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Effect of sowing dates and seed rates on some rice cultivars

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Two field experiment were conducted at Rice Research and Training Center (RRTC) – Sakha, kafr- El sheikh, governorate, Egypt in 2006 and 2007 seasons., to study the effect of seed rates under different of sowing dates (20th April, 1st May and 10th May) on some rice varieties. Three rice varieties Sakha 101, Sakha 103, Sakha 104 were tested. Three seed rates were used (48, 95 and 144 kg /ha). Nitrogen fertilizer was added as urea form 46.5% N in two splits, 2/3 was applied as mixed in dry soil before flooding irrigation water and 1/3 was added at panicle initiation. Under three different sowing dates 20th April, 1st May and 10th May with seedling age were transplanted 25 days from sowing by 20×20 cm planting spacing. All agricultural practices were added as recommended for each cultivar. The study was arranged as split- split plot design and with four replications; three sowing dates were allocated in the main plots; seeding rates were allocated in sup-plots and three rice varieties were allocated in the sup-sup plots. The results found that maximum tillering, panicle initiation, heading dates, leaf area index, chlorophyll content, 1000-grain weight, panicles length, number of panicles per hill and grain yield (Ton/ha^{-1}) were increase by increased seed rates up to 143 kg seed ha^{-1}. Earlier sowing time (20th April) date of sowing gave had the highest value of all studied characters in Sakha 101 variety and this rice variety surpassed other varieties to all attributes under study. While 30th May date of sowing with Sakha 103 inbred rice gave the lowest value of all traits under study.

Key words: Normal soil, rice crop, sowing dates, seed rates, rice varieties, physiological characters, yield.

INTRODUCTION

Rice crop is a main crop among different cultivated crops under Egyptian condition and all over the world. The experiment were conducted to study the effect of seed rates under different of sowing dates (20th April, 1st May and 10th May) on some rice varieties. Rice hybrids have a mean yield advantage of 10 to 15% over traditional varieties higher growth and development processes associated with higher grain yields of rice hybrids include a more vigorous and extensive root system (Li, 1981; Yang and Sun, 1989), increased growth rate during vegetative growth (Yamauchi, 1994), more efficient sink formation and greater sink size (Kabaki, 1993), greater carbohydrate translocation from vegetative plant parts to the spikelets (Song et al., 1990), and larger leaf area index (LAI) during the grain-filling period, but the physiological basis for heterosis remains unknown (Peng, 1998).

El-Hity et al. (1987) found that number of days after sowing (D.A.S) up to panicle initiation (P.I), maximum tillering (M.T.), heading dates (H.D.) and grain yield (t/ha^{-1}) were drastically reduced with delay of sowing. Abou Khalifa (1996) found that plant height, number of tillers/m^{-2}, and crop growth rate at 75 to 90 and 90 to 105 D.A.S were significant decreased by sowing delay from May 25th to June 15th. Sharief et al. (2000) found that early sowing dates (May 10th) had marked effect on number of

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Table 1. Soil chemical analysis of the experimental slits.

Soil characters	2006	2007	Mean
pH	7.3	7.4	7.35
EC	1.4	1.5	1.45
Organic matter (%)	2.1	2.4	2.25
Total N (%)	0.32	0.39	0.36
Available P (ppm)	17.55	19.20	18.38
Available K (ppm)	685.0	675.0	680
Available Zn (ppm)	1.4	1.3	1.35
Total soluble salts (mg/L)	10	14.0	12

panicles /m^{-2}, number of filled grains / per panicle, 1000-grain weight, grain and straw yields/fed^{-1}. El-Khoby (2004) showed that delaying sowing date sharply decreased the leaf area index, dry matter production and chlorophyll content. In addition, delaying sowing date up to June 15th significantly reduced (D.A.S) to heading. Abou Khalifa (2005) found that number of days from sowing up to maximum tillering, panicle initiation and heading date was significant affected by different sowing dates. Whereas, D. A. S. was higher under early sowing (April 20th) and gradually decreased with delaying sowing up to May 20th .Seeding rates is important traits for achieving higher seed yield in rice (Kurmi and Sarmah, 1993). Abou Khalifa et al. (2005) found that 1000-grain weight (g), number of grain/ per panicle and grain yield t/ha^{-1} were increased by increase seeding rate to 50 kg /fed^{-2} (Cock and Yoshida, 1972). Shortage of assimilate supply due to inhibition of photosynthetic processes is one of the major factors determining grain filling. Hari et al. (1997) and Rajendran and Veeraputhirm (1999) reported that low seed rate, 10 or 20 g/m^{-2} resulted high seedling quality, proper shoot dry weight and leaf area /per plant. Rieffel et al. (2000) found that both conventional and hybrid rice have differently responded to seed rates (Hoshikawa, 1967; Egli, 1998). From previous studies, however, it is doubtful that assimilate supply to the grain during the early grain filling period alone defines potential grain growth and determines final grain weight. If assimilate supply to rice is restricted by shading or unfavorable cultivated conditions in the first 10 days of the grain filling period, the grain may be profoundly affected, as grain growth rate is generally highest within the 2 week after heading. El-Khoby (2004) found significant variations among rice cultivars in growth, yield attributes and grain yield. El-kallawy (2002) studied the effect of different seeding rates, form 30 to 80 kg seed/fed on seedlings vigor. He found that low seed rate has significantly raised the seedling vigor where it gave the highest values of leaf area /$plant^{-1}$ and leaf number /per stem, Abou Khalifa et al. (2005) showed that the optimum seed rate was 114 kg seed /ha^{-1}.

The study aims to find the optimum sowing date and best seeding rate with all cultivars under study.

MATERIALS AND METHODS

A field experiment was conducted at Rice Research and Training Center (Sakha—Kafr El Sheikh, Egypt) in 2006 and 2007 seasons to study the response of 4 rice varieties for seeding rates under different dates of sowing. Three rice varieties (Sakha 101, Sakha 104 and Sakha 103) were used in this study. Three seeding rates were used (48, 95 and 144 kg seed/ha^{-1}). Three sowing dates were investigated at 20th April, 1st May and 10th May with seedling age 25 days were transplanted in hills spaced 20×20 cm for in 3×5 m plots. As split-split plot design with four replications was used. Sowing dates were allocated to the main plots, seeding rates in the sup-plot while rice varieties in the sup-sup plot. Nitrogen fertilizer was applied as urea form 46.5% N in two splits; 2/3 was application mixed in dry soil before flooding irrigation water and 1/3 was added at panicle initiation at stage of each rice variety).

Irrigation was carried out at usual local quantities, that is, 12000 m^2/ha. Such quantity was controlled by the use of partial flew (cut throw flew).

Soil sample from the experimental sites were collected from 0 to 30 cm depth. Sub sample were taken to the laboratory for chemical analysis according to Black et al. (1965). The results of analysis are presented in Table 1.

Studied topics and traits

1. Growth attributors: Data were recorded as DAS up to 50% heading. The following three traits were studied:

a. Light penetration by Lux / meter Pu 150 k – Pu,
b. Leaf area index by leaf area meter Minolta Camera Co. Ltd.,
c. Total chlorophyll content in the leaves of plants were recorded using chlorophyll meter 5 SPAD-502 Minolta Camera Co. Ltd., Japan (Futuhara et al., 1979) at heading date.

2. Yield attributes and yield:

a. No. of panicles/m^2, at 60 DAS the determination of panicles was daily recorded,
b. No. of grains/ panicle,
c. Panicle length (cm),
d. The 1000-grain weight (g),
e. No. of spikelets /m^2 (1000),
f. Spikelets – leaf area ratio,
g. Grain yield (ton/ha),
h. Straw yield (ton/ha). Both grain yield and straw yield were estimated from 12 m^2 (3×4 m) in the center of sub-sub plots. Grain yield was adjusted to 14% moisture content according to Yoshida (1981),

Table 2. Light penetration, leaf area index and chlorophyll content as affected by sowing dates, seeding rates and rice cultivars in the two studied seasons.

Treatments	Chlorophyll content (ppm)		Leaf area index (cm)		Light penetration (Lux)	
	2006	2007	2006	2007	2006	2007
Sowing dates						
April 20th	36.75	32.19	6.49	6.28	1906	1856
May 1st	31.83	26.33	6.36	6.04	2034	1984
May 10th	29.75	25.19	5.86	5.77	2164	2151
LSD $_{P<0.05}$	3.59	3.76	0.33	0.26	129	148
Seeding rates (kg ha^{-1})						
48 kg ha^{-1}	31.17	25.67	5.91	5.75	3650	3611
95 kg ha^{-1}	32.22	27.67	6.39	6.13	1541	1517
144 kg ha^{-1}	33.23	29.24	6.41	6.22	913	863
LSD $_{P<0.05}$	1.03	1.79	0.29	0.22	1433	1435
Cultivars						
Sakha 101	38.19	31.61	6.87	6.60	1986	1973
Sakha 104	32.94	27.47	5.98	5.77	2008	1958
Sakha 103	27.19	24.64	5.86	5.72	2111	2061
LSD $_{P<0.05}$	5.50	3.51	0.55	0.50	66	55

9. Harvest index (grain yield / straw yield).

The present study was planned to test the performance of some newly rice cultivars, under some dates and seeding rates, under an almost region, when flood irrigation is prevailing, for producing rice in Egypt. The final goal was to recommend a superior combination treatment for producing pronounced rice yield per unit area. Data collected were subjected to statistical analysis of variance according to Gomez and Gomez (1984) using IRRISTAT computer program. LSD test was used for comparing mean.

RESULTS AND DISCUSSION

Data in Table 2 showed that April 20th gave the highest value of leaf area index, and chlorophyll content, oppress light penetration was decreased at 20th April date of sowing. Leaf area index and chlorophyll content were increased by increasing seeding rates to 144 kg seed / ha ha^{-1}. On the other hand, light penetration was decreased by increasing seeding rates to (144 seed / ha ha^{-1}). Sakha 101 gave the highest value to leaf area index and chlorophyll content while light penetration was decreased at Sakha 103 rice Varity these data are in agreement with those reported by Song et al. (1990), El-Khoby (2004) and Abou Khalifa (2005).

Data in Table 3 showed that all aspects were obtained on April 20th. While May 10th gave the lowest value of number of panicles /m^2, 1000-grain weight, panicle length (cm). On the other hand number of panicles/m^2, 1000-grain weight, panicle length (cm) were increased by increasing seeding rates to (144 kg /ha). Sakha 101 rice variety surpassed other varieties as to respects all trails. The brews data are in a good harmony with those reported by Sharief et al. (2000) and Abou Khalifa et al. (2005)

Data in Table 4 gave means of number of spikelets/m^2 (1000), spikelets-leaf area ratio and number of grains/ panicle as affected by sowing dates, seeding rates, and rice cultivars in the two studied seasons. Number of spikelets/m^2*1000, spikelets-leaf area ratio and number of grains/panicle were decreased by delays in Agriculture to May 10th date of sowing, while all previous attribute were increased by increase seeding rates to 144 kg/ha.

However Sakha 101 gave the highest value of number of spikelets/m^2*1000, spikelets-leaf area ratio and number of grains/ panicle. While Sakha 103 rice varieties gave the lowest value to all previous attribute. These results are in agreement with those reported by Abou Khalifa et al. (2005), Song et al. (1990) and El-Khoby (2004).

Table 5 Indicates April 20th sowing date gave the highest value of grain yield (T/ha), straw yield (T/ha) and harvest index, while May 10th gave the lowest value of all previous attribute. Grain yield (T/ha), straw yield (T/ha) and harvest index were increased by increase seeding rates to (144 kg /ha). On the other hand Sakha 101 surpassed other varieties under study to all previous attribute. The brews data are in a good harmony with those reported by Abou Khalifa et al. (2005), Song et al. (1990) and El-Khoby (2004). Figure 1A showed that higher Leaf area ratio was obtained from the interaction between 197 kg/ha seeding rate under 20th April date of

Table 3. Number of panicles /m^2, 1000-grain weight and panicle length (cm) as affected by sowing dates, seeding rates and rice cultivars in the two studied seasons.

Treatments	No. of panicles/m^2		1000-grain weight		Panicle length (cm)	
	2006	2007	2006	2007	2006	2007
Sowing dates						
April 20th	425	408	23.75	22.75	24.56	24.28
May 1st	391	408	23.58	23.33	24.36	24.03
May 10th	344	348	23.24	23.34	24.16	23.85
LSD $_{P<0.05}$	41	35	0.26	0.34	0.20	0.22
Seeding rates (kg ha^{-1})						
48 kg	344	347	23.92	23.11	24.19	23.70
95 kg	373	361	23.45	23.22	24.38	24.08
144 kg	441	456	23.19	23.09	24.51	24.38
LSD $_{P<0.05}$	50	26	0.37	0.07	0.16	0.34
Cultivars						
Sakha 101	457	454	24.88	24.44	24.44	24.64
Sakha 104	364	357	24.37	22.74	22.74	23.78
Sakha 103	338	352	21.31	22.25	22.25	23.74
LSD $_{P<0.05}$	63	58	1.93	1.15	1.15	0.51

Table 4. Number of panicles /m^2, 1000-grain weight and panicle length (cm) as affected by sowing dates, seeding rates, and rice cultivars in the two studied seasons.

Treatments	No. of spikelets /M^2*1000		Spikelets-leaf area ratio		Number of grains/ panicle	
	2006	2007	2006	2007	2006	2007
Sowing dates						
April 20th	78	72	12.04	11.53	184	179
May 1st	68	68	10.69	11.23	174	168
May 10th	53	51	9.04	8.78	154	147
LSD $_{P<0.05}$	12	11	1.50	1.78	14.90	16.13
Seeding rates (kg ha^{-1})						
48	58	55	9.73	9.47	166	160
95	63	58	9.82	9.48	168	163
144	79	78	12.22	12.60	177	171
LSD $_{P<0.05}$	11	13	1.42	1.81	5.72	5.69
Cultivars						
Sakha 101	80	73	11.57	11.09	174	168
Sakha 104	61	59	10.15	10.31	166	161
Sakha 103	58	58	9.87	10.14	171	165
LSD $_{P<0.05}$	12	8	0.91	0.51	3.89	3.64

sowing, while 95 kg/ha seeding rate with 10th May gave the lowest value of leaf area ratio. Figure 1B showed that the interaction between 197 kg/ha seeding rate with Sakha 101 gave the highest value of leaf area ratio, while 95 kg/ha seeding rate with Sakha 103 gave the lowest value of leaf area ratio (Hoshikawa, 1967; Egli, 1998).

Figure 2A showed that higher leaf area index and grain yield was obtained from 20th April date of sowing on the other hand 10th May gave the highest value of light penetration. Figure 2B showed that Sakha 101 surpassed

Table 5. Grain yield (T/ha), straw yield (T/ha) and harvest index as affected by sowing dates, seeding rates and rice cultivars in the two studied seasons.

Treatments	Harvest index		Straw yield(T/ha)		Grain yield(T/ha)	
	2006	2007	2006	2007	2006	2007
Sowing dates						
April 20th	0.46	0.47	21.89	20.28	10.04	9.35
May 1st	0.43	0.46	21.56	19.56	9.10	8.80
May 10th	0.33	0.43	20.76	18.66	6.10	8.06
LSD $_{P<0.05}$	0.07	0.02	0.58	0.81	2.06	0.65
Seeding rates (kg ha^{-1})						
48 kg ha^{-1}	0.34	0.40	18.09	16.31	7.05	8.22
95 kg ha^{-1}	0.43	0.46	22.30	20.30	8.23	8.77
144 kg ha^{-1}	0.46	0.50	23.82	21.90	9.97	9.23
LSD $_{P<0.05}$	0.06	0.05	2.97	2.88	1.47	0.50
Cultivars						
Sakha 101	0.46	0.51	20.64	18.63	9.45	0.51
Sakha 104	0.36	0.39	22.17	20.32	7.51	0.39
Sakha 103	0.41	0.46	21.41	19.56	8.28	0.46
LSD $_{P<0.05}$	0.05	0.06	0.77	0.85	0.98	0.06

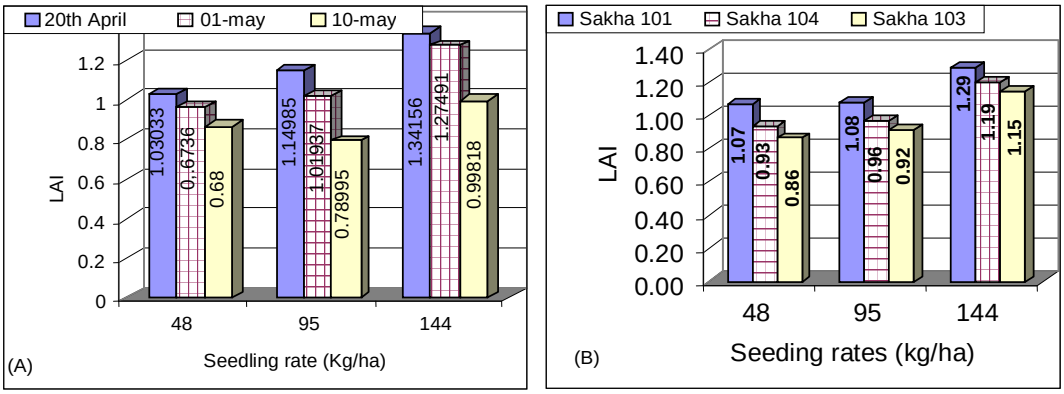

Figure 1. Effect of the interaction between seeding rates with (A) sowing dates and (A) rice varieties on Leaf area ratio.

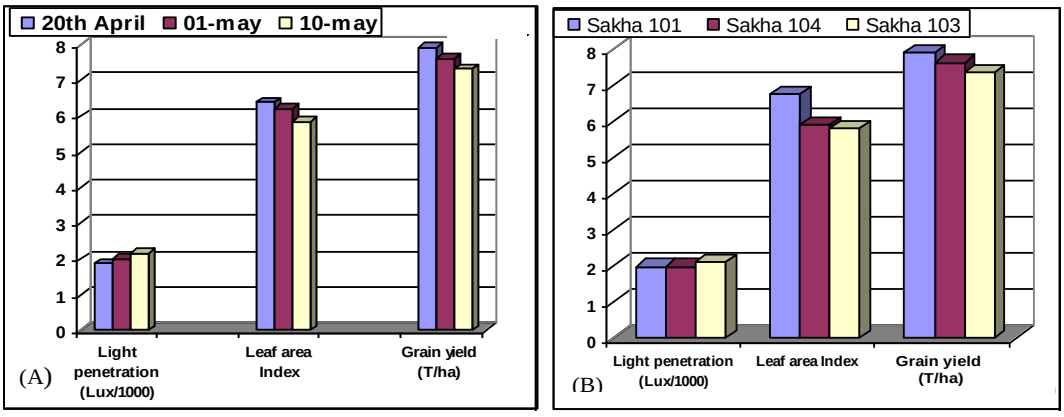

Figure 2. Light penetration, leaf area index and grain yield (T/ha) as affected by sowing dates and some rice varieties.

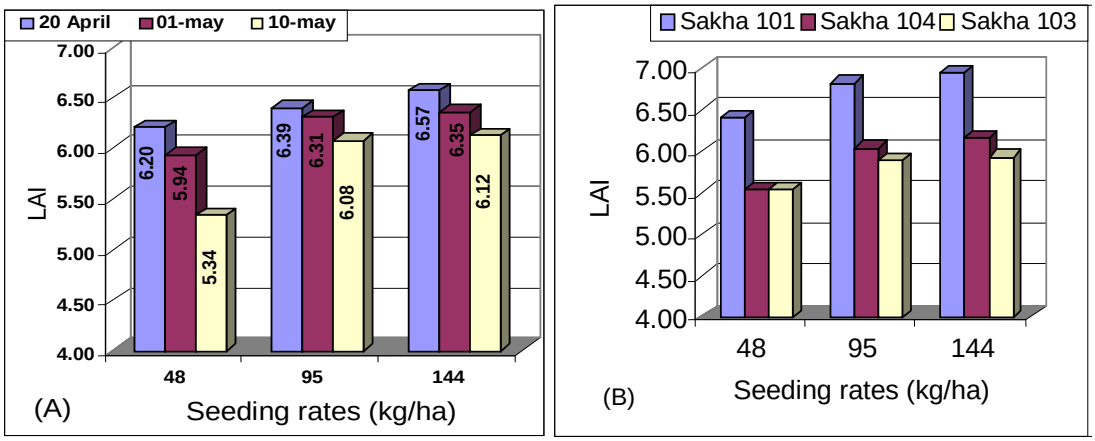

Figure 3. Effect of the interaction between sowing dates, seeding rates with rice varieties on leaf area index.

other varieties under study of leaf area index and grain yield (T/ha). Higher light penetration was obtained from Sakha 103 rice variety. These data are in agreement with those reported by Hoshikawa (1967) and Egli (1998).

Data in Figure 3 recorded that the interaction between 144 kg/ha seeding rate under 20th April dates of sowing condition gave the highest value of leaf area index. While the interaction between 48 kg /ha seeding rate with 10th May date of sowing gave the lowest value of leaf area index. Figure 3B showed that the interaction between Sakha 101 with 144 kg /ha seed rate gave the highest value of leaf area index. The brews data are in a good harmony with those reported by Hoshikawa (1967) and Egli (1998).

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