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Response of Some New Rice Genotypes to Foliar Application of Nano-N Fertilizer

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Abstract

Two field experiments were conducted at the Experiment and Research Center, Fac. Agric., Moshtohor, Benha Univ., Qalubia Governorate, Egypt, in the summer seasons 2021 and 2022 to study the performance of seven genotypes of rice under three levels of nano-N spraying on growth, yield and its attributes. The most important results obtained from this study can be summarized as follows:

The results of the study revealed that the maximum highest No. tillers plant^{-1} (23.26 tiller), No. spikes plant^{-1} (19.98 panicle), panicle length (25.41 cm), panicle weight (4.39 g), 1000-grain weight (29.11 g) and grain yield plant^{-1} (59.48 g) obtained by spraying with 800 ml fed^{-1} concentration treatment, while, spraying with zero and 400 ml fed^{-1} concentration treatments were decreased No. days to 50% flowering in the combined analyses.

Rice genotypes were highly significant affected on all of the studied characters. **G2** genotype was the earliest in No. days to 50% flowering compared with other rice genotypes, whereas, G1 genotype gave the highest values of No. tillers plant^{-1}, No. spikes plant^{-1}, panicle weight, 1000-grain weight and grain yield plant^{-1}, while, G5 genotype gave the highest value of panicle length in the combined analyses.

Effect of the interaction between nano-N spraying treatments and rice genotypes were showed highly significant for No. tillers plant^{-1}, No. spikes plant^{-1}, panicle length, panicle weight, 1000-grain weight and grain yield plant^{-1}. Generally, spraying with 800 ml fed^{-1} concentration treatment under G1 genotype recorded the highest values for these traits except panicle length in combined data.

It could be complemented that under the conditions of the experiment, planting G1 genotype with spraying with 800 ml fed^{-1} concentration is recommended.

Keyword: Rice genotypes, Nano-N concentrations, Growth, Yield and its components.

Introduction

Rice (*Oryza sativa* L.) is most important food commodity and a widely farmed cereal crop. For over all of the population, rice is considered as one the most important staple food crop in the planet. In Egypt, rice is a second staple food after wheat, and it is an export crop. Rice is cultivated on reclaimed saline land, which is widely spread in North delta and coastal area. Raising rice yield/unit area can be realized by breeding high yielding genotypes and beneficent the cultural dealings of the crop. Fertilizer has become increasingly crucial in improving food production and quality, particularly since the advent of high yielding and fertilizer responsive genotypes. Several investigators have been working to improve rice production, but only a few cases of nano-materials have been documented. Nano fertilizers are the next step in nanotechnology's journey to more sustainable agriculture. **Rathnayaka *et al* (2018)** revealed that the application of 100% Nano-Nitrogen fertilizer has given the highest growth performance with regard to plant height (57.9cm), number of tillers per plant (6) and yield (2.8 tonnes ha^{-1}) 100% Nano-Nitrogen fertilizer has given the highest performance. Over 1mm of urea prill, nano urea contained 55000 nitrogen particles (**Baboo, 2021**). Nano urea decreases the need for traditional urea by half or more while improving crop production, soil health, and nutritional quality of output without compromising soil productivity. It is less expensive than conventional urea, which lowers farmers' input costs and boosts their profits. **Midde *et al* (2022)** indicated that the application of 50 % RDN via Urea + 50 % N via Nano urea as reported increased plant height (104.7 cm), number of tillers (348) and grain yield (7056 kg ha^{-1}).

Several rice varieties and genotypes of different ideal types are spreading all over the world. Thereafter, it could be expected that the rice varietal variation was detected in many studies such as **AbouKhalifa (2012), Alam *et al* (2012), Mondal and Puteh (2013), Islam *et al* (2014) and Haque and Pervin (2015), Gewally *et al* (2018), Moe *et al* (2019), Mehasen *et al* (2020) .**

Therefore, this research aims to evaluate nitrogen nano-fertilizers effect on a selected rice genotypes growth, yield and its components, in Moshtohor Location, Qalybia Governorate, Egypt.

Material and Methods:

The present study was carried out during summer seasons 2021 and 2022 at the Experimental and Research Center, faculty of agriculture, Benha University, Qalybia Governorate, Egypt, to evaluate the efficiency of varying nano-nitrogen fertilizer rates on growth and yield parameters of one newly released rice variety Giza171 and six promising genotypes.

The ground was sandy in texture, pH value, organic matter%, EC (dSm^{-1}), total N%, total P% and total K% were 7.82, 1.75%, 1.70, 0.10%, 1.22% and 0.50% average of the first and second seasons.

The treatments were designed in a split-plot design with four replications. Nano-nitrogen fertilizer rates were sorted at random in the master plots while, new rice genotypes occupied the sub-plots. The sub-plot area was 10.5 m^2.

New rice genotypes were developed by Rice Research Section, Field Crops Research Institute, ARC, Giza, Egypt. The names, pedigree and origin of these cultivars are presented in Table (1).

Table 1. Names, pedigree and origin of parental cultivars

Code No.	Name	Origin
Kor27	Korea 27	Korea
IR152	IRRI 152	IRRI
G210848	G210848-1-2-2-1	Egypt
G210631	G210631-1-1-2-4	Egypt
AC 2882	AC 2882	IRRI
Zh97xEg360	Zhengshen 97 x Egy 360	Egypt
G179	Giza 179	Egypt

In both seasons, preceded crop was wheat. Seedbed of the nursery, area of 525 m^2 for 1 fed was well prepared and fertilized with calcium super phosphate (15.5% P_2 O_5) at 100 kg fed^{-1} before ploughing. Rice grains of genotypes were soaked in running water for 48 hr., and then incubated for another 48 hr. before seeding and 10 kg fed^{-1} of zinc sulphate was added. Seeds were manually broadcasted in the nursery on April 20th, at 60 kg fed^{-1} nursery. Two weeks after sowing, 40 kg N fed^{-1} was added at once as urea (46% N). Before transplanting, permanent field was well prepared, calcium super phosphate (12.5% P_2 O_5) at rate 100 kg fed^{-1} was added to the dry soil before ploughing. Flushing irrigation was done. Transplanting of seedlings from nursery to the permanent field was done 30 days after sowing, which transplanted in hills spaced 20X20 cm for all rice genotypes, as three plants hill^{-1}. Irrigation was withheld 15 days before harvest. Harvest was carried out according to each genotypes duration. The common cultural pursuits were carried out like recommends in the region.

Nano-N fertilizer treatments: 1- Zero nano-N rate (control) , 2- 400 ml nano-N fed^{-1} , 3- 800 ml nano-N fed^{-1} .

Nano application was sprayed after 30 and 45 days from transplanting (i.e., Tillering and Panicle initiation stage). Spray solution was 400 L fed^{-1}.

- Collected data.

The number of days from sowing to 50% flowering was recorded for each genotype. No. of tillers plant^{-1} were taken from the sub plot at random during the growing seasons. At harvest, No. spikes plant^{-1}, spike length (cm), spike weight (g) were measured. Grain yield (g plant^{-1}) was calculated on the base of yield ten plant^{-1} then plot^{-1}. Air dried plants were mechanically threshed and grain yield was estimated and adjusted to 14 % moisture content. Grain samples from each sub plot were taken to determine 1000 grains weight.

- Statistical analysis.

Analysis of difference was done for the data of every season individually and combined analysis was preceded for the data over the first and second seasons as stated by Snedecor and Cochran (1980) treatment means were compared using least significant difference test at 0.05 level of significance. Using the MSTAT-C Statistical Software package (Michigan State University, 1983).

Results and Discussion:

Analysis of differences for whole treatments in each season moreover the combined analysis is exhibited in Tables (2). Test of homogeneity detected that the error difference for the first and second seasons were homogenous, therefore combined analysis was treated. Year's mean squares were insignificant for all the studied traits except No. spikes plant^{-1} and grain yield plant^{-1} were significant. Nano-N fertilizer rates mean squares were extremely significant for all traits in first and second seasons as well as the combined data. Rice genotypes mean squares were highly significant for all characteristics in first and second seasons plus the combined data. The interaction between years and nano-N fertilizer rates mean squares was not significant for all studied characters except No. tillers plant^{-1}, No. spikes plant^{-1} and grain yield plant^{-1} were significantly affected. The interaction between years and rice genotypes mean squares was insignificant for all of the studied characters except No. spikes plant^{-1}, spike length and spike weight. The interaction between nano-N fertilizer rates and rice genotypes mean squares was highly significant for all studied attributes except flowering was insignificant. The interaction between years, nano-N fertilizer rates and rice genotypes mean squares was not significant for all of the studied traits except No. tillers plant^{-1}, No. spikes plant^{-1} and grain yield plant^{-1} were significantly affected.

- Effect of Nano foliar application.

Results in Table 3 were showed in general that nearly all rice characters were significantly affect by nano foliar application treatment in combined analyses. It is obvious that the significant greatest values of No. days to 50% heading (94.33 day), No. tillers plant^{-1} (23.26 tiller) , No. spikes plant^{-1} (19.98 spike), spike length (25.41 cm), spike weight (4.39 g), 1000-grain weight (29.11 g) and grain yield plant^{-1} (59.48 g) were outputted by 800 ml fed^{-1} sprayed treatment compared with other nano foliar application treatments. Otherwise, the control treatment (zero nano) outputting the minimum values of No. days to 50% heading (91.94 day), No. tillers plant^{-1} (15.25 tiller) , No. spikes plant^{-1} (13.71 spike), spike length (21.98 cm), spike weight (3.79 g), 1000-grain weight (25.78 g) and grain yield plant^{-1} (51.32 g). It could be due to the fact that nano encapsulated nitrogen effectively releases nutrients, regulating plant development and enhancing target activity. It may be caused due to combine application of conventional fertilizer as basal dose and split dosage application of Nano urea has been sprayed on plant surface leads to storage of remaining nitrogen in plant cells that may release slowly that can prevent the plant biotic and abiotic stress produces the high grain yield. The results were obtained by **Rathnayaka *et al* (2018), Baboo (2021) and Midde *et al* (2022).**

Table 2. Mean square values and significance for yield and attributes of rice in 2021, 2022 seasons and their combined analysis

SOV	df	Flower-ing	No. tillers plant^{-1}	No. spikes plant^{-1}	Spike length (cm)	Spike weight (g)	1000-grain weight (g)	Grain yield plant^{-1}(g)
				First season (2021)				
Rep	**3**	12.32	2.99	3.91	3.56**	0.14	1.13	104.98
N	**2**	32.90*	549.25**	338.36**	56.79**	3.19**	84.93**	431.51**
Err.(a)	**6**	3.36	4.18	1.32	0.30	0.19	0.79	31.82
Geno.	**6**	152 **	139.63**	72.20**	60.60**	3.03**	84.25**	448.41**
NxG	**12**	4.22	16.12**	11.60**	4.22	0.41**	5.20*	127.65**
Err.(b)	**54**	7.17	4.07	1.52	2.52	0.15	2.45	38.30
CV%		2.88	10.30	7.47	6.68	9.65	5.71	11.04
				Second season (2022)				
Rep	**3**	82.9**	4.99	3.07	5.40	0.22*	0.83	3.50
N	**2**	49.65*	390.61**	224.15**	114.03**	2.19**	70.96**	615.01**
Err.(a)	**6**	5.79	1.07	0.90	2.81	0.02	1.50	5.75
Geno.	**6**	179**	91.24**	33.87**	8.19*	1.11**	68.94**	436.46**
NxG	**12**	4.085	12.63**	9.84**	4.68	0.15**	5.79*	34.99*
Err.(b)	**54**	6.86	2.03	1.97	2.39	0.03	2.93	17.68
CV%		2.82	7.24	8.16	6.51	4.66	6.23	7.77
				Combined analysis				
Years	**1**	1.92	0.38	22.14**	0.02	0.03	0.12	156.21*
R(Y)	**6**	47.64**	3.99	3.49	4.48	0.18	0.98	54.24
N	**2**	81.68**	926.3**	550.12**	165.29**	5.22**	155.3**	949.39**
N (Y)	**2**	0.87	13.54*	12.39**	5.54	0.16	0.59	97.12*
Err.(a)	**12**	4.58	2.63	1.11	1.56	0.10	1.15	18.79
Geno.	**6**	330**	225.4**	99.08**	55.63**	3.83**	150.78**	838.77**
G(Y)	**6**	1.22	5.46	6.99**	13.16**	0.30**	2.41	46.10
NxG	**12**	6.18	23.05**	15.93**	5.48*	0.48**	8.31**	106.38**
NxGxY	**12**	2.12	5.708*	5.51**	3.43	0.09	2.68	56.26*
Err.(b)	**108**	7.02	3.05	1.74	2.45	0.09	2.69	27.99
CV%		2.85	8.89	7.84	6.60	7.59	5.98	9.61

* and ** significant at 5% and 1% level of probability, respectively

- Rice genotypes Effect.

Results reported in **Table (3)** indicate clearly that, there were significant differences between the different rice genotypes in all studied traits in combined analyses. IR152 genotype was earlier heading compared with other rice genotypes in combined analyses. Kor27 genotype gave the highest values of No. tillers plant^{-1} (24.25 tiller), No. spikes plant^{-1} (19.50 spike), spike weight (4.65 g), 1000-grain weight (30.00 g) and grain yield plant^{-1} (62.58 g), furthermore, AC 2882 genotype gave the highest value of spike length (26.62 cm) in the combined analyses. On the other hand, Zh97xEg360 genotype gave the lowest values of No. tillers plant^{-1} (15.54 tiller) and No. spikes plant^{-1} (14.58 spike), IR152 genotype gave the lowest value of spike length (21.66 cm), moreover, AC 2882 genotypes gave the lowest values of spike weight (3.56 g) and 1000-grain weight (23.64 g) lastly G210848 genotype gave the lowest value of grain yield plant^{-1} (47.58 g) in the combined analyses. It could be concluded that genotypes differences among rice genotypes may be due to genetical make up. The superiority of Sakha106 genotype in grain yield (kg fed^{-1}) over other genotypes might be due to the increase in the growth and yield components, namely, root length, No. of panicles hill^{-1}, No. of panicles m^{-2}, panicle length, No. of grains panical^{-1} and grain index.

Table 3. Grain yield and attributes of rice affected by Nano-N and genotypes in combined analysis

Treatments	Flowe-ring	No. tillers plant^{-1}	No. spikes plant^{-1}	Spike length (cm)	Spike weight (g)	1000-grain weight (g)	Grain yield plant^{-1} (g)
Nano-N							
Control	91.94	15.25	13.71	21.98	3.79	25.78	51.32
N1	91.94	20.44	16.92	23.89	4.03	27.41	54.44
N2	94.33	23.26	19.98	25.41	4.39	29.11	59.48
LSD at 5%	**0.88**	**0.66**	**0.43**	**0.51**	**0.13**	**0.44**	**1.78**
Genotypes							
Kor27	93.00	24.25	19.50	24.25	4.65	30.00	62.58
IR152	87.37	19.70	16.62	21.66	4.21	29.18	60.95
G210848	96.04	16.91	14.12	24.04	3.77	24.31	47.58
G210631	98.00	19.70	17.00	23.62	3.84	27.45	52.04
AC 2882	89.66	18.66	17.20	26.62	3.56	23.64	48.62
Zh97xEg360	95.16	15.54	14.58	23.12	4.50	29.27	58.50
G179	92.08	22.79	19.08	23.00	3.95	28.18	55.29
LSD at 5%	**1.51**	**0.99**	**0.75**	**0.89**	**0.17**	**0.93**	**3.02**

-Interaction effect.

Significant influence of interaction between nano foliar application and rice genotypes was get for all studied attributes except flowering trait in combined data (Table 4). Kor27 genotype under foliar application with by 800 ml fed^{-1} treatment afford the highest values of No. tillers plant^{-1} (28.87 tiller), No. spikes plant^{-1} (22.37 spike), spike weight (4.91 g), 1000-grain weight (31.37 g) and grain yield plant^{-1} (69.87 g), while AC 2882 genotype under foliar application with by 800 ml fed^{-1} treatment gave the highest value of spike length (28.62 cm). On the other hand, AC2882 genotype combined with zero nano-N foliar application treatment gave the lowest values of No. tillers plant^{-1} (12.37 tiller), spike weight (3.31 g), 1000-grain weight (21.43 g) and grain yield plant^{-1} (43.62 g), whereas, G210848 genotype under zero nano-N foliar application treatment gave the lowest value of No. spikes plant^{-1} (10.37 spike), lastly IR152 genotype under zero nano-N foliar application treatment gave the lowest value of spike length (20.12 cm) in combined data.

Table 4. Effect of the interaction between Nano-N and rice genotypes (over the combined analysis)

Nano-N	Genotypes	No. tillers plant^{-1}	No. spikes plant^{-1}	Spike length (cm)	Spike weight (g)	1000-grain weight (g)	Grain yield plant^{-1} (g)
	Kor27	18.00	15.75	23.37	4.45	28.37	51.87
	IR152	16.00	14.12	20.12	4.05	27.12	60.12
	G210848	12.87	10.37	20.62	3.38	22.37	45.75
Control	**G210631**	17.00	15.00	22.25	3.37	25.81	49.50
	AC 2882	12.37	11.62	24.62	3.31	21.43	48.12
	Zh97xEg360	12.75	12.12	22.25	4.36	28.62	55.00
	G179	17.75	17.00	20.62	3.60	26.75	48.87
	Kor27	25.87	20.37	24.37	4.61	30.25	66.00

	IR152	18.00	14.75	21.87	4.18	30.31	61.75
	G210848	17.37	15.12	24.87	3.50	23.12	43.62
N1	**G210631**	20.37	16.87	23.62	3.59	26.31	51.12
	AC 2882	20.12	17.75	26.62	3.77	24.93	47.12
	Zh97xEg360	16.37	15.00	22.75	4.56	28.75	55.50
	G179	25.00	18.62	23.12	4.03	28.18	56.00
	Kor27	28.87	22.37	25.00	4.91	31.37	69.87
	IR152	25.12	21.00	23.00	4.40	30.12	61.00
	G210848	20.50	16.87	26.62	4.45	27.43	53.37
N2	**G210631**	21.75	19.12	25.00	4.57	30.25	55.50
	AC 2882	23.50	22.25	28.62	3.61	24.56	50.62
	Zh97xEg360	17.50	16.62	24.37	4.60	30.43	65.00
	G179	25.62	21.62	25.25	4.23	29.62	61.00
LSD at 5%		**1.73**	**1.30**	**1.55**	**0.30**	**1.62**	**5.23**

References

AbouKhalifa, A. A. (2012). Response of some rice varieties to different sowing dates. Proc. 13th international Conf. Agron., Fac. of Agric., Benha Univ., Egypt, 9-10 September,pp:94-102.

Alam, M. S., M.A. Baki, M.S. Sultana, K.J. Ali, M.S. Islam (2012). Effect of variety, spacing and number of seedlings per hill on the yield potentials of Transplant Aman rice. Int. J. Agr. & Agri. R., 2(12): 10–15.

Baboo, P. (2021). Nano Urea the Philosophy of Future. https://www.researchgate.net/publication / 353260539.

Gewaily, E.E., A. M. Ghoneim and Marvet M.A. Osman (2018). Effects of nitrogen levels on growth, yield and nitrogen use efficiency of some newly released Egyptian rice genotypes. *Open Agriculture, 3: 310–318.*

Haque M.M. and E. Pervin (2015). Interaction effect of different doses of guti urea hill-1 on yield and yield contributing characters of rice varieties (*Oryza sativa* L.). *Inter. J. of Agric., Forestry and Fisheries, 3(2):37-43.*

Islam, M. S., M.A.R. Sarkar, M.J. Alam, M.A. Kashem, M.Y. Rafii and M.A. Latif (2014). Effect of number of seedling hill-1 on the growth and yield of aromatic fine rice varieties in rain fed condition. *Life Sci. J., 11(8):109-115.*

Midde, S. K., M. S. Perumal, G. Murugan, R. Sudhagar, V. S. Mattepally and M. R. Bada (2022). Evaluation of Nano Urea on Growth and Yield Attributes of Rice (*Oryza sativa* L.). *Chem. Sci. Rev. Lett., 11 (42): 211-214*

Mehasen, S.A.S.; Shimaa A. Badawy and and E. Hafez (2020). Performance of Some Rice Varieties under Different Irrigation Regimes. *Global Advanced Research Journal of Agricultural Science (ISSN: 2315-5094), 9(4): 77-86.*

Michigan State University , (1983). MSTAT-C: Micro- computer Statistical Program, Version 2.0. Michigan State University, East Lansing.

Mondal, M. M. A. and A. B. Puteh (2013). Optimizing plant spacing for modern rice varieties. *Int. J. Agric. Biol., 15: 175-178.*

Moe, K., S. M. Moh, A. Z. Htwe, Y. Kajihara and T. Yamakawa (2019). Effects of Integrated Organic and Inorganic Fertilizers on Yield and Growth Parameters of Rice Varieties. *Rice Science, 26(5): 309-318.*

Snedecor, G. W. and W. G. Cochran (1980): Statistical Methods, 7 th Ed., Iowa State Univ. Press, Ames, Iowa, USA.

Rathnayaka R. M. N. N., S. Mahendran, Y. B. Iqbal and L. M. Rifnas (2018). Influence of Urea and Nano-Nitrogen Fertilizers on the Growth and Yield of Rice (Oryza sativa L.) Cultivar 'Bg 250'. *International Journal of Research Publications, 15(2):1-7*

إستجابة بعض التراكيب الوراثية الجديدة من الأرز للرش الورقى بسماد النانو نيتروجين

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أجريت تجربتين حقليتين بمركز البحوث والتجارب الزراعية بكلية زراعة مشتهر– جامعة بنها – محافظة القليوبية – مصر خلال صيفي 2021، 2022م لتقييم كفاءة سبعة تراكيب وراثية من الارز وثلاثة معدلات للرش بسماد النانو نيتروجين علي المحصول ومكوناته. وكانت أهم النتائج المتحصل عليها كمايلي:–

- أعطت معاملة الرش بتركيز 800 مليللتر من النانو نيتروجين أعلي القييم لكل من عدد خلفات النبات (26.23 خلفة) ، عدد سنابل النبات (19.98 سنبلة) ، طول السنبلة (25.41 سم) ، وزن السنبلة (4.39 جم) ، وزن الألف حبة (29.11 جم) ومحصول النبات (59.48 جم). بينما أدت معاملة الرش بتركيز صفر أو 400 مليللتر من النانو نيتروجين نقص في عدد الأيام من الزراعة حتي طرد 50% من السنابل في التحليل المشترك لموسمي الزراعة.
- أظهرت التراكيب الوراثية للأرز تأثيراً عالي المعنوية في جميع الصفات المدروسة. سجل التركيب الوراثي G2 تبكيراً في عدد الأيام من الزراعة حتي طرد 50% من السنابل مقارنة بجميع تراكيب الأرز الآخري في التحليل المشترك لموسمي الزراعة. بينما أعطي التركيب الوراثي G1 اعلي القيم في صفات عدد الفروع/نبات ، عدد السنابل/نبات ، وزن السنبلة (جم) ، وزن الألف حبة (جم) و محصول النبات (جم) في التحليل المشترك لموسمي الزراعة. بينما كان التركيب الوراثي G5 أعطي اعلي قيمة في صفة طول السنبلة (سم) في التحليل المشترك لموسمي الزراعة.
- تأثر التفاعل بين معاملات الرش بالنانو نيتروجين والتراكيب الوراثية للأرز تأثيراً عالي المعنوية لصفات عدد فروع النبات ، عدد سنابل النبات، طول السنبلة (سم) ، وزن السنبلة (جم) ، وزن الألف حبة و محصول النبات (جم) في التحليل المشترك لموسمي الزراعة. عموما سجل التركيب الوراثي G1 اعلي القيم تحت معاملة الرش بالنانو نيتروجين بتركيز 800 مليللتر للفدان ماعادا طول السنبلة في التحليل المشترك.
- توصي الدراسة تحت ظروف هذه التجربة بزراعة التركيب الوراثي G1 من الأرز مع الرش بالنانو نيتروجين بتركيز 800 مليللتر للفدان