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Decomposition of Paddy Straw Improved Soil Health in NICRA Village of Chatra District: A Review

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Front line demonstration was conducted during the years 2014-15, 2015-16, 2016-17 in NICRA adopted village Mardanpur in Arra Panchyat of Chatra Block in Chatra district of Jharkhand. The study was conducted to assess the effects of decomposition of paddy stable on productivity and profitability with soil health in local farming system as well as extra pollution of the technology to similar micro farming situation. The experiment consisting of two technology option TO-I: (Farmers Practice) Burning of paddy stable in field and collecting paddy stable for use as fuel of cooking and after onset of monsoon field prepare and transplant rice (Variety-Abhishek) with $N_{80}P_{60}K_{30}$ TO-II: Decomposition of paddy stable 4.5q/ha after onset of monsoon in the month of June through rotovator and transplanted rice (Variety – Abhishek) with $N_{60}P_{45}K_{23}$ in RBD design with 20 replication. The result showed that an average grain and straw yield of rice was 25q/ha and 74.80 q/ha in farmers practice in technology option TO-I where as technology option (TO-II) i.e. 28.33 q/ha and 98.84 q/ha respectively. Return for rupee spent was also higher i.e. 2.40 in TO-II as compared to farmers practice i.e. 1.85 (TO-I). It is due to (25%) reduction of chemical fertilizer in technology option (TO-II).

Keywords: Paddy straw; soil health; farming system; farmers practice.

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1. INTRODUCTION

Burning of paddy and wheat straw was a common practice in the adopted village NICRA Mardanpur in Chatra block of Chatra district Jharkhand resulting in environmental pollution and microbial loss in soil. Recycling of rice residues constitutes more potential problems than recycling of wheat straw. Incorporation of wheat residues, increased the yield of rice and also had a positive residual effect on the yield of subsequent wheat crop [1]. Rice system is a dominating cropping system in the village, High yielding varieties of Rice and wheat produce huge quantities of crop residues. Farmers generally leave paddy and wheat stable about 1 and 1.5 fit height which are approximately 4.5 q/ha. Rice straw comprises mainly cellulose (36-37%) and hemicellulose (23-24%) encrusted by lignin (15-16%) [2]. To make the rice straw composting process economically viable, lignocellulolytic microbes based biodegradation may be an effective alternative to in-situ burning [3]. To avoid straw burning, innovation in crop residual management should assist in achieving Sustainable productivity and allow farmers to reduce nutrient and water inputs and minimize risk due to climate change.

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Keeping this fact under consideration KVK Chatra conducted training programme for convincing farmers about harmful effects of burning of paddy straw in field and similtenosly convinced about benefit through decomposition of paddy and wheat straw in field, accordingly farmers stopped burning of paddy stable in field and after onset of monsoon farmers corporate all paddy straw in same plot every year.

The appropriateness of any agricultural technology largely depends on its acceptability by the farmers. Agro climatic suitability, economic viability, operational feasibility and socio cultural compatibility determine the adoption behaviors of farmers. Many research studies indicated that technologies developed and transfer of technology modules adopted have been adequate enough to meet the specific needs and perspectives of the farmers. Frontline demonstration (FLD) had been helpful in developing technologies on the line of resource availability and aspiration of farmers. Chatra district in an monocropped area with rice. But productivity as well as profitability is very low due to not application of manure which reduces yield up to about 20 percent.

Keeping the fact under consideration a front line demonstration (FLD) was conducted during 2014-15. 2015-16 and 2016-17 in adopted NICRA Village, Mardanpur of Arra Panchyat of Chatra Block in Chatra district of Jharkhand to assess the effects of decomposition of paddy stable on productivity and profitability with soil health consideration in local farming system as well as extrapolation of the technology to similar micro farming situation.

2. MATERIALS AND METHOD

The FLD experiment was conducted in 20 replication (Farmers field) in National Innovation on Climate Resilient Agriculture (NICRA) village Mardanpur of Arra Panchat of Chatra block in Chatra district of Jharkhand in three consecutive year 2014-15, 2015-16 and 2016-17. The FLD experiment was conducted in randomized block design with 2000m^2 plot size for each techno-logical option. The two technology options are as follows TO-I:(Farmers Practice) Burning of paddy stable in field and collect paddy stable for use as fuel of cooking and after onset of monsoon field prepare and transplant rice (Variety-Abhishek) with $N_{80}P_{60}K_{30}$ TO-II: Decomposition of paddy stable 4.5q/ha after one seat of monsoon in the month of June through rotovator and transplanted rice (Variety– Abhishek) with $N_{60}P_{45}K_{23}$. The rationale behind selection of technology option (TO-II) was disseminate scientific recommendations i.e. decomposition of paddy straw or stable to demonstrate farmers, convincing the benefit of decomposition in the place of burning paddy straw or stable in field. The data on soil chemical analysis before and after decomposition, yield and economic was recorded.

The Pre and Post decomposition of paddy stable soils in 15 cm depth were collected from all 20 farmers' field. The textural classes of these soil was determined by the international pipette method [4] and the soil pH was determined in a soil water suspension of 1: 2.5 W/V, using glass electrode pH meter [5]. Organic carbon was determined by Walleye and Black [6] rapid titration method. The pre and post harvest soils of frontline demonstration field.

3. RESULTS AND DISCUSSION

3.1 Physical Chemical and Chemical Properties of Soil before Decomposition

The physico-chemical properties of soil before and decomposition of paddy stable at farmers field are depicted in Table 1.

Table 1 reveals that soils of 20 farmers field sites are sandy loam to sandy clay loams. Strongly acidic to slightly acidic 4.89-5.94 in soil reaction.

The organic carbon content ranges from 0.13 to 0.28 percent (Mean value of 0.20 percent) available N content are between 148-290 kg N ha^{-1} with mean value of 219 kg N ha^{-1}, available P varied from 19.0-28.60 kg P^H ha^{-1} (Mean=23.8 kg P ha^{-1}) and available K from 74.0-97.0 kg K ha^{-1} (mean 85.5 K ha^{-1}) in these soils showed poor soil fertility status.

3.2 Physico-Chemical Properties of Soil after Decomposition of Paddy Stables

The chemical analysis of soil after three year indicated that soil PH increased slightly i.e. 5.6. The available N, available P and available K also increased after three years of experimentation reflecting decomposition of paddy stable maintaining the soil health and affecting for cropping. This finding was supported with finding of Chakraborty et al. [7].

3.3 Yield and Economic Assessment

The Pooled Produced data on yield attributers of rice and its economic assessment (Table 3) showed that on an average grain and straw yield of rice were 25.1 q/ha and 74.75 q/ha in farmers practice, Where in technology option (TO-II) it was 28.33 q/ha and 81.21 q/ha respectively. Result indicated that Technology Option (TO-II) fetched more score on yield profitability and soil health.

The pooled data on economic assessment on return in Rs./ha found higher return Rs. 48166/ha in technology option TO-II where as Rs. 42160 forund in farmers practices. The return per rupee spent was calculated of Rs. 2.40 in technology option TO-II Where as Rs. 1.85 found in farmers practices it is only due to reduce 25% chemical fertilizer in technology option (TO-II). This fertilizer does was compensated through decomposition of paddy straw in field. This finding was supported with the finding of Singh R.K. et al. [8] and Sannath Immappa et al. [9].

Table 1. Physical, phys-chemical properties of soil before decomposition of paddy stable at 20 farmers fields

Soil parameters	Range	Mean
Physical properties		
Mechanical composition		
Sand %	52.2-72.8	62.1
Silt %	11.4 – 18.8	15.1
Clay %	14.5-31.1	22.8
Textural classes	Sandy loan to Sandy clay loam	
Dominant clay minerals	Kaolinite	
Phys-Chemical Properties		
Soil P^H	4.89 - 5.94	5.41
Chemical properties		
Organic Carbon (%)	0.13 - 0.28	0.20
Available Nitrogen (Kg/ha^{-1})	148.0 – 290.0	219
Available phosphorous (Kg/ha^{-1})	19.0 – 28.60	23.8
Available potassium (Kg/ha^{-1})	74.0 – 97.0	85.5

Table 2. Phys-chemical and chemical properties of soil before and after decomposition of paddy stable in field after three year

S.No	Parameters	Before	After	Change
01	Soil PH	5.4	5.6	+0.2
02	Available N (Kg/ha)	219	246	+27
03	Available P (Kg/ha)	23.8	31.62	+7.82
04	Available K (kg/ha)	85.5	103.6	+18.1

Table 3. Yield attributed and economic of rice as influenced by decomposition of rice stable

Treatment	Grain yield (Q/ha)				Straw yield (Q/ha)				Return (Rs/ha)				Average return replication
	2014-15	2015-16	2016-17	Pooled	2014-15	2015-16	2016-17	Pooled	2014-15	2015-16	2016-17	Pooled	
TO-I : (Farmers Practice) Burning of paddy stable in field and collecting paddy stable for use as fuel of cooking and after onset of monsoon field prepare and transplant rice (Variety-Abhishek) with $N_{80}P_{60}K_{30}$	25	25.5	24.8	25.1	72.62	76.85	74.8	74.75	42500	43.350	42160	42670	1.85
TO-II : Decomposition of paddy stable 4.5q/ha after one seat of monsoon in the month of June through rotovator and transplanted rice (Variety – Abhishek) with $N_{60}P_{45}K_{23}$	23	27	35	28.33	62.40	82.4	98.84	81.21	39100	45900	59500	48166	2.40

Note: Families labour cost not included in cost of cultivation

Inorganic fertilizer use across Sub-Saharan Africa is generally considered to be low. Yet, the notion that fertilizer use is too low is predicated on the assumption that it is profitable to use rates higher than currently observed by Liverpool-Tasie et al. [10].

4. CONCLUSION

The result of the present study showed that corporation of paddy stable (4.5 q/ha) helped in the balance maintaining the organic and in organic nutrients in soil and hence the increasing rice productivity. The present study also showed that rice straw could be efficiency exploited for conservation of soil nutrient under rice ecosystem through proper decomposition techniques.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Shrivastava S, Arya V. *In-situ* crop residue composting: A potential alternative to residue burning. International J. Chemical Studies. 2018;6(3):528-532.
2. Viji Neelanarayanan. Efficacy of lignocellulolytic fungi on the biodegradation of paddy straw. Int. J Environ. Res. 2015;9(1):225-232.
3. Kumar A, Gaind S, Nain L. Evaluation of thermophilic fungal consortium for paddy straw composting. Biodegradation. 2008; 19:395-402.
4. Piper CS. Soil and plant anaylsis. Indian Ed, Hans Publishers, Bombay; 1950.
5. Jackson ML. Soil chemical anaylsis. Indian edition, Prentice Hall of India, Pvt. Ltd. New Delhi; 1973.
6. Walkley A, Black CA. An examination of the Degijareff method for determining soil organic matter and proposed modification of the cromie acid titration. Soil Sci. 1934;3:29.
7. Chakraborty D, Gang RN, Tamar RK, Singh R, Sharma SK, Singh RK, et al. Synched and organic mulcing and nitrogen effect on winter wheat (*Triticum aestivum* L.) in a semi-arid environment. Agri Water Manage. 2010;97:738-748.
8. Singh RK, Dubey SK, Oraon D, Pandey VK, Rai VP, Singh UK, Alam Z. Overcoming low productivity and profitability in wheat through phosphor-compost: A farm participatory approach. Journal of Research (BAU). 2012;23(2):207-212.
9. Sannath Immappa HG, Gurumurth BR, Jayadeva HM, Rajanna D. IOSR Journal of Agriculture and veterinary science (IOSR-JAVS). 2015;8(IVER.1):74-77.
10. Liverpool-Tasie LSO, Omonona BT, Sanou A, Ogunleye WO. Is increasing inorganic fertilizer use for maize production in SSA a profitable proposition? Evidence from Nigeria. Food Policy. 2017;67:41-51.