

# Influence of Temperature and Humidity on the Growth of Sorghums

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**Introduction :** Ponnaiya and Appathurai (6) have discussed the yield behaviour of millets when sown in the different months of the year. A further study of the data, in relation to the weather factors reveal a few interesting indications about the influence of temperature and humidity on the growth of two Sorghum types.

**Materials and Method:** Two Sorghum types were studied (i) *Cholam K. 2* (Sorghum subglabrescens), a pure-line strain from the summer Vellai Cholam of the Tirunelveli area having a duration of 90 days and (ii) *Cholam Periyamanjal Irungu* (A. S. 7081) (Sorghum dochna), an extracted type from a cross between the Periamanjal Cholam (Sorghum durra) of Coimbatore and the Irungu Cholam of the Tirunelveli (Sorghum dochna). For the purpose of discussion in this paper the former type is being named as summer type and the latter as main season type.

The materials were sown over two small plots of 0.15 cents each, on the 15th day of every month commencing from June, 1951 to May, 1952, in the red-soil area of the Agricultural Research Station, Kovilpatti. The seeds were sown in lines 2 links apart and the plants were thinned to a final spacing of 1 link between the plants in the rows and 2 links between rows.

The following observations were recorded :

(1) Seedling weights (average of 5 sets of 10 seedlings each) were recorded on the 13th day after sowing for the crops sown each month.

(2) The mean height of 20 plants from each type was recorded on the 13th day after sowing, on the 20th day and once in twenty days thereafter until harvest.

(3) The flowering dates were recorded for each month's crop and the duration worked out from it.

(4) The yield of grain and straw were also recorded for the different months. The occurrence of diseases and pests were noted then and there. Threshing percentages were also calculated to have an idea of the seed setting when sown in different months.

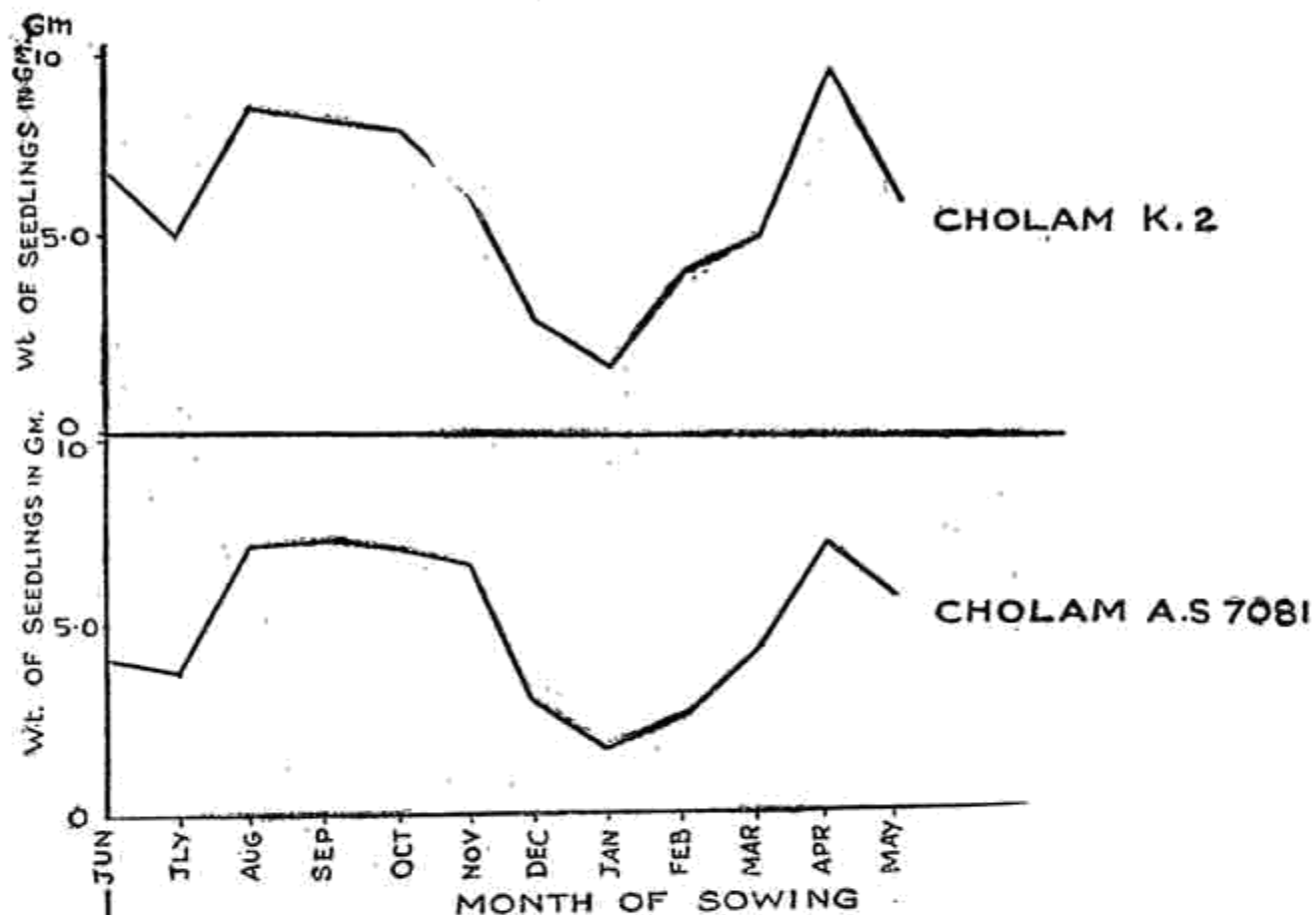
**Discussion:** (a) *The Vegetative Behaviour:* By studying the height attained by crops sown in the different months at different stages of growth (Table I) it can be observed that the rate of growth for Cholan K. 2 is maximum between the 20th and 60th day after sowing and differences due to seasons are noticed to the maximum extent only during this period. The period of maximum rate of growth for Cholan A. S. 7081 extends upto 80 days and the changes in growth due to seasons are also felt only between the 20th and 80th day after sowings. It is observed that the growth ceases soon after flowering, the general span between sowing and flowering, being 60 days for Cholan K. 2 and 80 days for Cholan A. S. 7081. The crops sown in December and January grows upto 80 days in the case of Cholan K. 2 and 100 days in the case of Cholan A. S. 7081 as they flower late when sown in these months.

It is interesting to note that the graph representing the weight of 10 seedlings on the 13th day after sowing almost follows the course of those for the average maximum and minimum temperature for 15 days following sowings. This is almost the same for both the crops which shows that both the types respond to temperature conditions in the same manner upto a fortnight after sowings. The maximum weight is attained by the crops sown in the months of August, September, October and April, when the mean maximum temperature is 94 deg. to 98 deg. F and the minimum 75 to 76 deg. F. As the temperature is very high (99.5 deg. F) in May the young seedlings probably could not withstand it which might have resulted in reduced seedling weight. As both the temperatures were very low (maximum 87 deg. F and minimum 67 deg. to 70 deg. F) for the crops sown in December and January the weight tends to be reduced. A minimum temperature below 74 deg. (March) or above 77 deg. (June, July) also seems to reduce weight irrespective of maximum temperature. The height also more or less follows the course taken by the weight of seedlings on the 13th day after sowings though there are changes which will be explained subsequently.

By studying the graphs representing the daily maximum and minimum temperatures, relative humidity, wind velocity, rainfall and sunshine in relation with those for height at various stages of growth and weight of seedlings on the 13th day after sowings the following general conclusions can be drawn.

September, October and April seem to be the best for the summer cholam type (Cholan K. 2) as far as the maximum height (vegetative vigour) is concerned. For the main season type

**FIG 1**  
**MEAN WEIGHT OF 5 SETS OF 10 SEEDLINGS**  
**ON THE 13<sup>th</sup> DAY AFTER SOWING**



**FIG 2**  
**MEAN TEMPERATURE OF 15 DAYS AFTER SOWING**

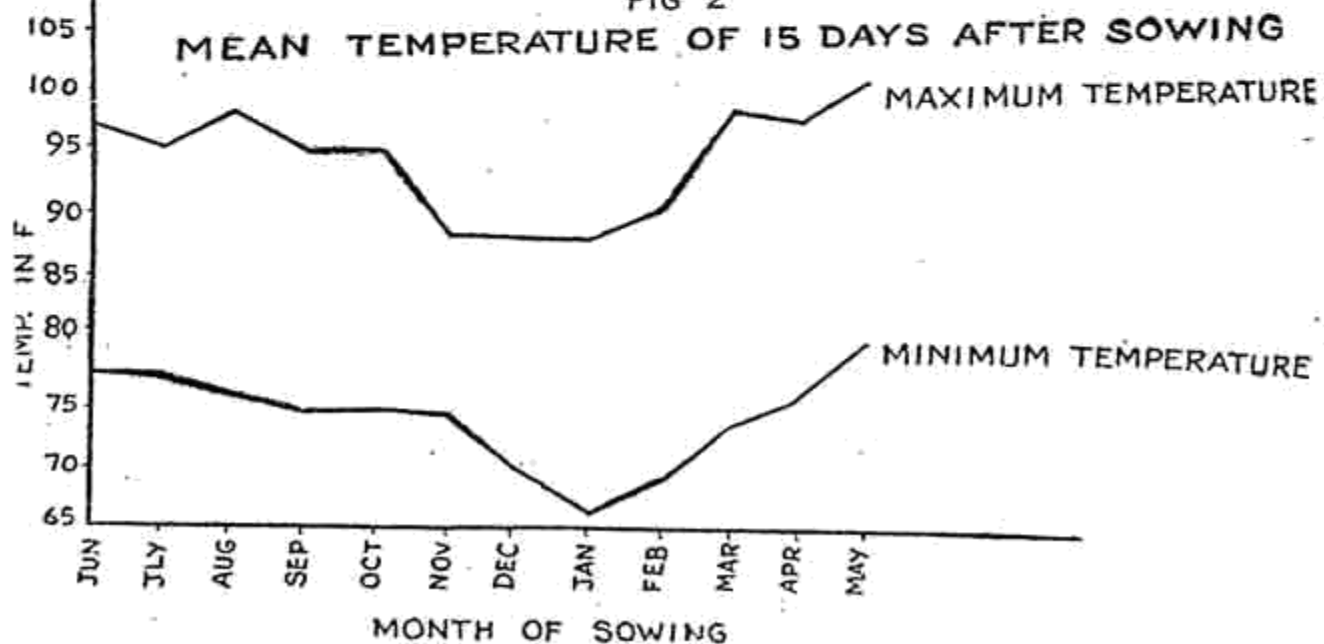
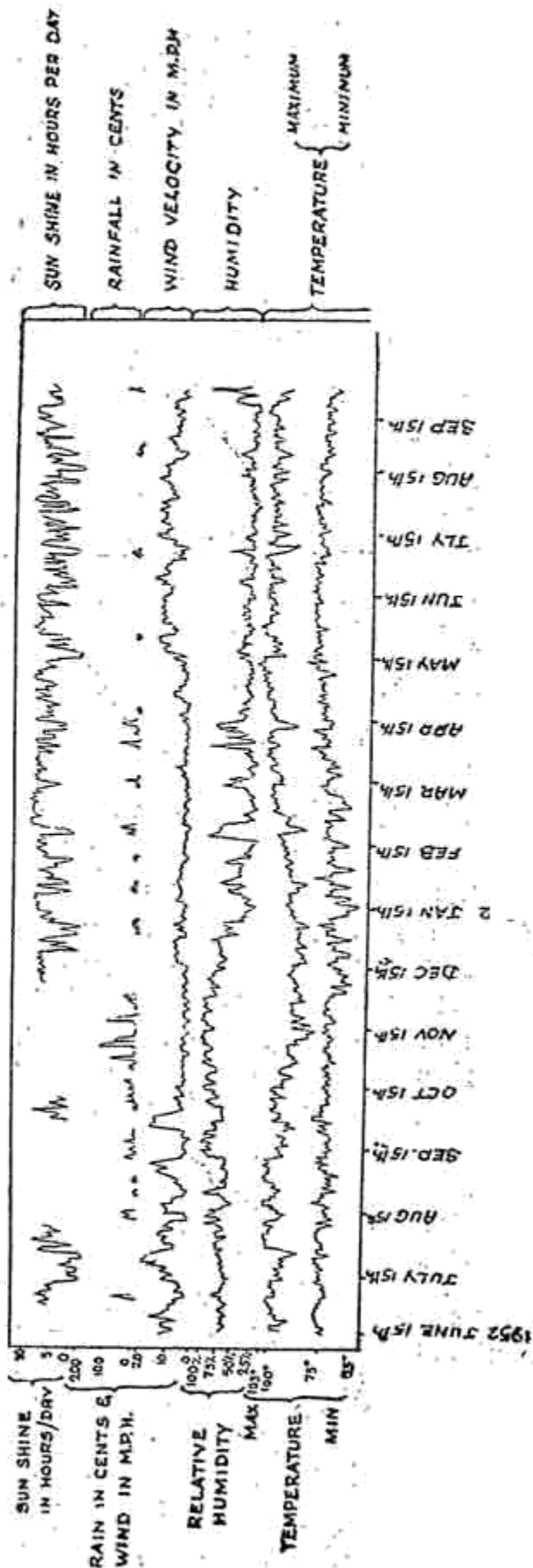


FIG 3  
 GRAPH REPRESENTING DAILY WEATHER CONDITIONS  
 PREVAILING DURING THE PERIOD UNDER DISCUSSION



(Cholam A. S. 7081.) the crops sown from June to October show the maximum height, those sown in February coming next and those of March to May being further next. Both the types show minimum vegetative growth when sown in December and January when the growth period is subjected to very low temperatures (maximum below 95 deg. F and minimum far below 75 deg F). The maximum temperature during the growth period of the September sown crops is ranging from 90 deg. to 100 deg. F and the minimum temperature round about 75 deg. F. This seems to be the best for elongation in height for both the types of Cholam. The summer type is able to withstand a higher maximum temperature (95 deg. to 105 deg. F) and is able to attain the same height as that of the September crop; whereas the main season type requires high humidity above 60% and is not able to tolerate a maximum temperature above 100 deg. F. This is clear from the heights attained by both the crops when sown in April, that of Cholam K. 2 almost equalling the September-sown crop and that of Cholam A. S. 7081 being far low. Even the summer type prefers a low temperature during the early seedling stage as the May sown crop suffers a lot, due to both the maximum and minimum temperatures being very high during the early seedling stage 104 deg. F and 80 deg. F respectively. The growth of the summer sown (March to May) A. S. 7081 extends upto 110 days showing slow rate of growth. This late development may be attributed to the low humidity prevailing during the period. When the minimum temperature is highly fluctuating during the early seedling stage the height seems to be affected as exemplified by the crops sown in December, January, March and May also. The good height attained by the October sown crops of both the types inspite of the maximum temperature going down below 90 deg. F after the first few days after sowings shows that the temperature during the first 15 days itself is sufficient to lay a good foundation for the final height of the crop. The minimum temperature during this period is normal (round about 75 deg. F) and uniform.

A reasonable maximum height attained by the February crop of *Cholam A. S. 7081* suggests that as this type has a longer duration, it is able to make up the height lost due to low maximum temperature during early seedling stage with the help of the gradual rise in temperature during its growth period. To begin with the temperature was near 95 deg. F. It went down to 85 deg. F in a week, then gradually rose up above 95 deg. F in March (15 days after sowing) and thereafter it continues to be like that throughout

the growing period. From the height graph also it can be seen that the rate of growth was slow in the beginning (20th to 40th day) but gains thereafter to make up a considerable maximum height on the 80th day.

In the summer type, this adaptability is lacking as the crop has a comparatively shorter life span, though there is a slight indication of the February crop growing faster after the 40th day to attain an equal height with the March crop. The proportional heights for the 40th day and 60th day are almost similar for the crops sown in the different months which shows that the height is more or less fixed by the conditions prevailing in the early stages of growth itself.

(b) *Duration*: In general the duration seems to be the combined effect of two factors viz., temperature and humidity. Very low temperature i. e., maximum below 95 deg. F and minimum below 75 deg. F during the growth period tends to extend the duration (December to January). High humidity above 80% seem to shorten the duration (e. g., October and November) a low humidity below 50% tending to lengthen it (e. g., April — May).

For the April sown *Cholam K. 2*. during the growth period the following conditions prevailed viz., maximum temperature round about 100 deg. F, minimum slightly above 75 deg. F (shortening factors), humidity ranging between 25% and 50% (lengthening factors). As both the shortening and lengthening factors are reacting, the duration of the April sown crop is medium.

*Cholam A. S. 7081* more or less follows the same principle with high stress on the effect of relative humidity. This is clear from the duration of crops sown in April and May being unduly lengthened because of low humidity, though the temperature tends to shorten it. The normal duration is attained by the crop sown in July which is subjected to the following weather conditions, maximum temperature round about 100 deg. F, the minimum round about or slightly about 75 deg. F and the humidity ranging from 50 to 80%.

(c) *Yield Behaviour*: The exact principles involved in the yield performance is difficult to be explained in a detailed way though a general outline of the behaviour of the two types of Sorghums is possible. The low relative humidity during the life period of April sown *Cholam K. 2* is accompanied by high yield, and the high relative

humidity during the life of the A. S. 7081 crop sown from June to September is attended by high yield. This indicates the importance of relative humidity in conditioning the yield behaviour of the two types of *Cholam* — *Cholam A. S. 7081* requiring high humidity and *Cholam K. 2* preferring a lower relative humidity.

That a good initiative (by way of enhanced vegetative vigour) helps in the production of grain yield inspite of the subsequent unfavourable factors for development (high relative humidity in the case of *Cholam K. 2*) is explained by the July to September sown *Cholam K. 2* giving moderate yields.

The crops sown from June to September experience a high windy weather and those sown in April receive light wind. It is possible that the differential response of the two types of *Cholam* to wind velocity may contribute to their distinctive yield behaviour.

**Summary:** A study of the behaviour of two distinct types of Sorghum in relation to weather conditions when sown in the different months of the year was taken up at the Agricultural Research Station, Kovilpatti. Both the types were found to be adversely affected when sown during the winter months of December and January — low vegetative vigour, late development, and very poor yield being the result. Among the other months, September and October seem to be very suitable for the vegetative growth of both the types. The summer cholam type is able to tolerate the April temperature and attain a good height equal to that of September crop whereas the main season type requires more moisture and cooler conditions and fails when sown in April. The duration of both the types of crop seems to be controlled by temperature and relative humidity, a low average in these factors delaying ripening; but A. S. 7081 seems to show some preference to humidity for quicker development as compared to the other type. The net result of the reaction of all the weather factors on the distinctive behaviour of the two types is that a good crop of *Cholam K. 2*, is attained when sown in April 15th and a good crop of A. S. 7081 when sown in the month of July to September.

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TABLE I  
 Height of Crops Attained at Different Stages of Growth.  
 (In Centimeters)

Months of sowing	CHOLAM K. 2 (Age of the crop in No. of days)										CHOLAM A. S. 7081 (Age of the crop in No. of days)									
	13	20	40	60	80	100	13	20	40	60	80	100	120	13	20	40	60	80	100	120
June	6.30	..	61.23	130.60	132.45	..	4.78	..	30.28	70.30	162.55	294.53	298.15	4.78	..	30.28	70.30	162.55	294.53	298.15
July	5.40	9.58	72.85	..	176.20	..	4.59	9.90	49.15	..	264.95	294.45	..	4.59	9.90	49.15	..	264.95	294.45	..
August	9.49	12.48	116.45	171.30	..	..	9.94	13.70	58.50	168.25	259.05	266.10	..	9.94	13.70	58.50	168.25	259.05	266.10	..
September	9.02	9.30	114.90	201.00	..	..	9.42	12.45	92.20	278.35	320.15	..	..	9.42	12.45	92.20	278.35	320.15	..	..
October	8.42	11.90	106.20	186.75	193.60	..	9.68	15.43	113.08	265.10	283.50	289.55	..	9.68	15.43	113.08	265.10	283.50	289.55	..
November	6.97	9.95	71.00	129.40	130.20	..	9.04	12.30	47.85	169.80	172.25	182.35	..	9.04	12.30	47.85	169.80	172.25	182.35	..
December	4.40	6.18	8.53	35.85	93.65	107.65	5.58	7.00	11.45	40.50	132.15	169.00	..	5.58	7.00	11.45	40.50	132.15	169.00	..
January	3.52	6.10	20.80	85.00	121.05	..	4.08	6.10	19.15	60.70	146.25	189.45	..	4.08	6.10	19.15	60.70	146.25	189.45	..
February	5.62	7.53	46.65	130.45	133.05	133.85	5.86	8.13	29.60	133.55	249.50	..	..	5.86	8.13	29.60	133.55	249.50	..	..
March	5.79	8.03	60.15	128.00	129.10	..	5.16	8.83	46.35	105.20	133.65	213.70	227.70	5.16	8.83	46.35	105.20	133.65	213.70	227.70
April	6.36	7.40	85.65	184.45	194.35	..	8.45	8.75	54.70	115.45	172.10	216.75	244.05	8.45	8.75	54.70	115.45	172.10	216.75	244.05
May	6.25	7.95	55.10	154.10	141.10	..	6.01	8.23	37.00	84.25	113.35	172.12	208.75	6.01	8.23	37.00	84.25	113.35	172.12	208.75

TABLE II.  
Duration and Yield Particulars.

Months of Sowing	Date of Sowing	Date of flowering	CHOLAM K. 2						CHOLAM A. S. 70S1					
			Duration (Sowing to ripening)	Wt. of ear-heads per acre in lb.	Wt. of dry grain per acre in lb.	Wt. of green straw per acre in lb.	Threshing %	Date of flowering	Duration (Sowing to ripening)	Wt. of ear-heads per acre in lb.	Wt. of dry grain per acre in lb.	Wt. of green straw per acre in lb.	Threshing %	
June	15-6-1951	11-8-1951	87	1395	237	13583	15.2	26-9-1951	133	3530	2651	26550	75.1	
July	15-7-1951	12-9-1951	89	2887	1379	17585	47.8	12-10-1951	119	4288	2522	32066	58.8	
August	15-8-1951	10-10-1951	86	1670	759	21722	45.5	30-10-1951	106	4353	2651	30601	60.9	
September	15-9-1951	11-11-1951	87	3663	1423	19998	33.8	20-11-1951	96	4396	2522	32691	57.4	
October	15-10-1951	8-12-1951	84	1121	377	11378	33.7	17-12-1951	93	2094	862	16895	43.8	
November	15-11-1951	7-1-1952	83	841	210	9352	25.0	12-1-1952	88	1629	927	13814	57.3	
December	15-12-1951	28-2-1952	105	586	75	5775	13.0	4-3-1952	110	1379	797	8275	58.2	
January	16-1-1952	26-3-1952	100	621	151	7586	24.1	26-3-1952	100	1508	474	14482	31.8	
February	15-2-1952	14-4-1952	89	1078	366	9310	34.0	4-5-1952	109	1853	673	19309	36.3	
March	15-3-1952	9-5-1952	85	562	215	5862	38.5	23-6-1952	130	948	350	27239	36.9	
April	15-4-1952	14-6-1952	91	6864	3556	22007	51.8	14-8-1952	152	1542	366	44522	23.6	
May	15-5-1952	17-7-1952	93	388	27	14783	6.9	2-9-1952	141	862	410	17369	46.9	