International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(3): 166-169

Received: 26-03-2019
Accepted: 30-04-2019

Sawant Sandeep Narayan
Research Scholars, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Ritesh Kumar Parihar
Research Scholars, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Kartikeya Choudhary
Research Scholars, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Anoop Kumar Devedee
Research Scholars, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Sandeep Kumar
Research Scholars, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Correspondence
Ritesh Kumar Parihar
Research Scholars, Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Performance of aromatic varieties and age of seedlings on yield and nutrient uptake of rice under irrigated ecosystem

Sawant Sandeep Narayan, Ritesh Kumar Parihar, Kartikeya Choudhary, Anoop Kumar Devedee and Sandeep Kumar

Abstract
An experiment was conducted during *kharif* 2015 at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi to study the performance of aromatic varieties and age of seedlings on yield and nutrient uptake of rice under irrigated ecosystem. Results revealed that, aromatic rice variety Adamchini and Badshahbhog recorded maximum grain and straw yield, respectively. Whereas, age of 14 days seedlings recorded maximum grain as well as straw yield which was statistically at par with age of 18 days seedlings. The nitrogen and phosphorous concentrations was recorded maximum with variety Kalanamak and the potassium content was found to be non-significant. Highest uptake of NPK by grains was recorded with variety Adamchini but the straw of variety Badshahbhog recorded maximum uptake of NPK. The nutrient concentration and uptake was found to be non-significant with age of seedlings.

Keywords: aromatic, nutrient concentration, seedlings and uptake

Introduction
Indian sub-continent is a home for aromatic rice diversity. Indian farmers grow a large number of rice varieties which include some of the finest quality aromatic rice. Aroma quality of scented rice is a major character which increases the value of rice in international market (Nayak *et al.,* 2002) [10]. The yield of aromatic rice is lower (Gangaiah & Prasad, 1999) [5] due to delayed planting time as well as photo-periodic effect (Van Heemst, 1986) [18] but its higher price and low cost of cultivation generated higher profit margins than other varieties.
Aromatic rice of all shapes and sizes available in the country represent the stupendous genetic diversity witnessed in the various agro climatic regions. Many non-Basmati traditional aromatic rice cultivars are famous in which Badshahbhog, Adamchini and Kalanamak are very popular in North East Plain Zone of India due to their excellent grain quality and aroma. Many researchers reported age of seedlings effect on the yield and yield contributing characters of rice and obtained better results from early transplanting than late transplanting. So, selection of right type of variety and suitable age of seedlings for transplanting are most important factors for maximizing yield. Response to planting date varies with varieties. Yield of rice also differs due to growing environment, such as different locations, seasonal fluctuations and different dates of transplanting etc. (Sarker, 2002) [13].
Therefore, effort should be made to improve the productivity of aromatic rice through agronomic manipulation including selection of suitable aromatic varieties and age of seedlings for transplanting. Also, there comparative analysis in Varanasi is still not be done. Keeping these facts in view, the present investigation was under taken to study the performance of aromatic varieties and age of seedling on yield and nutrient uptake of rice under irrigated ecosystem.

Materials and Methods
An experiment was conducted during *Kharif* 2015, at Agriculture Research farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India (situated at 25º02' N latitude and 83º03' E longitude with an altitude of 128.93 m above mean sea level). The soil was sandy clay loam in texture having a *p*H of 7.52, EC 0.30 (dSm^{-1}) organic Carbon 0.41%,

total N 213.10 kg ha^{-1}, available phosphorus 25.60 kg ha^{-1} and available potassium 156.80 kg ha^{-1}. The experiment was conducted in Randomized Complete Block Design (RCBD) with replicate thrice consists of four age of seedling levels (10 days, 14 days, 18 days under System of rice intensification (SRI) and rest 21 days under standard management practice (SMP)) and three varieties (Kalanamak, Adamchini and Badshahbhog).

The crop was transplanted in the 1st week of July in main field. In SRI method 10, 14 and 18 days old-seedlings were transplanted on the puddled field at the rate of one seedlings hill-1 by maintaining row spacing of 25 × 25 cm. But in SMP method, 21days old-seedlings were transplanted on the puddled field at the rate of three seedlings hill-1 by maintaining row spacing of 20 × 20 cm.

Full dose of P, K and half dose of N fertilizer was applied at the time of transplanting and rest half dose of N in two equal splits. Rice from each net plot in each replication was harvested and dried. The grains after threshing were weighed and recorded as grain yield per net plot. Further, this net plot grain yield was converted to grain yield per hectare.

Chemical analysis of plant sample

The plant samples were taken from each plot at the time of harvesting for estimation of N, P and K concentration. The samples were oven dried, then finely grinded with electric grinder and analyzed for nitrogen, phosphorus and potassium concentration. N, P and K uptake in grain and straw samples were calculated by multiplying per cent nutrient content with their respective dry matter accumulation as per the formula given below:

$$\text{Nutrient uptake (kg ha}^{-1}) = \frac{\text{Nutrient content (\%) x dry matter accumulation (kg ha}^{-1})}{100}$$

Nitrogen content of grain and straw were estimated by modified micro-kjeldhal's method as outlined by Jackson (1967) [9] and expressed in per cent. The phosphorus content of grain and straw were determined by Vanadomolybdo phosphoric acid method and absorbance of the solution was recorded at 430 nm using spectrophotometer (Jackson, 1967) [9] and potassium content in plant sample (grain and straw separately) was determined by flame photometer method (Jackson, 1967) [9].

Chemical analysis of soil

Representative soil samples from the experimental plot were drawn from the top 15 cm depth before sowing of the crop. Soil samples thus collected were air dried under shade, powdered with wooden mallet and passed through 2 mm sieve and analyzed for nitrogen, phosphorus and potassium content. Soil nitrogen was determined by alkaline permanganate method as outlined by Subbiah and Asija (1956) [17]. Phosphorus was determined by Olsen *et al*., 1954 and potassium was determined by ammonium acetate extractable K method using flame photometer as outlined by Jackson (1973) [8].

Statistical analysis and interpretation of data

Data recorded on various parameters of the experiment was subjected to analysis by using Fisher's method of analysis of variance (ANOVA) and interpreted as outlined by Gomez and Gomez (1984) [6]. The levels of significance used in 'F' and 't' test was p= 0.05. Critical difference values were calculated where F test was found significant.

Results and Discussion

Grain and straw yield

The outcomes of the study showed that different varieties and age of seedlings was significantly influence the grain and straw yield of aromatic rice presented in Table-1. Data indicated that among the aromatic varieties, Adamchini recorded maximum grain yield (2710 kg ha-1) which was significantly superior to the other varieties and magnitude of increase over Kalanamak and Badshahbhog was 11.70% and 2.46%, respectively. However, Adamchini variety remained statistically at par with Badshahbhog variety. The increased yield may be due to maximum panicle weight, more number of grains panicles-1 and more number of panicle m-2 (Choudhary *et al*., 2018a) [2]. Whereas, the maximum straw yield was noted in Badshahbhog (5900 kg ha-1) which proved significantly superior to Adamchini and Kalanamak. The increase in straw yield due to the genetic makeup of the variety Netam *et al*., 2008, Singh *et al*., 2012 and Chetri *et al*., 2015).

In respect to age of seedlings, highest grain yield (2715 kg ha-1) was recorded with 14-day old seedling under SRI which exhibited superiority over 10-day and 18-day old seedling under SRI and 21-day old seedling under SMP. However, it remained statistically at par with 18-day under SRI. This was due to the maximum number of panicles m-2 with 14-day old seedling under SRI. The number of panicles m-2 depends on age of seedling; younger seedlings recorded maximum tillering than aged seedlings (Styger *et al*., 2011; Singh and Singh 2012) [14, 15]. But in 10-day old seedling under SRI produce less number of tiller due to transplanting shock. Whereas, the maximum straw yield was registered under 14-day old seedling (5284 kg ha-1) closely followed with 21-day old seedling under SMP (5183 kg ha-1) and 18-day old seedling under SRI. This was also due to the genetic makeup of the variety Singh *et al*., 2012 and Chetri *et al*., 2015) [14, 1].

Table 1: Effect of aromatic varieties and age of seedlings on grain and straw yield of rice

Treatments	Grain Yield (kg ha^{-1})	Straw Yield (kg ha^{-1})
Varieties		
Kalanamak	2426	4624
Adamchini	2710	5030
Badshahbhog	2645	5900
SEm±	26.31	37.40
LSD(*P*=0.05)	77.17	109.69
Age of seedlings		
10-day under SRI	2450	5088
14-day under SRI	2715	5284
18-day under SRI	2631	5181
21-day under SMP	2579	5183
SEm±	30.38	43.18
LSD (*P*=0.05)	89.11	126.65

Nutrient Concentration

The nitrogen (Table-2) and phosphorus (Table-3) content in grain and straw as influenced by different aromatic varieties except potassium content (Table-4) which was found to be non-significant. Highest N and P concentration in grain and straw was recorded in variety Kalanamak over Adamchini and Badshahbhog with non-significant difference in phosphorus content in straw yield. In terms of age of seedlings, non-significant difference was observed in all the treatments.

Table 2: Effect of aromatic varieties and age of seedlings on Nitrogen concentration and uptake of rice

Treatments	Nitrogen Content (%)		Nitrogen uptake (kg ha^{-1})	
Varieties	**Grain**	**Straw**	**Grain**	**Straw**
Kalanamak	1.054	0.380	25.55	17.59
Adamchini	0.977	0.357	26.49	17.97
Badshahbhog	0.944	0.351	24.96	20.68
SEm±	0.025	0.008	0.65	0.48
LSD (*P*=0.05)	0.073	0.024	NS	1.42
Age of seedlings				
10-day under SRI	1.007	0.366	24.61	18.60
14-day under SRI	0.992	0.375	26.84	19.79
18-day under SRI	0.985	0.355	25.91	18.32
21-day under SMP	0.983	0.354	25.30	18.29
SEm±	0.029	0.010	0.75	0.56
LSD (*P*=0.05)	NS	NS	NS	NS

Table 3: Effect of aromatic varieties and age of seedlings on Phosphorous concentration and uptake of rice

Treatments	Phosphorous Content (%)		Phosphorous uptake (kg ha^{-1})	
Varieties	**Grain**	**Straw**	**Grain**	**Straw**
Kalanamak	0.384	0.0365	9.33	1.68
Adamchini	0.375	0.0370	10.16	1.86
Badshahbhog	0.356	0.0362	9.43	2.13
SEm±	0.006	0.002	0.20	0.09
LSD (*P*=0.05)	0.017	NS	0.59	0.27
Age of seedlings				
10-day under SRI	0.368	0.0358	9.02	1.82
14-day under SRI	0.378	0.0368	10.26	1.94
18-day under SRI	0.371	0.0370	9.74	1.92
21-day under SMP	0.370	0.0366	9.55	1.90
SEm±	0.007	0.002	0.23	0.11
LSD (*P*=0.05)	NS	NS	0.68	NS

Table 4: Effect of aromatic varieties and age of seedlings on Potassium concentration and uptake of rice

Treatments	Potassium Content (%)		Potassium uptake (kg, ha^{-1})	
Varieties	**Grain**	**Straw**	**Grain**	**Straw**
Kalanamak	0.406	1.395	9.86	64.51
Adamchini	0.413	1.365	11.19	68.62
Badshahbhog	0.411	1.354	10.88	79.86
SEm±	0.010	0.015	0.28	1.03
LSD (*P*=0.05)	NS	NS	0.83	3.01
Age of seedlings				
10-day under SRI	0.411	1.389	10.07	70.58
14-day under SRI	0.413	1.367	11.22	72.16
18-day under SRI	0.409	1.371	10.75	71.00
21-day under SMP	0.408	1.357	10.54	70.25
SEm±	0.011	0.018	0.33	1.19
LSD (*P*=0.05)	NS	NS	NS	NS

Nutrient uptake

Different aromatic varieties significantly influence the nitrogen, phosphorus and potassium uptake (Table 2-4) by grain and straw except nitrogen in grain. Highest uptake of total phosphorous and potash by grains was recorded with variety Adamchini followed by Badshahbhog. This might be due to higher grain yield of Adamchini (Choudhary *et al*., 2018b) [3]. Whereas, NPK uptake by grain as well as straw was not influenced with age of seedlings except phosphorous uptake in grain.

Conclusion

From data presented it might reasonably be argued that the highest yield and nutrient uptake of rice was recorded with variety Adamchini followed by Badshahbhog and Kalanamak. However, among the age of seedlings, 14 days seedlings produce maximum grain yield but the uptake of nutrients was not influenced with age of seedlings.

References

1. Chetri B, Ahmed S, Mahato SK, Singharoy AK. Farmers' response to the application of zinc in context of aromatic rice (*Oryza sativa* L.) Varieties. International Quarterly Journal of Environmental Sciences (The Ecoscan). 2015; 9(1&2):271-276.
2. Choudhary K, Bharti B, Kumar S. Effect of irrigation scheduling on yield and nutrient uptake of different direct seeded basmati rice varieties. Green Farming. 2018b; 9(5):824-827.
3. Choudhary K, Bharti B, Saha A, Kumar S. Growth and yield assessment of direct seeded basmati rice under different irrigation schedules. Journal of Hill Agriculture. 2018a; 9(1):55-59.
4. Farooq U, Iqbal M, Bashir A. Cost and Revenue Statistics of Paddy Production: Farmers' Perspective. International Journal of Agricultural Biology. 1999; 1:13-8.
5. Gangaiah B, Prasad R. Response of scented rice (*Oryza sativa* L.) to fertilizers. Indian Journal Agronomy. 1999; 44:294.
6. Gomez AK, Gomez AA. Statistical Procedures for Agriculture Res. Awiley-Inter Sci. Publication. Johan Wiley and Sons, New York, 1984, 680.
7. Hedayetuallah S, Sen S, Nair KR. Influence of date of planting and spacing some winter varieties of rice. Indian Journal of Agricultural Science. 1994; 14(3):248-259, 1994.
8. Jackson ML. Soil chemical analysis. Asia publication house, Bombay, 1973, 165-167.
9. Jackson ML. Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi, 1967, 38-226.
10. Nayak AR, Reddy JN, Pattnaik AK. Quality evaluation of some Thailand and Vietnam scented rice. Indian Journal of Plant Genetics. 2002; 15(2):125-127.
11. Netam AK, Sarawgi SK, Purohit KK. Performance of integrated nutrient management on growth, soil nutrient status and yield of traditional scented rice (Oryzq sativa L.) varieties. Journal of Agricultural Issues. 2008; 13(1):115-118.
12. Olsen SR, Cole CV, Watanable FS, Dean LA. Estimation of available phosphorus in soils by extracting with sodium bicarbonate. United State Department of Agriculture Circulation, 1954, 939.
13. Sarker U. Stability for grain yield under difference planting times in rice. Bangladesh Journal of Agricultural Research. 35(2):425-430, 2002.
14. Singh P, Panotra N, Singh P, Singh KN, Kanht RH. Spikelet sterility, harvest index and yield of rice (Oryza sativa) cultivars as influenced by low temperature and transplanting dates in temperate Kashmir. Indian Journal of Agronomy. 2012; 57(4):362-366.
15. Singh RN, Singh RK. 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. 2012; 3(1):41-46.

16. Styger E, Aboubacrine G, Attaher MA. The system of rice intensification as a sustainable agricultural innovation: introducing, adapting and scaling up a system of rice intensification practices in the Timbuktu region of Mali. International Journal of Agricultural Sustainability. 2011; 9:67-75.
17. Subbiah BV, Asija GL. A rapid procedure for the estimation of available nitrogen in soil. Current Science. 1956; 25:259-260.
18. Van Heemst HDJ. Crop phenology and dry matter distribution in Modeling of Agricultural production. Weather. Soils and Crops. Wageningen. Pudo, 1986, 27-40.