Some Nutrients Availability in Rice Soil under Utilization of Organic and Inorganic Fertilizers

EL-Hity, M.A.[1], Metwally, T.F.[2], Mohammed, A. A.[1], Gharieb, A.S.[2*] and Elsaka, M. A. M.[2]

[1]Agronomy Department, Faculty of Agriculture, Kafrelsheikh University, Kafr El-Sheikh, Egypt.
[2]Rice Research and Training Center, Field Crops Research Institute, Agricultural Research Center, Kafr El-Sheikh, Egypt.
*Corresponding author, e-mail: abdelfatah_sobhy@yahoo.com

ABSTRACT

A field experiment was conducted at the Experimental Farm of Sakha Agricultural Research Station; Kafr El-Sheikh, throughout the summer season of 2017 and 2018 to examine the nutrients status in rice soils under the utilization of organic and inorganic fertilizers. Egyptian hybrid rice one (EHR1) variety was used. The experiment was laid out in a split-plot design with four replications, where main plots were assigned to NPK fertilizer treatment and sub-plots were allocated to organic material treatments. The NPK fertilizer's treatments were full dose, 2/3, 1/3 of NPK recommended doses and control (without any mineral fertilizers application). The recommended doses of NPK are 165 kg N ha^{-1}, 36 kg P_2O_5 ha^{-1} and 58 kg K_2O ha^{-1}. The organic material treatments were control (without any organic materials application), rice straw compost, farm yard manure, chopped rice straw and mixture of chopped rice straw and farm yard manure (1:1). The application rate of the organic materials was 7 tons ha^{-1} for each treatment. The studied characteristics were the available ammonium (ppm), nitrate (ppm), phosphorus (ppm), potassium (ppm), zinc (ppm) as well as grain yield (t ha^{-1}). Soil samples were collected at 30, 45 and 60 days after transplanting (DAT) and after rice harvest during the two study seasons. The available nutrients in soil tended to increase as NPK fertilizer levels increased and by the application of organic materials. Available NH_4 markedly increased after flooding reached its high peak at 30 DAT and then declined to the minimum values at harvest. The high peak of NO_3 was observed at 30 DAT, then started to decline afterward and reached its minimum values at harvest. The highest amount of available K was obtained at 45 DAT and then decreased continuously with crop growth, reaching the lowest values at harvest time. Current data reveal that the maximum available Zn was found at 30 DAT. The application of a full recommended dose of NPK mineral fertilizer combined with compost or farm yard manure and compost alone produced the highest values of grain yield.

Key words: NPK fertilizers, farm yard manure, chopped rice straw, rice straw compost.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important cereal crops of the world, grown in wide range of climatic zones, to nourish the mankind. Increasing rice production can be achieved through improving overall management system of crop culture, especially the nutrient management of the crop, as well as the proper utilization of different sources of nutrients. The nutrient management aims to reduce agrochemical use and enhance soil fertility through using different sources of fertilizers. None of such sources is complete or sufficient to sustain soil fertility and crop productivity; hence the farmer is obliged to use more levels of the inorganic chemical fertilizers.

Compost is an organic fertilizer that can be made on the farm at very low cost. The most important input is the farmer's labor. Compost is decomposed organic matter, such as crop residues and/or animal manure, Most of these ingredients can be easily found around the farm (Li *et al.*, 2009). In order to increase soil fertility in the short run, nutrients have to be added to the soil. This is often done by applying chemical fertilizers. Chemical fertilizers, however, are expensive to purchase and for most small-scale farmers this is a problem. Preparation and use of compost can be a solution to that problem. To really improve soil fertility in the long term, it is necessary to improve the soil structure and to increase the organic matter content of the soil (Liang *et al.,* 2006).

Under the intensive cropping system, Egyptian farmers used to use huge amounts sets of mineral fertilizers. Mineral fertilizers have the potential to perform a crucial function in Egyptian agriculture development, but they also are non- renewable and many damage to the plants and soil. The long-term uses of chemical fertilizer change the physical and chemical characteristics of the soil. Thus, the utilization of organic fertilizer is becoming more important especially under the stress of climate change. Sharma and Dhaliwal, (2019) revealed that substitution with 50% N through rice straw compost significantly increased the rice grain yield and biochemical properties as compared to inorganic fertilizers (NPK) alone. These virtues make composting an ideal option for processing the enormous quantities of biodegradable solid wastes that are generated in the world.

Siavoshi *et al.,* (2013) investigated the use of various organic materials on morphological and yield parameters in rice. Cow manure, poultry manure, rice straw, and rice husk were used for the formulation of organic fertilizers with NPK. Grain yield and morphological parameters increased significantly in all the treatments over control. An improvement in the grain yield may be due to the increase parameters like dry matter, the whole number of tiller, flag leaf diameter, number of fertile tillers per hill and 1000-grain weight.

Metwally, (2015) studied the impact of some organic materials combined with different levels of mineral nitrogen on rice. The organic materials treatments were: control, chopped rice straw, farm yard manure and rice straw compost. Yield and yield components were positively and significantly affected by nitrogen, organic materials and the interaction. Most of the studied characters produced the highest values when the organic materials were combined with mineral fertilizer. He also reported that adequate application of mineral nitrogen combined with farm yard manure or compost could increase soil organic matter content. Mohanty et al., (2020) reported that the application of organics manure and inorganic fertilizer increased fertility of rice soil.

The main objective of the present study was to investigate the impact of NPK fertilizers and organic materials on rice yield and the nutrients status in rice soils.

MATERIALS AND METHODS

A field experiment was conducted at the Experimental Farm of Sakha Agricultural Research Station; Kafr El-Sheikh, during the summer season of 2017 and 2018 to examine the nutrients status of paddy fields under the utilization of organic and inorganic fertilizers. Egyptian hybrid rice one (EHR1) variety was used. Wheat was the preceding crop in the two seasons. Before land preparation, initial representative soil samples were collected at 0-15 cm depth from different spots and prepared for physical and chemical analysis. The physical and chemical characteristics of the experimental soil (Jones, 2001) are specified in Table 1.

The experimental site was opened by a tractor, and then the land was ploughed and cross-ploughed two times to obtain optimum tillage and puddle condition. The land was leveled and the experimental plot was partitioned into 12 m^2 as subplots (3X4 m). The experiment was laid out in a split-plot design with four replications, where, main plots were assigned to NPK fertilizers and sub-plots were allocated to organic materials. The NPK fertilizer's treatments were full dose, 2/3, 1/3 of NPK recommended doses and control (without any mineral fertilizers application). The recommended doses of NPK are 165 kg N ha^{-1}, 36 kg P_2O_5 ha^{-1} and 58 kg K_2O ha^{-1}. The organic materials treatments were control (without any organic materials application), rice straw compost, farm yard manure, chopped rice straw and chopped rice straw mixed with farm yard manure (1:1). The application rate of the organic materials was 7 tons ha^{-1}. The total amounts of calcium super phosphate (15% P_2O_5), potassium sulfate (50% K_2O), rice straw, farm yard manure (FYM) and compost were applied as a basal application according to the treatments' schedule.

Table 1: Physio-chemical characteristics of the experimental site.

Soil characteristics	Seasons	
	2017	**2018**
Soil texture (%)	**Clayey**	**Clayey**
clay %	57.00	54.00
Sand %	11.00	11.00
Silt %	32.00	35.00
pH (1: 2.5 water suspension)	8.05	8.20
EC (dSm^{-1})	3.09	2.90
Organic matter	1.65	1.50
Available P (ppm)	14.00	12.00
Available NH_4 (ppm)	13.50	12.60
Available NO_3 (ppm)	10.00	11.80
Available K (ppm)	366	350
Available Zn (ppm)	0.80	0.90
Cations (meq/L.)		
Ca+ +	6.30	5.80
Mg+ +	4.10	3.70
Na++	19.13	17.70
K+	1.40	1.70
Anions (meq/L.)		
HCO3-	6.50	5.77
Cl-	8.80	8.30
$SO4^{--}$	15.63	14.90
$CO3^{--}$	0.00	0.00

Chopped rice straw with farmyard manure was used to prepare the compost. The subsequent successive layers were piled as follows: a layer of about 10 cm rice straw; a layer of about 2 cm farmyard manure; a thin layer of soil. The used soil was collected from the top layer (10-30 cm) of a clean farm. The decomposition duration was about three months. Chemical analysis of the rice straw, farm yard manure (FYM) and compost are presented in Table 2.

Nitrogen fertilizer in the form of urea (46.5% N) was applied in 3 equal splits: one third was applied before transplanting (into dry soil), one third at 25 days after transplanting (DAT) and the remaining one third was applied at 45 DAT. Thirty days old seedlings of EHR1 were transplanted on 15^{th} and 17^{th} of June, 2017 and 2018 respectively. Two seedlings per hill in a spacing of 20 cm × 20 cm were used. The plants were reaped at full maturity when 80% of the panicles were turned yellow. Ten main panicles were selected randomly from each subplot for measuring yield contributing characters. After drying, the grain and straw yields were determined.

The studied characters were the available ammonium (ppm), nitrate (ppm), phosphorus (ppm), potassium (ppm), zinc (ppm) as well as grain yield (t/ha). Soil samples were collected at 30, 45 and 60 DAT and after rice harvest in during the two study seasons from the surface layer of (0-30 cm).The samples were dried for constant weight, then ground before conducting some soil analysis. Ammonium and nitrate were extracted with 2.0 M potassium chloride according to Page *et al.,* (1982) and determined by microkjeldahl apparatus. Potassium was extracted by ammonium acetate- EDTA according to Cottenie *et al.,* (1982). Potassium was determined by flam photometer. Phosphorus was extracted by ammonium acetate- EDTA according to Cottenie *et al.,* (1982). Phosphorus was measured by spectrophotometer using ascorbic acid method according to Page *et al.,* (1982). Available zinc in rice soil at different stages was measured by Perkin-Elemer Plasam 400 spectrophotometer.

The data was subjected to analysis of variance (Two-way ANOVA), and the differences among treatments' means were compared using Duncan's multiple range tests at 5% level of probability according to Duncan, (1955). All statistical analyses were done using Costat Statistical Software - CoHort Software.

RESULTS AND DISCUSSION

Nutrients availability in the soil

Available ammonium (ppm)

Availability of NH_4 at different periods through rice growing seasons as affected by NPK levels and organic materials treatments are presented in Figures 1 and 2. Data showed that available NH_4 greatly increased after flooding reached its high peak at 30 DAT, and then declined to the minimum value at harvest. De Datta, (1981) stated that the greater part of N fertilizer mineralized during rice season appears as ammonium form within two weeks after submergence. Data indicated that at 30, 45 and 60 DAT and harvest, the available ammonium in soil tended to increase as NPK fertilizer levels increased (Fig 1). Plots that received a high level of NPK fertilizer (full dose of NPK) showed more available ammonium concentration than plots that received low NPK levels. Data also show that, the highest value of available NH_4 was obtained at 30 DAT with the application of full dose of NPK, while the least values of NH_4 was obtained at harvest with untreated plots. This view could be in harmony with those found by De Datta, (1981), Sikdar *et al.,* (2008) and Gharieb *et al.,* (2015) who stated that increasing level of nitrogen application up to 73Kg N fed $^{-1}$ increased the available ammonium concentration in soil. This phenomenon might be due to that NPK uptake increased with the advancement of plant age and it might reflect directly on soil nitrogen concentration (Fageria, 2004, Zadeh, 2014 and Qaswar *et al.,* 2020).

Table 2: Selected chemical properties of different organic materials in 2017 and 2018 seasons.

Properties	Rice Straw		Farm yard manure		Compost	
	2017	2018	2017	2018	2017	2018
C %	65.4	67.7	42.63	43.38	32.44	29.78
N%	0.72	0.71	2.21	2.18	1.95	1.90
C:N Ratio	90.83	95.35	19.31	19.90	16.66	15.64
P%	0.23	0.19	0.72	0.70	0.64	0.55
K%	1.42	1.39	0.44	0.42	0.88	0.79
Fe ppm	356	331	595	567	628	530
Mn ppm	379	349	162	150	276	227
Zn ppm	41.60	36.07	68.17	65.67	73.58	44.36

Organic material treatments significantly affected available NH_4 at different growth periods and at harvest in the two seasons. Application of organic materials generally increased significantly available ammonium at the three growth periods and at the harvest in both seasons. The highest values were recorded when rice straw compost or farm yard manure was applied at 30 DAT in both seasons (Fig 2). Moreover, the least values of available ammonium were recorded when organic materials treatments were not applied. Release of N (also called mineralization) from compost is due to the conversion of organic forms of N to inorganic N as ammonium N (NH_4). Organic material application leads to enhance enrichment of organic nitrogen in the soil (Bhardwaj *et al.,* 2020). Surekha *et al.*, (2006) reported that rice straw incorporation or organic manure application increased significantly NH_4 concentration in rice soil. Similar trend was found by Ahmed and Naeem, (2012), and Selvarajh *et al.,* (2021).

Available nitrate (ppm):

Soil NO_3 concentration in both rice seasons at different growth periods and at harvest as affected by NPK levels and organic material treatments application is presented in Figures 3 and 4. Data reveal that the high peak of NO_3 was observed at 30 DAT in 2017 and 2018 seasons, then started to decline afterward and reached its minimum values at harvest. Figure 3 indicated that No_3 -N tended to increase as NPK levels increases. Plots that received the high level of NPK fertilizer (full dose) released more NO_3- N than low levels (control or two third). The maximum value of NO_3- N released was observed at 30 DAT with the application of full dose of NPK. The lowest NO_3- N released was obtained with untreated control at harvest. Supposing that the mineralization of nitrogen from native and added N-sources in submerged soil to ammonia, had stopped at that stage because of oxygen depletion (Naeem, 2006). Hashem, (2010) reported that, increasing levels of nitrogen application up to 165 kg N ha^{-1} increased the concentration of NO_3- N in rice soil. The same trend was found in the two seasons.

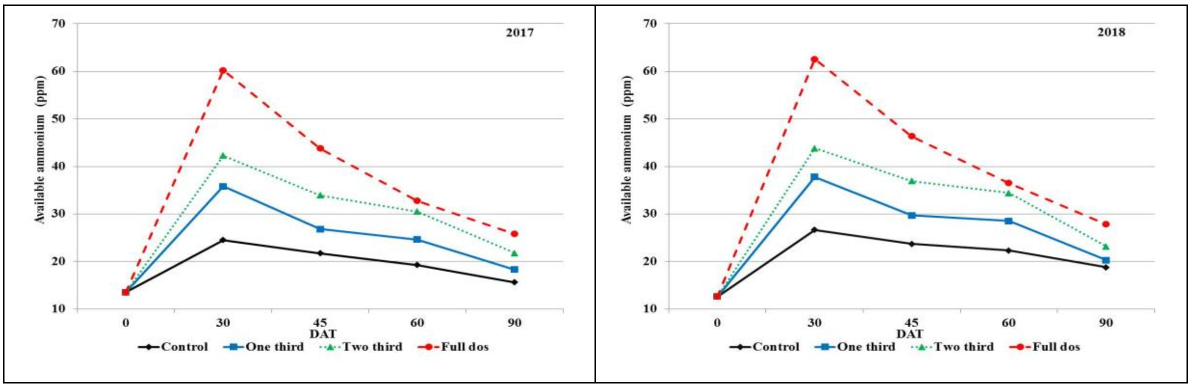

Figure 1; Available ammonium at different growth stages of different NPK rates in 2017 and 2018 seasons.

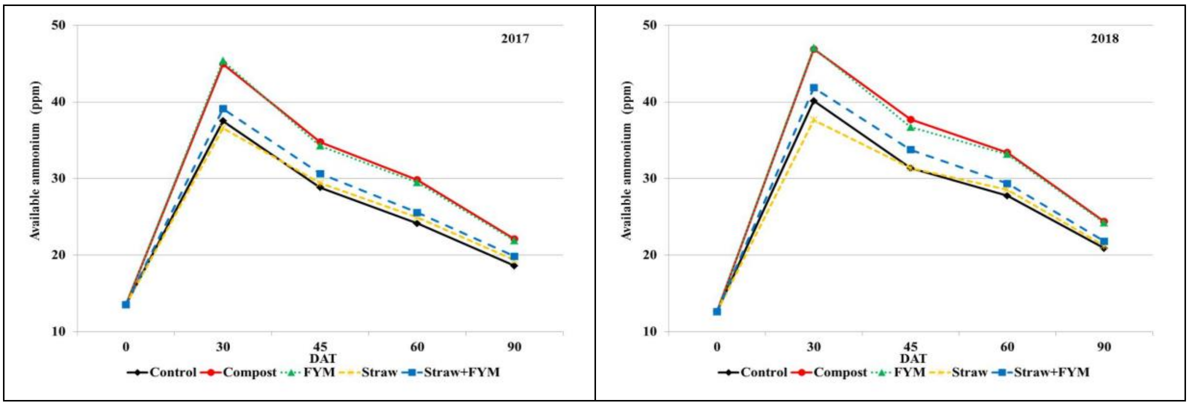

Figure 2; Available ammonium at different growth stages of of different organic material treatments in 2017 and 2018 seasons.

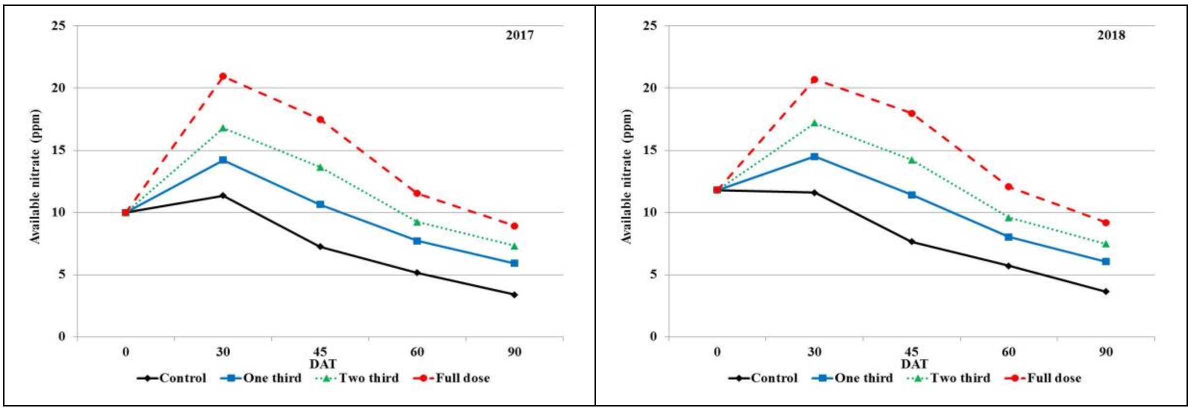

Figure 3: Available nitrate at different growth stages of different NPK rates in 2017 and 2018 seasons.

Available nitrate was found to be significantly affected by organic material treatments at various studied growth stages (Fig 4). The highest values of available NO_3- N recorded when plots received rice straw compost or farm yard manure at 30 DAT compared with other treatments. These results are in a harmony with those obtained by Gharieb *et al.*, (2015), Halder *et al.*, (2020) and Selvarajh *et al.*, (2021).

Available potassium (ppm):

Soil available potassium at various growth periods of rice as affected by NPK levels and organic material treatments application are presented in Figures 5 and 6. Data showed that the highest amount of available K was obtained at 45 DAT in both seasons, then decreased continuously with crop growth, reaching the least values at harvest time. The decrease in the available soil K under continuous flooding is mainly attributed to K uptake by rice plants and losses by leaching. Mohanty *et al.*, (2020) stated that the availability of K decreased with continuous flooding and development of plant growth. Also, Naeem, (2006) proposed that mobilization of non- exchangeable K in flooding rice is root induced through acidification, coupled with K removed from the soil solution by the root uptake. Under NH_4- N nutrition, interlayer K can also be replaced by NH_4 ions which are similar in ionic size.

Available potassium was significantly affected by organic material treatments at different growth periods and at harvest in the two seasons (Fig 6). The highest mean values were obtained with the application of rice straw compost or farm yard manure at 45 DAT. The lowest mean values were obtained without organic materials application at harvest time in the two seasons. This might be attributed to that K soil in solution is higher in the compost treatments, another reason might be the increase in soil Fe^{3+} and Mn^{2+} caused by rice straw composting which released K^{+} from exchangeable complexes (Naeem, 2006 and Sahu *et al.*, 2020). Gajalaksjmi and Abbasi, (2008) reported that the addition of compost to soil can affect soil fertility by modifying the physical, chemical and biological properties of the soil. The chemical changes include the enhancement of nutrients content of the soil. These results are in agreement with those of Ghimire *et al.*, (2017) and Kumar *et al.*, (2019).

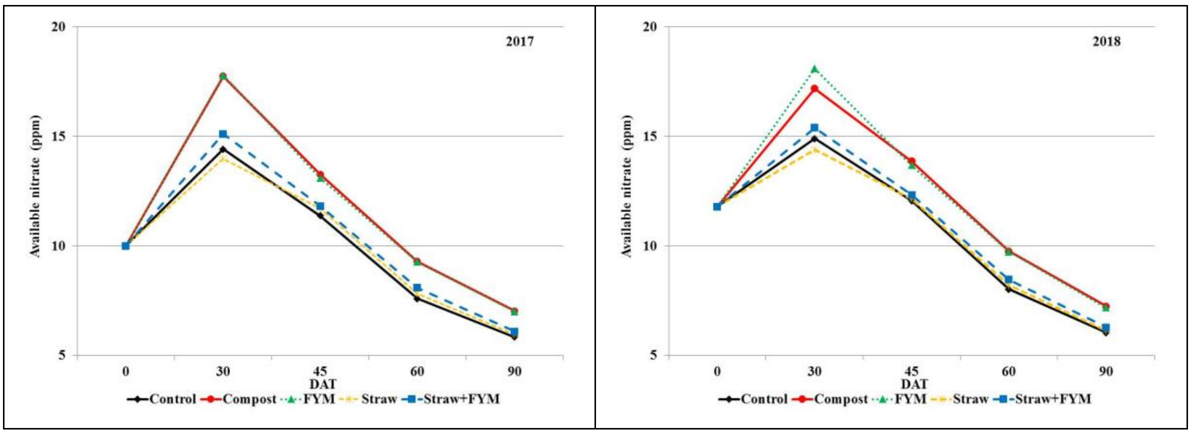

Figure 4: Available nitrate at different growth stages of different organic material treatments in 2017 and 2018 seasons.

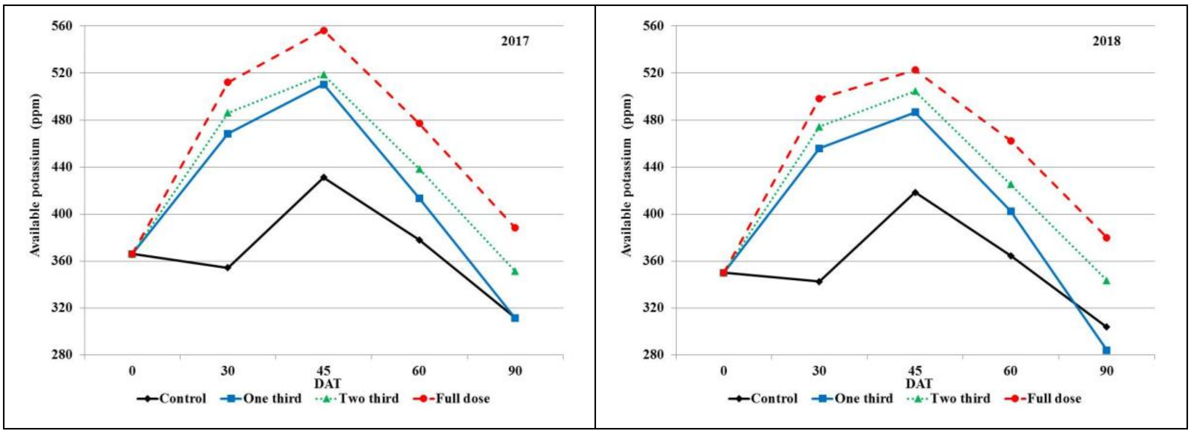

Figure 5: Available potassium at different growth stages of different NPK rates in 2017 and 2018 seasons.

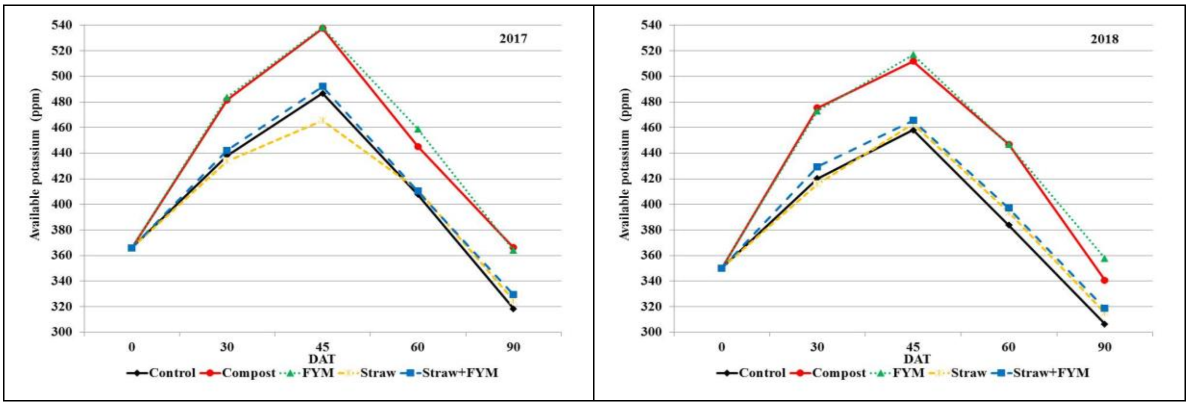

Figure 6: Available potassium at different growth stages of NPK rates in 2017 and 2018 seasons.

Available phosphorus (ppm):

Available phosphorus (ppm) in the soil as affected by NPK levels and organic materials treatments in the two seasons were presented in Figures 7 and 8. The level of NPK fertilizer levels significantly affected. Data reveal that available phosphorus in the soil at different growth periods and at harvest in the two seasons. Available phosphorus tended to increase as NPK levels increased. Plots that received the highest level of NPK (full dose) showed more available phosphorus than other plots, which received low NPK Levels. Data also showed that the highest values of available P were obtained at 30 DAT with the application of the full dose of NPK at both seasons. While, the least values of available phosphorus were obtained at harvest time in both seasons with untreated control.

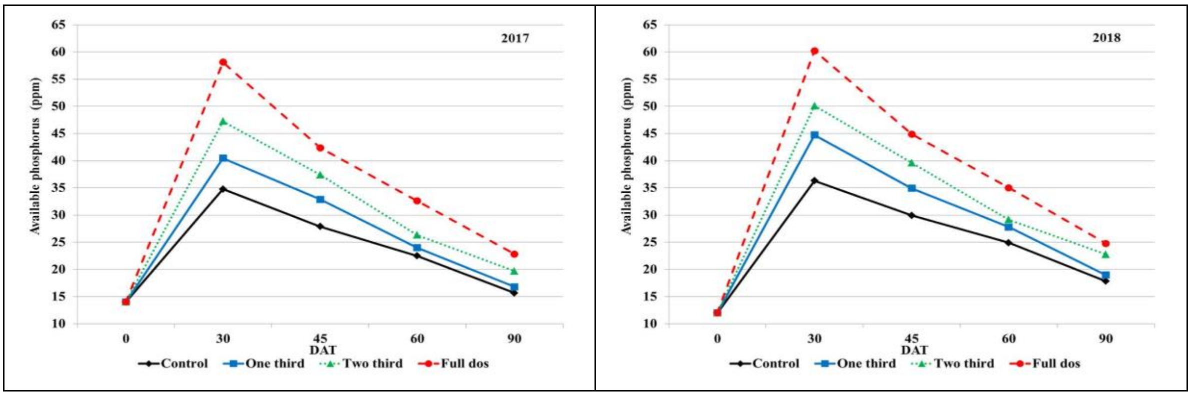

Figure 7: Available phospharus at different growth stages of different NPK rates in 2017 and 2018 seasons.

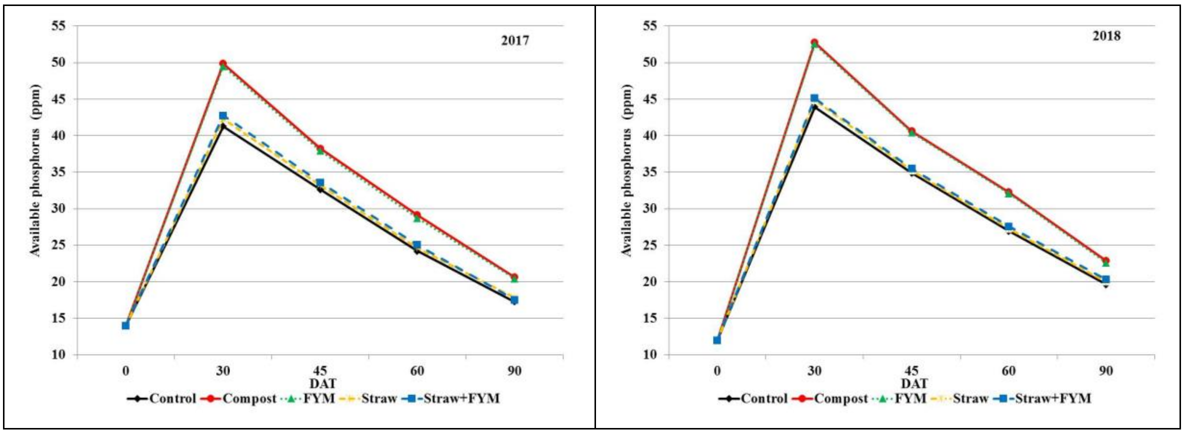

Figure 8: Available phosphorus at different growth stages of different organic material treatments in 2017 and 2018 seasons.

Phosphorus availability in the soil at 30, 45 and 60 DAT and at harvest was significantly affected by organic materials treatment in the two seasons. There was a significant increase in available phosphorus at the three different growth periods and at harvest with the application of rice straw compost or farm yard manure in both seasons. The highest values of available P were obtained at 30 DAT with application of compost or FYM in the two seasons. The least values of available P were obtained at harvest time with untreated control. The rise of phosphorus in the soil solutions that occurred with the application of organic materials is suggested to be an expression of enhanced mobilization of phosphorus from insoluble forms by biological activity. Jiang *et al.,* (2021) showed that, rice straw incorporation can be used to increase soil P availability and P use efficiency, while decreasing the use of chemical P fertilizers.

Available Zinc (ppm):

Available Zn at different growth stages of rice crop as affected by NPK levels and organic material application is presented in Figures 9 and 10. Data reveal that the maximum available Zn was found at 30 DAT with the application of the full dose of NPK fertilizer in 2017 and 2018 seasons, respectively. These results are in agreement with those obtained by Gharieb *et al.*, (2015) and Metwally, (2015).

Significant variations were detected on available zinc in the soil when organic materials were incorporated into the soil. The highest soil content of zinc at different growth stages and at harvest was recorded by the application of compost followed by farm yard manure. The application of those materials may increase the availability and translocation of zinc under submerged condition. Furthermore, compost and farm yard manure contain higher zinc content that rice straw (Table 2). Moreover, Marschner, (1993) reported that, soil organic matter is a constituent that enhances the diffusion rate of zinc in soils by desorption of zinc and formation of soluble complex, resulted in increasing its release, concentration, and supply rate to the root surface.

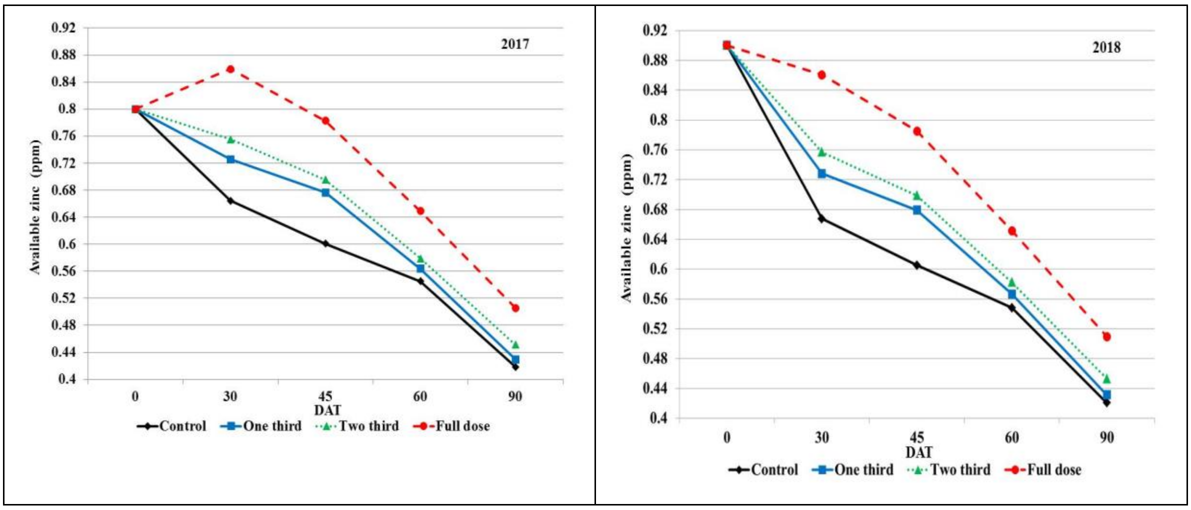

Figure 9: Available zinc at different growth stages of different NPK rates in 2017 and 2018 seasons.

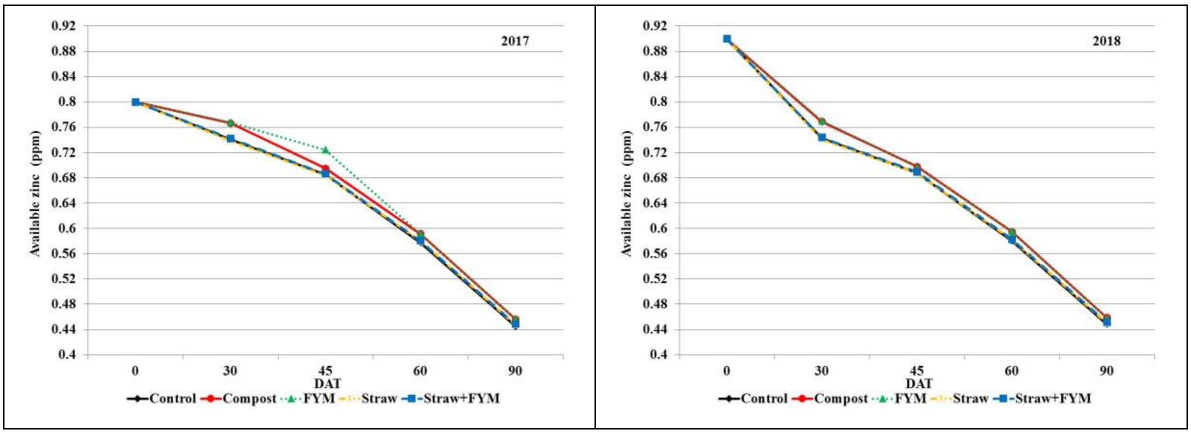

Figure 10: Available zinc at different growth stages of different organic material treatments in 2017 and 2018 seasons.

Grain yield (t ha^{-1}):

Grain yield is the final indicator of crop behavior under different crop management practices. Grain yield of Egyptian hybrid rice as affected by NPK fertilizer levels and organic material treatments in 2017 and 2018 rice growing seasons were presented in Table (3). The application of NPK fertilizer led to a significant increment of rice grain yield as NPK level was raised to full dose in both seasons. There was a significant difference between two- third and full dose of NPK fertilizer on grain yield. 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 applying NPK was the logical resultant due to the achieving increases in its components, i.e. the number of panicles per plant, filled grains percentage and the number of grains per panicle. Similar trend was found by Metwally *et al.*, (2011), Gharieb *et al.,* (2016), Sudhakar *et al.,* (2018) and Ramesh, (2019). Uddin *et al.,* (2013) found that, NPK application resulted in increasing photosynthetic efficiency as well as translocation of assimilates which reflected in increases in most of grain yield components.

Grain yield was significantly affected by organic material treatments in both seasons. The plots that received either rice straw compost or farm yard manure significantly increased grain yield. That increase in grain yield was due to an increase in some yield components. The application of rice straw statistically recorded the same values of control (without organic materials application). These findings could be attributable to the low amounts of nutrients released from rice straw which depends on the total N content and the C:N ratio. Rice straw contained less total N and higher C:N ratio than compost and farm yard manure (Table 3). Similar trends were obtained by Ahmed and Naeem (2012), Metwally (2015), Gharieb *et al.,* (2016), Halder *et al.,* (2020), *Qaswar et al.,* (2020) and Sahu *et al.,* (2020).

Table 3: Grain yield (t ha^{-1}) as affected by organic material treatments, NPK levels and their interaction in 2017 and 2018 seasons.

Treatments	Control	Compost	FYM	Straw	Straw + FYM	Mean
			2017			
Full dose	9.13cd	12.31a	11.92ab	8.39def	8.74de	10.10A
2/3	7.91d-g	10.29c	10.56bc	7.64d-g	8.17d-g	8.92B
1/3	7.67d-g	7.91d-g	8.50def	6.91f-i	7.23e-h	7.65C
Control	6.01hi	7.35e-h	7.65d-g	5.65i	6.60ghi	6.65D
Mean	7.68B	9.47A	9.66A	7.15B	7.69B	
			2018			
Full dose	10.00e	12.70a	12.17b	10.03e	10.53d	11.09A
2/3	9.22gh	11.72c	10.83d	8.94hi	9.36fg	10.01B
1/3	7.56k	10.10e	9.73ef	8.38j	8.64ij	8.88C
Control	5.52m	9.00ghi	7.68k	5.37m	6.57l	6.83D
Mean	8.08D	10.88A	10.10B	8.18D	8.77C	

Means of each factor designated by the same latter are not significantly different at 5% level using Duncan's Multiple Range Test. Capital letter for main effect and small letter for the interaction effect.

Regarding the interaction effect between NPK levels and organic material treatments on grain yield, data in Table (3) showed that the interaction effects were significant in both seasons. The application of a full dose of NPK mineral fertilizer combined with compost or farm yard manure and compost alone produced the highest values of grain yield in 2017 and 2018 responsively. The lowest grain yield was found in plots that did not receive NPK fertilizer under control, rice straw or rice straw + farm yard manure in 2017 and under control or rice straw in 2018. Sarwar *et al.,* (2008) indicated that the combination of compost with chemicals fertilizer enhanced the biomass and grain yield of rice. Sudhakar *et al.,* (2018) and Balasubramanian, (2019) they reported that the beneficial effects of integrated use of organic and mineral fertilizers on rice grain yield were significant.

CONCLUSION

It could be concluded that the maximum dose of NPK fertilizer combined with rice straw compost or FYM produced the maximum grain yield potential of EHR1with proper N, P, K and Zn availability during rice season.

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الملخص العربى

يُسر بعض العناصر الغذائية في أرض الأرز تحت استخدام الاسمدة العضوية وغير العضوية

محمود عبدالحميد الهيتي[١]، تامر فاروق متولي[٢]، ايمن عبدالدايم احمد[١]، عبدالفتاح صبحي غريب[٢]
ومي عبدالنبي السقا[٢]
[١]قسم المحاصيل– كلية الزراعة– جامعة كفرالشيخ – كفرالشيخ – مصر.
[٢]مركز البحوث والتدريب في الارز– معهد بحوث المحاصيل الحقلية– مركز البحوث الزراعية– كفرالشيخ– مصر.

أجريت تجربتان حقليتان بالمزرعة البحثية بمحطة البحوث الزراعية بسخا– مركز البحوث الزراعية – كفرالشيخ – مصر في موسمي ٢٠١٧ و٢٠١٨م. بهدف دراسة يُسر العناصر الغذائية في أرض الأرز تحت استخدام الاسمدة العضوية وغير العضوية وكذلك المحصول لصنف أرز هجين مصر واحد. وتم تنفيذ التجربة في تصميم القطع المنشقة في اربع مكررات وتم وضع معدلات التسميد المعدني في القطع الرئيسية بمعدلات (صفر والمعدل الموصي به كامل و ثلثي المعدل الموصي به و ثلث المعدل الموصي به من النيتروجين والفوسفور والبوتاسيوم) الجرعه الموصي بها من الاسمدة المعدنية هي السماد الازوتي ١٦٥ كجم نتروجين للهكتار وسوبر فوسفات احادي ٣٦كجم فوسفور للهكتار والتسميد بالبوتاسيوم بمعدل ٥٨ كجم بوتاسيوم للهكتار. وتم وضع الاسمدة العضوية في القطع الفرعية بمعدلات (معاملة المقارنة وكمبوست قش الارز وسماد بلدي وقش الارز المفروم وقش الارز المفروم مع مخلوط السماد البلدي بنسبة (١:١) وكان معدل استخدام المواد العضوية بمعدل ٧ طن للهكتار. وتم تقديربعض العناصر الغذائية الميسره في التربة وهي الامونيوم والنترات والفوسفور والبوتاسيوم والزنك وكذلك محصول الحبوب. تم تقدير العناصر الغذائية في التربة بعد الشتل ب ٣٠ و٤٥ و٦٠ يوم وكذلك بعد حصاد الارز في كلا الموسمين. اظهرت النتائج ان العناصر الغذائية الميُسره في التربة تزيد مع زيادة معدل الاسمدة المعدنية و العضوية. كما اوضحت النتائج زيادة نسبة الامونيوم والنترات الميسر في التربة وكانت اعلي قيمة له بعد الشتل ب ٣٠ يوم ثم انخفضا بنسبه كبيرة ووصلا الي الحد الادني عند الحصاد. كما كانت اعلي قيمه من البوتاسيوم المتاح في التربه عنج ٤٥ يوم من الشتل ثم تناقص باستمرار مع نمو المحصول. تم الحصول علي اعلي نسبة من الزنك المتاح في التربة عند ٣٠ يوم من الزراعة. كما اوضحت النتائج انه يمكن استخدام معدل الموصي به من الاسمده المعدنية مع الكمبوست او السماد البلدي او الكمبوست وحده للحصول علي اعلي محصول للصنف الارز الهجين.