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RESEARCH ARTICLE

ACCUMULATED THERMAL TIME AFFECTS GROWTH, YIELD AND PHENOLOGICAL DEVELOPMENT OF SESAME (*Sesamum indicum* L.) IN THE DRY ZONE OF SRI LANKA

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ABSTRACT

The present experiment was conducted to determine the impact of accumulated thermal time on the growth, yield and phenology of Sesame (*Sesamum indicum* L.) in the dry zone of Sri Lanka. Uma, Malee and MI-3 varieties were selected and the seeds were sown on three different dates in the 2016 *Yala* and 2016/2017 *Maha* seasons. The experiment was set up according to a two-factor factorial randomized completely block design with three replicates. Accumulated thermal time was calculated as growing degree days at the vegetative stage, flowering initiation, 50% of flowering, 100% of flowering and physiological maturity using minimum and maximum daily temperature. Then the plant height and the number of leaves per plant were plotted against the accumulated thermal time using the sigmoid growth model. The seed dry weight and dry weight of 1000 seeds were recorded at maturity. The relationship of plant height and the number of leaves per plant with accumulated growing degree days (AGDD) was significant for all varieties at different sowing dates in both seasons. The flowering of sesame initiated at 741 and 713.1 of AGDD in *Yala* and *Maha* seasons, respectively. The AGDD needed for 50 % flowering in the *Yala* is greater than the *Maha* season. Full flowering occurred in *Maha* earlier than the *Yala* season. Plants reached physiological maturity early in the *Maha* season. Seed weight per 15 plants and seed weight per plot were significantly affected by the interaction between variety and the sowing date in *Maha* and *Yala* seasons, respectively. The highest seed weight per 15 plants was recorded in var. Uma and var. Malee in *Yala* season while the highest seed weight per plot was also recorded by var. Uma. Furthermore, 1000 seed weight was greater in var. Uma than other varieties in both seasons. Sowing seeds early in the season increased seed weight per 15 plants in *Yala* while seeds per plot and 1000 seed weight in *Maha* season. According to the results of the present study, var. Uma could be considered as an efficient sesame variety that performed better when sown early in the season. Therefore, cultivating var. Uma, early in the seasons might be beneficial in terms of growth and yield in the dry zone of Sri Lanka. However, further field studies are needed to give a solid recommendation.

Keywords: Accumulated thermal time, *Maha* season, Phenology, Sesamum indicum, *Yala* season

INTRODUCTION

Plants need a certain amount of heat for development and shift from one phonological phase to another phase. Farmers take some important management decisions by considering the number of calendar dates more often. However, it is erroneous of using calendar dates, especially in the early crop growth, since temperature changes would affect the duration of some growth stages (Dubey *et al*. 2018; Hatfield and Prueger 2015; Miller *et al*. 2001). Therefore, the ability to predict a specific crop stage would allow taking better management decisions such as fertiliser application and predicting vegetative phase relatively to insect and weed life cycles (Ahmad *et al*. 2017). Sesame cultivation requires a different number of days for growth and development. Different

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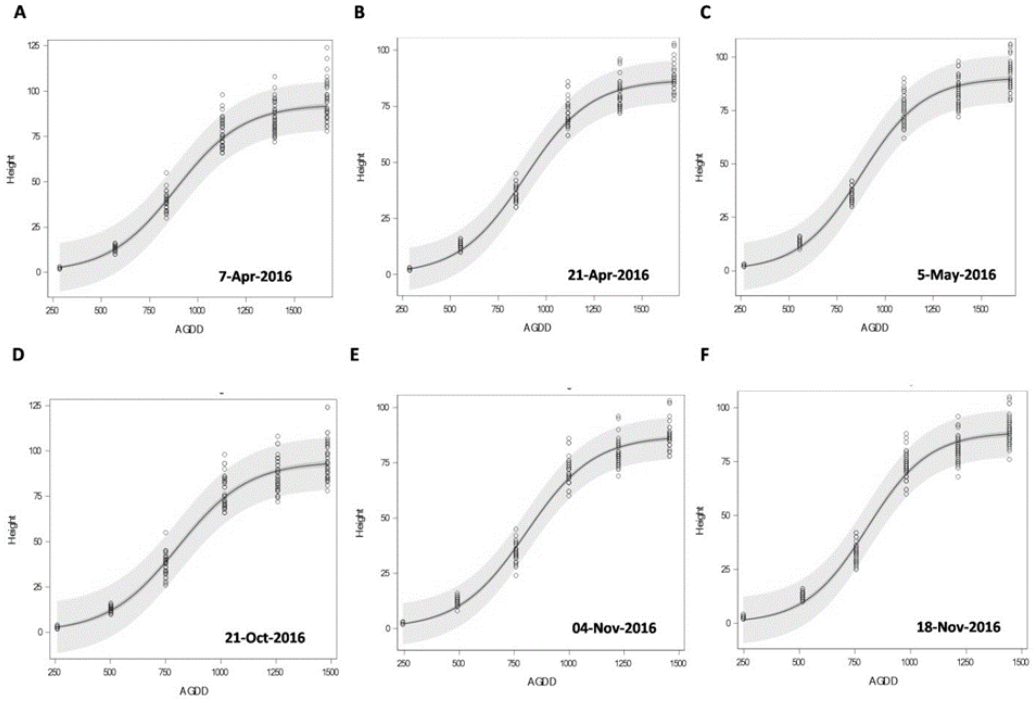

Figure 2: Observed values and fitted curves for plant height of variety Uma against accumulated thermal time (^{o}Cd) for different sowing dates in *Yala/Maha* seasons (A) 7th April 2016 (B) 21st April 2016 (C) 5th May 2016 (D) 21st October 2016 (E) 4th November 2016 and (F) 18th November 2016.

Table 2: Estimated parameters of sigmoid growth model for number of leaves per plant of three varieties (Uma, Malee and MI-3) in three sowing dates in *Yala* (07 April 2016, 21 April 2016 and 05 May 2016) and *Maha* (21 October 2016, 04 November 2016 and 18 November 2016) seasons

Season	Sowing Date	Variety	Parameters			F value	P value
			a	b	X_0		
Yala Season	07 April 2016	Uma	46.63	263.71	1004.54	9042.36	<0.001
		Malee	40.14	247.34	971.92	9146.15	<0.001
		MI-3	38.07	232.40	936.37	7578.86	<0.001
	21 April 2016	Uma	47.72	299.91	1082.65	6783.52	<0.001
		Malee	39.28	266.17	1004.43	5767.04	<0.001
		MI-3	37.97	239.12	966.01	9443.04	<0.001
	05 May 2016	Uma	44.14	277.70	1053.27	12815.20	<0.001
		Malee	40.41	262.61	1020.54	10952.50	<0.001
		MI-3	38.76	256.90	1008.60	13673.10	<0.001
Maha Season	21 October 2016	Uma	45.00	246.22	909.32	9896.63	<0.001
		Malee	40.24	227.91	876.45	8089.98	<0.001
		MI-3	40.53	219.95	858.23	7500.38	<0.001
	04 November	Uma	46.56	256.93	953.39	6679.68	<0.001
		Malee	41.66	241.25	926.83	6265.16	<0.001
		MI-3	39.74	227.65	893.40	7681.97	<0.001
	18 November 2016	Uma	43.58	237.21	948.62	10730.40	<0.001
		Malee	40.11	220.86	913.80	12639.00	<0.001
		MI-3	40.58	223.10	916.44	10996.70	<0.001