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Short-term growth and yieldCultivars of Aman rice (Oryza sativa) as affected by seedling age

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Abstract

From July to December 2019, an experiment was carried out at the Bangladesh Agricultural University (BAU), Mymensingh's Agronomy Field Laboratory to examine the impact of cultivar and seedling age on the productivity of short-duration transplant Aman rice. Four Aman rice cultivars—BRRI dhan49, BRRI dhan56, BRRI dhan66, and BRRI dhan71—as well as seedlings aged 20, 25, 30, and 35 days old—were used in the experiment.

A randomised complete block design with three replications was used to set up the experiment. The study's findings demonstrated that cultivars, seedling age, and their interactions had a considerable impact on growth, yield, and yield-contributing features. The tallest plant during growth stage was generated by BRRI dhan49 with seedlings that were 20 days old (57.67 cm and 67.33 cm at 30 and 50 DAT, there were the most total tillers hill-1 (15.00 and 13.67, respectively), as well as the highest amounts of total dry matter (8.03 g m - 2 and 11.50 g m - 2, respectively).

At harvest, the cultivar BRRI dhan66 produced the highest grain yield (5.35 t ha - 1), highest harvest index (51.69%), longest panicle (24.50 cm), highest number of grains panicle - 1 (128.80), heaviest 1000-grain weight (23.17 g), and highest number of total and effective tillers hill - 1 (12.82 and 12.00). While thirty-day-old seedlings generated the most total and effective tillers hill - 1 (13.46 and 12.70), the longest panicle (24.67 cm), the most grains panicle - 1 (136.90), the highest grain yields (5.62 t ha - 1), and the highest yields of straw (5.81). Day-old seedlings produced the most grain (5.62 t ha - 1), straw (5.81 t ha - 1), and harvest index (51.67%) as well as the most total and effective tillers hill - 1 (13.46 and 12.70). They also produced the longest panicle (24.67 cm) and most grains panicle - 1 (136.90).

When interactions occurred, BRRI dhan66 with 30-day-old seedlings generated the highest number of total and effective tillers hill-1 (14.67 and 13.97), longest panicle (26.00 cm), highest number of grains panicle-1 (146.7), highest grain yield (6.31 t ha - 1), and highest harvest index (52.72%). The current study's findings thus show that BRRI dhan66 with seedlings that are 30 days old is the optimum for maximising grain output.

Introduction The most significant food grain in the diets of billions of people in Asia, Africa, and Latin America is rice (Oryza sativa L.), and it likely will remain so in the future.According to Rahman et al. (2021), Bangladesh is the third-largest rice producer in the world. In Bangladesh, rice is the most common staple meal, making up more than 80% of all food supplies and providing 66% of all the protein needed for daily dietary consumption (Rahaman et al., 2020).Bangladesh's geographic location and agroecological environment are ideal for growing rice.

Bangladesh's agriculture is characterised by intensive cultivation production using a cropping method based on rice.On 11.4 million hectares of land, or 77% of the total cropped area, rice is farmed, yielding 36.6 million tonnes of rice year (BBS, 2020a), which is quite little compared to other highly developed rice-growing nations (FAO, 2014).As the nation's population grows, so does the need for rice.It is a small nation with a sizable population; each year, around 1.47 million people are added to the 164.4 million people who now live there (BBS, 2019). At this time, population growth is 1.37%.The rising population and demand for food will increase the strain on Bangladesh's land resources to produce more rice in the coming years.

Throughout Bangladesh, rice is cultivation of rice grown throughout the course of three separate growth seasons:

Aus (March to June), Aman (June to November), and Boro (November to May).Aman is the second-largest rice crop in the nation among these seasons in terms of acreage. It is noteworthy that Aman covers the most ground as a single crop.With a yield of 27.91 million metric tonnes, Aman rice covers an area of 5.5 million hectares (BBS, 2020).According to estimates, the average yield of Aman will be 2.5 metric tonnes per hectare in the fiscal year 2020–2021, which is 0.46% more than the prior year (BBS, 2021).The capacity to incorporate improved crop management for the various crops will have a significant impact on the potential for boosting rice productivity. cultivation of rice cultivars into current farming practises.

One of the most crucial elements that significantly affects rice yield and yield-related components is cultivar.If the right planting technique is

utilised, a higher yield from the right cultivar may be possible (Akhtar et al., 2007; Liu et al., 2022). Long-lasting rice types are typically grown in the Aman season, and numerous study papers on their management techniques are available (Chakrobarty et al., 2021; Al Mamun et al., 2021; Mia et al., 2022). Short-duration rice varieties for the Aman season have recently been created to address the Monga (workless period) issue and to facilitate the cultivation of early Rabi crops.Growing Aman rice for a brief period of time may present an opportunity. to triple crop the crop in order to increase cropping intensity.

As a result, efforts should be made to use better technology to boost the yield per unit area.Moreover, the use of short-duration Aman rice varieties should boost cropping intensity.Short-duration rice cultivars including BRRI dhan56, BRRI dhan66, and BRRI dhan71 have been developed by BRRI (Rahman et al., 2021). Due to its significant impact on plant height, tiller production, panicle length, grains per panicle, and other yield-contributing characters, seedling age is also a significant factor (Luna et al., 2017; Sinha et al., 2018; Virk et al., 2020; Islam et al., 2021).The act of transplanting seedlings at various times and at various ages is known as planted in stages.Simultaneous transplantation is not the same as this procedure.The age of seedlings at transplanting is not properly taken into consideration by Bangladeshi farmers.

The usage of over-aged seedling ultimately has an impact on the crop's overall performance, and the crop's output dramatically decreases. Determining the ideal age of seedlings of a variety for a given season is therefore crucial.The Bangladesh Rice Research Institute suggests that seedlings be planted at an age of according to the growing season, such as 20 to 30 days for transplanting during the Aus season, 20 to 35 days during transplantation during Aman season, and 45 days during Boro season (BRRI, 1991; BRRI, 1992). However, the farmers lack knowledge regarding how seedling age affects yield and features that contribute to yield for HYV.

The ability to increase rice output, however, is greatly influenced by a number of variables, including cultivar, seedling age, planting method, sowing time, seed rate, etc.The most crucial elements for optimising rice yield among them are choosing a better cultivar based on the geographical conditions of the cultivated area and seedling age.But there is relatively little information in the literature about cultivar and seedling age, and how they respond to yield. That For a higher yield, it is required to ascertain the ideal age of seedlings of a specific cultivar for a given season. In order to determine how cultivar, seedling age, and their interactions affect growth, yield, and yield parameters of transplant Aman rice, the current study was conducted.

METHOD AND MATERIALS

Site and experimentation for experiments:

The experiment was conducted at the Bangladesh Agricultural University's Agronomy Field Laboratory from July to November 2019 to determine how the age of seedlings affected the growth and yield of the short-duration Aman rice cultivar. The experimental field was situated at latitudes 24°75'N and 90°50'E. 'E longitude at a typical height of 18 metres.

It is a part of the Old Brahmaputra Floodplain Agro Ecological Zone (AEZ 9)'s Non-calcareous Dark Grey Floodplain Soil (Old Brahmaputra Alluvial Soil Tract) (UNDP and FAO, 1988). According to Chakraborty et al. (2020), the field was a medium-high flat land with well-drained loamy soil that had pH (6.5), total nitrogen (0.13%), accessible phosphorus (P 2 O 5) (16.3 ppm), potassium (0.28%), and low organic matter (0.93%), respectively. It was also above the flood level.

The experimental area experienced a sub-tropical environment with high temperatures, high humidity, and considerable precipitation during the Kharif season (April to September), and sparse precipitation and somewhat low temperatures throughout the winter. October through March is rabi season. Four different rice varieties—BRRI dhan49 (check), BRRI dhan56, BRRI dhan66, and BRRI dhan71—as well as four different seedling ages—20 days, 25 days, 30 days, and 35 days—were used in the experimental treatments. A randomised complete block design (RCBD) with three replications was used to set up the experiment.A 16-unit plot was created for each replication. Thus, there were 48 (443) unit plots in total.The unit plot was 2.5 m by 2.0 m.Blocks and plots were separated by 1.0 m and 0.5 m, respectively.

Crop management

The Bangladesh Rice Research Institute at Joydebpur, Gazipur, provided the seeds for the BRRI dhan49, dhan56, dhan66, and dhan71 varieties.
a portion of High Land was chosen. visiting the Bangladesh Agricultural University's Mymensingh Agronomy Field Laboratory to raise seedlings. The seedlings in the nursery bed were raised with the appropriate care. The final piece of ground was thoroughly prepared by using a power tiller once, a country plough three times, laddering, and following ploughing.
Urea (150 kg ha-1), triple super phosphate (55 kg ha-1), muriate of potash (105 kg ha-1), gypsum (70 kg ha-1), and zinc sulphate (10 kg ha-1) were used to fertilise the test plots.At the time of land preparation, the entire dose of triple super phosphate (TSP), muriate of potash (MoP), gypsum, and zinc sulphate were administered. At 10, 25, and top-dressed in three equally-spaced splits, Urea 40 days following the transplant. Every management procedure was carried out as and when it was required.

Data gathering

Data on several crop characteristics were gathered throughout both the vegetative and mature stages.Five hills were randomly chosen shortly after trans-planting and marked with bamboo sticks in each plot, excluding the border rows, to collect data on growth parameters. The data included plant height and the number of tillers per hill at 30 DAT and 50 DAT.At 30 and

90 DAT, plants were randomly chosen, ignoring boundary rows and the core area, to determine the total dry matter. Following the removal of each plant's roots, tap water was used to wash the entire plant.Following that, the plant samples were placed in marked brown paper bags and dried for 72 hours at 70° C to achieve constant weight. was attained, and samples that had been oven dried and weighed carefully to determine the plant's dry weight.

Five hills (excluding border hills) from each unit plot were randomly selected at maturity to record attributes that contributed to the yield, and the entire plots were harvested to acquire the yields of grain and straw.

Each plot's harvested crop was packed separately, properly identified, and taken to the threshing floor.Crops that had been harvested were manually threshed, and the grain was washed and dried to a moisture percentage of 14%.Straws were carefully sun-dried.The final grain and straw yields from plot 1 were calculated and translated to t ha - 1.This is how the harvest index was determined:Grain yield plus straw yield equals biological yield. Harvest index (%)=Biological yield/Grain yield 100

Statistical examination of data:

The analysis of variance technique was used to evaluate the data with the use of the computer programme MSTAT-C, and the mean differences were determined using the Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Conclusion

The study's findings suggest that the short-duration transplant Aman rice varieties have favourable growth characteristics. Most yield- and yield-contributing traits of short-duration trans-plant Aman rice cultivars respond better from 30 day-old seedlings of BRRI dhan66. -day-old seedlings of BRRI dhan49.

The results once again demonstrated that BRRI dhan66 with 30-day-old seedlings generated the largest number of effective tillers hill-1, highest number of grains panicle-1, and maximum grain and straw yields.The Old Brahmaputra Floodplain (AEZ-9) appears to be the best place to grow T. Aman rice, and BRRI dhan66 with 30 day old seedlings appears to be the best option.

REFERENCES

1. Akhtar, N., Nazir, M. F., Rabnawaz, A., Mahmood, T., Safda, M. E., Asif, M. &
2. Rehman, (2007). Estimation of heritability, correlation and path of coeffi-
3. cient analysis in fine grain rice Oryza sativaL.) Journal Animal Plant Science,21(4),660-664.
4. Al Mamun, M. A., Nihad, S. A. I., Sarkar, M. A. R., Aziz, M. A., Qayum, M. A.,
5. Ahmed, R., Rahman, N. M. F., Hossain, M. I. & Kabir, M. S. (2021). Growthand trend analysis of area, production and yield of rice: A scenario of rice security in Bangladesh. PloS one, 6(12), e0261128.
6. Alam, M. S., Baki, M. A., Sultana, M. S., Ali, K. J. & Islam, M. S. (2012).
7. variety, spacing and number of seedlings per hill on the yield potentials of transplant Amanrice. International Journal of Agronomy and Agricultural Research, 2(12), 10-15.
8. BBS (Bangladesh Bureau of Statistics). (2019).Statistics and Informatics Division (SID)
9. Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.
10. BBS (Bangladesh Bureau of Statistics). (2020). Estimates of AmanRice (Husked)2019-20.
11. BBS (Bangladesh Bureau of Statistics). (2020a).Yearbook of Agricultural Statistics.
12. Statistics and Informatics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka.BBS (Bangladesh Bureau of Statistics). (2021).
13. Preliminary Report on Agriculture Census-2019, Statistics Division, Ministry of Planning, Government of
14. peoples Republic, Bangladesh, Dhaka. pp. 254.
15. BINA (Bangladesh Institute of Nuclear Agriculture). (2018). Annual Report for 1998-
16. 99. Bangladesh Institute Nuclear Agriculture, Mymensingh. pp. 334.
17. BRRI (Bangladesh Rice Research Institute). (1991). Annual Report, Bangladesh Rice
18. Research Institute Joydebpur, Gazipur. pp. 45.
19. BRRI (Bangladesh Rice Research Institute). (1992).
20. Institute, Joydebpur, Gazipur, Annual Report, 329 1992.
21. Chakraborty, S., Rahman, A. & Salam, M. A. (2020). Effect

of integrated nutrient management on the growth and yield of Bororice (Oryza sativaL.) cultivars. Archives of Agriculture and Environmental Science,5(4), 476-481, https://dx.doi.org/10.26832/24566632.2020.050407

22. Chakrobarty, T., Asadulla al galib, M., Islam, M. Z. & Rahman, M. A. (2021). Adop-tion and adaptability of modern aman rice cultivars in faridpur region-Bangladesh. SABRAO Journal of Breeding & Genetics, 53(4).

23. Chamely, S. G., Islam, N., Hoshain S., Rabbani, M. G., Kader, M. A. & Salam, M. A. (2019). Effect of variety and nitrogen rate on the yield performance of Bororice. Progressive Agriculture 26(1), 6-14.

24. Dangi, K., Singh, S. K., Malviya, D. K., Gautam, A., Kanapuriya, N. & Kumar, B. (2017). Effect of Rice Varieties on Growth, Yield and Economics at Varying Levels of Nitrogen under Direct Seeded Upland Condition Rewa Region.

25. International Journal of Current Microbiology and Applied Sciences, 6(9), 2313-25.2318, https://doi.org/10.20546/ijcmas.2017.609.283Datta M. & Gautam R. (1998). Effect of seedling age and Zinc application on yield of rice. International Rice Research New,13,56-59

26. FAO. (2014). Land Resources Appraisal of Bangladesh for Agricultural Develop-ment. Report 2. Agro-ecological Regions of Bangladesh. United Nations Development Program Organization. pp. 212-221.

27. Faruk, M. O., Rahman, M. A. & Hasan, M. A. (2009). Effect of seedling age and num-ber of seedling per hill on the yield and yield contributing characters of BRRI Dhan33. International Journal of Sustainable Crop Production, 4(1), 58-61.

28. Gomez, K. A. & Gomez, A. A. (1984). Statistical Procedure for Agricultural Re-search. John Wiely and Sons. New York, Brisbane, Toronto. pp. 97-129, 207-215.

29. Haque, M. E., Alam, M. Z., Ahmed, M., Alam, M. S. & Hossain, M. (2002). Perfor-mance of Seedling Ages and Seedling Raising Techniques on Yield and Yield Components of Transplant AmanRice. Pakistan Journal of Biological Sciences,5, 1214-1216.

30. Hasan, M. S., Khan, A. R., Islam, M. & Haque, M. M. (2017). Growth and productiv-ityof sh o r t d u r at o n Aman rice genotype. Bangladesh Agronomy Journal,20(2), 27-36.

31. Hussain, S., Fujii, T., McGoey, S., Yamada, M., Ramzan, M. & Akmal, M. (2014).

32. Evaluation of different rice varieties for growth and yield characteristics. JAPS: Journal of Animal & Plant Sciences, 24(5).

33. Islam, M. K., Hossen, K., Afroge, M., Hosen, A., Masum, K. A. A. M., Osman, M. A.,

34. Joy, M. I. H. & Chowdhury, F. Y. (2021). Effect of different age of seedlings on the growth and yield performance of transplanted Ausrice variety.

35. Inno-vations in Agriculture, 4, 01-06, https://doi.org/10.25081/ia.2021.v4.6899Jisan, M. T., Paul, S. K. & Salim, M. (2014).

36. Yield performance of some transplant Amanrice varieties as influenced by different level of nitrogen. Journal of Bangladesh Agricultural University, 12, 321-24.

37. Kamal, M. M. (2006). Effect of variety and planting method on the growth and yield of boro rice. Thesis, MS. In Agronomy, Bangladesh Agricultural University, Mymensingh. pp. 33-35.

38. Koireng, R. J., Monica Devi, N., Priya Devi, K. H., Gogoi, M. & Rolling Anal, P. S.

39. (2019). Effect of Variety and Spacing on the Productivity of Direct Seeded Rice (Oryza sativaL.) under Manipur Condition. Indian Journal of Pure & Applied Biosciences, 7(5), 335-341, https://dx.doi.org/10.18782/2320-7051.7551

40. Liu, Y., Zhang, H., Li, G., Sun, X. & Wang, M. (2022). A comprehensive method to increase yield and narrow the yield gap of winter wheat for sustainable intensification. Journal of the Science of Food and Agriculture. https://doi.org/10.1002/jsfa.11775Luna, M. A., Sarkar, M. A. R., Uddin, M. R. & Sarker, U. K. (2017). Effect of age of seedlings at staggered planting and nitrogen rate on the growth and yield of transplant Amanrice. Journal of Bangladesh Agricultural University, 15(1), 21–25.

41. Mahmud, S., Hassan, M., Rahman, M. & Jannat, M. (2017). Response of short duration Amanrice varieties to date of transplanting.Journal of the Bangla-desh Agricultural University,15(1),1-6.

42. Mia, S., Ahmed, N. U., Islam, M. Z., Rashad, M., Islam, M., Islam, M. & Zaman, A. K.

43. M. (2022). Genetic diversity and yield performance among T. Amanrice (Oryza sativaL.) landraces in Barishal region of Bangladesh. Journal of Crop Science and Biotechnology, 25(2), 123-132.

44. Moula, G. (2018).Relationship between phenological stages of Bororice and the stages of life cycle of yellow rice stem borer

(Scirpophaga incertulas) in fields(Doctoral dissertation, University of Dhaka).

45. Naha, R. N. (2007). Effect of variety and seedling age on the performance of Amanrice. Thesis, M.S. in Agronomy, Bangladesh Agricultural University,

46. Mymemsin gh. pp. 34-54.Ninad, T. A., Bahadur, M. M., Hasan, M. A., Alam, M. M. & Rana, M. S. (2017). Effect of Spacing and Seedling Per Hill on the Performance of AusRice var. BRRI dhan48. Bangladesh Agronomy Journal,20(2), 17-26.Pathania, R., Shekhar, J., Rana, S. S. & Sharma, S. (2016).

47. Evaluationofseeding rates of rice nursery on seedling vigour and its effect on crop productivity under system of rice intensification. Journal of Applied and Natural Science,8(4), 2224-2230.

48. Rahaman, M. S., Sarkar, M. A. R., Rahman, M. C. & Kabir, M. J. (2020). Drivers of adoption of BRRI cultivars in Boroseason among farm households of Mymensingh district, Bangladesh.Journal of Bangladesh Agricultural University,18, 660–]\[klomk;.666, https://doi.org/10.5455/JBAU.102132

49. Rahman, M. C., Islam, M. A., Rahaman, M. S., Sarkar, M. A. R., Ahmed, R. & Kabir,

50. M. S. (2021). Identifying the threshold level of flooding for rice production in Bangladesh: an empirical analysis.Journal of Bangladesh Agricultural University,19, 243–250, https://doi.org/10.5455/JBAU.53297

51. Rahman, M., Haque, M., Kabir, M. J., Islam, A., Sarkar, M., Mamun, M., Salam, M. &

52. Kabir, M. (2021). Enhancing Rice Productivity in the Unfavourable Ecosys-tems of Bangladesh. Bangladesh Rice Journal, 24(2), 83102, https://doi.org/10.3329/brj.v24i2.53450

53. Roy, B. C., Sattar, S. H., Gaffer, M. A. & Islam, M. A. (1992). Seedling age effect on yield of irrigated rice. Bangladesh Rice Journal,3(1&2), 83-88.

54. Roy, S. K., Ali, M. Y., Jahan, M. S., Saha U. K., Ahmad-Hamdani, M. S., Hasan, M.

55. M. & Amirul, M. A. (2014). Evaluation of growth and yield attributing char-acteristics of indigenous Bororice varieties. Life Science Journal, 11(4),124.

56. Saha, S. R., Hassan, L., Haque, M. A., Islam, M. M. & Rasel, M. (2019). Genetic

57. variability, heritability, correlation and path analyses of yield components in traditional rice (Oryza sativaL.) landraces.Journal of the Bangladesh Agricul-tural University,17(1), 26-32.

58. arkar, S. K., Sarkar, M. A. R., Islam, N. & Paul, S. K. (2014). Yield and quality of aromatic fine rice as affected by variety and nutrient management. Journal of the Bangladesh Agricultural University, 12(452-2016-35812), 279-284.

59. Sinha, T., Paul, S. K. & Sarkar, A. R. (2018). Effect of age of seedlings at staggered transplanting and weed management on the growth and yield of aromatic Bororice (cv. BRRI dhan50). Journal of the Bangladesh Agricultural University, 16(1), 5-11.60.Sohel, M. A. T., Siddique, M. A. B., Asaduzzaman, M., Alam, M. 60.N. & Karim, M. M. (2009). Varietal performance of transplant Amanrice under different hill densities. Bangladesh Journal of Agricultural Research, 34(1), 33-39