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Effect of rice straw management and nitrogen scheduling on yield, harvest index and economics of summer rice

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Abstract
A field experiment was conducted in *Vertisols* at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya. Raipur (Chhattisgarh) to study the effect of rice straw management and nitrogen scheduling on yield, harvest index and economics of summer rice. Results indicated that incorporation of rice straw 5 t ha^{-1} by MB plough once + disc harrowing twice FB irrigation at 30 DBT (T_3) registered significantly highest grain, straw yields, Gross return and net return it was at par to incorporation of rice straw 5 t ha^{-1} by + disc harrowing twice FB irrigation at 30 DBT (T_2). Its Harvest index (%) and B/C ratio is non-significant. Among nitrogen scheduling, treatment 20% B + 20% 15 DAT + 30% AT + 30% PI (N_3) recorded significantly highest grain yield, Harvest Index (%), Gross return and Net return of summer rice, although it was at par to 10% B + 20% 15 DAT + 30% AT + 30% PI + 10% F (N_4).

Keywords: Rice straw management, nitrogen scheduling, summer rice, Harvest index (%), B/C ratio and yield

Introduction
Rice (*Oryza sativa* L.) is an important staple food and grown across the world. It is the second most widely consumed cereal in the World next to wheat (Kumari *et al*., 2014) [7]. Chhattisgarh state is popularly known as “Rice bowl of India”, which constitutes over 85% of the total food grain production in state. In *khaif*, rice is cultivated over an area of 3.68 m ha with productivity of 20.20 q ha^{-1}. In summer season, it is cultivated in 1.97 lakh ha area with productivity of 38.47 q ha^{-1} (Anonymous, 2015) [1]. Imbalanced nutrient management and decreased soil organic matter are the key responsible factors for the observed declining trend in rice-based cropping systems (Nambiar 1995; Reddy and Krishnaiah 1999) [9]. Most of rice straw is burnt or removed after harvesting due to lack of knowledge of farmers. Removal of rice straw from paddy field causes the loss of nutrients permanently from soils, but burying rice straw directly into soil also creates problems for farmer and soils. These rice straw cannot be applied or ploughed directly into the soil because of their high C: N ratio (Man and Ha, 2006) [8]. Management of crop residues has significant implications for soil physical and chemical properties and when handled correctly, they improve soil organic matter dynamics and nutrient cycling, thereby creating a most efficient system (Smith *et al*. 1992) [13]. Although rice straw have several nutrient, such as 0.38-1.01% N, 0.01-0.12% P and 1.0-3.0% K (Ponnamperuma, 1984) [10], they are known to produce phyto-toxic substances during their decomposition (Elliott *et al.* 1981) [5]. To alleviate such problems, the rice straw materials under intensive decomposition in heap or pits with adequate moisture and suitable microbial inoculants could be used as organic manure (Gaur *et al.* 1990) [6] in rice field.
Nitrogen scheduling/management is essential for rice cultivation as the nitrogen use efficiency is between the range of 40 to 60 percent, application of appropriate quantity of nitrogen at right time is perhaps the simplest agronomic solution for improving the use efficiency of nitrogen (Devi *et al.*, 2012) [4]. The scientific information on option for nitrogen management in rice cultivation needs to be workout for higher productivity and reducing nitrogen demand, which will be helpful to lower the cost of cultivation. The nitrogen is most limiting factors in rice production.

Materials and Methods
In order to effect of rice straw management and nitrogen scheduling on yield, harvest index

and economics of summer rice. A replicated field experiment was conducted during summer season of 2013-14 and 2014-15 at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The soil of the experimental area was '*Verticals*' which is locally known as *'Kanhar'*. The soil was neutral in reaction and medium in fertility levels having low in N, medium in P and high in K. The experiment was laid out in strip plot design with three replications. The treatments consisted of 4 rice straw management *viz*. Burning of rice residue (T_1), Incorporation of rice straw 5 t ha^{-1} by disc harrowing twice FB irrigation at 30 DBT (T_2), Incorporation of rice straw 5 t ha^{-1} by MB plough once + disc harrowing twice FB irrigation at 30 DBT (T_3) and Normal Transplanting (T_4) and 4 nitrogen scheduling *viz*., 40% B + 25% AT + 25% PI + 10% F (N_1), 30% B + 10% 15 DAT+ 30% AT + 30% PI (N_2), 20% B+ 20% 15 DAT + 30% AT + 30% PI (N_3) and 10% B + 20% 15DAT + 30% AT + 30% PI+ 10% F (N_4). Rice cultivar – MTU 1010 was transplanted on 31st January 2014 and 1st February 2015 and harvest in 3rd week of May in 2014 and 2015.

Results and Discussion

Effect on grain and straw yield and harvest index of summer rice

The data presented in Table 1 revealed that treatment incorporation of rice straw 5 t ha^{-1} by MB plough once + disc harrowing twice FB irrigation at 30 DBT (T_3) registered significantly higher grain and straw yield as compared to others but it was at par to treatment incorporation of rice straw 5 t ha^{-1} by + disc harrowing twice FB irrigation at 30 DBT (T_2) during both the years and on mean basis. This might be due to straw incorporation which saved considerable amounts of nitrogen, phosphorus, potassium and sulphur and organic matter which would otherwise lost by burning. This is in accordance with the finding of (Singh *et al*. 2008) [12]. The harvest index did not differ significantly due to different rice straw management treatments during both the years and on mean basis. Among nitrogen scheduling, treatment 20% B + 20% 15 DAT + 30% AT + 30% PI (N_3) recorded significantly higher grain and straw yield as compared to others, but it was at par to 10% B + 20% 15 DAT + 30% AT + 30% PI + 10% F (N_4) for grain and straw yields and in addition in case of straw yield, treatment 40% B + 25% AT + 25% PI + 10% F (N_1) also recorded comparable values during both the years and on mean basis, The harvest index was recorded significantly highest under treatment 20% B + 20% 15 DAT + 30% AT + 30% PI (N_3) which was at par to 30% B + 10% 15 DAT+ 30% AT + 30% PI (N_2) and 10% B +20% 15 DAT + 30% AT + 30% PI + 10% F (N_4) during both the years and on mean basis. The higher yields in above treatments are the resultant of higher yield attributes recorded in these treatments. Similar results were reported by (Sharma and Agrawal 2006). The lowest grain and straw yield was recorded under 40% B+ 25% AT + 25% PI + 10% F (N_1) treatment which might be due to the fact that major share of N were applied during the early growth stages, produced lower grain yield. This may be attributed to the failure to synchronize the N supply as per demand of the crop at all the major system of crop growth crucial for higher yields (Chaudhary *et al*. 2013) [2]. Delayed application of N might be helpful in keeping the plant greener for long and thereby facilitating the higher production and translocation of photosynthetic towards economic parts (Dar *et al*. 2000) [3].

Economics of production

Table 1: Grain yield, straw yield and harvest index of summer rice as influenced by rice straw management and nitrogen scheduling

Treatment	Grain yield (q ha^{-1})			Straw yield (q ha^{-1})			Harvest index (%)		
	2013-14	2014-15	Mean	2013-14	2014-15	Mean	2013-14	2014-15	Mean
Rice straw management									
T_1	46.93	45.51	46.22	56.87	54.64	55.75	45.22	45.45	45.34
T_2	49.41	48.22	48.81	60.51	57.85	59.18	44.90	45.42	45.16
T_3	50.74	50.09	50.41	61.52	58.99	60.26	45.13	45.87	45.50
T_4	48.03	46.07	47.05	57.60	55.84	56.72	45.43	45.21	45.32
SEm±	0.72	0.83	0.77	0.75	0.80	0.70	0.22	0.40	0.29
CD (P=0.05)	2.49	2.86	2.66	2.59	2.75	2.41	NS	NS	NS
Nitrogen scheduling									
N_1	46.61	44.92	45.76	58.91	56.45	57.68	44.17	44.32	44.24
N_2	47.16	46.00	46.58	57.33	54.60	55.97	45.12	45.71	45.41
N_3	51.11	50.32	50.71	59.99	58.97	59.48	45.97	46.01	45.99
N_4	50.23	48.65	49.44	60.28	57.29	58.79	45.43	45.91	45.67
SEm±	0.98	1.11	1.04	0.60	0.83	0.70	0.25	0.27	0.25
CD (P=0.0 5)	3.41	3.85	3.61	2.06	2.87	2.41	0.87	0.93	0.85

The data on economics of production Table 2 reveals that gross return was significantly highest with incorporation of rice straw 5 t ha^{-1} by MB plough once + disc harrowing twice FB irrigation at 30 DBT (T_3), which was statistically similar to incorporation of rice straw 5 t ha^{-1} by disc harrowing twice FB irrigation at 30 DBT (T_2) during both the years and on mean basis.

Different treatment of rice straw management failed to show significant difference with regards to net return and B/C ratio during both the years and on mean basis. However, maximum net return and B/C ratio was observed in incorporation of rice straw 5 t ha^{-1} by MB plough once + disc harrowing twice fb irrigation at 30 DBT (T_3) and normal transplanting (T_4), respectively during both the years and on mean basis. The gross and net returns and B/C ratio were calculated to be significantly highest with 20% B + 20% 15 DAT + 30% AT + 30% PI (N_3), which was found to be statistically similar to 10% B + 20% 15 DAT + 30% AT + 30% PI + 10% F (N_4) during both the years and on mean basis.

Table 2: Economics of summer rice production as influenced by rice straw management and nitrogen scheduling

Treatment	Cost of cultivation (Rs. ha^{-1})			Gross return (Rs. ha^{-1})			Net return (Rs. ha^{-1})			B/C ratio		
	2013-14	2014-15	Mean	2013-14	2014-15	Mean	2013-14	2014-15	Mean			
Rice straw management												
T_1	28330.00	28330.00	28330.00	68539.77	68715.30	68645.29	40209.77	40385.30	40315.29	1.42	1.43	1.42
T_2	30055.00	30055.00	30055.00	72198.49	72810.35	72519.30	42143.49	42755.35	42464.30	1.40	1.42	1.41
T_3	31430.00	31430.00	31430.00	74105.25	75574.09	74847.78	42675.25	44144.09	43417.78	1.36	1.40	1.38
T_4	28305.00	28305.00	28305.00	70123.40	69595.77	69884.07	41818.40	41290.77	41579.07	1.48	1.46	1.47
S.Em±				1038.43	1215.62	1117.49	1038.43	1215.62	1117.49	0.04	0.04	0.04
CD (P=0.05)				3593.44	4206.60	3867.02	NS	NS	NS	NS	NS	NS
Nitrogen scheduling												
N_1	29505.00	29505.00	29505.00	68201.70	67951.67	68097.87	38696.70	38446.67	38592.87	1.32	1.31	1.31
N_2	29505.00	29505.00	29505.00	68889.37	69432.52	69175.41	39384.37	39927.52	39670.41	1.34	1.36	1.35
N_3	29505.00	29505.00	29505.00	74546.74	75906.61	75236.54	45041.74	46401.61	45731.54	1.52	1.57	1.54
N_4	29605.00	29605.00	29605.00	73329.10	73404.71	73386.61	43724.10	43799.71	43781.61	1.48	1.48	1.48
S.Em±	29505.00	29505.00	29505.00	1407.14	1652.71	1518.60	1407.14	1652.71	1518.60	0.05	0.06	0.05
CD (P=0.05)				4869.34	5719.12	5255.06	4869.34	5719.12	5255.06	0.16	0.19	0.18

Reference

1. Anonymous. Report of Agriculture Department, Chhattisgarh Government Krishi Diary, Director of Extension Services, IGKV, Raipur, 2015.
2. Chaudhary SK, Singh Y, Pandey DN, Dharmindar. Nitrogen scheduling, phosphorus management and green maturing for increasing productivity of low land rice. Oryza. 2013; 50(3):253-258.
3. Dar S, Bali AS, Shah MH. Effect of different levels and time of nitrogen application on wet seeded rice in Kashmir Valley. Oryza. 2000; 37:244-46.
4. Devi MG, Reddy ST, Sumathi V, Pratima T, John K. Nitrogen management to improve the nutrient uptke, yield and quality parameters of scented rice under aerobic culture. International Journal of Applied Biology and Pharmaceutical Technology. 2012; 3(1):340-344.
5. Elliott L, Cochran VL, Papendick RI. Wheat residues and nitrogen placement effects on wheat growth in green house. Soil. Sci. 1981; 131:48-52.
6. Gaur AC, Neelakantan S, Dargan KS. Organic manures. ICAR. New Delhi. India, 1990.
7. Kumari P, Mishra GC, Pant AK, Shukla G, Kujur SN. Comparison of forecasting ability of different statistical models for productivity of rice (*Oryza sativa* L.) in India. The Eco scan. 2014; 8(3-4):193-198.
8. Man LH, Ha NN. Effect of decomposed rice straw at different times on rice yield. Moonrise. 2006; 14:58-63.
9. Nambiar KKM. Major cropping systems in India. In: Barnett B., Payne R. and Steiner R. (Eds), Agricultural Sustainability: Economic, Environmental and Statistical Considerations. John Wiley & Sons, New York, 1995, 133-169.
10. Ponnamperuma FN. Straw as source of nutrients for wetland rice. In: Organic matter and rice. IRRI, Los Baños, Laguna, Philippines, 1984, 117-136.
11. Sharma P, Agrawal A. Effect of different level of nitrogen fertilizer application on yield, yield attributes and chlorophyll in two rice varieties. Veneto's. 2006; 19(1):101-106.
12. Singh RP, Dhaliwal HS, Humphreys E, Sindhu HS, Singh M, Singh Y. Economic assessment of the happy seeder for rice- wheat systems in Punjab, India, AARES 52 nd Annual Conference, Canberra, ACT, Australia, 2008.
13. Smith JL, Papendick RI, Bezicek DF, Lynch JM. Soil organic matter dynamics and crop residue management. In Blaine Meting F. Jr. (ed.), Soil Microbial Ecology: Applications in Agricultural and Environmental Management. Marcel Dekker New York, 1992, 65-94.