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RESIDUAL EFFECT OF TILLAGE AND NUTRIENT MANAGEMENT ON PRODUCTION POTENTIAL AND ENERGY BUDGETING OF RICE (*ORYZA SATIVA*) UNDER OAT-RICE CROPPING SYSTEM

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Abstract: A field experiment was conducted at forage field situated at Ranchi Veterinary College of Birsa Agricultural University, Ranchi (Jharkhand) to study the residual effect of tillage and nutrient management on yield and energetic of rice during 2011 and 2012 under oat-rice cropping system. Result showed that among the different tillage practice the residual effect of zero tillage recorded on grain yield, straw yield and harvest index, gross energy return, net energy return and energy output : input ratio were significantly superior over conventional as well as minimal tillage. Among the nutrient management residual effect of 125 % RDF recorded significantly higher in all respects of growth, yield attributes & yield and economics parameters of rice. The treatments 100 % RDF was at par with 75% RDF+ Bio-fertilizer. No residual effect of interaction of treatments was observed

Keywords: Tillage, Nutrient management, Residual effect, RDF, Bio-fertilizer and Energy input: output ratio.

INTRODUCTION

The importance of rice for human consumption and forage oat for animal can't be ignored in India. Both crops have diversified agronomical suitability and may play important role in farming system not only to put inside the belly but also provide balance diet for last consumer *i.e* human. Qualitative green forage of oat which is the source of fiber, minerals and calcium directly fed by lactating animals or small ruminants and produced qualitative milk, meat and other product. Rice is the major crop during *Kharif* in Jharkhand under rice- fallow system. Lack of moisture and stubble of rice after harvest, tillage operation during *Rabi* becomes problematic and it is costlier as well as energy consuming. Role of bio- fertilizer is also considerable as it improves soil health, organic matter and availability of different nutrients with less use of energy. The energy use in crop production has not been given adequate importance in earlier year, but time has come where more focus is to be given on renewable and non commercial sources of energy. Agriculture is a way of energy conversion industry,

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which is actively involved in crop production process using intensive energy directly or indirectly. Though, photosynthesis plant transformed solar and chemical energy derived from the soil into storable chemical energy as carbohydrates, protein, fat, and all cellulose. Excessive use of energy results in the high unit cost of production, loss of profitability as well as market competitiveness. Thus, suitable tillage operation with required amount of fertilization in oat is essential. Further, as the entire applied nutrient not been consumed by single crop oat in same season, thus the rest amount of nutrient will be utilized by succeeding crop (rice) and which can be taken into consideration. Performance of rice can also be observed at reduced rate of RDF for rice under oat-rice system. Keeping all the facts about the importance of moisture, nutrient and energy in view an experiment was formulated to study the residual effect of tillage and nutrient management on production potential and energy budgeting of rice (*Oryza sativa*) under oat-rice cropping system.

MATERIALS AND METHODS

A field investigation was carried out during *Kharif* 2011 and 2012 at the forage field situated at Ranchi Veterinary College, campus Kanke under Birsa Agricultural University, Ranchi. The soil of field was sandy loam in texture having sand (56.8%, silt (28.0%), clay (15.2%) and water holding capacity (38.68%) with pH (6.2), organic carbon (3.8 g/kg) with available nitrogen (232 kg/ha), available phosphorus (23.25 kg/ha), and available potassium (156.41 kg /ha). The experiment was laid out in Split- plot Design with three tillage management, Zero tillage, Minimal tillage and Conventional tillage under main plot and four nutrient management, 125 % RDF, 100 % RDF, 75 % RDF and 75% RDF+ Bio-fertilizer (PSB+ *Azotobacter*) in sub plot treatment with three replications which were applied in oat. The fodder oat (CV : Kent) was sown in the second week of November, keeping row to row distance 25 cm with recommended seed rate 100 kg/ha in 5m x 4m plot area under medium land condition. Fertilizers were applied at the time of sowing through urea, DAP and MOP as basal application. Bio-fertilizer was applied as seed inoculating material in the form of PSB @ 500 g/ha and *Azotobactor* @ 500 g/ha and further top dressing were carried through urea. Rice was transplanted during *Kharif* after harvest of oat in the same laid out field at same levels of tillage and uniform fertilizer dose @100:50:25, NPK kg/ha (just 25% less than RDF). Rice was grown at normal agronomical practice to study the residual effect of treatments (applied in oat) on rice. The data on yield and energy involved in every inputs, output as well as Agronomical operation were recorded and properly analyzed in slandered format of Split- plot Design and presented below in tabular form.

RESULT AND DISCUSSION

Tillage management

Straw yield (57.14 q/ha) under zero tillage were significantly superior over minimal tillage (52.74 q/ha) and conventional tillage (53.88 q/ha), while same under minimal and conventional tillage were at par to each other. Harvest index (37. 38) under minimal tillage was more over conventional tillage (36.21) and zero tillage (36.51) which were at par to each other (Table:1). Energy output (86060 MJ/ha), net energy return (774834 MJ/ha) and energy use efficiency (7.66) under zero tillage were significantly superior over conventional tillage (78153 MJ/ha, 66927 MJ/ha, 6.96) and minimal tillage (78104 MJ/ha, 66878 MJ/ha, 6395) respectively. More straw yield and gross energy output, net energy return and energy use efficiency under zero tillage was due to more accumulation of organic carbon and favorable soil condition which converted to better grain and straw yield under zero tillage over conventional as well as minimal tillage. Kumar and Yadav (2005) also reported the similar results. In other hand, nutrient management also significantly influenced the above energy parameters, gross energy output, net energy return and energy use efficiency and it responded up to 125 % RDF (91917 MJ/ha, 80691 MJ/ha and 8.18) respectively. Further, the same at 100 % RDF (79792 MJ/ha, 68566 MJ/ha and 7.10) while at 75% RDF+ Bio-fertilizer (80156 MJ/ha, 58930 MJ/ha and 7.14) respectively were at par to each other. This was due to higher rice yield under zero tillage at 125 % RDF because of more residual nutrient availability. Sharma *et al*. (2002) also observed the similar result in wheat. Energy output and energy use efficiency under treatment 75 % RDF + Biofertilizers (*Azotobacter* + PSB) was at par with 100 % RDF. Due to inoculation of Bio-fertilizer availability of nutrient increased during *Kharif* and it was also due to better decomposition of crop residue and other organic matter present in the soil. Similar findings were also observed by Kumar and Yadav (2005) and Kachroo *et al.* (2012). Sharma *et al.* (2002) also observed the similar finding and stated that zero tillage was less energy input practice over conventional and farmers practice and nearly 13.64 per cent lesser than conventional practice. Sharma *et al*. (2008) and Verma and Srivastava (1989) also advocate the same.

No interaction effect of tillage and nutrient management was observed on rice cultivation during oat- rice system.

Table 1: Residual effect of tillage and nutrient management on yield and energetic of rice under oat – rice system. (Pooled data 2011 and 2012)

Treatments	Grain yield	Straw yield	Harvest index	Energy input*	Energy output*	Net energy	Energy use effi-
Tillage Management (T)							
Zero tillage	32.87	57.14	36.51	11226	86060	74834	7.66
Minimal tillage	31.35	52.74	37.38	11226	78104	66878	6.95
Conventional tillage	30.64	53.88	36.21	11226	78153	66927	6.96
S.Em ±	0.90	0.84	0.61		1003	1003	0.08
CD at 5%	NS	3.27	NS		3931	3931	0.35
Nutrient Management (N)							
125% RDF	34.46	60.7	36.21	11226	91917	80691	8.18
100% RDF	32.36	54.91	37.08	11226	79792	68566	7.10
75% RDF	28.54	48.76	36.92	11226	71224	59998	6.34
75% RDF+Bio-fertilizer	32.05	53.98	37.25	11226	80156	68930	7.14
S.Em ±	0.42	0.76	0.97		2007	2007	0.15
CD at 5%	1.27	2.26	NS		5960	5960	0.44
CV %	14.35	12.47	7.89		7.45	8.65	6.25
Interaction(TXN)	NS	NS	NS		NS	NS	NS

NB: Uniform fertilizer dose @100:50:25 kg/ha (NPK) were applied in rice. * (M J)

Conclusion: Residual effect of tillage and nutrient on cultivation of rice, transplanted at same levels of management at 25 % less NPK doses under oat-rice system were more under zero tillage over conventional and minimal tillage with regards to grain yield, straw yield, energy output, net energy return as well as energy use efficiency. In other hand higher dose of fertilization during *Rabi* for cultivation of oat resulted more residual effect during *Kharif* on rice. Inoculations of Bio-fertilizer (PSB+Azotobacter) can compensate the yield loss due to 25% lower application of nutrient during *Rabi* season.

References

[1] Kachroo, Dileep, Thakur, N., P. Kaur, Manpreet, Kumar, Parshotam and Sharma Rohit 2012: Productivity and energetic of rice(Oryza sativa) based cropping system under sub-tropical condition of Jammu. *Indian Journal of Agronomy* **57** (2):117-121.

[2] Kumar, R. and Yadav, D.S. 2005. Effect of zero and minimum tillage in conjunction with nitrogen management in white after rice. *Indian Journal of Agronomy* **50** (1): 54-57.

[3] Sharma, S.K., Pandey, D.K., Gangwar, K.S. and Chaudhary, V.P. 2008. Effect of weed management practices on productivity and profitability of direct-sown unpuddled rice (*Oryza Sativa*), wheat (*Triticum aestivum)* system. *Indian Journal of Agricultural Sciences,* **78** (4): 277:280

[4] Sharma, S.N., Kumar, T., Kumar, V., Singh, R.G. and Sharma, R.B. 2002. Effect of integrated nutrient management on transplanted rice and its residual effect in succeeding wheat crop in rain-fed low lands. *Indian Journal of Agronomy* **4** (3): 311-317.