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Short communication

Heat unit requirement of wheat cultivars as affected by moisure application frequencies

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Wheat (*Triticum aestivum* L.) as the harbinger of green revolution has played the key role in achieving self reliance in the food production. The growing period of wheat is variable from one agro climatic zone to the other that affects the vegetative and reproductive period leading to differences in potential yields.

Temperature is one of the most important climatic parameter affecting the growth, phenology, development and yield of wheat. The usefulness of different temperature indices like growing degree days (GDD) for predicting growth and development of wheat crop is well established (Rajput *et al,* 1987 and Tripathi *et al*, 2004). Significant effect of soil moisture on heat units was noticed by several workers (Singh *et al,* 1984; Alam *et al*, 2004). The present study describes and discusses the effect of various moisture application schedules on the heat unit requirement of three bread wheat cultivars.

A field experiment was conducted during winter season of 2002-03 and 2003-04 at student's instructional farm of Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad, U.P. ($26^0 47'$ North, $82^0 12'$ East and 113 m above mean sea level). Treatment consisted of 4 moisture levels viz., M_1 (one irrigation given at crown root initiation stage), M_2 (two irrigations given at CRI and flowering stages), M_3 (three irrigations given at CRI, late tillering and flowering stages) and M_4 (four irrigations given at CRI + late tillering + late jointing + ear head formation stages) with the combination of three wheat cultivars viz., HUW-234, HD-2285 and PBW-154. The experiment was laid out in randomized block design (RBD). Sowing of the wheat was done during the first week of December in lines with 20cm X10cm spacing. The meteorological data used in the study were recorded in the Agro-Meteorological Observatory situated near experimental site. Number of days taken to attain various phenophases was determined visually from the sowing date to respective phenophases. The growing degree days (GDD) were calculated using the threshold temperature

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Table 1: GDD accumulation for various phenophases of wheat as affected by moisture levels and cultivars (Average data of two years)

Treatments	Phenophases								
	Emergence	CRI	Late Tillering	Late Jointing	Ear Emergence	50% Flowering	Milk	Dough	Maturity
Moisture Levels									
M_1	92	267	485	570	755	907	1133	1430	1596
M_2	84	269	481	585	768	912	1146	1482	1642
M_3	88	269	487	582	782	935	1159	1487	1713
M_4	84	270	484	583	786	951	1159	1516	1740
Cultivars									
V_1	89	272	486	572	770	928	1118	1440	1626
V_2	89	269	479	581	761	916	1152	1482	1697
V_3	83	274	488	586	786	935	1177	1520	1713

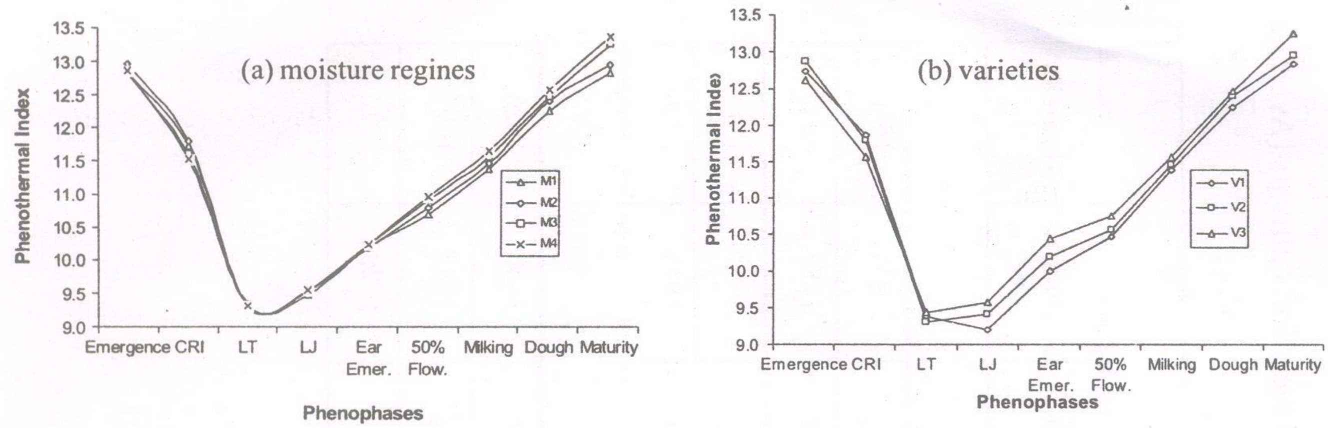

Fig.1 : PTI of wheat at different growth stages as affected by various (a) moisture application frequencies (b) varieties

value 5^{0}C considered for wheat crop (Nuttonson, 1955). Growing degree days (GDD) and phenothermal index (PTI) were calculated using the following formulae-

1. Growing Degree Days (GDD)

$$= \sum_{1}^{n}\left[\frac{(T\max + T\min}{2} - Tt\right]$$

2. Phenothermal index (PTI) = GDD / Number of days between phenological stages

Where,

T_{max} = Maximum daily temperature (^{0}C)

T_{min} = Minimum daily temperature (^{0}C)

T_t = Minimum Threshold temperature for wheat (^{0}C)

n = Days taken to attain respective growth stage

The pooled mean data of two years for accumulated growing degree days (GDD) as affected by various moisture application frequencies for three wheat cultivars is presented in Table 1. Days taken to maturity as well as accumulated growing degree days of wheat increased with increasing frequency of irrigation. Heat unit requirement from ear emergence up to maturity was recorded maximum in M_4 followed by M_3. Adequate moisture resulted in prolonged vegetative phase, delayed maturity and finally more heat unit accumulation. Between cultivars, heat unit accumulation showed difference from 50% flowering stage onwards. The reported results corroborate the findings of Alam *et al* (2004) and Singh *et al* (1984).

The heat units accumulated per growth day between different phenological stages expressed as PTI were computed. PTI value decreased till jointing stage and thereafter gradually increased towards maturity. On an average, the phenothermal index were found in the order of $M_4 > M_3$

$>M_2 > M_1$ in all cases from late tillering onwards (Fig.1), as also shown by Rahman *et al* (2001). Among the cultivars, HUW-234 recorded the highest PTI values at all the stages with the exception of emergence, CRI and late tillering stages. (Fig.1)

It may be concluded that phenothermal index can be used to express development characters as it integrates phenological behavior with the thermal regime.

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