Original Research Article

Evaluation of rice varieties (*Oryza sativa* L.)on the basis of physiological and morphological traits

ABSTRACT

The investigation entitled "Evaluation of rice varieties (*Oryza sativa* L.)on the basis of physiological and morphological traits" was conducted during *the Kharif* season, 2019-2020 at the field of Student's Instruction Farm, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya.Nine elite rice genotypes were shown in RBD with three replications, and morphological data were recorded. *i.e.*, Plant height (cm), tiller number per plant, ear bearing tillers per plant, dry weight per plant(g), number of grains/plant, test weight(g), grain yield per plant, chlorophyll content, soluble carbohydrate, protein content in seed, α-amylase activity in seed. The highest plant height was obtained at both the stages *i.e.*, 60 DAT and maturity in Sambha Sub-1 in comparison to other genotypes. Plant dry weight and number of tillers per plant was found significant in Sambha Sub-1. NDR-359 showed maximum chlorophyll content. Maximum carbohydrate and protein content was found in NDR-2065. Swarna Sub-1 showed maximum α-amylase activity at 48, 72 and 96 hrs of germination. Sambha BPT-5204 showed maximum grain yield per plant, test weight, and no. of grains per plant.

Keywords: Biofortification, chlorophyll, carbohydrate, protein, tiller, α-amylase

Introduction:

Rice (*Oryza sativa* L., 2n= 24), belongs to the family Poaceae (Graminae). Rice is primary staple food for more than 50% of the world's population. Rice is the most important and staple food crop in the developing world. The per capita consumption is very high ranging from 62 to 190 kg/year (Chandel *et. al*., 2011; Graham *et. al.*, 1999) in countries where rice is used as major staple food. It is most important crop in Asia, where more than 90% of world's rice is grown and consumed and where more than half of the world's people live. The annual production Rice is 495.9 million tones with an area of about 152.51 million hectares.. Asian farmers produce about 90% of the total, with two countries, China and India more than half. Among the rice-growing countries in the world, India has the largest area under rice crops and ranks second in production next to China. The total area under rice cultivation in 2018-19 is 44.2 million hectares and

Comment [A1]: These are the observations obtained from the experiment. However, what is the conclusion or recommendations?

Comment [A2]: Add 2 more key words

Comment [A3]: What was the objective of experiment?
Need more references

production is 116.42 metric tons (Anonymous, 2019) and in UP it is cultivated with an area of 5.86 million hectares with an annual production of 12.5 million tons. It is widely grown in South-East Asia where the largest population resides. Rice farming is about 10,000 years old and largest single use of land for producing food. About 11% of earth's arable land is covered by rice fields. Two rice species are important cereals for human nutrition. The grain is a caryopsis in which the single seed is fused with the wall which is the pericarp of the ripened ovary forming the grain which is the seed. However, rice is a poor source of essential micronutrients such as Iron (Fe) and Zinc (Zn) (Bouis and Welch, 2010). Biofortification has emerged as one possible solution to alleviate malnutrition and the development of new cultivars with elevated concentrations of Fe and Zn would be extremely useful (Zimmermann and Hurrell, 2002).

Material and Method:

Comment [A4]: Must have to give information on location of experiment, climate, soil, varieties used, experimental design, statistical analysis

Plant height was measured in cm from soil surface up to tip of the plant with the help of a meter scale and average height was calculated from the replicated data. Number of tillers per plant was recorded by counting tillers at each stage of observation. Number of tillers per plant was calculated by counting number of ear bearing tillers per plant at maturity stage of observation. Dry weight per plant was calculated by selecting five healthy and uniform plants from each treatment and samples were oven dried at 70±10C till a constant weight was achieved. Days to 50% flowering was calculated by counting time taken by the plant to attain 50% flowering.The number of grains was counted from 3 plants in each replication.Thousand well filled seeds having moisture content between 12-13 per cent were randomly selected from each replication and weighed in gram. The plants harvested from each plot were threshed and weighted of in gram to obtain grain yield per plant.

Result and discussion:

Comment [A5]: It is not about highest or lowest. If multiple genotype for a particular trait were performing outstanding and there were no significant difference among there performance (statistically at per), in that case all those genotype should be given equal importance.

Mean value of plant height influenced by biofortification of iron and zinc in rice is presented in table 1 and depicted in fig. 1. Data recorded at two stages showed that plant height progressively increased with the advancement of the growth stage. The plant height ranged from 78.60cm to 119.63cm at 60DAT. The maximum plant height of 119.63cm was recorded in SambhaSub-1, followed by NDR-2065*i.e.* 111.93 and minimum plant height of78.70cm was obtained in Sarju-52,followed by Chittimuthyalu and Sambha BPT-5204*i.e*84.47cm and 86.87cm respectively. At the advancement stage of the crop (*i.e.* at maturity), plant height ranged from 94.93cm to 127.53cm. Maximum plant height was observed in SambhaSub-1*i.e.*127.53cm followed by DRR Dhan-45*i.e.*123.07cm. Minimum plant height of 94.93cm was observed in Sarju- 52, followed

Comment [A6]: Consider NDR359

Comment [A7]: Consider NDR2065 as there were no significant difference in their performance

by Swarna *i.e.*95.60cm. All the replications showed a significant effect on the plant height at both stages of plant growth (60DAT and maturity).

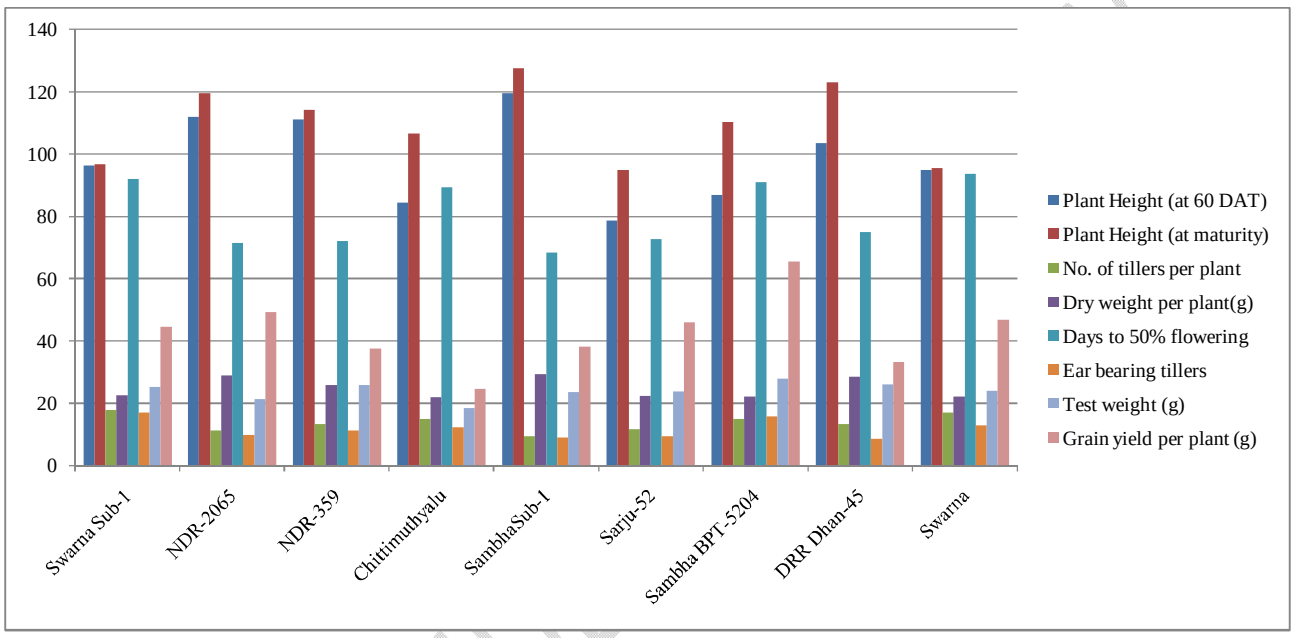
Table 1: shown ofPlant height at 60 DAT,Plant height at maturity, Number of Tillers, Dry weight per plant, Day to 50% flowering, Ear bearing tillers, Number of Grains per plant, Test weight, Grain yield

S.No.	Genotypes	Plant Height (at 60 DAT)	Plant Height (at maturity)	No. of tillers per plant	Dry weight per plant(g)	Days to 50% flowering	Ear bearing tillers	Number of grains per plant	Test weight (g)	Grain yield per plant (g)
1	Swarna Sub-1	96.37	96.83	17.67	22.45	92.00	17	3423.33	25.17	44.52
2	NDR-2065	111.93	119.50	11.33	28.84	71.33	9.67	2690.67	21.23	49.26
3	NDR-359	111.17	114.20	13.33	25.9	72.00	11.33	3348.33	25.70	37.42
4	Chittimuthyalu	84.47	106.53	15.00	21.92	89.33	12.33	2666.67	18.34	24.73
5	SambhaSub-1	119.63	127.53	9.33	29.23	68.33	9.00	2730.33	23.54	38.21
6	Sarju-52	78.70	94.93	11.67	22.41	72.67	9.33	3184.67	23.72	45.99
7	Sambha BPT-5204	86.87	110.20	15.00	22.01	91.00	15.67	3722.67	27.92	65.51
8	DRR Dhan-45	103.47	123.07	13.33	28.47	75.00	8.67	3562.00	26.03	33.33
9	Swarna	94.80	95.60	17.00	22.04	93.67	13.00	3586.33	24.06	46.87
-	~~Grand Mean~~	~~98.60~~	~~109.82~~	~~13.74~~	~~24.81~~	~~80.59~~	~~11.78~~	~~3212.78~~	~~23.97~~	~~42.87~~
	SEm±	4.65	4.09	0.91	0.47	1.56	1.00	51.34	0.63	3.82
	SE(d)	6.04	2.90	1.98	0.66	2.20	1.218	72.60	0.87	1.00
	C.V.	7.50	3.24	20.56	3.27	3.35	11.04	2.77	4.53	3.48
	CD at 5%	13.93~~*~~	12.27~~*~~	2.72~~*~~	1.41~~*~~	4.71~~*~~	3.00~~*~~	155.23~~*~~	1.89~~*~~	11.47~~*~~

~~*Significant at 5%~~

Formatted Table

Fig .1 Graphical representation of Plant Height 60 DAT, Plant Height at maturity, No. of tillers per plant, Dry weight per plant, Day to 50% flowering, Ear bearing tillers, Test weight, Grain yield per plant.



Number of tillers per plant was recorded and represented in theabove table and figure. The number of tillers per plant was ranged from 9.33 to 17.67. The maximum number of tillers *i.e.*17.67 was reported in Swarna Sub-1 and a minimum in of9.33 in SambhaSub-1, followed by NDR-2065*i.e.* 11.33.Maximum number of tillers was followed by Swarna *i.e.*17.00.The variability in tiller number of rice has also been reported by Golam (2001).

Data regarding dry weight per plant is presented in the above table and figure. Dry weight was ranged from 21.92 to 29.23g. Maximum dry weight was reported in SambhaSub-1 followed byNDR-2065 and DRR Dhan-45*i.e.* 28.84g and 28.47g respectively. Minimum dry weight per plant was obtained in Chittimuthyalu, followed by Sambha BPT-5204which is 22.01g.

Data about days to 50% flowering is shown in above shown table and figure. Days to 50% flowering ranged from 68.33 days to 93.67 days. Swarna took maximum number of days (93.67 days) toattain 50% flowering. Swarna was followed by Swarna Sub-1 and Sambha BPT- 5204*i.e.*, 92.00 and 91.00days respectively. SambhaSub-1took minimum number of days (68.33days) for achieving 50% flowering which was followed by NDR-2065 and NDR-359*i.e.*71.33days and 72.00days respectively.Similar finding in respect to varietal differences to attain 50% flowering was also repored by Srinivasulu*et. al.*,(1999).

Ear bearing tillers is shown in above table and figure. The number of ear-bearing tillers per plant was ranged from 8.67 to 17.00. Maximum ear bearing tillers were observed in Swarna Sub-1 *i.e.* 17.00 and was followed by Sambha BPT-5204 *i.e.* 15.67 in numbers. The minimum number of ear bearing tillers was observed in DRR Dhan-45 *i.e.*8.67 followed by SambhaSub-1*i.e.*9.00 and Sarju-52 i.e. 9.33.

Data regarding number of grains per plant is shown in table and figure. Number of grains per plant ranged from 2666.67 to 3722.67 in numbers. Sambha BPT-5204 constitutes the maximum number of grains per plant *i.e.* 3722.67, followed by Swarna and DRR Dhan-45 *i.e.*, 3586.33 and 3562.00 respectively. The minimum number of grains per plant was observed in Chittimuthyalu *i.e.* 2666.67 which was followed by NDR-2065 *i.e.* 2690.67 in numbers. Number of grains per plant showed significant effect on grain yield per plant. Variation in grain yield in rice has been also reported by Hari *et. al.*, (1997) and Golam (2001).

Comment [A8]: Mention numbers

Comment [A9]: Mention value

Data concerning the test weight is shown in table and figure.Test weight of resultant rice seeds was found maximum in Sambha BPT-5204*i.e.* 27.92g and was followed by DRR Dhan-45 and NDR-359*i.e.* 26.03g and 25.70g respectively. Test weight was found minimum in Chittimuthyalu *i.e.* 18.34g followed by Sambha BPT-5204 and Sarju-52 *i.e.*,21.23g and 23.72g respectively.Similar result of varietal variation was in conformity with Chandrashekhar *et. al.*,(2001).

Grain yield per plant was shown in table and figure. Grain yield per plant was ranged from 24.73g to 65.51g. Maximum grain yield per plant (65.51g) was obtained in Sambha BPT-5204 and minimum in Chittimuthyalu (24.73g). Maximum grain yield was followed by NDR2065 *i.e.*49.26g and Swarna *i.e.*, 46.87g. Minimum grain yield per plant was followed by DRR Dhan-45 *i.e.*33.33g.

Comment [A10]: Out of 9, total 6 genotype had performed with out any significant difference. So, all those genotype should be consider as best performing genotype for yield.

Conclusion:

~~The various observations like plant height, number of tillers per plant, ear bearing tillers per plant, number of grains per plant, test weight, dry weight, and grain yield per plant were recorded in field conditions. The present investigation was conducted and the significant finding of the study is summarized as under:~~

Comment [A11]: Not necessary

- The significant difference in respect to plant height was obtained at both the stages *i.e.*, 60 DAT and maturity. Sambha sub-1 showed a maximum increase in plant height at both stages.
- Plant dry weight, no. of tillers per plant and days to 50% flowering was found significantly superior in Sambha Sub-1, Swarna Sub-1, and Swarna respectively.
- All the yield parameters like grain yield per plant, no. of grains per plant, test weight, and EBT showed the significant result. Sambha BPT-5204 showed maximum grain yield per plant, test weight, and no. of grains per plant. Swarna Sub-1 showed significantly superior EBT per plant.

Comment [A12]: These were your observations, but mention what exactly you are suggesting from this experiment?

In conclusion, there was significant varietal difference in morphological characters. The study also suggest that there is a need to characterize more varieties for variable traitslike agronomical and biochemical characters that related to the yield components to produce F2 and further generations as another step to develop rice varieties with high yielding potential.

Comment [A13]: Rewrite with meaningful sentence

Comment [A14]: If these are op variety then why the question about advance generation is coming? Rewrite conclusion

References :

Anonymous (2019); Ministry of Agriculture and Farmers Welfare 2019.

Bouis, H.E., Welch, R.M., (2010); Biofortification—a sustainable agricultural strategy for reducing micronutrient malnutrition in the global south. Crop. Sci. 50, S20–S32.

Chandel, G., Samuel, P., Dubey,M., Meena, R., 2011. Insilico expression analysis of QTL specific candidate genes for grain micronutrient (Fe/Zn) content using ESTs and MPSS signature analysis in rice (Oryza sativa L.). J. Plant Genet. Transgenics. 2, 11–22.

Chandrasekhar, J.; Rao, G. R.; Reddy, B. R. and Reddy, K. B. (2001); Physiological analysis of growth and productivity of rice (Oryza sativa L.); *Indian J. Plant Physiol.*; **6**(2): 142-146.

Golam, D.S. (2001); Studies on physiological basis for yield of hybrid rice (Oryza sativa L.); M.Sc. (Agri.) Thesis, Department of Agril. Botany, Konkan Krishi Vidyapeeth, Dapoli: 35-79.

Hari Om; Katyal, S.K. and Dhiman, S.D. (1997); Effect of time of transplanting and rice (Oryza sativa L.) hybrids on growth and yield; *Indian J. Plant Physiol.*; **42**(2):2161-264.

R.D.; Welch R.M.; Saunders D.A.; Ortiz-Monasterio J.I.; Bouis H.E.; Bonierbale M.; de H.S.; Burgos G.; Thiele G.; Dominguez M.R.L.; Meisner C.A.; Beebe S.E.; Potts M.J.; Kadian M.; Hobbs; Gupta R.K.; and Twomlow S. (2007); Nutritious subsistence food systems. *Adv Agron.* **92**:1-74.

Srinivasulu, K.; Veeraraghavaiah, R. and Madhavi, K. (1999); Growth performance of rice hybrids under different method and densities of planting; *Crop Res.*; **18:**17.

Zimmermann, M.B., Hurrell, R., (2002); Improving iron, zinc and vitamin A nutrition through plant biotechnology;*Curr. Opin. Biotechnol*;**13**:142–145.