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EFFECT OF ORGANIC, INORGANIC FERTILIZERS AND STORAGE PERIODS ON GRAIN YIELD AND NUTRITIONAL VALUE OF TWO EGYPTIAN RICE CULTIVARS

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ABSTRACT

To evaluate the impact of organic fertilizer (composted rice straw), chemical fertilizer and storage periods on grain yield and nutritional value of two Egyptian rice cultivars .i.e. hybrid1 (SK-2034H) and Sakha 105, two field experiments were carried out in Rice Research and Training Center (RRTC) farm during the two rice growing seasons 2009 and 2010. Four fertilizer treatments i.e, T1= 0 (untreated control), T2= 5 tons Composted rice straw /ha, T3= 165 kg N/ ha andT4= 5 tons Composted rice straw/ ha + 165 kg N /ha with five storage periods 0 (without storage), 3, 6, 9 and 12 months after harvest. Grain yield, protein percentage and concentration of some micronutrients (Fe, Mn and Zn) in grains of the two cultivars significantly increase with individual or in combination of organic and inorganic fertilizers treatments in both seasons. Data indicated that the grain yield, protein percentage and concentration of micronutrients in grain of hybrid 1 were higher than that of Sakha 105 rice cultivar at all treatments under this study. The highest values of protein percentage and concentrations of Fe, Mn and Zn in rice grain of two cultivars were recorded at the treatment of T4= 165 kg N + 5 tons composted rice straw /ha. On the other hand Protein (%) was not affected by storage period but concentration of Fe, Mn and Zn in grains of two rice varieties increased with increasing storage periods and the highest concentrations of micronutrients was found at the storage period of 12 months. From these results of this study, it could be recommended that the integration of organic and inorganic fertilizers management could increase micronutrient contents in grain and consequently, improve nutritional quality of two rice cultivars under study.

INTRODUCTION

Rice is one of the most important cereal crops in the world, and staple for more than half of the global population. Rice is one of the major cereal crops in Egypt. Rice crop occupies annually about 17 % (1.4 million fed.) of the total cultivated area in Egypt during summer season (M.Harunur Rashid *et al 2009*). Mineral fertilizer plays an important role in rice production, but unbalanced application of nutrients leads to productivity losses arising from soil exhaustion of macro and micro-nutrients (Singh *et al., 2004*). Addition of organic fertilizers one of the most promising means for increasing rice yield and maintaining soil health. Integrated management of organic manure and chemical fertilizer is useful practice to increase crop yields and maintain soil fertility Yadav *et al* (2000). Utilization of organic fertilizers could increase the soil organic matter contents which serve several advantages like conservation and slow release of nutrients, improve soil chemical and physical properties in the soil. These advantages lead to increase the fertility, productivity of yield and quality of crops (*Doberman and Fairhruse, 2000*). Integrated use of organic and chemical fertilizers will augment the efficiency of both substantially to maintaining a high level of productivity, rice production and rice grain quality (Singh *et al*., 2001). Inorganic nitrogen could be assimilated by plants into the forms of glutamine and glutamic acid. There exists a close relation between rice protein synthesis and nitrogen metabolism. Protein is one of the important factors that affecting the nutritional value of rice besides Fe, Mn, Cu and Zn are important essential micronutrients for both plant and human. Deficiency of these microelements in human body will result in a series of severe adverse consequences, such as anemia, low immunity function, skin disease, children response slowness and intelligence stunt (*Wang., 1991and Miao .J., 1997 and San. 2006*).Fe and Zn deficiencies are widespread in developing countries, where it is estimated that 40-45 % of school–age children are suffer from anemia and approximately 50 % of this anemia resulted from Fe deficiency (WHO., 1996). Currently, about one third of world population are facing malnutrition problem due to the deficiencies of Fe/Zn or vitamin A (*FAO, 1997*).The problem about micronutrient deficiency of human can be solved economically and sustainably by increasing microelements contents in rice grain (line *et al.,* 2007).Utilization of organic fertilizer can help for improving nutritional value of rice grain, enhanced soil organic carbon, available phosphorus content and microbial population that help for release some micronutrients.

The conventional storage facilities used in Egypt permit not only harmful organisms to penetrate easily into the rice from the outside, but also cause qualitative and quantitative losses by physiological process during storage of rice period which can be prolonged. Concerning the long term storage, Taira (1995) found that safe storage for about 10 months was possible as long as the moisture content was maintained at below 15%. Meanwhile, El-Hissewy *et al*. (2002) recommended that rice grain, regardless of the variety, could be stored till six months without any significant changes in the chemical composition and nutritional value of the rice grain. Also, during storage process, the changes in chemical compositions of the rice grain have to be studied to know the effect of storage period on micro elements content, especially for that crop fertilized with organic fertilizer. Therefore, the main objective of this study is to investigate the effect of different sources of nitrogen fertilizers (composted rice straw and chemical fertilizer) and different storage period on nutritional value rice grain of two Egyptian rice cultivars.

MATERIALS AND METHODS

Field experiments were carried out at the farm of Rice Research and Training Center (RRTC), Sakha, Kafr El- sheikh, Egypt, during 2009 and 2010 rice growing seasons. Two rice cultivars; hybrid1 (SK.2034) and Sakha105 and four levels of fertilizer i.e. T1= 0 (untreated control), T2= 5 tons composted rice straw/ha (CRS), T3= 165 kg N/ ha and T4= 5 tons CRS / ha + 165 kg N /ha were used. In the same time impact of five storage periods

0 (without storage), 3, 6, 9 and 12 months from harvest on nutritional value of grain were evaluated. Composted rice straw was incorporated with soil before flooding and urea was added in two splits, 2/3 before flooding and 1/3 one month after transplanting on soil well drained. Plots were fertilized with superphosphate (15.5% P_2O_5) at the rate of 238.1 kg/ha before the first plowing. Zinc fertilizers (23.80 kg $ZnSO_4$ /ha) was applied before flooding. All plots were flooded immediately after the fertilizers application until two weeks before harvest, where water irrigation cut off. A guarded area of 10 m^2 was harvested, air-dried, weight for estimating biomass yield and then threshed; the grain yields was measured in kg /plot and adjusted to 14 % moisture basis and then converted to ton /ha. After harvest, to investigate the impact of different storage periods on nutritional value of grain for two Egyptian rice cultivars under fertilizers treatments. Ten kg from paddy rice after harvested were taken randomly from different replication of all treatment for each cultivar and packed on plastic bags and then stored under room temperature for different periods (0, 3, 6, 9 and 12 months). The results were collected and subjected to statistical analysis as depending on the split split design with four replications. The main plots were devoted to rice cultivars; the sub-plots were specified to fertilizer treatment, while the storage periods were laid in the sub –sub plots.

Table 1: Some chemical analyses of soil used in study before and after experiment during 2009 and 2010 seasons

Soil chemical properties	Before planting		After harvest	
	2009	2010	2009	2010
pH(1:2.5)	8.20	8.30	8.08	8.12
Ec ($ds.m^{-1}$)	3.20	3.39	3.70	3.50
Anoins(meq/l)				
$CO_3^{=}$	--	--	--	--
HCO_3^-	5.56	5.40	6.20	6.40
Cl^-	9.00	10.20	10.09	10.80
SO_4^{--}	18.33	18.30	19.91	17.80
Cations(meq/L)				
Ca	10.01	11.38	11.30	12.30
Mg	5.00	6.20	7.30	8.10
Na	1.88	2.00	2.50	2.70
K	16.00	14.80	15.10	16.50
Micronutrients (ppm)				
Fe	4.55	4.50	3.10	3.50
Mn	3.10	2.90	3.50	2.80
Zn	1.00	1.12	1.20	1.05

Grain samples were collected for chemical analysis according to Chapman and Pratt (1961). Some chemical analyses of soil used in this study before and after experiments were presented in Table 1. All collected data were subjected to statistical analysis according to procedure describe by Gomes and Gomes (1984).Total nitrogen in rice grains were determined by the semi-micro Kjeldahl method and then converted to protein by multiply the percentage of N by 5.95 in addition, pH, Ec, cations and anions were determined according to Jackson (1987). Iron (Fe), manganese (Mn) and

Zinc (Zn) extracted by DTPA according to Jackson (1987) and determined by Atomic Absorption*.*

RESULTS AND DISCUSSION

Grain yield

Data in Table 2 shows the grain yield (t/ha) of two Egyptian rice cultivars as affected by the application of organic and inorganic fertilizers. It is clear from the data that a highly significant increase in grain yields of hybrid1 than that of Sakha 105 cultivar. This increase in grain yield of hybrid 1 may be due to the hybrid1 vigor of hybrid1 in grain yield compared with inbred cultivars. Also, specific characteristics of the uptake and physiology of N in hybrid rice appear to a key role in characteristics of N uptake and N use by hybrid rice and consequently increasing grain yield. Data indicated also, that the grain yield of both rice varieties (hybrid1 and Sakha105) significantly increased with increasing levels of nitrogenous fertilizers, whether organic or inorganic (urea) added individual or in combined form compared with the control. Similar findings were reported by Singh et al. (2004) and Gorgy (2010) and Salem et al (2011) who found that increasing levels of nitrogen up to 165 kg/ha significantly increased number of panicles/m2, grain yield and straw yield. The obtained improvement in the yield as a result of increasing nitrogen fertilizer might be due to the increased accumulation of photosynthesis from source to sink and during grain filling as well as delaying leaf senescence under any bad conduction.

Table 2: Grain yield (t/ha) of two rice cultivars as affected by application of organic, inorganic fertilizers and different storage periods in two seasons of study

Treatments	2009	2010
	Grain yield (t/ha)	Grain yield (t/ha)
Cultivars		
hybrid1	9.393a	9.73a
Sakha105	8.07b	8.22b
(B)Fertilizers		
T1	6.58d	6.65d
T2	7.15c	7.50c
T3	10.17b	9.98b
T4	11.02a	11.17a
Interaction A x B	*	*

T1= 0 T2= 5 ton CRS/ha T3= 165 kg N/ha T4= 165 kg N/ha +165 kg N/ha

The highest values of grain yield (11.02 and 11.17 t/ha) for both cultivars was recorded at the treatment of T4 during the first and second seasons respectively. Generally integrations of urea with CRS gave higher grains yield than that observed with urea alone. The increase in grains yield with the combined use of both these sources is advantageous and substantial amount of inorganic N (urea) can be saved. These mainly could be attributed to that combined use of CRS and urea increase nutrients availability for plant through their different growth stages which make balance in nutrients uptake (Hammad *et al.,* 2006 and Naeem, 2006*)*. Data in Table 3 shows that the interaction between fertilizer treatments and two rice cultivars. It is clear from the data that grain yield of hybrid 1 was higher than Sakha 105 at all treatments of fertilizers. Data indicated also, that the highest values of grain yield (11.68 and 11.71t/h) for hybrid 1 and (10.35 and 10.40 t/h) for Sakha 105 in both seasons respectively, was found at the treatment of T4 and there was no significant difference between T3 and T4 with hybrid1cultivar.

Table 3: Grain yield of rice as affected by the interaction between fertilizers and cultivars in both seasons of study

Cultivars	Fertilizers							
	2009				2010			
	T1	T2	T3	T4	T1	T2	T3	T4
hybrid1	7.00 e	7.78d	11.10a	11.68a	7.12e	7.81d	11.11a	11.71a
Sakha 105	6.17 F	6.52ef	9.25c	10.35b	6.05F	6.64ef	9.35c	10.40b

T1= 0 T2= 5 ton CRS/ha T3= 165 kg N/ha T4= 165 kg N/ha +165 kg N/ha
Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

Protein percentage (%) in rice grain:

Data in Table 4 show protein % in paddy and white grain of both rice varieties (hybrid 1 and Sakha 105). Protein % was highly significantly increased in hybrid1 rather than Sakha 105 cultivar at all treatments.

The increase in protein % with hybrid 1 may be due to the high concentration of nitrogen inside grain beside its ability to absorb of nitrogen than inbred variety and may be related to the inherent characteristics of the cultivars. Protein % was highly significantly increased with increasing levels of nitrogen added in organic or inorganic forms whether individual or combined for both cultivars. The highest value of protein % in paddy and white grains were found at T4 treatment (8.58 and 7.83 t/ha) and (8.69 and 7.97 t/ha) for both seasons respectively compared with the control. These results are agreed with that obtained by *Tang (2000)* who found that more nitrogen application in the whole growth period or at the booting stage could increase the amounts of total nitrogen, protein nitrogen, non-protein nitrogen and the activities of glutamine synthetase in leaves and grains of rice. Also, Hao *et al*. (2007) showed that when the plant found higher amount of nitrogen to absorb increase the nitrogen concentration in rice grain and consequently protein percentage. Data also, showed that there is no significant difference in percentage of protein in paddy and white grains in both cultivars during different periods of storage; 3, 6, 9 and 12 months.

Table 4: Protein percentage (%) in paddy and white grains of two rice cultivars as affected by organic, inorganic fertilizers and storage periods during both seasons

Treatments	2009		2010	
	Paddy Grain	White Grain	Paddy Grain	White Grain
(A)cultivars				
hybrid 1	8.28 a	7.68 a	8.39a	7.82 a
Sakha 105	7.52 b	7.01 b	7.60b	7.16 b
(B)Fertilizers				
T1	7.21d	6.76 d	7.28d	6.91 d
T2	7.67c	7.29 c	7.74c	7.42 c
T3	8.14b	7.51 b	8.25b	7.67 b
T4	8.58a	7.83 a	8.69a	7.97 a
(C) Storage periods (month)				
0	7.81b	7.29 b	7.90b	7.47 a
3	7.90a	7.37ab	7.98a	7.52 a
6	7.93a	7.33ab	8.01a	7.48 a
9	7.93a	7.34ab	8.00a	7.49 a
12	7.94a	7.40 a	8.06a	7.50 a
Interaction A x B	*	*	*	*
Interaction A x C	**	**	**	**
Interaction B x C	**	**	**	**
Interaction A x B x C	Ns	Ns	Ns	Ns

T1= 0 T2= 5 ton CRS/ha T3= 165 kg N/ha T4= 165 kg N/ha +165 kg N/ha

This may be due to the good storage that protects the grain from the outside effect like disease, insect that make the grain keep the same amount of protein. These results are in harmony with those obtained by Barber (1972) who found that total protein does not change considerably during storage; however, the chemical properties of the proteins can be altered substantially. It is clear from the data protein % in paddy grain was higher than white grain for both cultivars. This may be due to Proteins are found in different parts of the rice grain including the endosperm, the polish and the bran, with most being within the endosperm (protein storage) cells, situated in protein bodies between the starch granules (Lasztity and Salunkhe, 1979).

Table 5: Protein percentage as affected interaction between fertilizers and cultivars in both seasons

Fertilizers	Cultivars			
	2009		2010	
	hybrid1	Sakha 105	hybrid 1	Sakha 105
T1	7.76 e	6.66g	7.83d	6.74f
T2	8.15c	7.18f	8.22c	7.26e
T3	8.37b	7.91d	8.49b	8.01d
T4	8.84a	8.33b	9.00a	8.38bc

T1= 0, T2= 5 ton CRS/ha, T3= 165 kg N/ha T4= 165 kg N/ha + 165 kg N/ha
Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

Table 6: Protein percentage (%) as affected by the interaction between storage periods and cultivars in both seasons

Storage periods (months)	Cultivars			
	2009		2010	
	hybrid1	Sakha 105	hybrid 1	Sakha 105
0	8.15b	7.47c	8.26c	7.53d
3	8.26a	7.53c	8.31c	7.65d
6	8.29a	7.56c	8.43ab	7.59d
9	8.35a	7.50c	8.44a	7.57d
12	8.33a	7.54c	8.49a	7.63d

Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

Results in Table 5 shows that the hybrid1 paddy gave the highest protein percent than Sakha 105 and the highest value of protein percent was found with T4 whether, hybrid 1 or Sakha 105 during season 2009 and 2010. This may be due to addition of N fertilizers plus compost rice straw which introduce higher amount of nitrogen to plant. Similar results were found with *Hao et al., (2007)*. Data in Table 6 show that the protein percentage as affected by the interaction between the cultivars and different storage periods. It is clear from the results that storage period 12 months gave the highest value of protein percent but the lowest value was found with control (without storage) of storage and Sakha 105 and no significant difference between the rest storage period in protein with hybrid 1 paddy and Sakha 105 during 2009 and 2010 seasons .

Iron (Fe) concentration (ppm) in rice grain

Results in Table7 shows that iron (Fe) concentration (ppm) in paddy and white grains of both rice cultivars as affected by organic, inorganic fertilizers and storage periods during first and second seasons. It is clear from the data Fe concentration in paddy and white grains of hybrid 1 was higher than Fe concentration in Sakha 105 at all treatments in both seasons. This may be due attributed to the difference in the genetic background of this variety under application of nitrogen and ability of hybrid1 rice to absorb more Fe. These results agreed with the findings of HAO Hu-li *et al* (2007). Data reported also, that Fe concentration increased with increasing levels of N fertilizers whether organic or inorganic forms used for both rice cultivars and the highest value of Fe concentration recorded at the treatment of T4 (323 and210.6 ppm) and (249.7 and 225.6 ppm) for paddy and white grains during both seasons respectively, compared with the control. These results agreed with Saha *et al* (2007) who found significantly higher iron content was recorded with organic fertilization compared to inorganic fertilization.

These results confirmed by *HAO Hu-li et al (2007)* who noted that Fe, Mn, Cu and Zn accumulation trends as affected by N fertilizer application were different between the two cultivars, but the concentrations of these elements in most parts of shoot increased with increasing N fertilizer application rate as a whole. This indicates that N fertilizer can improve the absorption and translocation abilities of Fe, Mn, Cu, and Zn to a certain extent in rice. However, N fertilizer only influences micronutrient accumulation amounts in different parts of rice shoot, and does not change the characteristic expression of varieties. This increase of Fe concentration could be attributed to the increase of nitrogen efficiency and so as a result increased iron concentration in grains. Also, organic farming increase iron concentration in rice grain.

Table7: Iron (Fe) concentration (ppm) in paddy and white grains of two rice cultivars as affected by organic, inorganic fertilizers and storage periods during two Seasons

Treatments	2009		2010	
	Paddy Grain	White Grain	Paddy Grain	White Grain
(A) Cultivars				
hybrid 1	189.50a	165.50a	200.50a	179.60a
Sakha 105	162.50b	135.80b	177.00b	146.80b
(B)Fertilizers				
T1	131.00d	105.30d	139.00d	114.30d
T2	152.00c	128.60c	163.70c	142.60c
T3	189.00b	158.00b	202.70b	170.30b
T4	232.00a	210.60a	249.70a	225.60a
(C) Storage periods (month)				
0	167.1c	143.30c	179.60d	157.5c
3	173.8bc	147.50bc	184.20cd	160.8bc
6	174.6bc	151.60ab	187.90bc	162.9abc
9	179.6ab	154.50a	194.60ab	166.6ab
12	185.00a	156.20a	197.50a	168.3a
Interaction A x B	*	*	*	*
Interaction A x C	**	**	**	**
Interaction B x C	**	**	**	**
Interaction A x B x C	Ns	Ns	Ns	Ns

T1= 0 T2= 5 ton CRS/ha T3= 165 kg N/ha T4= 165 kg N/ha +165 kg N/ha

Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

Table 8: Fe concentration (ppm) as affected by the inter action between fertilizers and cultivars in both seasons

Fertilizers	Cultivars			
	2009		2010	
	hybrid1	Sakha 105	hybrid 1	Sakha 105
T1	136.7d	125.30e	145.30ef	132.70f
T2	166.00c	138.00d	175.30d	152.00e
T3	206.70b	171.30c	221.30c	184.00d
T4	248.70a	215.30	260.00a	239.30b

T1= 0 T2= 5 ton CRS/ha T3= 165 kg N/ha T4= 165 kg N/ha +165 kg N/ha

Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

Table 9: Fe concentration (ppm) as affected by the interaction between the storage periods and cultivars in both seasons

Storage periods (months)	Cultivars			
	2009		2010	
	hybrid1	Sakha 105	hybrid 1	Sakha 105
0	185.80b	148.30e	193.30bc	165.80f
3	185.00b	162.50cd	195.00bc	173.30e
6	188.30b	160.80d	200.00cb	175.80def
9	186.70b	172.50c	202.50ab	186.70cd
12	201.70a	168.30cd	211.40a	183.30cde

Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

Table 10: Fe concentration (ppm) as affected by the interaction between the storage periods and fertilizers in both seasons

Storage pe (months)	Fertilizers							
	2009				2010			
	T1	T2	T3	T4	T1	T2	T3	T4
0	130.00g	143.30fg	178.30e	216.70c	140.0gh	155.0fg	193.30e	230.0d
3	131.70g	151.70g	186.7de	225.0bc	136.70h	161.70f	200.0e	238.3cd
6	130.00g	153.30f	188.3de	226.70c	140.0gh	161.70f	201.7e	248.3bc
9	128.30g	158.30f	193.30d	238.3b	138.3gh	171.70f	208.3e	260.0ab
12	135.00g	153.30f	198.30d	253.3a	140.0gh	168.30f	210.0e	271.7a

Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955)*

Moreover the data in Table 7 show that there was a significant difference by using different storage periods in both studied seasons. The highest values of Fe concentration (185.0 and 165.2 ppm) and (197.5 and 186.3 ppm) in paddy and white rice grains were recorded with 12 month storage period in both seasons respectively while the lowest values (167.0 and 143.3 ppm) and (179.6 and 157.5 ppm) were recorded without storage in both seasons respectively. Increasing Fe concentration in rice grains with increasing storage periods for two rice cultivars compared with the control (without storage) may be due to the decrease of moisture content in rice grains decrease with increasing storage periods which leads to increasing Fe concentration in rice grains.

As observed in Table 8 that the grain of hybrid 1 give the highest Fe concentration (ppm) than Sakha 105 and the highest value of Fe concentration was recorded with T4 with both hybrid1 and Sakha 105 during two seasons. Results reveal that addition of compost rice straw plus nitrogen fertilizers increased the amount of Fe concentration. This may be the proper fertilizers dose that is recommended by the plant to enhance the increase in Fe availability in rice grain. It is clear from the results in Table 9 that the storage period for 9 months gave the highest values of Fe concentration for Sakha 105 while, for Hybrid 1 cultivar the highest values of Fe concentration were recorded with 12 months storage periods in both studied seasons respectively, but the lowest values were found without storage for both cultivars in both seasons respectively. Data in Table 10 show that the highest values of Fe concentration in rice grain (253.30 and 271.70 ppm) were recorded at the treatment of T4 and 12 months storage periods in both studied seasons respectively. This may be due to the highest amount of available Fe from composted rice straw that gave the chance for plant to absorb more Fe and due to proper condition of storage that in turn results in higher Fe concentration in both seasons.

Manganese (Mn) concentration (ppm) in rice grains:

As declared in Table 10 represented that Mn concentration (ppm) in paddy and white grains significantly increase in hybrid 1 rather than Sakha 105 cultivar and also highly significant increased by using T4 treatment compared with the control (without fertilizer). It is clear from the data in Table 4 that Mn concentration increased with increasing levels of N whether applied in separately organic, inorganic forms or in combinations compared with the control for two rice varieties. These results agreed with the findings of Yuan *et al,* (2005) who found that suitable nitrogen application promoted Fe, Mn, Cu and Zn accumulation in grains of rice. The highest value of Mn concentration (57.03 and 47.33 ppm) and (58.46 and 48.60 ppm) in paddy and white grains of two rice cultivars were found at the treatment of T4 during both seasons respectively. This may be due to that the mixture between organic and inorganic nitrogen fertilizer enhance the absorption of manganese from soil thus in turn increase Manganese concentration in rice grain as clarified by Singh *et al*.,(2007). There was a significant difference by using different storage periods for two rice cultivars in both studied seasons. The highest values of Mn concentration (32.58 and 33.79 ppm) for paddy grains and (26.83 and 28.08 ppm) for white grains were found with 12 month storage period during both studied seasons. This may be attributed to the lower moisture content in rice grains after 12 months storage period that increase Mn concentration in rice grains.

Table 10: Manganese (Mn) concentration (ppm) in paddy and white grains of two rice cultivars as affected by organic, inorganic fertilizers and storage periods in both Seasons

Treatments	2009		2010	
(A) Cultivars	**Paddy Grain**	**White Grain**	**Paddy Grain**	**White Grain**
hybrid 1	33.30a	26.92a	34.33a	28.13a
Sakha 105	30.11b	24.95b	31.26b	26.17b
(B)Fertilizers				
T1	13.62d	10.47d	14.36d	11.27d
T2	16.73c	14.43c	17.53c	15.83c
T3	39.43b	31.50b	40.83b	32.90b
T4	57.03a	47.33a	58.46a	48.60a
(C) Storage periods (month)				
0	30.25b	24.92b	30.91c	26.00c
3	31.31ab	25.42b	32.50b	26.62bc
6	32.00a	25.75b	33.25a	27.04b
9	32.38a	26.75a	33.54a	28.00a
12	32.58a	26.83a	33.79a	28.08a
Interaction A x B	*	*	*	*
Interaction A x C	**	**	**	**
Interaction B x C	**	**	**	**
Interaction A x B x C	Ns	Ns	Ns	Ns

T1= 0 T2= 5 ton CRS/ha T3= 165 kg N/ha T4= 165 kg N/ha +165 kg N/ha

Data also, indicated that there was no a significant difference between (6, 9 and 12 months) storage periods for paddy grains and (9 and 12 months) for white grains respectively in both studied seasons.

Table 11: Mn concentration (ppm) as affected by the interaction between cultivars and fertilizers in both seasons

Fertilizers	Cultivars			
	2009		2010	
	hybrid1	Sakha 105	hybrid 1	Sakha 105
T1	14.27fg	12.97g	15.06fg	13.66g
T2	18.67e	14.80f	19.00e	16.06f
T3	41.8c	37.07d	43.60c	38.06d
T4	58.47a	55.60b	59.66a	57.26b

T1= 0 T2= 5 ton CRS/ha T3= 165 kg N/ha T4= 165 kg N/ha +165 kg N/ha
Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

Table 12: Mn concentration (ppm) as affected by the interaction between cultivars and the storage periods in both seasons

Storage periods (months)	Cultivars			
	2009		2010	
	hybrid1	Sakha 105	hybrid 1	Sakha 105
0	31.50b	29.00d	32.00c	29.83e
3	33.25a	29.38cd	34.08b	30.91d
6	33.67a	30.33bcd	34.91b	31.58cd
9	33.92a	30.83bc	35.25a	31.83cd
12	34.17a	31.00bc	35.41a	32.16c

Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

Table 13: Mn concentration (ppm) as affected by the interaction between the storage periods and fertilizers in both seasons

Storage periods (months)	Fertilizers							
	2009				2010			
	T1	T2	T3	T4	T1	T2	T3	T4
0	12.67g	16.50ef	36.50d	55.33b	13.33j	17.00h	37.66g	55.66d
3	13.58g	16.33ef	38.67cd	56.70ab	14.00ij	17.00h	40.50f	58.50ab
6	14.33fg	16.83ef	40.33c	56.50ab	15.00i	17.66h	42.00e	58.33ab
9	13.67g	17.00e	40.83c	58.00a	14.5ij	18.00h	42.00e	59.66ab
12	13.83g	17.00e	40.83c	58.67a	15.00i	18.00h	42.00e	60.61a

Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

As conducted in Table 11 the highest values of Mn concentration in rice grain (58.47 and 59.66 ppm) were achieved with hybrid 1 at the treatment of T4 in both seasons respectively. The application of composted rice straw in addition with chemical fertilizers gave higher Mn concentration than nitrogen alone. This may be due to the increment of Mn availability with compost rice straw. These results are in agreement with those reported by Hao *et al* (2007). Data in Table 12 also; present that the highest values of Mn concentration in rice grains. As shown in Table 12 the highest values of Mn concentration (34.17 and 35.41 ppm) were resulted by using hybrid1 and storage for 12 months during both seasons respectively. The result in Table 13 clear that the highest Mn concentration in grains (58.67 and 60.16 ppm) were found at the treatment of T4 and 12 months storage periods in both studied seasons respectively. This may be due to utilization compost rice straw that enhance Mn concentration in soil which help for more absorption of it by plant.

Zinc (Zn) concentration (ppm) in rice grain:

The result in Table 14 shows that Zn concentration in paddy and white grains of two rice varieties as affected by the application of organic and inorganic fertilizers and different storages periods. Data showed that there not was significant difference between hybrid1 rice and Sakha 105 rice cultivars in Zn concentration in paddy grains during both studied seasons but there was a significant difference between hybrid1 and Sakha 105 cultivar in Zn concentration in white grains during both studied season. It may be due to Zn concentrated in husk of Hybrid1 than Sakha 105. Data reported also, that Zn concentration in paddy and white grains of two rice varieties increased with increasing levels of N fertilizers applied in organic or chemical fertilizers whether individual or in combined form. These results are harmony with obtained by Yuau *et al,* (2005) and Singh *et al.*,(2007).

Table 14: Zinc (Zn) concentration (ppm) in paddy and white of two rice cultivars as affected by organic, inorganic fertilizers and Storage Periods during First and Second seasons

Treatments	2009		2010	
	Paddy Grain	White Grain	Paddy Grain	White Grain
(A) cultivars				
hybrid 1	16.52a	13.63a	17.26a	14.68a
Sakha 105	16.30a	12.30b	17.06a	12.98b
(B)Fertilizers				
T1	12.50d	9.86d	13.20d	10.76d
T2	15.17c	11.56c	15.96c	12.60e
T3	17.12b	14.33b	17.93b	15.40b
T4	20.87a	17.30a	21.56a	18.56a
(C) Storage periods (month)				
0	15.50d	13.08b	16.62c	14b
3	15.90cd	13b	16.54c	14.04b
6	16.33bc	13.08b	17.16b	14.50ab
9	16.96ab	13.87a	17.66a	14.66a
12	17.37a	13.29ab	17.83a	14.45ab
Interaction A x B	*	*	*	*
Interaction A x C	**	**	**	**
Interaction B x C	**	**	**	**
Interaction A x B x C	Ns	Ns	Ns	Ns

T1= 0 T2= 5 ton CRS/ha T3= 165 kg N/ha T4= 165 kg N/ha +165 kg N/ha

The highest value of Zn concentrations (20.87 and 21.56 ppm) for paddy grains and (17.30 and 18.56 ppm) for white grains in both studied seasons respectively were obtained with 165 kg N + 5 tons composted rice straw/ha compared with the control. As shown in Table 14 Zn concentration in paddy grain was higher than white grain with two rice cultivars. Results also, showed that there was a significant difference by using different storage periods in both studied seasons for two rice varieties. The highest values of zinc concentration in rice grain (17.37and17.83 ppm) for paddy grain and (13.29 and 14.45 ppm) were recorded with 12 month storage period in both seasons respectively but we found no change during 6, 9, 12 months in season Second. This may be attributed to the lower moisture content in rice grains after 9 month storage period that increase the percentage of zinc to the total size of rice grains.

Table 15: Zn concentration (ppm) as affected by the inter action between fertilizers and cultivars in both seasons

Fertilizers	Cultivars			
	2009		2010	
	hybrid1	Sakha 105	hybrid 1	Sakha 105
T1	12.67d	12.33d	13.60d	12.80d
T2	15.52c	15.13c	16.00c	15.93c
T3	17.10b	17.13b	17.73b	18.13b
T4	21.13a	20.60a	21.73a	21.40a

T1= 0 T2= 5 ton CRS/ha T3= 165 kg N/ha T4= 165 kg N/ha +165 kg N/ha

Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

Table 16: Zn concentration (ppm) as affected by the interaction between the storage periods and cultivars in both seasons

torage periods (months)	Cultivars			
	2009		2010	
	hybrid1	Sakha 105	hybrid 1	Sakha 105
0	15.67cd	15.33d	16.58de	16.66de
3	16.12bcd	15.67cd	16.91cd	16.15e
6	16.08bcd	16.58abc	17.80bcd	17.25bcd
9	17.08ab	16.83ab	17.77ab	17.66ab
12	17.67a	17.08ab	18.08a	17.58abc

Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

Table 17: Zn concentration (ppm) as affected by the interaction between the storage periods and fertilizers in both seasons

torage periods (months)	Fertilizers							
	2009				2010			
	T1	T2	T3	T4	T1	T2	T3	T4
0	11.50k	14.83fgh	16.83cde	18.83b	12.50k	15.83hi	17.83ef	20.33d
3	11.67k	14.50ghi	16.42cde	21.00a	12.66k	15.16i	17.33fg	21.00cd
6	12.83jk	14.67fgh	17.00cde	20.83a	13.83j	15.83hi	17.50fg	21.50bc
9	13.00ijk	15.67efg	17.50cde	21.67a	13.66j	16.33h	18.33ef	22.33ab
12	13.50hij	16.17def	17.83bc	22.00a	13.33jk	16.66gh	18.66e	22.66a

Means followed by the same letter are not significant by different according to DMRT at 0.05 level of probability (*Duncun, 1955).*

Data in Table 15 reveals that the Zn concentration in rice grains as affected by the interaction between cultivars and fertilizers. Data indicated that the highest values of Zn concentration in rice grains were recorded with hybrid 1 and Sakha 105 cultivar at the treatment of T4 during two seasons respectively. This mainly due to the higher Zn concentration in composted rice straw and by using increasing nitrogen fertilization that help transportation ability of micronutrients from roots to shoots then to the grain in rice was improved and these finding was in agreement with *Hao et al., (2007)*. From the Table 16 the highest values of Zn concentration (17.67 and

18.08 ppm) were recorded with hybrid 1 cultivar and storage periods of 12 months during both seasons respectively. As shown in Table 17 that the highest value of Zn concentration (22.00 and 22.66 ppm) was recorded by using T4 treatment and 12 months storage periods during both seasons respectively. In addition there is no significant difference between the last three storage periods in season 2009. This may be due to the accumulation of dry matter in plant and not in rice grains.

CONCLUSION

It could be concluded that the application of organic and inorganic fertilizers improved soil properties and thus improved soil fertility beside increase root hair activation that could increase the grain yield, protein percentage and micronutrient contents in grain and improve nutrition quality of rice that address deficiency of these micronutrients in human body help to prevent a series of severe adverse consequences, such as anemia, low immunity function, skin disease. In conclusion, if we need to protect our children from some diseases we have to supplement then with some micronutrients that can come from the combination of organic and inorganic fertilizers.

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تاثير الاسمده العضويه والمعدنيه وفترات التخزين المختلفه على المحصول وجوده الحبوب لبعض اصناف الارز.

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مركز البحوث و التدريب فى الارز بسخا

لتقيم تاثير اضافه الاسمده العضويه والمعدنيه وفترات التخزين المختلفه على محصول و جوده حبوب صنفين من الارز وهما هجين ١ وسخا ١٠٥ تم اجراء تجربتين حقليتين فى مركز البحوث والتدريب فى الارز بسخا خلال موسمين. فى هذه الدراسه كانت معاملات التسميد كالتالى صفر(الكنرول الغير معامل) - ٥ طن سماد مكموره قش الارز - ١٦٥ كجم نيتروجين - ٥ طن سماد مكموره قش الارز + ١٦٥ كجم نيتروجين / هكتار مع استخدام خمس فترات مختلفه لتخزين الحبوب وهى صفر (بدون تخزين)- ٣- ٦ - ٩- ١٢ شهر. ولقد اوضحت النتائج زياده محصول الحبوب زياده معنويه فى هجين ١ عن صنف سخا ١٠٥ ايضا زياده المحصول فى كلا الصنفين مع زياده مستوى الاسمده النتروجينيه سواء كانت فى صورة عضويه او معدنيه سواء اضيفت منفرده او مختلطه معا واكانت اعلى قيمه للمحصول هى (١١.٠٢ ، ١١.١٧طن / هكتار للموسمين على التوالى عند المعامله ٥ طن سماد مكموره قش الارز + ١٦٥ كجم نيتروجين / هكتار. كما اوضحت النتائج زياده نسبه البروتين وتركيزات بعض العناصر الصغرى مثل (الحديد – المنجنيز – الزنك) فى صنف الارز هجين ١ عن الصنف سخا ١٠٥ كما اوضحت النتائج انه بزياده مستوى الاضافه للاسمده النتروجينيه سواء فى الصوره المعدنيه او الصوره العضويه او اضيفت مختلطه معا هذا ادى الى زياده نسبه البروتين و العناصر الصغرى فى حبوب كلا الصنفين. وكانت اعلى قيمه لنسبه البروتين وتركيز كلا من الحديد والمنجنيز و الزنك (جزء فى المليون) عند المعامله ٥ طن سماد مكموره قش الارز + ١٦٥ كجم نيتروجين / هكتار فى كلا الصنفين. كما اوضحت النتائج ايضا ان نسبه البروتين فى حبوب صنفي الارز لا تتاثر بفترات التخزين بينما تركيزات العناصر الصغرى فى الحبوب لكلا من الصنفين تاثرت بفترات التخزين وزدات تركيزات هذه العناصر بزياده فترات التخزين وكانت اعلى قيمه للتركيز عند فتر التخزين (١٢ شهر) مقارنه بالفترات الاخرى. ومن خلال نتائج هذه الدراسه يتضح ان الاستخدام المناسب للاسمده العضويه والمعدنيه مختلطه معا بالكميات المناسبه هذا يزيد من نسبه البروتين فى حبوب الارز والعناصر الصغرى مم يودى لزياده جوده حبوب الارز التى تساهم فى حل مشكله سوء التغذيه فى الدول الناميه خاصه عند الاطفال نتيجه لنقص البروتين والعناصر الصغرى مثل الحديد و المنجنيز والزنك التى تسبب العديد من الامرض واشهرها الانيميا

قام بتحكيم البحث

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