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Short communication

Thermal time in relation to growth of *kharif* sorghum in Pune region

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Sorghum (*Sorghum bicolor* (L) moench) is one of the most important staple food crops of the drier parts of tropical Africa, India, and China. It is dual-purpose crop used as food and fodder. It is the crop par excellence for drier regions and areas with unreliable rainfall. It also with stands water logged conditions for short periods. The yield of sorghum varies with the climatic condition of each year as well as soil type and soil fertility. Medium and deep black soils are predominantly suitable for growing sorghum. The average sorghum productivity of the last five years is 882 kg ha^{-1} in the Maharashtra state as against the national productivity of 858 kg ha^{-1} for the same period (Anonymous, 1994). Sorghum is a major cereal crops in India occupying 12.6 M ha land with a production of 11.0 Mt and productivity of 873 kg ha^{-1} (Rana *et.al.*, 1998). Area under sorghum in India, represent 30% of world acreage of sorghum and out of this 40% area is cultivated in monsoon (*Kharif*) season.

A field experiment was conducted at CASAM farm, College of Agriculture, Pune, which climatically comes under semi-arid subtropical zone and agro climatically identified as plane zone of Maharashtra receiving 714.7 mm annual average rainfall mostly from south-west monsoon. It was laid out in randomized block design with five replications and four sowing date treatments at an interval of one week in *kharif* season. The treatments were allocated randomly to each experimental plot. Certified seed of hybrid CSH-9 was used for sowing. After leveling and preparation of plots 2-3 seed were dibbled per hill. The spacing adopted was 45x15 cm.

Daily meteorological observations like maximum and minimum temperature, rainfall and solar radiation were recorded in the observatory. Other biometric observations like leaf area and dry matter was recorded at different phenological stages of sorghum. The leaf area index was computed by using stage-wise data of leaf area and land area allotted to the plant. The leaf area was measured by the instrument LICOR – 3100. Growing degree days (GDD) are computed using 10 °C as base

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Table 1 : Effect of temperature on different growth stages of sorghum.

Date of Sowing	PI			Anthesis			PM			Grain yield (kg ha)$^{-1}$
	Mean Temp (°C)	Σ GDD (°d)	No. of Days	Mean Temp (°C)	Σ GDD (°d)	No. of Days	Mean Temp (°C)	Σ GDD (°d)	No. of Days	
D_1	25.5	380.7	27	24.4	984.9	63	25.2	1658.0	100	5421
D_2	24.4	370.0	28	25.6	992.8	64	26.2	1644.1	102	4313
D_3	24.7	365.1	28	24.9	975.0	63	26.8	1641.5	102	4893
D_4	24.8	380.2	28	25.3	985.7	64	27.3	1648.3	104	4710
Mean	24.8	374.0	28	25.0	984.4	63.5	26.5	1647.9	102	4834.5
SD	0.47	7.7	0.5	0.5	7.2	0.57	0.77	7.2	1.6	459.6
CV (%)	1.9	2.0	1.8	2.0	0.7	0.9	2.9	0.4	1.6	8.7

temperature from date of sowing.

Photosynthetically active radiation was manually computed by the formulae used in DSSAT. Mean global solar radiation and photosynthetically active radiation were calculated by the duration required for each phase. The cumulative total of biomass and anthesis were done from date of sowing.

Results revealed that on an average the panicle initiation (PI) was attained in 28 days, anthesis (AN) in 64 days and physiological maturity (PM) in 102 days. Mean air temperature experienced by the crop was 24.8 °C during panicle initiation, 25.0 °C during anthesis and 26.5 °C during physiological maturity stage. Summation of growing degree days (ΣGDD) taken by the crop for attainment of panicle initiation from sowing was 374.0 °d, for anthesis was 984.4 °d and for physiological maturity 1647.9 °d. Crop sown on 11th July experienced the highest temperature 25.5 °C during PI, second sowing of 29th July experienced the highest temperature 25.6 °C during anthesis and fourth sowing of 12th August experienced the highest temperature of 27.3 °C during physiological maturity stage. GDD accumulation for attainment of PI was the highest (993 °d) for 29th July sowing and for attainment of PM was the highest (1658 °d) for 11th July sowing (Table 1).

The number of days required for different phenophases were almost identical (Table 1). Treatment D_1 produced significantly higher yield over the rest. Similar trend was also noticed at

Table 2 : Effect of radiation on different growth stages and yields of sorghum.

Date of sowing	PI			Anthesis			PM			Grain yield (kg ha^{-1})
	SR (MJm^{-2})	PAR (MJm^{-2})	Biomass (gm^{-2})	SR (MJm^{-2})	PAR (MJm^{-2})	Biomass (gm^{-2})	SR (MJm^{-2})	PAR (MJm^{-2})	Biomass (gm^{-2})	
D_1	587.5	293.7	17.2	1181.3	590.3	402.3	1410.3	705.1	1011.2	5421
D_2	582.9	291.4	13.4	851.7	415.8	352.7	1051.5	525.7	853.4	4313
D_3	975.4	297.7	10.2	834.2	417.0	397.1	1068.0	534.5	939.8	4893
D_4	581.7	290.8	13.7	814.6	407.3	390.3	1055.4	537.7	932.2	4710
Mean	586.7	293.4	13.6	920.7	445.3	385.6	1146.3	573.2	934.2	4834.5
SD	6.3	3.1	2.8	176.3	81.6	22.5	176.1	87.9	64.4	459.6
CV (%)	1.1	1.0	20.6	19.1	18.3	5.8	15.4	15.3	6.9	8.7

SR – Solar Radiation, PAR – Photosynthetically Active Radiation, PI – Panicle Initiation, PM – Physiological Maturity

physiological maturity stage.

The mean PAR received at PI was 293.4 MJ m^{-2}, during anthesis 445.3 MJ m^{-2} and during PM 573.2 MJ m^{-2} (Table 2). The mean biomass produced during PI was 13.6 gm^{-2} at anthesis 385.6 gm^{-2} and at PM 934.2 gm^{-2}.

The data indicated that during anthesis and physiological maturity stage the highest photosynthetically active radiation (PAR) was available for the crop in treatment D1 which produced significantly higher grain yield. It can be inferred from above study that first sowing of 11th July experienced favorable temperatures and received sufficient solar radiation, which resulted in producing higher biomass and grain yield at this location.

REFERENCES

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