J. Agric. Sci. Mansoura Univ., 31 (6): 4001 - 4006, 2006

EFFICACY OF COMPOSTED RICE STRAW IN INTEGRATION WITH UREA IN RICE PRODUCTION AND THEIR RESIDUAL EFFECT ON SOIL ORGANIC MATTER

Hammad S.A.*; K.H. El-Hamdi*; S.A. Ghanem and E.S. Naeem****
*** Soil Sci. Dept. of Agric., Mansoura Univ., Egypt.**
**** Rice Resarch and training Center Sakha, Kafr EL-Sheikh**

ABSTRACT

A field experiment was conducted to study the influence of composted rice straw with different rates of urea on the yield of Sakha 101 rice variety (*Oryza sativa* L.) and yield attributes, agronomic efficiency and. organic matter .

The obtained data showed that the highest yield was found when 2 ton of composted rice straw plus 51.75 kg N.fed^{-1} was applied. The combination of nitrogen plus compost gave higher yield than either nitrogen or composted rice straw alone. The highest value of number of panicle.hill^{-1} observed when 2 ton composted rice straw + 51.75 kg N.fed^{-1} added . Results showed that, no significant difference in panicle length and filled grain percentage among all treatments. Higher 1000-grain weight was found in plots received no fertilizers.

Integration of composted rice straw plus nitrogen improved agronomic efficiency but increasing the amount of nitrogen applied decreased the agronomic efficiency. Data showed that, all treatments, which treated with composted rice straw, increased organic matter compared to the other treatments

INTRODUCTION

The need of rice plants to nitrogen fertilizer is a well known fact over the rice producing countries. Nitrogen can be supplied to rice plants either through chemical fertilizers and/or organic fertilizer. Nitrogen fertilizers are widely used in agriculture. The role of N fertilizer in Egyptian economy in general and Egyptian agriculture in particular is far reaching. Therefore laboratory and field studies have been conducted by several research centers and universities concerning on the amount of N-fertilizer used and pollution of the environment. Most of the Egyptian farmers tried to get rid of rice straw by burning which cause bad effect on the environment. Although there are other economical ways to get a feet from it such as making compost which can instead of burning. 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.

The present work was designed to evaluate the combination of composted rice straw plus different rates of nitrogen as a urea on :

1- Rice yield and its attributes.
2-Agronomic efficiency
3-Soil organic matter

MATERIALS AND METHODS

A field experiment was conducted at the Farm of Rice Research and Training Center Kafr El-Sheikh to fulfill the objectives of the present study as follows:

Soil : it was clayey in texture. The main characteristic were: clay = 55.4%, silt=32.33%, sand=12.27%, pH=8.2, Ec=2.3dS/m,OM=1.5%, available N=33.2mg/Kg, available P=15 mg/Kg and available K=308 mg/Kg.
The above soil characteristics were determined according to the standard procedures as described by Cottenie *et al.*, (1982) and Page *et al.*, (1982)
Studied crop: (Oryza sativa, L.) variety Sakha 101.
Date of sowing: 20 May 2004.
Experimental treatments: The Randomized complete block design with four replications was used, involving six treatments as follows: control, 69 kg N fed.$^{-1}$ (recommended), 2 ton of composted rice straw fed.$^{-1}$ · 2 ton compost fed.$^{-1}$ + 17.25 Kg N.fed^{-1}, 2 ton compost fed.$^{-1}$ + 34.5 Kg N.fed^{-1}, 2 t compost fed.$^{-1}$+ 51.75 Kg N.fed^{-1}.
Agronomic efficiency was calculated according to equation cited from Hammad *et al.*,(1994) equation as follows :

$$\text{Agronomic efficiency} = \frac{\text{Grain yield (kg) (fertilized) - Grain yield (kg) (unfertilized)}}{\text{N applied (Kg)}}$$

All collected data were subjected to the statistical analysis, according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Grain and straw yield:

Data in Table 1 , showed the effect of composted rice straw and urea treatments and their combinations on grain and straw yield of Sakha 101 rice variety during 2004 season. Data showed that, there is a significant increase in yield under all the treatments over the control. The highest yield of rice grains was recorded by the application of 2 ton composted rice straw.fed^{-1} plus 51.75 kg N.fed^{-1} from urea (83.3 % increase over the control) but the lowest yield was observed under the treatment which received no fertilizer. The increase in grain yield with the combined use of both these sources is advantageous and substantial amount of inorganic N can be saved. This mainly could be attributed to that combined use of compost and chemical fertilizer increase nutrients availability for plant throughout their growth stages. There was an increasing effect from the application of compost when adequate mineral fertilizers available. The effect have been due to factors other than nutrient supply, it may be necessary to consider influence due to the behavior of N organically provides (Cooke 1977) or the effects of bioreglators. These results are also in agreement with those obtained by Dei, (1975).

Data reported that, 69 kg N. fed^{-1} gave higher yield (50.41% increase over the control) than 2 ton composted rice straw.fed^{-1} alone (43.93 % increase over the control) but any addition from urea to composted rice straw gave higher grain yield than that observed with urea alone. The straw yield follow the same trend of the rice grains.

Yield attributes:

Data in Table 2 present the number of panicle.pot^{-1}, panicle length , filled grains percentage and 1000 grains weight of Sakha 101 rice variety as affected by composted rice straw and urea and their integration. Data showed that, the maximum 1000 grain weight was obtained by the plot receiving no fertilizer This increase in 1000 grains weight with control mainly due to decrease the number of seeds.panicle^{-1} with control consequently increase the weight of seeds. These results are in according with those obtained by Barnes(1985). Data showed also that, integration of composted rice straw with urea gave higher number of panicle.hill^{-1} than composted rice straw or urea alone. It could be concluded that the increase in number of panicle.hill^{-1} resulted from increasing nitrogen may be due to stimulation effect branches initiation which gave more panicle.hill^{-1}. These results are in quite agreement with those reported by Hemalatha *et al,(* 2000). Regarding to panicle length and filled grain percentage data demonstrate that all treatments didn't vary significantly from the control.

Table (1): Means of dry weight of rice grain and straw (kg.fed^{-1}) as affected by the application of composted rice straw and urea treatments at harvest in 2004 season

Treatment	Grain	% increase or decrease	Straw	% increase or decrease
Control	2983f	-	3081f	-
2TCRS . fed^{-1}	4294e	43.93	5200e	68.77
69 kg N.fed^{-1}	4487d	50.41	5410d	75.59
2TCRS + 17.25 kg N.fed^{-1}	4852c	62.6	5730c	85.97
2TCRS + 34.5 kg N.fed^{-1}	5137b	72.2	6100b	97.98
2TCRS + 51.75 kg N.fed^{-1}	5469a	83.3	6700a	117.64

TCRS = Ton composted rice straw
%=increase or decrease relative to the control

In the same column, means followed by the same letter are not significant by different according to DMRT (Duncan,1955)

Table (2): Yield attributes of rice variety 101 as affected by the application of composted rice straw and urea treatments in 2004 season.

Treatment	1000 grain weight (g)	No. of panicle. hill^{-1}	Panicle length (cm)	Filled grain (%)
Control	28.68a	15e	21.75a	94a
2TCRS .fed^{-1}	28.13b	23.1d	22.81a	94a
69 kg N.fed^{-1}	28.17b	24.4d	22.93a	95a
2TCRS + 17.25 kg N.fed^{-1}	27.87c	27.2c	22.95a	94a
2TCRS + 34.5 kg N.fed^{-1}	27.70d	29.1b	22.96a	94a
2TCRS + 51.75 kg N.fed^{-1}	27.12e	31.5a	22.96a	95a

TCRS = Ton composted rice straw
%=increase or decrease relative to the control

In the same column, means followed by the same letter are not significant by different according to DMRT (Duncan, 1955).

Agronomic efficiency:

Agronomic efficiency (kg rice.kg^{-1} nitrogen applied) as affected by composted rice straw and urea and their integration are presented in Table 3. Data revealed that, agronomic efficiency was higher when composted rice straw plus urea was applied than when urea was applied alone. Maximum agronomic efficiency(32 kg.kg^{-1}) was attained by the grain yield in plots fertilized with 2 ton composted rice straw plus 17.25 kg N.fed^{-1}. On the other hand, the plots receiving 69 kg N.fed^{-1} only produced the lowest agronomic efficiency (21.7 kg.kg^{-1}).

Data showed also that, decreased agronomic efficiency with increasing the amount of nitrogen applied. This mainly because the yield produced from the application of 69 kg N.fed^{-1} is not twice as yield obtained from the application of 34.5 kg N.fed^{-1}, so that the differences in the numerator is less than the difference in denominator. These results are in agreement with those obtained by Sirisena *et al.*, 2003).

Organic matter:

Organic matter of soil as affected by composted rice straw and urea treatments at harvest are presented in Table 4.Data showed that the percentage of organic matter reduced with no fertilizer added (1.46%) or 69 kgN.fed^{-1} (1.48%) compared to the value of organic matter before transplanting (1.5%) but the integration of composted rice straw with different rates of urea increased the percentage of organic matter. The reduction of organic matter with control or urea may be due to the decomposition of organic matter of the soil. The integration of 2 ton composted rice straw with 34.5 or 51.75 kg N.fed^{-1} gave the same percentage of organic matter (1.59%). The results confirm the findings of Singha (2003).

Table 3: Effect of composted rice straw and urea treatments on agronomic efficiency of rice plant in 2004 season

Treatment	CONTROL	2TCRS
69 kg N.fed^{-1}	21.7	-
2TCRS + 17.25 kg N.fed^{-1}	-	32
2TCRS + 34.5 kg N.fed^{-1}	-	24.4
2TCRS + 51.75 kg N.fed^{-1}	-	22.7

TCRS = Ton composted rice straw

Table 4: Soil organic matter as affected by the application of composted rice straw and urea treatments at harvest in 2004 season

Treatment	O.M (%)
Control	1.46
2TCRS .fed^{-1}	1.54
69 kg N.fed^{-1}	1.48
2TCRS + 17.25 kg N.fed^{-1}	1.57
2TCRS + 34.5 kg N.fed^{-1}	1.58
2TCRS + 51.75 kg N.fed^{-1}	1.59

TCRS = Ton composted rice straw

Conclusion

An experiment conducted during the summer season of 200[illegible] to study the efficacy of composted rice straw in integration with nitrogen fertilizer as a urea in lowland rice (*Oryza sativa* L.) indicated that the integration of composted rice straw with nitrogen fertilizer as a urea increased the productivity of rice. Effective substitution of the recommended N dose of rice could be done by composted rice straw. The combination of composted rice straw plus urea improved the agronomic efficiency. Combined application of organic fertilizer and mineral fertilizer had better build up of soil organic matter.

REFERENCES

Barnes, J. E. (1985). The response of rice to time and rate of application of nitrogen fertilizer in burdexin valley Queensland Jour. of Agric. and Anion Sci. 42 (2) : 71 –77.

Cooke, G. W. (1977). The roles of organic manures and organic matter is managing soils for higher crop yields. A review of the experimental evidence. Pages 53-64 in the proceedings of the international seminar on soil environment and fertility management in intensive agriculture. The soci. of the sci. soil and Manure. Japan (Nippon Adj Yohirye Gakkail, Tokyo).

Cottenie, A. M. Verloo; L. Kiekens, G. Velghe and R. Camerlynch. (1982). Chemical Analysis of Plants and Soils. Laboratory of Analytical and Agro. Chemistry state University, Ghent. Belgium.

Dei, Y. (1975). Effects of cereal crop residue on paddy soils. ASPAC ext. Bull. 49 : 1-29.

Duncan, B. D. (1995). Multiple range and multiple- F-test. Biometrics 11: 1-42

Gomez, K. A and A.A. Gomez (1984). Statical Procedures for Agriculture Research. Inc. New York.

Hammad, S.A.; E.E. Kaoud; M. Abou Seeda and S. Soliman (1994). Field evaluation of urease and nitrification inhibitors for rice production. J. Agric . Sci. Mansoura univ.19(11)3969-3977.

Hemalatha, M. T. and R. Balasubramanian (2000). Effect of organic sources of nitrogen on productivity, quality of rice and soil fertility in single crop wetland. Ind. J. Agron. 45 (3) : 564-567.

Page, A.L.; R.H. Miller and D. R. Keeney (1982). Method of Soil Analysis – part 2. Amer. Sco. Agric. Inc. Madison.

Singha D.D. (2003). Management of crop residue in summer rice and its effect on the soil properties and crop yield .Crop- Res. Hisar. 25(1): 191-193.

Sirisena D.N.; W. M. A. D. B. Wickramasinghe; , W. M. W. Weerakoon; D. Kumaragamage and S.T. Bandara (2003). Evaluation of the leaf-N based nitrogen fertilizer management in irrigated transplanted rice Ann. Sri Lanka Depart. Agric

فعالية دمج مكمورة قش الأرز مع اليوريا على إنتاجية محصول الأرز والتأثير المتبقى منهما على مادة التربة العضوية

سامى حماد*، خالد الحامدى*، صبحى غانم** و السيد نعيم**
* قسم علوم الأراضي-كلية الزراعة-جامعة المنصورة
**مركز البحوث والتدريب فى الأرز-سخا-كفر الشيخ

أجريت تجربة حقلية في موسم ٢٠٠٤ في مزرعة مركز البحوث والتدريب في الأرز – سخا – كفر الشيخ مستخدماً صنف الأرز سخا ١٠١ وذلك بهدف دراسة تأثير بعض الأسمدة العضوية (مكمورة قش الأرز) والأسمدة الكيماوية (اليوريا) على محصول الأرز ومكوناته وكفاءة استخدام السماد النيتروجيني وتغيرات المادة العضوية بالأرض.

أوضحت النتائج أن أعلى قيمة لمحصول الحبوب والقش ظهرت عند استخدام ٢طن كمبوست من قش الأرز + ٥١,٧٥ كجم نيتروجين . فدان$^{-1}$. وجدت زيادة معنوية في وزن ١٠٠٠ حبة مع معاملة الكنترول. أدى خلط الكمبوست مع معدلات مختلفة من اليوريا إلى زيادة عدد السنابل. جورة$^{-1}$. أوضحت النتائج أنه لا توجد فروق معنوية بين كل المعاملات في كلا من طول السنبلة ونسبة الحبوب الممتلئة. أظهرت النتائج أن إضافة الكمبوست مع السماد النيتروجيني أدى إلى تحسين كفاءة استخدام السماد ولكن مع زيادة كمية السماد النيتروجيني المستخدم قلت كفاءة استخدام السماد. أوضحت النتائج أن استخدام الكمبوست مع السماد النيتروجيني أدى إلى تقليل كمية السماد النيتروجيني المستخدم مما أدى إلى تقليل تكاليف استخدام الأسمدة المعدنية. أوضحت النتائج أن كل المعاملات التي استخدم فيها الكمبوست مع السماد النيتروجيني أدى إلى زيادة المادة العضوية بالمقارنة بالمعاملات الأخرى.