Indian Journal of Ecology (2023) 50(5) (SI): 1633-1636
DOI: https://doi.org/10.55362/IJE/2023/4108

Manuscript Number: 4108
NAAS Rating: 5.79

Influence of Different Dates of Transplanting on Yield Performance and Quality of Basmati Rice Cultivars

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Abstract: The study was conducted on influence of different dates of transplanting on yield performance and quality of basmati rice cultivars at Division of Agronomy, Faculty of Agriculture, SKUAST- Jammu, Chatha during the *Kharif* season of 2022 comprising factor A as different dates of transplanting *viz*., 1st July, 10th July, 20th July and 30th July and factor B basmati rice cultivars *viz*., Basmati-370, Jammu Basmati-138, Jammu Basmati-118 and Jammu Basmati-123. The 1st July transplanted crop recorded significantly higher growth, yield attributes and yield which was statistically at par with 10th July transplanted crop. Jammu Basmati-118 performed significantly better in terms of yield attributes and grain yield which was statistically at par with Jammu Basmati-138. The significantly highest kernel length after cooking was in 1st July transplanted crop and Jammu Basmati-118. Jammu Basmati-118 and 1st July transplanting recorded significantly highest yield along with highest net returns and B:C ratio of ₹ 217476 ha^{-1} and 4.6, respectively. Henceforth, basmati rice cultivars should be transplanted from 1st to 10th of July for realizing maximum yield along with improved kernel length after cooking.

Keywords: Basmati rice cultivars, Transplanting dates, Quality, Yield performance

Rice (*Oryza sativa* L.) is a vital staple food for most of the world's population and approximately 85% of Indian population (Mohapatra, 2014). On a global scale, India ranks as the world's second largest rice producer, where it is cultivated over an area of 45 million hectares with a production and productivity of 122.27 million tonnes and 27.13 quintals hectare^{-1}(Anonymous 2021). In Jammu and Kashmir rice is cultivated on 267.58 thousand hectares, producing 5816 thousand quintals with an average productivity of 21.73 quintals heactare^{-1} (Anonymous, 2020-21). Basmati, a premium rice has occupied an exceptional place in domestic as well global market. Globally, India ranks first in the basmati rice production with export earning of ₹ 26,416.49 crores by exporting a produce of 3,948,161.03 million tonnes during the year 2021-22 (APEDA 2022). Basmati rice is predominantly grown in the foothills of the Himalayas (Punjab, Haryana, Delhi, Uttarakhand, Himachal Pradesh, Jammu & Kashmir and Western Uttar Pradesh). The Union Territory of Jammu & Kashmir produces 1350 thousand quintals from an area of 62 thousand hectares (Anonymous 2018). Nevertheless, in recent years, there has been a notable decrease in both yield and quality of basmati rice, which could be attributed to the vulnerability of traditional cultivars to diseases, lodging, delayed maturation as well as the climate change. Optimizing transplanting dates, considering the photoperiod sensitivity, presents an agronomic cum climate-smart approach. This, coupled with specific cultivar selection, can enhance both quantitative and qualitative yield and thus food and economic security for farmers. Delay in transplanting has resulted in reduction of growth and yield (Abhilash et al 2021, Sharma et al 2022). Thus, the present investigation was undertaken with the objective to evaluate the growth, yield and quality of basmati rice cultivars along with economics under varied dates of transplanting.

MATERIAL AND METHODS

Field experiment was conducted during the during *kharif* season of 2022, at Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Chatha (32^0 40´ N latitude, 74^0 58´ E longitude). The experiment comprised of four basmati rice cultivars (Factor A) *viz*., V_1: Basmati-370, V_2: Jammu Basmati-138, V_3: Jammu Basmati-118 and V_4: Jammu Basmati-123, and four dates of transplanting (Factor B) *viz*., D_1: 1st July, D_2: 10th July, D_3: 20th July and D_4: 30th July, resulting in sixteen treatment combination, each replicated thrice within a factorial randomized block design. The soil of the experimental field was sandy clay loam in texture, slightly alkaline in reaction, low in organic carbon (3.84 g kg^{-1}) and available nitrogen (243.10 kg ha^{-1}), and medium in available phosphorus (15.86kg ha^{-1}) and potassium (153.89 kg ha^{-1}). The recommended doses of fertilizers were applied to the basmati rice cultivar as per the package of practices provided by the SKUAST-Jammu. Full quantity of phosphorous, potash and 1/3rd of nitrogen were applied through DAP, MOP and Urea at the time of puddling and incorporated into the soil thoroughly, while remaining 2/3rd nitrogen is applied in two splits –one at 30 days after transplanting and the other at 50 days after transplanting. Growth, yield and yield of basmati rice cultivars were recorded. The total grain yield was recorded by separately weighing the cleaned grains from each net plot and converted to kg ha^{-1}. Straw yield was weighed separately from each net plot after threshing and expressed in kg ha^{-1}. The harvest index was calculated (Nichiporovich 1967).

$$\text{Harvest index (\%)} = \frac{\text{Economic yield (kg ha}^{-1}\text{)}}{\text{Biological yield (kg ha}^{-1}\text{)}} \times 100$$

Kernel length after cooking was taken from ten cooked rice grains after soaking 25 whole milled rice grains in 20 ml distilled water followed by boiling water bath immersion for 12 minutes. The cooked rice was placed on a petri dish lined with filter paper before taking the reading. The data recorded was statistically analyzed using Fisher's analysis of variance technique. The software used for the data analysis were MS Excel and OPSTAT.

RESULTS AND DISCUSSION

Growth parameters: Early transplanting on 1st July resulted in significantly better plant height, dry matter accumulation and number of tillers $meter^{-2}$ at harvest compared to transplanting on 20th July and 30th , however, were statistically at par with 10th July transplanting (Table 1). This could be attributed to the fact that early transplanting provided an extended vegetative growth period due to photoperiodic response. This, in turn, might have led to a higher accumulation of photosynthates and their subsequent utilization for the growth of vegetative organs of the plant. These results were in conformity with Kumar et al (2017) and Tolma (2021). The significantly higher plant height and number of tillers $meter^{-2}$ were recorded by Jammu Basmati-123 over Jammu Basmati-118. The performance was statistically at par with Jammu Basmati-138 and Basmati-370. The dry matter accumulation at harvest in Jammu Basmati-118 was significantly higher over Basmati-370 and was statistically at par with Jammu Basmati-123 and Jammu Basmati-138. Vishwakarma et al (2016) also confirmed a variation in the growth parameters among the different rice hybrids under investigation. These differences might be attributed to the genetic makeup of the cultivars.

Yield attributes and yield: Transplanting basmati rice on 1st July significantly produced highest number of effective tillers $meter^{-2}$ and number of grains panicle over 20th and 30th July transplanted crop, but was statistically comparable to 10th July transplanting. 1000-grain weight was not affected by different transplanting dates. Significantly highest grain and straw yield was recorded under 1st July transplanting compared to 20th July and 30th July transplanting, but was statistically similar to 10th July transplanting. The increased yield related characteristics and consequently, the final yield

Table 1. Influence of different dates of transplanting on growth and yield parameters of basmati rice cultivars

Treatments	Growth parameters			Yield parameters		
	Plant height (cm)	Dry matter accumulation (g m^{-2})	Number of tillers (m^{-2})	Number of effective tillers (m^{-2})	No. of grains $panicle^{-1}$	1000-grain weight (g)
Basmati rice cultivars						
V_1(Basmati-370)	158.67	821.72	276.67	227.08	62.92	21.13
V_2 (Jammu Basmati-138)	164.26	963.14	291.67	250.00	69.13	21.51
V_3 (Jammu Basmati-118)	132.35	975.74	303.33	262.08	71.13	21.78
V_4 (Jammu Basmati-123)	164.84	970.08	306.25	245.00	66.68	21.44
CD (p=0.05)	6.62	50.35	12.42	14.44	3.49	NS
Dates of transplanting						
D_1 (1st July)	169.74	1052.13	315.42	267.50	72.24	21.83
D_2 (10th July)	163.45	1002.76	303.33	257.08	70.28	21.61
D_3 (20th July)	149.69	875.10	288.75	240.42	66.26	21.27
D_4 (30thJuly)	137.24	800.69	270.42	219.17	61.07	21.16
CD (p=0.05)	6.62	50.35	12.42	14.44	3.49	NS
Interaction (V×D)	NS	NS	NS	NS	NS	NS

Table 2. Yield, quality and economics as influenced by different dates of transplanting and basmati rice cultivars

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)	Kernel length after cooking (mm)	Net returns (₹ ha^{-1})	Benefit-cost ratio
Basmati rice cultivars						
V_1 (Basmati-370)	2876.26	5713.38	33.38	12.86	161886	3.4
V_2 (Jammu Basmati-138)	3498.74	6212.63	36.01	12.02	206140	4.3
V_3 (Jammu Basmati-118)	3646.46	6398.99	36.25	13.62	217224	4.5
V_4 (Jammu Basmati-123)	3267.68	6755.05	32.49	13.03	190861	3.9
CD (p=0.05)	249.69	400.83	1.97	0.26		
Dates of transplanting						
D_1 (1st July)	3791.67	6789.14	35.79	13.32	227710	4.7
D_2 (10th July)	3545.45	6549.24	35.09	12.98	210090	4.4
D_3 (20th July)	3184.34	6077.02	34.41	12.77	184068	3.8
D_4 (30th July)	2767.68	5664.65	32.84	12.45	154241	3.2
CD (p=0.05)	249.69	400.83	1.90	0.26	-	-
Interaction (V×D)	NS	NS	NS	NS	-	-

under early transplanting might be attributed to the fact that these yield parameters are influenced by growth and development of a plant during the vegetative phase. Better growth conditions under early transplanting likely led to improved partitioning of photosynthates from source to sink resulting in higher yield attributes and yield. These results are in agreement with the work of Limochi and Eskandari (2013). The reduction in yield under delayed transplanted might be associated with the decreased temperature during anthesis and grain filling stages of the crop (Gill et al 2006). The yield attributes and yield were significantly influenced due to basmati rice cultivars. Jammu Basmati-118 produced statistically similar number of effective tillers meter^{-2}, number of grains panicle and grain yield. However, significantly highest values were exhibited in terms of these parameters by Jammu Basmati-118 over Jammu Basmati-123 and Basmati-370. Genetic traits of this cultivar enabled the plants to convert higher energy into production of higher yield attributes and yield as highlighted in the study of Singh et al (2013). In terms of straw yield Jammu Basmati-123 produced significantly comparable straw yield with Jammu Basmati-118 but significantly higher was recorded over Jammu Basmati-138 and Basmati-370. This might be due to superior growth parameters like number of tillers meter^{-2}. These results are in accordance to the findings of Baghel et al (2013).

Harvest index was also influenced both the choice of basmati rice cultivars and the transplanting dates. Significantly higher harvest index was obtained under 1st July transplanting which remained statistically at par with 10th and 20th July transplanting. Between the cultivars Jammu Basmati-118 resulted in significantly higher harvest index over other cultivars and remained at par with Jammu Basmati-138.

Quality parameters: Kernel length after cooking is an important quality trait of basmati rice. 1st July transplanting exhibited significantly highest value for kernel length after cooking followed by 10th July, 20th July, and 30th July, respectively. These results are in line with the findings of Mahajan et al (2009) in Super basmati. Among the basmati rice cultivars, Jammu Basmati-118 recorded significantly highest value for kernel length after cooking followed by Jammu Basmati-123, Basmati-370 and Jammu Basmati-138, respectively. The genetic composition of the crop determines its characteristics resulting in variation in quality attributes (Gautam et al 2008).

Economics: The timely transplanting practice with appropriate crop cultivars does not require additional expenditure but gives acceptable yield and net returns. 1st July transplanting emerged as a more cost-effective option, giving a maximum net income of ₹ 227710 ha^{-1} and benefit-cost ratio of 4.7 than other dates (Table 2). In the category of basmati rice cultivars, Jammu Basmati-118 out performed in terms of net returns and benefit-cost ratio with the corresponding values of ₹ 217224 ha^{-1} and 4.5.

CONCLUSION

The early transplanting from 1st July to 10th July not only proved optimum for producing higher growth, yield parameters, yield and quality parameters but also fetched increased net returns and benefit-cost ratio than late transplanting (20th July to 30th July). Among the basmati rice cultivars, Jammu basmati 118 and Jammu basmati-138 were statistically similar for cultivation to get higher yield. Jammu basmati-118 realized higher net returns and benefit-cost ratio followed by Jammu basmati-138. However, there was no observed interaction between the basmati rice cultivars and transplanting dates.

REFERENCES

Anonymous 2018. *Basmati Survey-Final Report-6*. Basmati Export Development Foundation, APEDA, New Delhi, pp.1-70.

Anonymous 2020-21. *Digest of Statistics*: Directorate of Economics and Statistics, Government of Jammu and Kashmir.

Anonymous 2021. *Agricultural Statistics at a Glance*, Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India.

APEDA 2022. Basmati rice. Agricultural and Processed Food Products Export Development Authority (APEDA). Available at: www.apeda.gov.in/apeda website/SubHead_Products/ Basmati_Rice.htm. Accessed on 30 December, 2022.

Baghel JK, Singh YV, Kumar D, Abraham G and Singh S 2013. Effect of Varieties and Nitrogen Management on Nematodes Infestation and Productivity of Rice. *Indian Journal of Agronomy* **58**(3): 427-429.

Gautam AK, Kumar D, Shivay YS and Mishra BN 2008. Influence of nitrogen levels and plant spacing on growth, productivity and quality of two inbred varieties and a hybrid of aromatic rice. *Archives of Agronomy and Soil Science* **54**(5): 515-532.

Gill MS, Kumar A and Kumar P 2006. Growth and yield of rice (*Oryza sativa* L.) cultivars under various methods and times of sowing. *Indian Journal of Agronomy* **51**: 123-27.

Kumar V, Hooda VS, Nandal DP, Kumar S and Gupta G 2017. Influence of different transplanting date and weed management practices on yield and quality of basmati rice (Pusa Basmati-1509). *Journal of Applied and Natural Science* **9**(4): 1958-1961.

Limochi K and Eskandari H 2013. Effect of planting date on the performance of flag leaf stomata and grain yield of rice cultivars. *International Journal of Agronomy and Plant Production* **4**(4): 769-773.

Mahajan G, Sharma N and Bharaj TS 2009. Grain yield, water productivity and quality characteristics of basmati rice in response to cultivars and transplanting dates. *International Journal of Plant Breeding* **3**: 46-51.

Mohapatra T 2014. CRRI *Annual Report 2013-14. Central Rice Research Institute, Cuttak* (Odisha), India

Nichiporovich AA 1967. Aims of research on photosynthesis of plants as a factor of soil productivity. *Photosynthesis of Productive System* **4**: 3-36.

Sharma A, Puniya R and Nguyen AT 2022. Evaluation of the Performance of basmati rice (*Oryza sativa*) transplanting at different dates with nutrient sources under the method of SRI. *Agricultural Science Digest-A Research Journal* **42**(6): 764-767.

Singh K, Singh SR, Singh JK, Rathore RS, Singh SP and Roy R 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): 479-83.

Tolma T 2021. *Performance of new basmati varieties as influenced by different tillage methods and sowing environment in direct seeded rice*. M.Sc. Dissertation, Sher-e-Kashmir University of Agricultural Science & Technology of Jammu, India.

Vishwakarma A, Singh JK, Sen A, Bohra JS and Singh S 2016. Effect of transplanting date and age of seedlings on growth, yield and quality of hybrids under system of rice (*Oryza sativa* L.) intensification and their effect on soil fertility. *Indian Journal of Agricultural Sciences* **86**(5): 34-39.

Received 02 September, 2023; Accepted 04 November, 2023