International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 09-08-2021, Accepted: 24-08-2021, Published: 09-09-2021
Volume 6, Issue 5, 2021, Page No. 398-401

Growth and yield of wheat as influenced by different sources of nutrients and crop residue management

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Abstract
A field experiment was conducted during *Rabi* season 2020-2021 at Experimental farm of University Institute of Agricultural Sciences, Chandigarh University, Gharuan (Mohali) to study the effect of different sources of nutrients and crop residue management on growth and yield of wheat. The experiment comprised of 7 treatments of different combinations of nutrients and crop residue *i.e.* RDF (100%) + crop residue, FYM @4 t ha^{-1} + crop residue, FYM @2 t ha^{-1} + 50% RDF + crop residue, FYM @1 t ha^{-1} + 25% RDF + crop residue, VC @1.4 t ha^{-1} + crop residue, VC @0.7 t ha^{-1} + 50% RDF + crop residue and VC @0.35 t ha ha^{-1} + 25% RDF + crop residue. The experimental design was conducted in RBD (Randomized block design) with three replications. Results revealed that growth, yield attributes, grain yield and straw yield of wheat were increased with the application of RDF 100% + crop residue. The yield attributes and yield of the crop were highest with the application of RDF (100%) + crop residue. The grain yield was 44.91% more in RDF 100% + crop residue treatment than the lowest in FYM @4 t ha^{-1} + crop residue.

Keywords: growth, nutrients, yield, wheat

Introduction
Nutrients are crucial for the production of any crop same as wheat. The nutrients can be applied to the crop as fertilizers or manures. Both have its advantages and disadvantages. Fertilizers are easily available and can be quickly absorbed by the plants in an available form while manures take time to release nutrients. Anyhow, every nutrient has its own relevant role in the production of the wheat crop. The nutrients are involved in the metabolic process of the plant directly. So, any deficiency of the nutrients or the toxicity of the nutrients is harmful for the plants growth. Hence, one should apply nutrients in a balanced form. This helps in the optimal growth of the plant. The balanced and timely application of nutrients augment the growth and development of wheat crop (Singh and Singh, 2001) [11].

Crop residue management is a big deal as it interrupts soil water movement, runoff and also infiltration (Turmel *et al*, 2015) [12]. Crop residue management helps in the control of soil chemical, physical and soil biological functions (Cookson *et al*, 1998) [2]. The positive supervision of the residue is a part of conservation agriculture where the extreme advantage can be attained by in-situ management. Decomposition of crop residue have positive and negative sides. Researchers like us need to emphasis on the positive sides and advance the environmental impact. Residue management can also help in various conservation practices of tillage and control of weeds, pest hence to maximize the yield. The microbial decomposition helps to release out the chemicals which are present in the plant debris and this can be utilized by the crops and other organisms (McCalla *et al*, 1964) [9]. The degree of cycling of the nutrients and the availability of nutrients will be determined by the integrated management of the crop residues with the fertilizers and by seeing the amount of debris to be used in the field. The crop residue management is healthier for the carbon sequestration and to the amount and the site of application of crop residue. Therefore, an experiment was devised to study the response of different sources of nutrients and crop residue Management on growth and yield of wheat.

Materials and Methods
The field experiment was carried out at Experimental farm of University Institute of Agricultural Sciences, Chandigarh University, Gharuan (Mohali) situated at 30º 7' N latitude and 76º 5' E longitude during *Rabi* season 2020-2021. Experimental site was clay loam soil in texture, low in organic carbon and available nitrogen and medium in available phosphorus and available potassium. The experiment was laid out in Randomized Block Design with three replications. There were seven treatments comprising of different combinations of nutrients and crop residues i.*e.* RDF (100%) + crop residue, FYM @4 t ha^{-1} + crop residue, FYM @2 t ha^{-1} + 50% RDF + crop residue, FYM @1 t ha^{-1} + 25% RDF + crop residue, VC @1.4 t ha^{-1} + crop residue, VC @0.7 t ha^{-1} + 50% RDF + crop residue and VC @0.35 t ha ha^{-1} + 25% RDF + crop residue. The wheat variety Unnat PBW 343 was sown on 5th December, 2020. Sowing of wheat was done keeping row spacing of 22.5 cm. Seed rate of 100 kg ha^{-1} for wheat was used. The experimental fields were prepared with the help of power tiller. The layout of experiment was carried out manually and plots were prepared and then levelled. The sowing was done after pre-sowing irrigation when field had reached proper moisture condition. The recommended dose of NPK in wheat crop

used was 120 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1} in irrigated condition, respectively. Half dose of nitrogen and whole P_2O_5 and K_2O were incorporated in soil, as per the treatments, as basal dose and remaining half dose of nitrogen was top dressed at tillering stage of the wheat crop. The FYM and vermicompost was incorporated in soil at the time of sowing of crop as per the treatment with nutrient composition of 0.5% nitrogen, 0.2% phosphorus & 0.5% potassium (FYM) and 1.5% nitrogen, 1% phosphorus & 0.60% potassium (vermicompost). The crop was grown under irrigated condition and four irrigations were applied. Two manual weedings were carried out, one after first irrigation and second at 40 days after sowing to keep the crop free from weeds. Yield attributes such as number of effective tillers m^{-2}, length of spike, number of grains per spike, 1000 grain weight, grain yield, straw yield and harvest index were calculated. Harvest index was computed using the following formula:

$$\text{Harvest Index} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

Results and Discussion

Growth indices

The plant height was significantly influenced the application of RDF (100%) and crop residue and was statistically at par withVC@0.7 t ha^{-1} + 50% RDF + crop residue at 60, 90 days after sowing and at maturity represented in Table 1. The lowest plant height was found in FYM @4 t ha^{-1} + crop residue. The 100% RDF used in the treatment might be easily absorbed by the plant at the growth stages and hence provide maximum plant height at different stages of crop. (Hashim, 2014) [5] Also found similar results where he reported that 100% RDF and crop residue combination would affect plant height significantly in wheat.

The data regarding dry matter accumulation presented in Table 1 concluded that different nutrient sources and crop residue management had no significant effect at 30 and 60 days after sowing. However, the dry matter accumulation was highest in RDF (100%) + crop residue at both 30 and 60 days after sowing. The dry matter accumulation was significant at 90, 120 days after sowing and at maturity. Dry matter accumulation was found highest in RDF (100%) + crop residue at 90, 120 days after sowing and at maturity and lowest was found in FYM @4t ha^{-1} + crop residue The mineralization of the recommended nutrients and the improvement in the holding capacity of the soil by crop residue might be the reason for the higher dry matter accumulation. Similar findings were reported by (Hashim *et al*, 2015) [4] where 100% recommended dose of fertilizers and crop residue improved growth parameters of wheat crop especially dry matter accumulation.

The number of tillers was influenced under different sources of nutrients and crop residue management except at 60 days after sowing. The highest number of tillers was found in RDF (100%) + crop residue. The lowest number of tillers was found in FYM @4t ha^{-1} + crop residue. (Kumar *et al*, 2018) [8] Found that the application of recommended dose of RDF along with the crop residue can improve the growth attributes of the crop such as number of tillers m^{-2} in wheat crop. The combination of organic and inorganic fertilizers might provide the best results in the current season or in the upcoming season as they are slow in release of nutrients. While, the application of recommended dose of fertilizers always provide the nutrients in an easily absorbable form than that of organic source and hence improves the growth and yield of the crop.

Yield attributes of wheat

Number of effective tillers m^{-2} was significantly affected by different sources of nutrients and crop residue management. The maximum number of effective tillers were found in RDF (100%) + crop residue (267.80) followed by VC @0.7 t ha^{-1} + 50% RDF + crop residue (261.29). The minimum number of effective tillers was found in FYM @4 t ha^{-1} + crop residue (239.45). The number of effective tillers might be increased in the particular combination as it provides the optimum amount of nutrients required for the crop. The application of fertilizers in over dose or less than the recommended dose might not result in optimum growth and yield of the crop. (Katyal, 2000) [6] Also reported that application of 100% NPK significantly affect the number of effective tillers m^{-2} in wheat.

The data regarding spike length presented in Table 2 revealed that the spike length of the wheat crop was significantly influenced by different sources of nutrients and crop residue management. The maximum spike length was recorded with the application of RDF (100%) + crop residue which was statistically at par with the application of VC @0.7 t ha^{-1} + 50% RDF + crop residue. Minimum spike length was found with the application FYM @ 4 t ha^{-1} + crop residue. The proper utilization of nutrients in proper quantity might be the reason for the maximum spike length in the treatment with the application of 100% RDF and crop residue. Similar results were reported by (Chaudhary *et al*, 2017) [1].

The maximum number of grains $spike^{-1}$ were significantly influenced by application of RDF (100%) + crop residue and was statistically at par with VC @0.7 t ha^{-1} + 50% RDF + crop residue. The lowest number of grains $spike^{-1}$ was found in FYM @4 t ha^{-1} + crop residue. These results are in accordance with (Prasad *et al*, 2010) [10] who concluded that application of recommended dose of fertilizers significantly affect number of grains $spike^{-1}$.

1000 grain weight did not vary significantly with the application of various nutrient management practices and crop residue management. However, numerically maximum grain weight was found in RDF 100% + crop residue and the minimum was found in FYM @4 t ha^{-1} + crop residue.

Yield of wheat

The data on grain yield as influenced by nutrient and crop residue management have been presented in Table 3 revealed that the grain yield was significantly influenced by the application of different treatments. The maximum grain yield was found in RDF (100%) + crop residue (4314 kg ha^{-1}) which was statistically at par with VC @0.7 t ha^{-1} + 50% RDF + crop residue (4184 kg ha^{-1}). The lowest yield was found in FYM @4 t ha^{-1} + crop residue (2977 kg ha^{-1}). The yield was 44.91% more in RDF 100% + crop residue treatment than FYM @4 t ha^{-1} + crop residue. The application of recommended dose of fertilizers would positively influence the growth and yield of the crop because of the optimal use of the fertilizers. The chemical fertilizers are easily absorbed by the plants than that of organic fertilizers. Similar results were obtained by (Hashim *et al*, 2015) [4] where 100% recommended dose of fertilizers and crop residues improved yield of wheat crop.

The straw yield was significantly influenced by the application of different sources of nutrients and crop residue management. The application of RDF (100%) + crop residue (6834 kg ha^{-1}) had produced maximum straw yield which was statistically at par with VC @0.7 t ha^{-1} + 50% RDF + crop residue (6740.33 kg ha^{-1}). The lowest yield was found in FYM @4 t ha^{-1} + crop residue (5382.33 kg ha^{-1}). These results were in accordance with (Kumar *et al*, 2016) [7] where they found that the application of 100% of recommended dose of fertilizers with crop residue affect the straw yield of the wheat crop significantly. It might be due to better utilization of nutrients from the soil especially nitrogen. The uptake of nutrients produces better dry matter accumulation and hence affects the straw yield. Similar results were reported by (Ding *et al*, 2021) [3]. The harvest yield was not significantly affected by different sources of nutrients and crop residue management. The maximum harvest index was found in RDF 100% + crop residue FYM @4 t ha^{-1} + crop residue.

Conclusion

From the current study it was concluded that the growth and development of the crop was significantly influenced by various combinations of nutrients and crop residue. Plant height, dry matter accumulation and number of tillers were all maximum with the application of RDF (100%) + crop residue. The yield attributes and yield of the crop were highest with the application of RDF (100%) + crop residue.

Table 1: Effect of treatments on growth indices of wheat

Treatments	Plant height(cm)					Dry matter accumulation (gm^{-2})					Number of tillers m^{-2}				
	Days after sowing				Maturity	Days after sowing				Maturity	Days after sowing				Maturity
	30	60	90	120		30	60	90	120		30	60	90	120	
RDF (100%) + crop residue	15.25	23.77	51.8	75.05	94.18	18.94	176.65	413.65	728.3	915.33	89.67	178.62	249.79	282.03	276.26
FYM @4 t ha^{-1} + crop residue	9.37	18.26	38.03	66.26	84.6	15.32	154.26	356.33	683.7	849.58	78.67	161.96	228.57	258.44	248.69
FYM @2 t ha^{-1} + 50% RDF + crop residue	13.36	21.45	47.44	72.17	89.79	17.78	170.38	398.77	712.85	888.5	86.5	173.33	241.81	272.27	266.35
FYM @1 t ha^{-1} + 25% RDF + crop residue	11.71	19.81	42.17	68.8	87.77	15.6	158.35	382	696.35	880.3	83.67	169.54	236.4	265.56	257.52
VC @1.4 t ha^{-1} + crop residue	10.25	19.07	40.38	67.49	86.4	15.52	157.26	371.84	687.93	875.19	81.25	166.07	232.51	261.32	252.73
VC @0.7 t ha^{-1} + 50% RDF + crop residue	14.31	22.5	49.53	73.54	91.52	18.57	172.32	405.3	723.27	899.8	87.83	175.25	245.13	277.83	270.51
VC @0.35 t ha^{-1} + 25% RDF + crop residue	12.89	20.38	44.75	71.38	88.64	16.83	165.2	388.03	702.8	884.53	84.8	171.16	239.49	269	261.93
SEm (±)	0.25	0.57	0.69	0.79	0.98	0.48	1.1	1.26	1.36	1.63	0.41	1.2	0.82	1.03	1.24
CD (P=0.05)	0.76	1.69	2.05	2.34	2.91	NS	NS	3.75	4.03	4.85	1.21	NS	2.45	3.06	3.68

Table 2: Effect of treatment on yield contributing characters of wheat

Treatments	No. of effective tillers m^{-2}	Spike length (cm)	No. of grains $spike^{-1}$	1000 grain weight (g)
RDF (100%) + crop residue	267.80	12.07	56.61	45.10
FYM @4 t ha^{-1} + crop residue	239.45	9.43	49.42	38.97
FYM @2 t ha^{-1} + 50% RDF + crop residue	257.83	11.10	53.29	43.60
FYM @1 t ha^{-1} + 25% RDF + crop residue	249.75	10.25	51.20	42.15
VC @1.4 t ha^{-1} + crop residue	244.53	9.92	50.67	41.20
VC @0.7 t ha^{-1} + 50% RDF + crop residue	261.29	11.79	55.10	44.13
VC @0.35 t ha^{-1} + 25% RDF + crop residue	254.17	10.88	52.71	42.53
SEm (±)	0.90	0.36	0.71	0.53
CD (P=0.05)	2.68	1.06	2.10	NS

Table 3: Effect of treatments on grain yield and straw yield of wheat

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index
RDF (100%) + crop residue	4314	6834	11148	0.39
FYM @4 t ha^{-1} + crop residue	2977	5382	8359	0.36
FYM @2 t ha^{-1} + 50% RDF + crop residue	3929	6589	10518	0.37
FYM @1 t ha^{-1} + 25% RDF + crop residue	3647	5994	9641	0.38
VC @1.4 t ha^{-1} + crop residue	3420	5722	9141	0.37
VC @0.7 t ha^{-1} + 50% RDF + crop residue	4184	6740	10925	0.38
VC @0.35 t ha^{-1} + 25% RDF + crop residue	3790	6240	10030	0.38
SEm (±)	44	67	83	0.004
CD (P=0.05)	131	200	245	NS

References

1. Chaudhary VP, Patel A, Parmanik M. Effect of conservation tillage and crop residue management on soil physical properties and crop productivity of wheat. Agricultural mechanization in Asia, Africa and Latin America,2017:48(4):62-70.
2. Cookson WR, Beare MH, Wilson PE. Effects of prior crop residue management on microbial properties and crop residue decomposition. Applied Soil Ecology,1998:7(2):179-188.
3. Ding Z, Kheir AM, Ali OA, Hafez EM, El Shamey EA, Zhou Z, Wang B *et al*. A vermicompost and deep tillage system to improve saline-sodic soil quality and wheat productivity. Journal of Environmental Management,2021:277:111388.

4. Hashim M, Dhar S, Vyas AK, Pramesh V, Kumar B. Integrated nutrient management in maize (*Zea mays*)-wheat (*Triticum aestivum*) cropping system. Indian journal of Agronomy,2015:60(3):352-359.
5. Hashim M. Influence of crop residue mixed farm yard manure and fertilizer combinations on productivity and rhizospheric environment in maize-wheat cropping system. Ph.D. Thesis, Division of Agronomy Indian Agricultural Research Institute, New Delhi.
6. Katyal JC. Organic matter maintenance: Mainstay of soil quality. Journal of the Indian Society of Soil Science,2000:48(4):704-716.
7. Kumar M, Ghorai AK, Mitra S, Majumdar B, Naik MR, Kundu DK. Productivity and resource use efficiency of different jute based cropping systems under nutrient and crop residue management practices. Journal of Agri Search,2016:3(2):76-81.
8. Kumar M, Kundu DK, Ghorai AK, Mitra S, Singh SR. Carbon and nitrogen mineralization kinetics as influenced by diversified cropping systems and residue incorporation in Inceptisols of eastern Indo-Gangetic plain. Soil and Tillage Research,2018:178:108-117.
9. McCalla TM, Haskins FA. Phytotoxic substances from soil microorganisms and crop residues. Bacteriological Reviews,1964:28(2):181.
10. Prasad J, Karmakar S, Kumar R, Mishra B. Influence of integrated nutrient management on yield and soil properties in maize-wheat cropping system in an Alfisol of Jharkhand. Journal of the Indian Society of Soil Science,2010:58(2):200-204.
11. Singh Y, Singh B. Efficient management of primary nutrients in the rice-wheat system. Journal of Crop Production,2001:4(1):23-85.
12. Turmel MS, Speratti A, Baudron F, Verhulst N, Govaert B. Crop residue management and soil health: A systems analysis. Agricultural Systems,2015:134:6-16.