Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8817

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2021) *9*(5), 125-130

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Effect of Age of Seedlings and Number of Seedlings per Hill on Growth and Yield of Transplanted Rice (*Oryza sativa* L.) under Satna Condition

Shivam Namdev* and T. Singh

Department of Agronomy, AKS University, Satna (M.P.)

*Corresponding Author E-mail: namdevshivam0803@gmail.com

Received: 4.09.2021 | Revised: 12.10.2021 | Accepted: 19.10.2021

ABSTRACT

A experiment was conducted the Instructional Farm of Department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during kharif season of 2020-21. The experiment arranged in randomize block design having factorial concept with three replications. In this experiment, 12 treatment combinations including four age of seedling and number of seedling/hill were involved treatments were D1= 10 days old seedling, D2- 20 days old seedling, D3- 30 days old seedling and D4- 40 days old seedling, while three number of seedlings per hill viz., S1- One seedling per hill, S2- two seedling per hill and S3- three seedling per hill. During the course of the study, it was found that age of seedlings and number of seedlings per hill significantly affected plant height, number of leaves per plant, number of tillers per hill, length of panicle, number of grains per panicle, number of filled grain per panicle, test weight, grain and stover yield of rice. Higher plant height (90.97 cm), number of leaves per plant (49.80), number of tillers per hill (22.80) at maximum crop growth stage of 90 DAT were recorded in 10- days old seedlings and transplanted of one seedling per hill. Similarly, resulted in highest length of panicle (25.02 cm), number of grains per panicle (184.07), number of filled grain per panicle (176.27), test weight (23.45 g), grain yield/ha (51.78 q/ha) and stover yield/ha (89.88 q/ha) recorded under the use of 10- days old seedlings and transplanted of one seedling per hill.

Keywords: *Seedling, Grains, Panicle, Test weight, Stover yield.*

INTRODUCTION

Rice is the most important food grains. Rice has a largest growing area and it covers nearly 9 per cent of earth's arable land. Rice provides 35% of total calorie intake by the Asian people. Asian countries produce 89 per cent of world's rice, with China and India alone accounting for 55 per cent of production "Rice is Life" for millions of people and staple food for more than half of the world's population.

Cite this article: Namdev, S., & Singh, T. (2021). Effect of Age of Seedlings and Number of Seedlings per Hill on Growth and Yield of Transplanted Rice (*Oryza sativa* L.) under Satna Condition, *Ind. J. Pure App. Biosci. 9*(5), 125-130. doi: http://dx.doi.org/10.18782/2582-2845.8817

Worldwide, rice is grown on 161 million hectares, with the production of about 713.8 million tones with an average productivity of 4.44 tones/ha (IRRI, 2014). In India, Rice is cultivated on an area of 44 million ha, producing around 108.86 million tones (Annual Report, 2016-17). In M.P. rice is grown in the area of about 15.59 lakh ha with production of 14.62 lakh tons and productivity 989 kg/ha. (GOI, 2017).

Among the various cultural practices age of seedlings is the most important factor for yield maximization of rice. The success of transplanted rice cultivation depends upon the age and healthy seedlings. Performance of a variety entirely depends upon the time of planting. Delay in planting or overage of seedlings generally results in yield reduction which cannot be compensated by any other means. Rice crop have relatively higher degree of thermo sensitivity during flowering and grain filling stages as compared to high yielding varieties. Too high or too low temperature may cause damage on flowering and prevent pollen shedding leading to increased infertility and production of chaffy grains. In order to ensure normal flowering, fertilization and avoid damage due to high or low temperature, it is necessary to properly organize the date of nursery sowing and transplanting of hybrids rice. Timely transplanting of rice results in earlier harvest and allows timely planting of succeeding crops. Timely transplanting of rice crop is also found to increase the rain water use efficiency as compared to the delayed planting.

Number of seedlings per hill is another desirable agronomic factor for successful crop production as it affects plant population per unit area, availability of sunlight and nutrients, photosynthesis and respiration, which ultimately influence the yield contributing characters and yield (Chowdhury et al., 1993). More number of seedlings per hill increase the inter-specific competition for tiller formation, solar radiation interception, total sun shine reception, nutrient uptake, rate of photosynthesis and other physiological phenomena which eventually affects the growth and development of plants (Bozorgi et al., 2011). While lesser number of seedlings per hill may cause insufficient tiller number, thus keeping space and nutrients underutilized, resulting in lower grain yield. Therefore, optimum number of seedlings per hill is found essential which may facilitate the plant to grow properly both in its above and below ground parts. The present study was planned to estimate the appropriate age of seedlings and number of seedlings per hill and its impact on growth and yield of rice.

MATERIALS AND METHODS

The experiment was carried out at Instructional Farm, Faculty of Agriculture, AKS University, Satna (M.P.) during kharif season 2020-21. The experiment was conducted in randomize complete block design having Factorial concept with three replications. Different age of seedlings and number of seedlings per hill will be allocated to the plots as per treatments. Seed rate used as 30 kg/ha for transplanting with 20.0 cm row to row distance. The treatments were four seedling age i.e. D1= 10 days old seedling, D2- 20 days old seedling, D3- 30 days old seedling and D4- 40 days old seedling, while three number of seedlings per hill viz., S1- One seedling per hill, S2- two seedling per hill and S3- three seedling per hill. The gross and net plot size was 5.0 m x 3.5 m and 4.0 m x 3.0 m, respectively. Whole dose of P and K was applied as basal dose at the time of sowing. Full recommended dose of phosphorus and potassium at the rate of 80 kg P2O5 /ha and 60 Kg K2O /ha, respectively and half dose of nitrogen @ 120 kg/ha was uniformly applied to each plot (except control plots) as basal dose before transplanting. Remaining half dose of nitrogen was applied as basal dose at the time of sowing and remaining half dose of nitrogen was applied in two equal splits at 30 and 60 DAT i.e., at tillering and panicle initiation stage. All the other agronomic practices were applied uniformly to all the treatments. The experiment will be consisting of the following factors along with their respective levels.

RESULTS AND DISCUSSION

Data regarding plant height, number of leaves per plant and number of tillers per hill are reported in (Table- 1). Statistical analysis of the data revealed that maximum plant height (90.97 cm), number of leaves per plant (49.80) and number of tillers per hill (22.80) at maximum crop growth stage of 90 DAT were observed under the treatment combination of 10- days old seedlings and transplanted of one seedling per hill while, lowest values were observed under the 40 days old seedlings and transplanted of three seedling per hill.

Data regarding length of panicle, number of grains per panicle, number of filled grain per panicle, test weight, grain & stover yield of rice are reported in Table- 1 and maximum values were observed when crop fertilized with seedling age and number of seedlings per hill. Statistical analysis of the data revealed that highest length of panicle (25.02 cm), number of grains per panicle (184.07), number of filled grain per panicle (176.27), test weight (23.45 g), grain yield/ha (51.78 q/ha) and stover yield/ha (89.88 q/ha) recorded under the treatment combination of 10- days old seedlings and transplanted of one seedling per hill.

Transplanting of younger seedling showed better agronomic potential to produce significantly the highest dry matter production. Juvenile age of seedling (10- days) significantly more dry matter production over older age seedling (20, 30 and 40- days). The current results are confirmed with the finding of Ram et al. (2014) and Shukla et al. (2014). Transplanting of older seedlings (30 and 40- days old seedlings) induced a delay in the onset of linear dry matter production and tiller emergence, while the rate of dry matter production and tillers emergence remained unchanged. This delay increased energy expend toward tiller and leaves production based on phyllochronic hypothesis in nursery seedlings of rice (Hussain et al., 2012).

Transplanting with higher numbers of seedling per hill will decrease the number of tillers as a result of increased plant competition. The mortality of the tillers was more in 3 seedlings/hill which might be due to more under and above ground competition for space, plant nutrient, air and light for performing normal physiological activities of the plant. They concluded that the crop transplanted with two seedlings per hill produced significantly higher productive tillers. This is in conformity with the findings of Sarker and Nahar, (2016) and Pokharel et al. (2018).

Younger age seedling (10- days) significantly increased in effective tillers, grains/ panicle, yields and harvest index with lower number of non- filled grains/ panicle and number of chaffy grains over older aged seedling (20, 30 and 40- days). Similar findings were reported by Singh and Singh (2012) and Singh et al. (2013).

The increase in yield attributes may be accounted due to principles and concept of phyllochronic utilization that follow by younger age seedling and thus improved the growth parameters viz., production of green leaves and higher leaf-area index that are the major source of photosynthetic activity in rice with proper partitioning of assimilates into the leaf, stems and roots. Due to marked improvement in these growth parameters, higher production of panicles, panicle length (cm) and grains/ panicle appreciably improved which resulted in higher seed and Stover yield under 10- day old seedling.

Pramanik and Bera (2013) noticed that when seedlings allowed to stay for a longer period of time in the nursery beds, primary tiller buds on the lower nodes of the main column become degenerated leading to reduced tiller production and poor yield. It was also observed that tender age of seedling (10- day old) utilized early phyllochronic concept to produced significantly higher seed and straw yield over 20, 30 and 40- days old seedling.

The increment in yield under tender age of seedling (10- days) was mainly be due to higher photosynthetic and metabolic efficiency for assimilation of energy and their partitioning in to the yield attributing characters viz., effective tillers, panicle length, test weight and grains/ panicle with lower unfilled spikelets and thus increased the seed and Stover yield and vice versa under both older aged seedlings. These findings are confirmed by Ram et al. (2014) and Shukla et al. (2014). Transplanting of 10-days old seedling recorded the highest value of all the yield attributes and yield due to profuse root growth which helped in tillering, thus more tillering provided more photosynthesis to support root growth, both contributed to greater grain filling and larger grains along with sufficient availability of nutrient for vegetative and reproductive phase.

The number of seedlings per hill also contributed to number of filled grains because transplanting more number of seedling per hill increased the inter and intra plant competition which resulted in decreased number of filled grains per panicle and increased number of sterile spikelet which reduced the number of filled grains per panicle. The results are also in accordance with the findings of Barua et al. (2014).

Transplanting of single seedlings per hill showed significant superiority over the other treatments. Increase in grain yield might be due to production of a greater number of tillers per hill and a greater number of filled grains/panicle and finally increased in the grain yield. Similar observation was also reported. The results are also in accordance with the findings of Nandini Devi et al. (2019).

Table 1: Effect of age of seedlings and number of seedlings per hill on growth and yield of rice

Treatment	Plant height (cm)	Number of tillers/ hill	Number of leaves / plant	Length of panicle	Number of grains per panicle	number of filled grain per panicle	Test weight (g)	Grain yield (q/ha)	Stover yield (q/ha)
	Effect of seedling age								
D_1	89.92	21.33	47.51	24.43	180.18	165.89	22.47	46.97	88.41
D_2	85.30	19.51	43.27	23.73	167.58	153.13	21.48	39.62	85.31
D_3	79.44	16.29	41.51	22.09	156.84	146.31	20.95	32.84	82.42
D_4	68.75	14.22	36.80	20.48	141.22	133.98	20.15	30.92	70.26
S. Em±	1.76	0.44	0.78	0.26	1.99	2.93	0.12	1.55	1.88
CD	5.17	1.30	2.29	0.77	5.82	8.59	0.35	4.54	5.51
	Effect of number of seedlings per hill								
S_1	82.98	18.73	43.45	23.22	165.78	155.83	21.68	40.21	83.71
S_2	81.74	17.63	42.35	22.76	162.78	148.48	21.16	37.04	81.46
S_3	77.84	17.15	41.02	22.07	155.80	145.17	20.95	35.51	79.64
S. Em±	2.04	0.51	0.90	0.30	2.29	3.38	0.10	1.79	2.17
CD	5.97	1.50	2.64	0.89	6.72	9.92	0.30	5.25	6.36
	Interaction effect between seedling age and number of seedlings per hill								
D_1S_1	90.97	22.80	49.80	25.02	184.07	176.27	23.45	51.78	89.88
D_1S_2	90.90	20.87	47.13	24.27	180.80	162.93	22.06	46.00	88.42
D_1S_3	88.09	20.33	45.60	24.01	175.67	158.47	21.91	43.13	86.92
D_2S_1	86.34	19.80	43.60	23.94	171.73	156.07	21.61	43.08	85.98
D_2S_2	84.92	19.53	43.33	23.90	166.47	152.67	21.51	38.78	85.76
D_2S_3	84.64	19.20	42.87	23.35	164.53	150.67	21.33	37.00	84.19
D_3S_1	83.58	17.13	42.47	22.70	160.60	148.07	21.14	34.45	83.45
D_3S_2	81.98	16.00	41.67	22.20	158.80	146.60	20.95	32.28	83.39
D_3S_3	72.78	15.73	40.40	21.37	151.13	144.27	20.77	31.81	80.43
D_4S_1	71.24	15.20	37.93	21.23	146.73	142.93	20.54	31.53	75.52
D_4S_2	69.15	14.13	37.27	20.67	145.07	131.73	20.11	31.12	68.25
D_4S_3	65.87	13.33	35.20	19.54	131.87	127.27	19.81	30.11	67.00
S. Em±	1.02	0.26	0.45	0.15	1.15	1.69	0.20	0.89	1.08
CD	2.11	0.53	0.93	0.32	2.38	3.51	0.60	1.86	2.25

Acknowledgement

Authors are thankful to Dr.T. Singh prof.and head Agronomy for very kindly providing all the experimental facilities and suggestions for successful conduct of the experiment.

REFERENCES

Annual Report, (2016-17). Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, *Government of India 3*.

Barua, R., Islam, M. N., Zahan, A., Paul, S., & Shamsunnaher, (2014). Effects of spacing and number of seedlings hill-1 on the yield and yield components of rice. *Eco-friendly Agri. J. 7* (06), 65-68.

Riyana, D., Bhandaria, R., Paudela, R., Paudela, P., Bakabala, M., Bohoraa, S. L., & Bishal, B. (2021). Effect of age and number of seedlings in productivity of rice. *Tropical Agroecosystem, 2* (1), 06-11.

GOI (Government of India, Ministry of Agriculture and Farmer's Welfare). (2017). Annual Report 2016-2017. Government of India, Ministry of Agriculture and Framer's Welfare, Krishibhavan, New Delhi, Pp. 194.

Hussain, A., Bhat, M. A., & Ganie, M. A. (2012). Effect of number and age of seedlings on growth, yield, nutrient uptake and economics of rice under system of rice intensification in temperate conditions. *Indian Journal of Agronomy. 57* (2), 133-137.

IRRI, (2014). World rice statistics. http://ricestat.irri.org:8080/wrsv3/entrypoint.htm.

Devi, N., Ganesh Narayan, K., Khamba Singh, K., Anandi Devi, M., Athokpam, H. S. & Dorendro Singh, A. (2019). Effect of Age and Number of Seedling per Hill on Growth and Yield of Black Scented Rice (Oryza sativa L.) Variety 'Chakhao Poireiton' under Manipur Condition. *International Journal of Current Microbiology and Applied Sciences, 8* (7), 1738-1745.

Pokharel, S., Amgain, L. P., Sapkota, B., Khanal, A., & Gurung, T. B. (2018). Effect of spacing and number of seedling hill-1 on grain yield and other agronomic traits of hybrid rice (U.S. 312) on late transplantation. *JOJ Material Sci. 5* (1), 001- 004.

Pramanik, K., & Bera, A. K. (2013). Effect of seedling age and nitrogen fertilizer on growth, chlorophyll content, yield and economics of hybrid rice (Oryza sativa L.). *International Journal of Agronomy and Plant Production. 4* (S), 3489-3499.

Ram, Hardev, Singh, J. P., Bohra, J. S., Singh, Rajiv, K., & Sutaliya, J. M. (2014). Effect of seedlings age and plant spacing on growth, yield, nutrient uptake and economics of rice (Oryza sativa) genotypes under system of rice intensification. *Indian Journal of Agronomy, 59* (2), 256-260.

Chandro, S. B., & Nazmun, N. (2016). Effect of number of seedlings per hill and spacing on growth and yield of transplanted Aman rice (var. Ranisalute). *Khulna University Studies, 14* (1 &2), 27-38.

Shukla, U. N., Srivastava, V. K., Singh, Smita, Sen, A., & Kumar, V. (2014). Growth, yield and economic potential of rice (Oryza sativa) as influenced by different age of seedlings, cultivars and weed management under system of rice intensification. *Indian Journal of Agricultural Sciences, 84* (5), 628-636.

Singh, Kalyan, Singh, S. R., Singh, J. K., Rathore, R. S., Pal, Shishu, Pal, & Roy, Rina. (2013). Effect of age of seedling and spacing on yield, economics, soil health and digestibility of rice (Oryza sativa) genotypes under system of rice intensification. *Indian Journal of Agricultural Sciences, 83* (5), 479-483.

Singh, R. N., & Singh, R. K. (2012). Effect of age of seedling, number of seedlings per hill and fertility level on yield and NPK uptake by hybrid rice ("PHB-71"). *Research Journal of Agricultural Sciences, 3* (1), 41-46.