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Effects of different dates of transplanting on yield attributes, yields and quality of non-scented varieties of rice (*Oryza sativa*)

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Abstract
A field experiment was conducted during rainy *Kharif* season 2015 at Rice Research Station, Kaul (Kaithal) of CCS Haryana Agricultural University, Hisar, Haryana to find out the effect of different dates of transplanting on four non scented different duration rice (*Oryza sativa*) varieties. Results of experiments revealed that early transplanting dates (June 15 and July 05) increase the grain yield (70.60q/ha and 69.49q/ha) and yield contributing traits of non scented rice varieties as compared to late transplanting on July 25 (49.03q/ha). However, the quality characters *viz.* hulling, milling and head rice recovery were improved in delayed transplanting. Medium duration varieties HKR-128 and HKR-127, being statistically at par, recorded significantly higher yield as compared to mid-early variety HKR-47 and early duration variety HKR-48. The interaction between dates of transplanting and non scented varieties of rice was found significant and reveals that the reduction in grain yield about 30 per cent when delay in transplanting from June 15 to July 25. The extent of reduction in grain yield was less (23%) in early duration variety HKR-48 than mid early duration variety HKR-47 (30%) and medium duration varieties HKR-128 (31%) and HKR-127 (32%) when delayed in transplanting.

Keywords: transplanting, non-scented, rice, duration, yield, quality

Introduction
The profitability in terms of yield and quality is governed by varieties and management practices. Time of transplanting is the most important factor when affect the yield of crop. Performance and yielding ability of a crop depends on the time of transplanting. Too early and too late transplanting results in yield reduction which cannot be compensated by any other input or practice. There is vital role of time of planting in paddy crop because of the fact variation in the duration, photo sensitiveness, thermosensitivity and vegetative lag period of the variety. A variety of short duration may suit better from early planting to late planting because of the fact that such varieties complete their life cycle with in short period with less effect of photoperiod and temperature. In case of longer duration varieties photo and thermo sensitive varieties may not perform better under late planting condition while photo and thermo insensitive varieties may perform better under normal to late planting condition with limited effect on yield of crop. The extent of reduction in yield under late transplanting may be differ with variety (Singh *et al*., 2005) [6] and their duration (Ram *et al*., 2005) [3]. The present field investigations were, therefore, conducted to find out the effect of transplanting dates on different duration non-scented varieties of rice.

Materials and Methods
A field experiment was conducted during rainy *Kharif* season 2015 at Rice Research Station, Kaul (Kaithal) of CCS Haryana Agricultural University, Hisar, Haryana on a clay loam texture soil which alkaline in reaction having pH 8.1, low in organic carbon 0.32%, electrical conductivity 0.27dS/m, low in available nitrogen (161.2 kg N/ha), medium in phosphorus (16.2 kg P/ha) and high in available potassium (328.2 kg K/ha). The treatments consisted of three dates of transplanting *viz.* June 15, July 05 and July 25 and four non-scented varieties *viz.* 'HKR-48 (early duration)', 'HKR-47 (mid-early duration)', 'HKR-127 (medium duration)' and 'HKR-128 (medium duration)'. The experiment was laid out in split plot design with four replications, keeping transplanting dates in main plots and varieties in sub-plots.

The thirty days old seedlings were transplanted on a well puddled soil at a hill spacing of 20 × 15 cm with two seedlings per hill. Fertilizer with a uniform dose of 120:60: 0 kg/ha N, P and K was applied in HKR-48 variety and 150: 60:0 kg/ha N, P and K in remaining three varieties all the plots. N was applied through urea and P through DAP. One third dose of nitrogen and full dose of phosphorus were applied as basal application just before transplanting. The remaining dose of nitrogen was applied in two equal splits at 21 and 42 days after transplanting (DAT). Zinc was applied through zinc sulphate @ 25 kg $ZnSO_4$/ha as basal application before transplanting. Weed control and plant protection measures were adopted as per the recommended package of practices. The crop was harvested at maturity and threshed as per schedule. The data on yield attributes *viz.* number of panicles/m^2, grains/panicle, 1000-grains weight, yield and quality of rice were recorded.

Results and Discussion

Yield attributes *viz.* number of panicles/m^2, number of grains/panicle and 1,000-grain weights are presented in table 1 and showed that transplanting on June 15 and July 05 were on par and significantly superior over late transplanting (July 25) in respect of panicles/m^2 and grains/panicle. The varieties differ significantly in respect of panicles/m^2 and grains/panicle. 'HKR-128' recorded the maximum numbers of panicles/m^2 and grains/panicle, which statistically at par with 'HKR-127' but both were significantly superior than 'HKR-47' and 'HKR-48'. The 1,000-grains weight did not differ significantly due to time of transplanting. Transplanting on June 15 produced the highest grain 70.60 q/ha and straw yield 83.31 q/ha, which was statistically on par with July 05 (69.49 q/ha and 82.84 q/ha). The grain and straw yield decreased significantly due to delayed transplanting at July 25 and recorded lowest grain (49.03q/ha) and straw yield (68.59 q/ha) as compared to earlier transplanted rice on June 15 and July 5. The higher yield of early transplanted rice might be due to availability of more sunlight during critical growth period and higher air temperature during flowering periods (Roy *et al.,* 1994). Harvest index did not differ significantly due to time of transplanting. All varieties showed significant difference in grain yield. HKR-128 registered significantly highest grain yield (69.67 q/ha), than all other varieties. The HKR-127 (66.04 q/ha) was next to record significantly higher yield after HKR-128 followed by HKR-47 (63.82 q/ha) and HKR-48 (52.65 q/ha). The HKR-128 registered significantly higher straw yield (85.87 q/ha), which was statistically at par with variety HKR-127 (82.57 q/ha). The straw yield in HKR-127 (82.57 q/ha) and HKR-47 (80.14 q/ha) was statistically similar to each other but significantly superior to HKR-48 (64.41 q/ha). Superiority of medium duration varieties over short duration varieties were reported by Joon *et al.* (1989) [1]. With each successive delay in transplanting, the quality of rice grains was improved (Mukesh *et al.,* 2013) [2]. The improvement in hulling, milling and head rice recovery might be due to mild temperature coinciding with reproductive and ripening period under late transplanting (Rao *et al.,* 1996) [4]. The hulling percentage was increased with delay in transplanting from June 15 to July 25 (77.75 to 79.42%). Late transplanted crop (July 25) had significantly highest hulling recovery 79.42%, which was statistically at par with crop transplanted on July 05 (78.11%) but more than crop transplanted on June 15. The variety HKR-128 recorded significantly higher hulling recovery (79.66%) than other varieties except HKR-127, which was statistically at par (78.97%).

Similar to hulling percentage, the milling recovery of rice grains was improved under delayed transplanting. The milling percentage was increased with delay in transplanting from June 15 to July 25 (68.86 to 70.51%). The variety HKR-128 recorded significantly highest milling percentage (71.04%) than other varieties except HKR-127 (69.79%), which was statistically at par with HKR-128.

The highest head rice recovery of rice grains was recorded in delayed transplanting i.e. July 25 (58.94%), which was significantly higher than June 15 (53.05%) transplanted crop but statistically at par with July 05 (57.67%) transplanting. Similar to hulling and milling recovery, the head rice recovery was improved with delay in transplanting from June 15 to July 25 (53.05 to 58.94%). The perusal of the data revealed that the variety HKR-128 recorded significantly highest head rice recovery (59.94%), which was statistically at par with HKR-127 (58.28%).

Interaction between time of transplanting and varieties was found significant in respect of grain yield (Table 2), which revealed that different duration varieties showed different extent of reduction. The reduction in grain yield about 30 per cent when delay in transplanting from June 15 to July 25. The extent of reduction in grain yield was less (23%) in early duration variety HKR-48 than mid early duration variety HKR-47 (30%) and medium duration varieties HKR-128 (31%) and HKR-127 (32%) when delayed in transplanting.

Table 1: Yield and yield contributing characters and quality of rice as affected by different dates of transplanting and varieties

Treatments	Panicles/m^2	Grains/ panicle	1000-grain weight (g)	Yield		Harvest index (%)	Hulling (%)	Milling (%)	Head rice recovery (%)
				Grain	Straw				
Dates of transplanting									
June 15	296	126	25.78	70.60	83.31	45.87	77.75	68.86	53.05
July 05	289	123	25.63	69.49	82.84	45.61	78.11	69.56	57.67
July 25	243	75	25.83	49.03	68.59	41.50	79.42	70.51	58.94
SEm±	5	2	0.35	0.75	1.97	0.60	0.26	0.29	0.42
CD (P=0.05)	17	7	NS	2.61	6.98	2.20	0.90	1.01	1.48
Varieties									
HKR-48	242	92	25.71	52.65	69.41	43.13	77.27	68.18	55.86
HKR-47	272	107	26.40	63.82	80.14	44.33	77.80	69.31	57.08
HKR-127	293	115	25.23	66.04	82.57	44.43	78.97	69.79	58.28
HKR-128	297	119	25.64	69.67	85.87	44.79	79.66	71.04	59.94
SEm±	5	2	0.43	0.89	1.90	0.70	0.52	0.44	0.61
CD (P=0.05)	15	7	NS	2.58	5.55	NS	1.53	1.29	1.79

Table 2: Interaction effect of different dates of transplanting and non-scented varieties of rice on grain yield (q/ha)

Treatments	Varieties			
	HKR-48	**HKR-47**	**HKR-127**	**HKR-128**
Dates of transplanting				
June 15	59.03	73.76	74.09	75.54
July 05	55.84	72.98	73.86	75.25
July 25	43.06	44.70	50.16	58.21
	SEm±	CD (P=0.05)		
V at same level of D	1.52	4.67		
D at same level of V	1.53	4.65		

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