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Influence of Bright Sunshine Hours, Photothermal, Heliothermal and HUE of Rice Cultivars Growing under varying Environment

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A B S T R A C T

A field experiment was conducted during *kharif season* of 2015 at the AN.D.U.A. & T. Kumarganj, Ayodhya (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., Sarjoo-52, NDR-359 and Swarna Sub-1. Highest photothermal unit was recorded in I[st] date of transplanting on July 5th at vegetative stage (22270.5 ^{0}days hrs.) and reproductive stage (28863.9 ^{0}days hrs.) which was superior over July 15th at vegetative stage (21435.3 ^{0}days hrs.), reproductive stage (28210.6 ^{0}days hrs.) and July 25th at vegetative stage (20160.0 ^{0}days hrs.), reproductive stage (24417.8 ^{0}days hrs.). Highest Heat use efficiency (HUE) was recorded in growing environment of July 15th (0.499 gm^{-2} ^{0}days) transplanting at all the stage followed by July 5th (0.474 gm^{-2} ^{0}days) and July 25th (0.448 ^{0}days) transplanting while among the variety NDR-359 (0.503 gm^{-2} ^{0}days) recoded highest HUE followed by Swarna Sub-1(0.475 gm^{-2} ^{0}days) and Sarjoo-52 (0.457 gm^{-2} ^{0}days).

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 rice is cultivated worldwide in area 156.80 million hectare having an annual production of 680.19 million tonnes and an average productivity of 5.15 tonnes per hectare (Anonymous, 2013-14).) . In the latest report, In India, during 2014-15, the rice crop had production of 103.04 million tonnes. In Uttar Pradesh it was grown on over all area 50.94 million hectare with production of 15.30 million tonnes. The average productivity of Uttar Pradesh is 257.3 kg/ha which is more than the average national productivity. In Uttar Pradesh it is grown in about 6.20 m ha which comprises of 13.5% of total rice in India. (Anonymous, 2013-2014). Rice (*Oryza*

sativa L.,) belongs to the family Gramineae, genus *Oryza* and has two cultivated and 22 wild species. The cultivated species are *Oryza sativa* and *Oryza glaberrima*. *Oryza sativa* is grown all over the world while *Oryza glaberrima* has been cultivated in West Africa for the last ~3500 years. Most rice researchers agree that the area of *Oryza sativa* is located in a belt extending from the Assam-Meghalaya area in India to mountain ranges in the mainland Southeast Asia and Southwest China. Rice is the most important staple food for a large part of the world's population, especially in East and South Asia, the Middle East, Latin America, and the West Indies. As the population increases rapidly in these regions, the demand for rice will grow to an estimated 2000 million metric tons by 2030 (FAO, 2002). In2010-2011, area covered under rice was 59.25/ha with productivity of 21.20 q/ha. (Dwivedi, 2011).

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 deepwater, and 2% in tidal wetlands. Rice is one of the most important cereal crop belong to the family *Graminae.* It is the staple food for half of the world's population. Rice is cultivated of worldwide in area of 156.80 million hectare having an annual production of 650.19 million tonnes. Among the rice growing countries, India stands first in area and second in production next after China. Uttar Pradesh is largest rice growing state after West Bengal in the country. Rice production in Asia has increased by 2.6 times since 1961, primarily as a result of the "Green Revolution", which dramatically increased the rice productivity in the high input irrigated system (Khus, 1997). The rainfed systems, which occupy about 32% of the rice-growing area in Asia, have been less from the 'Green Revolution'. According to GRSP (Global Rice Science Partnership) Annual Report, 2011, rice production on 60 million hectares of rainfed areas in Asia and almost 7 million hectares in sub-Saharan Africa remain low (0.5-2.5 t/ha) and unstable due to frequent drought or flooding.

These events can occurs in different years, or both can happen in the same season during different crop growth periods. The yield of rice is stagnating around ≤ 2.0 tq/ha since 2001-2002 except in the year 2002-2003, 2004-2005 and 2009-2010 due to erratic rainfall distribution causes excess water stagnation/drought or both in different years.

Materials and Methods

An experiment was conducted during Kharif season of 2015 at Agro-meteorology Research Farm of A.N.D. University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.). The experiment was conducted in Randomized Block Design (RBD) and replicated the three times. The different growth parameters studied were rice as Heat Use Efficiency (HUE), Bright Sunshine Hours (BSS), Heliothermal, Photothermal.

Results and Discussion

Heat use efficiency (HUE) ($g/m^{2/0}$days) of rice cultivars at different growing environment has been depicted in (Table 1). The maximum Heat use efficiency ($g/m^{2/0}$days) (0.499) was recorded at IInd date of transplanting on July 15th at 105 DAT followed by July 5th (0.474) and July 25th (0.448). Among the varieties, NDR-359 possess highest Heat use efficiency (0.503) at 105 DAT followed by Swarna Sub-1(0.475) and Sarjoo-52 (0.457). The similar results found that by Nishad *et al.*, (2018) 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 Highest Heat use efficiency (HUE) was recorded in growing environment of July 25th transplanting at all the stage followed by July 15th and July 5th transplanting while among the variety NDR-3112 recoded highest HUE followed by BPT-5204and NDR-97.

Bright sunshine (hrs.) of rice cultivars at different growing environment has been depicted in (Table 2). From table it was revealed that highest bright sunshine (hrs.) was recorded at IIst date of transplanting on (669.8) July 15th followed by (661.6) July 5th and (598.8) July 25th respectively. Among the varieties bright sunshine hours were recorded highest in cultivar NDR-359 (633.8) followed by Sarjoo-52(633.8) and Swarna Sub-1(627.6). Samanta *et al.*, (2019) Irrespective of years, Swarna cultivar used the radiation more efficiently than the Satabdi cultivar. The mean RUE values were 2.75 and 2.57 gm MJ-1 IPAR for Swarna and Satabdi cultivars respectively.

Table.1 Heat use efficiency (HUE) as affected by different growing environment of rice cultivars

Treatments / **Growing environment**	**Heat use efficiency (g/m^2/^{0}days)**						
	15 DAT	**30 DAT**	**45 DAT**	**60 DAT**	**75 DAT**	**90 DAT**	**105 DAT**
5th July	0.387	0.340	0.383	0.403	0.466	0.460	0.474
15thJuly	0.389	0.350	0.390	0.456	0.488	0.495	0.499
25th July	0.351	0.334	0.375	0.353	0.436	0.445	0.448
Varieties							
Sarjoo-52	0.363	0.345	0.378	0.345	0.438	0.446	0.457
NDR-359	0.386	0.365	0.389	0.396	0.472	0.484	0.503
Swarna Sub-1	0.376	0.356	0.385	0.385	0.454	0.463	0.475

Table.2 Accumulated of Bright sunshine hours as affected by different growing environment of rice cultivars

Treatments / **Growing environment**	**Phenophases/Stage**	
	Bright sun shine (BSS) (hrs.)	
	Vegetative	**Reproductive**
5th July	487.4	661.6
15thJuly	490.5	669.8
25th July	451.1	598.8
Varieties		
Sarjoo-52	447.0	627.6
NDR-359	461.7	633.8
Swarna Sub-1	580.5	626.6

Table.3 Accumulated heliothermal unit as affected by different growing environment of rice cultivars

Treatments	Phenophases/Stage	
Growing environment	Heliothermal unit (^{0}days hrs.)	
	Vegetative	Reproductive
5th July	10241.4	13414.6
15thJuly	10006.2	13244.9
25th July	9273.6	11179.7
Varieties		
Sarjoo-52	10126.3	12177.7
NDR-359	10092.0	12165.4
Swarna Sub-1	11604.4	12483.2

Table.4 Accumulated photothermal units as affected by different growing environment of rice cultivars

Treatments	Phenophases/Stage	
Growing environment	Photothermal unit (^{0}days hrs.)	
	Vegetative	Reproductive
5th July	22270.5	28863.9
15thJuly	21435.3	28210.6
25th July	20160.0	24417.8
Varieties		
Sarjoo-52	22868.0	26241.9
NDR-359	21910.2	25802.9
Swarna Sub-1	23741.0	27593.3

Data pertaining to heliothermal unit as affected by different growing environment of rice cultivars have been presented in (Table 3). From table it was revealed that heliothermal unit was recorded highest in Ist date of transplanting on July 5th (^{0}days hours) followed by July 15th and July 25th. Among the varieties highest heliothermal unit at vegetative and reproductive stages were recorded in cultivars Swarna Sub-1 followed by Sarjoo-52 and NDR-359. Data pertaining to photothermal unit as affected by different growing environment of rice cultivars have been presented in (Table 4). From table it was revealed that photothermal unit was recorded highest in Ist date of transplanting on July 5th, at vegetative and reproductive stages as followed by July 15th and July 25th. Among the varieties highest photothermal unit at vegetative and reproductive stages was recorded in variety Swarna Sub-1, followed by Sarjoo-52 and NDR-359. Pal *et al.*, (2013) the Higher PTU and HTU were accounted in case of variety PBW-343 followed by WH-542 during all the phenophases of wheat for both the years. Wheat crop sown on 20th November (normal) required less photothermal unit as well as heliothermal unit, while, 09th January (late) sowing accounted higher values of PTU and HTU during crop growth period. Timely sown wheat crop (20th November) produced highest yield, while, with every 25 days delay in sowings reduction in yield was accounted

by 13 to 26.1 percent in the year 2007-08, whereas, 14.6 to 29.3 percent in 2008-09. Diwan *et al.,* (2017) In terms of genotypes heat use efficiency (HUE) was maximum in Mahamaya and radiation use efficiency (RUE) was maximum in MTU-1010.

In conclusion the maximum heat use efficiency ($g/m^2/^0$days) (0.499) was recorded at IInd date of transplanting on July 15th at 105 DAT followed by July 5th (0.474) and July 25th (0.448). The highest bright sunshine (hrs.) was recorded at IIst date of transplanting on (669.8) July 15th followed by (661.6) July 5th and (598.8) July 25th respectively. heliothermal unit was recorded highest in Ist date of transplanting on July 5th (^{0}days hours) followed by July 15th and July 25th. it was revealed that photothermal unit was recorded highest in Ist date of transplanting on July 5th, at vegetative and reproductive stages as followed by July 15th and July 25th.

References

Anonymous, (2013-14).Record Food grain production. Pratiyaogita Darpan. April, 2014: 1618.

Diwan, U.K., Chaudhary, J.L. and Unjan, D. (2017). Variation in Heat and Radiation Use Efficiency of Rice as Influenced by Different Growing Environments and Genotypes, *Int. J. Curr. Microbiol. App. Sci.*, 6 (11): 48-52.

Dwivedi, J. L. (2011). Status paper on rice in Uttar Pradesh. Rice Knowledge Management Portal (RKMP). *http://www.rkmp.co.in.*

FAO. World Agriculture (2002).Towards 2015/2030 Summary Report. Food and Agriculture Organization of the United Nations, Rome.

Khus, G.S. (1997). Origin, dispersal, cultivation and variation of Plant Mol. Biol., 35: 25-34.

Nishad, A., Mishra, A.N., Mishra, S.R., Singh, A.K., Chaudhari, R., Kumar, N. and Aryan, R.K. (2018). Effect of heat use efficiency and thermal unit at different phenophases of rice (*Oryza sativa* L.) Cultivars, J. Pharm. Phyto., 7(5): 1312-1314.

Pal, R.K., Rao, M.N.N. and Murty, N.S. (2013). Agro-meteorological Indices to Predict Plant Stages and Yield of Wheat for Foot Hills of Western Himalayas, International Journal of Agriculture and Food Science Technology, 4(9): 909-914.

Samanta, S., Banerjee, S., Mukherjee, A., Patra, P.K. and Chakraborty, P. (2019). Deriving PAR use efficiency of wet season rice from bright sunshine hour data and canopy characteristics, Mausam, 70(2): 349-358.

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