



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(5): 412-416
Received: 04-07-2018
Accepted: 06-08-2018

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Manuscript effect of temperature on morpho-physiological traits with respect of grain yield of basmati rice

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Abstract

The field experiment was conducted at Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.), during kharif season 2016 and 2017. The design in split-plot with three replication and three dates of transplanting *i.e.*, first date of transplanting (D₁), second date of transplanting (D₂) and third transplanting (D₃) conditions were allocated in the main plots and four basmati rice varieties V₁ (PB-1), V₂ (PB-1509), V₃ (PB-6), and V₄ (PB-1121), in sub plot. The significantly higher to plant height in cm first date of transplanting *i.e.*, (D₁) with 31.35 and 32.87 cm at 30 DAT, 72.79 and 73.36 cm at 60 DAT, 90.80 and 91.04 cm at 90 DAT, 99.20 and 98.46 cm at harvest stage (DAT), while minimum in third transplanting date (D₃) with 20.37 and 21.56 cm at 30 DAT, 64.28 and 65.82 cm at 60 DAT, 81.32 and 82.91 cm at 90 DAT, 89.46 and 91.11 cm at harvesting stage of concerning years respectively.

observed significantly higher plant height with variety V₄ *i.e.*, 28.30 and 29.48 cm at 30 DAT, 74.37 and 75.61 cm at 60 DAT, 91.86 and 92.40 cm at 90 DAT, 102.25 and 103.02 cm at harvest DAT followed by variety V₁ with 26.90 and 28.60; 69.12 and 70.43; 87.84 and 89.10; 96.23 and 97.39 cm meanwhile, minimum in variety V₂ with 23.17 and 24.08; 63.05 and 63.89; 78.97 and 80.72; 83.89 and 85.10 experimentation, respectively.

Keywords: Condition, rice, transplanting and variety

Introduction

Rice (*Oryza sativa*) is monocotyledonous angiosperms belongs to grass family Gramineae and is self-pollinated crop. Rice is a semi-aquatic annual grass plant and is the most important cereal crop in the developing world covering 164.72 million hectare with annual production of 745.70 million tonnes of grain with average productivity of 4.52 tonnes per hectare (FAO, 2014). India ranks first in acreage (43.50 m ha), second in production (159.20 m t) after China and average productivity of rice is 3659.77 kg ha⁻¹ (FAO, 2014). Rice provides 35–60% of the dietary calories and 50-80% of the energy intake of the people in developing countries (Fageria *et al.* 2003). Basmati rice is one of the most important and popular cereal grain crop of India. Basmati rice attracted the highest premium because it is very long grained rice with an aroma of its own which enhances the flavour it's mixed with. Basmati rice cultivation may play a vital role because of less water requirement and greater returns due to its higher price in the market, Basmati rice is prized for its intriguing, perfumed, almost popcorn-like aroma and nut-like flavour.

Method and materials

The present investigation entitled "Physiological studies on growth, development and yield component of Basmati rice under different planting times" was conducted at experiment Research Farm, Student's Instructional Farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.). During Kharif season *i.e.*, 2016 and 2017.

Location and Climatic Conditions: Geographically Kanpur is located of 26.28° North Longitude of 80.25° East Longitude and above 127 meters sea level. It lies in the sub-tropical regions where rice is grown in Kharif seasons.

Weather parameters prevailed during experimental year 2016 at experimental farm, Kanpur

SMW	Date to Date	Temperature(C)		Relative humidity (%)		Rain Fall (mm)
		Max.	Min.	Max.	Min.	
1	02.07.2016 - 08.07.2016	31.6	25.1	92	81	126.1
2	09.07.2016 - 15.07.2016	32.8	26.1	89	82	77.6
3	16.07.2016 - 22.07.2016	31.7	26.1	88	81	30.2
4	23.07.2016 - 29.07.2016	32.6	25.9	90	76	29.9
5	30.07.2016 - 05.08.2016	32.1	25.6	91.1	74.7	70.7
6	06.08.2016 - 12.08.2016	32.3	26.2	89	74	67.9
7	13.08.2016 - 19.08.2016	31.7	25.5	92	77	33.1
8	20.08.2016 - 26.08.2016	32.7	25.2	85	70	5.6
9	27.08.2016 - 02.09.2016	34.3	26.5	87	68	8.4
10	03.09.2016 - 09.09.2016	33.8	25.9	82	64	00
11	10.09.2016 - 16.09.2016	32.8	25.0	87	69	7.0
12	17.09.2016 - 23.09.2016	32.6	25.3	89	76	7.8
13	24.09.2016 - 30.09.2016	32.6	24.1	92	66	00
14	01.10.2016 - 07.10.2016	34.9	24.8	84	59	20.0
15	08.10.2016 - 14.10.2016	33.5	21.4	84	57	14.0
16	15.10.2016 - 21.10.2016	33.7	16.6	84	38	00
17	22.10.2016 - 28.10.2016	33.7	16.6	77	35	00
18	29.10.2016 - 04.11.2016	31.5	14.0	89	38	00
19	05.11.2016 - 11.11.2016	30.3	13.2	83	42	00
20	12.11.2016 - 18.11.2016	29.2	12.1	86	42	00
21	19.11.2016 - 25.11.2016	28.8	11.8	81	42	00
22	26.11.2016 - 02.12.2016	25.6	13.1	87	62	00

Experimental Details

• Location	:	Student's Instructional Farm, Kanpur
• Statistical Design	:	Spilt-plot Design Main plot: Date of transplanting (D) Sub plot: Variety (V)
• Replication	:	Three (3)
• Single Plot Size	:	4 x 4 m ²
• Total number of plots	:	36
• Date of transplanting	:	3 (Both year on same date)
• Varieties	:	4
• Plant to plant distance	:	10 cm
• Row to row distance	:	20 cm
• Detail about treatment	:	
Dates of transplanting (D)	:	Varieties (V)
D ₁ : First date transplanting 03 rd July	:	V ₁ :PB-1
D ₂ : Second date transplanting 16 th July	:	V ₂ :PB-1509
D ₃ : Third date transplanting 30 th July	:	V ₃ : PB-6 V ₄ : PB-1121

Fertilizer application Recommended doses of fertilizer were applied. Full dose of phosphorous (30 kg/ha) and ZnSO₄ (25 kg/ha) was applied at the time of preparatory tillage by broadcasting under transplanted plots. Nitrogen (60 kg/ha) was applied in three split doses i.e. 1/3rd at transplanting, 1/3rd at 21 days after transplanting (DAT) and remaining 1/3rd at 42 DAT in transplanted plots.

Irrigation schedule Field was irrigated frequently so as to maintain the 5 cm level of standing water till 15 days after transplanting. Thereafter irrigation was given as and when required to maintain the saturated conditions of soil,

Result and discussion

1. Plant Height (cm) Plant height was measured in cm from soil surface up to tip of the plant with the help of a meter scale. Measurement was done on the plants which were initially tagged for this purpose and average height was collected from the data.

The data showed on the effect of different transplanting times on basmati rice varieties, and their interaction to plant height (cm) at 30, 60 90 and Harvesting stage DAT in presented table 4.1.1 (A), (B) (C)& (D).

Effect of transplanting dates: The mean value of transplanting times to plant height in cm was recorded significantly maximum in first transplanting times (D₁) with 31.35 and 32.87 cm at 30 DAT, 72.79 and 73.36 cm at 60 DAT, 90.80 and 91.04 cm at 90 DAT, 99.20 and 98.46 cm at harvest stage (DAT), while minimum in third transplanting date (D₃) with 20.37 and 21.56 cm at 30 DAT, 64.28 and 65.82 cm at 60 DAT, 81.32 and 82.91 cm at 90 DAT, 89.46 and 91.11 cm at harvesting stage of concerning years respectively.

Effect of varieties: The mean value of varieties observed significantly higher plant height with variety V₄ i.e., 28.30 and 29.48 cm at 30 DAT, 74.37 and 75.61 cm at 60 DAT, 91.86 and 92.40 cm at 90 DAT, 102.25 and 103.02 cm at harvest DAT followed by variety V₁ with 26.90 and 28.60; 69.12 and 70.43; 87.84 and 89.10; 96.23 and 97.39 cm meanwhile, minimum in variety V₂ with 23.17 and 24.08; 63.05 and 63.89; 78.97 and 80.72; 83.89 and 85.10 experimentation, respectively.

Table 3: (A) Effect of different transplanting times on plant height (cm) at 30 (DAT) of Basmati rice varieties

Variety	Plant height (cm) 30DAT			
	2016-17			
	D1	D2	D3	MEAN
PB-1 - (V1)	31.07	26.44	23.20	26.90
PB-1509- (V2)	29.73	23.52	16.27	23.17
PB-6 - (V3)	30.30	24.50	19.42	24.74
PB-1121 - (V4)	34.35	28.00	22.61	28.30
MEAN	31.35	25.61	20.37	
	SE (dff)		CD (5%)	
D	0.47		1.29	
V	0.46		0.89	
DXV	0.81		1.70	
VXD	0.83		1.83	

Variety	Plant height(cm) 30 DAT			
	2017-18			
	D1	D2	D3	MEAN
PB-1 - (V1)	33.58	27.64	24.60	28.60
PB-1509- (V2)	30.23	24.63	17.39	24.08
PB-6 - (V3)	32.30	26.30	20.57	26.39
PB-1121 - (V4)	35.39	29.39	23.67	29.48
MEAN	32.87	26.99	21.56	
	SE (dff)		CD (5%)	
D	0.47		1.30	
V	0.46		0.97	
DXV	0.79		1.68	
VXD	0.81		1.74	

Table 3: (B) Effect of different transplanting times on plant height (cm) at 60 (DAT) of Basmati rice varieties.

Variety	Plant height(cm) 60DAT			
	2016-17			
	D1	D2	D3	MEAN
PB-1 - (V1)	74.37	68.87	64.12	69.12
PB-1509- (V2)	65.20	64.26	59.70	63.05
PB-6 - (V3)	72.86	66.71	63.21	67.59
PB-1121 - (V4)	78.72	74.30	70.11	74.37
MEAN	72.79	68.53	64.28	
	SE (dff)		CD (5%)	
D	0.89		2.45	
V	1.14		2.41	
DXV	1.98		N.S.	
VXD	1.93		N.S.	

Variety	Plant height (cm) 60DAT			
	2017-18			
	D1	D2	D3	MEAN
PB-1 - (V1)	75.27	70.60	65.42	70.43
PB-1509- (V2)	65.39	65.46	60.83	63.89
PB-6 - (V3)	73.46	68.42	64.70	68.86
PB-1121 - (V4)	79.33	75.17	72.33	75.61
MEAN	73.36	69.91	65.82	
	SE (dff)		CD (5%)	
D	0.72		1.99	
V	1.05		2.21	
DXV	1.82		N.S.	
VXD	1.69		N.S.	

Table 3: (C) Effect of different transplanting times on plant height (cm) at 90 (DAT) of Basmati rice varieties.

Variety	Plant height(cm) 90DAT			
	2016-17			
	D1	D2	D3	MEAN
PB-1 - (V1)	93.50	86.70	83.32	87.84
PB-1509- (V2)	82.07	79.08	75.77	78.97
PB-6 - (V3)	90.33	85.30	80.03	85.22
PB-1121 - (V4)	97.30	92.12	86.15	91.86
MEAN	90.80	85.80	81.32	

	SE (dff)	CD (5%)
D	1.02	2.83
V	1.32	2.77
DXV	2.28	N.S.
VXD	2.13	N.S.

Variety	Plant height (cm) 90DAT			
	2017-18			
	D1	D2	D3	MEAN
PB-1 - (V1)	94.30	88.50	84.50	89.10
PB-1509- (V2)	82.27	81.57	78.33	80.72
PB-6 - (V3)	90.42	86.53	81.50	86.15
PB-1121 - (V4)	97.17	92.72	87.33	92.40
MEAN	91.04	87.33	82.91	
	SE (dff)		CD (5%)	
D	1.15		3.17	
V	1.44		3.03	
DXV	2.50		N.S.	
VXD	2.23		N.S.	

Table 3: (D) Effect of different transplanting times on plant height (cm) at Harvesting (DAT) of Basmati rice varieties.

Variety	Plant height(cm)Harvesting DAT			
	2016-17			
	D1	D2	D3	MEAN
PB-1 - (V1)	101.27	96.03	91.39	96.23
PB-1509- (V2)	85.69	84.12	81.86	83.89
PB-6 - (V3)	100.23	93.23	89.30	94.25
PB-1121 - (V4)	109.64	101.93	95.19	102.25
MEAN	99.20	93.82	89.43	
	SE (dff)		CD (5%)	
D	2.11		5.84	
V	2.30		4.83	
DXV	3.98		N.S.	
VXD	4.16		N.S.	

Variety	Plant height(cm)Harvesting DAT			
	2017-18			
	D1	D2	D3	MEAN
PB-1 - (V1)	102.46	97.23	92.50	97.39
PB-1509- (V2)	87.29	84.83	83.18	85.10
PB-6 - (V3)	93.76	95.33	92.31	93.80
PB-1121 - (V4)	110.36	102.23	96.47	103.02
MEAN	98.46	94.90	91.11	
	SE (dff)		CD (5%)	
D	1.43		3.96	
V	1.63		3.42	
DXV	2.82		N.S.	
VXD	2.89		N.S.	

(II) Number of grains / hill

The data elucidated for Number of grains hill⁻¹ as affected by different transplanting times on basmati rice varieties, and their interaction on have been presented in Table 4.5.3.

Effect of transplanting dates: It is visualized from the mean value of different transplanting dates significantly influence the number of grains accumulation in (hill⁻¹). The statistically maximum number of grains hill⁻¹ (379.36 and 388.63hill⁻¹) was recorded first transplanting date (D₁) and minimum

Effect of different transplanting times on Number of grains/hill after harvesting of Basmati rice varieties

(299.05 and 308.10hill⁻¹) with D₃ during 2016 and 2017 respectively.

Effect of varieties: Significant effect of varieties was found for the accumulation of number of grains. Among the varieties, V₂ was recorded significantly superior (393.95 & 402.78hill⁻¹) followed by V₄ (342.32 & 353.73hill⁻¹), V₁ (328.05 & 334.74hill⁻¹) and mean while minimum in (298.58 & 307.46hill⁻¹) in year 2016 and 2017, respectively.

Variety	Number of grains/hill			
	2016-17			
	D1	D2	D3	MEAN
PB-1 - (V1)	355.49	335.11	293.56	328.05
PB-1509- (V2)	433.20	396.25	352.40	393.95
PB-6 - (V3)	340.26	304.31	251.17	298.58
PB-1121 - (V4)	388.50	339.37	299.10	342.32

MEAN	379.36	343.76	299.05	
	SE (dff)		CD (5%)	
D	7.39		20.40	
V	7.58		15.93	
DXV	13.13		N.S.	
VXD	14.91		N.S.	

Variety	Number of grains/hill			
	2017-18			
	D1	D2	D3	MEAN
PB-1 - (V1)	362.44	341.24	300.56	334.74
PB-1509- (V2)	442.14	404.80	361.41	402.78
PB-6 - (V3)	349.15	312.85	260.40	307.46
PB-1121 - (V4)	400.81	350.37	310.03	353.73
MEAN	388.63	352.31	308.10	
	SE (dff)		CD (5%)	
D	9.23		25.50	
V	9.49		19.94	
DXV	16.44		N.S.	
VXD	18.55		N.S.	

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