J. Plant Production, Mansoura Univ., Vol. 3 (7): 2249 - 2263, 2012

RESPONSE OF EGYPTIAN HYBRID RICE 1 TO DIFFERENT SEED RATES AND NITROGEN LEVELS BY USING BROADCAST SEEDED METHOD.

El-Rewainy, I. M.
Rice Research & Training Center, Field Crops Research Institute, ARC, Sakha - Kafr El-Sheikh, Egypt.

ABSTRACT

Application of the optimal seed rate and adequate amount of nitrogen fertilizer led to increase productivity of hybrid rice under broadcast seed condition. Two field experiments were carried out during 2010 and 2011 rice growing seasons at the Experimental Farm of Rice Research and Training Center, Sakha, Kafr El-Sheikh, Egypt to study the response of Egyptian hybrid rice 1 to four seed rates, i.e. 5, 7.5, 10 and 12.5 kg seed fed^{-1} and five nitrogen levels, viz 0, 23, 46, 69 and 92 kg N fed^{-1} under broadcast seeded-rice. The results of this study can be concluded as follows: the seed rate of 7.5 kg seed fed^{-1} produced the highest mean values of chlorophyll content, dry matter accumulation and leaf area index (LAI) at 65 days after sowing (DAS), while after harvesting also, gave the highest mean values of number of filled grains panicle-^{1} and grain yield tons fed $^{-1}$. The plots which planted with 10 kg seed fed^{-1} recorded the highest mean values of No. of tillers, No. of panicles m^{-2} without significant differences with the rate of 7.5 kg seeds fed^{-1}, but the heaviest 1000 grain and panicle grain weight. Also, data revealed that Egyptian hybrid rice 1 response positively to application of nitrogen levels up to 92 kg N fed^{-1}, which recorded the highest values of all traits. The highest grain yield was obtained when rice was grown at seed rate 7.5kg seeds fed^{-1}and fertilized with 92kg Nfed^{-1}.

INTRODUCTION

Importantly, agronomic management practices affect plant development, is arguably the most important cultural practice in direct-seeded rice. Rice crop occupies 17 % (1.4 million fed.) of the total agricultural land area in Egypt during summer season. In this context, there is no alternative other than a yield increase per unit area. This is possible by developing improved and cost-effective technologies. Producing more rice with the same or less amount of resources is of importance for higher productivity in a cost-effective manner (M. Harunur Rashida *et al* 2009)

There have been recent changes from transplanting to direct seeding for lowland crops (De Datta, 1986 and Fujisaka *et al*., 1993) to reduce labor costs particularly where irrigation water is available and weeds can be controlled with herbicides. Because of reduced water requirement in paddies, direct seeding can be used to establish the crop earlier than by transplanting. In the cultivation of paddy rice, direct sowing is both a cost-saving and a labor-saving practice. In order to produce high and reliable grain yields after direct sowing, it is necessary to clarify the ecophysiological characteristics related to dry matter production and yield, as well as methods for high and reliable rates of seedling establishment and resistance to lodging.

Rice farmers in Egypt have been using high seed rates for direct seeding and high fertilizer rates than necessary. These practices might have stemmed from the perceptions that high inputs, particularly seed and fertilizer rates would result in higher yields. On the other hand, the use of high seed rates and fertilizer can lead to higher pest and disease infestations, thus prompting higher use of pesticides. Research has shown that crops with enriched nitrogen can make insect pests produce more eggs, survive better, live longer and become ecologically more fit (Lu *et al*.,2004). Similarly dense crops sown from high seed rates enriched with fertilizers are more disease prone (Webster and Gunnell,1992). These beliefs formed by researchers as well as farmers have also contributed to the higher use of pesticides whenever crops are highly fertilized. Agronomic research has shown that farmers' seed rates and the amount of nitrogen used are higher than required (Luat *et al*.,1998).

Significant yield responses to applied N are obtained on nearly all lowland rice soils when irrigation is adequate and weeds or pest problems do not limit growth. In large part, plant N status determines rice yield potential through effects on leaf area development and canopy photosynthesis (Kropff *et al*., 1993), and N drives the demand for other macronutrients in irrigated rice systems (Dobermann *et al*., 1997).

The present study aims to find out the best combination between seeding rate and nitrogen levels to enhance the growth traits and yield and its attributes of Egyptian hybrid rice 1 under broadcast seeded condition.

MATERIALS AND METHODS

Two field experiments were conducted at Experimental Farm of the Rice Research and Training Center, Sakha, Kafr EL-Sheikh, Egypt, during 2010 and 2011 growing seasons to study the performance of Egyptian hybrid rice 1 (EHR1) under different seeding rate and nitrogen fertilizer levels by using broadcast seeded method.

Representative soil samples were taken from the experimental site at the depth of 0-30 cm from the soil surface before sowing. Samples were air-dried, then ground to pass through a two mm sieve and well mixed. The procedure of *soil analysis was conducted according to the methods described by Black et al.* (1965). Soil chemical analysis in both seasons are shown in Table 1.

Table (1): Soil properties and chemical analysis of the soil at the experimental sites in 2010 and 2011 seasons.

Soil prosperities and chemical content	2010	2011
Texture	Clay	Clay
pH	7.8	8.0
EC (ds/m)	1.73	2.37
OM(%)	1.7	1.6
Ca^{++} (meq. L^{-1})	4.00	4.63
Mg^{++} (meq. L^{-1})	5.71	5.62
K^{+} (meq. L^{-1})	469	467
Na^{+}(mg/L)	11	12
P mg kg^{-1}	14	15
Total nitrogen , mg kg^{-1}	445	563

The experiments were laid out in a split plot design with four replications. Main plots were adapted to four seeding rates namely 5, 7.5,10, and 12.5 kg seeds fed^{-1} while, subplots were developed to nitrogen fertilizer levels i.e. 0, 23, 46, 69 and 92 kg N fed^{-1}. The area of each subplot was 15 m^2 (3m X 5m). Phosphorus in the form of calcium mono phosphate (15.5% P_2O_5) was added and incorporated into dry soil during land preparation according to the recommended dose of phosphorus fertilizer in each subplot while, Zinc fertilizer was added as zinc sulfate form in the rate of 10 kg $ZnSo_4$ fed^{-1} after wet leveling immediately . Nitrogen in the form of urea (46.5%N) was added according to the rate of previously mentioned in the three equal doses the first one as basal application, the second one at panicle initiation stage (PI) and last one at late booting stage. Weeds were chemically controlled.

Seeds at the rate of previously mentioned were soaked in fresh water for 24 hr then incubated for 48 hr to hasten early germination. Pre-germinated seeds were uniformly broadcasted in the field on 10^{th} and 12^{th} of May in 2010 and 2011, respectively. The field was well prepared, i.e. plowed twice and then well dry leveled and all recommended agricultural practices were applied.

At harvest, Plant height (cm), number of panicles / m^{-2}, panicle grain weight, panicle length (cm), number of filled grains $panicle^{-1}$,number of unfilled grains $panicle^{--1}$ and 1000 grain weight were determined.

Harvesting was done when rice plants reached to full maturity. A guarded area of ten square meters was harvested, air-dried, weighted to estimate biomass production, then threshed. The grain yield was measured in kg $plot^{-1}$ (10 m^2) and adjusted to 14% moisture basis, then converted to tons ha^{-1}.

All collected data were subjected to an ordinary analysis of variance according to the proceeding described by Gomez and Gomez (1984). Significant different means were compared at $P < 0.05$ by the revised least significant difference (LSD) test, which adopted by Waller and Duncan (1969). Statistical analyses were made with commercial computer software.

RESULTS AND DISCUSSION

Seed rates affected significantly chlorophyll content at 65 days after sowing (DAS). By increasing seed rate from 5 to 7.5 kg fed^{-1} the chlorophyll content significantly increased. But by increasing it to12.5 kg seeds fed^{-1} the chlorophyll content decreased. The fertilizer treatments had significant effect on the leaf chlorophyll content at 65 DAS. It was found that application of N fertilizers increased the chlorophyll content significantly, while maximum chlorophyll content was obtained in plots where 69 kg N fed. $^{-1}$ was applied and the lowest was recorded for control (Table 2). The increase in chlorophyll content in response to application of N fertilizers is probably due to enhanced availability of nitrogen which enhanced more leaf area resulting in higher photo assimilates and thereby resulted in more chlorophyll content. These results are supported by the findings of Mandal *et al*. (1992). There was no significant difference in chlorophyll content due to the interaction between seed rates and nitrogen levels.

Table 2: Chlorophyll content SPAD, Dry matter accumulation g m^{-2} and leaf area index (LAI) of Egyptian hybrid rice 1 at 65 days after sowing as affected by seed rates and nitrogen levels.

Treatments	Chlorophyll content SPAD		Dry matter accumulation g m^{2}		LAI	
	2010	2011	2010	2011	2010	2011
Seed rate kg fed.-1						
5	41.92	42.34	1240.1	1252.5	7.50	7.58
7.5	42.64	43.06	1320.2	1333.4	7.96	8.04
10	42.2	42.44	1282.8	1295.6	7.50	7.58
12.5	41.3	41.44	1224.3	1136.5	7.30	7.37
L.S.D.0.05	0.52	0.53	18.76	18.95	0.09	0.09
N levels kg fed-1						
0	37.63	38.00	722.4	729.6	4.94	4.99
23	41.88	42.30	1083.8	1094.6	6.74	6.81
46	43.33	43.75	1388.6	1402.5	7.84	7.92
69	44.28	44.71	1560.3	1575.9	8.91	8.99
92	42.98	43.41	1579.2	1594.9	9.40	9..49
L.S.D.0.05	0.58	0.59	18.64	18.83	0.11	0.11
Interaction effect	N.S.	N.S.	**	**	**	*

Seed rates treatments significantly affected dry matter accumulation g m^{-2} at 65 DAS. BY increasing seed rate from 5 to 7.5 kg fed^{-1} significantly increased dry matter accumulation. On the other hand, increasing seed rate from 7.5 to 12.5 kg fed^{-1} significantly reduced dry matter accumulation.

Dry matter accumulation increased significantly with N fertilizer application in rice at 65 DAS (Table 2). Significant highest value of dry-matter accumulation was obtained at 92 kg N fed^{-1}. It was as expected since vegetative growth resulting from higher photosynthetic activities is well known to be influenced by nitrogen (Reddy 2000). The higher dry mass of nitrogen treated plants could be connected with the positive effect of nitrogen in some important physiological processes (Sachiko *et al*. 2009).

There was a significant effect on dry matter accumulation at 65 DAS due to the interaction between seed rates and nitrogen levels in the two seasons of the study as shown in Table 3. The highest values of dry matter accumulation were recorded when seed was applied at the rate of 7.5 kg fed^{-1} in combination with 69 kg N fed^{-1}. The lowest values were obtained when seed was broadcasted at the rate of either 5 or 12.5 kg fed^{-1} without nitrogen fertilizer application. These findings were fairly true in both seasons.

Table 3: Dry matter accumulation g m^{-2} of Egyptian hybrid rice 1 as affected by the interaction between seed rates and N levels at 65 days after sowing.

Kg N fed.$^{-1}$	Kg seed fed.$^{-1}$							
	2010				2011			
	5	7.5	10	12.5	5	7.5	10	12.5
0	718.2	735.9	721.4	714.2	725.3	743.2	728.6	704.3
23	1060.0	1115.4	1108.2	1051.6	1070.6	1126.5	1119.2	1062.1
46	1331.2	1472.6	1431.6	1318.9	1344.5	1487.3	1445.9	1332.1
69	1526.4	1641.5	1571.7	1501.6	1541.6	1657.9	1587.4	1516.6
92	1564.7	1635.4	1581.3	1535.2	1580.3	1651.7	1597.1	1550.5
L.S.D.	37.14				37.51			

The effect of seed rates and nitrogen levels on the leaf area index of Egyptian hybrid rice1 at 65 DAS are shown in Table 2. Data revealed that seed rate significantly affected leaf area index in both seasons. The highest values of leaf area index were found when seed was broadcasted at the rate of 7.5 kg fed^{-1}. While, the lowest values were observed at 12.5 kg seed fed^{-1}. Regarding leaf area index as affected by nitrogen levels data in Table 2 revealed that leaf area index was significantly increased gradually with increasing of nitrogen application. It might be due to improved nutrients availability which the reflected in enhancement growth of plant organs. These results are in line with the findings of (Sachiko *et al*. 2009).

Data in Table 4 presented the effect of the interaction between seed rates and nitrogen levels on leaf area index at 65 DAS. Results showed that there was a significant effect on leaf area index in the two seasons due to the interaction between seed rates and nitrogen levels. When seed was applied at 7.5 kg seed fed^{-1} in combination with 69 kg N fed^{-1}, the highest values of leaf area index were obtained. However, the lowest values of leaf area index, were obtained when no nitrogen was applied regardless seed rates.

Table 4: Leaf area index of Egyptian hybrid rice 1 as affected by the interaction between seed rates and N levels at 65 days after swoing.

Kg N fed. $^{-1}$	Kg seed fed. $^{-1}$							
	2010				2011			
	5	7.5	10	12.5	5	7.5	10	12.5
0	4.85	5.10	5.06	4.75	4.89	5.15	5.11	4.79
23	6.67	7.01	6.89	6.37	6.73	7.08	6.95	6.43
46	7.94	8.36	7.62	7.43	8.01	8.44	7.69	7.50
69	8.83	9.75	8.42	8.65	8.91	9.84	8.50	8.73
92	9.20	9.60	9.51	9.32	9.29	9.69	9.60	9.41
L.S.D.	0.21				0.22			

Data in Table 5 showed that number of tillers m^{-2} was significantly affected by seed rates and nitrogen fertilizer levels in both seasons.The highest values of no. tillers m^{-2} were found when 10 kg seed fed^{-1} was used. Increasing seed rate from 10 to 12.5 kg seed fed^{-1} caused a reduction thus the lowest values of no tillers m^{-2} were observed. This reduction may be attributed to that high seeding rate of rice implies severe competition among the plants for the environmental factors, i.e. light, water and nutrients which caused depression in the amount of metabolites synthesized by the plants.

Counce *et al*., 1992 and Schnier *et al*., 1990 reported that plant population density is a principal factor affecting tiller production.

Nitrogen fertilizer application increased significantly number of tillers m^{-2} in rice at harvest (Table 5). Application of 92 kg N fed.$^{-1}$ produced maximum number of tillers m^{-2} (809.7 and 829.7 in 2010 and 2011, respectively) than all other treatments. Number of tillers per unit area is the most important component of yield. More number of tillers/m^{-2} in this treatment might be due to the more availability of nitrogen that played a vital role in cell division. According to Yoshida *et al*. (1972), as the amount of nitrogen absorbed by the crop increases, there is an increase in the number of tillers per square meter.

Table 5: No. of tillers m^{-2}, No. of panicles m^{-2} and panicle length (cm) of Egyptian hybrid rice 1 at harvest as affected by seed rates and nitrogen levels.

Treatments	No. of tillers m^{-2}		No. of panicles m^{-2}		Panicle length cm	
	2010	2011	2010	2011	2010	2011
Seed rate kg fed^{-1}						
5	710.7	730.7	683.6	748.7	22.13	22.45
7.5	742.6	762.6	724.2	780.6	21.69	22.01
10	754.9	774.9	732.0	792.9	21.56	21.88
12.5	706.5	726.5	682.6	744.5	21.48	21.80
L.S.D.0.05	9.90	10.00	9.90	10.00	0.09	0.10
N levels kg fed-1						
0	601.8	621.8	573.2	639.8	20.50	20.82
23	701.5	721.5	677.4	739.5	21.55	21.87
46	748.4	768.4	719.7	786.4	21.84	22.16
69	782.0	802.0	768.5	820.0	22.28	22.60
92	809.7	829.7	789.3	847.7	22.40	22.72
L.S.D.0.05	9.34	9.43	9.34	9.43	0.06	0.07
Interaction effect	*	*	*	*	*	*

Data in Table 6 present the effect of the interaction between seed rates and nitrogen levels on number of tillers m^{-2}. Data showed that there was a significant effect on number of tillers m^{-2} in the two seasons due to the interaction between seed rates and nitrogen fertilizer levels. When seed was applied at the rate of 10 kg seed fed^{-1} combined with 92 kg N fed^{-1}, the highest values of number of tillers m^{-2} were obtained. However, the lowest values of number of tillers m^{-2} were found when no nitrogen fertilizer was applied combined with 12.5 seed fed^{-1} (554.7 and 574.7) for 2010 and 2011season,respectively.

Concerning the effect of seed rates and nitrogen fertilizer levels on number of panicles per m^{-2} are presented in Table 5. Data indicated that with increasing seed rate the number of panicles per m^2 significantly increased. The highest number of panicles per m^{-2} was obtained when 10 kg seed fed^{-1} was applied without significant difference with the rate of 7.5 kg seed fed^{-1} in the first season. This trend might be attributed to the reduction in number of plants within unit area in case of lowest seeding rate and also to the sever intraspecific competition among plants in case of the highest seeding rate. Similar results were obtained by Gravios and Helms (1992) and El-Rewainy (1996).

Table 6: Number of tillers m^{-2} of Egyptian hybrid rice 1 as affected by the interaction between seed rates and N levels.

Kg N fed. $^{-1}$	Kg seed fed. $^{-1}$							
	2010				2011			
	5	7.5	10	12.5	5	7.5	10	12.5
0	579.0	628.5	645.0	554.7	599.0	648.5	665.0	574.7
23	691.0	711.0	716.5	687.5	711.0	731.0	736.5	707.5
46	735.5	753.5	763.0	741.5	755.5	773.5	783.0	761.5
69	763.0	795.0	818.0	752.0	783.0	815.0	838.0	772.0
92	785.0	825.0	832.0	796.7	805.0	845.0	852.0	816.7
L.S.D.0.05	18.81				18.99			

Data showed also that nitrogen levels affected significantly number of panicles per m^2. Increasing nitrogen levels from 0 to 92 kg N fed^{-1} significantly increased number of panicles per m^2. The effect of nitrogen application on number of panicles per m^2 attributed mainly to the stimulation effect of nitrogen on effective tillers formation. These findings are consistent with those reported by Ebaid and Ghanem (2000), Chopra and Chopra (2004) and Singh *et al* (2004).

Concerning the effect of interaction, data in Table 7 showed that number of panicles per m^2 was significantly affected by the interaction between seed rates and nitrogen fertilizers levels. When seeds were used at the rate of either 7.5 or 10 kg seed fed^{-1}, combined with the application of 92 kg N fed^{-1}, the greatest number of panicles per m^2 was obtained. While, the lowest number of panicles per m^2 were obtained when no nitrogen was applied under 12.5 kg seed fed^{-1}.

Table 7: Number of panicles m^{-2} of Egyptian hybrid rice 1 as affected by the interaction between seed rates and N levels.

Kg N fed. $^{-1}$	Kg seed fed. $^{-1}$							
	2010				2011			
	5	7.5	10	12.5	5	7.5	10	12.5
0	540.5	612.2	617.2	523.0	617.0	666.5	683.0	592.7
23	658.5	688.5	694.0	668.5	729.0	749.0	754.5	725.5
46	718.5	711.7	727.5	3721.0	773.5	791.5	801.0	779.5
69	741.5	795.0	803.0	7.34.5	801.0	833.0	856.0	790.0
92	759.0	813.7	818.5	766.0	823.0	863.0	870.0	834.7
L.S.D.0.05	13.45				13.85			

The effect of seed rates and nitrogen fertilizer levels on panicle length (cm) are shown in Table 5. Data showed that by increasing seed rate from 5 to 12.5 kg seeds fed^{-1} panicle length gradually decreased in the two seasons of the study. The highest values of panicle length were obtained with the application of 5 kg seed fed^{-1}. The superiority in panicle length of low seeding rate is mainly attributed to the adequacy of light and nutrients for plant. El-Rewainy (1996) came to same conclusion .Data also, showed that panicle length significantly increased by increasing nitrogen levels from 0 to 92 kg N fed^{-1}. This result is in agreement with El-Kalla *et al*. 1992 and El-Rewainy (1996).

The interaction between seed rates and nitrogen fertilizer levels had a significant effect on panicle length in the two seasons of the study as shown in Table 8. The highest values of panicle length were recorded when nitrogen was applied at the rate of 92 kg N fed^{-1}in combination with 5 or 7.5 kg kg seed fed^{-1}. The lowest values were recorded when nitrogen was not applied under 12.5 kg seed fed^{-1}.

Table 8: Panicle length (cm) of Egyptian hybrid rice 1 as affected by the interaction between seed rates and N levels.

Kg N fed. $^{-1}$	Kg seed fed. $^{-1}$							
	2010				2011			
	5	7.5	10	12.5	5	7.5	10	12.5
0	20.85	20.63	20.32	20.21	21.17	20.95	20.64	20.53
23	21.88	21.51	21.46	21.35	22.20	21.83	21.78	21.67
46	22.50	21.68	21.60	21.58	22.82	22.00	21.92	21.90
69	22.68	22.25	22.13	22.05	23.00	22.57	22.45	22.37
92	22.75	22.35	22.29	22.19	23.07	22.67	22.61	22.51
L.S.D.0.05	0.13				0.13			

Seed rates and N fertilizer levels significantly affected the yield and yield attributes, i.e. panicle grain weight, no. of filled and unfilled grains panicle^{-1} and1000-grain weight (Tables 9 and 13).

Panicle grain weight was significantly and gradually decreased by increasing seed rate from 5 to 12.5 kg seed fed.$^{-1}$. The decrease in the mean values of panicle grain weight at high seeding rate was logically expected and attributed to the detected decrease in the mean value of number of filled grains panicle and 1000-grain weight. Similar results were previously reported by Abd-Rahman *et al*. (1992) and El-Rewainy (1996).

It was found that application of N fertilizers increased the panicle grain weight significantly. The highest panicle grain weight (4.35 and 4.75 g) were obtained with the application of 92 kg N ha^{-1} during 2010 and 2011 respectively and significantly lowest panicle grain weight (3.39 and 3.79 g) were recorded for control treatment. This trend might be due to role of nitrogen in crop maturation, flowering and fruiting including seed formation. These results are in accordance with those of Sachiko *et al*. 2009.

Table 9: Panicle grain weight (g), no filled grains panicle^{-1}and no unfilled grains panicle^{-1}of Egyptian hybrid rice 1 as affected by seed rates and nitrogen levels.

Treatments	Panicle grain weight (g)		No.of filled grains panicle^{-1}		No.of unfilled grains panicle^{-1}	
	2010	2011	2010	2011	2010	2011
Seed rate kg fed.-1						
5	4.13	4.53	168.64	176.64	5.34	5.66
7.5	4.04	4.44	172.18	180.18	5.00	5.32
10	3.94	4.34	171.55	179.55	4.54	4.86
12.5	3.89	4.28	165.63	173.63	5.20	5.52
L.S.D.0.05	0.03	0.03	1.27	1.28	1.12	1.13
N levels kg fed-1						
0	3.39	3.79	142.60	150.60	4.51	4.83
23	3.85	4.25	159.56	167.56	4.69	5.01
46	4.16	4.56	177.19	185.19	4.76	5.08
69	4.25	4.65	183.02	191.02	5.61	5.93
92	4.35	4.75	185.12	193.12	5.52	5.84
L.S.D.0.05	0.03	0.03	0.91	0.92	1.19	1.20
Interaction effect	*	*	*	*	*	*

Data in Table 10 show that there was a significant difference in panicle grain weight due to the interaction between seed rates and nitrogen levels. The heaviest panicles were obtained when plants sown at rate of 5 kg seed fed^{-1} and fertilized with 92 kg N fed^{-1}.While, the lightest panicles were remarked at the highest seed rate and nitrogen was not applied in both seasons.

Table 10: Panicle grain weight g of Egyptian hybrid rice 1 as affected by the interaction between seed rates and N levels.

Kg N fed. $^{-1}$	Kg seed fed. $^{-1}$							
	2010				2011			
	5	7.5	10	12.5	5	7.5	10	12.5
0	3.57	3.46	3.31	3.20	3.97	3.86	3.71	3.60
23	4.01	3.91	3.79	3.68	4.41	4.31	4.19	4.08
46	4.24	4.19	4.12	4.09	4.64	4.59	4.52	4.49
69	4.35	4.24	4.22	4.18	4.75	4.64	4.62	4.59
92	4.50	4.38	4.28	4.23	4.90	4.78	4.67	4.64
L.S.D.0.05	0.06				0.07			

Number of filled grains per panicle as affected by seed rates and nitrogen levels are presented in Table 9. Data showed that number of filled grains per panicle significantly increased by increasing seed rate from 5 to 7.5 kg seed fed^{-1}. There was no significant difference in number of filled grains per panicle between 7.5 and 10 kg seed fed.$^{-1}$ on the other hand, number of filled grains per panicle decreased significantly by increasing seed rate from 10 to 12.5 kg seed fed^{-1}.These results were true in both seasons. This mainly attributed to the low competition among plants for environmental compound which caused an increase in the ability of plants capacity in building of metabolites synthesized and this ,in turn, caused an increase in the dry matter content, and consequently the number of filled grains panicle$^{-1.}$ Bond *et al*. (2008) reported that filled grain per panicle was decreased by increasing seed rates. Also same trend was obtained by Gravios and Helms (1992) and El-Rewainy (1996).

The number of filled grains panicle^{-1} varis among N-fertilizers levels. The rate of 92 kg N fed.$^{-1}$ produced maximum number of filled grains per panicle (185.12 and 193.12) during 2010 and 2011 seasons, respectively. Significantly lowest number of grains per panicle i.e. 142.60 and 150.60 were obtained during both the years from control treatment. These results are in agreement with the results obtained by Thakur (1991), Abd El-Rahman *et al*. (1992) and El-Rewainy (1996).

The effect of the interaction between seed rates and nitrogen levels on number of filled grains per panicle was significant in both seasons of study as shown in Table 11. The highest number of filled grains per panicle were recorded when the rate of 7.5 kg seeds fed^{-1} was planted and combined with the rate of 92 kg N fed$^{-1.}$ On the other hand, the lowest number of filled grains per panicle were obtained when the highest rate of seed was used and nitrogen was not applied in the two seasons of study.

Table 11:Number of filled grains per panicle of Egyptian hybrid rice 1 as affected by the interaction between seed rates and N levels.

Kg N fed. $^{-1}$	Kg seed fed. $^{-1}$							
	2010				2011			
	5	7.5	10	12.5	5	7.5	10	12.5
0	148.40	144.20	143.30	134.50	156.40	152.20	151.30	142.50
23	160.50	161.80	160.65	155.30	168.50	169.80	168.65	163.30
46	171.60	179.80	183.20	174.15	179.60	187.80	191.20	182.15
69	180.10	186.50	184.20	181.30	188.10	194.50	192.20	189.30
92	182.60	188.60	186.40	182.90	190.60	196.60	194.40	190.90
L.S.D.0.05	1.90				1.92			

Number of unfilled grains panicle^{-1} of Egyptian hybrid rice 1 as affected by seed rates and nitrogen levels are presented in Table 9. There was a significant effect of seed rate on number of unfilled grains panicle^{-1} in both seasons. The undesirable highest number of unfilled grain panicle^{-1} were found when 5 kg seeds fed^{-1} were used. While, the lowest values of this trait were observed at rate of 10 kg seeds fed^{-1}.

Number of unfilled grains panicle^{-1} were found to be significantly affected by the application of nitrogen fertilizer in the two seasons. Data indicated clearly that plants received either 69 or 92 kg N fed^{-1} exhibited significantly increase compared with other levels. This finding hold fairly true in both seasons. In fact, such trend did not decrease the grain yield because the total number of filled grains panicle -1 was markedly increased by increasing the N levels. Similar trend was obtained by Mahrous *et al*. (1985).

Number of unfilled grains panicle^{-1} as affected by the interaction between seed rates and nitrogen levels are presented in Table 12. Data show that the interaction between seed rates and nitrogen levels had a significant effect on number of unfilled grain panicle^{-1}. The highest number of unfilled grain panicle^{-1} were found in plots which were planted by 12.5 kg seeds fed^{-1} and fertilized with 69 kg N fed^{-1}.while, the lowest number of unfilled grains panicle^{-1} were found when the rate of 12.5 kg seeds fed^{-1}was used and no nitrogen was applied.

Table 12: Number of unfilled grains per panicle of Egyptian hybrid rice 1 as affected by the interaction between seed rates and N levels.

Kg N fed. $^{-1}$	Kg seed fed. $^{-1}$							
	2010				2011			
	5	7.5	10	12.5	5	7.5	10	12.5
0	5.30	5.35	3.75	3.65	5.62	5.67	4.07	3.97
23	4.85	4.65	4.25	5.02	5.17	4.97	4.57	5.34
46	5.15	4.20	4.95	4.76	5.47	4.52	5.27	5.08
69	6.00	4.80	4.90	6.75	6.32	5.12	5.22	7.07
92	5.40	6.00	4.87	5.80	5.72	6.32	5.19	6.12
L.S.D.0.05	2.33				2.35			

It is obvious from the Table 13 that results pertaining to 1000-grains weight in all the treatments differed significantly from one to another and the highest values of 1000-grain weight were obtained from the plots planted by 5 kg seeds fed^{-1}.

Table 13: 1000- grain weight (g), grain yield t fed.$^{-1}$ and agronomic use efficiency (AUE) of Egyptian hybrid rice 1 as affected by seed rates and nitrogen levels.

Treatments	1000- grain weight (g)		Grain yield t fed.$^{-1}$		AUE (Kg seed/kg N)	
	2010	2011	2010	2011	2010	2011
Seed rate kg fed^{-1}						
5	24.16	24.37	4.76	5.06	50.69	53.63
7.5	23.70	23.91	4.92	5.22	51.88	54.80
10	23.22	23.43	4.85	5.15	51.59	54.24
12.5	23.30	23.51	4.48	4.78	48.34	51.65
L.S.D.0.05	0.55	0.55	0.05	0.05	0.59	0.60
N levels kg fed-1						
0	23.61	23.82	3.24	3.54	-	-
23	23.59	23.80	4.35	4.64	42.09	44.86
46	23.36	23.57	4.99	5.29	49.19	52.13
69	23.62	23.83	5.46	5.76	54.09	57.08
92	23.79	24.00	5.73	6.03	56.94	59.91
L.S.D.0.05	0.48	0.47	0.04	0.04	0.56	0.58
Interaction effect	*	*	*	*	*	*

Minimum values of 1000 – grain weight were produced by 10 kg seeds fed^{-1}. It could be safely concluded that high seeding rate had a depressing effect on seed weight, resulted from the reduction in the amount of the dry matter content synthesized by the plant and this, in turn, decreased the weight of 1000-grains. Data revealed also that application of nitrogen significantly affected the 1000-grain weight. Thus, the highest values of 1000-grain weight appeared when nitrogen was applied at the rate of 92 kg N fed^{-1} followed by either 69 or 0 kg N fed^{-1}.

The effect of the interaction between seed rates and nitrogen fertilizer levels on 1000-grain weight was significant in the two seasons of the study as shown in Table 14. The highest values of 1000-grain weight were obtained in plots that planted with 5 kg seeds fed^{-1} and fertilize with 23 kg N fed^{-1}.

Table 14: 1000- grain weight of Egyptian hybrid rice 1 as affected by the interaction between seed rates and N levels.

Kg N fed. $^{-1}$	Kg seed fed. $^{-1}$							
	2010				2011			
	5	7.5	10	12.5	5	7.5	10	12.5
0	24.05	23.95	23.15	23.30	24.26	24.16	23.36	23.51
23	24.53	23.83	22.98	23.05	24.74	24.04	23.19	23.26
46	24.10	23.58	22.25	23.50	24.31	23.79	22.46	23.71
69	23.77	23.80	23.85	23.05	23.98	24.01	24.06	23.26
92	24.35	23.35	23.88	23.58	24.56	23.56	24.09	23.79
L.S.D.0.05	0.98				0.99			

Grain yield of Egyptian hybrid rice 1 as affected by the seed rates and nitrogen fertilizer levels in 2010 and 2011 rice growing seasons are presented in Table 13. Significant grain yield increases were observed by increasing seed rates from 5 to 7.5 kg seeds fed^{-1} in the two seasons. Gravois and Helms, 1992 indicated that the plant population density is required to produce optimum rice grain yield. A reduction in grain yield was observed when seed rate increased from 7.5 to 12.5 kg seeds fed^{-1}. Excessive plant population densities can lead to greater plant height and weaker culms, increasing the potential for losses due to lodging and disease (Dofing and Knight, 1994).

Data indicated also that there was a significant difference in grain yield due to nitrogen fertilizer application. Data showed that significant increase in grain yield as nitrogen level increased from 0 to 92 kg N fed^{-1} in first and second seasons. The increase in grain yield by increasing nitrogen level to 92 kg N fed^{-1} was mainly due to the increase in most of yield components. The previous results are in good agreement with those obtained by Badawi *et al*. (1990), Abd El-Rahman *et al*. (1992), El-Kalla *et al*. (1992) and El-Rewainy (1996).

There was a significant effect on grain yield due to the interaction between seed rates and nitrogen fertilizer levels in the two seasons as shown in Table 15. The rate of 7.5 kg seeds fed^{-1} combined with 92 kg N fed^{-1} gave the maximum values of grain yield (t $fed.^{-1}$) compared with the other combinations. While, the minimum values were obtained with the rate of 12.5 kg seed $fed.^{-1}$ when nitrogen was not applied.

Table 15: Grain yield t $fed.^{-1}$ of Egyptian hybrid rice 1 as affected by the interaction between seed rates and N levels.

Kg N $fed.^{-1}$	Kg seed $fed.^{-1}$							
	2010				2011			
	5	7.5	10	12.5	5	7.5	10	12.5
0	3.22	3.53	3.40	2.79	3.52	3.83	3.70	3.09
23	4.41	4.49	4.38	4.10	4.71	4.79	4.68	4.40
46	5.08	4.98	5.00	4.91	5.38	5.28	5.30	5.21
69	5.38	5.67	5.65	5.12	5.68	5.97	5.95	5.42
92	5.70	5.93	5.83	5.46	6.00	6.23	6.13	5.76
L.S.D.0.05	0.08				0.09			

For agronomic use efficiency (kg grain/kg N) as affected by seed rates and nitrogen levels the main values of this trait are presented in Table 13. Data showed that there were significant differences among seed rates. The plots grown at the rate of 7.5 kg seeds fed^{-1}recorded the maximum values of AUE followed by the rate of 10 kg seeds while, the minimum values were obtained at the highest rate of seed (12.5 kg seeds $fed.^{-1}$) these results were true in both seasons. Also data revealed that the values of AUE were significantly increased by increasing of nitrogen levels up to 92 kg N fed^{-1}.

The values of AUE were significantly affected by the interaction between seed rates and N levels. The maximum value was obtained when plots were planted at rate of 7.5 kg seeds fed^{-1} and fertilized with 92 kg $Nfed^{-1}$ in 2010 season while, in the second season the rate of 10 kg seeds fed^{-1} combined with the same N level recorded the highest value. The minimum value was recorded at the highest seed rate (12.5 seeds $fed.^{-1}$) when fertilized with 23 kg N fed^{-1}

Table 16: Agronomic use efficiency of Egyptian hybrid rice 1 as affected by the interaction between seed rates and N levels.

Kg N fed.$^{-1}$	Kg seed fed. $^{-1}$							
	2010				2011			
	5	7.5	10	12.5	5	7.5	10	12.5
0	-	-	-	-	-	-	-	-
23	42.70	43.37	42.32	39.79	45.79	45.57	45.19	43.86
46	50.10	49.03	49.92	48.49	48.49	53.03	52.19	51.42
69	53.30	56.19	56.00	50.79	50.79	56.29	58.69	53.75
92	56.65	58.92	58.13	54.30	54.30	59.61	60.89	57.57
LSD 0.05%	0.61				0.63			

REFERENCES

Abd El- Rahman, A.A.; M.A.Shata and M.A. Nour(1992).Effect of culture practices on broadcast seeded rice productivity under saline soil condition .Proc. 5th Egyptian conf.Agron.,Zagazig Univ.,13-15 Sep.Vol(1):87-95.

Badawi,A.T.;A.A.Abd El-Rahman and I.,R., Aidy(1990).Fertilizer management in broadcast sown rice .1-Effect on grain yield and contributed variables .Proc.4th Conf.Agron.,Cairo,15-16 sept.(1):321-330.

Black, C.A.; D.D. Evans, L.E; Ensminger, and F.E. Clark. (1965). Methods of Soil Analysis. Part 2- Chemical and microbiological properties. J. Am. Soc. Agron. Inc. Publisher Madison Wisconsin, USA.

Bond, J. A.; T. W. Walker; B. V. Ottis, and D. L. Harrell. 2008. Rice Seeding and Nitrogen Rate Effects on Yield and Yield Components of Two Rice Cultivars. Agron. J. (100):2,393-397

Chopra,N.K. and N.Chopra,(2004). Seed yield and quality of 'Pusa 44' rice (Oryza sativa) as influenced by nitrogen fertilizer and row spacing . Indian J of Agric Sci.74(3): 144-146

Counce, P.A.; B.R. Wells, and K.A. Gravois. (1992). Yield and harvest index responses to preflood nitrogen fertilization at low rice plant populations. J. Prod. Agric. 5:492–497.

De Datta, S.K. (1986). Technology development and the spread of direct-seeded flooded rice in Southeast Asia. Exp. Agric., 22: 417-426.

.Dobermann, A.; K.G Cassman,.; C.P . Mamaril and J.E. Sheehy, (1997). Management of phosphorus, potassium, and sulfur in intensive, irrigated lowland rice. Field Crops Res.,

Dofing, S.M. and C.W. Knight. (1994). Yield component compensation in uniculm barley lines. Agron. J. 86:273–276.

Ebaid, R.A. and S.A. Ghanem, (2000). Productivity of Giza177 rice variety grown after different winter crops and fertilized with different nitrogen levels. Egyptian J for Agric Res. 78(2):717-731.

El-Kalla,S.E.; A.A. Leilah and E.M.Said.(1992).Effect of nitrogen fertilizer levels on the productivity of some rice cultivars.Proc.5th Conf. Agron.Zgazig.Univ.13-15 Sept.Vol.(1):133-140.

El-Rewainy,I.M.(1996).Effect of some cultural practices on rice. M.Sc. Thesis,Fac.of Agron. Menofia Univ.Egypt.

Fujisaka, S.; K Mood and K .Ingram (1993). A descriptive study of farming practices for dry seeded lowland rice in India, Indonesia, and Myanmar. Agric. Ecosyst. Environ., 45:115- 128.

Gomez, K.A. and A.A. Gomez. 1984. Statistical procedure for agicultural research. 2nd Ed. Johin Wiley & Sons. New yourk. USA.

Gravois, K.A., and R.S. Helms. 1992. Path analysis of rice yield components as affected by seeding rate. Agron. J. 84:1–4.

Kropff, M.J.; K.G. Cassman; H.H. vanLaar and S. Peng (1993). Nitrogen and yield potential of irrigated rice. Plant Soil 155- 156, 391-394.

Lu,Z.X.; Heong, K.L.; Yu,X.P. and C,Hu, (2004). Effects of plant nitrogen on fitness of the brown planthopper, Nilaparvata lugens Stal. in rice. J. Asia Pacific Entomol. 7,97–104.

Luat,N.V.;Thanh, N.D. and B.T.T. Tam (1998). Study on row seeding for rice production in the Mekong Delta,Vietnam . Omon, Rice Cuulong Delta Rice Res Institute,Vietnam, vol. 6, pp. 147–151.

M.Harunur Rashida, M. Murshedul Alam, M. Akhter Hossain Khan and J.K. Ladha. (2009). Productivity and resource use of direct-(drum)-seeded and transplanted rice in puddled soils in rice–rice and rice–wheat ecosystems Field Crops Res. 113 :274–281

Mahrous, F.N.; A.T.Badawi and M.S. Balal.(1985). IR1626 long grain rice variety as influenced by sowing date ,seeding rate and nitrogen levels.Proc. 2ed Conf.Aron.Alex.Univ.Vol.(1):115-117.

Mandal, N.N.; P.P. Chaudhry, and D..Sinha, (1992). Nitrogen, phosphorus and potash uptake of wheat (var. Sonalika). Env. and Eco. 10: 297 (Field Crop Abst. 46 (1): 30; 1993).

Reddy S. R. (2000). Principles of Crop Production,pp 91-101. Kalyani Publishers, Ludhiana.

Sachiko N.; T. Kazunobu and Y. Fukuta. (2009). Genetic variations in dry matter production and physiological nitrogen use efficiency in rice (*Oryza sativa L.*) varieties. Breed. Sci. 59:269-276.

Schnier, H.F. ; M. Dingkuhn S.K. De Datta; K. Mengel; and J.E. Faronilo (1990). Nitrogen fertilization of direct-seeded flooded vs. transplanted rice. I. Nitrogen uptake, photosynthesis, growth and yield. Crop Sci. 31, 1276–1284.

Singh,T.; Y.S. Shivay, and S.Singh,(2004). Effect of date of transplanting and nitrogen on productivity and nitrogen use indices in hybrid and non-hybrid aromatic rice. Acta Agronomica Hungarica.52(3): 245-252

Thakur,R.B.(1991).Responce of summer rice to nitrogen .Indian J.Agron.Vol.(36):229-230.

Waller, R.A. and D.B. Duncan. 1969. Base rule comparison symmetric multiple comparison proplem. Amer – stat Assoc. J. 1485-1503.

Webster,R.K. and P.S. Gunnell (1992). Compendium of Rice Diseases. American Phytopathological Society,St. Paul,Minnesota 62 p.

Yoshida S.; J.H. Cock and F.T. Parao (1972). Physiological aspects of high yield. Int. Rice Res. Inst. Rice breeding, pp. 455-469.

إستجابة صنف الأرز هجين مصري ١ المنزرع بطريقة البدار لمعدلات مختلفة من التقاوي ومستويات السماد النيتروجيني.

إبراهيم محمد الرويني
مركز البحوث والتدريب في الأرز – سخا – كفر الشيخ- معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية

إن استخدام المعدل الأمثل من التقاوي مع الكمية الكافية من السماد النيتروجيني تؤدي الي زيادة إنتاجية الأرز الهجين تحت ظروف الزراعة البدار. لذا أقيمت تجربتان حقليتان بالمزرعة البحثية لمركز البحوث والتدريب في الأرز بسخا – كفرالشيخ – مصر. لدراسة استجابة صنف الأرز الهجين مصري ١ لإضافة أربعة معدلات من التقاوي وهي ٥ و ٧,٥ و١٠ و ١٢,٥ كجم تقاوي للفدان مع خمسة مستويات تسميد نيتروجيني وهى ٠ و ٢٣ و ٤٦ و ٦٩ و ٩٢ كجم أزوت للفدان ويمكن تلخيص النتائج كما يلي: أظهرت النتائج أن معدل التقاوي ٧,٥ كجم تقاوي للفدان أعطت أعلى متوسطات لقيم صفات محتوى النبات من الكلوروفيل وكمية المادة الجافة المتجمعة ودليل مساحة الأوراق بعد ٦٥ يوم من الزراعة كما اعطي هذا المعدل اعلي قيمة لعدد الحبوب الممتلئة بالسنبلة واعلي محصول حبوب (طن/فدان). كما أظهرت النتائج أن معدل التقاوي ١٠ كجم أعطت أعلى قيم لمتوسطات عدد الاشطاء في المتر المربع وعدد السنابل في المتر المربع بدون فروق معنوية مع معدل ٧,٥كجم تقاوي للفدان بالنسبة لعدد السنابل في ال م٢ في الموسم الأول فقط بينما أعطى معدل التقاوي ٥ كجم للفدان أعلى متوسطات لقيم صفات طول السنبلة ووزن الألف حبة ومتوسط وزن حبوب السنبلة. أظهرت النتائج أيضا أن الأرز الهجين مصري ١ يستجيب لمستويات التسميد العالية حتى ٩٢ وحدة أزوت للفدان حيث أعطي هذا المعدل أعلى متوسطات لكل قيم الصفات تحت الدراسة. وتم الحصول علي أعلي محصول للحبوب عند زراعة الأرز بمعدل تقاوي ٧,٥كجم /فدان مع مستوي تسميد آزوتي ٩٢كجم آزوت / فدان.

قام بتحكيم البحث

أ.د / محمود سليمان سلطان	**كلية الزراعة – جامعة المنصورة**
أ.د / فوزى نعيم محروس	**مركز البحوث الزراعيه**