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Correlation of Seed Germination with Various Weather Parameters under Different Environments in Upland Cotton (*Gossypium hirsutum* L.)

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A B S T R A C T

The present study was conducted to find out the effect and correlation of meteorological parameters on seed germination in three varieties H 1098 – I, H 1300 and H 1316 under six environments (three sowing periods i.e. early, normal and late sown conditions in year 2015 and 2016). Observations were recorded for seed germination and meteorological parameters as maximum and minimum temperature (°C), relative humidity (%) morning as well as evening, sunshine hours, rainfall (mm) and number of rainy days. Tagging period stared from June end when there were sizable amount of flowers. Seed germination (%) was negatively correlated with T_{max} and sunshine hours while it was positively correlated with T_{min}, RH_m and RH_e. and rainy days.

Introduction

Cotton is important commercial crop of India, highly sensitive crop to changes in temperature, humidity, and soil moisture, which may affect its yield, yield components and fiber properties. It is an important fiber yielding crop of global importance, which is grown in tropical and subtropical regions of more than 80 countries of the world.

It is an important fiber yielding crop of global importance, which is grown in tropical and subtropical regions of more than 80 countries of the world (Malagouda *et al.*, 2014). India has a pride place in the global cotton scenario due to several distinct features such as the largest area under cotton (105 lakh ha) representing about one-third of the global cotton area (330 lakh ha) with production of 560 kg/ha in the world ha (ICAR 2016-17). Weather is one of the important factors that affect crop growth. Crop productivity is directly influenced by temperature, rainfall, total radiation and photoperiod.

Environmental factors for optimum seed germination plays a vital role in realizing crop growth and yields. The time of sowings as

varied growth condition for various crops differs depending on climate and varieties. Knowledge on effects of various elements of environment on crop growth, development and yield is important to harness good crop yield with better quality of seed and fiber (Ratnam *et al.*, 2014).

The productivity of cotton has not made headway, therefore, there is a need to break plateau of yield potential by developing high yielding cotton varieties or hybrids. Yield is a complex trait, polygenic in inheritance and more prone to environmental fluctuations than other traits. In the presence of G x E interactions, selection based solely upon mean performance is insufficient for a single or range of environments (Singh *et al.*, 2014). Cotton is not only our major fiber crop but also main source of edible oil, however, being ignored as an oilseed crop. Through developing the cotton varieties having both high fiber and oil yield, it would be possible to reduce edible oil imports in the country (Munawar *et al.*, 2013). Genetic correlation measures the magnitude of cause-effect relationship between various traits that determine the component traits on which selection can be made. Thus, for the development of promising genotypes, the cotton breeder is obliged to study the breeding material regarding the nature and degree of correlations among seed cotton yield, its plant height, number of bolls, boll weight and ginning outturn under particular environmental conditions (Naveed *et al.*, 2004).

Seed germination in cotton is a big problem under North Indian conditions. It remains much below the standard germination because of poor seed development and its quality is very much affected by environment. Sometimes seed germination in cotton may be reduced as low as 10% due to adverse environmental conditions and exact reasons for poor development of seed are not known. To overcome this problem correlation of seed germination (%) and meteorological parameters were studied.

Materials and Methods

The experiment was conducted during *kharif* 2015 and 2016 having three cultivars H 1098-I, H 1300 and H 1316 of upland cotton grown at CCS Haryana Agricultural University, Hisar in randomized block design replicated six times each in eight rows of 6 m length with a spacing of 67.5 x 30 cm. These varieties were grown in six environments that comprises of three sowings periods (Early: first fortnight of April, normal: first fortnight of May and late: end of May/early June) during the year 2015 and 2016 (Table 1).

Data was recorded as in all the three replications in every week flowers were tagged and number of effective bolls formed from these flowers was counted and the week in which maximum and minimum bolls developed was identified.

The seed cotton from these opened bolls was picked separately and ginned. This seed was used to test the seed quality parameters. These seed quality traits were correlated with different weather parameters to pin point the reasons for good or poor seed developments. The data on meteorological aspects was recorded from tagging period i.e. June, 24 to till the last picking of the experimental plots.

Meteorological data was recorded as:

Maximum and minimum temperature (°C)

Maximum and minimum temperature was calculated as the average temperature of different weeks and then averaged.

Relative humidity (%) morning as well as

evening

Relative humidity morning as well as evening was calculated as the average relative humidity of morning and evening of different tagging weeks and the averaged.

Sunshine hours

Sunshine hours were calculated as the average sunshine hours of different tagging weeks and the averaged.

Rainfall (mm) and number of rainy days

Rainfall and rainy days were calculated as the total rainfall and number of rainy days of different weeks and then finally total all the rainfall and number of rainy days of the tagging weeks.

Results and Discussion

Weakly meteorological data for seed development period in 2015 is presented in table 2. During 2015 flowering started from 28th June and it continued up to August 29. The fresh opened flowers were tagged daily and their number was recorded on weekly basis for10 weeks. The number of tagged flowers maturing in to well-developed open bolls was the number of retained bolls. These bolls were picked weekly and their number was counted, ginned and same were used for further tests like germination and biochemicals.

These results were correlated with different weather parameters. Data on weather parameters i.e. Temperature (Max. and Min.) or (T_{max} and T_{min}), Relative humidity (morning and evening) or (RH_m and RH_e), sunshine hours (SS), rainfall (RF) and rainy days (RD) were recorded for these 10 weeks (Table 2). Range for T_{max} during these 10 weeks was 33.0 – 37.8, for T_{min} it was 23.9 – 26.8, for RH_m was 72.4 – 92.7, for RH_e was 40.3 – 75.0, for sunshine hours was 2.6 – 9.5, for rainfall was 0- 77.3 and for rainy days was 0 – 4 during these weeks. Mean T_{max} for these 10 weeks was 34.9°C T_{min} was 25.8 °C, RH_m was 85.4%, RH_e was 60.7%, sunshine hours were 6.4 hours, rainfall was 220.6mm and rainy days were 16.

Weakly meteorological data for seed development period in 2016 is presented in table 3. During the year 2016 also data were recorded in similar way as that of 2015 starting from June 24 to Sept. 1. Temperature (Max. and Min.) or (T_{max} and T_{min}), Relative humidity (morning and evening) or (RH_m and RH_e), sunshine hours (SS), rainfall (RF) and rainy days (RD) were recorded for these 10 weeks (Table 3).

Table.1 Sowing dates and different environments in 2015 and 2016

Environment		Date of Sowing	Environment Designation
Year	**Sowing period**		
2015	Early	10 April	E_1
	Normal	15 May	E_2
	Late	5 June	E_3
2016	Early	26 April	E_4
	Normal	5 May	E_5
	Late	2 June	E_6

Table.2 Weakly meteorological data for seed development period during 2015

			Temperature (ºC)		Relative humidity %		SS (hrs)	Rainfall (mm)	Rainy days
2015	**Tagging period**	**Picking**	**T_{max}**	**T_{min}**	**Morning**	**Evening**			
1	**28-June-4 July**	1-Sep	37.8	25.8	80.1	48.1	8.3	15.8	2.0
2	**5-July- 11july**	7-Sep	34.0	26.1	86.1	70.7	2.8	46.7	1.0
3	**12-July- 18 July**	13-Sep	33.5	26.3	86.0	63.7	6.0	24.7	2.0
4	**19-July- 25 July**	20-Sep	35.6	26.7	87.3	63.0	7.3	77.3	1.0
5	**26-July- 1 Aug**	25-Sep	33.0	25.4	88.9	71.0	7.0	2.9	1.0
6	**2-Aug- 8 Aug**	2-Oct	33.7	26.0	90.0	62.7	4.2	7.4	2.0
7	**9-Aug-15 Aug**	9-Oct	34.3	26.8	92.7	75.0	2.6	29.2	4.0
8	**16-Aug-22 Aug**	13-Oct	34.2	26.1	88.1	57.7	6.9	7.8	2.0
9	**23-Aug-29 Aug**	20-Oct	36.2	25.6	82.0	55.0	9.3	8.8	1.0
10	**30-Aug-6Oct**	27-Oct	37.0	23.9	72.4	40.3	9.5	0.0	0.0
			34.9	25.8	85.4	60.7	6.4	220.6	16.0

T_{max} =Maximam Temperature T_{min}= Minimum Temperature SS= Sunshine

Table.3 Weakly meteorological data for seed development during period 2016

			Temperature (ºC)		Relative humidity %		SS (hrs)	Rainfall (mm)	Rainy days
2016	**Tagging Period**	**Picking**	**T_{max}**	**T_{min}**	**Morning**	**Evening**			
1	**24-June- 30 June**	28-Aug	38.0	28.0	74.7	58.3	6.7	13.0	1.0
2	**1-July- 7 July**	4-Sep	35.1	26.5	90.4	71.3	5.8	93.5	3.0
3	**8-July- 14 July**	11-Sep	36.3	27.2	86.6	72.3	7.3	4.0	1.0
4	**15-July- 21 July**	18-Sep	33.9	25.3	91.9	71.3	4.5	73.3	5.0
5	**22-July- 28 July**	23-Sep	36.7	26.0	89.4	70.4	8.0	27.0	1.0
6	**29-July- 4 Aug**	30-Sep	32.5	25.2	93.4	74.4	4.2	47.0	1.0
7	**5-Aug- 11 Aug**	7-Oct	34.6	26.1	91.6	75.7	6.0	4.3	1.0
8	**12-Aug- 18 Aug**	11-Oct	34.8	24.7	85.7	60.3	6.5	4.5	1.0
9	**19-Aug-25 Aug**	15-Oct	34.0	26.4	88.1	61.1	5.1	8.4	2.0
10	**26-Aug- 1 Sept**	19-Oct	32.8	25.3	94.4	77.7	6.0	63.2	2.0
			34.9	26.1	88.6	69.3	6.0	338.2	18.0

T_{max} =Maximam Temperature T_{min}= Minimum Temperature SS= Sunshine

Table.4 Correlation of seed germination (%) with various weather parameters under different environments in H 1098- I

				H 1098-I		
	E_1	E_2	E_3	E_4	E_5	E_6
T_{max}	-0.78*	-0.74*	-0.72*	-0.13	0.28	0.27
T_{min}	0.73*	0.71*	0.70*	-0.28	0.09	0.10
RH_m	0.88*	0.85*	0.85*	0.40	0.14	0.08
RH_e	0.88*	0.89*	0.89*	0.47	0.40	0.33
SS	-0.75*	-0.81*	-0.84*	-0.05	0.06	0.03
RF	0.45	0.42	0.39	-0.16	0.00	-0.10
RD	0.48	0.60*	0.62*	-0.06	-0.08	-0.13

T_{max} =Maximam Temperature T_{min}= Minimum Temperature RH_m= Morning Relative Humidity RH_e = Evening Relative HumiditySS= Sunshine; RF = Rainfall RD= Rainy Days

Table.5 Correlation of seed germination (%) with various weather parameters under different environments in H 1300

			H 1300			
	E_1	E_2	E_3	E_4	E_5	E_6
T_{max}	-0.75*	-0.76*	-0.72*	-0.15	0.25	0.13
T_{min}	0.69*	0.70*	0.70*	-0.28	0.12	-0.05
RH_m	0.86*	0.84*	0.84*	0.41	-0.01	-0.04
RH_e	0.89*	0.89*	0.89*	0.47	0.18	0.00
SS	-0.78*	-0.80*	-0.82*	-0.07	-0.02	-0.12
RF	0.42	0.41	0.42	-0.15	-0.24	-0.32
RD	0.50	0.59	0.61*	-0.09	-0.20	-0.26

T_{max} =Maximam Temperature T_{min}= Minimum Temperature RH_m= Morning Relative Humidity RH_e = Evening Relative HumiditySS= Sunshine; RF = Rainfall RD= Rainy Days

Table.6 Correlation of seed germination (%) with various weather parameters under different environments in H 1316

			H 1316			
	E_1	E_2	E_3	E_4	E_5	E_6
T_{max}	-0.77*	-0.75*	-0.74*	-0.14	0.28	0.20
T_{min}	0.68*	0.70*	0.69*	-0.30	0.03	-0.06
RH_m	0.85*	0.84*	0.84*	0.41	-0.09	0.06
RH_e	0.89*	0.89*	0.89	0.46	0.10	0.21
SS	-0.77*	-0.81*	-0.82*	-0.03	0.01	0.02
RF	0.45	0.40	0.39	-0.20	-0.28	-0.21
RD	0.46	0.60	0.61*	-0.09	-0.22	-0.29

T_{max} =Maximam Temperature T_{min}= Minimum Temperature RH_m= Morning Relative Humidity RH_e = Evening Relative HumiditySS= Sunshine; RF = Rainfall RD= Rainy Days

Range for T_{max} during these 10 weeks was 32.5 – 38, for T_{min} it was 24.7 – 28.0, for RH_m was 74.7 – 94.4, for RH_e was 58.3 – 77.7, for sunshine hours was 4.2 – 8.0, for rainfall was 4 - 95.5 and 1 – 5 rainy days for these weeks. Mean T_{max} for these 10 weeks was 34.9°C, T_{min} was 26.1 °C, RH_m was 88.6%, RH_e was 69.3%, sunshine hours were 6 hours, rainfall was 338.2 mm and rainy days were 18.

Correlation of seed germination (%) with weather parameters was shown in Tables 4, 5 and 6. In the variety H 1098- I seed germination in E_1, E_2 and E_3 was negatively correlated with maximum temperature (T_{max}). Seed germination in E_1, E_2 and E_3 was positively correlated with minimum temperature (T_{min}), relative humidity morning and evening (RH_m and RH_e). Seed germination in E_1, E_2 and $E_3$was negatively correlated with sunshine hours (SS). Seed germination in E_2 and E_3 was positively correlated with rainy days (RD).

In the variety H 1300 and H 1316 seed germination in E_1, E_2 and E_3 was negatively correlated with T_{max}. Seed germination in E1, E2 and E3 were positively correlated with T_{min}, RH_m and RH_e whereas, negatively correlated with Sunshine hours (SS). Seed germination in E3 was positively correlated with rainy days (RD).

The inclusion of various yield component characters in a selection scheme is obviously not practicable and under these situations, knowledge with respect to the association of various traits with yield would be of immense help in formulating an effective and efficient selection programme.

References

ICAR-All India Coordinated Research Project on Cotton Annual Report 2016-2017.

Malagouda, P. Khadi, B.M. Basamma, K. and I.S. Katageri (2014). Genetic variability and correlation analysis for fibre quality traits in diploid cotton (*Gossypium* spp). J. Agric. & Environ. Sci. 14 (5): 392-395.

Munawar, M. and Malik, T.A. (2013). Correlation and genetic architecture of seed traits and oil content in *Gossypium hirsutum* L. J. Plant Breed. Genet. 1(02): 56-61.

Naveed, M., Azhar, F.M. and Ali, A. (2004). Estimates of heritabilities and correlations among seed cotton yield and its components in *Gossypium hirsutum* L. Int. J. Agri. Biol. 6(4): 712-714.

Naveed, M., Azhar, F.M. and Ali, A. (2004). Estimates of heritabilities and correlations among seed cotton yield and its components in *Gossypium hirsutum* L. Int. J. Agri. Biol. 6(4): 712-714.

Preetha, S. and Raveendran, T.S. (2007). Genetic variability and association analysis in three different morphological groups of cotton (*Gossypium hirsutum* L.). *Asian J.Pl. Sci.* 6(1): 122-128.

Ratnam, M., Reddy, S.K., Bharathi, S. (2014). Influence of weather parameters on growth and yield of Bt cotton under krishina agro climatic zone of Andhra Pradesh. J. Cotton Res. Dev. 28(2): 214-216.

Singh, S., Singh, V.V. and Choudhary, A.D. (2014). Genotype × Environment interaction and yield stability in multienvironment. *Tropical subtrop. Agroeco*. 17: 477-482.

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