Asian Jr. of Microbiol. Biotech. Env. Sc. Vol. 25, No. (1) : 2023 : 78-82

ISSN-0972-3005

DOI No.: http://doi.org/10.53550/AJMBES.2023.v25i01.010

EVALUATION OF WHEAT VARIETIES FOR HIGHER YIELD UNDER ORGANIC FARMING

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(Received 9 July, 2022; Accepted 25 September, 2022)

Key words: *Organic farming, Wheat varieties, Yield, Economics*

Abstract– Organic wheat is being popular globally, due to continuous health awareness of the consumers towards organic food. In this context the demand for organic wheat is increasing to maintain high productivity. This study is focussed on the need to evaluate wheat varieties under organic farming. A field experiment was conducted at research farm of Birsa Agricultural University, Jharkhand with an objective to evaluate yield attributes, yield and economics of different wheat varieties under organic farming in the region of Jharkhand. The soil of experimental plot was sandy clay loam in texture having average carbon (6.16 Kg/ha), nitrogen (254.78 kg/ha), phosphorous (39.59 Kg/ha) and potassium (208.26 Kg/ha) with soil pH 6.04. Field experiments were carried out using randomized block design replicated thrice involving twelve treatments with twelve wheat varieties viz. Raj 4250, GW 366, NW 2036, K 0307, K 9107, HI 1563, Raj 4229, DBW 14, WR 544, BG 3, HD 2733 and DBW 39. Result of the study revealed that among wheat varieties K 0307 showed maximum no. of spikes per m^2 (336.67), total no. of filled grains (34.60), spike length (9.20 cm) and spike wt. (12.50 g) where as WR544 was recorded with maximum1000 grain wt. (45.47 g) and total no. of unfilled grains (9.33) was maximum in Raj 4250. Maximum grain yield (31.56 q/ha) and harvest index (42.80 %) was observed with K 0307 but the straw yield (45.16 q/ha) was maximum in GW 366. Gross return (62900₹/ha), net return (23035₹/ha) and B:C ratio (0.58) were found to be maximum in K 0307 and can be recommended under organic wheat production in the region of Jharkhand (India).

INTRODUCTION

Wheat is India's most staple crop, placed second to rice. In 2015-16, total wheat production in India amounted to 93.50 mt, in area of about 30.23 m ha with average production of 3093 kg/ha. In Jharkhand total wheat production accounts to 0.27 mt, in area of about 0.16 mha with average production of 1701 kg/ha (Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare Government of India, 2016-17). Wheat is an important food crop of the world as it provides food to 36 % of the global population. Wheat contains about 10-14% protein, 1-2% total fat, 0.3-0.5% carbohydrates (DWR, annual report 2015).

The underlying principle of organic wheat production is that: 'healthy plants grow from healthy soil'. Well balanced, biologically enhanced soil - measured by adequate organic matter, humus level, crumb structure and feeder root development - forms the basis of organic wheat production. Plants are nourished through a soil ecosystem built over time, and not primarily through fast-acting, soluble fertilisers added to the soil. Synthetic fertilisers and chemical pesticides and herbicides are not permitted and can be detrimental to active healthy soil. Well managed soils with adequate organic matter and biological activity tend to be more resilient against land degradation. Problems such as organic matter depletion, soil structure decline, compaction, erosion, and acidification are avoided through good management.

Cereal production like wheat is considered as the backbone of food self sufficiency, is facing a sustainability problem due to practices of modern production system with indiscriminate use of chemical fertilizers and pesticides (Duxbury and

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Gupta, 2000; Ladha *et al.*, 2000; Yadav *et al.*, 2000; Prasad, 2005). The concerns like declining factor productivity (Biswas and Sharma, 2008; Patil, 2008; Yadav, 2008), depletion of soil organic carbon and mineral nutrients content (Prakash *et al.*, 2008), water logging and salinization, increasing nitrate concentration in well water (Singh *et al.*, 1995) etc are the consequents of modern production system with unbalanced and injudicious use of chemical fertilizers and pesticides. The adverse effects of these chemicals are clearly visible on soil structure, microflora, quality of water, food and fodder. The quality of produce is also deteriorated due to entry of chemical residues in the plant body and then to food chain. The emerging scenario necessitates the need of adoption of the practices which maintains the soil health, keeps the production system sustainable and provides qualitative food for meeting the nutritional requirements of human beings.

There is a great demand for high quality products and organically grown foods in the international market and can capitalize on its potential to go for organic farming on a large scale. India, with its varied agro-climatic conditions and agricultural biodiversity, is most suited for organic farming. It is necessary to educate the farmers about the scientific methods of organic farming so that their income will increase gradually. So in the context of improved quality of food and maintenance of ecological balance the two major source of food that is rice and wheat and their cropping system under organic farming is emphasized. Adoption of organic farming will be able to make wheat production more sustainable without adverse effects on the natural resources and the environment (Stockdale *et al.*, 2001).

Therefore, the present study was carried out to evaluate the performance of different wheat varieties under organic farming. It will provide assistance to farmers to choose the best yielding varieties for organic wheat production in the region of Jharkhand.

MATERIALS AND METHOD

The experiment to study the performance of rice varieties for higher productivity in rice under organic farming was conducted at research farm (plot no. 43) of Birsa Agricultural University, Kanke, Ranchi (230 26′ N latitude, 850 19′ E longitude and 625 m above the mean sea level) during *kharif* season of 2017-18. The experimental plots had assured irrigation facility coupled with uniform topography, good drainage and soil characteristics typical to suit rice cultivation. The soil of experimental plot was sandy clay loam in texture having average carbon (6.16 Kg/ha), nitrogen (254.78 kh/ha), phosphorous (39.59 Kg/ha) and potassium (208.26 Kg/ha) with soil pH 6.04. Field experiments were carried out using randomized block design replicated thrice involving treatments with twelve wheat varieties viz. Raj 4250, GW 366, NW 2036, K 0307, K 9107, HI 1563, Raj 4229, DBW 14, WR 544, BG 3, HD 2733 and DBW 39. The crops received a total rainfall of 33.3 mm from November 2017 to April 2018, during the cropping period of wheat the maximum temperature varied between 33.9 °C and 20.0 °C while minimum temperature ranged between 21.1 °C and 2.0 °C., total experimental area was 62.5m X 11m, gross plot size was 5m X 3m. The wheat crop was sown on 3 dates i.e. timely sown on 13/11/2017, late sown on 28/11/2017 and very late sown on 13/12/2017 as per the harvesting of rice variety of different maturity period. Continuous sowing of wheat seeds is done manually in the line spaced at 20 cm. Seeds were then covered with soil manually. The field was prepared on 5th Nov. 2017, 14th Nov. 2017 and 20th Nov. 2017 for timely sown, late sown and very late sown wheat varieties respectively and leveled properly. Drainage channel 50 cm wide was constructed in between the two treatments. To meet out the nutrient requirement of wheat varieties i.e., 100:50:25 kg NPK/ha, respectively farm yard manure, vermicompost and karanj cake were applied based on nitrogen requirement. Each of the source were applied in amount to meet out the 1/3rd of the nitrogen requirement of the recommended level of nitrogen for wheat varieties. Harvesting of timely sown varieties, late sown varieties and very late sown varieties were done on 31st March 2018, 2nd April 2018 and 13th April 2018 respectively. All necessary precautions were taken to maintain uniform plant population in each treatment per replication. Observations were recorded on yield attributes of ten randomly selected plants in each replication. Grain and straw yield were recorded at harvesting. In calculation of economics, the purchase rates of input and the selling rates of outputs were assumed as per the prevailing local market rates.

Statistical analysis

The data were analyzed statistically by applying

"Analysis of Variance" (ANOVA) technique of RBD (Cochran and Cox, 1957). The significance of different sources of variations was tested by Error mean square of Fisher Snedecor's 'F' test at probability level 0.05. Least significant difference (LSD) at 5% level of significance was worked out for each character of the experiment.

RESULTS AND DISCUSSION

Yield attributes and Yield: Yielding ability is one of most important quantitative characters in a crop an its depends upon the development of other plant characters, *viz* leaf area, chlorophyll content, photosynthesis, and dry matter accumulation, which in turn resulted into higher growth parameters and yield attributes. The present study revealed that maximum no. of spike per m^2 was observed in K 0307 which was significantly superior over Raj 4250, HI 1563, WR 544 and HD 2733 whereas significantly at par with rest of the varieties. Total no of filled grain was best reported with K 0307 which was significantly superior over Raj 4250, NW 2036, HI 1563, DBW 14, WR 544 and HD 2733 and significantly at par with rest of the varieties. Total no. of unfilled grain was maximum in Raj 4250 and it was minimum in K0307. Spike length was best recorded with K0307 which was at par with GW 366, Raj 4229, BG 3 and DBW 39 but superior over rest of the wheat varieties. It was found that spike wt. was recorded highest in K0307 that was statistically at par with Raj 4250, GW 366, K 9107 and Raj 4229 however statistically superior over rest of the varieties. Among the wheat varieties, all the yield attributing characters were recorded maximum with K0307. This might be due to tillering ability of the plant which is genetically controlled so, favourable condition for the formation of higher number of tillers also resulted in production of higher number of spikes in K0307.

The increase of wheat grain yield was associated with the increase in yield attributing character since grain yield is manifestation of yield trait, i.e. number of spike per meter square, spike length, grain per spike, spike weight and 1000 grain weight. The maximum grain yield was recorded from variety K-0307 followed by Raj-4229, DBW-39 and GW-366 (Table 1). The wheat variety K-0307 recorded the maximum number of effective tiller per meter square, no. of filled grain per spike, spike length, spike weight and lowest no. of unfilled grain per spike as it is timely sown variety having longer maturity period than late and very late varieties, thus having higher CO_2 assimilation rate, delay in senescence of flag leaf and effective translocation of photosynthate from source to sink resulted in higher yield attributes, grain yield and harvest index. Straw yield was closely related to the vegetative growth comprising of plant height, number of tiller/m^2, LAI and dry matter production. The maximum straw

Table 1. Yield attributes of wheat varieties under organic farming

Treatments	Yield Attributes of Wheat					
	No. of spike m^{-2}	Total no. of filled grain	Total no. of unfilled grain	1000 grain weight (g)	Spike length (cm)	Spike weight (g)
T_1: Raj-4250	275.00	29.00	9.33	42.27	7.27	2.21
T_2 : GW-366	313.33	33.87	5.33	40.90	8.73	2.25
T_3 : NW-2036	300.00	30.00	6.67	43.83	7.90	2.12
T_4 : K-0307	336.67	34.60	3.00	40.53	9.20	2.50
T_5 : K-9107	301.67	32.00	7.00	41.40	8.00	2.17
T_6 : HI 1563	278.33	29.33	8.67	44.97	7.43	2.12
T_7 : Raj-4229	316.67	34.13	5.33	42.90	9.03	2.31
T_8 : DBW-14	296.67	30.00	7.00	43.33	7.67	2.06
T_9 : WR-544	283.33	29.67	8.33	45.47	7.57	2.04
T_{10}: BG-3	295.00	31.07	7.00	45.07	8.30	2.13
T_{11}: HD-2733	265.00	28.33	8.33	43.33	7.00	2.01
T_{12}: DBW-39	305.00	32.60	4.67	44.31	8.47	2.15
SEm±	14.26	1.48	0.42	1.27	0.40	0.11
C.D(P=0.05)	41.82	4.35	1.23	3.73	1.17	0.31
C.V(%)	8.31	8.24	10.81	5.10	8.57	8.47

*Data in parenthesis represents the duration of the variety

yield was recorded from variety Raj 4229 which was closely followed by GW 366, DBW 39, BG 3, K 9107, K 0307, NW 2036, DBW 14, WR 544 and HI 1563. The better growth of wheat variety Raj 4229 contributed towards higher dry matter accumulation resulted in significantly higher straw yield. Almost, similar yield results including grain yield, as well as harvest index were reported by Math and Trivedi (2000) and Davari *et al.* (2014).

Table 2. Yield of wheat varieties under organic farming

Treatments	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)
T_1: Raj-4250	22.44	39.13	36.44
T_2 : GW-366	28.78	45.16	38.92
T_3 : NW-2036	25.56	41.56	38.12
T_4 : K-0307	31.56	42.22	42.80
T_5: K-9107	26.67	43.24	38.11
T_6 : H.I 1563	24.22	40.00	37.71
T_7: Raj-4229	30.22	45.78	39.85
T_8: DBW-14	25.33	40.89	38.23
T_9: W.R-544	25.00	40.00	38.44
T_{10}: B.G-3	27.00	44.18	37.92
T_{11}: H.D-2733	21.56	39.33	35.43
T_{12}: DBW-39	28.89	44.22	39.51
SEm±	1.25	1.99	0.76
C.D(P=0.05)	3.68	5.83	2.23
C.V(%)	8.21	8.17	3.42

*Data in parenthesis represents the duration of the variety

Economics: Economics of wheat production depends on several factors such as input cost, labour requirement and above all the weather condition prevailing during the crop period. Among wheat varieties, K 0307 produced higher gross return, net return, and benefit cost ratio than Raj-4229, GW-366, DBW-39, BG-3, K-9107, NW-2036, DBW-14, WR-544, HI 1563, Raj-4250 and HD-2733 in decreasing order (Table 3). The higher grain yield wheat variety was responsible for higher gross return, net return and benefit cost ratio.

CONCLUSION

Based on one year experimentation it can be concluded that K0307 performed best among the wheat varieties and recorded the highest no. of spikes per m^2 (336.67), total no. of filled grains (34.60), spike length (9.20 cm), spike wt. (12.50 g), grain yield (31.56 q/ha), harvest index (42.80 %), gross return (62900 Rs/ha), net return (23035 Rs/ha) and B:C ratio (0.58). This variety of wheat, i.e. K 0307 is best suited in the region of Jharkhand (India) and can be recommended for cultivation under organic wheat production.

Table 3. Economics of production of wheat varieties under organic farming

Treatments	Economics of Wheat Production		
	Gross return (₹/ ha)	Net return (₹/ ha)	B:C ratio
T_1 : Raj-4250	47924	8059	0.20
T_2 : GW-366	59691	19826	0.50
T_3 : NW-2036	53517	13652	0.34
T_4 : K-0307	62900	23035	0.58
T_5 : K-9107	55802	15937	0.40
T_6 : HI 1563	50939	11074	0.28
T_7 : Raj-4229	62111	22246	0.56
T_8 : DBW-14	52944	13079	0.33
T_9 : WR-544	52125	12260	0.31
T_{10}: BG-3	56637	16772	0.42
T_{11}: HD-2733	46639	6774	0.17
T_{12}: DBW-39	59533	19668	0.49
SEm±	2489.9	2489.93	0.06
C.D(P=0.05)	7303.2	7303.17	0.18
C.V.(%)	7.8	28.38	28.38

*Data in parenthesis represents the duration of the variety

ACKNOWLEDGEMENT

The financial, technical support and providing the necessary facilities received from the Birsa Agricultural University, used in conducting the experiments and encouragement from honorable advisor Dr. C.S. Singh Jnr. Scientist cum Asst. Prof, Dept. of Agronomy, B.A.U. Ranchi to undertake this study is gratefully acknowledged. Thanks are due to all those who supported at different times and useful discussions during the course of the study.

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