



Short Communication

Growth analysis of rice hybrids as influenced by dates of transplanting under lowland conditions

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Abstract

A field experiment was undertaken at the Experimental Farm of Department of Agronomy of CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.) during *kharif* 2020 to study the growth and performance of rice hybrids under different dates of transplanting. The treatments consisted of three different dates of transplanting viz., 2nd week of June (12 June), 3rd week of June (19 June) and 4th week of June (26 June) as main plot and four rice varieties (three hybrids viz., Arize AZ 6508, Arize Swift Gold, Arize 6129 and check HPR 2143) as sub plot tested in split plot design. The trial was laid out with three replications. The plant height was not significantly influenced by the different dates of transplanting at all the stages of observation. Significantly higher dry matter at all stages of observation was accumulated by the crop when transplanting was done in 3rd week of June though it was statistically at par with 2nd week of June transplanting. Significantly higher CGR values between 30-60 and 60-90 DAT was recorded when the crop was transplanted in the 3rd week of June though this was statistically at par with the 2nd week of June transplanting which in turn was at par with the 4th week of June transplanting. The different dates of transplanting had no influence on the relative growth rate between different growth stages. Significantly higher grain yield was recorded in the 3rd week of June which was at par with the crop transplanted in the 2nd week of June, which was in turn was comparable to the crop transplanted in the 4th week of June. Rice genotypes also differed significantly with HPR 2143 producing significantly taller plants while Arize Swift Gold producing shorter plants. Hybrids accumulated more dry matter as compared to check variety HPR 2143 with Arize AZ 6508 recorded significantly higher value of this parameter. Among the varieties tested Arize AZ 6508 recorded significantly higher values of CGR between 30-60 DAT as well as 60-90 DAT though it was at with other two hybrids which in turn were at par with the check variety. RGR was not significantly influenced by varieties. Among the rice hybrids, Arize AZ 6508 produced significantly higher grain yield though this variety was statistically at par with Arize Swift Gold which in turn was at par with Arize 6129.

Key words: Growth, CGR, RGR, dates of transplanting, hybrids

Rice (*Oryza sativa* L.) is the staple food for more than half of the world's population. The fact that this crop supplies 35–60% of dietary calories and 50–80% of the energy intake of people in developing countries demonstrates its importance in meeting their nutritional demands. It is the primary source of nutrition for more than 60% of the world's population, especially in Southeast Asia (Sharma *et al.* 2018). Rice is also the second most important *kharif* food crop, after maize, of Himachal Pradesh, and was cultivated

on an area of 71.8 thousand hectare with the total production of 114.9 thousand tonnes and average productivity of 16 q ha⁻¹ (Anonymous 2019). Hybrid rice varieties have the ability to yield 15-20% more than the best pure line variety grown under similar conditions. Of late farmers in Himachal Pradesh have also adopted hybrid rice cultivation on a large scale for getting higher yields. The productivity of rice in our state is quiet low as compared to the national average as well as of the neighbouring states though there is an

immense potential to increase the productivity of this crop by developing suitable agro techniques. Timely transplanting of hybrids is one such technology that can boost the rice production in our state.

Yield is a dynamic aspect of the plant system that is influenced by a number of physiological and biochemical processes. Transplanting dates significantly affected the crop growth rate (CGR) of hybrid rice (Abid *et al.* 2015). The effect of the genetic makeup as well as the agricultural practises used to raise the crop also influence the performance of different varieties. To properly understand the impact of numerous factors on yield attributes and yield, it is essential to analyse the impact of these factors on various growth indices during the crop growing season. For this reason, the present study was conducted to examine the influence of various transplanting dates on growth, growth indices and yield of different rice hybrids.

The present investigation was carried out during *khariif* 2020 at the Experimental Farm of Department of Agronomy, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (32°09' N latitude, 76°54' E longitude and at an altitude of 1290 m above mean sea level). The area represents the mid hills sub humid zone of Himachal Pradesh and is characterized by mild summers and cool winters. The area received rainfall of 1600 mm during monsoon months from June to September. The soil of the experimental site was silty clay loam in texture, acidic in reaction, medium in available nitrogen, phosphorus, potassium and zinc.

The experiment consisted of twelve treatment combinations which included three dates of transplanting *viz.*, 2nd week of June (12 June), 3rd week of June (19 June) & 4th week of June (26 June) and four varieties which included three hybrids namely Arize AZ 6508, Arize Swift Gold & Arize 6129 and one check variety HPR 2143. The experiment was laid out in split-plot design, replicated thrice, with date of transplanting in main plot and varieties in sub plot. Twenty-five days old seedlings were transplanted on the scheduled dates and the crop was raised using standard package of practices. The data was recorded on the plant height, number of tillers, and dry matter accumulation at 30, 60 and 90 days after transplanting and these parameters were used to calculate the different growth indices using standard procedures and

formulas given below. The grain yield was also recorded at the harvest stage and has been presented here after adjusting to 14% moisture content.

$$\text{CGR (g m}^{-2} \text{ day}^{-1}) = \frac{W_2 - W_1}{P \times (t_2 - t_1)}$$

$$\text{RGR (mg g}^{-1} \text{ day}^{-1}) = \frac{(\text{Log}_e W_2 - \text{Log}_e W_1) \times 1000}{t_2 - t_1}$$

Where

W_1 & W_2 : Whole plant dry weight at time t_1 and t_2 , respectively

P is the ground area on which W_1 & W_2 are recorded

The data obtained was statistically analysed as per the procedure outlined by Gomez and Gomez (1984). The critical difference (CD) was estimated for parameters with significant impacts at 5% probability level. The results obtained are presented and discussed hereunder.

The data on effect of dates of transplanting on plant height, dry matter accumulation per square metre, crop growth rate (CGR), relative growth rate (RGR) and grain yield of paddy hybrids has been given in Table 1. The dates of transplanting had no significant effect on plant height at all the stages of observation while among varieties, HPR 2143 had significantly taller plants at all the stages of observation though this variety was statistically at par with Arize AZ 6508 at 30 days after transplanting (DAT). Significantly shorter plants were observed in Arize Swift Gold at all the stages of observation though this variety was statistically at par with Arize 6129 at 90 DAT. The differences in plant height of different varieties may be due to different genetic makeup with hybrids usually being short statured. Kumar (2019) and Dogra (2020) have also reported shorter plants in hybrids as compared to inbred checks which were taller.

Significantly higher dry matter accumulation by rice was recorded from the crop transplanted in 3rd week of June at all the stages of observation though this treatment was statistically at par with 2nd week transplanting which in turn was statistically at par with 4th week transplanting which recorded the lowest dry matter accumulation amongst all dates of transplanting. The higher dry matter accumulation in

Table 1. Effect of dates of transplanting on growth and growth indices of rice hybrids

Treatment	Plant height (cm)			Dry matter accumulation (g m ⁻²)			CGR (g m ⁻² day ⁻¹)	RGR (mg g ⁻¹ day ⁻¹)	Grain yield (q ha ⁻¹)		
	30 DAT*	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT				30-60 DAT	60-90 DAT
Dates of transplanting											
D ₁ : 2 nd week of June (12 June 2020)	42.5	85.5	99.2	61.2	371.1	896.2	10.33	17.50	60.06	29.34	50.3
D ₂ : 3 rd week of June (19 June 2020)	44.7	87.9	103.9	63.0	402.5	968.5	11.32	18.87	61.80	29.35	55.1
D ₃ : 4 th week of June (26 June 2020)	41.7	83.9	98.0	56.4	348.5	849.7	9.74	16.70	60.60	29.81	46.0
SEm±	0.8	1.5	2.0	1.3	8.8	18.7	0.29	0.40	1.2	0.4	1.3
CD (P=0.05)	NS	NS	NS	5.0	34.7	73.4	1.13	1.57	NS	NS	5.0
Varieties											
V ₁ : Arize AZ 6508	44.9	85.1	100.5	64.4	408.2	991.7	11.46	19.45	61.52	29.60	56.5
V ₂ : Arize Swift Gold	37.5	76.8	91.4	58.0	370.0	883.5	10.40	17.12	61.60	29.11	53.4
V ₃ : Arize 6129	43.4	83.1	95.8	60.6	374.9	901.3	10.48	17.55	60.66	29.37	51.1
V ₄ : HPR 2143	45.8	98.2	113.8	57.7	343.0	842.6	9.51	16.65	59.49	29.90	41.1
SEm±	0.7	1.4	2.8	1.5	11.8	25.7	0.38	0.80	1.1	1.1	1.5
CD (P=0.05)	2.2	4.2	8.4	4.5	35.2	76.5	1.13	2.38	NS	NS	4.5

*DAT: Days after transplanting

crop transplanted in 3rd week of June may be due to the congenial temperature regime encountered by the crop in this date. The crop transplanted a week earlier or a week later than this date was subjected to non-optimal temperatures resulting in lower dry matter production. Among varieties Arize AZ 6508 recorded significantly higher dry matter accumulation at all stages of observation though this variety was statistically at par with Arize 6129 at 30 and 60 DAT. Significantly lower dry matter accumulation was recorded in HPR 2143 though this variety was statistically at par with Arize Swift Gold and Arize 6129 at all stages of observations. The higher dry matter accumulated by the rice hybrids may be due to the hybrid vigour which ensures rapid initial growth. Also, the chlorophyll content in the leaves of rice hybrids is comparatively higher than the inbreds resulting in higher photosynthetic rate and higher dry matter accumulation. Similar results showing higher dry matter accumulation in hybrids have been reported by Dogra (2020).

The crop growth rate was significantly affected by dates of transplanting with 3rd week of June transplanting recording higher crop growth rate both between 30-60 DAT and 60-90 DAT though this date of transplanting was statistically at par with 2nd week transplanting. Significantly lower CGR between both stages (30-60 & 60-90 DAT) was recorded from crop transplanted in 4th week of June.

The rice varieties/hybrids also had a significant influence on the crop growth rate with Arize AZ 6508 had higher CGR both 30-60 DAT and 60-90 DAT,

though this variety was at statistically par with other two varieties. Inbred check HPR 2143 recorded significantly lower CGR both between 30-60 DAT and 60-90 DAT. This may be attributed to higher photosynthetic efficiency of the hybrids as explained above. RGR was not significantly influenced by either date of transplanting or varieties.

The crop transplanted in the 3rd week of June produced significantly higher grain yield which was at par with the crop transplanted in the 2nd week of June, which was in turn comparable to the crop transplanted in the 4th week of June. This was due to the higher values of different yield attributes and favourable temperature regime available to the crop transplanted in the 3rd week of June. The results so obtained are in conformity with the findings of Mahajan *et al.* (2009) and Vishwakarma (2015). Among the rice hybrids, Arize AZ 6508 produced significantly higher grain yield though this variety was statistically similar with Arize Swift Gold which in turn was at par with Arize 6129. The higher yields of Arize AZ 6508 and Arize Swift Gold was due to higher number of effective panicles m² and 1000-grain weight as compared to the check variety HPR 2143.

From the present investigation, it can be concluded that 3rd week of June is the optimum time for transplanting rice hybrids for obtaining better growth and productivity of rice hybrids. Also, among the hybrids Arize AZ 6508 is the most productive rice hybrid recommended for Himachal Pradesh.

Conflict of interest: The authors declare that there is no conflict of interest among the authors in this research paper.

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