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Nursery Management in *boro* rice Seedling through different dates of Sowing

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ABSTRACT
The present study was carried out during 2015-16 in Kishanganj, Katihar and Purnea districts of Bihar. In order to identify the appropriate date of seed sowing in boro rice, variety IR 64 was sown in the farmers' field at 15 locations in five blocks of three districts on four different dates at 10 day interval starting from 30th October, 2015. To assess the seedling vigour, observations on seedling height, number of leaves per seedling and seedling colour were recorded at 30, 45 and 60 days after seeding. Results revealed that early sowing of nursery at the end of October resulted in higher seedling height and more number of leaves per seedling but, it also resulted in more seedling discoloration and more incidence of disease occurrence as the seedling remained in the bed for a longer period. Delayed sowing by the end of November resulted in shorter seedlings with lesser leaves per seedling and more leaf yellowing. Seed sowing on 10th November and 20th November produced seedlings with optimum vigour without much leaf yellowing after 60 DAS. Therefore, these two are the optimum dates of seed sowing in boro rice for transplanting 60 days old seedling in the month of January-February for rice-potato-rice and rice-mustard-rice cropping system.

Key words: *Boro rice, Nursery, Seedling Colour, seedling vigour, seedling height, IR 64*

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INTRODUCTION

Boro rice(*Oryza sativa* L.) is an ancient system of rice cultivation in Eastern India and Bangladesh. It has been traditionally grown during winter season (Oct-Nov to May-June) in the deeply flooded areas of West Bengal, North East Bihar, Eastern Uttar Pradesh and Assam in Eastern India and in the Sylhet, Mymensingh and Faridpur districts in Bangladesh. Apart from these, there is no equivalent of boro rice in any other country. However, the rice culture *Mayin* (winter rice) in Myanmar is closest to boro rice with similar cropping period.Boro rice is grown in low lying areas in the flood prone ecosystem in dry season. It takes advantage of the residual water in the field after harvest of dry season paddy. *Boro* rice is the most productive season for growing rice. Higher productivity of boro rice is mainly due to higher solar radiation, lower night temperatures during early crop growth, and favorable temperatures during grain filling and ripening periods [9]. Farmers are encouraged to take up its cultivation in the season when irrigation facilities are available. It possesses an inherent high yield potential due to availability of good sunshine during growing season, good water control, less risk of crop failure (due to no flood and drought), high input use and less incidence of insect pests and diseases at some extent.The area under boro rice cultivation in India is 0.439 million ha approximately out of which 0.1 million ha in Bihar. Productivity of boro rice is much higher as compared to *kharif* rice in the same ecology. Compared to the 2-3 t/ha yield level of *kharif* rice varieties the newly developed boro rice varieties can yield as high as 5-7 t/ha.*'Gautam'* one of the released varieties, from Rajendra Agricultural University, Pusa (Samastipur) has recorded yields between 8-10 t/ha. Even on farmer's fields. [11]. Despite the higher cost of cultivating *boro* rice the returns per ha. are significantly higher than *kharif* rice.

MATERIAL AND METHODS

The present study was carried out during 2015-16 in Kishanganj, Katihar and Purnea districts of Bihar.These regions are located at 26º07.846'N,25º38.747'N & 25º46.245'Nlatitude 087º56.344E, 087º43.980E & 087º28.387E longitude 36, 36& 37 m above mean sea level.As per the agro-climatic zones classification, these districts are located in agro-climatic Zone II of Bihar. The average annual rainfall in Zone II is 1382.2 mm. Flood situation is most severe in the region. This is because almost all the major rivers enter in the region from Nepal. In Eastern IGP of Bihar, the major *boro* rice growing districts arePurnea, Katihar, Saharsa, Supaul, Arariya, Kishanganj, Madhepura and Khagaria. The area under boro rice cultivation is dependent on the occurrence of flood.

In order to identify the appropriate date of seed sowing in *boro* rice, variety IR 64 was sown in the farmers' field at 15 locations in five blocks (viz: Kishanganj, Kadwa, Pranpur, Amour &Baise) of three districts with three replicateson four different dates at 10 day interval starting from 30.10.2015. To assess the seedling vigour, observations on seedling height, number of leaves per seedling and seedling colour were recorded at 30, 45 and 60 days after seeding.

Analysis of Data

The data on different characters were subjected to estimates of ANOVA (analysis of variance) by using statistical software OPSTAT.

RESULTS AND DISCUSSION

Results revealed that early sowing of nursery at the end of October resulted in higher seedling height and more number of leaves per seedling but, it also resulted in more seedling discoloration and more incidence of disease occurrence as the seedling remained in the bed for a longer period. Delayed sowing by the end of November resulted in shorter seedlings with lesser leaves per seedling and more leaf yellowing. Seed sowing on 10th November and 20th November produced seedlings with optimum vigour without much leaf yellowing after 60 DAS. The mean values of the observation are presented in Table 1.

Table1. Mean values of seedling growth parameters at different dates of sowing

Date of nursery seeding	Seedling height (cm)			Number of leaf/seedling			Seedling colour		
	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
30-10-2015	13.21	15.30	22.64	4.20	4.60	5.60	3.00	5.40	6.20
10-11-2015	10.48	13.12	19.98	3.60	4.40	5.40	3.00	6.20	3.80
20-11-2015	8.80	11.20	19.92	2.60	3.40	5.40	2.20	5.40	3.80
30-11-2015	7.28	10.00	17.04	2.20	2.80	4.20	1.40	5.00	6.20
SEm±	0.41	0.42	1.68	0.25	0.28	0.34	0.29	0.50	0.54
C.D. at 5%	1.26	1.30	NS	0.77	0.87	NS	0.92	NS	1.67
CV (%)	9.12	7.50	18.90	17.63	16.47	14.94	27.43	20.46	23.94

To assess the soil status of the farmers' field, soil sample were collected from the field of each farmer. The samples were analyzed for different physico-chemical parameters. The result is summarized below in Table 2.

Table 2: Soil properties

Name of District	pH	EC (dS/m)	OC (%)	N (kg/ha)	P (kg/ha)	K (kg/ha)
Katihar	5.5 - 7.6	0.08 -0.14	0.26 -0.48	376	18.28	219
Purnia	4.4-6.5	0.06 - 0.10	0.30 – 0.50	320	28.96	218
Kishanganj	4.18- 4.37	0.09 -0.10	0. 50 – 0.70	383	15.27	161

Soil analysis revealed that the soils of Katihar districts were slightly acidic to normal in reaction (pH 5.5-7.6), Purnia; acidic to near normal (pH 4.4-6.5) and Kisanganj; acidic (pH

4.18-4.37).However, the organic carbon content in Kishanganj soils was higher (0.50-0.70) as compared to Purnia (0.30-0.50) and Katihar (0.26-0.48) soils. Nitrogen content was in medium range in all the districts, whereas the phosphorus content in katihar and Kishanganj soils was medium (15.27 to 18.28 kg/ha), but it was high in Purnia district (28.96 kg P/ha). The potassium content was medium in all the soils of all three districts and varied from 161 kg/ha in Kishanganj to 219 kg/ha in Katihar. On the basis of soil study, fertilizers were used according to soil type to maintained soil nutrient level at these locations. All the three selected districts are severely affected by flood (Table 3).

Table 3. Flood affected cropped areas in selected districts

District	**Flood affected area**	
	Area (000 ha)	Cropped area affected (%)
Katihar	194	70.00
Purnia	119	40.60
Kishanganj	39	22.80

However, the main environmental factor limiting *boro*rice cultivation is the cold stress. Cool water and air temperature affect the seedling growth, tillering ability, plant height and crop duration and cause yellowing of leaves and high sterility.Minimum temperature falls down to as low as 6-10^{0} C during seedling stage, 15^{0}C in the vegetative stage 15-20^{0} during PI stage and 35-40^{0} C during harvesting that are detrimental for obtaining potential yield. The maximum and minimum temperature of last 14 years throughout the nursery period of these three districts are sown by graph (fig 1).

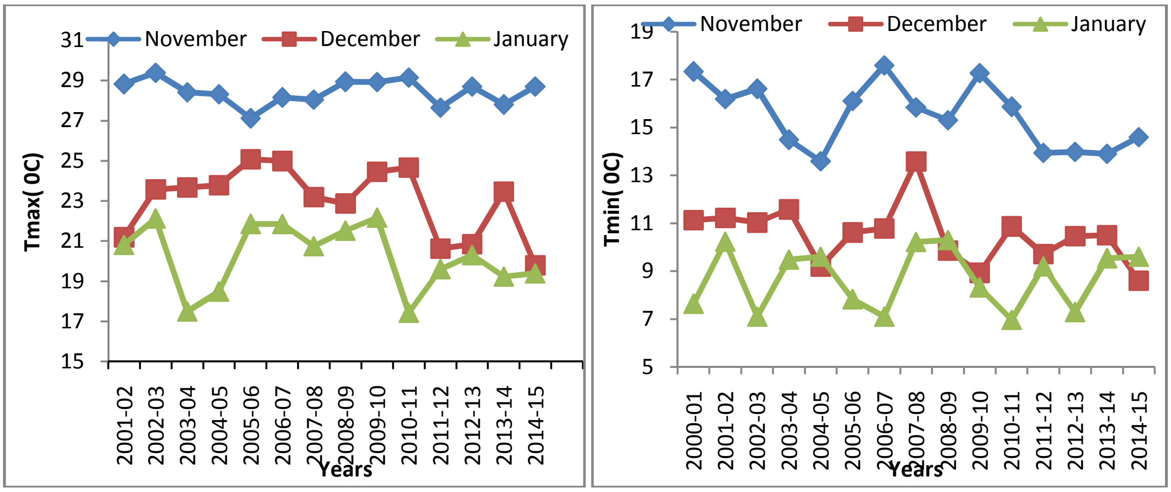

Fig 1:Temperature (max and min) variation during nursery management of Boro rice

There are many reasons for reduction in yield of boro. The important one is use of unsuitable aged seedlings and different water levels by farmers. The combined effect of these factors usually produces high seedlings mortality just after transplanting. Seedlings age at transplanting is an important factor for uniform stand of rice and regulating its growth and yield [1]. Tiller dynamics of the rice plant greatly depends on the age of seedlings at transplanting [7]. Tillering and growth of rice proceed normally when optimum aged seedlings are transplanted at the right time [6]. If the age of seedlings is increased than optimum, the seedlings produce fewer tillers due to reduced vegetative periodthereby resulting in poor yield [8]. When seedlings stay longer in nursery bed, primary tiller buds on the lower nodes of the main culm often degenerate. Primary tiller buds of 4th to 7th nodes are held inside when seedlings are planted at 7th leaf age [5]. Seedling age at staggered transplanting is an important factor due to its tremendous influence on plant height, tiller production, panicle length, grains panicle^{-1} and other yield contributing characters [3]. Younger seedlings produced more tillers than the older ones due to quick regeneration of seedlings and plant vigour. Similar trends were also reported by Haque [2] and Luna *et al.* [4].

Temperature in EIGP starts declining from November and reaches the lowest in January. It rises from the month of February onwards. During the month of December and January the average minimum temperature falls below 8^0 C. The period coincides with seedling stage in *boro* rice. Low temperature causes poor seed germination, stunted seedling, poor seedling vigour, seedling chlorosis and mortality and prolongation of crop duration. All these factors adversely affect the *boro* rice productivity. The numerical values for seedling colour were assigned in the scale of 1-9 (1 Seedlings dark green, 3. Seedlings light green, 5. Seedlings yellow, 7. Seedlings brown and 9. Seedlings dead) based on Standard Evaluation System for Rice (SES) of IRRI-2002.Under severe cold, the colour of leaves become bronze and seedling may die (Fig 2). In extreme cold conditions,the low temperature may cause the complete mortality of the seedlings. The early sown seedlind was severely affected by disease and pest. The disease causes reduction not only in quality and quantity of the produce, but also reduces the germination vigour of the infected seedlings [10]. Low temperature causes poor germination and seedling emergence, stunted seedling, poor seedling vigour, seedling chlorosis and mortality and prolongation of crop duration.All these factors adversely affect the *boro* rice productivity.

Fig 2: Death of seedling

Fig 3: Nursery of boro rice at different dates.

CONCLUSION

Therefore, 10-20th November is the optimum dates of seed sowing in *boro* rice for transplanting 60 days old seedling in the month of January-February for rice-potato-rice and rice-mustard-rice cropping system.Boro rice cultivation despite being a new phenomenon in Bihar plains has been able to make a significant impact in the economy of North Bihar areas, which could be achieved through their own innovative approach and a little help from the scientists. The study strengthened the belief that farmers are better innovators and a little support to them in terms of research and infrastructure could lead to even better results.It can thus be said that future food needs of the eastern India can be successfully met by extending the area under boro rice where ever possible, and to achieve this objective research efforts should be directed towards developing varieties which suit the needs of the farmers along with high yields which has become a characteristic feature of boro rice.

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