INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2001/03–4–389–390
http://www.ijab.org

Yield and Quality Response of two Cotton Cultivars to Pre-Sowing Heat Stress

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ABSTRACT

Seeds of two cotton cultivars i.e. NIAB-Karishma and CIM-443 were stressed at zero, 50, 60, 70 and 80ºC for 24 and 48 h before sowing and its effect on yield and quality parameters of crop was studied. The results revealed that boll weight, seed cotton per plant and fibre length were not affected significantly by different temperature stress levels and their interactions with other treatments in both the varieties. However, weight of cotton sticks per plant was higher in variety CIM-443 when stressed for 48 h than the NIAB-Karishma. Fibre strength was greater in NIAB-Karishma when subjected to different heat stress temperature for 48 h as compared to CIM-443.

Key Words: Cotton cultivars; Temperature; Stress; Yield parameters

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) occupies a pivotal position in Pakistan's economy but its yield per hectare is very low compared with other cotton growing countries of the world. Among various strategies, pre-sowing exposure of seed to high temperature stress is one of the simple, effective and practical methods to minimize the pre-mature flowers and bolls shedding losses to get higher yields in cotton (Khan *et al.*, 1973).

Similarly, stimulated germination, vigorous seedlings and subsequent better plant stand (Malik, 1971; Khan *et al.,* 1973; Ahmad & Banars, 1981), reduction in flower shedding (Khan *et al.*, 1973), increase in lint percentage, yield and fibre quality (Ahmad *et al.*, 1993) in cotton in response to pre-sowing exposure of seed to high temperature stress have been reported.

Availability of new cultivars, however, demands to determine their response to temperature stress of seed so that maximum yields can be obtained. Present study was planned to investigate the effect of pre-sowing temperature stress on growth, yield and quality parameters of two new cotton cultivars i.e. NIAB-Karishma and CIM-443.

MATERIALS AND METHODS

Studies were conducted at the Agronomic Research Area, University of Agriculture, Faisalabad. The experiment was conducted in pots and was replicated thrice with split split plot design. Pots were filled with 11 kg of normal soil and kept in a wirenet house under natural conditions. The crop was sown in the first week of June using five seeds/pot. Before sowing, seeds of two varieties of cotton i.e. NIAB-Karishma (V1) and CIM-443 (V2) were stressed at 50 (T1), 60 (T2), 70 (T3) and 80ºC (T4) for 24 (D1) and 48 h (D2); while non-stressed seeds were used as control (T0). A basal dose of P and K @ 75 kg ha^{-1} and 65 kg ha^{-1} on weight basis, respectively, was applied to each pot at sowing time. Nitrogen was applied @ 175 kg ha^{-1} in three doses to each pot i.e. first at sowing, second at flowering and third at fruiting stage. After one week of germination, plants were thinned out to one plant per pot. Crop was sprayed with pesticides (Phenthrin, Talstar and Trend) to protect against insect pest attack during the growth period. Data on growth, yield and quality characteristics of the crop were collected and were analysed statistically. Treatments showing significant F-values were compared by applying Least Significant Difference (LSD) test at 5% probability level (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

It is evident from Table I that pre-sowing heat stress of 50, 60, 70, and 80ºC imposed on the seeds of NIAB-Karishma and CIM-443 for 24 and 48 h had non significant effect on the boll weight which was approximately 3 g in all the treatments. The interactions between and among different treatments did not reach a level of significance. Data in Table I further indicate that none of the treatments i.e. varieties, temperature stress levels, stress durations and their interactions had significant effect on weight of seed cotton per plant. Weight of cotton sticks per plant (g) was, however, significantly affected by heat stress durations and the interactions between varieties and durations of heat stress was also significant.

A heat stress duration of 48 h caused an increase in the weight of sticks as compared to that of 24 h and the weights recorded were 74.16 and 59.76 g, respectively. Similar findings were reported by Khan *et al.* (1973), Ahmad and Banaras (1981) and Ahmad *et al.* (1993).

Variety CIM-443 significantly produced more weight of cotton sticks (73.0 g) as compared to that of NIAB-Karishma (60.93 g). This might be due to the difference in the genetic make up of the two varieties. Seeds of variety

Table I. Effect of heat stress on yield and quality characteristics of two cotton cultivars

Boll weight (g)	Weight of seed cotton per plant (g)	Weight of cotton sticks per plant (g)	Fibre length (mm)	Fibre strength (000 lb inch^{-1})	
V1 = 3.25	V1 = 15.01	V1 = 60.93 b	V1 = 26.78	V1D1T0 = 66.45 abcdef	V2D1T0 = 24.53 h
V2 = 3.20	V2 = 19.35	V2 = 73.00 a	V2 = 26.76	V1D1T1 = 64.88 bcdefg	V2D1T1 = 64.20 cdefg
		LSD = 8.62			
D1 = 3.16	D1 = 17.41	D1 = 59.76 b	D1 = 26.86	V1D1T2 = 64.37 bcdefg	V2D1T2 = 57.41 g
D2 = 3.29	D2 = 16.95	D2 = 74.16 a	D2= 26.68	V1D1T3 = 63.12 efg	V2D1T3 = 59.28 fg
		LSD = 8.62			
T0 = 3.11	T0 = 15.99	V1D1 = 65.20 b	T0 = 26.75	V1D1T4 = 66.79 abcdef	V2D1T4 = 26.58 h
T1 = 3.36	T1 = 17.81	V1D2 = 56.66 b	T1 = 26.41	V1D2T0 = 66.68 abcdef	V2D2T0 = 67.13 abcdef
T2 = 3.02	T2 = 19.50	V2D1 = 54.33 b	T2 = 26.41	V1D2T1 = 72.79 ab	V2D2T1 = 64.40 bcdefg
T3 = 3.18	T3 = 16.37	V2D2 = 91.66 a	T3 = 26.75	V1D2T2 = 72.34 abc	V2D2T2 = 68.74 abcde
T4 = 3.45	T4 = 16.23	LSD= 12.22	T4 = 27.54	V1D2T3 = 71.70 abcd	V2D2T3 = 63.99 cdefg
N.S.	N.S.		N.S.	V1D2T4 = 74.45 a	V2D2T4 = 63.34 defg
					LSD = 8.44

V1 = NIAB Karishma, V2 = CIM-443, T0 = Control, T1 = 50ºC, T2 = 60ºC, T3 = 70ºC, T4 = 80ºC, D1 = 24 hours duration, D2 = 48

CIM-443 stressed for 48 h produced plants having more weight of cotton sticks (91.66 g) than that of other combinations. Variety NIAB-Karishma when stressed for 24 h (V1D1) and 48 h (V1D2), and CIM-443 after 24 h (V2D1) heat stress produced 65.20, 56.66 and 54.33 g of cotton sticks per plant and they were statistically at par with one another. This indicates that CIM-443 was more heat tolerant than NIAB-Karishma.

Data on fibre length presented in Table I showed that neither the individual effect of pre-sowing temperature stress applied to the seeds of NIAB-Karishma and CIM-443 for 24 and 48 hours durations nor their interactions (VxD, VxT, DxT, VxDxT) had significant effect on fiber length. These findings are not in conformity with those reported by Ahmed *et al*. (1993) who reported an improvement in fibre quality by pre-sowing temperature stress. This may be due to the different varieties and environments under which the present studies were conducted. The fibre produced from NIAB-Karishma stressed for 48 h at 80ºC.

V1D2T4 showed the maximum strength 74.45 lb inch^{-2}. It is statistically at par with the treatments when the seeds of same variety were stressed at zero or 80ºC for 24 h, and also stressed for 48 h at 0, 50, 60 and 70ºC and that of CIM-443 stressed at 0 and 60ºC for 48 h. The lowest fibre strength of 24.53 lb inch^{-2} was recorded in variety CIM-443 subjected to zero temperature stress (V2D1T0) treatment. Non significant difference, however, was found between V2D1T0 and V2D1T4.

Fibre strength in NIAB-Karishma at various heat stress treatments for 24 or 48 h duration did not vary. CIM-443 though varied much in fibre strength at 24 h duration but became stable when subjected to various heat stress treatments for 48 h. Fibre strength of different cotton varieties due to heat stress effect was also reported by Ahmad *et al*. (1993).

REFERENCES

Ahmad, F.M., A.S.M. Azab and S.M.H., El-Halawany, 1993. Effects of pre-sowing high temperature on germination, growth and yield of seed cotton. *Assiut J. Agri. Sci.,* 24: 273–81.

Ahmad, S. and M. Banaras, 1981. Effect of pre-sowing high temperature stress on growth and yield of seed cotton. *J. Agric. Res.,* 19: 61–5.

Khan, R.A., S. Ahmad and S. Hussain, 1973. Effects of pre-sowing high temperature stress on seedling emergence and yield of seed cotton. *Expt. Agric.,* 9: 9–14.

Malik, M.A., 1971. Effect of heat stress on the germinability and seedling vigour on cotton. *M.Sc. (Agri.) Thesis,* Deptt, of Agronomy. Univ. Agri., Faisalabad.

Steel, R.G.D. and J.H. Torrie, 1984. *Principles and Procedures of Statistics,* 2nd Ed. pp: 172–7. McGraw Hill, Int. Book Co., Singapore.

(Received 19 May 2001; Accepted 20 August 2001)