J. Agric. Sci. Mansoura Univ., 29(2): 535 - 552, 2004

EFFECT OF NITROGEN LEVELS, HILL SPACING AND RICE CULTIVAR MIXTURES ON SOME RICE CHARACTERS

El-Sheref, E.El.; M. Haleem; A. Galelah and M. Abd El-Hameed
Dept. of Agron., Fac. of Agric., Klafr El-Sheikh, Tanta Univ., Egpt.

ABSTRACT

The present investigation was carried to study the effect of nitrogen levels, hill spacing and rice cultivar mixture on some rice characters. Where used, three nitrogen levels (40, 60 and 80 kg N/fed.); three hill spacing (10 × 20, 15 × 20 and 20 × 20 cm), combined with five rice cultivar mixtures (25% Giza 177 with 75% Sakha 102, 75% Giza 177 with 25% Sakha 102; 50% Giza 177 with 50% Sakha 102, 100% Giza 177 and 100% Sakha 102 were used. The experiments were laid out in a split-split plot design with three replications. A trial was conducted at Experimental Farm, Fac. of Agric., Tanta Univ. at Kafr El-Sheikh and Seed Tech. Lab., RRTC, Sakha, Kafr El-Sheikh, Egypt during the two growing seasons 1998 and 1999. The results revealed that, the mixed rice variety (25% Giza 177 with 75% Sakha 102) transplanted at 15 × 20 cm and fertilized with 60 kg N/fed. gave the highest values of number of tillers/m^2, number panicles/m^2, panicle weight (g), panicle length (cm), number of filled grains/panicle, 1000-grain weight (g), grain yield (t/ha.), biomass yield (t/ha.), harvest index %, hulling %, milling % and head rice % in both season.

INTRODUCTION

Rice is considered one of the major food and export crop in A.R. Egypt. Rice area annually ranged between 0.50 to 0.60 million ha (1.0 to 1.5 million fed.) which is about 20% of Egypt's total cultivated area during summer season. Rice productivity in 2000 was 9.12 t/ha (3.83 t/fed.) and total rice production was 5.8 million tons which was sufficient for local consumption and export (Aidy, 2000). Improvement of the production can be achieved through many factors such as fertilization, plant spacing and mixed rice varieties. (Son and Trouong, 2000).

Planned seed mixtures of different genotypes are on alternative two cultivars that are an individual (pure line, hybrid or clone). A mixture of closely related lines of wheat, "KSML3" was released in India to provide improved disease resistance (Gill *et al.*, 1980). Zhu, *et al.* (2000). Mentioned that, grain yields per hectare of the hybrids in mixture were nearly equal to the corresponding monocultures. This, mixed populations produced more total grain per hectare than their corresponding monocultures in all cases.

Mixed rice varieties method can applied to increase the grain yield, especially in case when both varieties has the same growth duration under our condition. The main objective of this investigation were: the effect of mixed rice varieties; different hill spacing and different levels of nitrogen on a growth attributes, yield and its components and grain quality tests of rice.

MATERIALS AND METHODS

Two field experiments were carried out at the experimental farm of Faculty of Agriculture, Kafr El-Sheikh, Tanta University, and Seed

Technology Lab of Rice research and Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt during the two summer seasons of 1998 and 1999 to study the effect of three different hill spacing, i.e., 10 × 20, 15 × 20 and 20 × 20 cm, nitrogen fertilization rates 40, 60 and 80 kg N/fed. and five mixed rice cultivars 100 % Giza 177, 100% Sakha 102, 50% Giza 177 and 50% Sakha 102, 75% Giza 177 and 25% Sakha 102, 25% Giza 177 and 75% Sakha 102. The variety Giza 177 as a short stature, low tellering ability and no lodging variety under hight level of nitrogen. The variety Sakha 102 as a long stature; high tellering ability and lodging variety with increasing of nitrogen level. Both varieties has the same duration about 125 days and good grain quality. So, the mixed between this varieties can applied to a void the lodging of Sakha 102; increase the number of tellering/m^2 and increase the mixed response to high level of nitrogen.

A split-split-plot design with three replications was used, the main plots were assigned to nitrogen levels, while the sub-plots were hill spacing and the sub-sub-plots to mixed rice varieties. Soil samples were taken from the experimental sites from the top to 30 cm. Mechanical analysis it's (Sand 12.25; Clay % 57.15 and silt % 31 31.05). While, chemical analysis it's, (PH 8.1; Organic matter % 1.71, Calcium carbonate % 2.09; Soil Salts (E. C/m) 2.75; total N (ppm) 360. Available No3 (ppm) 18.0; Available NH4 (ppm) 1.9; Available P (ppm) 15.2 and Available K (ppm) 175.

Rice Seeds at the rate of 120 kg/ha (50kg/fed.) from pure and mixed varieties were soked in fresh water for 24 hours and incubated for 48 hours. The pregerminated seeds were broadcasted by hand in the second weak of May in both seasons.

The data were recorded on 50% heading, plant height (cm), number of tillers/m^2, number of panicles/m^2, panicle weight (g), panicle length (cm), number of filled grains/panicle, 1000-grain weight (g), Grain yield (t/ha), Biomass yield (t/ha), Harvest index %, Hulling %, milling % and Head rice % according to IRRI 1996. Analysis of variances for the evaluated characters were done according to procedures of Gomez and Gomez (1984). Differences among treatment means were compared using the revised LSD at 5% level of significance adapted by Waller and Duncan (1969).

RESULTS AND DISCUSSION

The procedure used for the development of multilines depends on the type, that is used commercially. The types of multilines are mixture of isolines, closely related lines, or distinctly different genotypes (**Fehr, 1987**). The results obtained from the present investigation in the two seasons of 1998 and 1999 are presented and discussed in three topics: Growth attributes; yield and yield components and grain quality tests.

1. Growth attributes :

1.1. Heading date (days) :

Results in Table (1) revealed clearly that the effect of nitrogen levels, hill spacing and mixed rice varieties as well as their interaction on the number of days from sowing to 50% of heading for each plot were significant in both seasons.

Data indicated that number of days from sowing to 50% heading were significantly increased by nitrogen level up to 80 kg N/fed. The longest time of heading (93.11) in 1998 season and (94.29) in 1999 season was produced when plants were fertilized by 80 kg N/fed. While the shortest heading (88.24) in 1998 season and (88.07) in 1999 season was obtained when plants were fertilized by 40 kg N/fed.

It could be concluded that the vegetative stage tended to extend under high nitrogen levels. These results are in agreement with the results obtained by Osman (1999).

Data presented in Table (1) show that number of days to 50% heading significantly was decreased by increasing plant density in both seasons. So the highest value of this character (93.49) in 1998 season and (93.64) in 1999 season was produced by wide hill spacing (20 × 20 cm) while the shortest time of heading (88.67) in 1998 season and (88.71) in 1999 season was recorded when rice varieties were sown in narrow hill spacing (10 × 20 cm) in both seasons. These results are in agreement with these of **Akita and** Tanaka (1992). They found that number of days to heading date and maturity dates decreased with increasing plant density.

From Table (1) the differences among the five rice varieties treatments in number of days to 50% heading were significant in both seasons. It is clearly evident that the longest time to 50% heading (93.85) in 1998 season and (94.83) in 1999 season were obtained by Giza 177 pure rice variety, while the shortest period of days to 50% heading (89.11) in 1998 season and (89.44) in 1999 season came by 75% Sakha 102 with 25% Giza 177 mixed rice variety treatments. So as well as the mixed rice varieties such as 75% Giza 177 with 25% Sakha 102 was (91.11) and (90.85), respectively in 1998 and 1999 seasons and 50% Giza 177 with 50% Sakha 102 was (89.82) and (89.89), respectively in 1998 and 1999 seasons compared with pure rice variety Sakha 102 was (91.52) and (91.67), respectively in 1998 and 1999 seasons. These results indicated that the pure rice variety Giza 177 under (80 kg N/fed.) as well as (20 × 20 cm) hill spacing of transplanting gave the longest period to 50 % heading in both seasons.

1.2. Plant height (cm) :

Results in Table (1) revealed clearly the effect of nitrogen levels, hill spacing and mixed rice varieties as well as their interactions on plant height (cm) in 1998 and 1999 seasons.

Data show that plant height increase significantly as nitrogen level increased up to 80 kg N/fed. The highest value (98.93 cm) in 1998 season and (98.83 cm) in 1999 season was obtained when plants were fertilized with 80 kg N/fed. While the lowest value (97.54 cm) in 1998 season and (97.83 cm) in 1999 season were obtained when plants were fertilized with 40 kg N/fed. These results were consistence in both seasons of experiments. The changes in plant height might be due to the role of nitrogen in stimulating the meristematic activity and cell elongation of the plant. These findings agree with those reported by Abd El-Wahab (1998) and Osman (1999).

Data presented in Table (1) show that plant height was significantly increased by increasing plant density in both seasons. So, the highest value

of (98.21 cm) in 1998 season and (98.93 cm) in 1999 season were recorded when plants were sown in narrow hill spacing (10 × 20 cm) in both seasons, while the lowest value (97.25 cm) in 1998 season and (98.61 cm) in 1999 season were obtained when plants were sown in wide plant spacing (20 × 20 cm). This may be due to the more high plants population became crowdy in the dense sowing light became more needed and the stems ought to be elongated to ensure the light sufficiency. El-Gohary (1998) came to similar results.

Analysis of variance in Table (1) indicated that there were significant differences among the five mixed rice varieties in plant height in both seasons. The tallest value (105.48 cm) in 1998 season and (101.3o cm) in 1999 season was recorded by Sakha 102 pure rice variety. While the shortest value (96.87 cm) in 1998 season and (96.13 cm) in 1999 season was produced by 50% Sakha 102 with 50% Giza 177 mixed rice variety and (96.38 cm) in 1998 season and (97.07 cm) in 1999 season was produced by 75% Giza 177 with 25% Sakha 102 mixed rice varieties. So as well as the mixed rice varieties such as 25% Giza 177 with 75% Sakha 102 was (98.16 cm) and (97.71 cm), respectively in 1998 and 1999 seasons, compared with the pure rice variety such as Giza 177 was (96.83 cm) and (96.37 cm), respectively in 1998 and 1999 seasons. These results indicated that the pure rice variety Sakha 102 under (80 kg N/fed.) as well as (10 × 20 cm) hill spacing of transplanting gave the tallest plant height in two seasons.

1.3. Number of tillers/m^2 :

Results in Table (1) revealed clearly that the effect of nitrogen levels, hill spacing and mixed rice varieties as well as their interactions on number of tillers/m^2 were significant in both seasons.

Data indicated that number of tillers/m^2 increased significantly as nitrogen level increased up to 60 kg N/fed. The highest value (896.7) in 1998 season and (874.7) in 1999 season was obtained when plants were fertilized with (60 kg N/fed.). These results were always true in both seasons of experimentation and over the two seasons. These results had the same trend in both seasons it could be concluded that rice crop can be fertilized with high nitrogen level up to 60 kg N/fed. This increase clearly indicated the prominent role of nitrogen on vegetative growth and tillering. Similar findings were reported by Sarathe *et al.* (1969), Badawi (1977), Thakur (1993), Abd El-wahab (1998) and Osman (1999).

Data presented in Table (1) show that number of tillers/m^2 significantly increased by wide hill spacing in both seasons. The highest value of this character (1059.9) in 1998 season and (1056.6) in 1999 season were produced by (10 × 20 cm). While the lowest number of tillers (565.6) in 1998 season and (554.4) in 1999 season was recorded when rice varieties sown in narrow hill spacing (20 × 20 cm). These results were always true in both seasons of experiment and over the two seasons. This might be attributed to the lower number of tillers for these early maturity rice varieties. These results are in agreement with those El-Gohary (1998).

Table (1): Effect of nitrogen levels, hill spacing and cultivar mixtures as well as their interaction on 50% heading (days), plant height (cm) and number of tillers/m^2 in 1998 and 1999 seasons.

Main effects and interactions	50% heading (days)		Plant height (cm)		Number of tillers/m^2	
	1998	1999	1998	1999	1998	1999
A. Kg N/fed. (N):						
40	88.24c	88.07c	97.54b	97.83b	746.0c	743.4c
60	91.09b	91.24b	97.71b	99.51a	896.7a	874.7a
80	93.11a	94.29a	97.93a	98.83a	827.2b	822.7b
F. test	**	**	**	**	**	**
B. Hill spacing (cm) (S):						
10 x 20	88.67c	88.71c	98.21a	98.93a	1059.9a	1056.6a
15 x 20	91.09b	91.24b	97.72b	98.63a	845.5b	829.6b
20 x 20	93.49a	93.64a	97.25b	96.61b	565.6c	554.4c
F. test	**	**	**	**	**	**
C. Cultivar mixtures (V):						
Giza 177	93.85a	94.83a	96.83c	96.37c	746.9c	750.4c
Sakha 102	91.52b	91.67b	105.48a	101.3a	814.7ab	804.1bc
50% G.177+50% S.102	89.82c	89.89d	96.87c	96.13c	867.4ab	832.4b
75% G.177+25% S.102	91.11b	90.85c	96.38bc	97.07c	793.5bc	785.8bc
25% G.177+75% S.102	89.11d	89.44d	98.16b	97.71b	894.0a	895.2a
F. test	**	**	**	**	**	**
D. Interactions (F. test only):						
N x S	n.s.	n.s.	n.s.	*	*	*
N x V	**	**	**	**	n.s.	**
S x V	n.s.	n.s.	**	*	**	**
N x S x V	n.s.	n.s.	n.s.	**	n.s.	n.s.

n.s. : Not significant * : Significant at 5% ** : Significant at 1%
Mean followed by common letter are not significantly different in the 5% level by DMRT.

Analysis of variance in Table (1) indicated significant difference among the cultivar mixtures rice in number of tillers/m^2 in the two growing seasons. The highest number of tillers/m^2 (894.0) in 1998 season and (895.2) in 1999 season was obtained by mixed rice variety 25% Giza 177 with 75% Sakha 102, while the lowest one (746.9) in 1998 season and (750.4) in 1999 season was produced with pure rice variety Giza 177 in both seasons. So, cultivar mixture such as 25% Giza 177 with 75% Sakha 102, 50% Giza 177 with 50% Sakha 102 and 25% Sakha 102 with 75% Giza 177 was superior to the other pure rice varieties Giza 177 and Sakha 102 it was clear that all cultivar mixtures rice under this study produced a lot of numbers of tillers/m^2 compared with the pure rice varieties.

2. Yield and yield components :

2.1. Number of panicles/m^2 :

Results in Table (2) revealed clearly the effect of nitrogen levels, hill spacing and mixed rice varieties as well as their interactions on number of panicles/m^2.

The data reported in Table (2) show that number of panicles/m^2 was significantly increased by increasing nitrogen fertilizer level up to 60 kg N/fed. The highest value (699.89) in 1998 season and (697.87) in 1999 season was obtained when plants were fertilized with 60 kg N/fed. While the lowest value (630.20) in 1998 season and (640.24) in 1999 season was obtained when plants were fertilized with 40 kg N/fed. These results were always true in both seasons of experimentation. This increment clearly indicated prominent role of nitrogen on vegetative growth tillering and fertility in rice. These findings were in accordance with those obtained by El-Kalla *et al.* (1992).

Data presented in Table (2) show that number of panicles/m^2 was significantly decreased from narrow to wide hill spacing in both seasons. So, the highest value of this character (871.11) in 1998 season and (871.11) in 1999 season was produced by narrow hill spacing (10 × 20 cm), while the lowest number of panicles/m^2 (469.44) in 1998 season and (472.78) in 1999 season was recorded when rice varieties were sown in narrow hill spacing (20 × 20 cm) in both seasons. These results are in agreement with those of El-Gohary (1998).

Table (2): Effect of nitrogen levels, hill spacing and cultivar mixtures as well as their interaction on No. of panicles/m^2, panicle weight (g), Panicle length (cm) and No. of Filled grains/panicle in 1998 and 1999 seasons.

Main effects and interactions	No. of Panicle/m^2		Panicle weight (g)		Panicle length (cm)		No. of filled grains/panicle	
	1998	1999	1998	1999	1998	1999	1998	1999
A. Kg N/fed. (N):								
40	630.20b	640.24a	3.76ab	3.75n	22.13c	21.66c	129.33b	132.68b
60	699.89a	697.87a	3.85a	3.84a	23.98a	23.67a	138.09a	143.82
80	666.29ab	663.87a	3.66b	3.66c	22.92b	22.68b	127.76b	134.78b
F. test	**	**	**	**	**	**	**	**
B. Hill spacing (cm) (S):								
10 × 20	871.11a	871.11a	3.67b	3.66b	22.02b	21.28c	125.29c	128.80c
15 × 20	655.82b	658.09b	3.80a	3.67a	23.17a	22.86b	138.91a	146.20a
20 × 20	469.44c	472.78c	3.81a	3.80a	23.84a	23.86a	130.97b	136.29b
F. test	**	**	**	**	**	**	**	**
C. Cultivar mixtures (V):								
Giza 177	625.63d	640.52c	3.61c	3.61c	21.67c	19.56c	122.56d	122.59d
Sakha 102	658.19c	655.74bc	3.75b	3.74b	22.57b	22.61b	124.96cd	130.96c
50% G.177+50% S.102	686.85b	685.00ab	3.77b	3.78b	24.44a	24.59a	139.41b	144.96b
75% G.177+25% S.102	651.44c	652.04bc	3.72b	3.72v	22.17bc	21.25bc	127.67c	133.92c
25% G.177+75% S.102	705.19a	603.33a	3.92a	3.91a	24.47a	25.34a	144.04a	153.04a
F. test	**	**	**	**	**	**	**	**
D. Interactions (F. test only):								
N × S	n.s.	n.s.	*	**	*	n.s	*	*
N × V	**	n.s	**	**	*	*	n.s.	**
S × V	n.s.	n.s.	**	**	**	n.s	**	**
N × S × V	n.s.	n.s.	n.s.	*	*	n.s	**	n.s.

n.s. : Not significant * : Significant at 5% ** : Significant at 1%
Mean followed by common letter are not significantly different in the 5% level by DMRT.

Analysis of variance in Table (2) indicated that there were significant differences among the five varieties treatments in number of panicles/m^2 in the two growing seasons. The highest number of panicles/m^2 (705.19) in 1998 season and (703.33) in 1999 season was obtained by 75% Sakha 102 with 25% Giza 177 mixed rice variety. While the lowest number of panicles/m^2 (625.63) in 1998 season and (640.52) in 1999 season was produced by Giza 177 pure rice variety in both seasons. These results are in line with those obtained by El-Gohary (1998). These results indicated that the mixed rice variety 75% Sakha 102 with 25% Giza 177 under (60 kg N/fed.) as well as (15 × 20 cm) hill spacing of transplanting gave the highest number of panicles/m^2 in the two seasons.

2.2. Panicle weight (g) :

Results in Table (2) revealed clearly that the effect of nitrogen levels, hill spacing and cultivar mixtures rice as well as their interactions on panicle weight were significant in both seasons.

Data revealed that the panicle weight (g) significantly increased as nitrogen level increased up to 60 kg N/fed. The heaviest panicles (3.85g) in 1998 season and (3.84 g) in 1999 season was obtained when plants were fertilized at the rate of 60 kg N/fed. While the lightest panicle (3.66 g) in 1998 season and (3.66 g) in 1999 season was obtained when plants were fertilized with 80 kg N/fed. These results were always true in both seasons of experimentation. This might be due to the favourable effect of nitrogen on rice plants. The present finding is in agreement with those obtained by Badawi and Mahrous (1985), but these results were in unagreement with those obtained by Abd El-Rahman *et al.* (1986).

Data in Table (2) showed that panicle weight significantly increased by wide hill spacing in both seasons. So, the heaviest panicle (3.81 g) in 1998 season and (3.80 g) in 1999 season was obtained where rice varieties were sown in wide hill spacing (20 × 20 cm) in both seasons. While the lightest (3.67 g) in 1998 season and (3.66 g) in 1999 season was obtained when plant were sown in narrow hill spacing (10 × 20 cm) in both seasons.

Analysis of variance in Table (2) indicated that there were significant differences among the cultivar mixtures rice in panicle weight in two growing seasons. The heaviest panicle (3.92 g) in 1998 season and (3.91 g) in 1999 season was obtained from 25% Giza 177 with 75% Sakha 102 mixed rice variety. While the lightest panicle weight (3.61 g) in 1998 season and (3.61 g) in 1999 season was obtained by Giza 177 pure rice variety in both seasons. Rice varieties such as 50% Giza 177 with 50% Sakha 102 was (3.77 g) in 1998 season and (3.78 g) in 1999 season and 75% Giza 177 with 25% Sakha 102 was (3.72 g) in 1998 season and (3.72 g) in 1999 season as compared with the pure rice variety Sakha 102 was (3.75 g) in 1998 season and (3.74 g) in 1999 season.

2.3. Panicle length (cm) :

Results in Table (2) revealed clearly that the effect of nitrogen levels, hill spacing and cultivar mixtures rice as well as their interactions on panicle length (cm) were significant in both seasons.

Data in Table (2) indicated that panicle length (cm) significantly increased by increasing nitrogen level up to 60 kg N/fed. in both seasons. So, the longest panicle (23.98 cm) in 1998 season and (23.67 cm) in 1999 season was obtained when plants were fertilized with 60 kg N/fed. While the shortest panicle (22.13 cm) in 1998 season and (21.66 cm) in 1999 season was obtained when plants was fertilized with 40 kg N/fed. These results were always true in both seasons of experimentation and over the two seasons. This might be due to favourable effect of nitrogen on rice plants and this in turn encouraged the growth of rice plants and subsequently the excersion of panicle. The present finding is in agreement with obtained by Sarathe *et al.* (1969), Badawi and Mahrous (1985) and Osman (1999), but these results

were unagreement with those obtained by Abd El-Rahman *et al.* (1986) and Thakur (1993).

Table (2) showed that panicle length significantly increased by wide hill spacing in both seasons. So, the tallest panicle length (23.84 cm) in 1998 season and (23.86 cm) in 1999 season was recorded when rice varieties were sown in wide hill spacing (20 × 20 cm) in both seasons. While the shortest panicle length (22.02 cm) in 1998 season and (21.28 cm) in 1999 season was produced by narrow hill spacing (10 × 20 cm). This might be attributed to the tallest panicle length for the genetic constitution for early maturity rice varieties. The present finding is in agreement with those obtained by El-Gohary (1998).

Analysis of variance in Table (2) indicated that there were significant differences among cultivar mixtures rice in panicle length in the two growing seasons. The tallest panicle length (24.47 cm) and (25.34 cm) respectively in 1998 and 1999 seasons was obtained from 25% Giza 177 with 75% Sakha 102 mixed rice variety. While the shortest panicle length (21.67 cm) and (19.67 cm) respectively in 1998 and 1999 seasons was obtained by Giza 177 pure rice variety. So, as well as the mixed rice varieties such as 25% Sakha 102 with 75% Giza 177 was (22.17 cm) and (21.17 cm) respectively in both seasons and 50% Giza 177 with 50% Sakha 102 was (24.44 cm) and (24.59 cm) respectively in 1998 and 1999 seasons compared with the pure rice variety such as Sakha 102 was (22.57 cm) and (22.61 cm) respectively in 1998 and 1999 seasons.

2.4. Number of filled grains/panicle :

Results in Table (2) revealed clearly that the effect of nitrogen levels, hill spacing and cultivar mixtures as well as their interactions on number of filled grains per panicle were significant in both seasons.

Data indicated that the highly significant effect of nitrogen on number of filled grains/panicle was recognized. So, the highest number of filled grains/panicle (138.09) in 1998 season and (143.82) in 1999 season was obtained when plants were fertilized by 60 kg N/fed. While the lowest number of filled grains/panicle (129.33) in 1998 season and (132.68) in 1999 season was obtained when plants was fertilized with 40 kg N/fed. These results were consistence in both seasons of experimentation and over the two seasons. This increase might be attributed to favourable effect of nitrogen fertilizer on panicle length and number of branches/panicle. Similar results were obtained by Badawi and Mahrous (1985) and Thakur (1993). But these results were in unagreement with those obtained by Mahrous *et al.* (1986) and Koriem *et al.* (1992).

Data in Table (2) showed that the effect of hill spacing on number of filled grains/panicle was significant in both seasons. It was clear that the highest number of filled grains/panicle (138.91) in 1998 season and (146.2) in 1999 season was obtained by medium hill spacing (15 × 20 cm), while the lowest number of filled grains/panicle (125.29) in 1998 season and (128.8) in 1999 season by lowest hill spacing (10 × 20). These results were always true in both seasons of experimentation. That might be to the more rice plants in the dense sowing became crowdy and number of spikelets/panicle became

less as well as filled grains/panicle became lowest than wider hill spacing (15 × 20 cm) and (20 × 20 cm). These results are in harmony with those obtained by Lee *et al.* (1988) and El-Gohary (1998). They reported that number of filled grains/panicle decreased with closer spacing.

Analysis of variance in Table (2) indicated that the differences among the cultivar mixtures in the degree of filled grains/panicle were significant in both seasons. The highest number of filled grains/panicle (144.04) in 1998 season and (153.04) in 1999 season was obtained from mixed rice variety 25% Giza 177 with 75% Sakha 102, while the lowest number of filled grains/panicle (122.56) in 1998 season and (122.59) in 1999 season was obtained from pure rice Giza 177 as well as other cutlivar mixtures such as 50% Giza 177 with 50% Sakha 102 was (139.41) in 1998 season and (144.96) in 1999 season and 25% Sakha 102 with 75% Giza 177 was (127.67) in 1998 and (133.92) in 1999 season compared with the pure rice variety Sakha 102 was (124.96) in 1998 season and (130.96) in 1999 season.

2.5. 1000-grain weight (g) :

Results in Table (3) revealed clearly the effect of nitrogen levels, plant spacing and mixed rice varieties as well as their interactions on 1000-grain weight in both seasons.

Data revealed that the 1000-grain (g) significantly increased as nitrogen level increased up to 60 kg N/fed. The highest 1000-grain weight value (28.73g) in both seasons was recorded when nitrogen fertilizer was applied in the rate of 60 kg N/fed. While the lowest 1000-grain weight value (27.96 g) in 1998 season and (27.91 g) in 1999 season was obtained when plants were fertilized by 80 kg N/fed. These results were always true in both seasons and over the two seasons. The increase in the 1000-grain weight could be attributed to the fact that nitrogen fertilizer increased. The amount of photosynthetic accumulation by plants to which the dry matter content is a reliable index, and this in turn might account much for the superiority of 1000-grain weight. This could be in line with the results found by Thakur (1993).

Data in Table (3) show that 1000-grain weight was significantly decreased by increasing hill density in both seasons. So, the highest value of this character (28.83 g) in 1998 season and (28.72 g) in 1999 season was produced by the medium hill spacing (15 × 20 cm), while the lowest 1000-grain weight (27.93 g) in 1998 season and (27.74 g) in 1999 season was recorded when rice varieties were sown in narrow hill spacing (10 × 20 cm) in both seasons.

The differences among five mixed rice varieties treatments in 1000-grain weight were significant in both seasons Table (3). The highest 1000-grain weight (28.91 g) in 1998 season and (28.86 g) in 1999 season was obtained by mixed rice variety 25% Giza 177 with 75% Sakha 102. While the lowest 1000-grain weight (27.68 g) in 1998 season and (27.88 g) in 1999 season was obtained from Giza 177 pure rice variety in both seasons. As well as other mixed varieties such as 50% Giza 177 with 50% Sakha 102 was (28.61 g) in 1998 season and (28.44 g) in 1999 season. While the pure rice variety such as Sakha 102 was (28.23 g) in 1998 season and (28.18 g) in

1999 season. The five rice varieties treatments had the same trend also under the different nitrogen levels and hill spacing in both seasons. These results indicated that the mixed rice variety 25% Giza 177 with 75% Sakha 102 under 60 kg N/fed. of nitrogen level as well as (15 × 20 cm) hill spacing of transplanting in the two seasons was best treatment to gave the highest value of 1000-grain weight.

Table (3): Effect of nitrogen levels, hill spacing and cultivar mixtures as well as their interaction on 1000-grains weight (g), grain yield (t/ha.), biomass yield (t/ha.) and harvest index (%) in 1988 and 1999 season.

Main effects and interactions	1000-grain yield		Grain yield (t/h)		Biomas yield (t/ha)		Harvest index (%)	
	1998	1999	1998	1999	1998	1999	1998	1999
A. Kg N/fed. (N):								
40	28.32b	28.12b	9.00c	9.07b	24.13b	23.60b	37.15b	38.19c
60	28.73a	28.73a	10.73a	11.07a	25.11a	25.00ab	42.58a	44.14a
80	27.96c	27.91b	10.19b	10.73a	25.73a	25.50a	39.48b	41.85b
F. test	**	**	**	**	**	**	**	**
B. Hill spacing (cm) (S):								
10 × 20	27.93c	27.74c	9.90b	10.31b	25.78a	25.80a	38.29b	39.9b
15 × 20	28.83a	28.72a	11.04a	11.02a	24.94b	24.80b	44.19a	44.27a
20 × 20	28.46b	28.30b	8.98c	9.54c	24.28b	23.70c	36.55b	40.01b
F. test	**	**	**	**	**	**	**	**
C. Cultivar mixtures (V):								
Giza 177	27.68c	27.88c	8.28d	8.81d	22.30e	22.20d	37.40c	39.65b
Sakha 102	28.23b	28.18b	9.78c	9.59c	24.28d	24.30c	40.30b	39.38b
50% G.177+50% S.102	28.61a	28.44b	10.45b	11.21b	25.94b	26.20b	40.28b	42.78a
75% G.177+25% S.102	28.25b	27.91c	9.62c	9.92c	25.01c	23.20d	38.28bc	42.56a
25% G.177+75% S.102	28.91a	28.86a	11.71a	11.99a	27.44a	27.90a	42.73a	42.70a
F. test	**	**	**	**	**	**	**	**
D. Interactions (F. test only):								
N × S	**	*	*	**	*	**	n.s	n.s
N × V	**	**	**	**	**	**	*	**
S × V	**	**	**	*	**	**	n.s	**
N × S × V	*	**	**	n.s	n.s.	*	n.s	*

n.s. : Not significant * : Significant at 5% ** : Significant at 1%
Mean followed by common letter are not significantly different in the 5% level by DMRT.

2.6. Grain yield (tons/ha) :

Results in Table (3) reveal clearly the effect of nitrogen levels, hill spacing and mixed rice varieties as well as their interactions on rice grain yield (tons/ha) were significant in both seasons.

Data indicate that rice grain yield (tons/ha) was decreased significantly by the decreased in nitrogen level around the recommended level (60 kg N/fed.) in both seasons. On contrast, the increase of grain yield was obtained by increasing number of hills/m^2 (34 hills/m^2) or the hill spacing of transplanting (15 × 20 cm). The highest grain yield (10.73 and 11.07 tons/ha) in 1998 and 1999 seasons, respectively, were obtained when plants were fertilized with 60 kg N/fed. While the lowest grain yield (9.00 tons/ha) in 1998 season and (9.07 tons/ha) in 1999 season was obtained when the nitrogen

level was 40 kg N/fed. These results were always true in both seasons of experimentation and over the two seasons.

The average grain yield (tons/ha) was significantly affected by hill spacing in both seasons. It was obvious that planting rice varieties in a medium hill spacing (15 × 20 cm) gave the highest grain yield (11.04 tons/ha.) in 1998 season and (11.02 tons/ha) in 1999 season. While the lowest one results from sown rice varieties wide hill spacing (20 × 20 cm) since the average grain yield was (8.93 tons/ha) in 1998 season and (9.54 tons/ha) in 1999 season, respectively.

Also the highest grain yield (11.71 tons/ha) in 1998 season and (11.99 tons/ha) in 1999 season was obtained from mixed varieties 25% Giza 177 with 75% Sakha 102 compared with the pure variety Giza 177 was (8.28 tons/ha.) in 1998 season and (8.81 tons/ha.) in 1999 season and variety Sakha 102 was (9.78 tons/ha) in 1998 seasons and (9.59 tons/ha) in 1999 season as well as other mixed varieties such as 50% Giza 177 with 50% Sakha 102 were (10.45 tons/ha.) in 1998 season and (11.21 tons/ha) in 1999 season and 75% Giza 177 with 25% Sakha 102 was (9.62 tons/ha.) in 1998 season and (9.92 tons/ha.) in 1999 season.

These results indicate that the mixed rice variety 25% Giza 177 with 75% Sakha 102 under 60 kg N/fed. as well as (15 × 20 cm) hill spacing of transplanting in two seasons were the best treatment to gave the highest grain yield because the differences in plant height will increase the photosynthesis rate that will be reflected in the increase of grain yield. These results are in agreement with those obtained by Osman (1999) who showed that the grain yield (tons/ha) was significantly increased by increasing nitrogen level up to 144 kg N/ha in both seasons and El-Ghohary (1998) who found that the average grain yield (tons/ha) was significantly affected by hill spacing in both seasons. It was obvious that planting rice varieties with medium hill spacing (15 × 20 cm) gave the highest grain yield (tons/ha). While, the lowest one resulted from sowing rice varieties with wide hill spacing (20 × 20 cm) in both season. In other side, Rathi *et al.* (1984) found that close spacing (15 × 15 cm) gave significantly higher rice yield than normal (22.5 × 22.5 cm) and wider (30 × 30 cm) hill spacing.

2.7. Biomass yield (ton/ha) :

Results in Table (3) revealed clearly that the effect of nitrogen levels, hill spacing and cultivar mixtures rice as well as their interactions on total biomass (tons/fed.) were significant in both seasons.

Data indicated that total biomass (tons/fed.) decreased significantly by decreased the nitrogen level about (80 kg N/fed.) in both seasons. On contrast, the increase of total biomass by increase number of hills/m2 (50 hills/m2) or the spacing of transplanting (10 × 20 cm). The highest biomass yield (25.73 tons/ha) in 1998 season and (25.5 tons/ha) in 1999 season, was obtained when plants were fertilized with 80 kg N/fed. While the lowest biomass yield (24.13 tons/ha) in 1998 season and (23.6 tons/ha) in 1999 season was obtained when the nitrogen level was 40 kg N/fed. These results were always true in both seasons of experimentation and over the two seasons.

Data in Table (3) indicated clearly that total biomass significantly decreased by decreasing plant density in both seasons. So the highest value of this character was produced by narrow hill spacing (10 × 20 cm) was (25.78 tons/ha) in 1998 season and (25.8 tons/ha) in 1999 season. while, the lowest total biomass was recorded when rice varieties were sown in wide hill spacing (20 × 20 cm) was (24.28 tons/ha) in 1998 season and (23.7 tons/ha) in 1999 season.

Data indicated clearly that there was significant difference among the cultivar mixtures rice under study in biomass yield in the two seasons. Also the highest biomass yield was (27.44 tons/ha) in 1998 season and (27.9 tons/ha) in 1999 season was obtained from mixed varieties 2.5% Giza 177 with 75% Sakha 102 compared with pure variety Giza 177 was (22.3 tons/ha) in 1998 season and (22.2 tons/ha) in 1999 season and variety Sakha 102 was (24.28 tons/ha) in 1998 and (24.3 tons/ha) in 1999 season as well as other mixed variety such as 50% Giza 177 with 50% Sakha 102 was (25.94 tons/ha) in 1998 and (26.20 tons/ha) in 1999 season and 75% Giza 177 with 25% Sakha 102 was (25.01 tons/ha) in 1998 season and (23.2 tons/ha) in 1999 season.

2.8. Harvest index (%) :

Results in Table (3) revealed clearly that the effect of nitrogen levels, hill spacing and cultivar mixtures rice as well as their interactions on harvest index were significant in both seasons.

Data in Table (3) indicated that the harvest index significantly increased by increasing nitrogen level up to (60 kg N/fed.) in both seasons. The highest harvest index value (42.58%) in 1998 season and (44.14%) in 1999 season, was obtained when plants were fertilized with (60 kg N/fed.) While the lowest harvest index value (37.15%) in 1998 season and (38.19%) in 1999 season was obtained when plant were fertilized with 40 kg N/fed. These results were always true in both seasons of experimentation and over the two seasons.

Data presented in Table (3) show that harvest index significantly increased by decreasing plant density in both seasons. So the highest value of this character (44.19%) in 1998 seasons and (44.27%) in 1999 season was produced by the middle hill spacing (15 × 20 cm). While, the lowest harvest index was (38.29%) in 1998 season and (39.90%) in 1999 season was recorded by the narrow hill spacing (10 × 20 cm) but the lowest harvest index was (39.55%) in 1998 season was recorded by the wide hill spacing (20 × 20 cm). These might be attributed to the decrease gradually in total biomes from narrow hill spacing (10 × 20 cm) to the wide hill spacing (20 × 20 cm) and that gave the largest harvest index by decreasing in plant density and also, to the decrease in the moisture spacing and this decrease was reflected on the decrease of biological yield, which gave a greater grain yield and largest harvest index. These results were in agreement with those of Sahu *et al.* (1980) and El-Gohary (1998).

Analysis of variance in Table (3) indicated that there were significant differences among the cultivar mixture rice in harvest index (42.73%) in 1998

season and (42.70%) in 1999 season was obtained by 75% Sakha 102 with 25% Giza 177. as well as, 50% Giza 177 with 50% Sakha 102 mixed were (40.28%) in 1998 and (42.78) in 1999 season. While for Giza 177 and Sakha 102 pure rice varieties were (37.4%) and 39.65%) respectively. However, other mixed rice varieties such as 25% Sakha 102 with 75% Giza 177 was (38.28%) and (42.56%) in both seasons respectively compared to the pure rice varieties.

3- Grain quality tests :

3.1. Hulling percentage :

Results in Table (4) indicated that nitrogen levels, hill spacing and cutlivar mixtures rice as well as their interactions had significant effects on hulling or brown rice percentages in both seasons.

Data presented in Table (4) show that nitrogen levels had a significant effect on hulling percentage in two seasons. The highest percentage of hulling (82.51%) in 1998 season and (82.42%) in 1999 season, was obtained when plant was fertilized with 60 kg N/fed. While the lowest percentage of hulling (81.88%) in 1998 season and (81.90%) in 1999 season was obtained when plant was fertilized with 80 kg N/fed. These results were true in both seasons. This could be attributed to that increasing nitrogen level increased the unfilled grains and increased the hull thickner. The same results were obtained by Osman (1999).

Data presented in Table (4) show that hulling percentage was significantly increased by decreasing plant density in both seasons. So the highest value of this character was produced by wide plant pacing (20 × 20 cm) (82.83%) in 1998 season and (83.91%) in 1999 season while, the lowest hulling percentage was (82.00%) in 1998 season and (82.28%) in 1999 season was recorded when rice varieties were sown in narrow hill spacing (15 × 20 cm) in the two seasons. The recommended level of nitrogen and wide hill spacing were promoted significant improvements in grain quality characteristy, but at the cost of slightly reducing grain yield. These results are in agreement with those of El-Gohary (1998).

Analysis of variance in Table (4) indicated significant differences among the cultivar mixtures rice in hulling percentage on the two growing seasons. The highest hulling percentage (84.36%) in 1998 season and (84.4%) in 1999 season was obtained by 25% Giza 177 with 75% Sakha 102 in mixed rice variety. While the lowest hulling percentage (79.77%) and (79.79%) in both season, respectively was produced by Giza 177 pure rice variety. As well as other mixed rice varieties such as 75% Giza 177 with 25% Sakha 102 gave (82.4%) in 1998 and (82.9%) in 1999 season, while mixed variety 50% Sakha 102 with 50% Giza 177 was (82.45%) in 1998 season and (82.39%) in 1999 season compared with pure varieties Skaha 102 was (82.36%) in 1998 and (82.38%) in 1999 season.

3.2. Milling percentage :

Results in Table (4) indicate that nitrogen levels, hill spacing and mixed rice varieties as well as their interaction on milling percentage wee significant in both seasons.

Data indicate that the milling percentage increased significantly as nitrogen level increased up to 60 kg N/fed. then declined with increasing nitrogen levels beyond that level. The highest milling percentages (74.35 and 74.59%), respectively in 1998 and 1999 seasons, when the plants were fertilized with 60 kg N/fed. While the lowest milling percentages were (73.55 and 73.61%), respectively in 1998 and 1999 seasons when the plants were fertilized with 40 kg N/fed. These results were true in both seasons. The trend of results is in agreement with that of Assey *et al.* (1992) and Osman (1999).

Data in Table (4) show that milling rice percentage was significantly increased by increasing hill spacing in both seasons. So the highest a values of this character were (74.26 and 74.58%), respectively in 1998 and 1999 seasons when the rice varieties were sown in wide hill spacing (20 × 20 cm) in both seasons. While, the lowest values of this character were (73.63 and 73.83%, respectively) in 1998 and 1999 seasons were produced by narrow hill spacing (10 × 20 cm). All these results were true in both seasons. The reduction of grain quality characters with increasing plant density could be attributed to the high competition between plant of dense planting for light and nutrients.

Analysis of variance in Table (4) indicate that the differences among the five rice varieties treatments in milling percentage were significant in the two growing seasons. The maximum milling percentages (74.81 and 74.93%), respectively in 1998 and 1999 seasons were obtained by mixed rice varieties 75% Sakha 102 with 25% Giza 177, while the minimum percentages of this character (72.84 and 73.09%), respectively in 1998 and 1999 seasons were obtained by pure rice variety Sakha 102 in both seasons. The other mixed rice varieties such as 25% Sakha 102 with 75% Giza 177 and 50% Sakha 102 with 50% Giza 177 were (74.06, 74.43, 74.23 and 74.65%), respectively in 1998 and 1999 seasons compared with pure variety Sakha 102 (72.84 and 73.09), respectively in 1998 and 1999 seasons. These results indicate that the mixed rice variety 25% Giza 177 with 75% Sakha 102 under 60 kg N/fed. as well as (20 × 20 cm) hill spacing of transplanting gave the highest milling percentage in the two seasons.

3.3. Head rice percentage :

Results in Table (4) revealed clearly the effect of nitrogen levels, hill spacing and mixed rice varieties as well as their interaction on head rice percentage was significant in both seasons.

It is clear that, head rice percentage was significantly increased by increasing nitrogen level up to 60 kg N/fed. in the two seasons. The highest percentage of head rice was (62.49%) in 1998 season and (63.59%) in 1999 season obtained from the application of 60 kg N/fed. While the lowest percentage of head rice was (60.61) in 1998 season and (61.70) in 1999 season obtained from the application of 80 kg N/fed. These results may be due to the increases in empty grains which was affected by increased level of nitrogen. These results are in disagreement with those of **Gorgy (1995)** who found that head rice percentage tended to increase significantly with increasing nitrogen level.

Table (4): Effect of nitrogen levels, hill spacing and cultivar mixtures as well as their interaction on hulling %, milling % and head rice % in 1998 and 1999 season.

Main effects and interactions	Hulling %		Milling %		Head rice %	
	1998	1999	1998	1999	1998	1999
A. Kg N/fed. (N):						
40	82.41a	82.42a	73.55b	73.61b	61.61ab	62.06ab
60	82.51a	82.48a	74.35a	74.59a	62.49a	63.59a
80	81.88b	81.90b	74.06ab	74.39a	60.61b	61.70b
F. test	**	**	**	**	**	**
B. hill spacing (cm) (S):						
10 × 20	82.01b	82.01b	73.63b	73.83b	60.30c	61.34b
15 × 20	82.00b	82.28b	74.07a	74.38a	61.66b	62.76a
20 × 20	82.83a	83.91a	74.26a	74.58a	63.08a	63.26a
F. test	**	**	**	**	**	**
C. Cultivar mixtures (V):						
Giza 177	79.77c	79.79c	73.99a	74.37a	60.50b	62.04b
Sakha 102	82.36b	82.38b	72.84b	73.09b	61.56ab	63.28ab
50% G.177+50% S.102	82.47b	82.39b	74.23a	74.65a	62.63a	63.78a
75% G.177+25% S.102	82.38b	82.87b	74.06a	74.43a	60.39c	60.57c
25% G.177+75% S.102	84.36a	84.40a	74.81a	74.93a	63.31a	62.57ab
F. test	**	**	**	**	**	**
D. Interactions (F. test only):						
N × S	**	**	**	**	n.s.	*
N × V	**	**	**	**	**	**
S × V	**	**	**	**	**	n.s.
N × S × V	**	**	**	**	n.s.	**

n.s. : Not significant * : Significant at 5% ** : Significant at 1%
Mean followed by common letter are not significantly different in the 5% level by DMRT.

Data in Table (4) show that head rice percentage was significantly increased by increasing hill spacing in both seasons. So the highest head rice percentage was (63.08%) in 1998 seasons and (63.26%) in 1999 season obtained when the rice varieties were sown with hill spacing (20 × 20 cm) in both seasons. While, the lowest value of head rice percentage was (60.30%) in 1998 season and (61.34%) in 1999 season was produced by medium hill spacing (10 × 20 cm). The improve in grain quality, such as head rice percentage could be obtained by decrease hill spacing may be due to the increase in the 1000-grain weight under the same treatments. The present finding is in agreement with those obtained by **El-Rewiny (1996) and El-Gohary (1998).**

Analysis of variance in Table (4) indicate that the differences among the five rice varieties in their head rice percentage were significant in the two growing seasons. The maximum head rice percentage (63.31%) in 1998 season and (62.57%) in 1999 season was obtained by 25% Giza 177 with 75% Sakha 102 mixed rice variety, while the minimum percentage of this character (60.39%) in 1998 season and (60.57%) in 1999 season were obtained from 75% Giza 177 with 25% Sakha 102 mixed rice variety as well as other mixed rice variety such as 50% Giza 177 with 50% Sakha 102 were (62.63%) in 1998 season and (63.78%) in 1999 season. While the pure rice variety such as Sakha 102 was (61.56%) in 1998 season and (63.28%) in

1999 season. While the another pure rice variety Giza 177 were (60.50%) in 1998 and (62.04%) in 1999 season.

The five mixed rice varieties had the same trend under the different nitrogen levels and hill spacing in both seasons. These results indicate that the mixed rice variety 25% Giza 177 with 75% Sakha 102 under 60 kg N/fed. as well as (20 × 20 cm) hill spacing of transplanting in the two seasons was best treatment to give the highest percentage of head rice.

REFERENCES

Abd El-Rahman, A.A.M.; I.R. Aidy and M.M.H. El-Nahal (1986). Productivity of rice as influenced by different planting spaces and nitrogen levels. Proc. 2nd Conf. Agron., Alex., Egypt, Vol. (1): 47-60.

Abd El-Wahab, A.E. (1998). Physiological behavior of some Egyptian rice cultivars under different nitrogen levels. Egypt. J. Appl. Sci., 13 (4).

Aidy, I.R. (2000). Literature presented for African training. May 2000.

Akita, K. and N. Tanaka (1992). Effect of planting density and planting patterns of young seedlings transplanting on the growth and yield of rice plants. Japanese Journal of Crop Science. 61 (1): 80-86. (CF. Rice Abst., 16 (1): 151, 1993).

Assey, A.A.; E.M. En-Nagar; E.H.M. Fayed and E.E. Ibrahim (1992). Varying date and method of planting in rice. I-Effect of yield and yield attributes. II- Effect on some technological between studied characters. Proc. 5th Conf. Agron., Zagazig Egypt, Vol. 1: 150-161.

Badawi, A.T. (1977). Effect of some agronomic practices on chemical and technological properties of seed of some rice varieties, M.Sc. Thesis, Faculty of Agric., Zagazig Univ., Egypt.

Badawi, A.T. and F.N. Mahrous (1985). Optimizing agronomic practices for broadcast seeded rice. J. Agric. Res. Tanta Univ. 11 (2, PP: 268-278.

El-Gohary (1998). Evaluation of some early rice varieties under Egyptian conditions. M.Sc. Thesis, Fac. of Agric., Al-Azhar Univ.

El-Kalla, S.E.; A.A. Leilah and E.M. Saied (1992). Response of nitrogen fertilizer levels on the productivity of some rice cultivars. Proc. 5th Agron. Conf., Zagazig Univ., Vol. 1: 133-144.

El-Rewiny, I.M.O. (1996). Effect of some cultural practices on rice. M.Sc. Thesis, Fac. of Agric., Minufiya Univ. Egypt.

Fehr, W.R. (1987). Applied plant breeding Fourth Edition, Iowa State University.

Gill, *et al.* (1980). Applied plant breeding. Second Edition, Iowa State University.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedures for Agricultural Research. Second Edition. P. 680.

Gorgy, R.N. (1995). Effect of some agricultural treatments on rice yield and quality Ph. D. Thesis, Fac. Agric., Kafr El-Sheikh, Tanta Univ.

IRRI (International Rice Research Institute) (1996). Description for rice. Loss Banos, Laguna, Philippines.

Koriem, M.A.; R.A. Ali; M. Rizk and R.A. Saber (1992). 1- Effect of N forms, rates and methods of application on yield and yield components of rice cultivated in soalt affected clay soil. agric. res. Tanta Univ., 18 (3): 548-558.

Lee, S.Y.; S.S. Kim; J.S. Choi; Y.K. Choi; K.Y. Lee; M.S. Kim and T. Murakomi (1988). Influence of cultural methods and climatic conditions on rice yield in the southern plain area and olpine area. Research Reports of the Rurol Development Administration Rice. Korea Republic 30 (2): 25-31 (C.F. Field Crops Abst. (42): 7783, 1989).

Mahrous. F.N.; A.T. Badawi and J.P. Craigmiles (1985). Management and evaluation of rice cultivar for ratooning. J. Agric. Res. Tanta Univ., 11 (4): PP: 878-883.

Mahrous. F.N.; A.T. Badawi and M.S. Balal (1986). IR1626 long grain rice variety as influonced by sowing dates, seeding spacing and nitrogen levels. Proc. 2nd Conf. Agron., Alex., Egypt, Vol. (1): 115-127.

Osman (1999). Effect of different nitrogen fertilizer levels on some rice cultivars productivity. M.Sc. Thesis, Fac. of Agric. Kafr El-Sheikh, Tanta Univ.

Rathi, G.S.; J.P. Patel and R.S. Sharma (1984). Relative performance of some dwarf varieties on rice (*Oryza sativa*, L.) and their response to spacing and planting pattern. India J. of Agric., 29 (2): 218-221.

Sahu, G.; K.S. Murty and R.S.V. Ral (1980). Effect of seasons, Nitrogen rate and planting density on harvest index in rice. Oryza., 17 (1): P 28-33.

Sarathe, M.L.; K.K. Sharmma and M.N. Shrivastava (1969). Study of yield attributes and heritability in some varieties of rice (*Oryza sativa* L.). Indian J. of Agric. Sci., 39 (9): 925-930.

Son Ta Minh and Ta Minh Trouong (2000). Using variety blend rice in the rice insect-disease control and problem growing rice areas vietnam. 3rd International Crop Science Congress, 2000, 17August, Hamburg, Germany.

Thakur, R.B. (1993). Performance of summer rice (*Oryza sativa*, L.) to varying levels of nitrogen. Indian J. of Agron., 28 (2): 187-190.

Waller, R.A. and D.B. Duncan (1969). Bais rule comparison symmetric multiple comparison problem. Amer. Stat. Assoc. J., A485-1503.

Zhu, Y.; H. Fan; J. Fan; Y. Wang; Y. Li; J. Chem; J. Chen; S. Yang; L. Hu; H. Lenung; T. Mew; P. Teng; Z. Wang and C. Mundt (2000). Genetic diversity and disease control in rice. Nature, V. 460, No. 17, P. 718-722.

تأثير معدلات التسميد الأزوتى ومسافات الشتل ومخاليط الأصناف على بعض صفات الأرز

عيد المغازى الشريف – مجدى حليم – عبدالحميد جليله – محمود عبدالحميد
قسم المحاصيل – كلية الزراعة بكفرالشيخ – جامعة طنطا

أجرى هذا البحث بهدف دراسة تأثير كل من معدلات التسميد الأزوتى – مسافات الشتل ومخاليط الأصناف على صفات النمو والمحصول ومكوناته وصفات جودة الحبوب فى الأرز. حيث أجريت تجربتان حقليتان بمزرعة كلية الزراعة بكفرالشيخ ومعامل تكنولوجيا الحبوب بمركز البحوث والتدريب فى الأرز – سخا – كفرالشيخ وذلك خلال موسمى الزراعة ١٩٩٨، ١٩٩٩م. وكان التصميم المستخدم فى هذه الدراسة هو تصميم القطع المنشقة مرتين فى ثلاث مكررات.

حيث وزعت معدلات التسميد الزوتى فى القطع الرئيسية وهى (٤٠، ٦٠، ٨٠كجم نتروجين/فدان) والقطع المنشقة الأولى وزعت عليها مسافات الشتل وهى (٢٠ × ٢٠، ١٥ × ٢٠، ١٠ × ٢٠سم) والقطع المنشقة الثانية كانت مخاليط أصناف الأرز وهى (جيزه ١٧٧، سخا ١٠٢، ٥٠% سخا ١٠٢ مع ٥٠% جيزه ١٧٧، ٢٥% سخا ١٠٢ مع ٧٥% جيزه ١٧٧، ٧٥% سخا ١٠٢ مع ٢٥% جيزه ١٧٧).

أوضحت النتائج أن صنف الأرز المخلوط (٢٥% جيزه ١٧٧ مع ٧٥% سخا ١٠٢) تحت معدل تسميد ٦٠كجم نتروجين/فدان ومسافات شتل (١٥ ×٢٠سم) أعطى أعلى القيم معنويا فى صفات : عدد الأفرع فى المتر المربع، عدد السنابل بالمتر المربع ، وزن السنبلة – طول السنبلة – عدد الحبوب الممتلئة لكل سنبله – وزن الـ ١٠٠٠ حبه ومحصول الحبوب والقش وأعطت كذلك أعلى معدل من دليل الحصاد.

وكان لها تأثير معنوى كذلك على تحسين صفات الجودة فى الأرز حيث أدت الى زيادة تصافى التقشير وكذلك تصافى التبييض وارتفاع نسبة الحبوب السليمة بعد التبييض.