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STUDIES ON SYNCHRONISATION OF FLOWERING IN THE PARENTAL LINES OF SORGHUM HYBRIDS - II ASSOCIATION OF WEATHER ELEMENTS WITH THE DURATION TO FLOWERING

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The parental lines of sorghum hybrids CSH 5, CSH 6, CSH 9 and COH 2 were sown at fortnightly intervals to study the flowering behaviour. Correlations were worked out between the days to (i) panicle initiation, (ii) half-bloom and (iii) from panicle initiation to half-bloom on the one hand and the weather elements viz., maximum and minimum temperature, fore-noon and after-noon relative humidity, sun shine and rainfall that prevailed during the four phases of plant growth on the other. Nature and extent of association varied among the parental lines and also between growth phases.

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Sorghum ia a short day plant (Garner and Allard, 1923). Kunjammal and Meenakshi (1979) attributed the narrow range of flowering duration in CS 3541 to its non-photosensitiveness. Krishnamoorthy (1970) utilized the differential response of the female (CK 60A) and male (IS 3691) lines of CSH 2 to longer photoperiod to narrow the gap in their duration to flowering. Hence, studies were initiated to know the association of weather elements with the duration to flowering in the parental lines of a few sorghum hybrids so that the sowing time of the parental lines can be so adjusted for synchronized flowering and consequent high seed set.

MATERIALS AND METHODS

The lines CS 3541, IS 3541, ms 2077A, ms 2219A and ms 296A were sown from 26th January, at fortnightly intervals for one year. Seven rows of 4.05 m long and 45 cm apart were allotted for each line. The seeds were sown along the ridges adopting a spacing of 15 cm between plants. There were 27 plants in a row. Recommended package of practices were adopted uniformly for all fortnightly sowings. Observations on days to panicle initiation and to half-bloom were made Data on maximum and minimum temperature, relative humidity, hours of bright sun shine, amount of rainfall and number of rainy days (days receiving 2.5 mm or more of rainfall) were collected from the observatory of the Department of Agricultural Meteorology, Tamil Nadu Agricultural University, Coimbatore for the period from 26th January, 1980 to the end ofMarch, 1981.

The number of days to panicle initiation was divided into two equal periods and the first half was termed as phase I and the second as Phase II. The number of days from panicle initiation to half bloom was also divided into two equal periods and the first half was termed as Phase III and the second as Phase IV. Mean values of each of the weather elements pertaining to Phase I, II, III and IV were correlated with the number of days to panicle initiation as well as to half-bloom independently. So also, the mean values of the weather factors pertaining to Phase III and IV were correlated with number of days from panicle initiation to half-bloom and to half-bloom independently. In the case of IS 3541, correlations were worked out between the mean values of weather factors at Phase I and II and days to panicle initiation only. The number of days to panicls initiation was correlated with the days half-bloom. To partition the effects of individual weather elements, multiple regression analyses were carried out. The methods described by Goulden (1959) were followed for working out the correlation co-efficients and regression analyses

RESULTS AND DISCUSSION

The correlation between some of the weather factors corresponding to each phase and the days to panicle

Tab'e 1 Correlation and regression of days to panicle initiation in IS 3541 with weather factors

	Phase I		Phase II	
	Correlation coefficient (r)	Regression coefficient (b)	Correlation coefficient	Regression coefficient (b)
Maximum temperature	0 844**	0.243	0.647**	2·766
Minimum temperature	0·488*	4.583	0.775**	2·133
Forencon relative humidity	—0.456*	0·109	—0.310	0·052
Afternoon relative humidity	—0·291	—1.321	0·147	—0.504
Sunshine	0·046	—0.566	—0·390	—2·903
Rainfall	0 296	—0.083	0·300	—0.067
Rainy days	0.567**	3·474**	0.660**	3 170**
Constant (a)	—	—6·892	—	—52 767
Coefficient of determination (R^2)	—	0.902**	—	0·882*

Table 2 Correlation coefficients between different growth phases in the parental lines and weather factors

Phase	Temperature		Relative humidity		Sun shine	hainfall	Rainy days
	Maximum	Minimum	Fora-noon	After-noon			
			CS 3541				
Panicle initiation							
I	0·489*	0.331	—0.211	0.042	--8.140	0.222	0·328
II	0·370	0.680*	0.149	0 341	—0 229	8·524**	8 511**
Panicle initiation to half bloom							
III	—0 324	0·470*	0·336	0 716**	—0.466	0 459*	0·515*
IV	—0 359	0.137	0.471	0.575**	—0.320	0.518**	0.378
Half-bloom							
I	0 413*	0.532**	—0.263	0·202	—0 328	0.158	0.195
II	0.165	0 765**	0 090	0.559**	—0.465*	0.476*	0·594**
III	—0.154	0·670**	0.307	0 743**	0·517**	0 588**	0.653**
IV	—0.266	0·408*	0·420*	0.712**	—0.461*	0·477*	0·408**

MS 2077A

Panicle initiation							
I	0.117	−0.417*	0.447*	−0.392	0.739**	0.276	0.198
II	0.123	−0.387	0.320	−0.348	0.566**	0.173	0.198
Panicle initiation to half-bloom							
III	0.006	0.457*	0.256	0.452*	−0.102	0.484*	0.437*
IV	−0.126	0.329	0.538**	0.457*	−0.316	0.376	0.353
Half-bloom							
I	0.367	−0.181	0.261	−0.417*	0.572**	0.231	0.108
II	0.240	0.032	0.329	−0.090	0.370	0.431*	0.507*
III	0.197	0.095	0.301	−0.041	0.269	0.112	0.137
IV	0.034	0.092	0.333	0.133	−0.051	0.125	0.275

ms 2219 A

Panicle initiation							
I	−0.083	−0.594**	0.546	−0.290	−0.540**	0.209	0.045
II	−0.128	−0.488*	0.388	−0.205	0.549**	0.192	0.046
Panicle initiation to half-bloom							
III	−0.254	0.479*	0.238	0.505*	−0.372	0.227	0.296
IV	−0.436*	0.233	0.124	0.637**	−0.529	0.066	0.272
Half-bloom							
I	0.135	−0.139	0.470*	−0.121	0.477*	0.393	0.191
II	−0.160	−0.107	0.725**	0.193	0.223	0.488*	0.431*
III	−0.145	−0.144	0.560**	0.069	0.325	0.403	0.286
IV	−0.345	−0.333	0.256	0.066	0.059	0.047	0.144

ms-296 A

Panicle initiation							
I	0.242	−0.368	0.392	−0.442*	0.781**	0.273	0.166
II	0.238	−0.315	0.444*	−0.333	−0.607**	0.245	0.248
Panicle initiation to half-bloom							
III	−0.213	0.255	0.259	0.645**	−0.227	0.274	0.219
IV	−0.428*	0.011	0.620**	0.430*	−0.194	0.326	0.255
Half-bloom							
I	0.221	0.002	0.430*	−0.086	0.429*	0.486*	0.283
II	0.150	0.126	0.507*	0.143	0.178	0.590**	0.581**
III	−0.112	0.052	0.448	0.173	0.154	0.264	0.161
IV	−0.304	−0.051	0.493	0.270	−0.028	0.334	0.330

* Significant at P=0.05; **Significant at P=0.01

Table 3 Regression of different growth phases in the parental lines on weather factors

Phase		Partial regression coefficients of								
		Constant (a)	Maximum temperature (b_1)	Minimum temperature (b_2)	Fore-noon relative humidity (b_3)	Afternoon relative humidity (b_4)	Sun Shine (b_5)	Rainy fall (b_6)	Rainy days (b_7)	Coefficient of determination (R^2)
					CS 3541					
Panicle initiation	I	—22.509	0.887	—0.090	— 0.117	0.061	—0.0183	0.11	0.019	0.164
	II	4.938	—0.273	1 665	0.130	—0.157	0.124	0.035*	—0.455	0.725**
Panicle initiation to	III	4.363	0.282	0.010	—0.039	0.325	0.587	0 009	—0.160	0 570*
half-bloom	IV	5.275	0.284	—0.403	0.123	0.274**	0.151	0.013	—0.265	0.459
Half-bloom	I	24.195	1.714	0.031	—0.252	0.234	—0.348	0.045	—1.089	0.491
	II	35.002	—0.691	2.330	0.049	0.088	0.424	0.018	0.148	0.692**
	III	29.537	—0.328	1.328	0.227	0.016	—0.176	0.022	—0.015	0.714**
	IV	12.308	0.357	0.094	0.148	0.486**	0.618	0.008	—0.390	0.583*
					ms 2077A					
Panicle initiation	I	34.764	—0.857	0.520	0.078	—0.049	2.034*	—0.023	0.904	0.702**
	II	47.243	—1.214	0.621	0.413	—0.436	0.314	—0 052	1.777*	0.574*
Panicle initiation to	III	17.249	—2 216	3.023*	0.199	—0.163	1.653**	0.020	—0.198	0.694**
half-bloom	IV	—4.860	—0.125	0.645	0.406	—0.082	—0.355	0.008	—0.256	0.418
Half-bloom	I	50.157	—0.289	0.918	0.257	—0.301	0.424	0.018	—0.065	0.439
	II	84.391	—2.187	2.402	0.113	—0.392	1.780	—0.032	1 698*	0.618*
	III	37.742	— 1.600	2.559	0.430	—0.220	1.309	—0.001	—0.317	0.307
	IV	37.574	0.175	0.007	0.421	—0.125	—0.312	—0.053	1.397	0.288

Contd .....

					ms 2219A					
Panicle I initiation	I	9.389	−1.609	−2.627	0.057	0.381	0.032	0.009	0.095	0.632*
	II	22.169	−0.253	−0.264	−0.015	0.170	1.578	−0.006	0.192	0.501
Panicle initiation	I	24.510	−1.809	2.393*	0.294	−0.347	0.273	−0.016	0.243	0.505
to half-bloom	II	−5.009	0.739	0.914	−0.031	0.541*	0.608	−0.052*	0.310	0.578*
Half-bloom	I	32.853	−0.868	1.393	0.199	−0.112	1.494	0.022	−0.298	0.503
	II	28.512	−0.994	1.012	0.440*	−0.128	0.913	−0.021	0.890	0.630*
	III	53.749	−1.227	0.868	0.211	0.099	1.315**	0.008**	0.762	0.575*
	IV	69.516	−0.093	−0.973	0.060	0.076	0.128	−0.041	1.147	0.318
					ms 296 A					
Panicle initiation	I	21.688	−0.511	0.666	0.013	0.004	2.198**	−0.005	0.357	0.717**
	II	4.651	−1.255	1.757	0.174	0.049	3.168**	−0.031	0.927*	0.771**
Panicle initiation to	I	−21.117	−0.359	1.213	0.040	0.426*	1.822*	0.037	−0.953	0.572*
half-bloom	II	14.500	−0.625	0.016	0.582	−0.191	−0.738	−0.007	0.464	0.485
Half-bloom	I	−25.342	−0.120	1.221	0.095	0.012	1.589	0.060	−1.112	0.557*
	II	9.060	−0.588	−0.711	0.549*	−0.369	0.464	−0.037	1.254*	0.722**
	III	−11.232	−0.620	2.026*	0.354	0.217	0.128*	0.006	−0.458	0.502
	IV	48.483	−0.674	−0.021	0.720	−0.338	−0.616	−0.072	−2.030	0.429

Initiation, to half-bloom and from panicle initiation to half-bloom were significant (Table 1 to 4) showing the role played by these elements in modifying the durations to flowering among the lines studied. For example, at Phase I, days to panicle initiation showed negative correlation with minimum temperature in ms 2077A, while a positive correlation with maximum temperature in CS 3541. The association between after-noon relative humidity at Phase I and that at Phases II, III and IV and days to half-bloom was respectively negative in ms 2077A and positive in CS 3541. Similarly, the association between fore-noon relative humidity and days to panicle initiation was positive in ms 2219A and negative in IS 3541. The extent of synchronised flowering was dependent on the degree or level of interaction between the varieties and the environmental factors considered. Such similar interaction between varieties and weather factors were reported by Singh and Nayeem (1980).

Mathematical models were constructed for predicting flowering data based on weather factors in rice. Hence, multiple regression analyses were carried out to fit equations to predict the days to (i) panicle initiation, (ii) half-bloom and (iii) from panicle initiation to half-bloom based on weather factors that prevailed at the four phases of plant growth (Table 5 to 8). Availability of such models for different parental lines of hybrids will be highly useful to predict the staggering required in any new location where the seed production is intended to be taken up.

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