Yield, Yield Components and Grain Quality of Giza 179 Egyptian Rice Cultivar as Affected by Seeding Rates and Nitrogen Levels using Broadcasting Planting Method

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ABSTRACT

The present study was conducted to evaluate the yield and grain quality of Giza179 rice cultivar as affected by seeding rates (20, 30, 40 and 50 Kg/fed) and nitrogen fertilization levels (0, 20, 40and 60 Kg N/fed) with broadcasting planting method. Two field experiments were carried out at the Experimental Farm of Etai El- Baroud Agricultural Research Station, Behaira Governorate, Agriculture Research Center (ARC) in 2014 and 2015 seasons. The results revealed that seeding rate of 40 kg /fed gave a significantly higher paddy yield of (3.77 -3.79 ton/fed) in both seasons. Nitrogen application at 40 Kg N/fed provided a maximum paddy yield (4.25 and 4.10 ton/fed) in both seasons. The yield and all yield components were significantly affected by seeding rates and nitrogen levels in the two seasons. Regarding quality, the amylose, protein content, elongation, hardness, gel consistency (GC), gelatinization temperature (GT), the rice kernel characteristics, hulling, milling and broken rice were affected by seeding rates and nitrogen levels with insignificant interaction. From the results, it is concluded that using broadcasting planting method for Giza179 Egyptian rice cultivar, higher paddy rice yield, yield components and good quality can be obtained at 40 Kg/fed seeding rate with 40 kg N/fed.

Key words: Seeding rates, nitrogen application levels, broadcasting method, yield, quality, amylose content, *Oryza sativa*, L.

INTRODUCTION

Rice (*Oryza sativa* L.) is the most important and widely cultivated crop in the world. It is grown in more than 100 countries, predominantly in Asia (Depar *et al.,* 2011) and provides 21% and 15% per capita of dietary energy and protein, respectively. Rice crop is grown by many ways depending upon resource availability. Due to resource constraints, especially water and labours, direct seeding under dry condition is now emerging as a new trend in rice cultivation.

Rice occupies a unique position in many countries because for its importance in traditional diets and the main source of income of many peoples in the world. It is considered the most popular and important field crop in Egypt for several reasons as a staple food after wheat, as an exporting crop, as a land reclamation crop for improving the productivity of the saline soils widely spread in northern part of the delta and coastal area, and finally it is a social crop, where every person in the farmers family could find work in rice fields and earn money during the growing season. Rice crop plays a significant role. In Egypt, rice crop is considered a strategic crop for sustaining the food self-sufficiency (Anis *et al*. 2016).

Badr *et. al.* (2007) reported that the maximum seed productivity was obtained by using manual transplanting and big combine and the minimum yield was obtained by using seed drill and manual harvesting.

Nowadays, rice cultivation is done in different ways in the world. The most important cultivation ways are direct seeded and transplanting methods. Direct seeding of rice (DSR) refers to the process of establishing a rice crop from seeds sown in the field rather than by transplanting rice (TPR) seedling from the nursery. There are three principal methods of DSR: dry seeding (sowing dry seeds into dry soil), wet seeding (sowing pre-germinated seeds on wet puddle soils) and water seeding (seeds sown into standing water) (Hassan and Kaviani, 2011). In Asia, conventional TPR has been replaced by dry seed broadcasting (DSR), mainly because of the higher cost of TPR and a shortage of the labor required (Dawe, 2005; Pandey *et al.,* 2002; Tuong *et al.*, 2005).Finally the rice cultivation system in the world is affected by water deficient, low suitable land, and shortages of worker (Nguyen and Ferrero, 2006). At present, 23% of rice is direct-seeded globally (Rao *et al.,* 2007). In addition to higher economic returns, DSR crops are faster and easier to plant, less labor intensive and consume less water (Jehangir *et al.*, 2005; Balasubramanian and Hill, 2002).

Direct seeding is practiced where water supply control is good. Advantages of direct seeding over transplanting include good stand establishment, higher tillering, and sometimes higher grain yield. Other advantages are stable growth and reduced lodging, better pest control, less risk due to drought and flooding damage, and low requirements for better water

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management practices Farooq *et al.* (2007). In contrary, transplanting is more laborious, time-consuming, and expensive than direct seeding. This is because of difficulties in raising seedlings, high cost of labor, and labor shortage (Pandey *et al*. 2002).

Nitrogen plays a vital role in determining the growth and yield potential of crops. According to Ananthi *et al.* (2010), the best rate of mineral fertilizer is that which produces maximum economic return at minimum cost. Nitrogen is one of the most essential macronutrients for rice production and usually, it is one of the most yield limiting in irrigated regions of rice production all over the world (Samonte *et al*. 2006).

The nitrogen deficiency in the Egyptian soils is one of major limiting factor for rice production, as nitrogen is an essential element to the rice plant, with about 75% of leaf N associated with chloroplasts, which are physiologically important in dry matter production through photosynthesis (Abdel Fattah *et al* 2013).

Modern rice cultivars are always responsive to balanced application of fertilizer. Proper management of nitrogen is necessary to improve crop growth and grain yield (Alam *et al.*, 2011). Compared with other mineral nutrients, the optimal rate of nitrogenous fertilizer application is vital to decrease the environmental impact of excessive nitrogen and to increase profitability in crop production (Bilbao *et al*. 2004). In most cases, farmers use imbalanced dose of nitrogenous fertilizer which results in higher incidence of attacks by insects or pests, thereby lowering the yield of rice (Alam *et al*. 2011).

At present, the world is facing the problem of shortage of major fertilizer nutrients especially Nitrogen and Phosphorous. The developing countries like Egypt are more sensitive to this shortage because the fertilizer production in these countries is expensive and less than its demand. Even when the fertilizer supply is satisfactory, the importance of increasing its efficient use cannot be underestimated. The application of nitrogen fertilizer either in excess or less than optimum rate affects both yield and quality of rice to remarkable extent, hence proper management of crop nutrition is of immense importance.

Nitrogen absorbed by rice during the vegetative growth stages contributed in growth during reproduction and grain-filling through translocation (Bufogle *et al.*, 1997; Norman *et al.*, 1992). Nitrogen is very essential for the growth and development of crops. It enhances biomass and seed yield subject to the efficient water supply. Lack of N results stunted growth, pale yellow color, small grain size and poor vegetative as well as reproductive performance. Nitrogen is an essential component of amino acid and related protein of the plant structure. Growth of plants primarily depends on nitrogen availability in soil solution and its utilization by crop plants during growth and development (Awan *et al.* 2011).

Quality of the produce is much important as quantity in all walks of life and particularly in directly consuming commodities. Present investigation was planned to determine the effect of seeding rates combined with different nitrogen levels on the yield, yield components and grain quality of Giza 179 Egyptian rice cultivar using broadcasting planting method.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Farm of Etai El- Baroud Agricultural Research Station, Behaira Governorate, Agriculture Research Center (ARC), during 2014 and 2015 seasons to evaluate the performance of Giza 179 rice cultivar under different seeding rates and nitrogen levels. The experiment was laid out in split plot arrangements under the Randomized Complete Block design using three replications, with seeding rates as the main plots and nitrogen levels as the sub plots.

Four different seeding rates were used for planting with broadcasting method, i.e. (20, 30, 40, and 50 Kg/fed).

Nitrogen fertilizer was applied in the urea form (46.5%N) in two splits (2/3 was applied and mixed in the dry soil before flooding. The remaining 1/3 was added at panicle initiation stage) with different levels, i.e. (0, 20, 40 and 60 Kg N/fed).

Soil samples were taken from experimental site at depth of 0- 30 cm from soil surface. Soil analysis was conducted according to the methods of Black *et al*. (1965). Results of soil analysis were shown in Table (1) for both seasons.

Table 1. physical and chemical analysis of the soil at the experimental site during 2014 and 2015 seasons

Soil properties	2014	2015
Sand %	11.8	12.5
Silt %	20.6	22.4
clay %	67.6	65.1
Soil texture	Clay	Clay
Organic matter %	1.3	1.8
pH	7.5	7.9
EC	1.3	1.7
Total N %	0.23	0.30
Available P ppm	16.2	19.1
Available K ppm	621	645
Available Zn ppm	0.85	1.12
Total soluble salts (mg/L)	10.21	9.45

Grain yield was measured from an area of 12 m^2 (3x4 m) which was harvested from each plot at random; avoiding the border effects. Grain yield was adjusted to 14% moisture content determined according to Yoshida(1981).Ten panicles were randomly collected from each plot to determine 1000-grain weight and number of filled grains/ panicle.

Furthermore, grain quality characters were recorded according to International Rice Research Institute (IRRI 1996).

Data collected were subjected to statistical analysis of variance according to Gomez and Gomez (1984) using SAS program, version 8.0.

RERSULTS AND DISCUSSION

Data in table (2) revealed that number of filled grains/ panicle, number of panicles/m^2, 1000 grain weight and grain yield were significantly affected by using different seeding rates during both seasons. The paddy yield was significantly affected by increase seeding rate up to 40 Kg S/fed and gave the highest yield (3.77 and 3.79t/fed) in 2014 and 2015 seasons respectively, while the lowest values obtained at 20 Kg Seeds/fed (3.58 and 3.30 t/fed) in 2014 and 2015 seasons, respectively. These results were in harmony with Ali Abou Khalifa *et al.* (2014). Generally, increasing nitrogen rates significantly enhanced the paddy yield over the control in both seasons, and the best results obtained from using 40 kg N/fed that recorded the highest yield (4.25 and 4.10 t/fed) in 2014 and 2015 seasons, respectively. Similar results were obtained by Sultan *et al.* (2014).

Data indicated that number of filled grains/ panicle was affected significantly with different seeding rates. The highest values (93.00 and 91.08) produced at 50 Kg seeds/fed in 2014 and 2015 sesons. In the reverse trend, the lowest values (76.67 and 74.58) resulted from 20 Kg seeds /fed in the first and second seasons, respectively. These results are in agreement with those reported by Abou Khalifa *et al*. (2005), and El-Khoby (2004).

Number of filled grains/ panicle was affected significantly with different nitrogen levels. Nitrogen fertilizer application at 40 Kg/fed recorded the highest number of filled grains /panicle (93.58 and 92.08) in 2014 and 2015 seasons. Conversely the lowest values of filled grains /panicle (71.33 and 70.25) resulted from control treatment in the two successive seasons. Similar findings have been reported by Bhowmick and Nayak (2000), Nawaz (2002), Namba (2005). Increasing number of grains per panicle that obtained in treatments receiving higher nitrogen rates were probably due to better nitrogen status of plant during panicle growth period.

The highest number of panicles/m² (370.2 and 370.5) were recorded with seeding rate of 50 Kg seeds/fed in 2014 and 2015 seasons, respectively. In the reverse trend, the lowest values (319.8 and 318.1) were recorded with seeding rate 20 Kg S/fed in the first and second seasons, respectively Table (2). These results are in a good harmony with those reported by Sharief *et al*. (2000) and Abou Khalifa *et al.* (2005).

Data presented in Table (2) showed that the variation in nitrogen fertilization levels induced highly significant differences in number of panicles/m² in both seasons. The highest number of panicles/m^2 (364.3 and 365.5) were recorded with the treatment of 40 kg N/fed, in the first and second seasons, respectively,

Table 2. Grain Yield and its components characters of Giza 179 rice cultivar as affected by different seeding rates and nitrogen levels during 2014 and 2015 seasons

Main effects & interaction	Number of filled grains/panicle		Number of panicles/m^2		1000 grain weight (gm)		Grain yield (ton/fed)	
	2014	2015	2014	2015	2014	2015	2014	2015
Seeding rate (S):								
20 Kg/fed	76.67	74.58	319.8	318.1	23.02	22.65	3.58	3.30
30 Kg/fed	80.08	78.92	343.7	340.6	23.05	22.86	3.70	3.44
40 Kg/fed	93.00	91.08	370.2	370.5	23.87	23.61	3.77	3.79
50 Kg/fed	85.58	85.33	365.4	364.4	23.52	23.53	3.75	3.76
$L.S.D_{0.05}$	3.071	0.104	3.578	5.468	0.175	0.422	0.127	0.137
Nitrogen levels (N):								
Control	71.33	70.25	334.5	330.1	19.72	19.57	2.40	2.41
20 Kg N/fed	82.08	81.00	346.0	343.7	24.28	24.03	4.05	3.78
40 Kg N/fed	93.58	92.08	364.3	365.5	25.11	24.83	4.25	4.10
60 Kg N/fed	88.33	86.58	354.3	354.2	24.35	24.22	4.05	3.99
$L.S.D_{0.05}$	2.02	2.13	3.34	4.09	0.31	0.24	0.09	0.05
Interaction:								
S x N	**	**	**	**	**	**	**	**

while lowest numbers of panicles(334.5 and 330.1) were found in the non-fertilized plots in the two successive seasons. Similar results were obtained by El-Kassaby *et al.* (2012).

The 1000-grain weight was affected significantly with different seeding rates. The highest values were obtained (23.87 and 23.61 g) with seeding rate at 50 Kg /fed in 2014 and 2015 seasons, respectively, however, the lowest values were obtained (23.02 and 22.65 g) with seeding rate 20 Kg /fed in the first and second seasons, respectively. Similar results were obtained by Sharief *et al.* (2000) and Abou Khalifa *et al*. (2005)

The 1000-grain weight was affected significantly with different nitrogen levels. .Nitrogen application at 40 Kg/fed recorded the highest values (25.11 g and 24.83 g) in 2014 and 2015 seasons, however, the lowest values (19.72 and 19.57 g) were produced by control treatment in both seasons, respectively. Similar finding have been reported by Bhowmick and Nayak (2000),

Gorgy (2007),Awan *et al*. (2011), and Yousef *et al*. (2012),

Increase the grain weight at higher nitrogen rates might be primarily due to increase in chlorophyll content of leaves which led to higher photosynthetic rate and ultimately plenty of photosynthesis available during grain development.

Data in Table (3) showed that seeding rate × nitrogen level interactions had highly significant effects on grain yield, number of filled grains, numbers of panicles/m^2 and 1000-grain weight in the two growing seasons. It was clear that the interaction between 40 kg seeds/fed seeding rate under 40 Kg N/fed gave the highest value of grain yield (4.45 and 4.50 t/fed), number of filled grains/panicle (114.67 and 109.67), numbers of panicles/m^2 (401.67 and 410.00) and 1000-grain weight (25.30 and 25.06 g) in 2014 and 2015 seasons, respectively. These results are in harmony with those obtained by Abdel-Hamed (2005) and Salem *et al.* (2011).

Table (4) indicated that no significant difference was observed in traits hulling %, milling% and broken rice% traits at different seeding rates in both seasons. On the other hand, nitrogen application scheduling had significant effect on these traits. The highest hulling % values (79.51and 79.60%) resulted from 40 Kg N/fed application in 2014 and 2015 respectively, however, the lowest values (78.65 and 78.59%) resulted from the control treatment in 2014 and 2015 seasons, respectively. Where, the highest milling % values (70.55and 70.50%) resulted from 40 Kg N/fed application in 2014 and 2015 respectively, however, the lowest values (69.77 and 69.56 %) resulted from the control treatment in 2014 and 2015 seasons, respectively. Hulling%, milling % were increased with increasing nitrogen levels and the best results were recorded with 40 Kg N/fed application.

Table 3. The interaction between seeding rates and nitrogen levels effect on yield and yield components characters during 2014 and 2015 seasons

Seeding rate (Kg)	Nitrogen levels (Kg N/fed)	Number of filled grains/panicle		Number of panicles/m^2		1000 grain weight (gm)		Grain yield (t/fed)	
		2014	2015	2014	2015	2014	2015	2014	2015
20	Control	65.33	61.33	309.33	304.33	18.73	18.60	2.13	1.90
	20	79.00	78.00	319.33	318.67	24.26	23.56	3.98	3.65
	40	80.00	79.00	325.33	328.33	25.20	24.73	4.18	3.88
	60	82.33	80.00	325.00	321.00	24.03	23.70	4.03	3.77
30	Control	71.00	73.00	331.67	327.00	18.50	18.30	2.60	2.46
	20	81.00	80.33	344.33	342.67	24.33	24.16	3.88	3.67
	40	84.33	81.33	349.67	343.00	24.96	24.73	4.20	3.81
	60	84.00	81.00	349.33	347.00	24.30	24.26	4.11	3.79
40	Control	74.67	75.33	346.00	341.33	20.83	20.80	2.33	2.56
	20	86.00	82.67	361.00	359.33	24.86	24.20	4.20	3.80
	40	114.67	109.67	401.67	410.00	25.30	25.06	4.45	4.50
	60	96.67	96.67	372.33	371.67	24.50	24.36	4.01	4.26
50	Control	74.33	71.33	351.33	348.00	20.83	20.60	2.53	2.70
	20	82.33	83.00	359.33	354.33	23.66	24.20	4.20	3.99
	40	95.33	98.33	380.67	378.00	24.96	24.76	4.26	4.21
	60	90.33	88.67	370.33	377.33	24.60	24.53	4.12	4.17
L.S.D 0.05		4.68	3.75	6.46	8.18	0.58	0.48	0.20	0.19

Table 4. Hulling%, milling%and broken rice% of Giza 179 rice cultivar as affected by seeding rates and nitrogen levels during 2014 and 2015 seasons

Main effects & interaction	Hulling %		Milling %		Broken rice %	
	2014	2015	2014	2015	2014	2015
Seeding rate (S):						
20 Kg/fed	78.94	78.95	70.05	69.95	12.57	11.62
30 Kg/fed	79.01	79.03	70.16	69.96	12.14	11.42
40 Kg/fed	79.25	79.21	70.30	70.11	11.96	10.95
50 Kg/fed	79.16	79.01	70.22	70.21	11.98	11.21
$L.S.D_{0.05}$	n.s	n.s	n.s	n.s	n.s	n.s
Nitrogen levels (N):						
Control	78.65	78.59	69.77	69.56	12.55	11.95
20 Kg N/fed	78.77	78.52	69.94	69.82	12.04	11.54
40 Kg N/fed	79.51	79.60	70.55	70.50	12.10	11.43
60 Kg N/fed	79.41	79.49	70.46	70.36	11.94	11.27
$L.S.D_{0.05}$	0.22	0.25	0.24	0.23	0.11	0.18
Interaction:						
S x N	n.s	n.s	n.s	n.s	n.s	n.s

The brews data are in a good harmony with those reported by Singh *et al.* (2015).Broken rice % decreased with increasing nitrogen levels,

however, the highest broken rice % values (12.55 and 11.95 %) resulted from the control treatment in 2014 and 2015 respectively, however, the lowest values (11.94 and 11.27 %) resulted from 60 Kg N/fed application in 2014 and 2015 seasons, respectively.

Data in table (5), showed the effect of both seeding rates and nitrogen levels on physical properties of the grains during 2014 and 2015 seasons. Grain length was significantly affected with different seeding rates. The highest grain length values (5.43 and 5.33 mm) resulted from 40 Kg seeds/fed in 2014 and 2015 reasons respectively, however, the lowest grain length values (5.30 and 5.20 mm) resulted from 20 Kg seeds/fed in 2014 and 2015 reasons respectively. The grain width (mm) was insignificantly affected with different seeding rates in both seasons. Significant difference was conducted at grain thickness (mm) in 2014 and 2015 seasons, respectively. The highest grain thickness values (1.94 and 1.91 mm) resulted from 40 Kg seeds/fed in 2014 and 2015 reasons respectively, however, the lowest grain length values (1.89 and 1.86 mm) resulted from 20 Kg seeds/fed in 2014 and 2015 reasons respectively. The grain shape (L/W ratio) was insignificantly affected with different seeding rates in both seasons.

However, application of various nitrogen levels significantly affected grain length in both seasons. However, increasing levels of nitrogen increased grain length over the control. The maximum grain length value (5.44 and 5.35 mm) resulted from 60 Kg N/fed application in 2014 and 2015 seasons, respectively. There were significant differences in grain width among nitrogen rates during two seasons, maximum grain width (2.55 and 2.52mm) were recorded with the application of 40 and 60 kg N/fed in 2014 and 2015 seasons, respectively. The grain thickness recorded maximum values (1.95 and 1.93 mm) with the application of 60 kg N/fed in 2014 and 2015 seasons, respectively. Grain length width ratio was not significantly affected by nitrogen levels in both study seasons. These results are in line with those of Maqsood *et,al*. (2013). The interaction between the different seeding rates and nitrogen levels application was not significant.

Means of protein content, gel consistency and gelatinization temperature during 2014 and 2015 seasons are presented in table (6). Protein content was affected by different seeding rates, where, the highest values (8.64 and 8.66%) resulted from sowing 40 Kg seeds/fed in 2014 and 2015 respectively, however, the lowest values (8.36 and 8.35%) resulted from 20 Kg seeds/fed in 2014 and 2015seasons, respectively. Also, protein content was significantly affected by different nitrogen levels. The highest values (8.59 and 8.60 %) resulted from 40 Kg N/fed application in 2014 and 2015seasons, respectively. However, the lowest values (8.45 and 8.32%) resulted from control treatment in 2014 and 2015 seasons, respectively. These results are in harmony with those reported by Ahmed *et al*. (2009).

Seeding rates did not affect the gel consistency in the 2014 season. However, there were significant difference in gel consistency among seeding rates during 2015 season, the highest value 88.67mm resulted from 50 Kg Seeds/fed , however, the lowest value 87.17mm resulting from 20 Kg Seeds/fed in 2015 season. Data in table (6) showed that gel consistency was significantly affected by different nitrogen levels.

Table 5. Grain length, width, thickness and shape of Giza 179 rice cultivar as affected by seeding rates and nitrogen levels during 2014 and 2015 seasons

Main effects & interaction	Grain length (mm)		Grain width (mm)		Grain thickness (mm)		Grain shape (L/w ratio)	
	2014	2015	2014	2015	2014	2015	2014	2015
Seeding rate (S):								
20 Kg/fed	5.30	5.20	2.49	2.44	1.89	1.86	2.13	2.16
30 Kg/fed	5.38	5.28	2.54	2.47	1.90	1.88	2.12	2.14
40 Kg/fed	5.43	5.33	2.47	2.43	1.94	1.91	2.16	2.16
50 Kg/fed	5.32	5.25	2.49	2.46	1.93	1.90	2.13	2.14
$L.S.D_{0.05}$	0.02	0.03	n.s	n.s	0.02	0.02	n.s	n.s
Nitrogen levels (N):								
Control	5.27	5.24	2.46	2.40	1.87	1.85	2.14	2.15
20 Kg N/fed	5.31	5.29	2.48	2.44	1.89	1.87	2.14	2.14
40 Kg N/fed	5.35	5.30	2.55	2.49	1.94	1.91	2.13	2.15
60 Kg N/fed	5.44	5.35	2.51	2.52	1.95	1.93	2.14	2.16
$L.S.D_{0.05}$	0.06	0.03	0.03	0.01	0.01	0.02	n.s	n.s
Interaction:								
S x N	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s

Table 6. Protein content, Gel Consistency and Gelatinization Temperature of Giza 179 rice cultivar as affected by seeding rates and nitrogen levels during 2014 and 2015 seasons

Main effects & interaction	Protein%		G.C		G.T (spreading)		G.T (clearing)	
	2014	2015	2014	2015	2014	2015	2014	2015
Seeding rate (S):								
20 Kg/fed	8.36	8.35	90.25	87.17	5.09	4.86	4.22	4.14
30 Kg/fed	8.54	8.50	90.33	87.66	5.15	4.96	4.34	4.23
40 Kg/fed	8.64	8.66	91.17	88.25	5.31	5.13	4.45	4.32
50 Kg/fed	8.49	8.52	90.75	88.67	5.27	5.06	4.36	4.24
$L.S.D_{0.05}$	0.03	0.12	n.s	0.96	0.16	0.11	n.s	0.11
Nitrogen levels (N):								
Control	8.45	8.32	88.33	84.75	4.90	4.68	4.18	4.09
20 Kg N/fed	8.51	8.47	90.17	88.42	5.15	4.93	4.30	4.17
40 Kg N/fed	8.59	8.60	92.67	89.50	5.47	5.32	4.46	4.34
60 Kg N/fed	8.50	8.57	91.33	89.08	5.30	5.09	4.44	4.32
$L.S.D_{0.05}$	0.04	0.03	1.19	1.24	0.20	0.14	0.10	0.10
Interaction:								
S x N	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s

The highest values (92.67 – 89.50 mm) resulted from 40 Kg N/fed application in 2014 and 2015 seasons,

however, the lowest values (88.33,-84.75 mm) resulted from control treatment in 2014 and 2015 seasons respectively. These results are in line with those obtained with Abdel-Salam et, al. (2014).

Gelatinization temperature (spreading and clearing) determines water absorption and the time required for cooking. It may also reflect the hardness of rice starch granules for cooking, Badawi (2002).However, spreading was affected by different seeding rates, where, the highest values (5.31 and 5.13) resulted from sowing 40 Kg seeds/fed in 2014 and 2015 respectively, however, the lowest values (5.9 and 4.86) resulted from 20 Kg seeds/fed in 2014 and 2015seasons, respectively.

Also, spreading was significantly affected by different nitrogen levels. The highest values (5.47 and 5.32) resulted from 40 Kg N/fed application in 2014 and 2015seasons, respectively. However, the lowest values (4.90 and 4.68) resulted from control treatment in 2014 and 2015 seasons, respectively. These results are agreement with those reported by Pang (2016).

Clearing was not affected by different seeding rates in 2014 season, but was affected by different seeding rates, where, the highest values 4.32 resulted from

Table 7. Hardness, Elongation and amylose content of Giza 179 rice cultivar as affected by seeding rates and nitrogen levels during 2014 and 2015 seasons

Main effects & interaction	Hardness		Elongation		Amylose	
	2014	2015	2014	2015	2014	2015
Seeding rate (S):						
20 Kg/fed	5.20	5.06	53.50	51.50	18.85	18.68
30 Kg/fed	5.25	4.90	54.06	51.25	18.90	18.78
40 Kg/fed	5.55	5.16	55.92	53.58	19.10	18.90
50 Kg/fed	5.53	5.15	55.25	52.25	19.06	18.85
$L.S.D_{0.05}$	n.s.	n.s.	1.45	1.68	0.12	0.09
Nitrogen levels (N):						
Control	4.60	4.33	54.17	51.33	18.67	18.39
20 Kg N/fed	5.18	4.75	54.25	51.58	18.86	18.68
40 Kg N/fed	5.83	5.50	55.25	53.92	19.30	19.17
60 Kg N/fed	5.96	5.60	55.08	51.75	19.10	18.96
$L.S.D_{0.05}$	n.s.	0.16	n.s.	1.23	0.17	0.16
Interaction:						
S x N	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

sowing 40 Kg seeds/fed in 2015, however, the lowest value 4.14 resulted from 20 Kg seeds/fed in2015season. However, clearing was significantly affected by different nitrogen levels. The highest values (4.46 and 4.34) resulted from 40 Kg N/fed application in 2014 and 2015seasons, respectively. However, the lowest values (4.18 and 4.09) resulted from control treatment in 2014 and 2015 seasons, respectively. Similar results were reported by Kong (2015). There was no interaction between the different seeding rates and nitrogen levels application.These results are harmony with reported by Abdel-Salm *et, al*. (2014).

Hardness, elongation and amylose content results are presented in Table (7). Regarding nitrogen levels effect, the highest values of hardness were 5.96 with 60 Kg N/fed in 2014 season and 5.60 with 60 Kg N/fed in 2014 season and 5.60 with 60 Kg N/fed in 2015 season, however, the lowest values recorded 4.60, 4.33 resulted from the control treatment in 2014 and 2015 seasons, respectively.

Concerning grain elongation, the highest values were 55.92, 53.58 with 40 Kg seeds/fed in 2014 and 2015 seasons, while the lowest values recorded 53.50, 51.25 with 20 and 30 Kg seeds/fed in both seasons, respectively. As for nitrogen levels affect the highest values of elongation 55.25, 53.92 with 40 Kg N/fed for both seasons, however, the lowest values 54.17, 51.33 recorded with control treatment in 2014 and 2015 seasons respectively.

Amylose content had values 19.10 and 18.90 with 40 Kg seeds/fed in 2014 and 2015 seasons. Conversely, the lowest values obtained were18.85and 18.68 with 20 Kg seeds/fed in both seasons, respectively. Nitrogen levels affected amylose content, where the highest values 19.30 and 19.17 resulted from 40 Kg N/fed in both seasons. However, the lowest values 18.67 and 18.39 resulted from control treatment in both seasons. These results were harmony with Ahmed *et al.* (2009).

It may be concluded that the application of nitrogen fertilizer offers a large scope for obtaining higher yield of rice and better grain quality. It appears that good results can be achieved by the seeding rate of 40 Kg seeds fed^{1} combined with nitrogen application of 40kg N fed^{-1}.

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الملخص العربي

تأثير معدلات التقاوي ومستويات التسميد النيتروجينى على محصول الحبوب و مكوناته و صفات الجودة لصنف الأرز المصري جيزة ١٧٩ المنزرع بطريقة البدار

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أجريت الدراسة الحالية لمعرفة تأثيرمعـدلات التقـاوى (٢٠، ٣٠، ٤٠، ٥٠ كيلو جـرام / فـدان) و مسـتويات مختلفة من التسميد النيتروجينـى (٠، ٢٠، ٤٠، ٦٠ كيلـو جرام / فدان) على الصنف المصرى جيزة ١٧٩ المنزرع بطريقة البدار لتقييم محصول الحبوب ومكوناتـه وصـفات جودة الحبوب. تم إجراء تجربتان حقليتان بمزرعة محطـة البحوث الزراعية بإيتاى البارود- محافظة البحيرة - مركز البحوث الزراعية لمـدة موسـمين ٢٠١٤ و٢٠١٥. وقـد أظهرت النتائج أن معدل التقاوى (٤٠ كيلو جرام / فـدان) أعطى معنوية عالية لصفة المحصول (٣.٧٧ -٣.٧٩ طن / فدان) في كلا الموسـمين. وأعطـى مسـتوى التسـميد النيتروجينى ٤٠ كيلو جرام/ فدان أعلى محصول من صنف الأرز تحت الدراسة (٤.٢٥- ٤.١٠ طن/الفـدان). كمـا أوضحت النتائج تأثر المحصول و مكوناته بكل من معدلات التقاوى و مستويات التسميد النيتروجينـى وكـان التفاعـل معنويا. بينما تأثرت صفات الجودة و هى الأميلوز، محتوى البروتين، صفة استطالة الحبة، صفة صلابة الحبوب، صفة كثافة الجل، درجة حرارة الجلتنة ،خصائص حبـة الارز،و نسب التقشير، التبييض، كسر الأرز بكـل مـن معـدلات التقاوى وكذلك مستويات التسميد النيتروجينى بينمـا كـان التفاعل بينهما غير معنويا لجميع هذه الصفات المدروسـة. وخلصت النتائج إلى أنه باستخدام باستخدام ٤٠ كيلو جـرام تقاوى / فدان مع تسميد نيتروجينى٤٠ كيلو جرام / فدان وطريقة الزراعة البدارلصنف الأرز المصرى جيـزة ١٧٩ يمكن الحصول على أفضل محصـول لـلأرز ومكوناتـه وكذلك صفات جودة جيدة للحبوب.