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Short Communication

A note on thermal unit requirement for phenological development in pearl millet, sorghum, tomato and brinjal

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Thermal regime in the growth environment greatly influences the phenological development of plants. Optimal temperature regimes for growth vary from growth phase in a crop species and species to species. Since each phase of plant growth is influenced by temperature the occurrence of a phenological event can be predicted based on thermal indices like Growing Degree Days (Iwata, 1979). Earlier studies indicated that the occurrence of phenological events in maize is faster under warmer environments compared to cooler environments and the heat unit requirement for different phenological stages were worked out (Naresh Kumar, 1995; Naresh Kumar and Singh, 1999). Information on growing degree-day requirement for crops like sorghum is available from other countries (Nield and Seeley, 1977). Whereas, such information on crops like pearl millet, tomato and brinjal is scanty or non existent. The study was conducted to estimate the thermal requirement for major phenological events in these crops.

The seeds of pearl millet, sorghum, tomato and brinjal were sown on the red-sandy loam soils of the research farm of the Plant Gene, Medchal, Hyderabad during 1994 monsoon season to estimate the thermal requirement for phenological development. The recommended inter and intra row spacing was maintained for each crop and plant population was maintained at recommended level. Experiment was laid-out in RBD with three replications with a plot size of 750 m^2/ replication. The phenological development was recorded based on the leaf appearance. The dates were recorded when 75% of the plants in a plot attained a particular phase. The number of dead leaves was taken in to account while recording the phenological development. Daily weather data was collected from the weather station located at 1 km away from the experimental site. The thermal unit requirement for phenological stages was computed with different base temperatures.

Sorghum: Under Hyderabad conditions, the monsoon grown sorghum crop comes to harvest at around 100 days. Data indicate that for germination of sorghum the GDD requirement is 120 GDDs and from germination to first pollen burst it takes around 1100 GDDs (Table 1). In this study the base temperature (Tb) is put at 10 ^{0}C. These values closely followed those reported by Nield and Seeley (1977) from USA, with

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Table 1: Growing degree days and days required for phenological stages in sorghum and pearl millet

Phenological stage	Days	GDD
(a) Sorghum		
Sowing to germination	7	123
From germination to		
2-leaf stage	7	109
5-leaf stage	14	213
6-leaf stage	20	314
Tillering	30	473
8-leaf stage	53	821
First panicle emergence	66	1017
12-leaf stage	67	1033
First pollen burs	70	1097
(b) Pearl millet		
Sowing to germination	7	123
From germination to		
4-leaf stage	8	129
8-leaf stage	22	350
11-leaf stage	33	524
Start of tillering	32	509
First panicle emergence	47	748
10% panicles emerged	55	873
Harvest	92	1444
Tb - Base temperature		

Tb=10 ^{0}C.

Pearl millet: The thermal time requirement for germination of pearl millet is around 125 GDD, with Tb=10 ^{0}C. The first tillering started when the accumulated GDD were around 500. Crop required 1570 GDD from sowing to harvest (Table 1).

Brinjal: Literature on the temperature requirement of brinjal indicates Tb at 18 ^{0}C (Lenka, 1998), since it is a tropical vegetable crop, models with different Tb i.e.,10 ^{0}C and 15 ^{0}C, are also tried. Obviously, with increase in Tb, sum of GDD decreased for a given phase. GDD requirement from transplantation to first flowering is around 670 at Tb as10 ^{0}C (Table 2a). From sowing

Table 2: Growing degree days (GDD) and days required for phenological stages in brinjal and tomato

Phenological stage	Days	GDD at different base temperature (Tb)		
(a) Brinjal				
		Tb=10 °C	Tb=15 °C	Tb=18 °C
Sowing to transplantation	38	640	446	328
Transplantation to				
4- leaf	27	429	294	213
First flowering	43	669	454	325
(b) Tomato				
		Tb=6.1 °C	Tb=10 °C	Tb=15 °C
Sowing to transplantation	45	900	722	502
Transplantation to first flowering	29	570	455	309

Tb - Base temperature

to first flowering it took around 1310 GDD.

Tomato: The thermal time requirement for first flowering, from sowing, of tomato is around 800 GDD (Table 2) with Tb = 15 °C (Holmes and Robertson, 1959). The GDD are calculated using different Tb i.e., 6.1°C (Warnock and Isaacs, 1969) and 10°C (Valli and Jaworski, 1966). Tomato harvest prediction using heat units was done earlier also (Austin and Ries, 1968; Warnock and Isaacs, 1969).

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REFERENCES

Austin, M.E. and. Ries, S.E. 1968. Use of heat units to predict dates for once-over tomato harvest. *Hort. Sci.*, 3: 41.

Holmes, R.M. and Robertson, G.W. 1959. Heat units and crop growth. *Canada Deptt. Agric. Publ.*, 1042: 1-35.

Iwata, F. 1979. Heat unit concept of crop maturity In: *Physiological Aspects of Dryland Farming* (Ed. U.S. Gupta) 351-370. pp 391

Lenka, D. 1998. Climate Weather and Crops in India, Kalyani Pub., New Delhi, Pp 481.

Naresh Kumar, S. 1995. Accumulation of thermal units for different growth phases of maize (*Zea mays L.*): A genotypic and seasonal account. *J. Rec. Adv. Appl. Sci.*, 10 (1&2): 49-52.

Naresh Kumar, S. and Singh, C.P. 1999. Accumulation of thermal units for different growth phases of maize (*Zea mays L.*): Effect of nitrogen application and seasonal variation. **In**: *Plant Physiology for Sustainable Agriculture* (eds. G.C. Srivastava, Karan Singh and Madan Pal), Pointer Pub., Jaipur: 141-150.

Nield, R.E. and Seeley, M.W. 1977. Growing degree day predictions for corn and sorghum development and some applications to crop production in Nebraska. *Res. Bull.*, 280.

Valli, V.J and Jaworski, C.A. 1966. Influence of biometeorological factors in tomato transplant production. *Proc. Fla. St. Hort. Soc.*, 78: 102-106.

Warnock, S.J. and Isaacs, R.I. 1969. A linear heat unit system for tomatoes in California. *J. Am. Hort. Sci.*, 94: 677-678.