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Performance of different wheat genotypes under different thermal environments (Short communication)

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Abstract
The present field experiment was conducted at the Research Farm of Indira Gandhi Krishi Vishwavidhalaya, Raipur during *rabi* season of 2011-2012. The treatment combinations of five sowing dates (26 November, 06 December, 16 December, 26 December and 05 January) and four varieties (Kanchan, GW-273, Sujata and Amar) were laid out in a Split plot design with three replication. Results revealed that wheat variety Kanchan followed by GW-273 obtained higher Heat Use Efficiency and Radiation Use Efficiency.

Keywords: performance, genotypes under, thermal environments

Introduction
The radiation received by an organism consists of direct beam, diffuse sky and reflected radiation from terrestrial objects. The resultant net radiation is used for such natural processes as evapotranspiration, sensible heat, soil heat flux and biological processes. Different land uses may affect the absorption and reflection of solar radiation causing different values for the radiation use efficiency (RUE) of crops. Temperature based agrometeorological indices such as heat use efficiency (HUE) can be quite useful in predicting growth and yield of crops. Growing degree days are based on the concept that real time to attain a phenological stage is linearly related to temperature in the range between base temperature (T_b) and optimum temperature. Heat use efficiency (HUE), *i.e.* efficiency of utilization of heat in terms of dry matter accumulation is an important aspect, which has great practical application. The total heat energy available to any crop is never completely converted to dry matter even under the most favorable agro climatic conditions. Efficiency of conversion of heat energy into biomass depends upon genetic factors, sowing time and crop type. (Rao *et al*., 1999) [2].

Methodology
In the experiment five sowing dates (26 November, 06 December, 16 December, 26 December and 05 January) and four varieties (Kanchan, GW-273, Sujata and Amar) treatment combinations were laid out in a Split plot design and replicated thrice. Nutrients were applied uniformly to the crop as per the recommendations. i.e. 100 kg N, 60 kg P_2O_5, and 40 kg K_2O/ ha.
One third of N and full quantity of P_2O_5, and K_2O were applied before sowing as basal. The remaining half quantity of nitrogen was applied as two equal split doses, first at the crown root initiation stage and second at ear head initiation stage. Following heat units were used-

Photothermal Unit (PTU)
PTU is calculated by multiplying GDD with maximum possible sunshine hours

$$PTU = GDD \times N$$

Where,
N = maximum possible sunshine hour.

Heliothermal Unit (HTU)
HTU is calculated by multiplying GDD with actual sunshine hours (n) (Rajput, 1980).

HTU = GDD X n

Where,
N = actual sunshine hour.

Result and Discussion

Heat use efficiency (HUE)

Heat Use Efficiency (HUE) for different genotypes under different thermal environments varied considerably (Table 1). Higher HUE was observed with wheat variety Kanchan followed by GW-273. Minimum HUE was observed with variety Amar it was observed that as regards the sowing dates. The sowing dates maximum HUE was observed under 06 December (D2) sowing followed by 16 December (D3) sowing and the minimum HUE was observed under 05 January (D5) sowing. As regards the response of wheat varieties under different sowing dates it was found that higher HUE were observed in wheat varieties Kanchan followed by GW-273 when sown on 06 December whereas, in Sujata HUE was higher in 16-December and in case of Amar it was observed highest when sown on 26 December. Rao *et al*. (1999) [2] found that the HUE in terms of dry matter accumulation (DMA) was highest in mustard followed by chickpea and wheat and decreased when planting was delayed after recommended time of sowing for these crops.

Patra and sahu (2007) [1] also found that the crop accumulated higher amount of heat units than late sown condition. The RUE and HUEs were also higher for earlier sowings than later sowings. Similar result find to be Rao *et al.* (1999) [2] field experiments conducted at Research Farm, HAU, Hisar during winter seasons of 1993-94 and 1994-95 with wheat and mustard and 1992-93 and 1993-94 with chickpea. Experimental results indicated highest heat use efficiency (HUE) in wheat in terms of seed yield (2.56 kg ha-1 day-1 in 1993-94 and 2.18 kg ha-1 day-1 in 1994-95) as compared to mustard and chickpea crops in that order. HUE values varied between two seasons within dates of planting in three crops. The HUE in terms of dry matter accumulation (DMA) was highest in mustard followed by chickpea and wheat and decreased when planting was delayed after recommended time of sowing for these crops.

Table 1: Heat use efficiency (HUE) of wheat varieties under different thermal environments

			Heat use efficiency (g/m^2 deg day)			
Varieties	**D1-26 Nov.**	**D2-06 Dec.**	**D3-16 Dec.**	**D4-26 Dec.**	**D5-05 Jan.**	**Mean**
Kanchan	0.48	0.50	0.49	0.41	0.38	0.45
GW-273	0.41	0.47	0.45	0.40	0.34	0.41
Sujata	0.34	0.43	0.44	0.39	0.38	0.40
Amar	0.37	0.42	0.36	0.43	0.38	0.39
Mean	0.40	0.46	0.43	0.41	0.37	0.41

Radiation Use Efficiency (RUE)

Radiation Use Efficiency (RUE) for different genotypes under different thermal environments varied considerably (Table 2). On the mean basis higher RUE value was observed under 16 December sowing followed by 06 December, 26 December 26 November and 05 by GW-273, Sujata and Amar. All the varieties showed maximum RUE when the crop was sown on 06 December in other dates of sowing the varieties sown different response for example variety Kanchan showed similar RUE under 26 November and 16 December sowing. Variety GW-273 showed minimum RUE in 05 January sowing, where Sujata showed lowest RUE in 06 December sowing while Amar sowed lower RUE in 16 December sowing. Sharma *et al.* (2003) [3] also found that the delayed in sowing from 25th November to 10th December significantly reduced the radiation use efficiency.

Table 2: Radiation Use Efficiency (RUE) of wheat varieties under different thermal environments

		Radiation Use Efficiency ($g\ MJ^{-1}$)				
Varieties	**D1-26 Nov.**	**D2-06 Dec.**	**D3-16 Dec.**	**D4-26 Dec.**	**D5-05 Jan.**	**Mean**
Kanchan	1.12	1.17	1.12	0.97	0.91	1.06
GW-273	0.96	1.10	1.02	0.94	0.82	0.97
Sujata	0.82	1.04	1.04	0.94	0.91	0.95
Amar	0.89	1.01	0.85	1.04	0.92	0.94
Mean	0.95	1.08	1.01	0.97	0.89	0.98

Efficiencies varied from 1.24 to 2.85 gm dry matter MJ·lof intercepted photo synthetically active radiation for wheat crop. Among varieties and sowing dates, Sunshine hours, vapor pressure deficit, maximum; minimum and mean temperatures of whole season were negatively associated while positive correlation existed for relative humidity with radiation use efficiency. Similar results find to be Patra and sahu (2007) [1] conducted an experiment to use various agro meteorological indices for suitable sowing time of wheat, thermal and radiation use efficiency indices were used to identify the appropriate sowing time for wheat at Junagadh. The results revealed that under normal sowing condition the crop accumulated higher amount of heat units than late sown condition. The RUE were also higher for earlier sowings than later sowings. Thus the study suggested that the appropriate time of sowing for wheat is 15th Nov to 25th Nov for getting higher and stable yield of wheat under South Saurashtra Agro climatic Zone of Gujarat.

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