

Effect of Age of Seedlings and Split Application of Nitrogen on Growth, Yield and Quality of Coarse Grain Variety of Rice (*Oryza sativa* L.)

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ABSTRACT

An experiment was conducted at Instructional Farm, Department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during Kharif season of 2019-2020. The experiment consisted of randomized block design having factorial arrangement in three replications. In this experiment, 12 treatment combinations including four different age of seedlings D₁- 12 days, D₂- 18 days, D₃- 24 days and D₄- 30 days old seedlings, while three levels of nitrogen viz., N₁- 100% RDN as basal, N₂- 50% RDN as basal + 50% RDN at tillering stage and N₃- 50% RDN as basal + 25% RDN at tillering stage + 25% at panicle initiation, it was found that age of seedlings and nitrogen levels significantly affected plant height, number of leaves per plant, number of grains/panicle, thousand grain weight, grain and Stover yield of rice. Higher plant height of rice was recorded under the treatment combination consisting of transplanting of 12- days old seedling with application of nitrogen in three split doses with the respective values of 50.13, 78.98 and 99.52 cm at growth stage of 30, 60 and 90 DAT, respectively. Similarly, resulted in significantly maximum total number of grains per panicle of rice was recorded under the treatment combination consisting of transplanting of 12- days old seedling with application of nitrogen in three split doses with the respective values of 187.93. It was concluded from highest grain yield per hectare of rice was recorded under the treatment combination consisting of transplanting of 12- days old seedling with application of nitrogen in three split doses with the respective values of 64.61 q/ha.

Keywords: Rice, Nitrogen, Seedling, Grains/panicle, Grain weight, Stover yield

INTRODUCTION

Rice (*Oryza sativa* L.) is the most important and widely cultivated crop of the world. Rice crop belongs to family Gramineae. Rice is cultivated in about 157.8 m ha which produce about 749.1 mt of rice grain (FAO, 2015).

Rice is the cultivated in almost all states of India. 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).

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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. Seedling age at transplanting is an important factor for uniform stand of rice and regulating its growth and yield. Tillering is an important agronomic trial which finally determines the number of panicles, grains and grain yield per unit land area. Tillering dynamics of the rice plant greatly depends on the age of seedling at transplanting (Pasuquin et al., 2008). Younger seedlings can relieve the transplanting stress in a shorter period of time compared to that of older seedling due to increased N-content in the former (Yamamoto et al., 1998).

Rice is a poor use of nitrogen with nitrogen use efficiency (NUE) ranging from 30-50%. In the soil, Nitrogen is lost through nitrate-nitrogen ($\text{NO}_3\text{-N}$) leaching, ammonia (NH_4^+) volatilization, surface runoff, and denitrification resulting in 30-50 % nitrogen use efficiency (NUE) only (Shivay et al., 2005). In lowland rice ecosystem, nitrogen use efficiency can be increased by adding a nitrification inhibitor (NI) with the nitrogenous fertilizers split application of nitrogenous fertilizers is one of the strategies for efficient use of nitrogen throughout the growing period by synchronizing with plant demand, reducing de-nitrification losses and improved nitrogen uptake (Hirzel et al., 2011).

Keeping this aspect in mind, the present investigation is planned with the objectives to study the age of seedlings and nitrogen levels on optimizing the crop growth and grain yield.

MATERIALS AND METHODS

Experiment was carried out at the Instructional Farm, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during *Kharif* season 2019-2020. The experiment was conducted in randomized block design with Factorial concept with three replications. Different age of seedlings and split application of nitrogen allocated as per treatments, combinations including four age of seedlings (D_1) 12 days,

(D_2) 18 days, (D_3) 24 days and (D_4) 30 days old seedlings, while three levels of nitrogen viz., N_1 - 100% RDN as basal, N_2 - 50% RDN as basal + 50% RDN at tillering stage and N_3 - 50% RDN as basal + 25% RDN at tillering stage + 25% at panicle initiation. The gross and net plot size was 5 m x 3 m, respectively. The experimental plots were fertilizers as per treatments.

RESULTS AND DISCUSSION

The result shows that plant height, number of leaves per plant, number of grains/panicle, thousand grains weight, grain and Stover yield was influenced significantly due to different concentrations of age of seedlings and nitrogen levels.

Data regarding plant height and number of leaves per plant are reported in (Table-1). Statistical analysis of the data revealed that maximum plant height and number of leaves per plant (96.02 cm and 61.36, respectively) were recorded in plots treated with the 12 days old seedlings while, lowest values were observed in plot that received 30 days old seedlings. However, nitrogen levels three split doses gave maximum plant height and number of leaves per plant value of 90.36 cm and 58.82, respectively.

As regards split nitrogen application, increased height in N_3 (50% RDN application at the time of transplanting, 25% RDN application at the time of tillering and 25% RDN application at the time of panicle initiation in 3 equals) up to 90 days after transplanting (DAT) was due to increased availability of nitrogen. Nitrogen being essential constituent of plant tissues, induces rapid cell division. Increased height of plant was due to the nitrogen management provided specific amounts of nitrogen as per crop need throughout the growing season and reduced leaching of nitrate (NO_3^-) in the soil. Sathiya and Ramesh (2009) also reported significantly higher plant height with nitrogen application in splits.

The age of seedling to transplanting and recommended dose of nitrogen in three splits were found to significantly improve test

weight. The significantly highest test weight of rice was recorded under the treatment combination consisting of transplanting of 12-days old seedling with application of nitrogen in three split doses with the respective values of 23.01g.

The age of seedling to transplanting and recommended dose of nitrogen in three splits were found to significantly improve grain yield per hectare. The significantly highest grain yield per hectare of rice was recorded under the treatment combination consisting of transplanting of 12- days old seedling with application of nitrogen in three split doses with the respective values of 64.61 q/ha.

The age of seedling to transplanting and recommended dose of nitrogen in three splits were found to significantly improve straw yield per hectare. The significantly highest straw yield per hectare of rice was recorded

under the treatment combination consisting of transplanting of 12- days old seedling with application of nitrogen in three split doses with the respective values of 82.33 q/ha.

The higher straw yield obtained with 12-days old seedlings was mainly attributed to more plant height, higher number of leaves, higher number of tillers and dry matter production compared to other three age of seedlings. These findings confirm some earlier studies on younger seedlings with the findings of Ajit Kumar et al. (2002).

The higher straw yield obtained with three splits doses of nitrogen was mainly attributed to more plant height, higher number of leaves, higher number of tillers and dry matter production compared to other application. These findings confirm some earlier studies on split application of nitrogen with the findings of Shukla et al. (2015).

Table 1: Influence of Age of Seedlings and Split Application of Nitrogen on Growth and Yield and Quality of Rice

Treatment	Plant height (cm)	Number of leaves/ Plant	Number of grains/ Panicle	Test weight (g)	Grain yield (q/ha)	Stover yield (q/ha)
Effect of age of seedlings						
D ₁	96.02	61.36	179.93	22.15	56.79	73.99
D ₂	92.70	58.53	173.67	21.56	46.69	62.37
D ₃	85.78	54.62	160.51	20.92	36.18	49.66
D ₄	74.49	49.11	145.20	20.16	30.43	43.43
SEm±	0.35	0.28	0.62	0.09	0.63	0.85
CD	1.04	0.83	1.83	0.27	1.84	2.48
Effect of nitrogen levels						
N ₁	82.96	53.27	157.18	20.83	38.52	53.08
N ₂	88.43	56.27	167.32	21.14	43.30	58.27
N ₃	90.36	58.22	169.98	21.62	45.74	60.73
SEm±	0.31	0.24	0.54	0.08	0.54	0.73
CD	0.90	0.72	1.58	0.24	1.59	2.15
Interaction effect of age of seedlings and nitrogen levels						
D ₁ N ₁	91.26	58.00	170.07	21.46	47.56	63.24
D ₂ N ₁	90.98	57.07	168.27	21.29	43.62	59.32
D ₃ N ₁	79.11	52.33	154.80	20.74	35.37	48.56
D ₄ N ₁	70.48	45.53	135.60	19.83	27.55	41.19
D ₁ N ₂	97.27	61.73	181.80	21.99	58.21	76.40
D ₂ N ₂	92.69	58.27	175.40	21.56	47.79	63.43
D ₃ N ₂	88.32	55.20	162.47	20.92	36.07	49.52
D ₄ N ₂	75.45	49.87	149.60	20.11	31.15	43.75
D ₁ N ₃	99.52	64.33	187.93	23.01	64.61	82.33
D ₂ N ₃	94.45	60.27	177.33	21.85	48.67	64.37
D ₃ N ₃	89.92	56.33	164.27	21.10	37.11	50.89
D ₄ N ₃	77.55	51.93	140.40	20.53	32.59	45.35
SEm±	0.61	0.49	1.08	0.16	1.09	1.46
CD	1.80	1.43	3.17	0.47	3.18	4.29

SUMMARY AND CONCLUSION

Based upon this experiment it is concluded that the treatment combination consisting of transplanting of 12- days old seedling with application of nitrogen in three split doses recorded the maximum seed yield 64.61 q/ha with total cost of cultivation of Rs. 32612.00.

The treatment combination consisting, transplanting of 12- days old seedling with application of nitrogen in three split doses recorded the maximum and significantly higher net monetary returns (Rs. 105154.50/ha) and B:C ratio (3.22:1).

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