1 and H2 produced the greatest number of panicles /m^2 without significant differences between them. While, H3 gave the lowest value in this respect. The data in Table (5) also pointed out that both H2 and H3 produced the maximum values of 1000-grain weight without significant difference between them, while H1 gave the minimum value in this aspect. In the same table, it can be easily observed that both H1 and H3 produced the tallest panicles without any significant difference between them, while H2 gave the least.

These data are in agreement with those reported by Lilley and Fukai (1994), Nour *et al*., (1994), Prasad *et al*., (1990), Marazi *et al*., (1993) and Fang *et al*., (2001), El-Refaee (2002), Hefeina (2007), Abed El-hamed (2009), Abou khalifa (2010) and Metwally *et al*., (2012).

Table (5): Number of panicles /m^2, 1000-grain weight (g) and panicle length (cm) of some hybrid rice varieties as affected by irrigation intervals under different sowing dates, during 2014 and 2015 seasons.

Characters	No. of panicles/M^2		1000-grain weight (g)		Panicle length (cm)	
Treatments	2014	2015	2014	2015	2014	2015
Sowing dates (S)						
May 1st	689	684	25.79	25.53	25.98	25.76
May 15th	670	652	25.72	25.47	25.83	25.64
May 30th	539	534	24.23	24.21	25.24	24.92
LSD at 5 %	81.8	80.9	0.19	0.21	0.39	0.46
Irrigation Intervals (I)						
Every 4 days	761	750	25.04	25.85	26.09	25.90
Every 8 days	657	655	23.72	23.61	25.92	25.63
Every 12 days	473	460	23.34	23.11	24.74	24.43
LSD at 5 %	147	150	0.41	0.99	0.79	0.84
Rice hybrids (H)						
SK-2034H (H1)	690	672	22.62	22.28	26.24	25.83
SK-2046H (H2)	695	675	24.48	24.13	28.18	27.78
SK-2025H (H3)	575	583	27.99	27.84	25.38	24.99
LSD at 5 %	61	51	1.96	1.88	0.57	0.55
Interaction						
S x I	ns	ns	ns	ns	ns	ns
S x H	ns	ns	ns	ns	ns	ns
I x H	ns	ns	ns	ns	ns	ns
S x I X H	ns	ns	ns	ns	ns	ns

Number of spikelets x 1000, spikelets - Leaf area ratio and number of grain/panicles of some hybrid rice varieties as affected by both different dates of sowing and irrigation intervals are presented in Table (6).

Data indicated that all the previously mentioned characters reached to the highest values when the tested rice varieties were cultivated in both May first and May,15 without any significant difference between them except spikelet leaf-area ratio in 2015 season which reached to the maximum value under May first only. On the other side all the preview tested traits reached to the minimum values under the third date of sowing (May, 30). It can be easily noticed that in the same Table either irrigation every 4 days or every 8 days gave the highest values in all the previously mentioned traits without any significant difference between them. On the other hand irrigation every 12 days cased a significant reduction in all the tested traits under study. These results were hold true in the two studied seasons. These results were in agreement with that obtained by Abou khalifa (2010) and Ashouri (2012).

As for the varietal differences, data in Table (6) classified that H1 produced the greatest values in all the previous traits, while H2 and H3 varieties gave the lowest values in these aspects without significant difference between them in the two studied seasons. These data are in agreement with those reported by Lilley and Fukai (1994), Nour *et al*., (1994), Prasad *et al*., (1990), Marazi *et al*., (1993), El-Refaee (2002) and Abed El-hamed (2009).

Table (6): Number of spikelets / m^2*1000, spikelets-leaf area ratio and number of grains/ panicle of some hybrid rice as affected by irrigation intervals under different dates of sowing, during 2014 and 2015 seasons.

Characters	No. 0f spikelets /M^2*1000		Spikelets-Leaf area ratio		Number of grains/ panicle	
Treatments	2014	2015	2014	2015	2014	2015
Sowing dates (S)						
May 1st	110	118	1.64	1.78	163	177
May 15th	101	104	1.56	1.65	153	162
May 30th	76	76	1.45	1.32	143	145
LSD at 5 %	19	22	0.10	0.24	10.33	11.12
Irrigation Intervals (I)						
Every 4 days	130	126	1.76	1.80	163	162
Every 8 days	100	105	1.58	1.54	142	155
Every 12 days	67	72	1.32	1.26	135	149
LSD at 5 %	31	27	0.24	0.28	14.39	6.53
Rice hybrids (H)						
SK-2034H (H1)	111	110	1.54	1.61	154	162
SK-2046H (H2)	119	115	1.46	1.48	163	167
SK-2025H (H3)	95	93	1.45	1.47	144	156
LSD at 5 %	11.5	11	0.05	0.08	6.79	6.98
Interaction						
S x I	ns	ns	ns	ns	ns	ns
S x H	ns	ns	ns	ns	ns	ns
I x H	ns	ns	ns	ns	ns	ns
S x I X H	ns	ns	ns	ns	ns	ns

Spikelets-Leaf area ratio = Spikelets formation efficincy

Grain yield and straw yield of some hybrid rice varieties as influenced by both different dates of sowing and irrigation intervals are presented in Table (7).

Data demonstrated that grain yield and Straw yield were increased and reached to the highest values when the tested hybrid rice varieties were sown at May first followed by May, 15 without a significant difference between them. In contact cultivated the tested hybrids gave the lowest values in all the previously mentioned traits under the last date of sowing (May, 30) in the two seasons of study. These results were in agreement with that reported by Abou khalifa (2010) and Metwally *et al.*, (2012).

Data in the same Table also revealed that either irrigation every 4 days or every 8 days produced the greatest grain or straw yield without any significant difference between them. On the other side irrigation every 12 days caused a significant reduction in the all the previously mentioned characters. The decrease in the grain yield and most of the yield attributes could be attributed to the insufficient water in the plant cell which cause water imbalance inside the plant and also the water shortage around the root zone which cause a decrease in the uptake in both water and nutrient elements. Also the water deficit led to the decreased in plant growth canopy consequently a decrees in photosynthesis products resulted in low filling process that cause a decrees in the weight of grain yield and most of its components.

As for the varietal differences, date in Table (7) indicated that H1 produced the greatest grain and straw yield followed by H3 and H2 which gave the lowest value in these aspects.

It can be easily observed that the most important results was the insignificant difference between irrigation every 4 and 8 days intervals in all the yield components or attributes and grain yield (Tables 4, 5 and 6). So from economic point of view using irrigation every 8 days interval with the three tested hybrid rice varieties which cultivate through the period of May first up to May, 15 was the best combination treatment to save about 984.3m^3/ha of irrigation water without a significant reduction in the grain yield.

Table (7): grain yield and straw yield of some rice varieties as affected by irrigation intervals under different dates of sowing, during 2014 and 2015 seasons.

Characters	Grain yield (t/ha)		Straw yield (t/ha)	
Treatments	2014	2015	2014	2015
Sowing dates (S)				
May 1st	10.85	9.87	16.00	15.17
May 15th	9.93	9.84	15.13	14.97
May 30th	6.73	6.61	13.45	14.00
LSD at 5%	1.88	1.76	1.44	0.76
Irrigation Intervals (I)				
Every 4 days	12.46	12.25	18.95	18.87
Every 8 days	12.22	11.94	17.12	18.97
Every 12 days	6.27	5.93	8.92	9.15
LSD at 5 %	4.79	4.93	5.35	7.05
Rice hybrids (H)				
SK-2034H (H1)	10.39	10.18	15.36	14.82
SK-2046H (H2)	9.77	8.64	14.08	14.73
SK-2025H (H3)	9.23	8.89	14.87	13.64
LSD at 5 %	0.59	0.60	0.60	0.52
Interaction				
S x I	ns	ns	ns	ns
S x H	ns	ns	ns	ns
I x H	ns	ns	ns	ns
S x I X H	ns	ns	ns	ns

These data are in agreement with those reported by Mahrous and Aly (1986), El-Bershamgy *et al.*, (1988), Prasad *et al.*, (1990), Marazi *et al.*, (1993), Lilley and Fukai (1994), Nour *et al.*, (1994), Awad (2001) and El-Reface (2002), Hefeina (2007) and Abed El-hamed (2009) Abou khalifa (2010).

Data in Table (8) indicated that total water used was decreased as intervals of irrigation increased up to 12 days. These results were hold true with the three hybrids under study in the two studied seasons. It can be observed that Sk-2151 (H3) used less amount of irrigation water followed by Sk-2034 (H1), while Sk-2046 (H2) used the highest amount of total water as compared with the other two tested hybrids.

Table (8) : total water used (m3/ha) for some hybrids as influenced by irrigation intervals during 2014 and 2015 seasons.

Irrigation Intervals	4 days		8 days		12 days	
Rice hybrids	2014	2015	2014	2015	2014	2015
SK-2034H (H1)	13433	13345	12480	12372	11665	11723
SK-2046H (H2)	13635	13573	12690	12561	11816	11729
SK-2151H (H3)	12591	12410	11455	11521	10695	10808

The average of the two studied seasons in total water used by the three tested hybrids and water saved are presented in Table (9). Data revealed that the total water used as average of the two studied seasons increased as irrigation intervals decreased up to 12 days intervals in the

three hybrids under study. The hybrid Sk-2046 (H2) used the highest amount of water followed by Sk-2034 (H1), while Sk-2151 (H3) used lowest.

Data in the same table pointed out that Sk-2151 (H3) saved more irrigation water (about 1013m^3/ha) followed by Sk-2046 (H2) which saved about 978m^3/ha, while Sk-2034 (H1) saved the lowest amount of irrigation water although there were abig differences among them and because of Sk-2034 (H1) produced the highest grain yield with nearly the same amount of water saved, so cultivated Sk-2034 (H1) through the first two weeks of May and irrigate every 8 days interval was the best combination to get higher yield and save of irrigation water without significant reduction in the yield.

Table (9) : total water used (m3/ha) as average of the two studied seasons and water saved by some hybrids under different irrigation intervals

Irrigation Intervals	Average of total water used (m^3/ha)			Water saved (m^3/ha)		
Rice hybrids	4 days	8 days	12 days	4 days	8 days	12 days
SK-2034H (H1)	13389	12426	11694	-	963	1695
SK-2046H (H2)	13604	12626	11773	-	978	1831
SK-2151H (H3)	12501	11488	10752	-	1013	1749
Average	13164.7	12180	11406.3	-	984.7	1758.3

4 days : continues flooding

CONCLUSION

According to the previous results which using Sk-2034 with irrigation every 8 days intervals produced the greatest grain yield (10.39Ton/ha) and saved about (984,3 m^3/ha) which equal 413.6m^3/feddan when cultivate it through the first two weeks of May.

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تقييم أداء بعض تراكيب الأرز الهجينية تحت فترات ري مختلفة ومواعيد زراعة مختلفة

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أقيمت تجربتان حقليتان بمزرعة محطة البحوث الزراعية بسخا- كفر الشيخ - جمهورية مصر العربية خلال موسمي ٢٠١٤ و ٢٠١٥ لدراسة سلوك بعض هجن الأرز للري على فترات مختلفة وتحت مواعيد زراعة مختلفة وتم استخدام ثلاثة هجن من الأرز وهى SK-2034H (H1)، SK-2046H (H2)، SK-2151H (H3) وذلك تحت ثلاثة فترات ري مختلفة وهى كل ٤ ، ٨ ، ١٢ يوم وذلك تحت ثلاثة مواعيد زراعة وهى أول مايو و١٥ مايو و ٣٠ مايو ، وأستخدم تصميم القطع المنشقة مرتين في أربع مكررات بحيث احتوت القطع الرئيسية على مواعيد الزراعة وهى الزراعة عند ١مايو و١٥مايو و٣٠مايو - واحتوت القطع المنشقة على فترات الري المختلفة وهى الري كل ٤ أيام و كل ٨ أيام والري كل١٢ أيام كما وضعت الأصناف في القطع المنشقة مرتين وهى الصنف هجين ١والصنف هجين ٢ والصنف هجين ٣ سابقي الذكر ، وتم إجراء العمليات الزراعية طبقا للتوصيات الفنية لزراعة محصول الأرز. وتم دراسة صفات نفاذية الضوء و دليل مساحة الأوراق و محتوى الكلوروفيل و معدل النمو، طول النبات، عمق الجذور، عدد الداليات في المتر المربع ووزن الألف حبة وطول السنبلة وعدد السنيبلات بالمتر المربع وعدد الحبوب الممتلئة بالسنبلة ومحصول الحبوب بالهكتار ومحصول القش بالهكتار . وأوضحت النتائج أن ميعاد زراعة ١ مايو يليه ميعاد زراعة ١٥ مايو أعطى أعلى قيمة لكل الصفات المدروسة السابقة ما عدا صفتي نفاذية الضوء وطول النبات فى مرحلة أقصى تفريع ومرحلة نهاية الحبلان. وفيما يتعلق بفترات الري كانت فترتي ري كل أربعة وثمانية أيام أعطت أفضل النتائج فى كل الصفات المدروسة ما عدا صفتي نفاذية الضوء وعمق الجذور الذي وصل إلى أعلى قيمة تحت فترة ري كل ١٢ يوم . وأظهرت النتائج أيضا أن الهجين واحد (سخا ٢٠٣٤) متفوق على الأصناف الأخرى في معظم الصفات المدروسة وأعطى أعلى محصول للحبوب علاوة على أنه وفر كمية معقولة من مياه الرى تبلغ ٩٨٤,٣ متر مكعب للهكتار تحت فترة رى ثمانية أيام. وبالتالى نستطيع أن نخلص إلى أن زراعة الهجين سخا ٢٠٣٤ (الهجين واحد) خلال أول أسبوعين من شهر مايو وتحت فترات الري كل ٨ أيام كانت أفضل توليفة للحصول على محصول عالي مع توفير بعض كميات مياه الري دون حدوث نقص معنوي فى المحصول