https://doi.org/10.29321/MAJ.10.A02644

Madras agric. J. 70. (7): 446—450 July 1983

INFLUENCE OF RELATIVE HUMIDITY, HEAT UNITS AND HOURS OF SUNSHINE ON GRAIN SORGHUM.

V. S. JOSHI*

In a study on influence of relative humidity, heat units and hours of sunshine, under different planting dates and plant population on growth and yield of hybrid sorghum (variety-CSH 5). It was found that the values of relative humidity were higher close to ground (5cm. height) and the same decreased gradually as the height of observation increases. Panicle emergence to grain maturity is a critical period for final grain production of Jowar. If the accumulation of heat units, hours of sunshine and the relative humidity inside the crop canopy is maximum during this period higher grain yield can be obtained.

The growth and yield of Jowar crop is closely related to daily and seasonal temperature level and solar radiation pattern received with in crop canopy. Vinall and Read (1918) from California reported that sunshine deficiency was found to have significant retarding effect on growth of sorghum under low temperature condition. Growing Degree Days or Heat unit concept assume that there is a direct and linear relationship between growth and temperature. It starts with the assumption that growth of the plant is dependent on the total accumulation of heat unit to which it is subjected during its life time.

The humidity of air is of considerable importance to the life of the plant. It increases growth of shoot and leaves at earlier stages of crop growth (Flizer 1939 and Lee *et al* 1972). At later stage (Panicle emergence to grain maturity) it increases the grain yield.

A study was taken up to investigate effect of relative humidity inside crop canapy, heat unit accumulation and hours of sunshine under varying planting dates and plant poplation on grain yield of hybrid sorghum, at Central Research Station Farm. Punjabrao Krishi Vidyapeeth Akola (M. S.) with variety-CSH 5 from July to December 1976 under rainfed condition.

MATERIAL AND METHODS

The field expriment was carried out in clay loam soil with pH 7.4. The expriment was laid out in Factorial Randomised Blocks Design, with three treatments of planting dates i. e. 8th July (P1). 15th July (P2, and 22nd July (P3) and three treatments of plant density i. e. 2.77,777 plants/ha. (D1) 1,85,185, plants/ha (D2) and 1,38,888 plants/ha (D3) with four replications. Observation of relative humidity (%) within crop canopy at different heights

* Part of M. Sc. Thesis submitted to Punjabrao Krishi Vidyapeeth Akola. (M. S.)
Lecturer in agronomy, Anand Niketan College of Agriculture, Warora-442 907 Distt. Chandrapur. (M. S.)

i. e. 5, 30, 60, 90, 120 cm. and top of the plant were recorded by using Assmann Psychrometer in the centre of each plot.

The data on hours of sunshine were recorded daily at Agrometeorology observatory and total hours of sunshine required for various growth stages were calculated.

The accumulation of heat units at different growth stages were calculated as under.

$$\text{G.D.D.} \sum_{1}^{N} \left(\frac{\text{T. Max} + \text{T. Min.}}{2} - \text{Tt} \right)$$

Where- $\frac{\text{T. Max.} + \text{T. Min.}}{2}$ is the average daily Temperature & Tt = Minimum thresh-hold temperature for a crop.

Modern methods of analysis were followed to interpret the results as explained by - (Snedecor, 1946).

RESULTS AND DISCUSSION

Data on vertical humidity profile inside the plant canopy are given in Table 1, indicate that the values of relative humidity were higher close to ground (5 cm. height) and the same decreased gradually as the height of observation incresed. Similar results were reported by Gadre (1934) in sugarcane.

In correlation studies between relative humidity and grain yield (Table II) The "r" values were significant (at 5% level) at Flag leaf and Panicle emergence stages. The r value were negetively correlated at flag stage but the same were correlated positively at panicle emergence stage. It indicates that if relative humidity increases at flag leaf stage there would be decrease in crop yield. But the same increases at panicle emergence stage higher grain yield can be obtained due to good grain setting.

Accumulation of heat units were recorded significantly more in third planting date to attain flag leaf stage (Table III) However for subsequent stages i. e. flag leaf to panicle emergence and panicle emergence to grain maturity stage. First planting date accumulation maximum heat unit and gave higher grain yield i. e. 36.83 q/ha.

Dense plant population accumlated significantly more heat units to attain flag leaf stage (Table III). No significant differences were observed at panicle emergence stage, but to attain grain maturity stage significantly more accumlation of heat units were recorded in lowest plant population and maximum grain yield of 30.03q/ha. were obtained from the same.

In correlation studies between grain yield and heat units (Table IV) significant results were observed from panicle emergence to grain maturity stage. Thus, it is a critical period for final grain production of jowar. Moderate temperature during this period is essential for good yield. First planting date and lower plant population accumulated significantly more heat units during the same period and gave higher grain yield,

Duration of light is a most important climatic factor for growth and development of crop. In correlation study between hours of sunshine and crop yield (Table IV) the values of "r" from sowing to panicle emergence stage were negetively correlated but the same is positively carrelated to attain grain maturity stage. It means this stage is critical for radiation energy effect on final grain production in CSH 5 jowar. First planting date availed significantly more hours of sunshine during a period of panicle emergence to grain maturity and gave maximum grain yield 36.83 q/ha (Table III) Higher grain yield obtained during this period because of good grain filling and increasing grain size. These, results are supported by findings of Quinby and Karper (1947).

REFERENCES

FLIZER, R. 1939. Study of Planting corn with different densities. *Plants* 30 : 215-23.

GADRE, K. M. 1934. microclimatic survey of Sugarcane Field. Indian J. Met. and Geophsics 2 : 142-150.

LEE, T. A.; D.L. KETRING and R.D. POWELL 1972. Flowering aud growth. resposnses of Pea-nut plats *(Arachis hypogaea)* at two levels of relative humidity. Pl. Physical 49: 190-3.

QUINBY., J.R. and R.E. KARPER, 1947. The effect of short Photoperiod on sorghum varities and first germination hydrids J. Agri. Res. 75 : 295-300.

VINALL, H. N. and H.R. REED. 1918. Effec of temperature and other meteorologica factors and growth of sorghum. Jout. Agr. Res. 13 : 133-48.

Table 1 Average Relative Humidity (%) inside the crop at different growth stages.

Observation at different Height, (Mean of 9 treatment combination)	Flag leaf stage				Panicle emergence				Grain matulity, stage			
	TIME OF OBSERVATION											
	8.00A.M.	12.00Non	2.30PM	6 00P.M.	8.00A.M.	12.00Non.	2.30P.M.	6.00PM	8.00A.M.	12.00Non.	2.30P.M.	6.30P.M
5 cm.	81.3	63.1	59.8	69.1	81.6	70 8	72.5	83.6	44.9	26.9	26.5	37.1
30 cm.	79.9	62.1	58.9	67.8	80.4	68.1	69.5	82.1	43.7	26.7	26.4	37.4
60 cm.	78.8	61.4	58.1	67.1	78.7	67.1	68.3	81.4	43.5	25.3	26.4	38 2
90 cm.	78.3	61.1	57.1	66.2	77.8	66.0	68.0	80.3	43.6	26.1	29.2	38.6
120 cm.	77.5	60.5	56.5	65.1	77.6	64.8	67.5	79.6	43.3	26.8	26.4	36.1
Top of Plant*	78.2	61.8	57.1	65 4	77.8	65.1	67.2	79.0	43.5	25.9	26.6	38.1
C. D. at 5%	1.0	1.4	1.6	2.2	1.2	1.8	2.4	1.4	N.S.	N.S.	N.S.	N.S.
Mean.	79.0	61.5	58 0	66.8	79.0	67.0	68.8	81.0	43.7	26.3	26.5	67.6

* *Top at* Flag leaf — *65 58* cm., Panicle emergence — *114.83* cm., Grain maturity stage — *183.66* cm.

** N.S. — Non significant.

Table 2. Correlation Coefficient of grain yield and relative humidity (%), inside the crop canopy, at different growth phases crop.

Height	GROWTH STAGES											
	Flag leaf				Panicle emergence							
					Time during the day				Crain maturity			
	8.00AM.	12.00Noon	2.30 PM	6.00 PM	8.00AM.	12.00 Noon.	2.30 PM.	6.00 PM.	8.00 AM.	12.00AM.	2.30PM.	6.00PM.
5 cm.	—0.75*	—0.75*	—0.53*	—0.65*	0.75*	0.71*	0.52*	0 49*	N.S.	N.S.	N.S.	0.36*
30 cm.	- 0.74*	—0.69*	0.59*	—0.71*	0.69*	0.66*	0.56*	0.02*	N.S.	N.S.	W.S.	N.S.
60 cm.	—0.81*	—0.92*	—0.68*	—0.69*	0.75*	0.72*	0.49*	0.38*	N.S.	N.S.	N.S.	0.39*
90 cm.	—0.74*	—0.77*	—0.73*	—0.72*	0.76*	0.69*	0.50*	0.46*	N S.	N.S.	N.S.	N.S.
120 cm.	0.76*	—0.81*	0.67*	—0.70*	0.78*	0.73*	0.55*	0.41*	N.S.	N.S.	N.S.	N.S.
Top.	—0.77*	—0.67*	—0.71*	0.67*	0.42*	0.68*	0.15	0.18	N.S.	N.S.	N.S.	N.S.

* Significant at 5% level.

N.S. — Not significant.

Table 3. Influence of Heat Unit accumulation and Hours of Sunshine on Crop yield.

Treatment	GROWTH PERIODS									Total days required from sowing to harvest.	Grain yield q/ha.
	Sowing to Flag leaf			Flag leaf to panicle emergence			Panicle emergence to grain maturity stage.				
	G.D.D.*	H.S.**	Days.	G.D.D.	H.S.	Days	G.D.D.	H.S.	Days		
Planting Dates											
P 1	919.1	278.7	53	190.1	36.1	11	493.9	240.3	27	114	36.8
P 2	946.7	283.3	56	166.1	81.1	10	453.7	236.2	24	108	26.3
P 3	982.5	279.7	58	153.0	72.8	9	346.8	194.0	19	102	16.8
C. D. at 5%	28.8	—	—	21.6	9.2	—	18.2	9.4	—	—	4.3
Plant density.											
D 1	969.2	286.9	57	167.7	62.6	12	418.8	219.7	23	114	24.9
D 2	951.0	281.2	56	170.0	63.2	10	428.0	222.8	24	108	27.0
D 3	927.7	273.6	54	171.5	64.9	10	448.7	227.9	25	102	30.0
C. D. at 5%	28.8	4.6	—	—	—	—	18.2	—	—	—	4.3

* G. D. D. – Growing Degree Days or *Heat Units*.
** H. S. — Hours of Sunshine.

Table 4. Correlation Coefficient (r value) between Heat Units and Yield of Grain and in between Hours of Sunshine and yield of grains.

Growth Phases	Heat Units "r"	Hours of Sunshine "r"
Sowing to Flag leaf	0.08	0.80*
Flag leaf to panicle emergence	0.22	—0.54*
Panicle emergence to grain maturity	0.47*	0.49*

* Significant at 5% level.