International Journal of Statistics and Applied Mathematics

ISSN: 2456-1452
Maths 2023; SP-8(3): 215-218

https://www.mathsjournal.com
Received: 13-02-2023
Accepted: 18-03-2023

Ashish Nath
Research Scholar, Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Uttar Pradesh, India

RB Yadav
Professor, Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Uttar Pradesh, India

Gaurav Shukla
Senior Research Fellow, Department of Agronomy, ICAR- Indian Institute of agriculture Research, New Delhi, India

Sauhard Dubey
Subject Matter Specialist, Department of Agronomy, Krishi Vigyan Kendra, Budaun, Uttar Pradesh, India

Subedar Singh
Assistant Professor, Faculty of Agriculture, Motherhood University, Roorkee, Uttarakhand, India

Ashutosh Kumar Rai
Senior Research Fellow, ICAR-Indian Farming Research Institute, Modipuram, Meerut, Uttar Pradesh, India

Roop Kishor Pachauri
Research Scholar, Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Uttar Pradesh, India

Corresponding Author:
Ashish Nath
Research Scholar, Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut, Uttar Pradesh, India

Economic evaluation of different treatments in rice residue and nutrients management on performance of timely sown wheat crop

Ashish Nath, RB Yadav, Gaurav Shukla, Sauhard Dubey, Subedar Singh, Ashutosh Kumar Rai and Roop Kishor Pachauri

Abstract
A field experiment was conducted to economic evaluation of different treatments in rice residue and nutrients management on performance of timely sown wheat crop at Crop Research Centre campus of Sardar Vallabhbhai Patel University of Agriculture and Technology in Meerut, Uttar Pradesh, during the Rabi seasons of 2020-21 and 2021-22. The significantly maximum cultivating wheat grain and straw with residue bio-decomposer treated residue and 125% RDF + growth regulator resulted in a significant increase in yield. The gross return and net return was higher in different rice residue managements under Bio-decomposer Treated Residue while, benefit cost ratio was recorded in treatment Residue burning. Combinations of rice Bio-decomposer Treated Residue with treatment of 125% RDF+ Growth Regulator (Chlormequat chloride @ 0.2% + Tebuconazole @ 0.1%) recorded maximum net return of and benefit cost ratio, while it was minimum under rice Residue Removal treatment with minimum in rice residue retained with application of 75% RDF +10 t FYM during both the years of crop.

Keywords: Rice residue management, nutrient management, economics, wheat production

Introduction
Wheat (*Triticum aestivum* L.) is an important staple food crop, which is grown since ancient time in the world and known as 'king of cereal' belongs to the family 'Poaceae'. Wheat is cultivated in 122 countries and occupies an area of 217 million ha produced 774.8 million tones globally during 2020-21 (Anonymous, 2021) [3]. Total world consumption of wheat is around 759.5 million tones per year and this is expected to continue grow over the coming years (Anonymous, 2021) [3]. It is the most important Rabi cereal crop of India, cultivated on an area of 193.42 lakh hectares and 108.8 million tons of total production and an average national productivity of 3424 kg ha^{-1} (Anonymous, 2021) [3]. In Uttar Pradesh, wheat is the cultivated in an area of 9.85 million ha with an annual production of 36.21 million tones with average productivity of 3.68 tones ha^{-1}. Wheat grain carbohydrate 78.10%, protein 14.70%, fat 2.10%, minerals 2.10% and considerable proportions of vitamins (thiamine and vitamin-B) and minerals (zinc, iron) Wheat is also a good source of traces minerals like selenium and magnesium, nutrients essential to good health Wheat flour is used to prepare bread, produce biscuits, confectionary products, noodles and vital wheat gluten. Wheat straw is also used as animal feed, for ethanol production, brewing of wheat beer, wheat based raw material for cosmetics, wheat protein in meat substitutes and to make wheat straw composites. Wheat germ and wheat bran can be a good source of dietary fiber helping in the prevention and treatment of some digestive disorders (Kumar *et. al*., 2011) [9]. Crop residue is a good source of plant nutrients and important component for the stability of the agricultural ecosystem. About 25% of N and P, 50% S and 75% of K uptake by cereal crops are retained in crop residue, making them viable nutrient sources (Dotaniya, 2013) [6]. Indian agriculture produces about 500-550 million tones (Mt) of crop residues annually. There is production of 93.9 million tonns of wheat, 104.6 Mt of rice, 21.6 Mt of maize, 20.7 Mt of millets, 357.7 Mt of sugarcane, 8.1 Mt of fiber crops (jute, mesta, cotton), 17.2 Mt of pulses and 30.0 Mt of oilseeds crops, in the year 2011-12 (Anonymous 2012) [2].

The nutrient cycling from crop residue is a complex process that takes different time periods based on the type of crop residue. Residue decomposition included the processes of N immobilization and mineralization, both of which are regulated by microbes and environmental conditions. Soil microbes feed upon the C in crop residue and then require N for this process. A higher level of C as compared to N in crop residue will take longer time to break down and it will use more N to do their job. (Meena *et. al*., 2016) [13] The 5% urea solution spray on rice residue at time of incorporation of residue which maintain the C:N on the decomposition stage.
Nutrient schedule along with balanced fertilization using organic manures as considered as promising agro-technique to maintain yield, increase fertilizer use efficiency and to restore soil fertility. The reduction in grain yield caused by lodging ranged from 7 to 35% with greatest effect when lodging occurred within the month after anthesis is most commonly reported under Indian condition. The yield potential of high yielding genotypes of wheat under irrigated and high input rates could be achieved consistently and efficiently by finding suitable solutions of lodging problem. In this context, the use of growth retardants found to be most effective for managing the problem of lodging (Zhang *et al.* 2017) [17] and realizing productivity potential especially under high fertilization conditions Growth retardants are chemical substances that have the potential (Rajala *et. al*., 2002 and Tripathi *et. al*., 2003) [15, 16]. to alter structural or vital processes inside the plant by modifying hormone balance to increase yield, improve quality or facilitate harvesting through checking lodging especially in cereals (Zhang *et. al*., 2017) [17].

Material and Methods

A field experiment was conducted to economic evaluation of different treatments in rice residue and nutrients management on performance of timely sown wheat crop at Crop Research Centre campus of Sardar Vallabhbhai Patel University of Agriculture and Technology in Meerut, Uttar Pradesh, during the Rabi seasons of 2020-21 and 2021-22.The experiment was laid out in split plot design with three replications. The treatments comprised of four rice residue managements practices *viz.*; Residue Removal, Residue Burning, Urea Treated Residue and Bio-decomposer Treated Residue and five levels of nutrient management *viz.*; 100% RDF (150:75:60 NPK kg ha^{-1}), 75% RDF +10 t FYM, 75% RDF +10 t FYM +Growth Regulator (Chlormequat chloride @ 0.2% +Tebuconazole @ 0.1% applied at first node and flage leaf stage), 125% RDF and 125% RDF+ Growth Regulator. The soil of experimental site was sandy loam; it was low in organic carbon and available nitrogen and medium in available phosphorus and potassium. Wheat cultivar HD 3226 was used in experiment in timely sown condition in rice wheat cropping system and seed sown on November 15th, 2020 and November 18th, 2021 with a row spacing of 22.5 cm. The recommended nutrient dose was 150:75:65 kg N:P:K ha^{-1}. Before sowing, the entire amount of phosphorus and potassium was applied. Nitrogen was applied in three stages: 50% as a basal, 25% during tillering, and 25% during panicle emergence. The experiment was carried out under irrigated conditions and was irrigated 5 times at various crop stages. The observation recorded Cost of cultivation (Rs ha^{-1}) of crops was calculated treatment wise, on the basis of prevailing local market price of different inputs used in their cultivation. The monetary value of grain yield and straw yield were computed in Rs. ha^{-1} by using the minimum support prices for grains and prevailing local market prices for straw. The gross return was obtained by adding monetary value of grain and straw yield in Rs. ha^{-1} treatment wise. Net returns per hectare for each treatment were calculated by deducting the cost of cultivation from their respective gross returns. Benefit cost ratio in terms of net return per rupee investment was calculated by using the following formula:

$$\text{B : C ratio} = \frac{\text{Net return(Rs/ha)}}{\text{Cost of cultivation(Rs/ha)}}$$

The net plot's grain yield (q.ha^{-1}) was threshed, and the grains obtained were winnowed, cleaned, and weighed. The yield was measured in kg plot^{-1} and converted to qha^{-1}. The experiment data was subjected to statistical analyses of Split Plot Design as proposed by Cochran and Cox (1970) and used online Programmer, Computer Section, CCS HAU, Hisar software developed by O.P Sheoran.

Table 1: Effect of nutrients and rice residue management on yield of wheat.

Treatment	Grain yield (qha^{-1})		Straw yield (qha^{-1})	
	2020-21	2021-22	2020-21	2021-22
RR- Residue Removal	47.31	42.23	62.52	56.65
RB- Residue Burning	50.89	45.95	66.66	60.43
UTR-Urea Treated Residue	52.32	47.35	68.51	62.05
BTR- Bio-decomposer Treated Residue	52.39	47.64	68.75	62.37
SE m ±	1.07	0.98	1.15	1.57
CD (P=0.05%)	3.78	3.44	4.06	4.55
N_1-100% RDF	48.31	43.69	64.02	58.17
N_2-75%RDF +10 t FYM	47.93	43.38	63.50	57.71
N_3-75% RDF +10 t FYM+ GR	52.15	47.32	68.08	62.34
N_4 -125% RDF	49.15	44.18	65.98	58.72
N_5-125% RDF + GR	55.25	50.42	71.47	64.94
SE m ±	1.42	1.29	1.67	1.57
CD (P=0.05%)	4.12	3.74	4.83	4.55

G R- Growth Regulator (Chlormequat chloride @ 0.2% +Tebuconazole @ 0.1% spray at first node and flag leaf stage) RDF: 150: 75:60 kg NPK ha^{-1}

Table 2: Effect of nutrients and rice residue management on economics of study of wheat.

Treatment	Economics							
	Total cost (Rs ha^{-1})		Gross return (Rs ha^{-1})		Net return (Rs ha^{-1})		B:C	
	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22	2020-21	2021-22
Rice Residue management								
RR- Residue Removal	40130	40130	143462	141758	89287	86059	1.65	1.55
RB- Residue Burning	36940	36940	153849	153041	102865	100533	2.04	1.94
UTR-Urea Treated Residue	41530	41580	158147	157471	102572	100323	1.86	1.77
BTR- Bio-decomposer Treated Residue	42480	42480	158474	158354	104524	102970	2.00	1.93
SE m ±	---	----	3016	2961	3016	2961	0.06	0.06
CD (P=0.05%)	--	-----	10641	10448	10642	10447	0.21	0.21
Nutrient management								
N_1-100% RDF	44895	45621	146629	146215	98114	96962	2.02	1.97
N_2-75% RDF +10 t FYM	53704	56242	145471	145055	88147	85181	1.54	1.42
N_3-75% RDF +10 t FYM+ GR	57624	60162	157486	157706	96243	93912	1.57	1.47
N_4 -125% RDF	46667	47574	151514	147706	101228	96546	2.01	1.88
N_5-125% RDF + GR	50587	51494	166316	166550	115327	114755	2.29	2.25
SE m ±	----	----	4124	4159	4124	4159	0.07	0.07
CD (P=0.05%)	-----	---	11934	12036	11934	12036	0.22	0.21

G R- Growth Regulator ((Chlormequat chloride @ 0.2% +Tebuconazole @ 0.1% spray at first node and flag leaf stage) RDF: 150: 75:60 kg NPK ha^{-1}

Results and Discussion

The current findings revealed that residue management and nutrient management have a significant impact on wheat straw and grain yield (Table 1). The maximum grain and straw yield was recorded with Bio-decomposer Treated Residue it may be due to higher value of mostly the yield attribute, which was at- par with Urea Treated Residue followed by Residue Burning and significantly superior to Residue Removal during the both year of experimentation. These results confirmed by the findings of Kumar *et al*., 2015 and Karunakaran and Behera, 2016. Among the nutrients management practices, 125% RDF + GR and 75% RDF + 10 t FYM + GR with each other and significantly superior to and 75% RDF + 10 t FYM during both the years of study. This could be due to the fact that nitrogen played a vital role in increased sink size. Nitrogen is required throughout the grand growth period and hence adequate and regular supply might have a great role towards increased number of major yield attributes and subsequently improved yields. These results are in close conformity with those of Mitra *et al*., 2014 [14]; Manna *et al*. 2003 [12] and Kumar *et al*. 2019 [1]. Economics of different rice residue management practice and nutrients managements have been tabulated in Table 2. Economics of wheat was significantly influenced by different rice residue management practices and nutrients management. The highest cost of cultivation was recorded under Bio- decomposer treated Residue followed by Urea Treated Residue. The lowest cost of cultivation was recorded in Residue Burning and Residue Removal. The maximum gross returns, net returns and B:C ratio were recorded in Bio-decomposer Treated Residue and it was significantly superior to rest of the treatments on par with Urea Treated Residue and significantly superior to other two treatments in 2020-21 and 2021-22. This might be due to higher yield under Bio-decomposer Treated Residue compared to other treatments. Among the nutrient management practices, the highest cost of cultivation was observed under 75% RDF+ 10 FYM + Growth Regulator followed by 75% RDF+ 10 FYM RDF and the lowest cost of cultivation was observed with 100% RDF treatments. This was due to higher cost incurred in extra nutrient and labour cost. The maximum gross returns, net returns and B: C ratio were observed with basal application of 125% RDF + Growth Regulator and this was statistically identical with 125% RDF and significantly superior to rest of the treatments. This might be due to higher grain and straw yields at higher nutrient + Growth Regulator doses. The gross and net returns were relatively higher during first year because of higher yield of wheat and relatively lower cost of cultivation as compared to 2021 although, the MSP was higher during second year of experimentation as compared to 2021-22. Similar results of higher farm profitability were also reported by Benbi *et al.* (2012) [4], Bhandari *et al.* (2002) [5] for integrated nutrient management and Guoping *et al.* (2001) [7] for plant growth regulators. Similar results of higher farm profitability were also reported by Benbi *et al.* (2012) [4], Bhandari *et al.* (2002) [5] for integrated nutrient management and Guoping *et al.* (2001) [7] for plant growth regulators.

Conclusion

The findings of this study showed that cultivating wheat grain and straw yield with residue bio-decomposer treated residue and 125% RDF + growth regulator resulted in a significant increase in yield. As a result, it is concluded that gross return and net return was higher in different rice residue managements under Bio-decomposer Treated Residue while, benefit cost ratio was recorded in treatment Residue burning. Combinations of rice Bio-decomposer Treated Residue with treatment of 125% RDF+ Growth Regulator (Chlormequat chloride @ 0.2% + Tebuconazole @ 0.1%) recorded maximum net return of and benefit cost ratio, while it was minimum under rice Residue Removal treatment with minimum in rice residue retained with application of 75% RDF +10 t FYM during both the years of experimentation.

Future Scope

The use of bio-decomposer treated residue, as well as nutrient management of 125% RDF + Growth Regulator, are suggested for increasing grain and straw yield as well as economy of farmer.

Reference

1. Kumar S, Sharma PK, Yadav MR, Sexena R, Gupta KC, Garg NK, *et al*. Impact of nutrient management practices and plant growth regulators on growth, productivity and profitability of wheat (*Triticum aestivum*). Indian Journal of Agricultural Sciences. 2019;89(4):604-9.

2. Anonymous. Annual report, Agricultural at glance Ministry of Agriculture Government of India, New Delhi; c2012. www.eands.dancet.nic.in.
3. Anonymous. Agricultural statistics at a glance, directorate of economics & statistics, DAC&FW, Ministry of Agriculture & Farmers welfare, Govt. of India; c2021.
4. Benbi DK, Toor AS, Kumar S. Management of organic amendments in rice-wheat cropping system determines the pool where carbon is sequestered. Plant and Soil. 2012;360:145-162.
5. Bhandari AL, Ladha JK, Pathak H, Padre AT, Dawe D, Gupta RK. Yield and Soil Nutrient Changes in a Long-Term Rice-Wheat Rotation in India. Soil Science Society of American Journal. 2002;66(1):162-170.
6. Dotaniya ML. Impact of crop residue management practices on yield and nutrient uptake in rice-wheat system. Current Advances in Agricultural Sciences. 2013;5(2):269-271.
7. Guoping Z, Jianxing C, Bull DA. The effects of timing of N application and plant growth regulators on morphogenesis and yield formation in wheat. Plant Growth Regulation. 2001;35:239-245.
8. Karunakaran V, Behera UK. Tillage and residue management for improving productivity and resource-use efficiency in soybean (glycine max)-wheat (*Triticum aestivum*) cropping system. Experimental Agriculture. 2016;52(4):617-634.
9. Kumar P, Yadava RK, Gollen B, Kumar S, Verma RK, Yadav S. Nutritional Contents and Medicinal Properties of Wheat: A Review, Life Sciences and Medicine Research. 2011;22:1-10.
10. Kumar A, Kumar AN, Dwivedi A, Dhyani BP, Shahi UP, Sengar RS. Production potential, nutrient uptake and factor productivity of scented rice in rice-wheat cropping system along with physico-chemical and microbiological properties under site specific integrated plant nutrient management. Journal of Pure and Applied Microbiology. 2015;9(2):1487-1497.
11. Kumar S, Sharma PK, Yadav MR, Sexena R, Gupta KC, Garg NK, *et al*. Impact of nutrient management practices and plant growth regulators on growth, productivity and profitability of wheat (*Triticum aestivum*). Indian Journal of Agricultural Sciences. 2019;89(4):604-609.
12. Manna MC, Ghosh PK, Ganguly TK. Comparative performance of four sources of enriched phosphocompost and inorganic fertilizer application on yield, uptake of nutrients and biological activity of soil under soybean-wheat rotation. Food Agriculture and Environment. 2003;1(2):203-8.
13. Meena RK, Arya MPS, Meena AL, Singh YV, Shukla L, Meena HS. Effect of compost inoculants, temperature and indigenous technical knowledges on decomposition process of rice crop residue. Annals of Agricultural Research. 2016;37(3):327-333.
14. Mitra B, Mookherjee S, Das S. Performances of wheat under various tillage and nitrogen management in sub-Himalayan plains of West Bengal. Journal of Wheat Research. 2014;6(2):150-153.
15. Rajala A, Peltonen-Sainio P, Onnela M, Jackson M. Effects of applying stem shortening plant growth regulators to leaves on root elongation by seedlings of wheat, oat and barley: mediation by ethylene. Plant Growth Regulators. 2017;38:51-59.
16. Tripathi SC, Sayre KD, Kaul JN, Narang RS. Growth and morphology of spring wheat (*Triticum aestivum* L.) culms and their association with lodging: effects of genotypes, N levels and ethephon. Field Crops Research. 2003;84(3):271-90.
17. Zhang M, Wang H, Yi Y, Ding J, Zhu M, Li C, *et al*. Effect of nitrogen levels and nitrogen ratios on lodging resistance and yield potential of winter wheat (*Triticum aestivum* L.). PloS ONE. 2017;12(11):45-9.