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RICE PRODUCTION UNDER ORGANIC AND INORGANIC FERTILIZATION

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ABSTRACT

Two field experiments were carried out at the Farm of Rice Research and Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt during 2004 and 2005 season to study the effect of organic and inorganic fertilizers on growth, yield and its attribute, and grain quality characters of Giza 177 and Giza 178 rice varieties.

Each experiment involved eight treatments which were the combination of straw, compost and urea with different rates. (Control, 164 kg N/ha, 6 tons compost/ha alone and with 82 and 123 kg N/ha, 6 tons rice straw/ha alone and with 82 and 123 kg N/ha).

The results could be summarized as follows:

Application of 164 kg N/ha or 6 tons compost/ha plus 124 kg N/ha gave the highest number of tillers, dry matter yield (g/hill), leaf area index, number of panicles/hill, number of grains per panicle, filled grains percentage, panicle weight, straw yield and grain yield compared to other treatments. Regarding grain quality hulling and milling rice percentage were not affected by organic and inorganic application, while the head rice percentage was affected by them. Also, the results indicated that the use of straw alone or combined with inorganic nitrogen had no significant effect on the studied traits.

According to the previous results it could be concluded that application of compost plus inorganic fertilizers gave the best results compared with the other treatments. The use of compost either alone or combined with nitrogen was better than that of straw mainly due to the fast decomposition of compost. Recently, compost plays a major role in crop production, science it minimizes the use of chemical fertilizer and decreases environmental pollution.

INTRODUCTION

Rice (*Oryza sativa*, L.) is one of the most important cereal crop in the world as well as in Egypt. It ranks the 2nd after cotton regarding to exportation. It contributes more than 20 percent of the per capita cereal consumption. Increasing productivity per unit land area is a native goal to meet the consistent demands from this crop. Increasing rice production can be achieved through optimizing the cultural practices, improving the soil conditions, water management and biological control of pests and diseases.

Crop residue management and its impact on soil organic matter and nutrient recycling are increasing in importance with the current renewed interest on sustainable soil fertility and crop productivity. Among forms of organic residues, incorporation rice straw plays an important role in maintain soil productivity if returned to the soil in form of raw or compost. In Egypt more than 6 million ton of rice straw are estimated to be producted annually, but only a small fraction is presently reincorporated into the soil while, the rest is subjected to burning. A number of field studies have been done on the use of rice straw as a part of integrated nutrient management strategies in many parts of the world.

Most of the Egyptian farmers tried to get red of rice straw by burning which cause bad negative effect on the environment. Compost made from rice straw is an effective material for improving the physical and chemical condition of soil. Attempts were made to substitutes the amount of nitrogen used in the normal basal dressing of chemical fertilizer with the compost.

Therefore the present work aimed to investigate the effect of rice straw management practices (rice straw as a raw material and as a compost) with and without N-fertilizers on growth, yield and its attribute, and grain quality.

MATERIALS AND METHODS

Two field experiments were carried out at the farm of the Rice Research and Training Center (RRTC), Sakha, Kafr El-!Sheikh, Egypt, during 2004 and 2005 seasons to study the effect of rice straw, compost and mineral fertilizer application on growth, yield and its components and some grain quality characters of two rice cultivars namely, Giza 177 and Giza 178. The preceding crop was Egyptian clover in both seasons. The experiment was laid out in a split plot design with four replicates. Rice cultivars were allocated in the main plots and fertilizer treatments in the sub-plots.

There were 8 treatments combinations consisting of (urea) applied with or without organic fertilizers (compost and rice straw). Rice straw was chopped into small pieces and incorporated into the soil before flooding at the rate of 6t/ha.

For compost the chopped rice straw was treated with 1 kg of fungal inoculants (*Trichodrima* sp.)/1000 kg of rice straw and incubated 30-40 days with actuated moisture to produce the compost.

Average of the composition of the organic materials are shown in Table (1).

Table (1):Some chemical properties of compost and rice straw.

Analysis	C%	N%	P%	K%	C/N ratio
Compost straw	30.50	1.90	0.83	2.01	16.05
Rice straw	41.0	0.6	0.13	1.90	68.33

Soil analysis:

The mixed composite soil samples for the experimental sites revealed the following: pH = 8.23, EC = 2.3 dS.m^{-1}, organic matter % = 1.45 total nitrogen = 550 mg/kg and texture was clay.

Experimental treaments:

1. Control. 2. 164 kg N/ha.
3. 6 ton straw/ha. 4. 6 ton straw + 82 kg N/ha.
5. 6 ton straw + 123 kg N/ha. 6. 6 ton compost/ha.
7. 6 ton compost + 82 kg N/ha. 8. 6 ton compost + 123 kg N/ha.

Mineral nitrogen on the form of urea (46%) at the rate of 164 (recommended), 123 and 82 kg N/ha were applied in two split doses. The first dose was 2/3 as basal application incorporated in dry soil before transplanting, while the second dose was applied at 30 days after transplanting. Rice straw and compost at the rate of 6 ton/ha were applied to the plots (the plot size was 12 m^2 (3 x 4) m and incorporated basely in the dry soil before rice transplanting.

Pregerminated seeds were uniformly broadcasted in the nursery on 1^{st} and 7^{th} May in the 1^{st} and 2^{nd} season, respectively. The experimental site was fertilized by phosphorus in the form of mono super phosphate (15% P_2O_5) with recommended dose of240 kg/ha before sowing. After 30 days from sowing, four seedling were transplanted in hills of 15 x1 5 cm spacing for Giza 177 and 20 x 20 cm for Giza 178.

Studied characters:

The following plant characters were estimated according to the recommended methods:

1. Growth characters:

Ten hills from the third row were randomly collected from each plot at 45 and 60 days after (DAT) to determine the following:

1.1. Number of tillers/hill.
1.2. Leaf area index.
1.3. Dry matter production/hill.

2. Yield and its attributes:

2.1. Number of panicles/hill.
2.2. Panicle weight (g).
2.3. 1000-grain weight (g).
2.4. Number of grains per panicle.
2.5. Filled grains per panicle (%).
2.6. Grain yield (ton/ha).
2.7. Straw yield (ton/ha).

3. Grain quality:

3.1. Hulling and milling rice percentage.
3.2. Head rice percentage.

Statistical analysis:

All data were collected and subjected to the standard statistical analysis following the procedure described by Gomez and Gomez (1984) using the computer program (IRRISTAT).

RESULTS AND DISCUSSION

1. Growth characters:

1.1. Number of tillers per hill:

Data in Table (2) indicate that there were significant differences in number of tillers per hill between Giza 177 and Giza 178 rice cultivars. Giza 177 rice cultivars produced less number of tiller per hill than Giza 178 rice cultivars. This results might be due to variation in tillering ability. Varietal difference in tillering ability were claimed by several investigators: Gorgy (1988 and 1995), Kalboch (1997) and Waheiba Zaghlol (1999).

Table (2): Number of tillers per hill at 45 and 60 DAT of Giza 177 and Giza 178 rice cv. as affected by organic and inorganic fertilizers treatments in 2004 and 2005 seasons.

Factor	Number of tillers at 45 days		Number of tillers 60 at days	
	2004	**2005**	**2004**	**2005**
Cultivars:	*	*	*	*
Giza 177	13.95 b	16.10 b	17.04 b	18.82 b
Giza 178	18.97 a	19.07 a	21.76 a	21.82 a
Treatments:	*	*	*	*
Control	11.28 g	14.81 f	13.24 f	15.06 f
164 kg N/ha (recommended)	20.80 a	23.42 a	24.53 a	24.93 a
6 ton straw/ha	12.72 f	16.71 e	15.36 e	16.41 e
6 ton straw/ha + 82 kg N/ha	15.05 d	19.06 d	19.61 d	19.43 c
6 ton straw/ha + 123 kg N/ha	17.63 c	20.97 c	20.10 c	21.43 b
6 ton compost/ha	14.63 e	17.67 e	16.74 e	17.52 d
6 ton compost/ha + 82 kg N/ha	18.83 b	21.66 bc	21.36 b	21.88 b
6 ton compost/ha + 123 kg N/ha	20.8 a	22.40 ab	24.26 a	25.13 a
Interaction	NS	NS	**	NS

*** = Significant at 5% level**
**** = Significant at 1% level and N.S = not significant, respectively in column values designated by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.**

Data indicate also that application of either 164 kg N/ha or 6 tons compost/ha plus 123 kg N/ha produced the highest number of tillers per hill at all sampling dates in the two seasons. This mean that when 6 tons compost were added one fourth of the nitrogen fertilizer can be saved. There were significant differences in number of tillers per hill between plants treated with 6 tons compost plus 123 kg N/ha and plants treated with 6 tons of straw plus 123 kg N/ha in both seasons Table (2). So, data indicate that application of compost was better than incorporation of rice straw even when both combined with the same rate of inorganic nitrogen. This mainly due to the fact that compost is readily decomposed and organic materials provide rice plants with available nutrients particularly nitrogen. Compost contains some available micronutrients for plants. These findings are in agreement with those reported by Takahashi *et al.* (2003). The interaction between treatments and rice varieties had a significant effect on number of tillers per hill at 60 days after transplanting (DAT) in 2004 season only. These results are in agreement with those reported by Panichsakpatana *et al.* (1985).

1.2. Leaf area index (LAI):

Data in Table (3) show that, Giza 178 rice cultivars was superior to Giza 177 rice cultivar in leaf area index at the two sampling dates in both seasons. There was an apparent difference in leaf area index due to fertilizer sources at 45 and 60 days after transplanting in both seasons. Plants received nitrogen fertilizer at the recommended rate (164 kg N/ha) alone or 6 ton compost plus 123 kg N/ha, exceeded those received other fertilizer treatments at the two sampling dates in both seasons. These results indicate that application of compost is so much better than the incorporation of straw mainly because compost is readily decomposed and have low C/N ratio than straw.

Application of compost plus 123 kg N/ha caused an increase in number of tillers per hill and leaves number consequently leaf area was increased, such increasing in leaf area index from applying 164 kg N/ha might be due to the fact that nitrogen composes protoplasmic protein required for increasing the tillering and leaf area. These results are in agreement with those reported by Anzai *et al.* (1989) and Sharma and Mittra (1990 and 1991).

The interaction between rice cultivars and fertilizer sources had a significant effect on leaf area index at the two sampling dates in both seasons. Giza 178 rice cultivar was superior to Giza 177 rice cultivar at all compost treatment. Application of compost plus 123 kg N/fed. produced the highest leaf area index, for the same cultivar, while unfertilizer treatment control and straw treatments produced the lowest one.

Table (3): Leaf area index at 45 and 60 DAT of Giza 177 and 178 rice cultivars as affected by organic and inorganic fertilizers treatments in 2004 and 2005 seasons.

Factor	45 DAT		60 DAT	
	2004	**2005**	**2004**	**2005**
Cultivars:	**	**	**	**
Giza 177	3.027 b	4.23 b	5.18 b	5.06 b
Giza 178	4.40 a	4.71 a	5.91 a	5.76 a
Treatments:	*	*	*	*
Control	2.98 d	3.53 d	3.62 f	3.25 f
164 kg N/ha (recommended)	5.47 a	6.35 a	7.99 a	7.95 b
6 ton straw/ha	2.30 f	2.67 e	3.27 g	3.24 f
6 ton straw/ha + 82 kg N/ha	3.02 d	3.50 d	5.17 d	4.62 d
6 ton straw/ha + 123 kg N/ha	3.70 c	4.81 c	6.40 b	6.02 c
6 ton compost/ha	2.86 e	3.39 d	3.94 e	3.89 e
6 ton compost/ha + 82 kg N/ha	3.87 b	4.95 b	5.97 c	6.16 c
6 ton compost/ha + 123 kg N/ha	5.47 a	6.56 a	7.99 a	8.14 a
Interaction	**	**	**	**

*** = Significant at 5% level**

**** = Significant at 1% level and N.S = not significant, respectively in column values designated by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.**

1.3. Dry matter accumulation (g/hill):

Data in Table 4 show that Giza 178 rice cultivar produced the highest value of dry matter (g/hill) at the two sampling dates in both seasons, while the lowest mean value of dry matter production were obtained by Giza 177 rice cultivar Table (4**)**. These results might be due to the variation in tillering ability and LAI as a photosynthetic area.

Significant variation in dry matter production was found among fertilizers treatments at the two sampling dates in both seasons (Table 4). The application of either 164 kg N/ha or 6 tons compost plus 123 kg N/ha produced the highest dry matter accumulation at 45 and 60 DAT (g/hill) in both seasons. That means the applications of 6 ton compost can save one fourth of the nitrogen fertilizer dose under study. Data indicated that application of compost is so much better than the incorporation of straw even if it was combined with the high rates of inorganic nitrogen. This mainly due to the fast decomposition of compost which led to increase the availability of nutrients and also because of the high C/N ratio of rice straw. These findings are in agreement with those reported by Ladha *et al.,* (1987) and Kalita and Sharmah (1992).

The interaction between fertilizers treatments and rice cultivars had a significant effect on dry matter accumulation (g/hill) at 45 and 60 DAT in both seasons. The cultivar Giza 178 surpassed Giza 177 in dry matter accumulation at any fertilizers treatments in both seasons.

Table (4): Dry matter accumulation (g/hill) at 45 and 60 DAT of Giza 177 and Giza 178 rice cultivars as affected by fertilizers treatments in 2004 and 2005 seasons.

Factor	45 DAT		60 DAT	
	2004	2005	2004	2005
Cultivars:	*	*	*	*
Giza 177	20.748 b	27.92 b	24.51 b	28.23 b
Giza 178	28.68 a	44.93 a	32.08 a	44.60 a
Treatments:	*	*	*	*
Control	18.20 f	25.15 g	24.00 ef	26.10 f
164 kg N/ha (recommended)	31.65 a	46.00 a	33.07 a	48.54 a
6 ton straw/ha	18.65 f	29.00 f	23.90 f	26.57 f
6 ton straw/ha + 82 kg N/ha	23.47 d	34.56 d	27.39 c	32.05 d
6 ton straw/ha + 123 kg N/ha	24.54 c	37.01 c	27.894 c	35.94 c
6 ton compost/ha	22.63 e	32.80 e	25.84 d	29.37 e
6 ton compost/ha + 82 kg N/ha	27.33 b	41.45 b	31.07 b	44.46 b
6 ton compost/ha + 123 kg N/ha	31.40 a	45.75 a	33.28 a	48.24 a
Interaction	**	**	**	**

*** = Significant at 5% level**
**** = Significant at 1% level and N.S = not significant, respectively in column values designated by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.**

Data in Table 4 indicate also that applying straw or compost separately was less effective in dry weight per hill for each cultivar than applying mineral nitrogen alone or combined with them.

Such favourable effect of mineral nitrogen or combined with 6 ton compost on dry matter accumulation might have been resulted from quickly providing the necessary nitrogen in roots zone and other nutrient to rice plant which results in a more vegetative growth and high photosynthetic rate.

The increase in dry matter production due to compost application might be attributed to the increase in plant height and number of tillers since compost is readily decomposed organic materials. These results are in agreement with those reported by Sheeba and Kumarasamy (2001), Khoshgoftarmanesh and Kalbasi (2002) and Misra *et al.* (2002).

2. Yield and its attributes:

2.1. Number of panicle per hill:

Data in Table 5 indicate that there were highly significant differences in number of panicles per hill between Giza 177 and Giza 178 rice cultivars. Giza 178 rice cultivar significantly surpassed Giza 177 in this respect.

Data in Table (5) show that, there was an apparent significant differenc in number of panicles per hill due to fertilizers treatments in both seasons. Mineral nitrogen alone or combined with organic fertilizer significantly increased number of panicles per hill compared with control treatments in both seasons. Plants received urea at the recommended rate alone or 6 tons compost with 123 kg N/ha, exceeded those received straw or compost alone or combined with 82 kg N/ha, in number of panicle per hill. The increase in number of panicles per hill by adding mineral nitrogen reflects the important role of nitrogen as an essential constituent of all proteins and its concern in the production of new living stuff and thus in growth and reproduction. Data indicate that the application of compost is better than the incorporation of straw either alone or combined with high rate of mineral nitrogen. This mainly due to the fact that compost is readily decomposed organic materials and provide rice plants with the released nutrients particularly nitrogen. These findings are in agreement with those reported by Kalita and Sharmah (1992).

Table (5): Number of panicle per hill and panicle weight (g) of Giza 177 and Giza 178 rice cultivars as affected by fertilizers treatments in 2004 and 2005 seasons.

Factor	No. of panicle per hill		Panicle weight (g)	
	2004	**2005**	**2004**	**2005**
Cultivars:	**	**	*	*
Giza 177	16.36 b	17.88 b	2.88 b	3.19 b
Giza 178	19.98 a	19.02 a	3.12 a	3.28 a
Treatments:	*	*	*	*
Control	12.40 g	13.58 g	2.35 d	2.46 e
164 kg N/ha (recommended)	22.92 b	23.29 a	3.69 a	4.17 a
6 ton straw/ha	14.00 f	14.53 f	2.59 c	2.75 d
6 ton straw/ha + 82 kg N/ha	18.30 d	17.36 d	3.01 b	3.03 c
6 ton straw/ha + 123 kg N/ha	18.90 d	19.44 c	3.00 b	3.20 c
6 ton compost/ha	15.55 e	15.68 e	2.62 c	2.72 d
6 ton compost/ha + 82 kg N/ha	20.05 c	20.31 b	3.15 b	3.43 b
6 ton compost/ha + 123 kg N/ha	23.22 a	23.49 a	3.60 a	4.12 a
Interaction	NS	**	NS	**

*** = Significant at 5% level**
**** = Significant at 1% level and N.S = not significant, respectively in column values designated by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.**

The interaction between fertilizers treatments and rice cultivars had significant effect on number of panicles per hill in 2005 season only. Application of 164 kg N/ha alone or 6 tons compost plus 123 kg N/ha produced the highest number of panicles per hill in both varieties.

The results indicate that either mineral nitrogen or organic fertilizer combined with mineral nitrogen are needed for higher production of active tillers.

2.2. Panicle weight (g):

Panicle weight as influenced by the application of straw, compost, N fertilizer and their combination are presented in Table (5). Significant effect on panicle weight was recorded when rice plants were fertilized with either mineral nitrogen at the rate of 164 kg N/ha or 6 ton compost + 123 kg N/ha in both seasons. Giza 178 rice cultivar produced significantly heavier panicle than Giza 177 rice cultivar in both seasons. The heaviest panicle (4.17 g) was produced when rice plants received 164 kg N/ha in 2005 seasons. Likewise the lightest panicle (2.35 g) was obtained from control.

There was no significant difference in panicle weight (g) in both seasons between plants treated with 164 kg N/ha and those treated with 6 tons compost/ha plus 123 kg N/ha. That means the application of 6 ton compost saved about 40 kg N/ha. Data indicate also that there was no significant difference in panicle weight between plants received 6 tons straw/ha. plus 82 kg N/ha and those received 6 tons straw/ha plus 123 kg N/ha in both seasons. On the other hand higher panicle weight (g) was produced by application of 6 tons compost/ha plus 123 kg N/ha than the application of 6 tons straw/ha plus 123 kg N/ha. So data indicate that the application of compost is better than incorporation of straw mainly due to the difference in the C: N ratio which is low in compost and high in straw. The decomposition of compost provides the rice plant with essential nutrients which cause on increase in photosynthesis and improve grain filling (Kalita and Sharmah, 1992).

The interaction between treatments and rice cultivars gav a significant difference in panicle weight (g) in season 2005 only. The highest panicle weight values were found in plants that received either 164 kg N/ha or those which received 6 ton compost plus 123 N/ha for both varieties.

2.3. 1000-grain weight (g):

Data in Table (6) show that there was high significant difference in 1000 grains weight (g) between Giza 177 and Giza 178 rice cultivars in both seasons. Giza 177 rice cultivar was superior to Giza 178 rice cultivar in both seasons.

The highest value of 1000 grain weight was found when no fertilizer was applied (control). On the other hand, the lowest value was found when 6 tons compost/ha or 6 ton compost + 82 kg N/ha were applied. Data show also that there was no significant difference in 1000-grains weight in plants received 164 kg N/ha or received 6 tons compost plus 123 kg N/ha for both varieties under study. This is mainly due to the increase in number of grains per panicle in plants which received 164 kg N/ha and plants that received 6 tons compost plus 123 kg N/ha over those obtained from the control. So negative correlation was found between 1000-grain weight and number of grains per panicle (Perez *et al.,* 1990).

The interaction between fertilizer treatments and rice cultivars had a significant difference in 1000-grain weight (g) in both seasons. There was no significant difference in 1000-grains weight (g) between plants treated with 6 tons straw/ha plus 82 kg N/ha and those treated with 6 tons straw plus 123 kg N/ha.

Table (6): 1000-grain weight (g) and number of grains per panicle of Giza 177 and Giza 178 rice cultivars as affected by fertilizers treatments in 2004 and 2005 seasons.

Factor	1000-grain weight (g)		No. of grains per panicle	
	2004	2005	2004	2005
Cultivars:	**	**	**	**
Giza 177	23.99 a	23.51 a	92.14 b	95.40 b
Giza 178	21.62 b	22.65 b	132.74 a	138.94 a
Treatments:	*	*	*	*
Control	25.30 a	25.07 a	96.46 e	106.37 f
164 kg N/ha (recommended)	24.03 b	24.16 ab	125.13 a	131.08 a
6 ton straw/ha	21.42 d	21.11 c	105.93 d	109.12 e
6 ton straw/ha + 82 kg N/ha	23.28 c	23.21 b	110.13 c	114.62 d
6 ton straw/ha + 123 kg N/ha	23.01 c	23.25 b	110.38 c	117.67 c
6 ton compost/ha	20.51 e	21.90 c	108.92 c	109.27 e
6 ton compost/ha + 82 kg N/ha	20.96 e	20.98 c	118.46 b	123.12 b
6 ton compost/ha + 123 kg N/ha	23.95 b	24.98 a	124.08 a	132.08 a
Interaction	**	*	**	**

*** = Significant at 5% level**
**** = Significant at 1% level and N.S = not significant, respectively in column values designated by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.**

2.4. Number of grains per panicle:

Data corresponding to number of grains per panicle as influenced by straw, compost, urea and their combination are presented in Table (6). With respect to rice performance, it was found that rice cultivars, significantly varied in their number of grains per panicle in the two seasons. Giza 178 rice cultivar had the superiority in the majority of the discussed traits and it continued to perform better regarding to number of grains per panicle. On the other hand, Giza 177 rice cultivar gave the lowest number of grains per panicle in the two seasons. the varietal differences in number of grains per panicle is mainly due to the genetic background. Similar findings are reported by Gorgy (1995) and Kalboch (1997).

There was which no significant difference in number of grains per panicle between plants which received 164 kg N/ha and those that received 6 tons of compost/ha plus 123 kg N/ha in both seasons. This is mainly because the application of compost improves the soil properties and provides rice plant with different nutrient elements.

Data indicate also that there was no significant difference in number of grains per panicle between plants treated with 6 tons of compost, and those treated with 6 tons straw plus 82 or 123 kg N/ha in the first season. All treatments involved with compost gave the highest number of grains per panicle in the two seasons compared to the control or straw treatment.

The interaction between fertilizer treatments and rice cultivars had a significant effect on number of grains per panicles in both seasons under study. The highest value of number of grains per panicle was found with the application of 164 kg N/ha or 6 ton compost + 123 kg N/ha. while, the lowest value of grains per panicle were found in unfertilized plants in both seasons.

2.5. Filled grains per panicle (%):

Filled grains percentage as affected by the application of rice straw, compost and urea are presented in Table (7). Data indicate that there was substantial difference in filled grains percentages between Giza 177 and Giza 178 rice cultivars in both season. Giza 177 produced greater filled grains percentage than Giza 178 rice cultivar.

Table (7): Filled grains percentage of Giza 177 and Giza 178 rice varieties as affected by fertilizers in 2004 and 2005 seasons.

Factor	Filled grains (%)	
	2004	**2005**
Cultivars:	**	**
Giza 177	96.36 a	96.1 a
Giza 178	92.36 b	92.75 b
Treatments:	*	*
Control	90.95 e	91.23 f
164 kg N/ha (recommended)	96.47 a	96.60 a
6 ton straw/ha	91.97 d	91.94 e
6 ton straw/ha + 82 kg N/ha	94.47 c	94.60 cd
6 ton straw/ha + 123 kg N/ha	95.24 b	95.07 bc
6 ton compost/ha	94.1 c	94.02 d
6 ton compost/ha + 82 kg N/ha	95.48 b	95.51 b
6 ton compost/ha + 123 kg N/ha	96.16 a	96.51 a
Interaction	*	NS

*** = Significant at 5% level**
**** = Significant at 1% level and N.S = not significant, respectively in column values designated by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.**

Data indicate also that there was no significant difference in filled grains percentage in plants which received 164 kg N/ha and those that received 6 tons compost/ha plus 123 kg N/ha under study in both seasons. The highest mean value of filled grains percentage was found in plants which received 164 kg N/ha and plants that received 6 tons compost plus 123 kg N/ha.

There was significant difference in filled grains percentage between plants which received 6 tons straw plus 123 kg N/ha and plants that received 6 tons compost/ha plus 123 kg N. So data indicated that the application of compost is more beneficial to both soil and rice than the incorporation of rice straw even it was combined with high rate of inorganic nitrogen. This is mainly because compost is readily decomposed organic materials and provides rice plant with some nutrients particularly nitrogen. A significant increase in filled grains percentage was accompanied with applied nitrogen and compost. This may be attributed to the considerable increase in LAI, and dry matter production for plants which received 164 g N/ha and compost plus 123 kg N/ha. These results are in harmony with the findings reported by Andrade *et al.* (1986), Verma and Bhagat (1992) and Pathak and Sarkar (1997).

The interaction between fertilizer treatments and rice cultivars had a significant effect on filled grains percentage in the first season (2004), only. The highest filled grains percentages were obtained with the application of either 164 kg N/ha or 6 tons compost plus 82 or 123 kg N/ha, while the lowest value was found in the control.

So, data indicate that the readily decomposed compost provides plants with nitrogen and other nutrients but straw needs long time to be decomposed based on its C/N ratio which is very much higher than that of the compost.

2.6. Grain yield (ton/ha):

Grain yield of Giza 177 and Giza 178 as affected by fertilizers treatments in 2004 and 2005 seasons are presented in Table (8). The data reveal that, highly varietal differences were observed among the tested cultivars in grain yield in the two seasons. Giza 178 gave higher yield than Giza 177 reached the level of significance. The superiority of Giza 178 in this respect was mainly due to its high ability to have high dry matter production, LAI, number of panicle/m^2, number of grains/panicle. The varietal differences in the grain yield of rice plants were found by Gotoh *et al.* (1985), Perez *et al.* (1991), Songmuang *et al.* (1991), El-Kalla *et al.* (1992), Lee *et al.* (1995) and Misra *et al.* (2002).

There was a significant difference in grain yield/ha among fertilizers treatments in the two seasons (Table 8). Plants which received urea at the recommended rate alone or 6 ton of compost plus 123 kg N/ha, being insignificant, and out yielded substantially control plants and those which received straw or compost separately or their combination with low rate of N fertilizer. Data show that application of compost is better in grain yield/ha than the incorporation of rice straw even when both combined with the same rate of inorganic nitrogen in both seasons. The fertilization treatments containing inorganic nitrogen significantly increased grain yield/ha compared with those contain straw or compost alone in both seasons. No significant difference in grain yield among the treatments which received straw alone or with 82 kg N/ha and 6 tons of compost alone in 2005 season (Table 8).

Table (8): Grain and straw yields of Giza 177 and Giza 178 rice cv. as affected by fertilizers treatments in 2004 and 2005 seasons.

Factor	Grain yield (ton/ha)		Straw yield (ton/ha)	
	2004	2005	2004	2005
Cultivars:	**	**	**	**
Giza 177	6.42 b	6.37 b	7.96 b	8.18 b
Giza 178	8.05 a	8.4 a	10.0 3a	10.84 a
Treatments:	*	*	*	*
Control	5.44 e	5.16 f	7.77 c	8.23 d
164 kg N/ha (recommended)	8.92 a	9.70 a	10.23 a	10.65 a
6 ton straw/ha	5.58 e	5.86 e	7.80 c	8.35 d
6 ton straw/ha + 82 kg N/ha	7.13 c	7.02 e	9.02 b	9.50 c
6 ton straw/ha + 123 kg N/ha	7.72 b	7.53 c	9.34 a	10.17 b
6 ton compost/ha	6.21 d	6.22 e	8.15 c	8.58 d
6 ton compost/ha + 82 kg N/ha	7.98 b	8.20 b	9.5 a	10.05 b
6 ton compost/ha + 123 kg N/ha	8.87 a	9.61 a	10.10 a	10.56 a
Interaction	NS	*	**	**

*** = Significant at 5% level**
****= Significant at 1% level and N.S = not significant, respectively in column values designated by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.**

Table (9): Grain yield (ton/ha) as affected by interaction between fertilizers and rice cultivars in 2005 season.

Treatments	2005	
	Giza 177	**Giza 178**
Control	4.11 i	6.22 efg
164 kg N/ha (recommended)	8.30 c	11.10 a
6 ton straw/ha	5.02 h	6.70 def
6 ton straw/ha + 82 kg N/ha	6.02 fg	8.02 c
6 ton straw/ha + 123 kg N/ha	6.52 def	8.55 c
6 ton compost/ha	5.60 gh	6.82 de
6 ton compost/ha + 82 kg N/ha	7.17 d	9.22 b
6 ton compost/ha + 123 kg N/ha	8.22 c	11.00 a

Means followed by a common latter are not significantly different at the 5% level by DMRT

Application of 164 kg N/ha or 6 ton of compost plus 123 kg N/ha increased grain yield through improved early growth, in terms of dry matter accumulation, leaf area index and tillers number, which was reflected in higher number of panicle/hill, number of grain/panicle, filled grain percentage and 1000-grain weight.

The interaction between fertilizers treatments and rice cultivars had significant effect on grain yield (t/ha) in the second season only (Table 9). Data show that the highest grain yield (t/ha) was recorded in plants of Giza 178 which received mineral nitrogen at the recommended rate alone or 123 kg N/ha combined with 6 tons of compost/ha, while the lowest one was found in unfertilized Giza 177. In this connection the results are in agreement with these of Takahashi *et al.* (2003) and Singha (2003).

2.7. Straw yield (ton/ha):

Straw yield of Giza 177 and Giza 178 as affected by the application of straw, compost and urea are presented in Table (8). Varietal differences were detected among the two tested cultivars in straw yield (ton/ha) in the two seasons. Giza 178 rice cultivar had the superiority over Giza 177 cultivar. The highest straw yield of Giza 178 rice cultivar could be attributed mainly to its higher tillering ability, large LAI and higher dry matter production than that of Giza 177. These results are in agreement with those reported by Gorgy (1988).

Data in the same Table also indicate that there was no significant difference among the treatments which received 164 kg N/ha urea, 6 tons of straw + 123 kg N/ha, 6 tons of compost + 82 kg N/ha and 6 tons of compost + 123 kg N/ha in 2004 season, while in 2005 season there was no significant difference between 164 kg N/ha and 6 tons compost + 123 kg N/ha in straw yield. Application of 164 kg N/ha gave the highest mean value of straw yield (ton/ha) in both seasons. while, unfertilized plants gave the lowest one.

Data in Table (10) indicate that both cultivars responded likely to the application of fertilizer treatments. There was no significant difference in straw yield between plants received 6 tons straw plus 123 kg N/ha and 6 tons compost plus 82 kg N/ha in both season. There was no consistence of clear trend in the response to both cultivars to the application of any of the treatments for this traits.

Table (10): Straw yield ton/ha as affected by the interaction between fertilizers treatments and Giza 177 and Giza 178 cultivars in 2004 and 2005 seasons.

Treatments	2004		2005	
	Giza 177	Giza 178	Giza 177	Giza 178
Control	6.95 f	8.60 cd	6.80 h	9.67 d
164 kg N/ha (recommended)	9.00 cd	11.40 a	9.00 e	12.30 a
6 ton straw/ha	7.00 f	8.60 cd	7.40 gh	9.30 de
6 ton straw/ha + 82 kg N/ha	7.62 ef	10.42 b	8.15 f	10.82 c
6 ton straw/ha + 123 kg N/ha	8.12 de	10.5 ab	8.70 ef	11.65 ab
6 ton compost/ha	7.40 ef	8.90 cd	7.47 g	9.70 d
6 ton compost/ha + 82 kg N/ha	8.60 cd	10.55 ab	8.95 e	11.15 bc
6 ton compost/ha + 123 kg N/ha	9.05 c	10.20 b	9.00 e	12.10 a
Interaction				

Means followed by a common latter are not significantly different at the 5% level by DMRT.

3. Grain quality:

3.1. Hulling and milling rice percentage:

Table (11) show that, hulling and milling percentage were not significantly affected by any of the applied treatments in the two seasons. This might be attributed to the fact that these traits ware genetically controlled and the environment has a minor effect on these traits.

3.2. Head rice percentage:

Head rice percentage as affected by different fertilizer treatments in both seasons of study are presented in Table (11). Varietal differences were observed among tested cultivars in head rice percentage. Giza 177 produced greater head rice % than Giza 178 in both seasons.

Table (11): Hulling, milling and head rice percentage of Giza 177 and Giza 178 rice cultivars as affected by fertilizers treatments in 2004 and 2005 seasons.

Factor	Hulling rice %		Milling rice %		Head rice %	
	2004	2005	2004	2005	2004	2005
Cultivars:	NS'	NS	NS	NS	*	*
Giza 177	80.89	81.09	71.00	71.21	81.96 a	80.61 a
Giza 178	81.02	81.38	70.33	71.57	77.14 b	74.71 b
Treatments:	NS	NS	NS	NS	*	*
Control	80.67	80.71	70.87	71.38	79.53 ab	77.99 abc
164 kg N/ha (recommended)	81.32	81.92	71.00	71.75	78.46 bc	76.99 cd
6 ton straw/ha	81.65	81.56	71.58	71.92	78.72 bc	77.50 bc
6 ton straw/ha + 82 kg N/ha	80.90	80.40	70.52	70.92	81.13a	79.12 a
6 ton straw/ha + 123 kg N/ha	81.27	81.27	71.70	71.65	80.61a	77.95 abc
6 ton compost/ha	80.30	81.32	69.82	71.08	76.97c	75.75 d
6 ton compost/ha + 82 kg N/ha	79.70	81.05	69.03	71.53	80.02 ab	77.20 cd
6 ton compost/ha + 123 kg N/ha	81.40	81.66	710.81	70.91	80.95 a	78.81 ab
Interaction	N.S	N.S	N.S	N.S	N.S	N.S

*** = Significant at 5% level**
**** = Significant at 1% level and N.S = not significant, respectively in column values designated by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.**

Data reveal that there was no significant difference in head rice percentage among the fertilizer treatments except the treatments which received only compost or straw alone or 164 kg N/ha in 2004, while in 2005 there were significant differences among all the treatments and the highest value was obtained from the treatment which received 6 tons straw + 82 kg N/ha.

That data indicate also that there was no significant difference between plants received 164 kg N/ha and plants treated with 6 tons compost plus 82 kg N/ha. The highest value of head rice percentage was obtained by the application of 6 tons compost plus 123 kg N/ha while, the lowest value of head rice percentage was found with the application of 6 tons compost alone. These results may be due to the decomposition of compost in increasing nutrient availability and leading to high elements uptake by rice plants. These results are in agreement with those reported by Jeong *et al.* (1996). The interaction between fertilizers treatments and rice varieties was not significant in hulling, milling and head rice percentage in both seasons.

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إنتاجية الأرز تحت التسميد العضوى والمعدنى

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أجريت تجربتان حقليتان بالمزرعة البحثية بمركز البحوث والتدريب فى الأرز بسخا ـ خلال موسمى ٢٠٠٤ ، ٢٠٠٥م بهدف دراسة تأثير الأسمدة العضوية والغير عضوية على إنتاجية محصول الأرز ومكوناته وبعض الصفات التكنولوجية لصنفى جيزه ١٧٧ ، جيزه ١٧٨.

اشتملت التجربة على ثمانية معاملات عبارة عن استخدام القش والكمبوست وسماد اليوريا بمعدلات مختلفة كالاتى: كنترول ، ١٦٤كجم نيتروجين/هكتار ، ٦طن كمبوست/فدان فقط أو مضافا إلى ٨٢ أو ١٢٣كجم نيتروجين/هكتار ، ٦طن قش أرز/فدان فقط أو مضافا إلى ٨٢ أو ١٣٢كجم نيتروجين/هكتار).

تتلخص النتائج المتحصل عليها فيما يلى:

أدت إضافة الكمبوست مع ١٢٣كجم نيتروجين هكتارا وإضافة ١٦٤كجم نيتروجين للهكتار إلى زيادة معنوية فى عدد الفروع ، المادة الجافة ، دليل مساحات الأوراق ، عدد السنابل بالجورة ، عدد الحبوب بالسنبلة ، نسبة الحبوب الممتلئة ، وزن السنبلة ، محصول الحبوب والقش مقارنة بالمعاملات الأخرى. فى حين وجد أن الصفات التكنولوجية للحبوب لم تتأثر بإضافة الكمبوست مثل نسبة التقشير والتبييض فى الحبوب بينما تأثرت نسبة الحبوب السليمة بإضافة التسميد العضوى والمعدنى. كما أوضحت النتائج أن استخدام قش الأرز منفردا أو مصحوبا بالنيتروجين المعدنى لم يكن له تأثير معنوى على الصفات المدروسة.

وتبين النتائج المتحصل عليها أن خلط الأسمدة المعدنية بالكمبوست يؤدى إلى الحصول على أفضل النتائج للصفات المدروسة بالمقارنة بالمعاملات الأخرى ، كما أوضحت النتائج أيضا أن استخدام الكمبوست كان أفضل من استخدام القش نظرا لسهولة تحلل الكمبوست وإنفراد ما به من عناصر. وأن اضافة الكمبوست يلعب دورا هاما فى إنتاج المحصول وتقليل أستخدام الاسمدة الكيماوية والتى تحد من تلوث البيئة.