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Impact of rice husk biochar and inorganic amendments on growth attributes of wheat (*Triticum aestivum* L.)

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Abstract
A pot experiment was conducted in Completely Randomized Design with three repetitions in the field of School of Agriculture, Lovely Professional University, from 31st November 2017 to 28th April 2018 to study Impact of rice husk biochar and inorganic amendments on growth attributes parameter of wheat. Different pots were treated with different level of biochar and inorganic amendments *viz.*, T1(100% RDF), T2(3% Biochar+50% RDF), T3(3% Biochar+75% RDF), T4(3% Biochar+100% RDF), T5(5% Biochar+50% RDF), T6(5% Biochar+75% RDF), T7 (5% Biochar+100% RDF) with control. Result revealed that application of (3% Biochar+75% RDF) recorded significantly highest growth attributes (Plant height (cm), Number of tillers, Leaf length (cm)) after 30, 45, 60, 75 and 90 DAS.

Keywords: Biochar, inorganic, growth attributes, wheat

Introduction
Wheat is a staple food which is cultivated for its uses as cereal grains in World wide. The genus Triticum is a combination of a variety of wheat species in which the most widely grown wheat variety is scientifically known as *Triticum aestivum* (generally known as common wheat). In India, UP, Punjab, Haryana, MP, Rajasthan, Bihar, Gujarat, Maharashtra, Uttaranchal and West Bengal are the vital wheat developing states. In India only three species are growing which is know as *Triticum aestivum, T. durum, T. diccocum* are economically important. The significance of wheat is chiefly because of the way that its seed can be ground into flour, semolina, and so forth., which frame the fundamental elements of bread and other pastry kitchen items, just as pasta, and along these lines it shows the primary wellspring of supplements to the vast majority of the total populace (Sramkova, Z. *et al.*, 2009).
Biochar is a combination of two words one is "Bio" that means biomass and another one is "Char" that means charcoal (Nartey, D. *et al.,* 2014). It is a solid and high carbon compound in nature. It is made by Pyrolysis. Pyrolysis is a process which known as thermal decomposition of biomass (Aslam, Z. *et al*., 2014) [6]. During the biochar production all the biomass install in Pyrolysis chamber under low oxygen condition.
The process typically occurs at temperature above 4300 and under pressure. Biochar helps in ecosystem to mitigate the climate. In Carbon Cycle green plant remove CO2 from atmosphere via photosynthesis and convert it into biomass but when it is decomposed it returns 99% CO2 to the atmosphere, in case of biochar cycle green plants remove CO2 from atmosphere via photosynthesis it convert into biomass but when it is making in the form of biochar its give less return to the atmosphere near about 50% properties (Mukharjee, A. And Lal, R., 2013) [20]. Biochar addition does not influence yield components of any crop, but resulted in increased soil N retention. Biochar addition also increases the porosity in soil. Porosity means space between two particles present in soil (Bhattacharjee, S. *et al.*, 2015) [9]. The biochar treatments were found to increase the final biomass, root biomass, plant height and number of leaves in all the cropping cycles in comparison to no biochar treatments (Gebremedhin, G., *et al* 2015). Because biochar attracts and holds soil nutrients, it potentially reduces fertilizer requirements. As a result, fertilization costs are minimized and fertilizer (organic or chemical) is retained in the soil for longer.
After harvesting of rice crop farmers generally pulverize the soil with paddy straw but the problem is that due to high C:N in the rice husk takes lots of time to decompose because it have good elastic capacity so during pulverization the straw are remain same in the field (Thavanesan, S., and Seran, T. H., 2018) [23]. On this current situation, it is an urgent need to change the decline soil quality, conserve organic matter and improve soil nutrient use efficiency.

Materials and methods

Genetically pure seeds of wheat cv. HD2967 obtained from Wheat Research Station, Punjab Agricultural University, Ludhiana for combined study of biochar and inorganic amendments. Different pots were treated with different level of biochar and inorganic amendments *viz.*, T1(100% RDF), T2(3% Biochar+50% RDF), T3(3% Biochar+75% RDF), T4(3% Biochar+100% RDF), T5(5% Biochar+50% RDF), T6(5% Biochar+75% RDF), T7 (5% Biochar+100% RDF) with control. The pots were then arranged in a completely randomized block design. The pots were randomly rotated each day to a different position within the block for the duration of the trial. Observations were recorded after 30, 45, 60, 75 and 90 days after sowing. Observations were collected for Growth attributes viz., Plant height (cm), Number of tillers, Leaf length (cm). Statistical data were analysed as per method given by Panse and Sukhatme (1961).

Result and Discussion

Plant height

The data on plant height (cm) of wheat as affected by use of biochar and inorganic amendments after 30, 45, 60, 75 and 90 days of sowing are presented in Table 1.

Plant height was significantly affected by application of use of biochar and inorganic amendments after 30, 45, 60, 75 and 90 days of sowing (Table 1). Significantly maximum plant height (22.76 cm) was recorded by application of 3% biochar + 100% RDF (T4) after 30 days of sowing, while application of 3% biochar + 75% RDF (T3) recorded highest plant height 38.10 cm and 68.10 cm after 45 and 60 days sowing, respectively and application of 3% biochar + 50% RDF (T2) recorded significantly maximum plant height 88.90 cm and 95.86 cm after 75 and 90 days of sowing, respectively. Significantly minimum plant height (cm) 13.66 cm, 25.36 cm, 46.86 cm was recorded by plot without any biochar and inorganic amendments application (T0) after 30, 45 and 60 days after sowing respectively. Gebremedhin *et al.,* 2015 conclude that the significant difference in plant height increase in case of wheat after biochar application**.** On the other hand when rice crop was treated with biochar it gives better result as compare to untreated plant (Kamara *et al.,* 2015)

Table 1: Effect of biochar and inorganic amendments on plant height (cm) of wheat at 30, 45, 60, 75 and 90 DAS.

Treatment	30 DAS	45DAS	60 DAS	75DAS	90DAS
T0	13.66c ± 0.66	25.36c ± 0.98	46.86e ± 2.06	68.86c ± 1.27	79.63d ± 0.20
T1	15.63c ± 1.97	26.10c ± 0.83	51.20d ± 0.58	78.30b ± 1.91	80.40d ± 1.56
T2	22.63ab ± 1.44	35.60a ± 0.80	66.43b ± 0.80	88.90a ± 1.22	95.86a ± 1.44
T3	22.63ab ± 0.61	38.10a ± 0.66	68.10a ± 0.66	88.53a ± 0.78	95.13a ± 0.84
T4	22.76ab ± 1.15	35.96a ± 1.29	63.30b ± 2.08	74.06b ± 0.23	85.66c ± 1.38
T5	19.40b ± 0.36	27.50c ± 0.88	51.63c ± 0.88	78.26b ± 2.16	83.63c ± 1.66
T6	21.70b ± 0.26	30.36b ± 0.42	53.66c ± 0.95	75.46b ± 1.94	90.96b ± 1.85
T7	20.70b ± 0.61	31.20b ± 0.51	47.40d ± 1.10	63.96c ± 0.37	71.56e ± 2.03

As per DMRT (Duncan's Multiple Range Test) significant variance at $p<0.05$

T0- control; T1- 100% RDF; T2- 3% biochar + 50% RDF; T3 -3% biochar + 75% RDF;T4- 3% biochar + 100% RDF;T5-5% biochar + 50% RDF; T6-5% biochar + 75% RDF; T7-5% biochar + 100% RDF

Number of tillers

The data on number of tillers of wheat as influenced by application of biochar and inorganic amendments during 45, 60 and 75 days after sowing are presented in Table 2.

The number of tillers was significantly affected by application of biochar and inorganic amendments during 45, 60 and 75 days after sowing (Table 2). Among the treatments application of 3% biochar + 50% RDF (T2) pot plants produced significantly highest number of tillers 8.83, 13.73, 21.70 after 45, 60 and 75 DAS respectively, while significantly lowest number of tillers 6.53 and 7.36 was recorded by pot of plants treated with 5% biochar + 50% RDF (T5) after 60 and 75 days of sowing respectively and pot without any treatment also recorded significantly lowest numbers of tillers (4.40) after 45 days of sowing. Ahmad (2016) concluded that biochar application, irrespective of application rate, had a positive impact on it. It is probably due to land reclamation properties of biochar, which increases fertility and nutrient use efficiency. Similar results were reported by Gebremedhin *et al.,* (2015), Kawsar (2019) higher number of tillers was achieved by application of biochar as nutrient source.

Table 2: Effect of biochar and inorganic amendments on No. of Tillers (cm) of wheat at 45, 60 and 75 DAS.

Treatment	45DAS	60DAS	75DAS
T0	04.40c ± 0.36	07.40c ± 0.25	08.26c ± 0.38
T1	05.23bc ± 0.17	06.73c ± 0.23	07.60c ± 0.20
T2	08.83a ± 0.54	13.73a ± 0.68	21.70a ± 0.47
T3	05.20bc ± 0.23	09.63b ± 0.38	17.73b ± 0.88
T4	05.66bc ± 0.64	07.06c ± 0.29	08.06c ± 0.29
T5	05.13bc ± 0.34	06.53c ± 0.08	07.36c ± 0.23
T6	06.10b ± 0.20	07.66c ± 0.53	08.43c ± 0.61
T7	05.30bc ± 0.34	06.76c ± 0.31	07.83c ± 0.39

As per DMRT (Duncan's Multiple Range Test) significant variance at $p<0.05$

T0- control; T1- 100% RDF; T2- 3% biochar + 50% RDF; T3 -3% biochar + 75% RDF;T4- 3% biochar + 100% RDF;T5-5% biochar + 50% RDF; T6-5% biochar + 75% RDF; T7-5% biochar + 100% RDF

Leaf length (cm)

The leaf length of wheat significantly affected by application of biochar and inorganic amendments after 45, 60, 75 and 90 days of sowing (Table 3). Among the treatments, application of 5% biochar + 100% RDF (T7) recorded significantly maximum leaf length (cm) 7.16, 12.56 and 20.76 cm after 45, 60 and 75 days of sowing respectively, while significantly maximum leaf length 22.53 cm was recorded by 3% biochar + 75% (T3) after 90 days of sowing. Significantly lowest leaf length 5.20 cm was recorded by application of T2- 3% biochar + 50% RDF after 45 days of sowing, 8.96 cm leaf length found in application of T4- 3% biochar + 100% RDF after 60 days of sowing. Without any treatment also recorded significantly lowest leaf length (16.43 and 16.53 cm) after 75 and 90 days of sowing. Graber 2010 conclude application of biochar on pepper and tomato plant, increases leaf area because after application of biochar near rhizosphere zone of plant increase the microbial activity in soil.

Table 3: Effect of biochar and inorganic amendments on leaf length (cm) of wheat at 45, 60, 75 and 90 DAS.

Treatment	45 DAS	60DAS	75DAS	90DAS
T0	05.70bc ± 0.11	09.86bc ± 0.50	16.43c ± 2.02	16.53cd ± 0.29
T1	05.83bc ± 0.26	11.4ab ± 0.58	20.50ab ± 0.66	21.70ab ± 1.04
T2	05.20c ± 0.20	09.30c ± 0.55	17.63bc ± 0.20	21.73ab ± 0.69
T3	05.76bc ± 0.51	09.63c ± 0.46	18.43abc ± 0.78	22.53a ± 0.78
T4	06.13bc ± 0.23	08.96c ± 0.62	16.63c ± 0.37	19.46bc ± 1.08
T5	06.00bc ± 0.37	09.36c ± 0.29	16.90c ± 0.37	18.00cd ± 0.57
T6	06.33ab ± 0.18	10.66bc ± 0.27	18.16abc ± 0.59	19.33bcd ±1.36
T7	07.16a ± 0.17	12.56a ± 0.65	20.76a ± 0.95	17.36cd ± 0.73

As per DMRT (Duncan's Multiple Range Test) significant variance at $p<0.05$

T0- control; T1- 100% RDF; T2- 3% biochar + 50% RDF; T3 -3% biochar + 75% RDF;T4- 3% biochar + 100% RDF;T5-5% biochar + 50% RDF; T6-5% biochar + 75% RDF; T7-5% biochar + 100% RDF

Conclusion

The study indicates that the different growth parameter like plant height (cm), numbers of tillers, leaf length (cm) were improved due to the application of T3 -3% biochar + 75% RDF compare to all other treatments and control. Hence, it can be conclude that proper application of biochar with inorganic amendments helps to maintain soil fertility and increase growth attributes. This could long term beneficial effect on the soil health together with the increased yield.

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