International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(5): 1381-1383

Received: 09-07-2018
Accepted: 13-08-2018

Anil Nishad
Department of Agricultural Meteorology, Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, Uttar Pradesh, India

AN Mishra
Department of Agricultural Meteorology, Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, Uttar Pradesh, India

Rajan Chaudhari
Department of Agricultural Meteorology, Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, Uttar Pradesh, India

RK Aryan
Department of Agricultural Meteorology, Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, Uttar Pradesh, India

Purusharth Katiyar
Department of Agricultural Meteorology, Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, Uttar Pradesh, India

Correspondence
Rajan Chaudhari
Department of Agricultural Meteorology, Narendra Deva University of Agriculture & Technology Narendra Nagar, Kumarganj, Faizabad, Uttar Pradesh, India

Effect of temperature on growth and yield of rice (*Oryza sativa* L.) cultivars

Anil Nishad, AN Mishra, Rajan Chaudhari, RK Aryan and Purusharth Katiyar

Abstract
A field experiment was conducted during kharif season of 2017 on the topic entitled "Effect of temperature on growth and yield of rice (*Oryza sativa* L.) cultivars." in sandy loam soil of N.D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.). The experiment consisted of nine treatment combinations comprised of three transplanting dates viz., July 5th, July 15th and July 25th and three varieties viz., NDR-97, NDR-3112 and BPT-5204. Results reveal that different phenophases of rice markedly varied with only dates of transplanting but also different weather variables which ultimately create the different crop growing environment to harvest the yield accordingly.

Keywords: rice, plant height, GDD, total dry matter, yield

Introduction
Rice (*Oryza sativa* L.) is one of the important foods for most people living in India. It is being grown under diverse agro-climatic condition at wide range of latitudes. It is essential to human diet in India as it is a richest source of carbohydrates and adds the proteins component in human diet too. Generally 6.8 % protein, 78.2 % carbohydrates, 0.5 % fat and 0.6 % mineral matters are found in rice hence it is primarily used as a staple food crop. The optimum temperature for rice cultivation is between 25°C and 35°C, and in temperate regions, rice growth is impressed by limited period that favours its growth (Reyes *et al.*, 2003) [7]. Exposure to cold temperature affects all phonological stages of rice and lower grain production and yield, too. Low temperature in vegetative stage can cause slow growth and reduce seedling Vigor (Ali *et al.*, 2006) [2] low number of seedlings, reduce tillering (Shimono *et al.*, 2002) [8] increase plant mortality (Farrell *et al.*, 2006, Baruah *et al.*, 2009, Fujino *et al.*, 2004) [5, 3, 6] increase the growth period (Alvarado and Hernaiz 2007) [1] and in reproductive stage, it can cause to produce panicle sterility and lower grain production and yield. Critical stages for cold damage include germination, booting, flowering, and filling stages (Satake 1976) [9]. Since the most sensitive stage for cold harm is the flowering stage, which occurs 10–12 days prior to heading, our objective of this study is to evaluate the effect of cold stress on yield and yield components in flowering stages and identify the Iranian current rice crop resistant and sensitive cultivars. Rice is grown under different conditions. Rice is the only cereal crop that can grow for long periods of time in standing water. 57 % of rice is grown on irrigated land, 25 % on rainfed lowland, 10 % on the uplands, 6 % in deep water, and 2 % in tidal wetlands. The impact of air temperature on rice growth would be location-specific because of the different sensitivity of different locations with regard to temperature. In tropical regions, the temperature increase due to the climate change is probably near or above the optimum temperature range for the physiological activities of rice (Baker *et al*. 1992) [4].

Materials and Methods
An experiment was conducted during kharif 2017 at the Agrometeorology Research Farm of N.D. University of Agriculture& Technology, Kumarganj, Faizabad (U.P.) on the topic entitled "Effect of temperature on growth and yield of rice (*Oryza sativa* L.) cultivars." The experimental site is located in the main campus of NDUA&T, Kumarganj, (Faizabad) situated at a distance of about 42 km. away from Faizabad district headquarter on Faizabad Raibarelly road. The geographical situation of experimental site lies at latitudes 26^0 47' North longitude

82^0 12′ East and altitude of 113 meter from mean sea level in the Indo genetic alluvium of eastern Uttar Pradesh. The details of materials and methods employed & techniques adopted during the course of experimentation has been described in this chapter. The experiment was conducted in Randomized Block Design (RBD) and replicated the three times. The different growth parameters studied were rice as.

Results

Plant height of rice cultivars recorded at different growing environment significantly affected the plant height varieties have been presented in (Table-1) The maximum plant height was recorded with 1st date of transplanting on July 5th (107.38cm) at all the growth stages which remained at par to 2nd date of transplanting July 15th (102.75cm) and significantly superior over 3rd date of transplanting July 25th (92.52cm) at all the stages of crop. Among the varieties the maximum plant height was recorded with NDR-3112 (109.47cm) at all the growth stages of crop, which remained at par to BPT-5204(102.85cm) and significantly superior over NDR-97 (90.33cm) at all growth stages. Plant height increased with the advancement of the crop growth in all the three varieties of rice.

Growing degree days (GDD) of rice cultivars taken in different phenophases at different growing environment have been presented in (Table-2). From it is evident from the table that the highest value of growing degree days (2149.5^0days) was taken by 1st date of transplanting 5th July in followed by the July 15th (2163.74^0days) and lowest was recorded July 25th ($1922.4\ ^0$days). Among the varieties it is evident that GDD was highest in cultivar BPT-5204 (2275.9^0days) followed by NDR-3112 (2035.65^0days) and NDR-97 ($1933.3\ ^0$days).

Total dry matter of rice cultivars recorded at different growing environment significantly affected the dry matter accumulation (gm^{-2}) have been presented in (Table-3). From it is evident from the table that the Maximum dry matter accumulation was noticed with 1st date of transplanting (July5th) at 30, 45, 60, 75, 90 and 105 days after transplanting which remained at par to 2nd date of transplanting July 15th and significantly higher over 3rd date of transplanting July 25th at all the stages of crop. Among the varieties maximum dry matter accumulation (gm^{-2}) was observed in NDR-3112 at 30, 45, 60, 75, 90 and 105 days after transplanting which was significantly superior over BPT-5204 and NDR-97 at all growth stages of crop. The interaction effect of varieties and date of sowing on dry matter accumulation was found non-significant.

Number of effective tillers (m^{-2}) as affected by different growing environment of rice cultivars have been presented in (Table-4). A perusal of data showed that different growing environment were recorded maximum no. of tillers (351.06) when crop was transplanting on July 25th, which was superior over July 15th, and July 5th. The minimum no. of effective tillers (m^{-2}) was recorded at July 5th. Among the varieties maximum no. of effective tillers (m^{-2}) was recorded with NDR-3112 (356.38) followed by BPT-5204 (335.4) and then NDR-97 (313.94).

Test weight (g.) as affected by different growing environment of rice cultivars have been presented in (Table-4). A perusal of data showed that different growing environment influenced significantly to the test weight. Maximum test weight (22.28) was recorded when crop was transplanting July 5th which was superior over July 15th and July 25th. The minimum test weight (21.36) was recorded when transplanting was done at July 25th. Among the varieties maximum test weight (23.42) was recorded with BPT-5204 variety followed by NDR-3112 (22.39) and then NDR-97(19.58).

Grain yield (q ha^{-1}) as affected by different growing environment of rice cultivars have been presented in (Table-4). A perusal of data showed that different growing environment influenced significantly to the grain yield. Maximum grain yield (48.50) was recorded when crop transplanting dates was July 5th which was significantly superior over July 15th, and July 25th. The minimum grain yield (40.52) was recorded when transplanting was done on July 25th. Among the varieties maximum grain yield (49.38) was recorded with NDR-3112 variety followed by BPT-5204(48.17) and then NDR-97 (38.98)

Harvest index (%) as affected by different growing environment of rice cultivars have been presented in (Table-4). A perusal of data showed that different growing environment transplanting (41.5) influenced non-significantly to the harvest index. 1st date of transplanting maximum harvest index (42.06) was recorded was transplanting on July 5th followed by July 15th and July 25th. Among the varieties data recorded that growing environments influenced non-significantly to the harvest index. Maximum harvest index (41.77) was recorded with NDR-3112 followed by NDR-97 and BPT-5204.

Table 1: Plant height as affected by different growing environment of rice cultivars

Treatment	Plant height (cm)						
Date of Transplanting	**15 DAT**	**30 DAT**	**45 DAT**	**60 DAT**	**75 DAT**	**90 DAT**	**105 DAT**
5th July	28.37	47.28	78.80	87.56	97.29	105.75	107.38
15thJuly	27.73	46.22	77.04	85.60	95.11	103.38	102.75
25th July	24.82	41.37	68.94	76.60	85.11	92.51	92.52
SEm±	0.965	1.336	2.242	2.671	3.017	3.439	3.338
CD (5%)	2.983	4.004	6.721	8.008	9.046	10.310	10.007
Varieties							
NDR-97	24.48	40.80	67.99	75.55	83.94	91.24	90.33
NDR-3112	29.39	48.99	81.65	90.72	100.80	108.56	109.47
BPT-5204	27.05	45.09	75.14	83.49	92.77	100.84	102.85
SEm±	0.965	1.336	2.242	2.671	3.017	3.439	3.338
CD (5%)	2.893	4.004	6.721	8.008	9.046	10.310	10.007

Table 2: Growing Degree Days (GDD) as affected by different growing environment of rice cultivars

Treatments	Growing Degree Days (Degree Days)		
Growing environment	**Days to panicle initiation**	**Days to 50%Flowering**	**Physiological Maturity**
5th July	1429.5	1622.85	2149.4
15thJuly	1367.5	1566.25	2119.4
25th July	1325.0	1511.25	2018.9
Varieties			
NDR-97	1184.0	1471.25	1933.9
NDR-3112	1230.0	1511.25	2035.65
BPT-5204	1429.9	1758.1	2275.9

Table 3: Total dry matter as affected by different growing environment of rice cultivars

Treatments	Total dry matter (g/m^2)						
Growing environment	**15 DAT**	**30 DAT**	**45 DAT**	**60 DAT**	**75 DAT**	**90 DAT**	**105 DAT**
5th July	110.60	196.42	286.04	405.65	622.61	811.82	1002.5
15thJuly	115.60	202.47	294.51	419.66	646.78	876.11	957.68
25th July	103.46	181.02	262.58	375.22	576.06	780.50	886.89
SEm±	2.945	4.275	8.058	8.049	12.930	20.094	27.610
CD (5%)	8.830	12.816	24.158	24.130	38.763	60.242	82.773
Varieties							
NDR-97	110.57	194.41	260.13	369.65	568.38	773.77	813.11
NDR-3112	107.17	188.67	307.67	438.16	673.57	912.39	1072.73
BPT-5204	111.93	196.83	275.33	392.73	603.50	782.87	960.77
SEm±	2.945	4.275	8.058	8.049	12.930	20.094	27.610
CD (5%)	NS	NS	24.158	24.130	38.763	60.242	82.773

Table 4: Yield and yield contributing characters as affected by different growing environment of rice cultivars

Treatments	Yield attributes			
Different Date of Transplanting	**No. of effective tillers / hill**	**Test weight (g)**	**Grain Yield (kg/ha)**	**Harvest Index (%)**
5th July	351.06	22.28	48.50	42.06
15thJuly	333.25	22.02	47.52	41.50
25th July	321.65	21.36	40.52	40.16
SEm±	6.900	0.736	1.245	0.622
CD (5%)	20.685	NS	2.661	NS
Varieties				
NDR-97	313.94	23.42	38.98	41.77
NDR-3112	356.38	22.39	49.38	41.18
BPT- 5204	335.64	19.58	48.17	40.76
SEm±	6.900	0.736	1.245	0.622
CD (5%)	20.685	2.208	2.661	NS

Conclusion

It is concluded that study in highest Growing Degree days (GDD) was recorded in growing environment of July 15th (2208.9 0days) transplanting at all the phenophases followed by July 5th (2139.4 0days) and July 25th (2018.9 0days) transplanting while among the variety BPT-5204 (2257.9.9 0days) recoded highest GDD due to occurrence of long duration. Variety NDR-3112 found suitable for higher productivity (42.60 q/ha) followed by BPT-5204 (38.07 q/ha) and NDR-97 (32.77q/ha).

References

1. Alvarado R, Hernaiz S. Antecedentes Generales sobre el arroz en Chile, in *Arroz Manejo* Tecnológico, R. Alvarado, Ed., of Boletín INIA, Instituto de Investigaciones Agropecuarias INIA, Centro Regional de Investigación Quilamapu, Chillán, Chile. 2007; 162:179.
2. Ali MG, Naylor REL, Matthews S. Distinguishing the effects of genotype and seed physiological age on low temperature tolerance of rice (*Oryza sativa* L.), Experimental Agriculture. 2006; 42(3):337-349.
3. Baruah AR, Ishigo-Oka N, Adachi M. Cold tolerance at the early growth stage in wild and cultivated rice, Euphytica. 2009; 165(3):459-470.
4. Baker JT, Allen LH, Boote KJ. Temperature effects on rice at elevated CO_2 concentration. J Exp Bpt. 1992; 43:959-964.
5. Farrell TC, Fox KM, Williams RL, Fukai S, Lewin LG. Minimising cold damage during reproductive development among temperate rice genotypes. II. Genotypic variation and flowering traits related to cold tolerance screening, Australian Journal of Agricultural. 2006; 57(1):89-100.
6. Fujino K, Sekiguchi H, Sato T. Mapping of quantitative trait loci controlling low-temperature germinability in rice (*Oryza sativa* L.), Theoretical and Applied Genetics, 108(5):794-799.
7. Reyes BG, De Los, Myers SJ, McGrath JM. Differential induction of glyoxylate cycle enzymes by stress as a marker for seedling vigor in sugar beet (*Beta vulgaris*), Molecular Genetics and Genomics. 2003; 269(5):692-698.
8. Shimono H, Hasegawa T, Iwama K. Response of growth and grain yield in paddy rice to cool water at different growth stages, Field Crops Research. 2002; 73(2/3):67-79.
9. Satake T. Determination of the most sensitive stage to sterility pe cool injury in rice plants, Bulletin of the Hokkaido National Agricultural Experiment Station. 1976; 113:1-33.