International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: SJIF: 5.995
Available Online at www.journalijcar.org
Volume 6; Issue 12; December 2017; Page No. 8591-8595
DOI: http://dx.doi.org/10.24327/ijcar.2017.8595.1390

Research Article

COMPARATIVE ANALYSIS OF THE GROWTH OF PADDY (Oryza sativa) CROP BY USING SLAG, COW MANURE AND MUNICIPAL SOLID WASTE COMPOST

Mir Syeda Yuhannatul Humaira and Manoj Ranjan Sinha

Kolhan University, Chaibasa

A R T I C L E I N F O

Article History:
Received 17th September, 2017
Received in revised form 21st October, 2017
Accepted 05th November, 2017
Published online 28th December, 2017

Key words:
Cow manure, Morphology, MSWC, paddy, Slag

A B S T R A C T

This paper attempts for assessing the effect of MSW compost, slag and cow manure on the morphology of paddy *(Oryza sativa)*. Remarkable variations were observed due to different levels of organic manure on plant height, number of leaves, number of roots, shoot length, root length, yields/tray. In the MSWC, growth performance of paddy was significantly better than that of control. Application of varying compost rate to nutrient deficient soil had significant effect on growth. The residual effect of applied compost had significant influence only on plant height but not on all other growth parameters. There was no significant difference in leaves of the cow manure and control. However effect of compost applied had significant ($p<3.01$) effect on biomass accumulation. 40% slag had significantly healthiest leaves in its shoot and roots. The effect of different levels of compost application on biomass yield revealed that tray with 60% compost accumulated highest biomass. This had significantly higher values than those of other compost rate.

INTRODUCTION

Morphology is the study of the physical form and external structure of plants. This is usually considered distinct from plant anatomy which is the study of the internal structure of plants, especially at the microscopic level. Plant morphology is useful in the visual identification of plants [1]. Rice *(Oryza sativa L.)* is considered as one of the most important cereal crops and the staple food for more than half of the world's population [2]. Cow dung manure, slag and municipal solid waste compost are very good sources of organic matters and play a vital role in soil fertility improvement as well as supplying primary, secondary and micronutrients for crop production. Thus the present study was undertaken to assess the effectiveness of three different organic manures on the growth and yield of paddy. A visual health observation ranking system was developed to describe the growth and health of the plants. The observation system was based on colour, size, insect damage and signs of toxicity [3].

MATERIALS AND METHOD

Morphological analysis was done by me at home as the instruction given by the horticulture. To analyze paddy (Oryza sativa) nursury tray was used. Plant morphology "represents a study of the development, form, and structure of plants, and, by implication, an attempt to interpret these on the basis of similarity of plan and origin [4].

Corresponding author:* **Mir Syeda Yuhannatul Humaira
Kolhan University, Chaibasa

I used morphological characters of plants which was compared, measured, counted and described to assess the differences and similarities in paddy (Oryza sativa) [5].

For the morphology of paddy (Oryza sativa) I have done quantitative characters because the quantitative characters are morphological features that can be counted or measured for example a paddy (Oryza sativa) has leaf 4–6 mm wide.

The good quality paddy seeds from the bagicha was used. A visual check of the seeds was done for any seed coat cracking or other damage from insects and disease [6] [7].

Statistical Analysis

A randomized completely block design with different ratio was used in this experiment. Analysis of variance (ANOVA) was carried out to determine the effect of slag, cow manure and compost application on plant height, root growth and number of leaves. Least significant (LSD) at $p < 3.01$ were calculated when the treatment effect was significant.

Observation

13 Flat tray of 30 cm breadth, 50cm length and 5 cm deep (a nursery seedling tray) is used to see the growth rate of the paddy (Oryza sativa). I added MSW compost , slag and cow manure in the tray with the ratio of 20%, 40 %, 60% and 80% , single tray is taken as control.

Table and Graph

Table 1 Showing the mean of the growth of paddy (Oryza sativa) in different ratio of slag

Slag	mean 20%	mean 40%	mean 60%	mean 80%	Mean control
No. of plants	**3**	**3**	**3**	**3**	**3**
No. of leaf	4.4	4.8	6.2	4.2	4
Shoot length In cm	24.7	27.6	29	25.6	17.9
No. of roots	9.6	11	8.2	9.4	5.4
Root length In cm	4.9	5.1	4.4	5.3	2.76

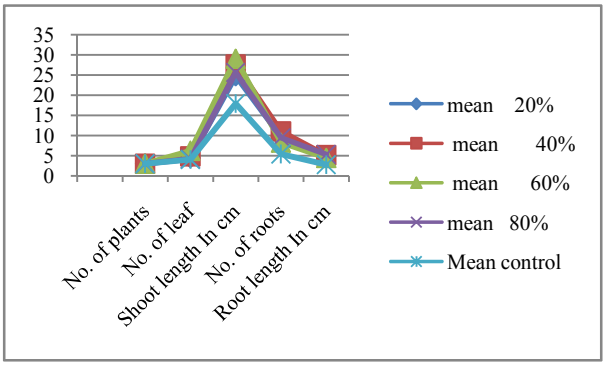

Fig 1 Comparison of the growth profile of the paddy (Oryza sativa) in control and different ratio of slag

Table 2 Calculation of the variation of the growth of paddy (Oryza sativa) in different ratio of slag

Source of variation	*ss*	*Df*	*Ms*	*F*	*P*
Between treatment	B-D= 44.657	U-1 5-1= 4	ss/df = ms =11.16425	3.3098687	3.01
Between plant parts	C-D= 1646.4066	V-1 5-1 = 4	411.60165	122.02768	3.01
Residual	A-D-{(C-D)+(C-D)} = 53.9683	(u-1) (v-1) = 16	3.3730188		
Total	1745.0319	Uv-1=24			

Table 3 showing the mean of the growth of paddy (Oryza sativa) in different ratio of Cow manure

Cow manure	mean 20%	mean 40%	mean 60%	mean 80%	Mean control
No. of plants	3	3	3	3	3
No. of leaf	5	4.4	4.2	3.4	4
Shoot length In cm	19.1	25.5	19.1	17.8	17.9
No. of roots	9.6	6.2	5.2	4.4	5.4
Root length In cm	4.8	5.6	3.4	5.6	2.76

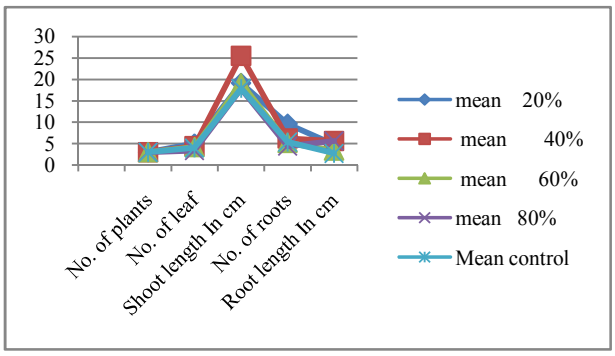

Fig 2 Comparison of the growth profile of the paddy (Oryza sativa) in control and different ratio of cow manure

Table 4 Calculation of the variation of the growth of paddy (Oryza sativa) in different ratio of cow manure

Source of variation	ss	Df	Ms	F	P
Between treatment	B-D= 21.01114	U-1 5-1= 4	ss/df = ms =5.252785	1.8863805	3.01
Between plant parts	C-D= 978.03354	V-1 5-1 = 4	244.508385	87.807873	3.01
Residual	A-D-{(C-D)+(C-D)} = 44.55334	(u-1) (v-1) = 16	2.78458375		
Total	1043.69828	Uv-1=24			

Table 5 Showing the mean of the growth of paddy (Oryza sativa) in different ratio of Compost

Compost	mean 20%	mean 40%	mean 60%	mean 80%	Mean control
No. of plants	**3**	**3**	**3**	**3**	**3**
No. of leaf	4.8	5.6	6.2	5.2	4
Shoot length In cm	29.1	28.4	32.2	29.8	17.9
No. of roots	7.8	6	13.2	11.2	5.4
Root length In cm	4.6	4.6	10.2	8.5	2.76

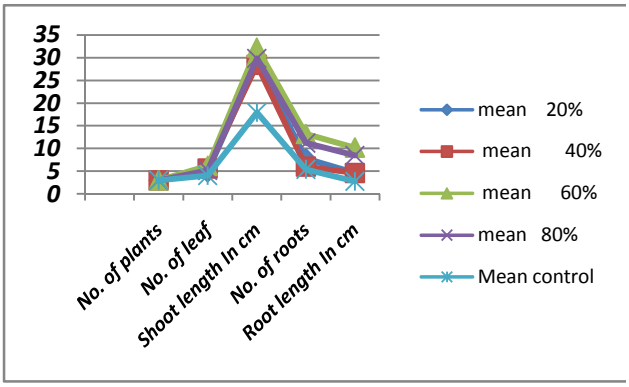

Fig 3 Comparison of the growth profile of the paddy (Oryza sativa) in control and different ratio of compost

Table 6 Calculation of the variation of the growth of paddy (Oryza sativa) crops in different ratio of compost

Source of variation	ss	Df	Ms	F	P
Between treatment	B-D= 114.06666	U-1 5-1= 4	ss/df = ms =28.516665	4.7875963	3.01
Between plant parts	C-D= 1972.63706	V-1 5-1 = 4	493.159265	82.795356	3.01
Residual	A-D-{(C-D)+(C-D)} = 95.30182	(u-1) (v-1) = 16	5.95636375		
Total	2182.00554	Uv-1=24			

Counted out 200 seeds of Oryza sativa and sowed in the tray. Seeds are sown at normal seeding depth of 2-3 cm. Placed the seeds on top of the soil and pushed them in with a piece of pencil and cover it well.

Kept the tray moist (not wet) Over-watering will result in fungal growth on the seeds, causing possible seed rot, affecting normal germination. The seedlings were counted after 7 to 10 days when the majority of seedlings are up.

Results from (Table 2.) show the effect of slag on plant height and on the number of leaves of paddy. Paddy crop was showing the best growth rate in 40% slag after one month of the germination. Paddy growth was significantly ($P<3.01$) affected by different ratio of slag. Slag had a significant ($P<3.01$) effect on the number of leaves of Paddy in the ratio of 40% but the values for the control and the varying sources of slag were statistically similar.

In different ratio the results further showed that paddy plants supplied with cow manure (Table 4). It recorded an average of 5 leaves, which was closely followed by cow manure with average value of 21.63 and 20.44 of leaves respectively. Cow manure had no significant effect on the number of leaves. The 80% cow manure had significantly the least number of leaves. Paddy crop was showing the best growth rate in 40% cow manure after the one month of the germination.

Different sources of compost have produced longer leaves than the rest of the sources and the control. The results presented in (Table 6.) compost had significant effect ($P<3.01$) on paddy plant growth. Paddy crop was showing the best growth rate in 60% compost after the one month of the germination. The control and cow manure produced statistically similar leaves growth. Compost was at par with the growth of leaves in control. Compost source was found to produce significantly higher number of root than any other source.

Values for cow manure, slag and compost were statistically at par in each ratio. Paddy grown on MSWC were significantly ($P<3.01$) taller than the other two sources of organic manure. Results further showed that treating Paddy with cow manure and slag also bring out significant difference in plant height from the control.

Compost application significantly increased soil pH due the reduced exchangeable acidity and the increased levels of exchangeable bases like K, Ca and Mg. Compost application also increased the nutrient content of P, K, Ca, Mg and Na in the topsoil.

RESULTS AND DISCUSSION

The results of this experiment show that it is possible to increase the production of the paddy by slag, cow manure and compost, although substantially different effects were observed between these substrates in plant morphology and growth depending on the dose used. The doses of slag higher than 50% caused prompt plant mortality. Plant mortality after slag introduction in the tray has already been reported in previous studies and it has been attributed to the change in the physical properties of the substrate (i.e. increase in bulk density and decrease in pore and readily available water) [8], and to the presence of excessively high concentrations of certain ions [9].

A visual health observation ranking system was developed to describe the growth and health of the plants. The observation system was based on colour, size, insect damage and signs of toxicity [3]

Consequently, substitution of different ratio by cow manure could only be accomplished at low doses, but total substitution was feasible with 40% of cow manure. Further, upon application of the adequate dosage, significant improvements in plant growth were observed as compared to the control. Root morphology was also significantly improved through the increase in root volume and branching as compared to the control. These improvements in plant growth and morphology involve an enhancement of post-transplant success, since they determine a higher capacity to exploit soil resources [10] and a higher photosynthetic capacity through the increase of the available surface for gas exchange and light interception, all of these features resulting in a potentially higher yield of the plants. Most likely, such large substitution doses were possible because of the adequate pH and salt content of the cow manure of favourable physical conditions for plant growth. Also the use of different ratio could be a reason for the high variability observed in the response of the paddy plants.

Compost and cow manure have shown to enhance plant growth in several occasions and these growth enhancements have been attributed to an improvement of the physical, chemical and biological properties of the growing substrate. Generally, with moderate amounts of compost produces beneficial effects on plant growth due to the increase on the bulk density of the growing media. Such changes in the physical properties of the substrates might be responsible for the better plant growth with the lower doses of compost as compared to the cow manure and slag. In spite that the amount of nutrients in these amendments varies depending on the parent material from where they are originated, both compost and cow manure constitute a slow release source of nutrients that supply the plants with the nutrients when they are needed [11].

The positive effect of MSWC on plant height could be due to the contribution made by manure to fertility status of the soils as the soils were low in organic carbon content. Municipal solid waste when decomposed increases both macro and micro nutrients as well as enhances the physico-chemical properties of the soil. This could have led to its high vegetative growth. Paddy grown on MSWC performed better in terms of the height of the plant than other two sources. This shows that MSWC were readily available and in the best form for easy absorption by the plant roots, hence there was a boost in the morphological growth of the plant. The obtained results corroborated the finding of [12] in paddy production in which they reported that organic manure, especially MSWC could increase plant height of crops when compared with other sources. The increase in number of leaves per plant with organic fertilizer application stressed its importance during the vegetative growth of crop plants [13].

The increase in leaves of paddy due to MSWC application could be attributed to easy solubilization effect of released plant nutrient leading to improved nutrient status and water holding capacity of the soil. The results obtained were in agreement with the findings of [14] in paddy in which they reported that higher yield response of crops due to organic manure application could be attributed to improved physical and biological properties of the soil resulting in better supply of nutrients to the plants.

The effect of varying rates of compost on growth of paddy is presented in Table-6, there was no significant ($P<3.01$) difference in the growth performance of the paddy in slag, cow manure and MSWC. In the MSWC, growth performance of paddy was significantly better than that of control. Application of varying compost rate to nutrient deficient soil had significant effect on growth. However, the residual effect of applied compost had significant influence only on plant height but not on all other growth parameters.

There was no significant difference in leaves of the cow manure and control. However effect of compost applied had significant ($p<3.01$) effect on biomass accumulation. 40% slag had significantly healthiest leaves. The effect of different levels of compost application on biomass yield revealed that tray with 60% compost accumulated highest biomass. This had significantly higher values than those of other compost rate.

Root morphology is known to be influenced by water and nutrient availability as well by external applications of hormones [10]. Root growth and branching is favored in nutrient-rich environments and in the presence of hormones like auxins, this enables the plant to optimize the exploitation of the available resources which are in turn transformed into photoassimilates and transported again to the root consequently influencing plant growth and morphology in a systemic manner. It is evident that development of such morphology in the paddy was favored after the application of nutrient-rich and biologically-active substrates like compost, slag and cow manure as compared to the control. Growth of paddy plants in trays by compost, slag and cow manure was possible and, in addition, with the adequate doses for each substrate, significant improvements in plant growth and morphology were observed as compared with the control. Although the effects of compost, slag and cow manure might vary depending on the type of waste and production process, and therefore they cannot be generalized, these results constitute a new proof of the viability of sustainable culture practices in horticulture and agricultural field, which entail both environmental and economic benefits.

Research has indicated that compost or the combined application of compost has beneficial effects on soil properties, plant growth and yield. However, minerals which are requirement of the human body are found in all MSW compost, and there are obvious concerns about such elements entering the food chain through food crops to which compost have been applied as fertilizer.

Based on the experiments it can be concluded that municipal solid waste is suitable for composting because of the presence of high percentage of biodegradable organic matter, acceptable moisture content and C/N ration in the waste. Jamshedpur soil is low water holding capacity with little organic matter and nutrient content, the application of compost would be an investment in the long term for the health of soils and plants.

CONCLUSION

The application of cow manure, slag, and MSWC had a significant effect on plant height, number of leaves per plant and root number of paddy. The positive effect of MSWC on plant height could be due to the contribution made by manure to fertility status of the soils as the soils were low in organic carbon content. Municipal solid waste when decomposed increases both macro and micro nutrients as well as enhances the physico-chemical properties of the soil. This could have led to its high vegetative growth. Paddy grown on MSWC performed better in terms of the height of the plant than other two sources. This shows that MSWC were readily available and in the best form for easy absorption by the plant roots, hence there was a boost in the morphological growth of the plant. The effect of different levels of compost application on biomass yield revealed that tray with 60% compost accumulated highest biomass. This had significantly higher values than those of other compost rate. Although the effects of compost, slag and cow manure might vary depending on the type of waste and production process, and therefore they cannot be generalized, these results constitute a new proof of the viability of sustainable culture practices in horticulture and agricultural field, which entail both environmental and economic benefits. The results obtained revealed that paddy responded well to the application of MSW compost compared to other sources of organic manures and control treatment in the study. Based on the finding of this study, it may be recommended that, the used of organic manure in crop production is desirable as it had variable impacts on the growth and yield of crops. The used of organic manure will improve soil organic matter status, nutrient availability and good crop yield as well as ensures stability of soil structure. The organic manure is cheap, more easily accessible and available. It is a good alternative to chemical fertilizer and has sustainability effects on soil. Therefore it is advisable to use MSW compost for the production of paddy and other vegetable/horticultural crops for better crop planting and increase in farmer's yield and income.

Acknowledgement

I, Mir Syeda Yuhannatul Humaira, express my deep sense of gratitude to my research supervisor Dr. Manoj Ranjan Sinha , Associate Professor ,Department of Botany ,Jamshedpur Co-Operative College, Jamshedpur, for his kind co-operation and guidance in the research work. I am also extremely grateful to my parents who make home environment suitable for my research.

References

1. Raven, P. H., R. F. Evert, & S. E. Eichhorn. (2005). Biology of Plants, 7th ed., page 9. New York: *W. H. Freeman*, ISBN 0-7167-1007-2.
2. Jiang, S.H., Zhou, H., Lin, D.Z., Dong, Y.J., Ye, S. H. and Zhang, X.M. (2013). Identification and gene mapping of a thermo-sensitive leaf-color mutant at seedling stage in rice. *Chin J Rice Sci.* 27, 359 - 364.
3. Ghaly, A.E., and Alkoaik, F.N., (2010). Effect of Municipal Solid Waste Compost on the Growth and Production of Vegetable Crops, Riyadh, Kingdom of Saudi Arabia, *American Journal of Agricultural and Biological Sciences* 5 (3): 274-281.
4. Harold C. Bold, C. J. Alexopoulos, and T. Delevoryas. (1987) Morphology of Plants and Fungi, 5th ed., New York: Harper-Collins, 3
5. Tsnoda S, Takahashi N. (1984). Biology of rice. Tokyo: *Japan Science Society Press,* 89-115.
6. SAS. SAS (1993). Programming for researchers and social scientists. California: *SAGE Publications Inc;* SAS Institute Inc.
7. SAS. SAS (2001). Programming for researchers and social scientists. California: *SAGE Publications Inc;*. SAS Institute Inc.
8. Papafotiou, M., Kargas G., Lytra, I., (2005). Olive- mill waste compost as a growth medium component for foliage potted plants, *HortScience* 40: 1746-1750.
9. Hashemimajd, K., Kalbasi, M., Golchin, A., Shariatmadari, H., (2004). Comparison of vermi-compost and composts as potting media for growth of tomatoes. *J Plant Nutr* 27, 1107-1123.
10. Lopez Bucio, J., Ramirez, A. C., EstrellaL. H., (2003). The role of nutrient availability in regulating root architecture, *Curr Opin Plant Biol,* 6: 280-287.
11. Chaoui, H.I., Zibilske L.M., Ohnot, (2003). Effects of earthworm casts and compost on soil microbial activity and plant nutrient availability, *Soil Biol Biochem* 35: 295-302.

12. Ajari, O., Tsado, L.E.K., Oladiran, J.A. and Salako, E.A. (2003). Plant height and fruit yield of okra as affected by field application of fertilizer and organic matter in Bida, Nigeria. *The Nigerian Agricultural Journal*, 34: 74 - 80.
13. Tindall, H.D., (1992). Vegetables in the tropics. *Macmillan Press Ltd*, London, 533.
14. Sanwal, S.K., Lakminarayana, K., Yadav, R.K. Rai, N., Yaldav, D.S. and Mousumi, B., (2007). Effect of organic manures on soil fertility, growth, physiology, yield and quality of turmeric. *Indian Journal of Horticulture*. 64(4): 444 – 449.

How to cite this article:

Mir Syeda Yuhannatul Humaira and Manoj Ranjan Sinha (2017) 'Comparative analysis of the growth of paddy (oryza sativa) crop by using slag, cow manure and municipal solid waste compost ', *International Journal of Current Advanced Research,* 06(12), pp. 8591-8595. DOI: http://dx.doi.org/10.24327/ijcar.2017.8595.1390

****