



Short Note

## Thermal Indices for Suitable Sowing Window of Sweet Sorghum in Coimbatore District of Tamil Nadu

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**A field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore from June to November, 2005 to identify the suitable sowing window of sweet sorghum in Coimbatore district of Tamil Nadu by using thermal indices and heat use efficiency. The result revealed that higher yield recorded on June 8<sup>th</sup> (23<sup>rd</sup> SMW) due to higher thermal use efficiency than other dates of sowing.**

**Key words:** Sweet sorghum, Thermal indices and Heat use efficiency

Sweet sorghum (*Sorghum bicolor*, L. Moench) belongs to the same species as grain sorghum. A number of reports have shown that sweet sorghum is a potential source of sugar and a multi purpose industrial crop. Sweet sorghum will thrive under drier and warmer conditions than many other crops and is grown primarily for forage, silage and sugar production. Optimum time of sowing is one of the important no cost technologies that gives an opportunity for better utilization of natural resources by the crop during its growth. It also helps in identification of critical phenological phases of crops for achieving potential productivity. Suitable time of sowing enables the crop to take full advantage of favourable weather conditions during growing season. Determination of sowing window depends upon the thermal time and thermal use efficiency of the crops.

Temperature is also an important environmental factor that affects plant growth development and yield. Heat unit concept has been applied to correlate phenological development in crops to predict sowing dates (Mills, 1964). Therefore, in this paper thermal indices and heat use efficiency were used to identify suitable sowing window of sweet sorghum in Coimbatore district of Tamil Nadu.

### Material and Methods

The investigation was carried out during kharif season (2005) at the Eastern block (Field number 37 F) of Tamil Nadu Agricultural University, Coimbatore situated in the Western Agro climatic zone of Tamil Nadu located at 11°N latitude and 77°E longitude with mean altitude of 426.7 m above mean sea level. The soil of the experimental field was well drained and sandy clay loam in texture. The field experiment was laid out in split plot design and the treatments were replicated thrice keeping four dates of sowing with one variety SSV 84. First

date of sowing was fixed as 8<sup>th</sup> June and after that in 15 days interval subsequent sowings (June 23<sup>rd</sup>, July 8<sup>th</sup> and July 23<sup>rd</sup>) were taken up. The crop was raised using the recommended agronomic practices in this region.

Growing degree days (GDD) or heat units were determined as per (Nuttonson, 1955) using the base temperature 10°C from the daily mean temperature. The photo thermal units (PTU) and helio thermal units (HTU) were calculated as the product of maximum possible sunshine hours and actually measured bright hours with GDD, respectively. The thermal use efficiency for grain or biomass yield was computed:-

$$\text{Heat use efficiency (HUE)} = \frac{\text{Seed or Biomass yield (kg ha}^{-1}\text{)}}{\text{GDD}^{\circ}\text{C}}$$

### Results and Discussion

#### Grain yield

Crop sown on first date of sowing (June 8<sup>th</sup>, 23<sup>rd</sup> SMW) recorded the overall significantly higher grain yield (2483 kg ha<sup>-1</sup>) than all the other treatments. The fourth date of sowing (July 23<sup>rd</sup>, 30<sup>th</sup> SMW) recorded the lowest yield (1171 kg ha<sup>-1</sup>) of sweet sorghum which is attributable to continuity of the rains during the subsequent weeks. Yields from crop sown during second date of sowing (June 23<sup>rd</sup>, 25<sup>th</sup> SMW) (1968 kg ha<sup>-1</sup>) and third date of sowing (July 8<sup>th</sup>, 27<sup>th</sup> SMW) (1875 kg ha<sup>-1</sup>) were comparable with each other.

#### Thermal indices

The GDD, HTU and PTU varied with different stages of crop growth under sowing dates (Table 1). The units required for attaining all the phases decreased consistently with delay in sowing window.

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**Table 1. Growing Degree days, Helio Thermal Unit and Photo Thermal Unit for various stages of sweet sorghum under different sowing dates**

Crop Stages	June 8 <sup>th</sup>			June 23 <sup>rd</sup>			July 8 <sup>th</sup>			July 23 <sup>rd</sup>		
	GDD	HTU	PTU	GDD	HTU	PTU	GDD	HTU	PTU	GDD	HTU	PTU
Emergence	93.0	626.1	1152.6	89.9	396.6	1114.1	86.5	414.3	1064.0	86.3	331.3	1060.9
Vegetative	854.5	4007.5	10551.5	843.8	4117.3	10392.9	843.7	4792.6	10377.5	839.8	4853.2	10299.0
Reproductive	1338.3	7045.3	16501.6	1322.9	7012.5	16261.2	1313.8	7643.5	16085.9	1314.9	8087.9	16047.2
Physiological Maturity	1892.8	10572.3	23238.0	1880.8	10643.6	23012.4	1865.5	11100.3	22760.8	1840.9	10535.7	22398.1

**Thermal use efficiency**

Data pertaining to thermal use efficiency for SSV-84 variety in terms of grain and biomass production under different sowing window are presented in (Table 2). Sweet sorghum variety SSV-84 sown on first date of sowing (23<sup>rd</sup> SMW) recorded the highest thermal use efficiency for grain yield (0.59 Kg ha<sup>-1</sup>

°C day<sup>-1</sup>) followed by second date of sowing (25<sup>th</sup> SMW) (0.48 Kg ha<sup>-1</sup>°C day<sup>-1</sup>). The least efficiency (0.29 Kg ha<sup>-1</sup> °C day<sup>-1</sup>) was noticed under fourth date of sowing (30<sup>th</sup> SMW). This indicates that the crop got exposed to the sub optimal thermal regime with delay in sowing dates. Similar result was reported by Rajput and Shrivastava (1999) and Prasad et al. (2008).

**Table 2. Heat use efficiency under different sowing dates of sweet sorghum.**

Dates of sowing	Grain yield(Kg ha <sup>-1</sup> )	HTU(Kg ha <sup>-1</sup> °C day <sup>-1</sup> )	DMP(Kg ha <sup>-1</sup> )	HTU(Kg ha <sup>-1</sup> °C day <sup>-1</sup> )
D <sub>1</sub> (June 8 <sup>th</sup> )	2483	0.59	8981	2.15
D <sub>2</sub> (June 23 <sup>rd</sup> )	1968	0.48	8489	2.05
D <sub>3</sub> (July 8 <sup>th</sup> )	1875	0.46	8125	1.98
D <sub>4</sub> (July 23 <sup>rd</sup> )	1171	0.29	6930	1.70
SEd	46.3		198.7	
CD	113.4		449.1	

As regards thermal use efficiency in terms of biomass production, data revealed that the variety SSV-84 sown on first date of sowing (23<sup>rd</sup> SMW) recorded the highest heat use efficiency (2.15 Kg ha<sup>-1</sup> °C day<sup>-1</sup>) followed by second date of sowing (25<sup>th</sup> SMW) (2.05 Kg ha<sup>-1</sup> °C day<sup>-1</sup>).

From the present study, it can be concluded that sweet sorghum (variety SSV-84) can be sown on (23<sup>rd</sup> SMW) June 8<sup>th</sup> in Coimbatore district of Tamil Nadu based on thermal indices and thermal use efficiencies for getting higher productivity.

**References**

Mills, W.T. 1964. Heat unit system for predicting optimum

pea nut harvesting time. *Trans, Am. Soc. Agric. Engrs.* **7**: 307-310.

Nuttonson, M.Y. 1955. Wheat climatic relationship and use of phenology in ascertaining the thermal and photo thermal units of wheat. *Am. Inst. Crop Ecol.* Washington D.C.

Prasad, P.V.V., Pisipatis, R., Mutavar, N. and Tuinstra, M. R. 2008. Sensitivity of Grain Sorghum to High Temperature Stress during Reproductive Development. *Crop Sci.*, **48**: 1911-1917.

Rajput, R. L. and Shrivastava, U.K. 1999. Influence of varieties, sowing dates and seed rate on physiological parameters and yield of soybean. *Legume Res.* **22**: 117-120.