

PHENOLOGY GROWTH AND YIELD OF SESAMUM (*SESAMUM INDICUM* L.) IN RELATION TO RAINFALL AND TEMPERATURE

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ABSTRACT

Study on phenology, growth and yield of sesamum (*Sesamum indicum* L.) revealed that the correlation coefficient between growing degree days (GDD) and plant height, leaf area and total drymatter production were 0.91, 0.93 and 0.82, respectively. About 281 GDD were needed for emergence of sesamum seed and about 31 GDD were required to produce 1 g drymatter. The rainfall growing degree days (RGDD) was better than GDD in explaining the phenological stages i.e. 50% flowering and maturity of sesamum crop.

INTRODUCTION

The rate of many physiological and morphological developments occurring in plants are mainly controlled by the thermal regime. Physiological growth stages have strongly been correlated with accumulated thermal units. Bootsma (1977) used heat units for predicting maturity of maize crop whereas, Treidl (1977) used the corn heat units for zonation of maize growing in Canada. The growing degree days and other energy summation indices were used by Shastry and Chakravorty (1982) for identification of phenology of wheat crop. An attempt was made to study the phenology and the growth of sesamum crop, in relation to temperature and rainfall at Sardarkrishinagar, Gujarat.

MATERIAL AND METHODS

The sesamum crop (CV GT-1) was sown at Regional Research Station, Gujarat Agricultural University, Sardarkrishinagar during kharif 1982 and 1983 under rainfed condition. The experiment was conducted in randomised block design with eight replications. The net plot size was 2.7 x 5.0 m, inter-and intra-row spacings were 45 and 10 cm respectively. The seed rate was used @ 2.5 kg/ha and the plant stands were 93 and 99 per cent in 1982 and 1983 respectively. Fertilizer applications were made as per standard recommendations.

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For morpho-physiological studies five random plants were selected 20 days after sowing and subsequently at an interval of 15 days. The sample were dried at 60 °C for constant weight. The daily temperature and rainfall were taken from the agrometeorological observatory located very near to the experimental plot. The heat units for growing degree days (GDD) were calculated following Bootsma (1977). In the present case the base temperature was taken as 15°C. Similarly soil moisture growing degree days (SMGDD) as defined by Kish et al. (1972) and the rainfall growing degree days (RGDD) were calculated.

GDD thus obtained were used to derive the regression equation of the form

$$Y = mX + C$$

where, Y is any physiological parameter like plant height (PH), leaf area (LA) and total dry matter production (DM), X is GDD, m and c are regression constants.

RESULTS AND DISCUSSION

During 1982 the monsoon was much delayed and the sowing was attempted during week 28 (July 15) whereas, in 1983 the sowing was done during week 26 (June 30). The season's total rainfall of 481 mm during 1982 was received in 17 days (Table 1) whereas approximately the same amount (474 mm) during 1983 was received in 30 days. The maximum temperature was slightly less in 1983 than that of 1982 whereas the minimum temperature was slightly higher in 1983 than that in 1982 throughout the season. During 1982 the crop experienced 21 day dry spell and it was harvested

Table 1. Weekly rainfall and temperatures during kharif 1982 and 1983

Standard week	1982			1983		
	Rainfall (mm)	Temperature °C Max.	Min.	Rainfall (mm)	Temperature °C Max.	Min.
26 (Jun 25-Jul 1)	0.0	39.8	26.6	24.2	39.5	27.3
27 (Jul 2- 8)	0.0	38.4	26.7	3.7	34.6	27.1
28 (Jul 9-15)	25.2	34.3	25.8	11.5	38.2	27.2
29 (Jul 16-22)	67.0	36.1	25.7	68.8	35.4	26.8
30 (Jul 23-29)	206.8	31.5	25.0	35.5	31.9	26.5
31 (Jul 30-Aug 5)	24.0	32.1	25.6	91.3	33.0	26.2
32 (Aug 6-12)	6.0	31.3	25.0	43.0	33.1	26.3
33 (Aug 13-19)	124.7	31.2	25.1	35.5	31.1	25.6
34 (Aug 20-26)	0.8	32.4	24.9	10.3	30.0	25.4
35 (Aug 27-Sep 2)	0.0	34.3	23.6	0.0	31.7	25.6
36 (Sep 3- 9)	0.0	34.8	23.9	104.4	31.3	25.6
37 (Sep 10-16)	26.4	34.9	24.3	0.0	34.1	26.1
38 (Sep 17-23)	0.0	35.7	23.5	5.4	36.2	26.2
39 (Sep 24-30)	0.0	36.9	22.2	11.8	36.1	24.7
40 (Oct 1- 7)	0.0	38.0	22.5	0.0	37.8	23.9
41 (Oct 8-14)	0.0	38.4	22.0	28.7	33.3	24.1
42 (Oct 15-21)	0.0	38.0	22.7	0.0	33.7	22.1

on October 6 (week 40) whereas in 1983 there was no such dry condition and therefore the harvesting was done on October 19 (week 42).

The GDD were calculated from date of sowing to different periods. The GDD thus obtained were used in the simple linear regression analysis as independent variables and height (PH), leaf area (LA) per plant, and total dry matter production (DM) per plant as dependent variables and following equations were developed.

$$PH = 0.1248 \times GDD - 37.84 : r = 0.91^{**}$$

$$LA = 1.6899 \times GDD - 410.84 : r = 0.93^{**}$$

$$DM = 0.0325 \times GDD - 11.11 : r = 0.82^{**}$$

** significant at P = 0.01

It can be estimated from the equations that at zero growth i.e. for emergence the sesamum seed require about 281 degree days. For 1 cm increase in height 7.4 degree days are required whereas for increasing leaf area by 10 sq. cm the plant required about 6 degree days. To produce one gram of dry matter the energy required by the crop is 30.8 degree days.

The cumulative values of GDD and RGDD at 50% flowering and maturity periods are shown in Table 2. It is understood that both GDD and RGDD units

Table 2. The GDD and RGDD at 50% flowering and at maturity.

Year	50% flowering		Maturity	
	GDD	RGDD	GDD	RGDD
1982	568	2542	1126	5572
1983	808	2581	1331	5707

were higher in magnitude in 1983 than in 1982. The GDD at 50% flowering differed significantly and its variability was 24.7%. Similarly at maturity also the variability was about 12%. On the other hand RGDD with average value of 2562 and 5640 units at 50% flowering and maturity, respectively, varied less and its variability was less than 2% during both phenological stages. Therefore, RGDD can be safely used in identifying the phenological stages like 50% flowering and maturity of sesamum crop under arid and semi-arid conditions of north Gujarat.

Seed yields in 1982 and 1983 were 549.0 and 806.3 kg/ha respectively (Table 3). Higher yield in 1983 was mainly due to significant increase in number of capsules per plant.

Table 3. Yield and yield components of sesamum CV GT-1

Yield components	Year	
	1982	1983
Yield (kg/ha)	549.00	806.30
Number of capsules per plant	40.60	57.20
Number of seeds per capsule	66.60	62.90
1000 seed weight (g)	3.06	3.10
Yield (g/plant)	6.28	7.82

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