International Journal of ChemTech Research
CODEN (USA): IJCRGG ISSN: 0974-4290
Vol.8, No.4, pp 1533-1542, 2015

Impact of Organic Materials Combined with Mineral Nitrogen on Rice Growth, Yield, Grain Quality and Soil Organic Matter

Metwally T.F.

Rice Research Department, Field Crops Research Institute, Agricultural Research Center, Egypt.

Abstract: A 2-year field experiment was conducted at the Experimental Farm of Rice Research and Training Center (RRTC), Sakha, Kafer El-Sheikh, Egypt, during 2013 and 2014 rice growing seasons to study the impact of some organic materials combined with different levels of mineral nitrogen on Giza 179 rice cultivar. The field experiment was laid-out in a split- plot design with four replications. The main plots were devoted to nitrogen levels (0, 55, 110 and 165 kg N ha^{-1}). The sub plots were allocated to the organic materials (control, chopped rice straw, farm yard manure and rice straw compost). The studied characters were plant height at harvest, number of panicle m^{-2}, panicle weight, number of grains $panicle^{-1}$, filled grain %, 1000-grain weight, grain yield, straw yield, hulling, milling, and head rice percentages. With the exception of 1000-grain weight that was negatively affected by nitrogen, all studied characters were positively and significantly affected by nitrogen, organic materials and the interaction. However, hulling % was affected significantly by only mineral fertilizer. Most of the studied characters produced the highest values when the organic materials were combined with mineral fertilizer. Adequate application of mineral nitrogen combined with farmyard manure or compost could increase soil organic matter content.
Key words: rice, straw, farm yard manure, urea and compost.

Introduction

Rice (*Oryza sativa* L.) is one of the world's most important staple foods. Paddy soil system favors fertility maintenance and build-up of organic matter in soils, and is the backbone of long-term sustainability of the wetland rice systems[1]. Rice straw has been used for animal feed and livestock bedding. Rice straw residues can be used for producing some products such as compost, fiberboard, paper, liquid fuels and others. Also, the composition of rice straw is fibrous nature and high contents of silicon dioxide cause it to resist decay when incorporated into the soil and can lead to a reduction in yield the following season. Moreover, rice straw physically difficult to incorporate into the soil and a greater number of tillage operations may be required to prepare the field for planting winter crops. Because the average cost to store and transport rice straw is high, the rice growers burn rice straw for quick preparing of winter crops. This wrong practice becomes a controversial source of visible pollution in Egypt.

Nitrogen (N) status of soils is sustained by maintaining equilibrium between N loss of crop harvest and N gain from different N sources. The application of inorganic fertilizers is costly and gradually leads to the environmental problems. Thus, organic residue recycling is becoming an increasingly important aspect of environmentally sound sustainable agriculture. Now-a-days, agricultural production based on organic applications is growing in interest and the demands for the resulting products are increasing. Therefore, the effective use of organic materials in rice farming is also likely to be promoted[2].

Numerous reports indicated that when organic fertilizers are supplemented with inorganic fertilizers, they give more positive effect on crop growth. In this respect, grain yield and morphological parameters of rice increased significantly with the application of cow manure, poultry manure, rice straw and rice husk over control[3]. An increase in the grain yield may be due to the increase parameters like dry matter, total number of tiller, flag leaf length, number of fertile tillers per hill and 1000-seed weight[3]. Application of chemical fertilizers with farmyard manure or wheat straw in alternate wetting and drying condition increased N, P, & K uptake by rice plants, increased 1000 grain weight and grain yield of rice[4]. Use of appropriate levels of fertilizer and irrigation in rice is important for maintaining productivity and fertility[3-4]. Addition of organic matter (FYM, rice straw and rice hulls) may improve the efficiency of fertilizer use and rice grain yield. These different organic materials enhanced soil nutrient balances [5].

The objective of this study was to investigate the impact of organic materials (rice straw, farm yard manure and rice straw compost) combined with mineral nitrogen on rice growth, yield, grain quality and soil organic matter.

Experimental

A 2-year experiment was conducted at the Experimental Farm of Rice Research and Training Center (RRTC) Sakha, Sakha, Kafer El-Sheikh, during the 2013 and 2014 rice growing seasons. The preceding crop was barley in the both seasons. Soil was sampled, before cultivation, one part was kept in the refrigerator for chemical analysis and the other one used for physical analysis[6-7]. The physical and chemical properties of the experimental field soil are given in Table 1.

Table (1). Some physical and chemicals analysis of the soil at the experimental sites during 2013 and 2014.

Soil Properties	2013	2014
Clay %	57.0	54.5
Silt %	32.0	35.0
Sand %	11.0	11.5
Texture %	Clayey	Clayey
Organic matter %	1.65	1.55
Available P, mg kg^{-1}	12.5	12.6
Available NH_4, mg kg^{-1}	13.0	12.0
Available NO_3, mg kg^{-1}	10.0	11.8
Available K, mg kg^{-1}	321	366
pH (1:2.5 soil suspension)	8.45	8.2
EC dS m^{-1} (soil paste)	2.3	2.05
Soluble cations, meq. L^{-1}		
Ca^{++}	7.2	7.0
Mg^{++}	1.6	1.5
K^{+}	0.5	0.5
Na^{+}	13.0	12.0
Soluble anions, meg. L^{-1}		
CO_3^{--}	0.00	0.00
$H CO_3^{--}$	5.3	5.0
CL^{-}	15.0	14.0
SO_4^{--}	2.0	2.0

The field experiment was laid-out in a split plot design with four replications. The main plots were devoted to nitrogen levels (0, 55, 110 and 165 kg N ha^{-1}). The sub plots were assigned to the organic materials (control, rice straw, farm yard manure and rice straw compost). Nitrogen was used in the urea form (46.5 % N) in two equal splits, i.e. half as basal and incorporated into the soil just before flooding, followed by the second dose after 30 days from transplanting. The organic materials were incorporated into the soil two weeks before flooding at the rate of 5 t ha^{-1}. Compost was prepared in heap (2 X 1.5 X 1.5 m) from rice straw and farm yard manure, composted for three months. Chemical analysis of the rice straw, farm yard manure (FYM) and compost are presented in Table 2.

Table 2. Chemical analysis of the organic materials in 2012 and 2013 seasons.

Organic material	Season	C %	N%	C:N Ratio	P%	K%	Fe ppm	Mn ppm	Zn ppm
Straw	2013	60.44	0.69	87.59	0.21	1.31	329	350	38.45
	2014	62.57	0.65	96.26	0.18	1.10	306	323	33.34
Farm yard manure	2013	39.4	2.04	19.31	0.67	0.41	550	150	63
	2014	40.09	1,92	20.88	0.65	0.39	524	139	61
Compost	2013	30	1.80	16.67	0.59	0.81	580	455	68
	2014	28	1.76	15.91	0.51	0.73	490	210	41

Giza 179 Egyptian rice variety was used in this investigation. Sowing date was on April 25th and 24th in the two seasons, respectively. After 28 days, the seedlings were transplanted to the experimental field. The studied characters included, plant height (cm), number of panicles m^{-2}, panicle weight (g), No. of grains panicle^{-1}, filled grain %,1000-grain weight, grain and straw yield t ha^{-1}, hulling %, milling %, head rice % and soil organic matter %. Data collected were subjected to Analysis of Variance (ANOVA) [8]. Mean separation was based on the least significant differences (LSD) at the 5% probability level.

Results and Discussion

Plant height of Giza179 at harvest was affected significantly by nitrogen fertilizer and organic materials application in the two seasons (Table 3). Plant height was found to be affected significantly by the application of nitrogen fertilizer in the two seasons. Data indicated that plants receiving either 110 or 165 kg N ha^{-1} exhibited significant increase compared with those receiving 55 kg N ha^{-1} or planted under control (without N fertilizer). There was a significant effect of organic materials application on plant height at harvest in booth seasons. There was a progressive response in plant height with the application of rice straw compost followed by farm yard manure. Plant height at harvest as affected by the interaction between nitrogen fertilizer levels and organic materials is presented in Table 4. Data showed that the interaction between nitrogen fertilizer levels and organic materials had a significant effect on the plant height. The tallest plants were found in plots receiving either 110 or 165 kg N ha^{-1} nitrogen fertilizer combined with rice straw compost. The shortest plants were found when neither nitrogen fertilizer nor organic material was applied. These results are in harmony with several investigation[3,9].

Table 3. Plant height at harvest, number of panicle and panicle weight of Giza179 rice cultivar as affected by nitrogen level and organic material application.

Treatment	Plant height (cm)		No. of panicle m^{-2}		Panicle weight (g)	
	2013	2014	2013	2014	2013	2014
Kg N ha^{-1}						
0	76.08	77.49	389.60	409.83	2.284	2.373
55	81.75	82.62	454.73	460.18	2.505	2.598
110	88.30	88.96	475.73	482.78	2.881	2.964
165	90.63	91.21	502.58	517.60	2.921	3.008
LSD0.05	1.85	1.93	10.50	12.55	0.144	0.128
Organic Material						
Control	82.67	82.65	425.63	438.08	2.169	2.268
Rice straw	83.12	84.38	440.65	455.35	2.353	2.471
Farm yard manure	84.25	85.86	458.25	468.13	2.948	3.034
Rice straw compost	86.73	87.38	498.10	508.83	3.120	3.172
LSD0.05	1.57	1.45	9.75	12.87	0.138	0.128
Interaction	**	**	**	**	**	**

Table 4. Plant height (cm) at harvest of Giza179 rice cultivar as affected by the interaction between nitrogen level and organic material application.

Organic Material	Kg N ha^{-1}							
	2013				2014			
	0	55	110	165	0	55	110	165
Control	71.67	80.67	88.67	89.67	72.90	81.33	86.38	90.00
Rice straw	75.33	81.33	85.67	90.13	77.00	82.19	87.67	90.67
Farm yard manure	76.33	81.67	88.67	90.33	78.33	82.78	90.67	91.67
Rice straw compost	81.00	83.33	90.19	92.40	81.74	84.19	91.11	92.48
LSD0.05	2.22				2.12			

Data in Table 3 present the effect of nitrogen fertilizer and organic materials application on number of panicles per m^2. Data indicated that nitrogen levels affected significantly number of panicles per m^2. Increasing nitrogen levels from 0 up to 165 kg N ha^{-1} increased significantly number of panicles per m^2.These findings hold fairly true for the two seasons. Data showed also that organic materials application increased significantly number of panicles per m^2. The highest values of panicle number per m^2 were obtained when rice straw compost was applied followed by farm yard manure. On the other hand, the lowest numbers of panicles m^{-2} were found when organic materials were not applied. Concerning the effect of interaction, data in Table 5 showed that number of panicles per m^2 was significantly affected by the interaction between nitrogen fertilizer and organic materials. When nitrogen was applied at the rate of either 110 or 165 kg N ha^{-1}, combined with the application of compost, the greatest number of panicles per m^2 was obtained. While, the lowest values of number of panicles per m^2 were obtained when nitrogen and organic materials were not applied. These results are in the trend of data reported by other authors [2,10].

Table 5. No. of panicle m^{-2} of Giza179 rice cultivar as affected by the interaction between nitrogen level and organic material application.

Organic Material	Kg N ha^{-1}							
	2013				2014			
	0	55	110	165	0	55	110	165
Control	349.9	409.3	446.1	497.2	375.4	416.2	452.6	508.1
Rice straw	367.8	442.7	463.3	488.8	395.7	445.9	468.9	510.9
Farm yard manure Rice	393.4	464.4	473.4	501.8	410.5	471.1	475.3	515.6
straw compost	447.3	502.5	520.1	522.5	457.7	507.5	534.3	535.8
LSD0.05	11.5				15.4			

Data in Table 3 present the effect of the application of different levels of nitrogen and organic materials on panicle weight in the two seasons. The application of nitrogen increased significantly panicles weight. Plants fertilized with either 110 or 165 kg N ha^{-1} produced the heaviest panicles followed by the plants fertilized with 55 kg N ha^{-1}. The lightest panicles were obtained when no nitrogen was applied. Panicle weight was significantly high when organic materials were applied. Application of either rice straw compost or farm yard manure recorded the highest values of panicle weight. The lowest values were recorded when organic materials were not applied. The weight of panicle is a result of number of grains per panicle and filled grain percentage. The effect of compost and farm yard manure on these characters might be due to the increase in metabolites translocated to the panicles which has high number of spikelets. Data in Table 6 showed that there was a significant difference in panicle weight due to the interaction between nitrogen fertilizer and organic materials application. The heaviest panicles were obtained when plants were fertilized with either 110 or 165 kg N ha^{-1} combined with compost. The lightest panicles were observed when nitrogen and organic materials were not applied.

Table 6. Panicle weight (g) of Giza179 rice cultivar as affected by the interaction between nitrogen level and organic material application.

Organic Material	Kg N ha^{-1}							
	2013				2014			
	0	55	110	165	0	55	110	165
Control	1.333	1.920	2.633	2.790	1.437	2.007	2.810	2.817
Rice straw	2.240	2.287	2.450	2.437	2.367	2.487	2.460	2.570
Farm yard manure	2.677	2.853	3.127	3.137	2.703	2.890	3.250	3.293
Rice straw compost	2.887	2.960	3.313	3.320	2.987	3.010	3.337	3.353
LSD0.05	0.18				0.16			

Number of grains per panicle as affected by nitrogen fertilizer and organic materials application is presented in Table 7. Data showed that number of grains per panicle increased significantly when nitrogen was applied at the rate of 55 up to 165 kg N ha^{-1}. There was no significant difference in number of grains per panicle between 110 and 165 kg N ha^{-1}. These results were similar in both seasons. Organic materials application showed significant effect on number of grains per panicle in both seasons. Number of grains per panicle increased significantly with the application of either rice straw compost or farm yard manure compared with rice straw and control. The effect of the interaction between nitrogen fertilizer and organic materials application on number of grains per panicle was significant in both seasons of study as shown in Table 8. The highest number of grains per panicle were recorded when nitrogen was applied at the rate of either 110 or 165 kg N ha^{-1} combined with either rice straw compost or farm yard manure. On the other hand, the lowest number of grains per panicle was obtained when neither nitrogen nor organic material was applied in two the seasons of the study. Similar conclusion was previously drawn [11].

Table 7. No. of grains panicle^{-1}, filled grain % and 1000-grain weight of Giza179 rice cultivar as affected by nitrogen level and organic material application.

Treatment	No. of grains panicle^{-1}		Filled grain (%)		1000-grain weight (g)	
	2013	2014	2013	2014	2013	2014
Kg N ha^{-1}						
0	132.50	138.77	95.57	96.70	28.64	28.95
55	192.75	199.21	96.65	97.03	27.45	27.71
110	212.12	220.62	97.78	97.95	27.07	27.24
165	220.50	229.58	98.17	98.50	26.65	26.93
LSD0.05	13.79	13.83	1.44	1.58	0.32	0.29
Organic Material						
Control	173.04	179.25	96.68	96.09	26.94	27.15
Rice straw	184.29	191.05	97.22	96.78	27.36	27.60
Farm yard manure	198.67	206.66	97.85	97.40	27.58	27.85
Rice straw compost	201.87	211.23	98.44	97.89	27.94	28.22
LSD0.05	12.44	12.45	0.60	1.12	0.20	0.19
Interaction	**	**	**	**	*	**

Table 8. No. of grains panicle^{-1} of Giza179 rice cultivar as affected by the interaction between nitrogen level and organic material application.

Organic Material	Kg N ha^{-1}							
	2013				2014			
	0	55	110	165	0	55	110	165
Control	118.8	161.2	190.3	221.8	123.3	166.4	197.4	230.0
Rice straw	131.3	188.5	206.2	211.2	136.5	194.2	213.6	219.8
Farm yard manure	139.2	210.3	223.7	221.5	146.5	216.7	232.8	230.6
Rice straw compost	140.7	211.0	228.3	227.5	148.7	219.5	238.7	238.0
LSD0.05	15.3				15.3			

Filled grain percentage as affected by nitrogen fertilizer and organic materials application in the two seasons is shown in Table 7. Data showed that filled grain percentage was significantly affected by nitrogen application. Plants which fertilized with 165 kg N ha^{-1} produced the highest percentage of filled grain, followed by plants which received 110 kg N ha^{-1}. While, the plants that didn't receive nitrogen gave the lowest values of filled grain percentage. It could be concluded that nitrogen fertilization resulted in an increase in the amount of metabolites synthesized by rice plant and this, in turn, might account much for the superiority of filled grain percentage. Organic materials affected significantly filled grain percentage in both seasons. The application of any of the organic materials increased filled grain percentage. Application of rice straw compost gave the highest values of filled grain percentage. The improvement caused by organic fertilizer may be due to high available some nutrients such as nitrogen and phosphorus in the soil resulting in greater growth subsequently yield components involving filling percentage[11].

Data in Table 9 present the effect of the interaction between nitrogen fertilizer and organic materials on filled grain percentage. Results showed that there was a significant effect on filled grain percentage in the two seasons due to the interaction between nitrogen fertilizer and organic materials. When rice straw compost was applied in combination with any nitrogen rate, the highest values of filled grain percentage were obtained. Integrated use of organic and mineral fertilizers resulted in a significant increase in filled grain per panicle[4].

Table 9. Filled grain % of Giza179 rice cultivar as affected by the interaction between nitrogen level and organic material application.

Organic Material	Kg N ha^{-1}							
	2013				2014			
	0	55	110	165	0	55	110	165
Control	94.34	95.57	96.83	97.63	95.82	96.02	96.97	97.89
Rice straw	95.02	96.16	97.86	98.08	96.07	96.21	98.10	98.48
Farm yard manure	96.13	97.36	97.90	98.20	97.08	97.45	98.11	98.77
Rice straw compost	96.80	97.50	98.52	98.75	97.83	98.45	98.63	98.84
LSD0.05	1.46				1.31			

A thousand-grain weight as affected by the application of nitrogen fertilizer and organic materials is presented in Table 8. Data revealed that application of nitrogen significantly decreased the 1000-grain weight. Thus, the highest values of 1000-grain weight appear when nitrogen was not applied and the lowest values were obtained when either 110 or 165 kg N ha^{-1} was applied. This is mainly due to the higher number of spikelets per panicle in plants received nitrogen at any of the rates than those did not receive any nitrogen. So the sink capacity is high and the source is limited, therefore, the filling of grains will be more consequently the weight of grains will be high[12]. Data indicated also that the application of different organic materials significantly affected the 1000-grain weight. The highest values of 1000-grain weight were found when rice straw compost was applied. While, the lowest values were obtained when organic material was not applied. These results were true under the two seasons of the study. The effect of the interaction between nitrogen fertilizer and organic material on 1000-grain weight was significant in the two seasons of the study as shown in Table 10. The highest values of 1000-grain weight were obtained in plants without nitrogen whatever the organic materials application. While, the lowest values were obtained at the higher levels of nitrogen without organic material application. Another author recorded that 1000-grain weight increased by the application of chemical fertilizer along with organic manure[4].

Table 10. 1000-grain weight (g) of Giza179 rice cultivar as affected by the interaction between nitrogen level and organic material application.

Organic Material	Kg N ha^{-1}							
	2013				2014			
	0	**55**	**110**	**165**	**0**	**55**	**110**	**165**
Control	28.40	27.03	26.54	25.77	28.69	27.37	26.45	26.10
Rice straw	28.60	27.19	26.93	26.73	28.93	27.48	27.15	26.85
Farm yard manure	28.73	27.52	27.17	26.89	29.01	27.92	27.54	26.93
Rice straw compost	28.83	28.07	27.64	27.21	29.16	28.07	27.81	27.82
LSD0.05	0.43				0.39			

Grain yield of Giza179 rice cultivar, as affected by the application of different levels of nitrogen and organic materials in 2013 and 2014 rice growing seasons, is presented in Table 11. Data indicated that there was a significant difference in grain yield due to nitrogen fertilizer application. Data showed significant increase in grain yield as nitrogen level increased from 0 up to 165 kg N ha^{-1} in first and second seasons. Significant grain yield increases were observed for application of organic materials. Application of different organic materials increased grain yield in the two seasons over the control. Rice straw compost recorded the highest value of grain yield followed by farm yard manure. There was a significant effect on grain yield due to the interaction between nitrogen fertilizer and organic materials in the two seasons as shown in Table 12. Applications of nitrogen at the rate of either 110 or 165 kg N ha^{-1} combined with rice straw compost were superior to other treatments. While, the minimum values were obtained when neither nitrogen fertilizer nor organic material was applied. Grain yield, in fact, is the out-product of its main components. Any increase in one or more of such components without decrease in the others will lead to an increase in grain yield. Therefore, the increase in grain yield due to nitrogen fertilizer and organic material application was the logical resultant due to the increase components, i.e. the number of panicles m^{-2}, panicle weight, the number of grain per panicle and filled grain percentage. Several investigations reported the beneficial effects of integrated use of organic and mineral fertilizers on rice grain yield [2,3,4].

Table 11. Grain and straw yield of Giza179 rice cultivar as affected by nitrogen level and organic material application.

Treatment	Grain yield t ha^{-1}		Straw yield t ha^{-1}	
	2013	2014	2013	2014
Kg N ha^{-1}				
0	6.27	6.60	9.58	9.84
55	7.02 8.92	7.60	11.57	11.94
110	10.43	9.38	11.95	12.37
165	0.43	10.42	13.56	13.82
LSD0.05		0.33	0.23	0.20
Organic Material				
Control	7.11	7.49	10.61	10.94
Rice straw	7.62	7.95	11.30	11.63
Farm yard manure Rice	8.53	8.79	11.92	12.27
straw compost LSD0.05	9.39	9.77	12.84	13.12
	0.27	0.22	0.25	0.21
Interaction	**	**	**	**

Table 12. Grain yield (t ha^{-1}) of Giza179 rice cultivar as affected by the interaction between nitrogen level and organic material application.

Organic Material	Kg N ha^{-1}							
	2013				2014			
	0	55	110	165	0	55	110	165
Control	4.47	5.94	7.89	10.12	4.79	6.53	8.38	10.27
Rice straw	5.19	6.49	8.32	10.47	5.32	7.08	9.08	10.32
Farm yard manure Rice	7.35	7.13	9.13	10.53	7.83	7.59	9.38	10.39
straw compost	8.07	8.53	10.36	10.61	8.48	9.20	10.67	10.72
LSD0.05	0.40				0.33			

The effect of nitrogen fertilizer and organic materials application on straw yield in the two seasons is shown in Table 11. Straw yield was significantly affected by nitrogen application. Increasing nitrogen level up to 165 kg N ha^{-1} increased significantly straw yield. Straw yield increased significantly by organic materials application. Applying rice straw compost recorded the highest values of straw yield in the two seasons of study. The effect of the interaction between nitrogen fertilizer and organic material in the two seasons is presented in Table 13. The highest straw yield was obtained when nitrogen fertilizer at the rate of 110 or 165 kg N ha^{-1} and rice straw compost were applied. On the other hand, the lowest values of straw yield were recorded when nitrogen fertilizer and organic materials were not applied. This is mainly due to the fact that nitrogen fertilizer and organic materials application increased dry matter, leaf area index and number of tillers. The combination of compost with chemical fertilizer further enhanced the biomass, straw and grain yields of rice and wheat[2,9].

Table 13. Straw yield (t ha^{-1}) of Giza179 rice cultivar as affected by the interaction between nitrogen level and organic material application.

Organic Material	Kg N ha^{-1}							
	2013				2014			
	0	55	110	165	0	55	110	165
Control	8.75	10.42	10.35	12.93	8.89	10.86	10.87	13.15
Rice straw	8.92	11.66	11.46	13.17	9.26	11.93	11.80	13.53
Farm yard manure	9.58	11.84	12.18	14.07	9.81	12.21	12.86	14.21
Rice straw compost	11.08	12.38	13.81	14.08	11.41	12.74	13.94	14.38
LSD0.05	0.47				0.40			

Hulling percentage as affected by the application of different levels of nitrogen and organic materials in the two seasons is presented in Table 14. Data showed that nitrogen application had a significant effect on hulling percentage in both seasons. Increasing nitrogen level up to 165 kg N ha^{-1} increased significantly hulling percentage. There was no significant difference in Hulling percentage between 110 and 165 kg N ha^{-1}. While, the lowest values were obtained at zero level of nitrogen. This could be attributed to that nitrogen application increased grain-filling rate consequently reduced the hull thickness[12]. Data showed that there was no significant difference in hulling percentage due to organic materials application or the interaction in the two seasons of the study.

Table 14. Hulling %, milling % and head rice % of Giza179 rice cultivar as affected by nitrogen level and organic material application.

Treatment	Hulling %		Milling %		Head rice %	
	2013	2014	2013	2014	2013	2014
Kg N ha^{-1}						
0	80.75	80.98	62.30	66.55	55.09	57.83
55	81.95	82.07	68.19	69.63	56.72	61.53
110	82.60	82.97	71.16	71.52	59.99	64.61
165	83.16	83.95	72.86	72.83	62.28	66.57
LSD0.05	1.21	1.53	2.27	2.42	3.89	3.49
Organic Material						
Control	81.46	81.94	67.13	68.45	56.55	60.92
Rice straw	81.88	82.27	67.92	69.79	57.87	61.96
Farm yard manure	82.42	82.62	69.41	71.11	59.75	63.63
Rice straw compost	82.70	83.14	70.05	71.16	59.91	64.02
LSD0.05	N.S	N.S	2.34	2.01	3.94	2.46
Interaction	N.S	N.S	**	*	**	**

Data in Table 14 show the effect of application of different levels of nitrogen and organic materials on milling percentage in the two seasons. Milling percentage was significantly affected by the application of nitrogen levels. The application of nitrogen at the rate of 110 or 165 kg N ha^{-1} increased significantly milling percentage compared with 0 and 55 kg N ha^{-1}. Moreover, there were no significant differences between application of 110 or 165 kg N ha^{-1} on milling percentage. Similar trend was found in the two seasons. Application of different organic materials increased milling percentage significantly. The highest values were recorded when rice plants were fertilized with rice straw compost or farm yard manure. Moreover, the differences were insignificant between rice straw and control in both seasons. Data in Table 15 present the effect of the interaction between nitrogen and organic material application on milling percentage in the two seasons of study. The highest milling rice percentages were obtained from the application of 110 or 165 kg N ha^{-1} irrespective of organic material treatment. Data revealed also that the effect of organic materials on milling percentage at the zero level of nitrogen is significant. The increase in milling percentage due to nitrogen fertilizer and organic materials application may be due to the increase in metabolites in grains [13].

Table 15. Milling % of Giza179 rice cultivar as affected by the interaction between nitrogen level and organic material application.

Organic Material	Kg N ha^{-1}							
	2013				2014			
	0	55	110	165	0	55	110	165
Control	58.71	66.82	70.15	72.82	63.11	68.65	70.01	72.04
Rice straw	61.12	67.01	70.76	72.79	64.98	69.89	71.17	73.14
Farm yard manure	64.51	69.11	71.26	72.76	68.95	70.17	72.25	73.08
Rice straw compost	64.86	69.83	72.45	73.07	69.15	69.81	72.66	73.04
LSD0.05	3.62				2.01			

The effect f nitrogen and organic material application on head rice % in the two seasons is presented in Table 14. Data showed that head rice % increased significantly with the application of nitrogen fertilizer. The highest values of head rice % were realized when nitrogen was applied at the rate of 165 kg N ha^{-1} with no significant differences with the application of 110 kg N ha^{-1}. The lowest values of head rice % were obtained when nitrogen was not applied. Data showed also that application of organic material increased significantly head rice % of rice grain in both seasons. Application of rice straw compost or farm yard manure significantly increased head rice % compared with control and rice straw application. Regarding the effect of nitrogen and organic material interaction on head rice %, data in Table 16 showed that high value of head rice % was found when nitrogen was applied at the rate of 165 kg N ha^{-1} irrespective of organic material. On the other hand, there was no significant difference between the mentioned treatment and application of 110 kg N ha^{-1} combined with rice straw compost or farm yard manure. Low head rice % was found in plots free from fertilizers[13].

Table 16. Head Rice % of Giza179 rice cultivar as affected by the interaction between nitrogen level and organic material application.

Organic Material	Kg N ha^{-1}							
	2013				2014			
	0	55	110	165	0	55	110	165
Control	52.17	55.25	56.39	62.37	54.62	60.14	62.34	66.59
Rice straw	54.64	56.11	58.29	62.41	57.03	60.65	63.57	66.60
Farm yard manure	56.17	57.94	62.50	62.39	59.45	62.58	65.89	66.58
Rice straw compost	57.36	57.57	62.79	61.93	60.21	62.76	66.62	66.50
LSD0.05	4.78				3.88			

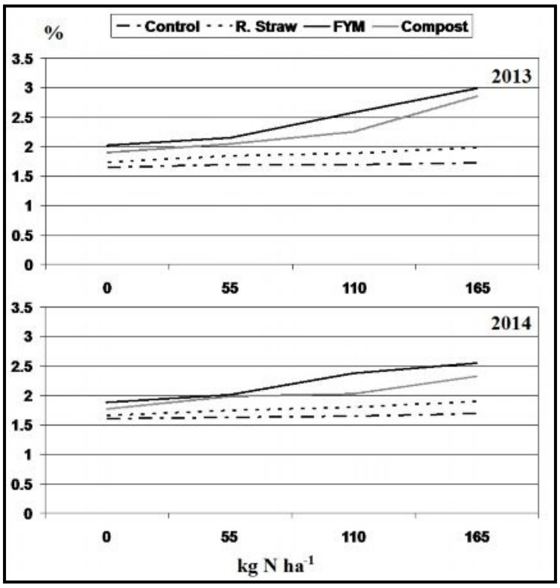
Nitrogen rates and organic materials application affected significantly soil organic matter % as present in Table 17. Increasing nitrogen rate from 0 up to 165 kg N ha^{-1} increased significant soil organic matter %. Compared with other organic materials, farm yard manure application recorded the highest percentage of soil organic matter followed by compost. There were no significant differences between control and rice straw application. Soil organic carbon was positively correlated with the increasing rates of manure application[14].

Regarding the interaction (Fig 1), when N was applied at different rates alone or combined with rice straw, soil organic matter was slightly greater than that of the control (no N applied). On the other hand, soil organic matter increased significantly with the application of nitrogen rates under farm yard manure and rice straw compost application. Adequate application of fertilizers combined with farmyard manure could increase soil nutrients, and soil organic carbon content[15]. Manure or crop residue alone may not be adequate to maintain soil organic carbon levels.

Table 17. Soil organic matter % as affected by nitrogen level and organic material application.

Treatment	2013	2014
Kg N ha^{-1}		
0	1.83	1.73
55	1.93	1.84
110	2.10	1.96
165	2.39	2.12
LSD0.05	0.18	0.13
Organic Material		
Control	1.69	1.64
Rice straw	1.86	1.78
Farm yard manure	2.44	2.21
Rice straw	2.26	2.03
compost LSD0.05	0.16	0.13
Interaction	**	**

Fig1. Soil organic matter % as affected by the interaction between nitrogen level and organic material application.



Conclusion

It could be concluded that the integrated use of organic materials and inorganic fertilizer significantly increased the yield and yield contributing characters of Egyptian rice cultivar Giza179. The higher values of yield, yield parameters and grain quality characters were recorded when urea plus compost was used. Combined of mineral nitrogen with farmyard manure or compost could increase soil organic matter content.

References

1. Sahrawat, K. L. Organic matter accumulation in submerged soils. Advances in Agronomy, 2004, 81:169−201.

2. Myint, AK, Yamakawa T, Kajihara Y, Zenmyo T. Application of different organic and mineral fertilizers on the growth, yield and nutrient accumulation of rice in a Japanese ordinary paddy field. Sci. World J., 2010, 5:(2):47-54.
3. Siavoshi M, Dastan S, Yassari E, Laware SL. Role of organic fertilizers on morphological and yield parameters in rice (Oryza sativa L.). Int. J. Agron. Plant. Prod., 2013, 4(6):1220-1225.
4. Yang CM, Yang L, Yang Y, Ouyang Z. Rice root growth and nutrient uptake as influenced by organic manure in continuously and alternately flooded paddy soils. Agricultural Water Management, 2004, 70(1):67-81.
5. Linquist BA, Phengsouvanna V, Sengxue P. Benefits of organic residues and chemical fertilizer to productivity of rain-fed lowland rice and to soil nutrient balances. Nutr Cycl Agroecosyst., 2007, 79:59–72.
6. Cottenie A, Verloo PM, Kiekens L, Velghe G, Camerlynek R. Chemical Analysis of Plants and Soils. Laboratory of Analytical and Agrochemistry. State Univ. Ghent-Belgium, 1982.
7. Page AL, Miller RH, Keeney DR. Methods of Soil Analysis- Part 2. 2nd ed., Am. Soc. Agron., Madison, WI, USA. 1982.
8. Gomez K, Gomez A. Statistical Procedures of Agricultural Research. John Wiley and Sons. Inc., New York, U.S.A. 1984.
9. Sarwar G, Schmeisky H, Hussain N, Muhammad S, Ibrahim M, Safdar E. Improvement of soil physical and chemical properties with compost application in rice-wheat cropping system. Pak. J. Bot., 2008, 40(1): 282-275.
10. Qiao-gang YU, Jing YE, Shao-na YANG, Jian-rong FU, Jun-wei MA, Wan-chun SUN, Li-na JIANG, Qiang WANG, Jian-mei WANG. Effects of nitrogen application level on rice nutrient uptake and ammonia volatilization. Rice Sci., 2013, 20(2):139-147.
11. Satyanarayana V, Prasad PVV, Murthy VRK, Boote KJ. Influence of integrated use of farmyard manure and inorganic fertilizers on yield and yield components of irrigated lowland rice. J. of Plant Nutr., 2002, 25(10):2081–2090.
12. Metwally TF, Gewaliy EE, Naeem ES. Nitrogen response curve and nitrogen use efficiency of Egyptian hybrid rice. J. Agric. Res. Kaferelsheikh Univ., 2011, 37(1):73-84.
13. Srivastava P, Srivastava PC, Singh US, Shrivastava M. Effect of integrated and balanced nutrient application on soil fertility, yield and quality of Basmati rice. Shrivastava Archives of Agron. and Soil Sci., 2009, 55(3): 265–284.
14. Zhang YG, Yang S, Fu MM, Cai JP, Zhang YY, Wang RZ, Xu ZW, Bai YF, Jiang Y. Sheep manure application increases soil exchangeable base cations in a semi-arid steppe of Inner Mongolia. J. Arid Land. 2015, 7(3): 361–369.
15. Liu X, Herbert SJ, Hashemi AM, Zhang X, Ding G. Effects of agricultural management on soil organic matter and carbon transformation – a review. Plant Soil Environ., 2006, 52 (12): 531–543.

***** *****