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Influence of biopriming and organic manures on growth, seed yield and quality of black wheat (*Triticum aestivum* L.)

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Abstract
To study the influence of biopriming and organic manures on growth, seed yield and quality of black wheat (*Triticum aestivum* L.), results revealed that the application of 50% Poultry manure + 50% Vermicompost + Priming with water showed significantly maximum plant height (107.86 cm), number of tillers per plant (21.33), spike length (14.22 cm), number of spikelet's per spike (18.48), number of seeds per spike (42.17), seed yield per plant (7.35 g.), seed yield (28.78 q ha^{-1}), 1000 seed weight (40.76g), germination percentage (97.35%), root length (23.47cm), shoot length (14.56 cm.) and seed vigour index (3702.22), respectively in comparisons to other treatments. While lower plant height, number of tillers per plant, spike length, number of spikelets per spike, number of seeds per spike, seed yield per plant, seed yield, 1000 seed weight, germination percentage, root length, shoot length and seed vigour index (21.33, 14.22 cm, 18.48, 42.17, 7.35 g, 28.78 q ha^{-1}, 40.76g, 97.35%, 23.47cm, 14.56 cm and 3702.22, respectively) was recorded in 100% Poultry manure +Priming with *Trichoderma viride*.

Keywords: black wheat, biopriming and organic manures

Introduction
Cereals play an important role in healthy diet among all the food grains. It is used as a form of bread, noodles and biscuits. It is a good source of starch, proteins, minerals and dietary fibre and is major contributor towards daily caloric requirements of most of the consuming population. Further enhancement in its nutritional value is expected to increase consumer demands regarding health, nutrition and convenience.

The wheat is named 'Nabi MG' is available in black, blue and purple colour and much more nutritious than common wheat. The pigment anthocyanin is generally available 5 to 15 passes per million in common wheat, while black wheat contain 40 to 140 passes per million in black wheat. It provides health benefits like fruits like blueberry. Anthocyanins removes free radicals from the body and prevents heart, cancer, diabetes, obesity, and other diseases. The amount of zinc is also found in higher quantity in this wheat.

India stands second among wheat producing countries with respect to area and production. Wheat was grown over an area of 29.14 million ha. with production of 102.19 MT with an average productivity of 3507 kg per ha Anonymous 2019 [2]. In Uttar Pradesh, wheat is grown over an area 9.54 million hactares with production of 32.75 million tonnes and with an average productivity of 3432 kg per ha which is much lower than national average (Anonymous, 2020) [3]. Organic agriculture is a production techniques which largely excludes or completely avoids the use of synthetically compounded pesticides, fertilizers, growth regulators, preservatives and livestock feed additives, organic agriculture practices, thus relay upon recycling of crop residues, animal manures, off-farm organic residues and wastes, biofertilizers exploitation of native soil fertility, non-pesticidal methods of pest control and weed management. Seed priming is a technique to reduce emergence time, better algometric (changes in growth of plant parts over time) attributes and provide requisite stand in many horticultural and field crops. Many prehydration or priming treatments have been employed to increase the speed and synchrony of seed germination (Bradford, 1986). Seed priming resulting in faster development, earlier flowering and maturity and higher yields in barley. (Abdulrahmani *et al*., 2007). Harris *et al*. (1999) demonstrated that on-farm seed priming (soaking seeds overnight in water) markedly improved establishment and early vigour of upland rice, maize and chickpea, resulting in faster development, earlier flowering and maturity and higher yields.

Material and Methods

A field experiment was carried out at Organic Research Farm, Department of Seed Technology, Institute of Agricultural Sciences, Bundelkhand University, Jhansi during 2020-21 to evaluate the Influence of biopriming and organic manuress on growth, seed yield and quality of black wheat (*Triticum aestivum* L.) cv. NABI-MG. The soil of experimental plots was red soil, (pH 7.2), low in organic carbon (0.63%), available nitrogen (326 kg/ha), available phosphorus (4.5 kg P_2O_5/ha) and medium in available potassium (87.0 kg K_2O/ha) content by adopting randomized block design with three replications. Nine treatment combination were applied *Viz*.

T_1- (100% Poultry manure +Priming with *Trichoderma viride*),
T_2- (100% Vermicompost + Priming with *Trichoderma viride*),
T_3-(50% Poultry manure + 50% Vermicompost + Priming with *Trichoderma viride*),
T_4- (100% Poultry manure + Priming with Azotobactor),
T_5- (100% Vermicompost + Priming with Azotobactor),
T_6-(50% Poultry manure + 50% Vermicompost + Priming with Azotobactor), T_7- (100% Poultry manure + Priming with water),
T_8-(100% Vermicompost + Priming with water) and T_9- (50% Poultry manure + 50% Vermicompost + Priming with water).

Poultry manure and vermicompost was incorporated as per treatments and for biopriming, wheat seeds were subjected to hydro-biopriming (*Trichoderma viride*, azotobactor and distilled water) for 12 hours at 25 ^{0}C to 30 ^{0}C. In seed biopriming; seeds were soaked in water for 12 hours. Thereafter, seeds were removed and the seeds were dried at 25 ^{0}C for 24 hours in the laboratory for close to original moisture level. The black wheat variety Nabi MG was sown on 21th November 2020 at 22.5 cm row to row spacing by using recommended seed rate of 100 kg ha-1. Agronomic practices were adopted as per need of the crop. For recording data like, growth character plant height (cm), number of tillers per plant, yield and yield attributing characters spike length(cm), number of spikelet per spike, number of seed per spike, seed yield per plant (g), seed yield (q ha^{-1}) and 1000 seed weight (cm), seed quality parameters namely (germination percentage(%), root length(cm), shoot length(cm) and seedling vigour index were recorded as per schedule.

Result and Discussion

A significant enhancement were noticed in growth characters are presented in (Table-1). The maximum plant height (107.86 cm) was recorded with the application of 50% Poultry manure + 50% Vermicompost + Priming with water followed by 100% Vermicompost + Priming with water (107.00 cm) and 100% Poultry manure + Priming with water (106.00 cm). While lowest plant height (102.52 cm) was recorded in 100% Poultry manure +Priming with *Trichoderma viride*. Similar findings were also reported by Maiti (2011) [15].

A Significant result were noted in number of tillers per plant was reported (21.33) with application of 50% Poultry manure + 50% Vermicompost + Priming with water and at par with 100% Vermicompost + Priming with water (20.98), 100% Poultry manure + Priming with water (20.93), 50% Poultry manure + 50% Vermicompost + Priming with Azotobactor (20.38) and 100% Poultry manure + Priming with Azotobactor (20.13). However, lower number of tillers per plant (18.40) was recorded in 100% Poultry manure +Priming with *Trichoderma viride*. It might be due to addition of biopriming and organic manures in the soil, which increased the availability of nutrients resulting in positive effect on growth parameters. Similar findings were also reported by Babalad (1999). With the increased in height and growth of the plants may be the possible reason for more tillers in the plant with seed soaking treatments. This findings is also corroborated with the result of Abnavi and Ghobadi (2012) [11].

A significant difference were noted in spike length. The maximum spike length (14.22 cm) was recorded with application of 50% Poultry manure + 50% Vermicompost + Priming with water. While, minimum spike length (11.12 cm) was noted in 100% Poultry manure +Priming with *Trichoderma viride*.

The number of spikelets per spike (18.43) was significantly influenced with the application of 50% Poultry manure + 50% Vermicompost + Priming. However, minimum number of spikelets per spike (14.87) was reported in 100% Poultry manure +Priming with *Trichoderma viride*.

The number of seeds per spike was varied significantly higher number of seeds per spike (42.17) was obtained with 50% Poultry manure + 50% Vermicompost + Priming with water. The minimum number of seeds per spike (37.10) was recorded in 100% Poultry manure +Priming with *Trichoderma viride*. Hamidi *et al*. (2013) [13] found similar results in previous.

The maximum seed yield per plant (7.35 g), seed yield (28.78 q ha^{-1}) and 1000 seed weight (40.76 g) were recorded in treatment T_9 (50% Poultry manure + 50% Vermicompost + Priming with water) at par with the application of 100% Poultry manure + Priming with water (7.35 g, 28.78 q ha^{-1} and 40.76 g), 100% Vermicompost + Priming with water (7.35 g, 28.78 q ha^{-1} and 40.76 g) and 50% Poultry manure + 50% Vermicompost + Priming with Azotobactor (7.35 g, 28.78 q ha^{-1} and 40.76 g). However, minimum seed yield (7.35 g, 28.78 q ha^{-1} and 40.76 g) were reported with 100% Poultry manure +Priming with *Trichoderma viride*. Similar findings were also reported by Singh *et al*. (2011) [19], Kumar *et al.* (2013), Bassi *et al*. (2015) [8] and Patra *et al.* (2016) [17] in wheat. It might be due to application of organic matter contineously supply both major and minor nutrient, which increase cell division and cell enlargement, hormonal regulation, enzymatic activities of plant leading to more accumulation of photosynthetic compounds though out life cycle which increase growth, yield and yield attributing parameters of crop plant.

The recorded data on germination percentage of seeds in the laboratory after harvesting of crops have been presented in table-1. A significant results were reported in germination. The maximum germination (97.35%) was recorded with the application of 50% Poultry manure + 50% Vermicompost + Priming with water followed by 100% Poultry manure + Priming with water (95.27%) and 100% Vermicompost + Priming with water (94.46%). However, lower germination percent (87.01%) was recorded with 100% Poultry manure +Priming with *Trichoderma viride*. Similar result were also reported by Raj *et al*. (2013) [18] and Ghasemi *et al.* (2014) [10], Mirza *et al.* (2015) [16] in wheat.

It might be due to seeds treated with hydro-priming increase the quick sprouting lead to faster gernination resulting early emergence, better crop stand, faster growth, longer vegetative growth period. Plants height and better tillering by sprouted/ pre germinated and pre-sowing seed soaking.

Increased seed quality parameters might be due to the hydropriming treatment increased higher seed weight, produced more number of grains, heavier and bold seeds contributing to better seed quality.

Data regarding root length, shoot length and seed vigour index presented Table -1 showed the maximum root length (23.47 cm), shoot length (14.56 cm) and seedling vigour index (3702.22) were recorded in treatment T_9 (50% Poultry manure + 50% Vermicompost + Priming with water) followed by 100% Poultry manure + Priming with water and 100% Vermicompost + Priming with water. However, lowest root length (15.76 cm), shoot length (9.89 cm) and seedling vigour index (2231.81) were recorded with 100% Poultry manure +Priming with *Trichoderma viride*. Channabasanagowda *et al.* (2008), Tabatabaei (2014) [20] and Ghobadi *et al.* (2017) [11] in wheat reported similar results.

Increased seed quality parameters were might be due to the hydropriming treatment. Higher seed weight, might be produced more number of heavier and bolder seeds contributing to better harvest index and seed quality.

Table 1: Influence of biopriming and organic manures on growth, seed yield and quality of black wheat (*Triticum aestivum* L.)

Treatment	Plant height (cm.)	Number of tillers per plant	Spike length (g)	Number of spikelets per spike	Number of seeds per spike	Seed yield per plants (g)	Seed yield (qha^{-1})	1000 seed weight (g)	Germination (%)	Root length (cm)	Shoot length (cm)	Seed vigour index
T_1	102.52	18.40	11.12	14.87	37.10	4.13	20.47	36.12	87.01	15.76	9.89	2231.81
T_2	102.53	19.26	11.41	15.14	38.12	4.53	21.62	37.55	88.09	16.12	10.21	2319.41
T_3	102.58	19.46	11.70	15.63	39.58	4.94	21.78	37.89	89.45	17.58	10.54	2515.33
T_4	103.33	20.13	13.01	16.86	40.47	5.07	22.43	38.97	91.24	19.47	11.05	2784.64
T_5	103.93	19.56	12.67	16.30	40.12	5.12	23.07	38.08	90.35	18.37	10.97	2650.87
T_6	103.73	20.38	13.10	16.89	41.55	6.57	25.47	39.44	92.76	20.00	11.12	2886.69
T_7	106.00	20.93	13.84	17.48	42.07	7.27	26.98	40.45	95.27	21.47	13.23	3305.87
T_8	107.00	20.98	13.53	17.25	41.99	7.12	26.12	39.56	94.46	19.56	12.87	3063.34
T_9	107.86	21.33	14.22	18.48	42.17	7.35	28.78	40.76	97.35	23.47	14.56	3702.22
S.Em±	0.86	0.46	0.13	0.46	0.79	0.29	1.15	0.40	1.34	0.42	0.40	53.75
CD at 5%	2.88	1.38	0.40	1.38	2.37	0.88	3.45	1.21	4.00	1.25	1.20	159.73

*T_1- (100% Poultry manure +Priming with *Trichoderma viride*), T_2- (100% Vermicompost + Priming with *Trichoderma viride*), T_3-(50% Poultry manure + 50% Vermicompost + Priming with *Trichoderma viride*), T_4- (100% Poultry manure + Priming with Azotobactor), T_5- (100% Vermicompost + Priming with Azotobactor), T_6-(50% Poultry manure + 50% Vermicompost + Priming with Azotobactor), T_7- (100% Poultry manure + Priming with water), T_8- (100% Vermicompost + Priming with water) and T_9- (50% Poultry manure + 50% Vermicompost + Priming with water)

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