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Original Research Article

Evaluation of Kalanamak Rice under Double (Kalam) Transplanting in Eastern Uttar Pradesh

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A B S T R A C T

Double-transplanting (Kalam) a crop establishment system for rice cultivation where farmers transplant Kalanamak rice seedlings twice, first on a piece of high land, and then in the main field after the recession of heavy rains . The seedlings are prepared in a seed bed for about a month. The seedlings are first transplanted in a plot called as "Kalam". Farmers transplant seedlings in the Kalam plot with closer spacing and large number of seedling per hill. The experiment consists of two treatment combinations, viz. 2 plant stand establishment methods (normal transplanting and double transplanting) in main plots. The average yield of Kalanamak rice grown under Kalam system was 3504 kg/ha, about 45.09% higher than that of Normal, the yield of rice was 3504 and 2415 kg/ha under Kalam and Normal transplanting systems due to reduce plant height, stem borer and no lodging respectively, per hectare cost of rice cultivation (Rs. 49175) under Kalam system is marginally higher than that of Normal (Rs. 47255), but the difference is not statistically significant. The technology of Kalam gave higher grass return of Rs. 157250/ha with a benefit cost ratio of 3.22 and additional net return of Rs.48700/ha as compared to Normal transplanting.

Keywords

Double transplanting, Economics, Rice, Kalam, Yield

Introduction

More than 90% of the world's rice is grown and consumed in Asia, where 60% of the calories are consumed by 3 billion Asians (Khush, 1997). India is one of the world's largest producers of white rice, accounting for 20 % of all world rice production. India stands first in area, second in production, followed and preceded by China on these two aspects. Now these days rice is excessively produced in whole of the world. Rice grain quality is a major factor from consumer as well as marketing point of view. Aromatic rice, which has stronger aroma and kernel elongation than ordinary rice, has more in demand in different countries of the world. The consumer demand has increased markedly to pay a premium price for fragrance (Louis *et al.*, 2005). Scented rices grow best and produce finest quality grains under cool, humid conditions, which are common in Himalayan Tarai of U.P and Uttarakhand and foot hills of Vindhya Hills. Hence Himalayan Tarai of Uttar Pradesh (U.P) and Uttarakhand is probably the place of origin of aromatic rices (Khush, 2000). Among non basmati aromatic rices,

Kalanamak is the most popular scented rice variety grown in Uttar Pradesh. It is among one of the most important scented rice varieties of India. This variety is famous for its taste and aroma. It is cooking at marriages is considered auspicious and its smoke is believed to be purifying the atmosphere. It derives its name from its black husk. It is grown widely in Tarai area of Uttar Pradesh adjoining Nepal particularly in the districts of Siddharthnagar, Santkabirnagar and Basti and in small pockets in districts Gorakhpur, Mahrajganj, Balrampur, Gonda, Bahraich, Shrawasti, Deoria and Padrauna (North Eastern Plain Zone of eastern UP). According to Singh *et al.,* (2006). Kalanamak is one of the finest quality scented rices of India. It derives its name from black husk (kala = black; the suffix 'namak' means salt). This variety is in cultivation since the Buddhist period (600 BC). Cooked rice is fluffy, soft, non-sticky, sweet, and easily digestible with relatively longer shelf-life. In local market it earns higher price than Basmati rice, which is approximately 4 to 5 times higher than non-scented rice varieties (Singh *et al.,* 2000). Kalanamak belongs to group V (Glaszmann, 1987). Aligarhwa in the foothills of the Himalayas is considered the paddy bowl (Singh *et al.,* 2003a). During excavation carbonized rice grains resembling Kalanamak were recovered from one of the rooms, which was supposed to be the kitchen store (Singh *et al.,* 2003b).

Materials and Methods

Kalam is a crop establishment method for rice cultivation where farmers transplant Kalanamak rice seedlings twice, first on a piece of high land, and then in the main field after the recession of heavy rains. The seedlings are prepared in a seed bed for about a month. The seedlings are first transplanted in a plot called as "Kalam". Farmers transplant seedlings in the Kalam plot with closer spacing and large number of seedling per hill. They take care of this plot like a main rice field and apply chemical fertilizers, and insecticide to nurture the seedlings. After 25 to 30 days, these seedlings are uprooted, separated from each other, and transplanted again at a normal distance. In the past, this method was widely followed by farmers for the cultivation of Kalanamak. However, with decline in area of Kalanamak, this method has virtually gone out of practice. In one study, Kalam method of establishment was compared with normal method (where transplanting is done only once). The seedlings grown in one decimal area of the seedbed would occupy three decimals of land in the "Kalam", and are sufficient for transplanting about 24 decimals of land in the main rice field. At the time of final transplanting the seedbed and the Kalam are also covered with sparse transplanting, so no land is wasted. The ill-effect of aged seedlings can be overcome by transplanting seedlings from primary to secondary nursery (Sarma *et al.,* 2010). Simultaneously, this practice helps in producing healthy and taller seedlings that can easily overcome the adverse situation like high water depth at the time of transplanting (Rautaray, 2007; Ashim *et al.,* 2010). Ziagun (2000) also reported yield advantage with double transplanting in rice. They take care of this plot like a main rice field and apply chemical fertilizers, and insecticide to nurture the seedlings. After another 25-30 days these aged seedlings are again transplanted to the main field with broader spacing and less number of seedlings per hill. A experiment was conducted during the wet season of 2017 and 2018 at Krishi Vigyan Kendra, Mahrajganj to assess the performance of Kalanamak variety of rice (*Oryza sativa* L.) under double-transplanting (Kalam) method in rainfed lowland rice ecosystem of Eastern Uttar Pradesh. A field experiment was conducted during the WS of 2017 and 2018 at the Krishi Vigyan Kendra

Basuli, Mahrajganj, located at 27° 8' 40.5744" N and 83° 33' 43.8192" E. and at an altitude of 66 m above mean sea-level and annual average rainfall 1364 mm. The maximum rainfall occurs in during June–September keeps water stagnation in lowlying areas during early crop-growth period. The soil was Silty Loam . The field experiment was carried out in split-plot design with four replications. The treatments consisted of 2 planting dates viz. 2 plant-stand establishment methods [normal transplanting and double transplanting (Kalam)] in main plots. Rice seedlings were raised in primary nursery in the end of May every year for both systems of plant stand establishment. After 28 days, seedlings from primary nursery were uprooted and closely transplanted (10 cm × 10 cm) in bunches of 4 to 9 seedlings/hill in the secondary nursery for double transplanting. The seedlings from secondary and normal nursery were up rooted at age of 28 and 56 days, respectively, and transplanted in the field with 2 to 3 seedlings or clones or hill at a spacing of 20 cm × 15 cm in last week of July during both the years. The crop was fertilized with recommended dose of 80:40:40 kg N, P and K/ha. Half of the dose of N and K and full dose of P were applied basal, while remaining N and K were top-dressed in 2 equal splits–at tillering and panicle initiation stage. Data were recorded at different crop-growth stages and statistically analyzed. Economics were calculated for both systems of cop establishment based on prevailing minimum support price of rice and labour wages/man-days.

Results and Discussion

Seedlings obtained from secondary nursery under double (Kalam) transplanting had dwarf plant height, high aroma, low sterility %, high number of EBT/m2, than seedlings obtained from conventional nursery; it may be due to less competition between plants in secondary nursery. Nutrient availability may also contribute to obtain vigour seedlings from secondary nursery. Rautaray (2007) also recorded thicker culm and better food reserve with double transplanted seedlings than normal seedlings. The better health of seedlings under double transplanting leads to quick establishment in main field and early production of effective nodal and basal tillers. The double transplanting system is an inefficient method of rice establishment compared to the single transplanting system. They argue that the aged seedlings would have less time to produce tillers in the field compared to the young seedlings, and hence the crop stand would less dense in the double transplanted field, resulting in lower crop yield. Also the cost of rice production would be higher in the double transplanted systems due to the additional cost of labor for transplanting in the Kalam field, which can be avoided under the single transplanting system. Thus, the profitability of rice farming would be less under the double transplanting system. Through weeding and the pesticide use in the Kalam plot and Normal planting they avoid the need for further crop care in the main field, and thereby reduce the cost of inter-cultural operations. According to the farmers, diseases and insect infestation is comparatively lower under this system than under single transplanting system. On the other hand, due to staggering of the time of transplantation (single transplanting on high land early in the season and double transplanting on low-land. The data show use 10 kg of seed per ha under the Kalam system compared to 35 kg seeds for normal transplanting system. The savings on account of seed, land preparation, transplantation and chemical fertilizers. Regarding the use of labor, require an additional 14 mandays/hectare for transplanting seedlings to the second transplanting that could be saved under the late in the season).The productivity of Kalanamak rice was

comparatively higher under Kalam system than that of normal transplanting. Panicles/m2, filled grains/panicle and 1,000 grain weight were significantly more under double transplanting than normal transplanting (Table 2). The increase in grain yield was owing to higher number of panicles/m2, more filled grains/panicle and better 1,000-grian weight than normal transplanting. These yield attributes might be influenced by better seedling health. These results were fully confirmed the findings of Ashim *et al.,* (2010) and Ghosh (2006). The Kalam system permits a flexible late transplanting during the rainy season, which is its prime advantage. The rice growers can transplant rice in their main plot/field at an advantageous time with regard to seasonal pattern of rainfall. The medium to low lying parcels of rice land is generally submerged during the months of July to mid August. However, the average crop duration of Kalam is reported at 146 days, 8 days shorter compared to the normal transplanting system.

The average yield of Kalanamak rice grown under Kalam system was 3504 kg/ha, about 45.09% higher than that of Normal (Table 2). Besides, the yield of rice was 3504 and 2415 kg/ha under Kalam and Normal transplanting systems, due to reduce plant height, stem borer and no lodging respectively. The study shows, per hectare cost of rice cultivation (Rs. 49175) under Kalam system is marginally higher than that of Normal (Rs. 47255), but the difference is not statistically significant (Table 3). Although the cost of labor under the Kalam system was significantly higher than that of Normal, but other cost such as pesticide was significantly lower under this system (Table 3). On balance, the total cost of cultivation is not significantly different between the two systems. The technology of Kalam gave higher grass return of Rs. 157250/ha with a benefit cost ratio of 3.22 and additional net return of Rs.48700/ha as compared to Normal transplanting.

Based on the above findings, double (Kalam) transplanting is beneficial Kalanamak variety of rice were found economically viable and suitable for double (Kalam) transplanting .

Table.1 Variation in agronomic parameters practiced in Kalam and Normal systems

Agronomic parameters	Kalam system		Normal system
	Kalam plot	Main plot	
Age of seedlings for transplanting in the rice field (days)	25-30	55-60	25-30
Seedlings per hill	6-12	3-4	2-3
Line spacing (cm) Line to line	10	15	20
Plant to plant	6	15	15
Crop duration (days)	146		154

Table.2 Influence of stand-establishment method and variety on yield attributes and yields of rice

Growth parameters	Kalam	Normal	Kalam	Normal	Mean	Mean	Increase %
	2017	2017	2018	2018	Kalam	Normal	
Days to 50% flowering	115	123	117	125	116	124	-6.45
Plant Height (cm)	128	156	119	162	124	159	-28.22
Panicle Length (cm)	27.2	25.4	26.9	24.7	27.1	25.1	+7.96
Sterility %/Panicle	7.6	19.8	5.4	16.9	6.5	18.4	+183.07
Ebt/m2	303	275	293	267	298	271	+9.96
Test Weight (g) 1000 seeds	19.2	18.1	19.7	18.4	19.5	18.3	+6.55
Yield kg/ha	3590	2440	3418	2390	3504	2415	+45.09

Table.3 Influence of stand-establishment method and variety on economics of rice

	Kalam	Normal	Kalam	Normal	Mean	Mean
Parameters	2017	2017	2018	2018	Kalam	Normal
Yield (kg/ha)	3590	2440	3418	2390	3504	2415
Labor cost (Rs./ha)	7704	7488	8400	8119	8052	7804
Pesticide/Fungicide cost (Rs./ha)	396	526	425	699	411	613
Gross cost (Rs./ha)	48150	46110	50200	48400	49175	47255
Sale price of grain /qt.	4000	4000	5000	5000	4500	4500
Net return (Rs./ha)	143600	97600	170900	119500	157250	108550
Extra returns	-	46000	-	51400	-	48700
Benefit: Cost ratio	-	3.12	-	3.32	-	3.22

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