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Research article

FACTORS AFFECTING CROSSED BOLL SETTING IN INTER-SPECIFIC CROSSES OF COTTON (*G. hirsutum* × *G. barbadense*)

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ABSTRACT: The present study was conducted during *Kharif* 2013 at Regional Agricultural Research Station, Lam farm, Andhra Pradesh. Any crop improvement programme starts with crossing programme, which involves emasculation and pollination. Hand emasculation and pollination was generally adopted practice in cotton in hybridisation programme. The amount of crossed boll setting was influenced by genotypic factors as well as environmental conditions; especially in inter-specific cross combinations crossed boll setting was low. In the present investigation, crossed boll setting ranged from 55 per cent (BS 37 × GSB 40) to 27 per cent (BS 37 × DB 11,TSH 0250 × GSB 40). The higher per cent crossed boll setting was observed during October first week (1 standard week) when higher minimum temperature and higher minimum relative humidity was recorded. The variation in amount of crossed boll setting during 1 standard week between different cross combinations due to genotypic differences. Higher amount of crossed boll setting was not only influenced by the genotypic differences of parents but also by environmental conditions of location. So proper schedule of sowing parental lines to coincide peak flowering with optimum environmental conditions is very crucial in most successful hybridisation programme.
Key words: Cotton, inter-specific hybridisation, genotypic and environmental factors

INTRODUCTION

Cotton (*Gossypium*spp) is a major fibre crop of global significance. It is grown in tropical and sub-tropical regions of more than 80 countries. The flowers of cotton are extra-auxillary, terminal and solitary. Calyx cup shaped, sepals five in number and joined at the base and free at the top, corolla consists of five petals in twisted aestivation. Stamens are numerous, consists of filament and anther lobe. The lower part of the filaments united into a tube and upper part free, bears unilocular anthers which surround the pistil except the exposed portion. Flower is complete in actinomorphic condition. Cotton is an often cross pollinated crop. Pollen of cotton being heavy, sticky and is not generally windblown. Pollination is most predominantly autogamous and natural out crossing in cotton was observed from zero to very low per cent [3]. Anthesis takes place between 8.00 am to 12.00 noon with some variations depending upon type of cultivars, location and environmental conditions.

Emasculation methods like straw pipe insertion and hand emasculation methods generally used in cotton. [1, 2, 4] reviewed different crossing techniques in cotton and revealed that hand emasculation method with minor modifications was more productive and reliable. In plant breeding crop improvement programme starts with hybridisation programme. The success of hybridization programme evaluated based on the amount of crossed seed got at the end of the programme. The higher amount of crossed seed set depends upon so many factors like genotypic differences, environmental conditions, correct time of crossing initiation and skill of labour. In the present study crossing was done between *hirsutum* and *barbadense* genotypes i.e inter specific hybridisation with an aim to study the role of genotypic differences and environmental conditions and optimum time of crossing in deciding the amount of crossed boll setting.

MATERIALS AND METHODS

The experiment was conducted during *Kharif* 2013. The experimental material consisted of 60 crosses of ten lines of high diverse origin of *Gossypiumhirsutum* L. having good yield characters and agronomically superior and with six testers of *Gossypiumbarbadense* L. with good fibre quality traits. The crosses were affected in line × tester fashion using lines as females and testers as male parents. The experimental material was sown in four rows of 6.0 m length. The spacing between rows was 120 cm and plants in a row were kept 60 cm apart. Recommended agronomic and plant protection measures were taken.

The crossing programme was initiated during October to first week of November. Flower buds in female lines expected to open next day morning were emasculated with hand in the evening hours between 3.0 to 5.0 pm and covered with the butter paper bag. Next day morning the butter paper bag was removed and emasculated buds were pollinated with the flower of male lines used as tester. The pollination work was done between 8.0 am to 12.0 noon. Single male flower was used to pollinate 3-4 female flowers. On each day, number of emasculated and pollinated flowers were counted and labelled with jewel tags with marking of dates. To avoid the differences in crossed boll setting due to difference in skill of labour, same labour was engaged throught the crossing programme. Opened crossed bolls were picked up and recorded their numbers cross wise upto final opening of such bolls. The per cent boll setting was calculated by dividing the number of opened crossed bolls to the total numbers of crossed flowers/buds × 100 [7].

RESULTS AND DISCUSSION

In cotton crop the setting of crossed bolls is affected by various factors like location, genotype, skill of labour and climatic conditions. Genotypic differences seem to play an important role in crossed boll setting. The boll setting ranged from 27 (TSH 0250 × GSB 40, BS 37 × DB 11) to 55 per cent (BS 37 × GSB 40) in different inter-specific cross combinations. Maximum crossed boll setting (44 %) was observed in crosses having NDLH 1938 as a common female parent with different testers followed by L 1060 (41%), BS 37 (41%), MR 786 (39%) and SCS 793 (39%), L 1058 (38%) and H 1442 (38 %). The least crossed boll setting was observed in crosses TSH 0250 as a female parent. These results indicated that genotypic differences played a vital role in crossed boll setting, although the variation could be partly due to difference in environmental conditions. The probable reasons for differences in per cent crossed boll setting may be the difference of cross compatibility and degree of tolerance to injury during the process of emasculation in different female lines [5]. The highest per cent of crossed boll setting was observed in crosses having SUVIN (40%) and DB 16 (40%) as testers followed by TCB 37 (38%). The least crossed boll setting was observed in crosses having DB 11(36%) and GSB 41(36%) as common testers (Table 2). During crossing programme when minimum temperature 25.9 and minimum relative humidity (77 %) 68 per cent of crossed boll setting was observed. But only 19 per cent crossed boll setting was observed when minimum temperature 24.1 and minimum relative humidity 62 % (Table 3, Fig 1). It indicates that among the observed environmental factors there is a positive correlation between bolls setting per cent and minimum temperature and minimum relative humidity [6]. When compared to intra specific cross combinations inter-specific cross combinations boll setting was low in any crop so that cotton is not exceptional from this. This may be due to wider genetic differences leads to cross incompatibility, abortion of embryo, poor development of endosperm and lethal genes. The results reveal that minimum temperature and minimum relative humidity plays a crucial role in deciding amount of per cent crossed boll setting. Success of crossing programme in cotton not only depends upon selecting compatible parents but also depends upon environmental conditions prevailing during crossing programme. So, while planning the crossing programme in cotton one should know the environmental situations of location based previous meteorological data and according to that time of sowing of parental lines have to adjust to get maximum flowers during favourable environmental conditions.

Table 1: Genotypic effect of female parent on per cent boll setting in inter-specific crosses of cotton

Cross	Crosses attempted	Crossed boll set	Boll setting %
MCU 5 × SUVIN	190	63	33
MCU 5 × GSB 40	185	59	32
MCU 5 × DB 11	150	53	35
MCU 5 × TCB 37	120	37	31
MCU 5 × DB 16	160	51	32
MCU 5 × GSB 41	165	50	30
	970	**313**	**32**
L 1060 × SUVIN	205	85	41
L 1060 × GSB 40	190	55	29
L 1060 × DB 11	155	68	44
L 1060 × TCB 37	160	70	44
L 1060 × DB 16	137	67	49
L 1060 × GSB 41	175	75	43
	1022	**420**	**41**

Table-1 cont...

Cross	Crosses attempted	Crossed boll set	Boll setting %
L 1058 × SUVIN	129	55	43
L 1058 × GSB 40	154	68	44
L 1058 × DB 11	160	66	41
L 1058 × TCB 37	174	70	40
L 1058 × DB 16	191	71	37
L 1058 × GSB 41	170	46	27
	978	**376**	**38**
NDLH 1938 × SUVIN	155	75	48
NDLH 1938 × GSB 40	145	65	45
NDLH 1938 × DB 11	187	85	45
NDLH 1938 × TCB 37	189	65	34
NDLH 1938 × DB 16	171	82	48
NDLH 1938 × GSB 41	183	82	45
	1030	**454**	**44**
MR 786 × SUVIN	150	53	35
MR 786 × GSB 40	174	86	49
MR 786 × DB 11	184	87	47
MR 786 × TCB 37	183	85	46
MR 786 × DB 16	192	52	27
MR 786 × GSB 41	201	63	31
	1084	**426**	**39**
H 1442 × SUVIN	190	97	51
H 1442 × GSB 40	202	65	32
H 1442 × DB 11	185	56	30
H 1442 × TCB 37	167	60	36
H 1442 × DB 16	154	45	29
H 1442 × GSB 41	145	73	50
	1043	**396**	**38**
SCS 793 × SUVIN	175	76	43
SCS 793 × GSB 40	156	52	33
SCS 793 × DB 11	189	55	29
SCS 793 × TCB 37	185	82	44
SCS 793 × DB 16	156	80	51
SCS 793 × GSB 41	195	69	35
	1056	**414**	**39**
L 762 × SUVIN	178	59	33
L 762 × GSB 40	165	51	31
L 762 × DB 11	154	53	34
L 762 × TCB 37	145	46	32
L 762 × DB 16	173	80	46
L 762 × GSB 41	165	58	35
	980	**347**	**35**
TSH 0250 × SUVIN	147	53	36
TSH 0250 × GSB 40	176	40	27
TSH 0250 × DB 11	145	41	28
TSH 0250 × TCB 37	168	60	36
TSH 0250 × DB 16	186	55	30
TSH 0250 × GSB 41	174	51	29
	996	**300**	**30**
BS 37 × SUVIN	187	68	36
BS 37 × GSB 40	199	110	55
BS 37 × DB 11	181	50	27
BS 37 × TCB 37	187	60	32
BS 37 × DB 16	178	95	53
BS 37 × GSB 41	185	73	39
	1117	**456**	**41**

Table 2: Genotypic effect of male parents on per cent boll setting in inter-specific crosses of cotton

Cross	Crosses attempted	Crossed boll set	Boll setting %
MCU 5 × SUVIN	190	63	33
L 1060 × SUVIN	205	85	41
L 1058 × SUVIN	129	55	43
NDLH 1938 × SUVIN	155	75	48
MR 786 × SUVIN	150	53	35
H 1442 × SUVIN	190	97	51
SCS 793 × SUVIN	175	76	43
L 762 × SUVIN	178	59	33
TSH 0250 × SUVIN	147	53	36
BS 37 × SUVIN	187	68	36
	1706	**684**	**40**
MCU 5 × GSB 40	185	59	32
L 1060 × GSB 40	190	55	29
L 1058 × GSB 40	154	68	44
NDLH 1938 × GSB 40	145	65	45
MR 786 × GSB 40	174	86	49
H 1442 × GSB 40	202	65	32
SCS 793 × GSB 40	156	52	33
L 762 × GSB 40	165	51	31
TSH 0250 × GSB 40	176	40	27
BS 37 × GSB 40	199	110	55
	1746	**651**	**37**
MCU 5 × DB 11	150	53	35
L 1060 × DB 11	155	68	44
L 1058 × DB 11	160	66	41
NDLH 1938 × DB 11	187	85	45
MR 786 × DB 11	184	87	47
H 1442 × DB 11	185	56	30
SCS 793 × DB 11	189	55	29
L 762 × DB 11	154	53	34
TSH 0250 × DB 11	145	41	28
BS 37 × DB 11	181	50	27
	1690	**614**	**36**
MCU 5 × TCB 37	120	37	31
L 1060 × TCB 37	160	70	44
L 1058 × TCB 37	174	70	40
NDLH 1938 × TCB 37	189	65	34
MR 786 × TCB 37	183	85	46
H 1442 × TCB 37	167	60	36
SCS 793 × TCB 37	185	82	44
L 762 × TCB 37	145	46	32
TSH 0250 × TCB 37	168	60	36
BS 37 × TCB 37	187	60	32
	1678	**635**	**38**
MCU 5 × DB 16	160	51	32
L 1060 × DB 16	137	67	49
L 1058 × DB 16	191	71	37
NDLH 1938 × DB 16	171	82	48
MR 786 × DB 16	192	52	27
H 1442 × DB 16	154	45	29
SCS 793 × DB 16	156	80	51
L 762 × DB 16	173	80	46
TSH 0250 × DB 16	186	55	30
BS 37 × DB 16	178	95	53
	1698	**678**	**40**

Table-2 cont....

Cross	Crosses attempted	Crossed boll set	Boll setting %
MCU 5 × GSB 41	165	50	30
L 1060 × GSB 41	175	75	43
L 1058 × GSB 41	170	46	27
NDLH 1938 × GSB 41	183	82	45
MR 786 × GSB 41	201	63	31
H 1442 × GSB 41	145	73	50
SCS 793 × GSB 41	195	69	35
L 762 × GSB 41	165	58	35
TSH 0250 × GSB 41	174	51	29
BS 37 × GSB 41	185	73	39
	1758	**640**	**36**

Table 3: effect of environmental factors on per cent of crossed boll setting in inter-specific crosses of cotton

Standard week no.	%bolls set	Temp (max)	Temp (min)	RH (max)	RH (min)
1	68	31.5	25.9	93	77
2	21	32.4	24.2	91	71
3	34	32.1	25	87	73
4	48	29	24.3	99	88
5	19	31.3	24.1	94	62

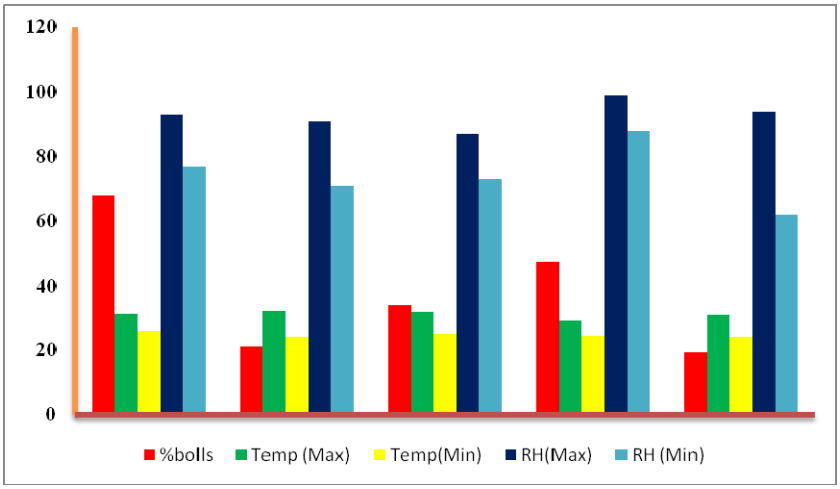

Fig 1: Effect of environmental factors on per cent of crossed boll setting in inter-specific crosses of cotton

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