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Effect of staggered planting and crop establishment methods on scented organic rainfed rice

K. Thakuria*, P. Bharali and C. Thakuria

Department of Agronomy,
Assam Agricultural University, Jorhat-785 013, Assam, India.
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ABSTRACT

A field experiment was carried out during *kharif* (*sali*) 2016 at Jorhat, Assam to study the performance of two scented local varieties (Kalajoha and Bakuljoha) of rice under different staggered planting and crop establishment methods (transplanting and throwing of seedlings). Both the varieties were comparable in respect of grain and straw yields. However, delay in planting beyond 20th July with 30 days seedlings upto 20th September using 90 (30+60) days double planted seedlings significantly reduced the yield of rice. Transplanting of seedling significantly increased the grain and straw yields over the throwing of seedling method. Variety 'Bakuljoha' recorded significantly higher net returns and benefit-cost ratio-when transplanted on 20 July over-other planting methods and dates.

Key words: Age and type of seedling, Crop establishment, Organic, Scented rice, Staggered planting.

Rice is the major food crop of Assam occupying the largest cropped area of 25.03 lakh ha with an annual production of 51.93 lakh tones. Among different rice crops grown in Assam, *kharif* (*sali*) rice occupies maximum area of 18.81 lakh ha with a productivity of 20.02 q/ha (Anonymous, 2014). Rice is cultivated by different methods though conventional (manual) transplanting in puddled soil is the most dominant and traditional method followed in *sali* rice cultivation. Transplanting cost is equal about 15 per cent of total rice production cost (Ponnuswamy *et al.,* 1999). Sometime transplanting is delayed owing to labour shortage and higher charges during the peak growing period of rice. To overcome the problems of labour, farmers have to adopt a labour and time saving planting technique.

In Assam, *Sali* rice is transplanted during June-July depending on the onset of monsoon. However, in certain situations due to adverse seasonal conditions and late onset of monsoon there are chances of delayed transplanting causing reduction in yield. Use of overaged and double planted seedlings influence the general performance and yield of the crop. Different rice varieties including scented rice may perform differently under such situation. Hence, an attempt was made to study the performance of two organically grown local scented rice varieties planting in different dates using seedlings of varying ages and types with two planting methods.

A field experiment was conducted under rainfed condition during *kharif* (*sali*) season of 2016 in the organic block of Assam Agricultural University, Jorhat to study the performance of scented rice under different planting dates using different aged seedlings and planting methods. The experiment was laid out in Split-plot design with three replications. The treatments consisted of two local scented varieties of rice (Kalajoha and Bakuljoha) allocated in main plots and combinations of five planting dates with age and type of seedlings (Table 1) and two establishment methods (transplanting, and throwing of seedlings) in sub-plots. The soil of the experimental plot was medium in organic carbon (0.58%), available P (10.5 kg/ha) and available K (140.9 kg/ha) but low in available N (260.2 kg/ha) with acidic pH (5.8). Transplanting was done as per treatment at a spacing of 20 cm x 10 cm and in case of throwing of seedlings equal number of seedlings were used with that of normal transplanting treatment maintaining equal population density per unit area. Rice seedlings were raised in primary nursery on 20 June, 2016 for using both the types of seedlings. After 30 days, seedlings from primary nursery were uprooted and closely transplanted (10 cm x 10 cm) with 2-3 seedlings/hill in the secondary nursery for double transplanting/ throwing. The seedlings from normal (primary) and secondary nursery were uprooted at the age of 30 and 60 days for transplanting on 20 July and 20 August, respectively in the main field with 2-3 seedlings or clones per hill as per treatment. Beyond 20th August, ten days planting interval was maintained upto 20th September and used only double planted seedlings with the age of 70, 80 and 90 days, respectively. A uniform dose of FYM @ 5 t/ha was applied as half at the time of final puddling and remaining half dose after 30 days of planting as per treatment. Other cultural operations were followed as per recommendation. Irrespective of planting dates and

*Corresponding author's e-mail: thakuria_k@yahoo.com

Table 1: Response of local scented rice cultivars to time of planting and crop establishment techniques.

Treatment	Plant height (cm)	No. of effective tillers/m^2	Panicle length (cm)	No. of filled grains/ panicle	1000 grain weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index (%)	Net return (Rs./ha)	Benefit-cost ratio
Variety										
Bakuljoha	101.3	211.8	23.1	116.8	10.97	1.32	2.96	30.84	44,975	1.99
Kalajoha	120.2	197.5	21.8	107.6	11.94	1.26	2.94	30.00	42,475	1.88
S.Em±	1.56	1.32	0.37	0.93	0.104	0.019	0.058	-	-	-
CD (P=0.05)	9.5	8.1	NS	5.6	0.63	NS	NS	-	-	-
Time of planting and age and type of seedling										
20thJuly (30 DNS)	121.5	237.3	22.6	121.6	11.57	1.75	4.24	29.22	68,875	3.09
20th August (60 DNS)	116.8	229.2	22.4	117.2	11.46	1.58	4.05	28.06	61,125	2.74
20th August (30+30 DPS)	115.4	223.1	23.6	112.4	11.56	1.48	3.40	30.33	53,415	2.35
30th August (30+40 DPS)	110.8	213.7	23.1	108.7	11.48	1.29	3.09	29.45	44,275	1.94
10th September (30+50 DPS)	103.9	170.9	22.5	107.3	11.44	0.97	1.70	36.33	24,525	1.08
20th September (30+60 DPS)	96.3	153.7	20.6	106.0	11.24	0.65	1.22	34.76	9,325	0.41
S.Em±	1.02	3.03	0.24	1.01	0.064	0.033	0.065	-	-	-
CD (P=0.05)	2.8	8.4	0.7	2.8	0.18	0.09	0.18	-	-	-
Methods of establishment										
Transplanting	112.7	207.9	22.7	112.9	11.47	1.38	3.02	31.36	46,675	1.98
Throwing of seedling	108.8	201.4	22.3	111.5	11.45	1.19	2.89	29.17	40,425	1.87
S.Em±	0.59	1.75	0.14	0.58	0.037	0.019	0.037	-	-	-
CD (P=0.05)	1.6	4.8	NS	NS	NS	0.05	0.10	-	-	-

DNS = Days nursery seedling, DPS = Double planted seedling, NS = Non-significant.

methods of planting both the varieties of rice matured in the third week of November, 2016. Total rainfall received during the whole growing period of the crop was 632.8 mm.

Variety: Results indicated that both the scented varieties of rice could not influence the grain and straw yields significantly though slight increase in yields were recorded with, 'Bakuljoha' (Table 1). Signifcant increase in tillers/m^2 and filled grains/panicle in case of 'Bakuljoha' might have influence on grain and straw yields. Both the varieties being local and similar in plant architecture and duration, probably performed equally in respect of yield also. Similar results were reported by Gangwar and Sharma (1997) in Basmati type scented rice varieties.

Staggered planting: Irrespective of types of seedlings used, grain and straw yields decreased significantly and consistently with delay in planting from 20thJuly using 30 days old nursery seedling upto 20 September planting with 90 (30+60) days old double planted seedlings (Table 1). The decrease in grain yield with successive delay in planting from 20th July to 20th September was 9.7, 6.3, 12.8, 24.8 and 32.9 per cent. The corresponding decrease in straw yield was 4.5, 16.0, 9.1, 44.9 and 28.2 per cent. All the growth and yield attributing characters also decreased with delay in planting dates, recording the highest with 20th July and lowest with 20th September with delayed planting reflecting reduction in yield of rice. Significant reduction in yield with delayed planting might be due to low temperature and less time available for assimilation of photosynthates in grain besides use of overaged seedlings. Similar was the trend in net returns and benefit-cost ratio. Reduction in yield due to delay in planting was also reported by Changmai and Thakuria (2017), Singh and Thakur (1991), Thakur *et al.* (1996) and Thakuria *et al.* (2017).

Crop establishment method: Out of the two methods of crop establishment, line transplanting recorded significantly higher grain and straw yields over the throwing of seedling method. Under line transplanting there was 13.8 and 4.3 per cent increase in grain and straw yield, respectively over throwing of seedling method. The increase in yield under line transplanting may be owing to taller plants, higher effective tillers/m^2, more filled grains/ panicle and harvest index owing to proper placement spetially in the puddled field. The results corroborate the findings of Jaiswal and Singh (2001) and Singh (2012). Late establishment of seedlings in throwing of seedling method might have decreased the capacity to utilize the resources at the initial growth period. Non-uniform crop geometry in case of throwing of seedlings might be another reason for reduction in yield. The results are in contrast to those reported by Ponmuswamy *et al.* (1999) and Budhar and Tamilselvan (2002).

Line transplanted rice recorded higher net returns (Rs. 46,675/ha) and benefit-cost ratio (1.98) due to higher production of grain and straw though the cost of labour for throwing of seedling method was less as compared to line transplanting.

Overall, it could be concluded that local scented varieties of rice can be organically grown profitably with normal line transplanting in the month of July under rainfed condition of Assam.

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