Menoufia J. Plant Prod., Vol. 6 January (2021): 71 – 82 https://mjppf.journals.ekb.eg/

USING OF BIO AND ORGANIC FERTILIATION TO REDUCE MINERAL NITROGEN FERTILIZER AND IMMPROVE SKHA 108 RICE CULTIVAR PRODUCTIVITY

B.B. Mikael[(1)], Hasnaa A. Ghazy[(1)], Nehal M. Elekhtyar[(1)] and Manal A. Aziz[(2)]

[(1)] **Rice Research and Training Center, Field Crops Research Institute, Agricultural Research Center, Egypt.**

[(2)] **Plant Nutrition Department, Soil, Water and Environment Research institute, Agricultural Research Center, Egypt.**

Received: Jan. 18 , 2021 Accepted: Jan. 31 , 2021

ABSTRACT: Two field experiments were conducted at the experimental farm of Sakha Agriculture Research Station, Sakha, Kafr El-Sheikh, Egypt during 2017 and 2018 seasons. The aim of the current investigation was to study the effective of bio and organic fertilizers in declining the mineral nitrogen fertilizer in rice fields (Sakha 108 cv.). The treatments were: T_1: 165 kg N/ha as recommended nitrogen rate (RN), T_2: ⅔ RN, T_3: ⅔ RN + 5 t/ha poultry manure as organic fertilizer, T_4: ⅔ RN + *Anabaena oryzae* (N – fixing anabaena) as bio-fertilizer, T_5: ⅔ RN + organic manure + bio-fertilizer, T_6: ⅓ RN, T_7: ⅓ RN + organic manure, T_8: ⅓ RN + bio-fertilizer and T_9: ⅓ RN + organic manure + bio-fertilizer. The obtained results revealed that the integration among mineral, organic and bio-fertilization of T_5 (110kg N/ha + 5 t/ha poultry manure + 600 g/ha N-fixing anabaena) gave the maximum values of tillers number m^{-2}, days to heading, dry matter accumulation, flag leaf chlorophyll content, flag leaf area, leaf area index, panicles number m^{-2}, panicle weight, 100-grain weight, grain yield, straw yield, milling percentage and grain protein content, as well as, the lowest number of unfilled grains panicles^{-1}. However, the differences between T_5 and T_1 (165 kg N/ha as recommended mineral N level) in panicles number m^{-2}, number of unfilled grains per panicle, straw yield, milling percentage and grain protein content were insignificant. In addition, T_1 gave the tallest plants and the maximum values of number of filled grains per panicle and hulling percentage, but the differences with T_5 in number of filled grains panicle^{-1} and hulling percentage were insignificant. Number of branches panicle^{-1}, panicle length, harvest index and head rice had insignificant response. It could sum up that adding ⅔ of the recommended mineral nitrogen plus of 5 t/ha of poultry manure plus 600 g/ha of N-fixing anabaena could be the recommended for reducing mineral nitrogen fertilizer and brining high grain yield of Sakha 108 rice variety.

Key words: Rice, inorganic, mineral, poultry manure, Bio-fertilization, *Anabaena oryzae* and N-fixing.

INTRODUCTION

Rice is one of the most important staple cereal crops for human nutrition. Nitrogen is the key element in rice nutrition. It is required for the formation of nucleic acid, Chlorophyll and proteins so, it has a great role in rice growth and productivity (Yoshida, 1981). Extensive and improper used of chemical fertilizers cause an imbalance in ecosystem and environmental pollution (Hasanuzzaman, *et al.,* 2010). Soil fertility is decline year by year due to nutrient depletion as the result of the continuous cultivation of the same agriculture land even with the chemical fertilization. (Ju *et al.,* 2018).

Developing the system of nutrient management through the integration among mineral, bio and organic fertilizers is the most common approach for soil fertility, sustainable agriculture in rice cultivation (Saba *et al.,* 2013). Organic matter provide the micro nutrients and increase the cation exchange capacity of soil so, improve nutrients availability (Rani *et al.,* 2001), improve soil structure and reduce the level of carbon dioxide in the atmosphere that contributes positively to climate change (Arif *et al.,* 2014).

Bio fertilizer is inoculants which contains active organisms functioning to catch specific nutrients or to facilitate nutrients availability within soil for crop. The application of bio fertilizer is most effective and natural way to keep the bio-system active and working for providing the nutrients to the plants (Naher *et al.,* 2016). The fixing nitrogen cyanobacteria (*Anabaena oryzae*) can serve as eco-friendly source of bio-nitrogen fertilizer in place of synthetic eco-hazardous costly urea N-fertilizer in rice cultivation with sustained rice productivity (Snehee and Verma, 2018). Yanni and Osman (1991) found that the application of N-fixing anabaena with one-third of mineral N-fertilizer level recorded the maximum grain yield and the lowest leaves and neck blast natural infection of Giza 171 rice cultivar as compared to 100% mineral nitrogen fertilization.

The current investigation was conducted to study the effect of partial substitution of mineral nitrogen fertilizer with organic and bio-fertilizers on growth and productivity of Sakha 108 rice cultivar.

MATERIALS AND METHODS

To study the integration effect of bio- and organic fertilizers along with mineral N fertilizer on Sakha 108 rice cultivar productivity. Two field experiments were carried out at the experimental farm of Sakha Agriculture Research Station, Sakha, Kafr El-Sheikh Governorate, Egypt, during 2017 and 2018 seasons. The previous winter crop was wheat and barley in the first and the second season, respectively.

The experimental field during both seasons was laid out in a randomized complete block design (RCBD) with three replications. The experimental plot area was 15 m^2 (3 x 5m).

Representative soil samples were collected at 0-30cm depth from soil surface to analyze soil physical and chemical properties, according to Piper (1950) and Black *et al.* (1965), respectively and presented in Table 1.

The experimental treatments were as follow:

T_1: 165 kg N/ha., recommended nitrogen rate (RN).

T_2: ⅔ RN(110 kg N /ha).

T_3: ⅔ RN + poultry manure as organic fertilizer.

T_4: ⅔ RN + *Anabaena oryzae* (N – fixing anabaena) as bio-fertilizer.

T_5: ⅔ RN + organic manure + bio-fertilizer.

T_6: ⅓ RN(55 kg N /ha).

T_7: ⅓ RN + organic manure.

T_8: ⅓ RN + bio-fertilizer.

T_9: ⅓ RN + organic manure + bio-fertilizer.

Organic fertilizer used in this study was poultry manure which added basally and incorporated into dry soil during land preparation at the rate of 5 t/ha. (7m^3). Chemical compositions of the used poultry manure were shown in Table 2.

The bio-fertilizer used in this investigation was N-fixing anabaena (600g/ha.) as soil application in nursery at 2 weeks after sowing.

Table 1: Soil physical and chemical properties of the experimental sites in 2017 and 2018 seasons.

Season	Physical properties				Chemical properties						
	Clay %	Sand %	Silt %	Soil texture	pH	EC. ds/m	Organic mater%	Available nutrients (ppm)			
								N	P	K	Zn
2017	51.97	18.85	29.18	clayey	8.06	2.29	1.71	16.76	13.21	324	0.93
2018	53.04	18.57	28.39	clayey	7.93	2.44	1.63	17.57	14.62	309	0.86

Table 2: Chemical composition of the poultry manure used in this study in 2017 and 2018 seasons.

Season	pH	E.C (dS m^{-1})	C/N ratio	Organic matter	N%	P%	K%
2017	7.27	4.68	11.34	42.72	2.38	0.81	1.53
2018	7.54	4.59	10.92	40.43	2.46	0.78	1.57

Anabaena oryzae **was grown in modified watanabe medium (El-Nawawy *et al.,* 1958) for 10 days under controlled laboratory conditions of 30 + 2C^{o} and continuous illumination of 5500-6500 Lux. Soil as the cyanobacteria carrier, 2.5 cm of soil was spread in try (0.5 x 1.0m) and covered with 5cm tap water, then, supplied with phosphate (0.29 Na_2HPO_4/L), molybdenum (0.2 mg M_o O/L) and 1.09 carbofaran. After the soil settles down and the water in the trays becomes clear, each try was inoculated with 100 ml cyanobacteria culture of *Anabaena oryzae*, the trays were kept in the open air up to 2 weeks and collected to dry.**

Sowing dates were 12th and 18th May in 2017 and 2018 season, respectively. The other cultural practices for transplanting rice cultivation were applied, according to Rice Research Department Recommendations package.

At heading stage, days to heading, chlorophyll content of flag leaf SPAD value (chlorophyll meter SPAD-502 model) flag leaf area, leaf area index (leaf area meter-LI 3000 A model) and dry matter production (gm^{-2}) were estimated.

At harvesting time, ten hills were randomly identified from each plot to estimate plant height. Furthermore, tillers and panicles number were counted and adjusted to square meter. Moreover, ten panicles were randomly taken from each plot to determine panicle length and weight, number of primary branches panicle^{-1}, numbers of filled and unfilled grains panicle^{-1}, as well as, 1000-grain weight, according to IRRI (1996).

Rice hills of the central 10 square meters of each plot were handily harvested, air dried for about five days, then mechanically threshed to determine its grain and straw weights. Grain and straw yields were adjusted into tons per hectare based on 14% moisture content and harvest index was calculated.

Hulling, Milling and head rice percentages were estimated as described by Juliano (1971) and Khush, *et al.* (1979). Rice grains nitrogen content was measured by using Microkieldahl, according to A.O.A.C. (1990). Then protein content in rice grains was calculated as the following formula: protein % in rice grains = N% in rice grains x 5.95.

Collected data of both seasons were statistically analyzed, as described by Gomez and Gomez (1984). The differences among treatment averages were compared, according to Duncan (1955), using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

1. Vegetative growth parameters:

Tables 3 and 4 showed that the different tested integration nitrogen treatments significantly varied and affected the measured growth parameters in both seasons of study. Meanwhile, T5 (⅔ RN + poultry manure + Anabaena oryzae) gave the highest significant values of tillers number m-2, days to heading, dry matter accumulation, flag leaf chlorophyll content, flag leaf area and leaf area index in the first and second seasons. Moreover, there were no significant differences between T_5 and T_3 (⅔ RN + poultry manure) in flag leaf area and leaf area index in both seasons and number of tillers m^{-2} only in the first season. Also, the differences between the treatments of T_5 and T_9 (⅓ RN + organic manure + bio-fertilizer) were insignificant with respect to number of tillers m^{-2}, days to heading and flag leaf chlorophyll content during both seasons. However, the tallest plants were obtained by T_1 (Recommended mineral nitrogen fertilizer level). On the other side, the lowest values of the abovementioned characters in the both seasons were produced by the treatment of T_6. (the plants which received 55 kg N ha^{-1}).

Table 3: Days to heading, flag leaf chlorophyll content, flag leaf area and dry matter accumulation of Sakha 108 rice cultivar as influenced by mineral, organic and bio-fertilization treatments during 2017 and 2018 seasons.

Treatments	Days to 50% heading		Flag leaf chlorophyll content (SPA value)		Flag leaf area (cm^2)		Dry matter ($g\ m^{-2}$)	
	2017	2018	2017	2018	2017	2018	2017	2018
T_1: RN	104.8bc	103.2b	39.32bc	40.15b	32.73bc	32.23bc	1248bc	1198c
T_2: ⅔ RN	102.6def	101.6bc	37.59cd	37.23e	31.86ef	31.78cd	959ef	882e
T_3: ⅔ RN +organic manure	103.5bcd	102.6bc	39.07bc	39.56bc	33.12ab	32.83ab	1339b	1271b
T_4: ⅔ RN +bio-fertilizer	103.0cde	101.8bc	37.89cd	38.02de	32.45cd	32.16bc	1204c	1167c
T_5: ⅔ RN +organic manure +bio-fertilizer	107.2a	105.7a	41.74a	41.98a	33.34a	33.15a	1503a	1489a
T_6: ⅓ RN	98.8g	97.4e	35.59e	34.36g	29.96g	29.36e	786g	734g
T_7: ⅓ RN +organic manure	101.4ef	101.3c	38.93bc	38.61cd	32.01def	32.02c	1062de	1057d
T_8: ⅓ RN +bio-fertilizer	100.7f	99.1d	36.13de	35.82f	31.59f	31.21d	873fg	806f
T_9: ⅓ RN +organic manure +bio-fertilizer	105.3b	104.9a	40.26ab	41.44a	32.27cde	32.14bc	1186cd	1138c
F-test	*	*	**	**	*	*	**	**

RN: 165 kg N/ha as recommended mineral N-level (Urea 46.5%).
Organic manure: 5t/ha poultry manure.
Bio-fertilizer: *Anabaena oryzae* (N-fixing anabaena)
* Significant at 0.05 level.
** Significant at 0.01 level.
N.S Not significant.
Mean followed by the same letter(s) are not significantly varied, according to D.M.R.T.

Table 4: Leaf area index, plant height and number of tillers m^{-2} of Sakha 108 rice cultivar, as influenced by mineral, organic and bio-fertilization treatments during 2017 and 2018 seasons.

Treatments	Leaf area index		Plant height (cm)		Number of tillers m^{-2}	
	2017	2018	2017	2018	2017	2018
T_1: RN	3.71b	6.89a	102.43a	101.17a	569.8cd	566.2c
T_2: ⅔ RN	5.66ef	5.51d	96.72cd	94.37d	512.6e	523.7e
T_3: ⅔ RN +organic manure	6.92ab	7.13a	98.91bc	97.83bc	593.8abc	581.3b
T_4: ⅔ RN +bio-fertilizer	6.24c	6.39b	97.56bcd	96.16cd	559.4d	551.6d
T_5: ⅔ RN +organic manure +bio-fertilizer	7.09a	7.28a	99.08b	98.34b	608.9a	603.5a
T_6: ⅓ RN	5.15g	5.07e	89.69f	88.25f	463.5f	478.2f
T_7: ⅓ RN +organic manure	5.83de	5.68cd	93.14e	91.79e	573.1bcd	574.0bc
T_8: ⅓ RN +bio-fertilizer	5.39fg	5.46de	91.29ef	90.42e	547.3d	539.4d
T_9: ⅓ RN +organic manure +bio-fertilizer	6.10cd	6.04bc	95.67d	94.98d	601.7ab	597.1a
F-test	**	**	**	**	**	**

RN: 165 kg N/ha as recommended mineral N-level (Urea 46.5%).
Organic manure: 5t/ha poultry manure.
Bio-fertilizer: *Anabaena oryzae* (N-fixing anabaena)
*** Significant at 0.05 level.**
**** Significant at 0.01 level.**
N.S Not significant.
Mean followed by the same letter(s) are not significantly varied, according to D.M.R.T.

The superiority of the integration among mineral nitrogen, organic manure and bio-fertilizer of T_5 might be due to the role of organic matter in providing the macro and micro nutrients and increasing the cation exchange capacity of soil, then, enhancing nutrients availability and improving growth patterns (Rani *et al.,* 2001). In addition, bio-fertilizers are mostly used for increasing microbial activity which in return increases nutrients availability which can be easily assimilated by plants (Goswami *et al.,* 2016; Mazid and Khan, 2017 and Okur, 2018). However, Malusa *et al.* (2012) mentioned that N-fixation bio-fertilizers sufficiently increase the surface area of plant leaves, photosynthesis rats and efficiency of water availability which improve plant growth vigor. Similar results were also reported by Javaied (2011), Saba *et al.* (2013), Malo *et al.* (2018), Sharada and Sujathamma (2018) and Mohan and Kumar (2019).

2. Grain yield attributes:

Grain yield attributes as affected by mineral, organic and bio-fertilizers are listed in Tables 5 and 6. Data showed highly significant variations in values of number of panicles m^{-2}, panicle weight, number of filled grains panicle^{-1} and 1000-grain weight in both seasons due to the tested fertilization treatments. However, number of branches panicle^{-1} and panicle length characteristics did not significantly affected by any of the investigated treatments. The combination treatment of T_5 (⅔ RN + poultry manure + bio-fertilizers) gave the highest number of panicles m^{-2}, as well as, the heaviest weights of the panicles and the one-thousand grains.

Table 5: Number of panicles m^{-2}, panicle length and panicle weight of Sakha 108 rice cultivar, as influenced by mineral, organic and bio-fertilization treatments during 2017 and 2018 seasons.

Treatments	Number of panicles m^{-2}		Panicle length (cm)		Panicle weight (g)	
	2017	2018	2017	2018	2017	2018
T_1: RN	589.8a	591.2ab	23.07	23.14	4.13b	4.17ab
T_2: ⅔ RN	553.1b	576.9c	22.87	22.56	3.82cd	3.83cde
T_3: ⅔ RN +organic manure	582.9a	584.3bc	22.91	22.98	3.91bcd	4.04bc
T_4: ⅔ RN +bio-fertilizer	558.7b	552.4d	22.96	23.02	3.99bc	3.93bcd
T_5: ⅔ RN +organic manure +bio-fertilizer	596.2a	600.7a	23.13	23.27	4.38a	4.42a
T_6: ⅓ RN	479.8d	468.4g	22.34	22.26	3.03g	2.89g
T_7: ⅓ RN +organic manure	537.4bc	527.1e	22.62	22.48	3.42f	3.64e
T_8: ⅓ RN +bio-fertilizer	518.2c	513.6f	22.54	22.39	3.57ef	3.33f
T_9: ⅓ RN +organic manure +bio-fertilizer	546.3b	539.5de	22.76	22.51	3.68de	3.72de
F-test	**	**	N.S	N.S	**	**

RN: 165 kg N/ha as recommended mineral N-level (Urea 46.5%).
Organic manure: 5t/ha poultry manure.
Bio-fertilizer: *Anabaena oryzae* (N-fixing anabaena)
*** Significant at 0.05 level.**
**** Significant at 0.01 level.**
N.S Not significant.
Mean followed by the same letter(s) are not significantly varied, according to D.M.R.T.

Table 6: Number of branches $panicle^{-1}$, number of filled grains $panicle^{-1}$, number of unfilled grains $panicle^{-1}$ and 1000-grain weight of Sakha 108 rice cultivar, as influenced by mineral, organic and bio-fertilization treatments during 2017 and 2018 seasons.

Treatments	Number of branches $panicle^{-1}$		Number of filled grains $panicle^{-1}$		Number of unfilled grains $panicle^{-1}$		1000-grain weight (g)	
	2017	2018	2017	2018	2017	2018	2017	2018
T_1: RN	10.49	10.35	146.2a	151.4a	3.1g	4.3g	28.35b	28.31b
T_2: ⅔ RN	10.32	10.16	126.9bc	122.8c	13.3e	12.7e	27.68c	27.59c
T_3: ⅔ RN +organic manure	10.61	10.48	131.7b	134.3b	11.8e	9.5f	28.46b	28.48ab
T_4: ⅔ RN +bio-fertilizer	10.36	10.24	134.5b	136.2b	7.6f	6.1g	28.17b	28.24b
T_5: ⅔ RN +organic manure+bio-fertilizer	10.69	10.51	143.8a	149.9a	2.4g	3.5g	29.12a	28.69a
T_6: ⅓ RN	9.97	9.67	93.7e	96.4f	31.9a	29.8a	25.71f	25.59f
T_7: ⅓ RN +organic manure	10.18	10.03	97.5e	101.6f	27.1b	24.9b	26.84d	26.38d
T_8: ⅓ RN +bio-fertilizer	10.13	9.94	108.4d	107.9f	22.4c	19.4c	26.29e	26.03e
T_9: ⅓ RN +organic manure+bio-fertilizer	10.24	10.09	119.6c	116.0d	18.2d	16.2d	27.34c	27.69c
F-test	N.S	N.S	**	**	*	*	**	**

RN: 165 kg N/ha as recommended mineral N-level (Urea 46.5%).
Organic manure: 5t/ha poultry manure.
Bio-fertilizer: *Anabaena oryzae* (N-fixing anabaena)
*** Significant at 0.05 level.**
**** Significant at 0.01 level.**

N.S Not significant.
Mean followed by the same letter(s) are not significantly varied, according to D.M.R.T.

The differences between T5 and T1 (Recommended mineral nitrogen fertilizer level) in number of panicles m-2 did not significantly varied. In addition, the maximum number of filled grains panicle-1 was obtained by T1 without any significant variation with T5. In contrast, T6 (⅓ RN) recorded the lowest values of all studied grain yield attributes, except number of unfilled grains panicle-1. Both T1 and T5 treatments gave the minimum numbers of unfilled grains per panicle without any significant differences between them while the highest values were recorded by T6. The obtained improvement in grain yield attributes happened by urea, poultry manure and nitrogen-fixing anabaena application might be due to supply important hormones like auxins, cytokinein, gibberellins by the bio-fertilizers, which providing the essential elements and improving the availability and absorption of N, P and K by rice plants (Jan *et al*., 2018) and enhancing grain filling processes (Alam *et al*., 2014). These results are in harmony with those reported by Ahmad *et al*. (2004), Zahir *et al*. (2007), Genxing *et al*. (2009), Sarker *et al*. (2015) and Elhabet (2018).

3. Grain and straw yields and harvest index:

Grain and straw yields and harvest index as influenced by mineral, organic and bio-fertilization treatments are presented in Table 7. The results proved significant and positive effects were developed by varying studied integration nitrogen management involving bio- and organic fertilizer along with. Data of both seasons cleared that the maximum mean of grain and straw yields were obtained by the combination treatment of T5 (⅔RN + poultry manure + N-fixing anabaena) as compared to control (Recommended mineral N-level of T1). Interestingly, the treatments of T5, T1 and T3 (⅔ RN + poultry manure) were at a par regarding straw yield in both season. On the other side, harvest index did not significantly affected by fertilization treatments. The lowest values of the above-mentioned traits were obtained when one-third of the recommended mineral N-level (T6) was applied. The superiority of the integration among mineral, organic and bio-fertilizers (T5) in improving rice grain yield as compared to the control treatment of T1 (100% mineral N-fertilizer) could be mainly attributed to the role of poultry manure in improving soil chemical and physical properties and root growth, which in turn has a positive correlation with N-uptake, biomass production and grain yield (Iqpal *et al*., 2019). Meelu and Singh (1991) reported that poultry manure is an excellent organic fertilization for rice, as it contains high N, P and K concentrations and other essential nutrients when it use at the rate of 4 t/ha with 40kg/ha mineral N-fertilizer as a combination treatment for obtaining the maximum grain yield. In addition, Singh *et al.,* (2016) mentioned that nitrogen fixing anabaena as bio-fertilizer decrease the use of mineral nitrogen fertilizer by about 25% in rice fields. The positive impact of organic fertilizers on soil fertility improvement might be due to the following relationships. First, decomposition and mineralization of nutrients present in the organic material. Second, release of some organic acids as a result of organic decomposition, which reduces the soil pH while improving nutrient availability (Zayed *et al.,*2013) who found that Organic manure application gave acceptable yield levels of economic significance, particularly with continued application. From an environmental and economic viewpoint as well as for sustainable soil management, application of 5 t ha-1 rice straw compost + 110 kg N ha-1 could be recommended for use with

salinized clay. These results are supported by the findings of Ali *et al.* (2009), Ju *et al. (2018) and Snehee and Verma (2018).*

Table 7: Grain yield, straw yield and harvest index of Sakha 108 rice cultivar, as influenced by mineral, organic and bio-fertilization treatments during 2017 and 2018 seasons.

Treatments	Grain yield (t/ha)		Straw yield (t/ha)		Harvest index	
	2017	2018	2017	2018	2017	2018
T_1: RN	10.926b	10.971b	13.893a	13.946a	44.02	44.03
T_2: ⅔ RN	10.098c	10.268cd	12.442c	12.713b	44.80	44.68
T_3: ⅔ RN +organic manure	10.882b	10.897b	13.958a	14.002a	43.81	43.77
T_4: ⅔ RN +bio-fertilizer	10.632b	10.576c	13.226b	13.107b	44.57	44.64
T_5: ⅔ RN +organic manure +bio-fertilizer	11.263a	11.319a	14.171a	14.299a	44.28	44.18
T_6: ⅓ RN	8.357f	8.613f	10.884f	10.986d	43.43	43.94
T_7: ⅓ RN +organic manure	9.749de	10.032de	11.979d	12.311c	44.86	44.93
T_8: ⅓ RN +bio-fertilizer	9.463e	9.754e	11.583e	11.998c	44.97	44.82
T_9: ⅓ RN +organic manure +bio-fertilizer	9.921cd	10.245d	12.293cd	12.852b	44.66	44.35
F-test	**	**	**	**	N.S	N.S

RN: 165 kg N/ha as recommended mineral N-level (Urea 46.5%).
Organic manure: 5t/ha poultry manure.
Bio-fertilizer: *Anabaena oryzae* (N-fixing anabaena)
* Significant at 0.05 level.
** Significant at 0.01 level.
N.S Not significant.
Mean followed by the same letter(s) are not significantly varied, according to D.M.R.T.

4. Some of grain quality characters:

Concerning the effect of mineral, bio and organic fertilizers on hulling, milling, head rice and grain protein percentages of Sakha 108 rice cultivar, the obtained data in Table 8 indicated that the highest hulling percentages were obtained by recommended mineral nitrogen level (T_1) without any significant differences with T_4 (⅔ RN + N-fixing anabaena) and T_5 (⅔ RN + poultry manure + N-fixing anabaena) in the both seasons and with T_3 (⅔ RN + poultry manure) in the first season. The treatment of T_5 recorded the highest percentage of milling without significant differences with those of, T_1, T_3 and T_4 during both seasons. Furthermore, all treatments failed to show any significant effect on head rice percentage. On a related note, either T_5 or T_1 gave the maximum protein content of rice grains. However, the treatment of T_6 (⅓ RN) gave the lowest values of the above-mentioned studied grain quality characters.

Such advantage brought in rice grain quality with the integration among mineral, organic and bio-fertilization could be mainly attributed to improve growth escalating photosynthetic rate consequently improve grain quality and nitrogen absorption (Table, 2014). Biswas *et al.,*2000 concluded that the higher grain N concentration resulting from inoculation might be attributed to increased N uptake by a larger root surface area associated with additional root hairs and lateral root development and, also, due to biological nitrogen fixation. Increasing N content of rice grains significantly attributed to raising protein percentage of rice grains. The integration among bio, organic and mineral nitrogen fertilizers showed high efficiency in improving hulling and milling percentages that might be owing to improve grain filling operation and reduce coats thickness. These findings confirmed with those reported by Firouzi (2015) and Gomaa *et al.* (2015).

Table 8: Hulling, Milling, head rice and Grain protein percentages of Sakha 108 rice cultivar, as influenced by mineral, organic and bio-fertilization treatments during 2017 and 2018 seasons.

Treatments	Hulling (%)		Milling (%)		Head rice (%)		Grain protein (%)	
	2017	2018	2017	2018	2017	2018	2017	2018
T_1: RN	83.37a	84.11a	72.32ab	73.09ab	64.58	64.93	6.09ab	6.24a
T_2: ⅔ RN	82.52bcd	83.29bcd	71.41cd	72.52cd	63.73	64.32	5.68cde	5.79c
T_3: ⅔ RN +organic manure	82.71abc	83.48bcd	72.62a	73.26ab	64.08	64.79	5.97abc	6.03b
T_4: ⅔ RN +bio-fertilizer	83.09ab	83.63abc	72.16ab	73.01abc	63.95	64.51	5.83bcd	5.88bc
T_5: ⅔ RN +organic manure +bio-fertilizer	83.24ab	83.85ab	72.68a	73.44a	64.13	64.86	6.26a	6.37a
T_6: ⅓ RN	81.86d	82.07e	70.23e	70.97e	63.21	63.62	4.49g	4.56f
T_7: ⅓ RN +organic manure	82.05cd	82.96d	71.17cd	72.63d	63.69	64.14	5.34ef	5.41d
T_8: ⅓ RN +bio-fertilizer	82.18cd	83.14cd	71.03d	72.23d	63.47	64.08	5.21f	5.13e
T_9: ⅓ RN +organic manure +bio-fertilizer	82.31cd	83.27bcd	71.84bc	72.78bcd	63.84	64.46	5.52def	5.56d
F-test	*	*	**	**	N.S	N.S	**	**

RN: 165 kg N/ha as recommended mineral N-level (Urea 46.5%).
Organic manure: 5t/ha poultry manure.
Bio-fertilizer: *Anabaena oryzae* (N-fixing anabaena)
* Significant at 0.05 level.
** Significant at 0.01 level.
N.S Not significant.
Mean followed by the same letter(s) are not significantly varied, according to D.M.R.T.

From results, it could be concluded that applying 5t/ha poultry manure + 600 g/ha N-fixing anabaena showed elevated affecting to reduce mineral N-fertilizer by one-third of the recommended level and bring high grain yield with high quality for Sakha 108 rice cultivar under the experiment condition.

REFERENCES

A.O.A.C. (1990). Association of official agriculture chemists, official methods of analysis. 15th Ed., Washington D.C., U.S.A.

Ahmad, A., A. Noaim and S. Hamad (2004). Effect of bio-fertilization along with different levels of nitrogen fertilizer application on the growth and grain yield of hassawi rice (*Oryze sative* L.). Sci. J. King Faisal Univ., 5: 215-228.

Alam, S., K. Seth and D. Shukla (2014). Role of Blue green algae in paddy crop. Eur J. Exp. Biol., 4: 24-28.

Ali, M., M. Islam and M. Jahiruddin (2009). Effect of integrated use of organic manures with chemical fertilizer in the rice-rice cropping system and its impact of soil health. Bang. J. of Agric. Res., 34(1): 81-90.

Arif, M., M. Tasneem, F. Bashir, G. Yaseen and R. Iqbal (2014). Effect of integrated use of organic manures and inorganic fertilizers on yield and yield components of rice. J. of Agric. Res., 52(2): 197-206.

Biswas, J., K. Ladha, F. Dazzo, Y. Yanni and G. Rolfe (2000). Rhizobial inoculation influences seedling vigor and yield of rice. Agron. J., 92: 880-886.

Black, C., D. Evans, L. Ensminger and F. Clark (1965). Methods of soil analysis (Chemical and Microbiological Properlies, Part II). Amer. Soc. Agron., Inc. Pub., Madison, Wisconsing, U.S.A.

Duncan, B. (1955). Multiple Range and Multiple F-Test. Biometrics, 11: 1-42.

Elhabet, H. (2018). Effect of organic and inorganic fertilizers on rice and some nutrients availability under different water regimes. J. of Agri. Sci. and Food Res., 9(4): 247-263.

El-Nawawy, A., M. Lotfi and M. Fahmy (1958). Studies of the ability of some blue-green algae to fix atmospheric nitrogen and their effect on growth and yield of paddy. Agric. Res. Rev., Min. Agric., Cairo, 36: 308-320.

Firouzi, S. (2015). Grain milling and head rice yields as affected by nitrogen rate and bio-fertilizer application. Acta Agric. Solo., 105(2): 241-248.

Genxing, P., Z. Ping, L. Zhipeng, S. Pete, L. Lianquing, O. Duosheng, Z. Xuhu, X. Xiaobo, S. Shengyuan and C. Xuemin (2009). Combined inorganic and organic fertilization enhances N efficiency and increases rice productivity through organic carbon accumulation in a rice paddy from the Tai lake region. China Agric. Ecosys. And Environ, 131: 274-280.

Gomaa, M., J. Radwan, E. Kandil and M. Shawer (2015). Impact of micronutrients and bio-fertilization on yield and quality of rice (*Oryza sativa* L.). Middle East J. Agric. Res., 4(4): 919-924.

Gomez, K. and A. Gomez (1984). Statistical procedures of Agricultural Res., John Wiley and Sons. Inc., New York, U.S.A.

Goswami, M., P. Bhattacharyya, A. Ghosh, B. Das, S. Bhattacharjee and T. Mahanty (2016). Bio fertilizers: potential approach for sustainable agriculture development. Environ. Sci. Poullut. Res., 24(4): 3315-3335.

Hasanuzzaman, M., K. Ahmed, N. Rahmatullah, N. Akhter, K. Nahar and M. Rahman (2010). Plant growth characters and productivity of wetland rice (*Oryza sativa* L.) as affected by application of different manures. J. Food Agric., 22(1): 46-58.

Iqpal, A., H. Liang, K. Aziz, W. Shangqin, A. Kashif, A. Izhar, U. Saif, M. Fazal, Z. Ceuan and J. Ligeng (2019). Organic manure coupled with inorganic fertilizer, an approach for the sustainable production of rice by improving soil properties and nitrogen use efficiency. Agronomy, 9: 651-670.

IRRI (1996). Standerd evaluation system for rice, 3rd Ed., Inc. Rice. Res. Int., Los Banos, Philippiens.

Jan, Z., S. Ali, T. Sultan, M. Khan, Z. shah and F. Khan (2018). Impact of different strains of cyanobacteria on rice crop growth and nutrients uptake under saline soil condition, Sabad J. of Agric., 34(2): 450-458.

Javaied A. (2011). Effect of bio fertilizers combined with different soil amendments on potted rice plants. Chllean J. of Agric. Res., 7(1): 157-163.

Ju, I., W. Bang and A. Onyimba (2018). A review: bio fertilizer a key player in enhancing soil fertility and crop productivity. Microbiol. Biotechnol. Rep., 2(1): 22-28.

Juliano, B. (1971). Amplified assay for milled rice amylose "Chemical Aspect of Rice Grain Quality". Cereal Sci. Today (16): 334-360.

Khush, G., C. Parle and N. Delacuruze (1979). Rice grain quality evaluation and improvement at International Rice

Research Institute Proc. Workshop on Chemical aspect of Rice Grain Quality.

Malo, M., S. Rath and D. Dutta (2018). Response of rice cultivation to inorganic and bio-fertilizers in New Allurial zone of West Bengal. Int. J. Curr. Microbrol. App. Sci., 7(2): 2707-2714.

Malusa, E., L. Paszt and J. Ciesielska (2012). Technologies for beneficial micro-organisms inoculate used as bio fertilizers. Sci. World J., 49(1): 1-12.

Mazid, M. and T. Khan (2017). Future of Bio-fertilizers in Indian agriculture. Agric. Food Res., 3(3): 10-23.

Meelu, O. and Y. Singh (1991). Integrated use of fertilizers and organic manures for higher returns. Prog. Fmg., Punjab Agric Univ., 27: 3-14.

Mohan, A. and B. Kumar (2019). Plant growth promoting activities of cyanobacteria growing in rhizosphere of agriculturally fertile soil. ISOR J. of Biotech. And Biochemis., 5(4): 28-36.

Naher, U., Q. Panhwar, R. Osman, M. Ismail and Z. Berahim (2016). Bio fertilizer as supplement of chemical fertilizer for yield maximization of rice J. of Agric. Food and Develop., 2: 16-22.

Okur, N. (2018). Bio-fertilizers, power of beneficial micro-organisms in soils. Biomed J. Sci. Tech. Res., 4(4): 1-12.

Piper, C. (1950). Soil and plant analysis. Inc. Soc., Pub. Inc., New York, U.S.A.

Rani, R., O. Srivastava and Y. Rani (2001). Effect of integration of organics with fertilizer N on rice and N-uptake. Fertilizer News., 46: 63-65.

Saba, N., I. Awan, M. Bloch, I. Shah, M. Nadim and J. Qadir (2013). Improving synthetic fertilizer use efficiency through Bio-fertilizer application in rice.Gomal Univ. J of Res.,29: 32-38.

Sarker, D., S. Mazumder, S. Kundu, F. Akter and S. Paul (2015). Effect of poultry manure incorporated with nitrogenous and sulfur fertilizers on the growth, yield, chlorophyll and nutrient contents of rice var: BRRi Jhan 33. Bangladesh Agron. J., 18(1): 99-111.

Sharada, P. and P. Sujathamma (2018). Effect of organic and inorganic fertilizers on quantitative and qualitative parameters of rice (*Oryza sativa* L.). Curr. Agric. Res. J., 6(2): 166-174.

Singh, J., A. Kimar, N. Rai and D. Singh (2016). Cyanobacteria a precious bio-resource in agriculture ecosystem and environment sustainability. Front Microbiol., 21(7): 529.

Snehee, S. and M. Verma (2018). Anabaena as substitute for urea-nitrogen during rice cultivation in wet fields of Bahr Bihar India. Int. J. of Environ. Sci., 7(4): 117-119.

Table, M. (2014). Response of some rice cultivars to plant spacing and nitrogenous bio-fertilizations. Ph.D. Thesis, Fac. Of Agric., Saba Basha, Alex. Univ., Egypt.

Yanni, Y. and Z. Osman (1991). Contributions of algalization to rice growth, yield and N attributes and incidence of infestation with the blast fungus *Pyricularia oryzae* under different fungicidal treatments. World J. of Microbiol. and Biotechnol., 6: 371-37.

Yoshida, S. (1981). Fundamentals of rice crop Science. Int. Rice Res. Insti., Loos Banos, Philippenes, pp. 135-46.

Zahir, Z., M. Naveed, M. Zobar, A. Khulid and M. Arshad (2007). Enrichment of composted organic wastes for improvement in rice production. J. Chem. Soc. Pak., 29: 514-519.

Zayed, B., W. Elkhoby, A. Salem, M. Ceesay and N. Uphoff (2013). Effect

of integrated nitrogen fertilizer on rice productivity and soil fertility under saline soil conditions. Journal of Plant Biology Research, 2(1): 14-24.

استخدام التسميد الحيوى والعضوى لتقليل معدل السماد النيتروجينى المعدنى وتحسين إنتاجية صنف الأرز سخا 108

بطرس بشرى يوسف ميخائيل[1]، حسناء عبدالحميد غازى[1]، نهال محمد الإختيار[1]، منال عادل عزيز[2]

[1] مركز البحوث والتدريب فى الأرز ـ معهد بحوث المحاصيل الحقلية ـ مركز البحوث الزراعية ـ مصر.

[2] قسم بحوث تغذية النبات ـ معهد بحوث الأراضى والمياه والبيئة ـ مركز البحوث الزراعية ـ مصر.

الملخص العربى

أجريت تجربتان حقليتان بالمزرعة البحثية لمحطة البحوث الزراعيه بسخا ، محافظة كفرالشيخ ، مصر خلال موسمى صيف 2017م ، 2018م بهدف دراسة تقليل كمية السماد لأزوتى المعدنى لصنف الأرز سخا 108 باستخدام زرق الدواجن (كسماد عضوى) و الأنابينا المثبته للأزوت (كسماد حيوى). اشتملت الدراسة على تسع معاملات وهى:

1- 165كجم أزوت/هكتار (معدل السماد المعدنى الموصى به).
2- ثلثى كمية الأزوت المعدنى(110 كجم أزوت/ هكتار).
3- ثلثى كمية الأزوت المعدنى + التسميد العضوى.
4- ثلثى كمية الأزوت المعدنى + السماد الحيوى.
5- ثلثى كمية الأزوت المعدنى + التسميد العضوى + السماد الحيوى.
6- ثلث كمية الأزوت المعدنى(55 كجم أزوت/ هكتار).
7- ثلث كمية الأزوت المعدنى + التسميد العضوى.
8- ثلث كمية الأزوت المعدنى + السماد الحيوى.
9- ثلث كمية الأزوت المعدنى + التسميد العضوى + السماد الحيوى.

أظهرت نتائج الدراسة أن التكامل ما بين التسميد المعدنى والعضوى والحيوى من خلال المعاملة (5) قد أعطى أعلى القيم لصفات عدد الفروع/م^2 ، عدد الأيام حتى تزهير 50% من النباتات ، المادة الجافة ،عدد الداليات/م^2 ، وزن الدالية ، وزن الألف حبة ، محصول القش والحبوب ، النسبة المئوية للتبييض ومحتوى الحبوب من البروتين وأيضا أقل عدد من الحبوب الفارغة/الدالية. فى حين كانت الاختلافات غير معنوية بين المعاملة (5) والمعاملة (1) بالنسبه لصفات عدد الداليات/م^2 ، عدد الحبوب الفارغة/الدالية ، محصول القش ، النسبة المئوية للتبييض ومحتوى الحبوب من البروتين.

أظهرت نتائج الدراسة أيضا أن المعاملة (1) أعطت أعلى القيم لصفات إرتفاع النبات ، عدد الحبوب الممتلئة/الدالية والنسبة المئوية للتقشير ، فى حين كانت الإختلافات غير معنوية بين معاملة الكنترول (1) والمعاملة (5) فى صفتى عدد الحبوب الممتلئة/الدالية والنسبة المئوية للتقشير.

أوضحت نتائج كلا الموسمين عدم ظهور أى تأثيرات معنوية للمعاملات على صفات عدد الفروع/الدالية ، طول الدالية، دليل الحصاد والنسبة المئوية للتدريج. وعلى الجانب الآخر فإن أقل القيم لجميع الصفات المدروسة إلى جانب أعلى عدد من الحبوب الفارغة/الدالية قد لوحظ عند إضافة ثلث المعدل الموصى به من الأزوت المعدنى.

وعلى ذلك فإن إضافة 110كجم أزوت / هكتار + 5 طن / هكتار من زرق الدواجن + 600 جم / هكتار من الأنابينا المثبته للأزوت ، تعتبر أفضل طريقه للتكامل بين التسميد المعدنى والعضوى والحيوي لتحقيق أعلى إنتاجيه لصنف الأرز سخا 108 تحت ظروق هذه الدراسه.

السادة المحكمين

أ.د/ بسيونى عبدالرازق زايد مركز البحوث الزراعية – الجيزة ، أ.د/ محمود الدسوقى إبراهيم كلية الزراعة – جامعة المنوفية