Response of Some Rice cultivars to Plant Spacing and Nitrogenous Biofertilization

Radwan, F. I. *, M. A. Gomma *,A. A. El-Kady ** and Dalia M.M. Tabl **
Plant Production Dept., Faculty of Agriculture (Saba Basha), Alexandria University
Rice Research and Training Center, Field Crops Res. Inst., ARC, Egypt

ABSTRACT: Two field experiments were carried out at the experimental farm, Rice Research and Training Center, Agricultural Research Center, Egypt, during the two growing seasons, 2010 and 2011. The experiments were conducted to investigate the effect of different nitrogen biofertilizers and plant spaces on some growth characters, yield and its attributes and grain quality characters of some Egyptian rice varieties. A split split-plot design with three replications was used. The main plots were devoted to the rice cultivars namely Giza 178, Sakha 103 and Sakha 105, while the combination of five nitrogen fertilizer sources was arranged in the sub plots (i.e. control, nitrogen recommended rate of, micorrhiza +50% N rate, blue green + 50% N rate and microrrhiza +blue green + 50% N rate) were assigned to the sub plots and three plant spacings (i.e. 10x150, 10x20 and 10x25) were assigned to sub sub plots.

The obtained results could be summarized as follow:

Sakha 105 cultivar recorded the highest panicle weight, No. of filled grains/panicle, 1000-grain weight, and grain yield followed by Giza 178 while, Sakha 103 recorded the lowest values. On the other hand, Giza 178 rice cultivar gave the largest No. of panicles/m^2 in both seasons and the best harvest index (HI). Rice cultivar Sakha 103 gave the highest straw yield followed by Sakha 105.

Rice cultivar Sakha 103 gave the highest hulling % while, Giza 178 recorded the lowest value in both seasons. But Sakha 105 cultivar surpassed significantly the other two cultivars in head rice and milled rice %.

Plant received half of the recommended rate of mineral nitrogen combined with micorrhiza + blue green recorded the greatest panicle grain weight, no. of filled grain/panicle, no. of panicles/m^2, weight of 1000-grain, grain yield and harvest index. The application of recommended rate of nitrogen out yielded the other nitrogen sources and control in rice straw.

Highly significant differences were recorded between the three different plant spacing. Rice plants which planted at 10 x 20 cm gave the highest values in panicle weight, no. of filled grains/panicle, No. of panicles/m^2, weight of 1000-grain, grain yield . While, the narrow plant spacing 10 x 15 cm gave the highest value for straw yield among the other plant spaces. The greatest HI was recorded when rice cultivars were planted at 10 x 20 cm while no differences was found between the other two plant spacing.

Analysis of variance indicated that the differences in hulling % among the plant spacing were significant. The highest means of hulling, milling and head rice % comes from planting at 10 x 20 cm followed by 10 x 25 cm.

The highest values on most traits, except straw yield, were obtained from the combination of Micorhiza + Blue green + 50% of recommended nitrogen rate /ha under the medium spacing conditions with Sakha 105 rice cultivar.

Keywords: N-fertilizer, Biofertilizer, Oryza sativa, cultivars, Hill spacing

INTRODUCTION

Rice (*Oryza sativa*, L.) is one of the most important and leading food crops of the world and the major stable food for over half of the world's population. More important, it is the stable food in areas of high population density and fast population growth. Therefore, it is important to increase the productivity of rice yield to cover the increasing consumption needs. This problem had two solutions; first, horizontal increase by increasing the total cultivated area but it was faced by water shortage problem. Therefore, the Egyption government has tried to limit rice cultivation areas, second, the vertical increase by increasing the productivity of unit area.

Plant spacing is important production factor in transplant rice. Mohapatra and Sharma (1988) found that plant spacing of 20 x 20 cm was better than those of 15 x 15 or 15 x 20 cm under normal soil for rice productivity. Patel (1999) observed that hill spacing of 20 x 20 cm recorded perceptible increase in number of panicles/m^2, straw yield and yield compared to plant density obtained from 20 x 15 and 20 x 10 cm hill spacings. Number of grains/panicle and 1000- grain weight were not affected by spacings. El-Shayieb (2003) and Gorgy (2007) confirmed that narrow spacing of 10 x 20 cm gave the highest grain yield and yield components of Giza 177 rice cultivar (inbred rice) as compared with 20 x 20 or 30 x 20 cm.

Utilization of biological N_2 fixation (BNF) can decrease the application of mineral N fertilizers, reducing environmental risks (Raimam *et al*.,2007 and Radwan *et al*.,2008). Also, mycorrhiza fungi play on important role in whole plant nutrient balance by aiding in the uptake of limiting nutrients and maintaining the nutrient balance (Ning and Gumming, 2001). Using biofertilization or microbial inculcates to replace or increase the efficiency of chemical fertilizer partially or totally is effective in reducing the cost of crop production and maintaining the natural fertility of soil (Bassal *et al*, 1996).

The information on role of mineral nitrogen, biofertilizers and plant spacing as well as their combinations on production of rice are very scanty. Therefore, there is an urgent need to study the response of some rice cultivars to different plant spacing and bio fertilization nitrogenous, on some growth characters, yield components and grain yield as well as grain quality characteristics under the conditions of Kafr El-Sheikh Governorate.

MATERIALS AND METHODS

Experimental treatments

Two field experiments were carried out at the experimental farm of Rice Research and Training Center (RRTC) -Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, Egypt, during the two successive summer seasons of 2010 and 2011. Field experiments were conducted to study the effect of some of biofertilization treatments and plant spacing on growth characters, yield and its components and some grain quality characters of three rice cultivars. The soil analysis of the experimental fields is shown in Table (1). Biofertlizers were prepared in Sakha Agriculture Station–Bacterial Lab.

Table (1): Some physical and chemical properties of the soil at the experimental site under growing seasons.

Soil Properties	2010	2011
- <u>Mechanical Analysis</u>		
Clay %	55.75	55.20
Silt %	31.68	32.02
Sand %	12.57	12.35
Soil texture	Clay	Clay
- <u>Chemical Analysis</u>		
Organic Matter (OM) %	1.6	1.51
Available NO_3 (Nitrate) mg/kg	14.3	12.42
Available NH_4 (Ammonium) mg/kg	19.35	20.58
pH (1:2.5)	8.20	8.08
EC (ds m^{-1})	3.33	3.70
- <u>Soluble anions (meq.l^{-1})</u>		
$CO_3^{=}$	--	--
HCO_3^{-}	5.56	6.20
Cl^{-}	9.00	10.09
$SO_4^{=}$	18.33	19.91
- <u>Soluble cations (meq.l^{-1})</u>		
Ca^{++}	10.01	11.30
Mg^{++}	5.00	7.30
Na^{+}	1.88	2.50
K^{+}	16.00	15.10

The experimental design was split-split-plot with three replications. The main plots included three rice cultivars (C) i.e., Giza 178, Sakha 103 and Sakha 105. While the combination of five nitrogen sources fertilizer was arranged in the sub plots (i.e. control, recommended rate of nitrogen, micorrhiza +50% N rate, blue green + 50% N rate and microrrhiza +blue green + 50% N rate). Plant spacings (S) i.e., 10x15 , 10x20 and 10x25 cm were allocated to sub-sub-plots. The plot area was 12m^2 (4 m length and 3 m width). Rice seeds at the rate of 100 kg/ha were soaked in fresh water for 24 hours then drained and incubated for 48 hours to hasten early germination. The pre -germinated seeds were uniformly broadcasted in the nursery on 7th May in 2010, and 2011 seasons. Nursery seedbed was well ploughed and dry leveled. Phosphorous fertilizer in the form of single super phosphate (15.5% P_2O_5) was added at the rate of 240 kg/ha (100 kg/fed.) before tillage. Nitrogen in the form of Urea (46% N) at the rate of 144kg N/ha (60kg

N/fed.) was added in two portions, first at the rate of (40kg N/fed.) as basal dressing and the rest (20kg N/fed.) at panicle initiation. Zinc sulphate (22% Zn) at the rate of 50kg /ha (20kg /fed.) was added after pudding and before planting. All cultivation practices were done according to the common practices in rice growing.

Data recorded:

I- Yield and its components:

1. Panicle weight (g): The panicle weight in grams was recorded as the average of ten panicles.
2. Number of filled grains/panicle: It was recorded as a number of filled grains from ten main panicles randomly taken from each plant at harvesting time.
3. Number of panicles/m^2: Average number of panicles from ten hills selected randomly in each plot were counted and then computed as number of panicles per square meter.
4. 1000-grain weight (g): Weight of 1000 rough grains, which were randomly taken from the grain yield of each sub-sub plot.
5. Grain yield (t/ha): Area of 10 m^2 (2.5 $\times$ 4 m) in the center of each sub-sub plot was manually harvested, then left for air drying for about four days then mechanically threshed and recorded and the weight was adjusted to 14% moisture content (IRRI, 1996).
6. Straw yield (t/ha): Dry weight of straw of 10 m^2 was weighted as straw yield and adjusted to (t/ha).
7. Harvest index : It was estimated as follows :
8. $\text{Harvest index (HI)} = \dfrac{\text{Grain yield (economic yield)}}{\text{Biomass yield (biological yield)}} x100$

II. Grain quality characters:

Milling characters:

Hulling percentage, milling output and head rice percentage were estimated according to the methods reported by Adair (1952).

1. Hulling percentage:

About 150 g cleaned rough rice samples at moisture content 12-14% were estimated using experimental huller machine (Satake) at Rice Technology and Training Center, Alexandria.

$$\text{Hulling } \% = \frac{\text{Brown rice weight}}{\text{Rough rice weight}} x100$$

2. Milling percentage:

Brown rice was consequently milled using milling machine model TMO5 at Rice Technology and Training Center, Alexandria. The milled rice sample was then collected and the weight was taken and percentage of total milled rice was calculated by the following equation:

$$\text{Milling } \% = \frac{\text{Milled rice weight}}{\text{Rough rice weight}} x100$$

3. Head rice percentage:

Whole milled grains were separated from milled rice by using a rice-sizing device. Then, the percentage of head rice yield was obtained and calculated as follows:

$$\text{Head rice } \% = \frac{\text{Whole grain weight}}{\text{Rough rice weight}} x100$$

Statistical analysis:
All data collected were subjected to analysis of variance according to Gomez and Gomez (1984). Treatment means were compared by Duncan's multiple range test (Duncan, 1955). All statistical analysis was performed using analysis of variance technique by means of "IRRISTAT" computer soft ware package.

RESULTS AND DISCUSSION

Yield and its components:

Data cited in Table (2and 3) show that the three tested rice cultivars varied in their yield and its components in both seasons. Sakha 105 cultivar significantly surpassed the other cultivars in its panicle weight, number of filled grains/ panicle, 1000-grain weight (g) and grain yield in 2010 and 2011 seasons. Giza 178 cultivar gave the highest values of number of panicles /m^2 and harvest index, in the two seasons. In addation, Giza 178 rice cultivar recorded the highest straw yield followed by Sakha 105. So it is clear from these results that Sakha 105 cultivar was the best on most traits. The trends of the obtained results are in good accordance with that reported by many investigators such as Salem *et al.* (2006), Gorgy (2007), Radwan *et al.* (2008), Tabl (2008), Shaalan (2009) and Abou-Khalifa (2012).

It is clear that plant received half of the recommended rate of mineral nitrogen combined with micorrhiza + blue green significantly increased panicle weight, number of filled grains/ panicle, number of panicles /m^2 and 1000-grain weight and grain yield as well as harvest index in the two seasons (Table 2and 3). On the other hand, the lowest values were obtained from control (without fertilizer), while nitrogen recommend gave the highest value of straw yield ha^{-1} in the two seasons. This effect may be due to that the bio-fertilizer plus mineral fertilizer has much higher nitrogen which essential for building up protoplasm and proteins as well as induces cell division and initiate meristematic activity. This effect resulted in an increase in cell number and cell size with an overall increase in leaf production.The same results were recorded by Salem (2006), Radwan *et al.* (2008) and Wijebandara *et al.* (2009) and Xian *et al*. (2009) are supported the obtained results.

It is clear that panicle weight, number of filled grains/ panicle, number of panicles /m^2 and 1000-grain weight , grain yield and harvest index were significantly influenced by plant spacing during both growing seasons (Table 2and 3). increasing plant spacing from 10×25 to 10×20 cm significantly increased values on most traits consequently the low plant spacing 10×15 cm produced the lowest values of yield and its components, meanwhile, the highest straw yield was obtained from the high plant density (low spacing, 10×15cm) in both seasons. The increase in number of panicles/m^{2}by decreasing plant spacing was mainly due to the increase in number of tellers per plant. These findings are in harmony with those recorded by Salem (2006), Abd El-Salam (2006), Gorgy (2007), Shaalan (2009) and Radwan *et al.* (2008) and Xian *et al*. (2009).

It is clear from Table (1) that the highest number of filled grains/ panicle and 1000-grain weight were recorded under the treatment including the combination of Sakha 105 cultivar and 50% recommend rate nitrogen and inoculation with Micorhiza + Bluegreen in 2010 and 2011seasons. While the narrow was true for

Giza 178, under % recommend rate nitrogen and inoculation with Micorhiza + Bluegreen in the second season.

Table (2): Panicle weight (g), number of filled grains/ panicle, number of panicles /m^2 and 1000-grain weight (g) as influenced by rice cultivar, N-fertilizer source, plant spacing and their interaction in 2010 and 2011 seasons.

	2010				2011			
Main effects and interaction	Panicle weight (g)	No. of filled grains/ panicle	No. of panicles/ m^2	1000-grain weight (g)	Panicle weight (g)	No. of filled grains/ panicle	No. of panicles/ m^2	1000-grain weight (g)
Cultivar (C):								
Giza 178	2.60 b	99.86 c	443.13 a	21.25 c	3.07 b	113.31 c	471.19 a	23.83 c
Sakha 103	2.22 c	109.18 b	394.34 c	22.43 b	2.78 c	114.62 b	418.13 c	26.00 b
Sakha 105	3.08 a	114.91 a	426.04 b	23.36 a	3.21 a	117.25 a	441.58 b	28.33 a
F- test	**	**	**	**	**	**	**	**
N -fertilizer source (N):								
Control	2.38 e	104.53 e	389.55 d	20.67 e	2.79 e	113.18 e	438.83	24.79 e
Nitrogen recommend	2.52 d	106.31 d	405.41 c	21.70 d	2.92 d	114.04 d	441.36	25.26 d
Micorhiza + 50% N	2.76 b	109.39 b	434.17 b	22.90 b	3.14 b	116.04 b	445.55	26.76 b
Blue green + 50% N	2.64 c	107.47 c	409.81 c	22.23 c	3.04 c	115.01 c	443.58	26.11 c
Micorhiza + Bluegreen + 50% N	2.88 a	112.22 a	466.92 a	24.23 a	3.23 a	117.05 a	448.84	27.35 a
F- test	**	**	**	**	**	**	N.S	**
Plant spacing(S):								
10 x 15 cm	2.52 c	105.81 c	413.80 c	21.59 c	2.99 c	114.88 c	441.19 c	25.85 c
10 x 20 cm	2.74 a	110.06 a	428.10 a	23.02 a	3.06 a	115.24 a	445.61 a	26.24 a
10 x 25 cm	2.64 b	108.09 b	421.62 b	22.44 b	3.02 b	115.06 b	444.10 b	26.08 b
F- test	**	**	**	**		**	**	**
Interaction:								
C x N	N.S	**	N.S	N.S	N.S	**	N.S	**
Cx S	N.S	**	N.S	N.S	N.S	**	N.S	N.S
N x S	**	N.S	N.S	N.S	*	N.S	N.S	*
C x N x S	N.S	**	N.S	*	N.S	**	N.S	N.S

*, **, N.S indicates P < 0.05, P > 0.01 and not significant, respectively. Means of each factor designated by the same latter are not significantly different at 5% level, using Duncan's multiple range test.

Table (3): Effect of different N-fertilizer source, plant spacing and their interaction on grain yield, straw yield and harvest index of three rice cultivars in 2010 and 2011 seasons.

Main effects and interaction	2011			2010		
	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index
Cultivar (C):						
Giza 178	9.26 b	10.50 c	46.88 a	10.03 b	10.86 c	48.00 a
Sakha 103	8.82 c	14.52a	37.78 c	9.59 c	15.01 a	38.97 c
Sakha 105	10.12 a	12.07 b	45.59 b	10.88 a	12.56 b	46.41 b
F- test	**	**	**	**	**	**
N- fertilizer source (N):						
Control	8.80 e	12.13 c	42.32 d	9.57 e	12.51 d	43.57 d
Nitrogen recommend	9.15d	12.68 a	42.18 d	9.91d	13.16 a	43.20 e
Micorhiza + 50% N	9.68 b	12.17 c	44.47 b	10.44 b	12.64 d	45.48 b
Blue green + 50% N	9.42 c	12.45 b	43.32 c	10.18 c	12.94 b	44.24 c
Micorhiza + Bluegreen + 50% N	9.96 a	12.39 b	44.79 a	10.73 a	12.80 c	45.80 a
F- test	**	**	**	**	**	**
Plant spacing(S):						
10 x 15 cm	9.31c	12.43 a	43.04 c	10.08 c	12.87 a	44.12 c
10 x 20 cm	9.49 a	12.31 b	43.73 a	10.25 a	12.72 b	44.84 a
10 x 25 cm	9.41 b	12.35 b	43.47 b	10.17 b	13.82 a	44.41 b
F- test	**	**	**	**	**	**
Interaction:						
C x N	N.S	N.S	*	N.S	N.S	N.S
C x S	**	**	N.S	**	*	N.S
N x S	N.S	N.S	N.S	N.S	N.S	*
C x N x S	N.S	N.S	N.S	N.S	N.S	N.S

*, **, N.S indicates P < 0.05, P > 0.01 and not significant, respectively. Means of each factor designated by the same latter are not significantly different at 5% level, using Duncan's multiple range test.

As for the interaction between rice cultivar and plant spacing on No. of filled grains/ panicle, grain yield and straw yield there was significant effect in the two seasons (Tables 2and 3). Planting at a narrow spacing 10×20 cm of Sakha 105 cultivar recorded the highest values of traits, while the lightest straw yield were produced by Giza 178 cultivar with hill spacing (10×20 cm) according to Table (3).
The interaction between N-fertilizer source and plant spacing (N x S) in both seasons were only significant on panicle weight as well as 1000-grain weight and harvest index in 2010 and 2011 seasons, (Table 2and 3). The highest panicle weight, 1000-grain weight and harvest index were obtained when nitrogen fertilizer was applied at the rate of 50% of recommended mineral nitrogen + Micorhiza + Bluegreen with medium plant spacing (10×20cm). While, the inferior value was observed with the treatment combination of control (without fertilizer) under the lowest density (10×15cm) conditions.

The results in Table (2) indicate that the highest number of filled grains/ panicle recorded by Sakha 105 cultivar with application of Micorhiza + Bluegreen + 50% of recommended nitrogen rate as well as plant spacing10×20 cm. Whereas, Giza 178 cultivar produced the lowest number of filled grains/ panicle under control treatment (without fertilizer) and using 10×15 cm plant spacing in 2010 and 2011 seasons.

II. Grain quality characters:

It is clear that hulling, milling and head rice percentage of the three tested cultivars varied significantly in both seasons (Table 4). The highest hulling percentage (82.76 and 83.63% in 2010 and 2011 seasons, respectively) belonged to Sakha 103 cultivar. While, Sakha 105 cultivar produced the highest values of milling and head rice percentage (75.56 and 72.63%) and (69.54 and 66.01%) in both seasons, respectively. These differences may be due to the differences in the genetic structure and its interaction with environmental conditions. Similar differences among rice cultivars in hulling percentage were reported by **Chauhan and Singh (1992), Gorgy (2007) and El-Ekhtyar (2004).**

N-fertilizer source significantly affected hulling, milling and head rice percentage in the two seasons. Application of Micorhiza + Bluegreen + 50% of recommended nitrogen rate produced the highest values of brown rice, milling and head rice percentage (80.18, 74.42, 67.70, 80.86, 72.77 and 65.34 %) followed by adding Micorhiza + 50% nitrogen in 2010 and 2011 seasons. Likewise, mineral nitrogen plus bio-fertilization had favorable effect on grain quality characters via improving growth, escalating photosynthetic rate consequently improving both grain filling and grain quality as shown in Table (4).

Table (4): Hulling, milling and head rice percentage as influenced by N-fertilizer source, plant spacing and their interaction of three rice cultivars in 2010 and 2011 seasons.

Main effects and interaction	2011			2010		
	Hulling %	Milling %	Head rice%	Hulling %	Milling %	Head rice%
Cultivars (C):						
Giza 178	76.62 c	71.89 c	66.12 b	77.65 c	71.24 c	64.50 b
Sakha 103	82.76 a	73.43 b	64.18 c	83.63 a	72.27 b	63.23 c
Sakha 105	78.55 b	75.56 a	69.54 a	79.10 b	72.63 a	66.01 a
F- test	**	**	**	**	**	**
N- fertilizer source (N):						
Control	78.35 e	72.51 e	65.45 e	79.24 e	71.06 e	63.61 e
Nitrogen recommend	78.89 d	73.36 d	66.08 d	79.82 d	71.79 d	64.27 d
Micorhiza + 50% N	79.74 b	74.02 b	67.19 b	80.50 b	72.44 b	65.05 b
Blue green + 50% N	79.41 c	73.80 c	66.66 c	80.21 c	72.16 c	64.63 c
Micorhiza + Bluegreen + 50% N	80.18 a	74.42 a	67.70 a	80.86 a	72.77 a	65.34 a
F- test	**	**	**	**	**	**
Plant spacing(S):						
10 x 15 cm	78.95 c	72.86 c	65.69 c	80.02 c	71.91 c	64.44 c
10 x 20 cm	79.64 a	74.15 a	6721 a	80.23 a	72.17 a	64.72 a
10 x 25 cm	79.35 b	73.87 b	66.95 b	80.13 b	72.06 b	64.59 b
F- test	**	**	**	**	**	**
Interaction:						
C x N	N.S	**	**	N.S	**	**
Cx S	**	**	N.S	**	**	N.S
N x S	N.S	**	**	N.S	**	**
C x N x S	*	**	**	**	**	**

**, N.S indicates P > 0.01 and not significant, respectively. Means of each factor designated by the same latter are not significantly different at 5% level, using Duncan's multiple range test.

Concerning, the effect of plant spacing on grain quality characters, the data in Table (4) reveal that plant spacing had a significant effect on the values of hulling, milling and head rice percentage in the two seasons. Data in the same Table show also that increasing plant spacing from 10×20 up to 10×25 cm decreased percentage of hulling significantly in both seasons. The highest values of hulling, milling and head rice percentage (79.64 and 80.24%),(73.87 and 72.06%) and (66.95 and 64.59 %) were produced from 10×20 cm hill spacing, while the lowest ones (78.95 and 80.02%),(72.86 and 71.91%) and (65.69 and 64.44 %) were produced from narrow plant spacing during the two growing seasons, respectively. These results are in harmony with those reported by El-Shayb (2003).

Data documented in Table (4) show that the combination between Sakha 105 cultivar and Micorhiza + Bluegreen + 50% of recommended nitrogen rate /ha produced the highest values of milling percentage (76.51 %) in 1st season and head rice percentage (70.57 and 66.67 %) in both seasons, respectively in 2nd season of study Sakha 103 cultivar and Micorhiza + Bluegreen + 50% nitrogen recommend /ha recorded the highest values of milling percentage (73.34%).While the lowest values of milling and head rice percentage were recorded when Giza 178 rice cultivar was planted without fertilization in 1st and 2nd seasons.

Data in Table (3) reveal that the highest values of hulling percentage were recorded by Sakha 103 cultivar under the medium spacing (10×20 cm) in both seasons. Meanwhile, the highest values of milling percentage were produced from Sakha 103 and narrow spacing (10×15 cm) in 2010 and 2011 seasons. On the other hand, Giza 178 gave the lowest ones when it was planted under the narrow spacing in both seasons of study.

Data in Table (4) reveal that the highest values of hulling rice percentage were recorded by Sakha 103 cultivar when it was fertilized with Micorhiza + Bluegreen + mineral nitrogen at 50% of recommend nitrogen rate /ha and it planting 10×20 cm. Meanwhile, the highest values of head rice were produced from Sakha 105 cultivar when fertilized with Micorhiza + Bluegreen + 50% of recommended nitrogen rate /ha under medium spacing in both seasons. On contrast, Giza 178 cultivar recorded the lowest percentage of hulling without fertilizers at narrow plant spacing (10×15 cm) in both seasons.

From the above mentioned results and under the conditions of this study it could be concluded that the most economic fertilization treatment for maximum yield and its components of rice Sakha 105 rice cultivar as well as grain quality characteristics in North delta region are 50% of recommended nitrogen rate/ha with bio-fertilization (Micorhiza + Bluegreen) when, planted at medium hill spacing (10×20 cm), reduce the cost of production and pollution which could occur by the excessive use of chemical fertilization.

REFERENCES

Abd El Salam, K.M.H. (2006). Effect of some agricultural practices on yield and grain quality of rice M.Sc. Thesis, Faculty of Agric., (Saba Basha), Alex. Univ., Egypt.

Abou-Khalifa A. A. B. (2012). Study some physiological characters, yield and yield component for five new rice varieties under different sowing dates. Pelagia Research Library Advances in Applied Science Research, 3 (1):440-445.

Adair C.R. (1952). The McGill miller method for determining the milled quality of small samples of rice Journal of Applied Sciences Research, 55 (2): 21-23.

Bassal, S.A.A., A.M. Abd El-All, I.O.E. Metwally and K.E. El-Habbak (1996). Growth and yield of rice in relation to winter preceding crops and N-fertilizer levels J. Agric. Sci. Mansoura Univ. 21 (1): 79-88.

Chauhan, J. S. and B.N. Singh (1992). Grain quality of Indian rice varieties. Seed & Farms. 8 (6): 8.

Duncan, D.B. (1955). Multiple range and multiple F-test Biometrics, 11: 1-24.

El-Ekhtyar, A.M.M. (2004). Behavior of some rice cultivars as affected by drought treatments and direct seeding method (drilling). Ph.D. Thesis, Agron. Dep., Fac. of Agric., Mansoura Univ., Egypt.

El- Shayb, O.M. (2003). Effect of hill spacings nitrogen levels and harvest date on rice productivity and grain quality. M.Sc. Thesis, Faculty of Agric., Mansoura Univ., Egypt.

Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for the agricultural researches. John Wiley and Son. Inc. New York

Gorgy, R.N. (2007). Performance of hybrid rice and inbred rice cultivars under different planting and number of seedlings per hill. J Agric. Sci. Mansoura Uni., 32(1): 117-131.

IRRI (1996). Standard evaluation system for rice. 3rd ed. International Rice Research Institute, Los Banos, Philippines.

Jianchang, N and J. R. Cumming (2001). Arbuscular mycorrhizal fungi enhance aluminium resistance of broomsedge (Andropogon virginicus L.) J. Exp. Bot. (2003) 54 (386): 1447-1459 first published online March 31, 2003 doi:10.1093/jxb/erg149.

Mohapatra, B.S. and G.L. Sharma (1988). Effect of Azospirillum, cyanobacteria and Azolla bio-fertilizers on productivity of low land rice. Indian Journal of Agronomy, 33(4): 368-371.

Patel, J.R. (1999). Response of rice (*Oryza sativa* L.) to time of transplanting, spacing and age of seedlings. Indian J. Agron., 4(2): 344-346.

Radwan, F. I., I. Abou El Seoud and Elham A. Badr(2008). Response of two rice cultivars to blue green algae, A-mycorrhiza lineoculation and mineral nitrogen fertilizer. Middle Easten and Russian Journal of Plant Science and Biotechnology. Global Science Book. Received: 17 March, 2008. Accapted: 13 Septemper, 2008.

Raimam, MP, U. Albino, MF Cruz, GM Lovato, F Spago, TP Ferracin, DS Lima, Goulart, T; Bernardi, CM; Miyauchi, M; Nogueira, MA; Andrade, G. 2007. Interaction among free-living N-fixing bacteria isolated from Drosera villosa var. villosa and AM fungi (Glomus clarum) in rice (Oryza sativa). APPLIED SOIL ECOLOGY. 35(1):25-34.

Salem, A.K.M (2006). Effect of Nitrogen Levels, Plant Spacing and Time of Farmyard Manure Application on the Productivity of Rice. Journal of Applied Sciences Research, 2(11): 980-987.

Shaalan A.M.A. (2009). Studies of some factors affecting quality characteristics in rice crop. Ph.D. Thesis, Agro. Dep., Facukty of Agri., Alexandria Univ., Egypt.

Tabl, D.M.M. (2008). Effect of nitrogennous and potash fertilization on productivity and grain quality of some rice cultivars. M.Sc. Thesis, Faculty of Agric., (Saba Basha), Alex. Univ., Egypt.

WIJEBANDARA, D., M. D. IRANIE, G. S. DASOG, P. L. PATIL AND M. HEBBAR (2009). Response of rice to nutrients and bio fertilizers under conventional and system of rice intensification methods of cultivation in Tungabhadra command of Karnataka. Department of Soil Science and Agricultural Chemistry University of Agricultural Sciences, Dharwad-580 005, India. Karnataka J. Agric. Sci., 22(4) (741-750): 2009

Xian, Q. L., D. Zhu., H. Chen, and Y.Zhang (2009). Effect of plant density and nitrogen application rate on grain yield and nitrogen uptake of super hybrid rice. Rice Sci, 16, (2):138-142.

الملخص العربى

استجابة بعض أصناف الأرز لمسافات الزراعة والتسميد النيتروجينى الحيوى

فتحى ابراهيم رضوان* ، محمود عبد العزيز جمعة* ، عادل عبد المعطى القاضى** و داليا محمد محمد طبل**

*قسم الأنتاج النباتى بكلية الزراعة – سابا باشا – جامعة الاسكندرية.

** مركز بحوث وتدريب الارز– محطة البحوث الزراعية بسخا– مركز البحوث الزراعية.

أقيمت تجربتان حقليتان بمزرعة مركز بحوث وتدريب الأرز محطة البحوث الزراعية بسخا بمركز البحوث الزراعية خلال موسمى الزراعة ٢٠١٠م ، ٢٠١١م وكان الهدف الرئيسى من التجربة هو بحث مدى استجابة بعض أصناف الأرز المصرى لنوعيات من التسميد النيتروجينى– الحيوي وتأثير مسافات الزراعة المختلفة على بعض صفات المحصول ومكوناته وبعض صفات جودة الحبوب. تم استخدام تصميم القطع المنشقة مرتين فى ثلاث مكررات حيث وزعت ثلاثة من أصناف الأرز المصرية هى (جيزه ١٧٨ ، سخا ١٠٣ ، سخا ١٠٥) على القطع الرئيسية ،وخمسة معاملات من مصادر التسميد النيتروجين (مقارنة ، نيتروجين موصى به ٦٠ وحدة/فدان ، ميكوريزا + ٢/١ تسميد نيتروجينى ، بلوجرين + ٢/١ تسميد نيتروجينى + ميكوريزا + بلوجرين + ٢/١ تسميد نيتروجينى)على القطع الشقية الأولى أما مسافات الزراعة (١٠ × ١٥ ، ١٠ × ٢٠ ، ١٠ × ٢٥سم) فقد وزعت عشوائيا على القطع الشقية الثانية.

ويمكن تلخيص أهم النتائج فيما يلى:

تفوق الصنف سخا ١٠٥ فى وزن السنبلة ونسبة الحبوب الممتلئة بالسنبله ووزن الألف حبة يليه الصنف سخا ١٠٣ بينما كان الصنف جيزه ١٧٨ أقلهم ، فى حين تم الحصول على أعلى القيم من عدد السنابل/م^2 وافضل دليل الحصاد مع الصنف جيزه ١٧٨ ، بينما سجل الصنف سخا ١٠٣ اعلى محصول للقش/هكتار.

أعطى الصنف سخا ١٠٣ أعلى تصافى حبوب بنيه وأقل نسبة سرسه بين أصناف الأرز الثلاثة تلاه الصنف سخا١٠٥ واقلهم الصنف جيزة ١٧٨ فى كلا الموسمين على عكس الصفة السابقة أعطى الصنف سخا ١٠٥ نسبة تبييض ونسبة الحبوب السليمة أعلى بين الأصناف الثلاثة .

أشارت النتائج الى الحصول علي أعلى القيم من وزن السنبلة و أكبر نسبة من الحبوب الممتلئة بالسنبله ووزن الألف حبة والمحصول الكلى للحبوب ومعامل الحصاد بالتسميد بمخلوط ميكرويزا + بلوجرين + ٥٠% نيتروجين معدنى ولكن أظهر التسميد باستخدام النيتروجين المعدنى تفوقا واضحا فى محصول القش عن باقى المعاملات السمادية.

أيضا كان هناك تأثيراً عالى المعنوية واضحا لمسافات الزراعة بالموسمين، حيث أدت مسافة الزراعة الموصى بها ١٠ × ٢٠سم اعلى وزن السنبلة ونسبة الحبوب الممتلئة بالسنبله وعدد السنابل/م^2 ووزن الألف حبة بالاضافة الى معامل الحصاد والزراعة على مسافة الضيقة ١٠ × ١٥سم هى الأعلى والأفضل فى محصول القش.

ظهر اختلاف وفروق معنوية بين مسافات الزراعة فكانت الزراعة على مسافات ١٠ × ٢٠سم هى الأعلى والأفضل فى تصافى التقشير والتبييض و نسبة الحبوب السليمة.

وقد تحققت أعلى القيم فى معظم الصفات المدروسة مع التسميد الحيوى كالعادة مخلوط ميكرويزا + بلوجرين + ٥٠% نيتروجين معدنى على المسافة العادية ١٠ × ٢٠سم مع الصنف سخا ١٠٥.

إجمالا أكدت الدراسة والنتائج المتحصل عليها استجابة أصناف الأرز المستخدمة للتسميد الحيوى المتمثل فى ميكرويزا + بلوجرين حيث ادى إلى تحسين بعض صفات النمو وزيادة المحصول ومكوناته وتحسين بعض صفات الجودة لحبوب الأرز لذا فإنه من الممكن الاعتماد على بعض الأسمدة الحيوية فى التسميد وباستخدام مسافة الزراعة الموصى بها ١٠ × ٢٠سم فإن ذلك سيؤدى إلى تقليل تكلفة إنتاج محصول الأرز وزيادة دخل المزارع المصرى وقد يؤدى ذلك أيضا إلى تقليل الضرر الناتج على البيئة من الإسراف فى استخدام الأسمدة المعدنية.