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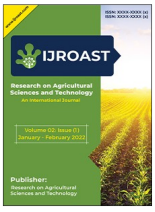

Correlation studies of certain genetic characters in Upland Cotton (*Gossypium hirsutum* L.)

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ABSTRACT

Study of correlation of the yield contributing characters paves way in any selection programme targeted towards yield improvement. Twelve *G hirsutum* F_4 populations were raised at the farm of Cotton Research Station, Veppanthattai ($11^0 32'$ N latitude and $78^0 83'$ E longitude) during 2018-19 under winter rainfed conditions. Single plant selection was performed for quantitative characters *viz*., number of monopodial branches per plant, number of sympodial branches per plant, plant height, number of bolls per plant and seed cotton yield. Among the test crosses, (F484 x Surabhi, C-10-3 x COD - 5-1-2 and F489 x KC3) jassid resistance was predominant and number of plants selected were higher for studying the inter-relationship. Number of bolls per plant, number of monopodial branches, and number of sympodial branches had direct effect on seed cotton yield in all the crosses. Out of three crosses, in two crosses (F484 x Surabhi and F489 x KC3) plant height had direct effect on seed cotton yield. Targeted selection for above characters would be useful in breeding programme under rainfed conditions.

Introduction

Cotton, called as 'white gold', is one of the most important commercial crops being traded worldwide and more than 60% of foreign exchange revenues come from cotton and its value added products in India [1]. However, the productivity is low compared to countries like Brazil and China [2]. Increasing cotton productivity is the need of the hour for sustainable cotton farming in India. Development of high yielding varieties / hybrids is inevitable approach towards yield improvement. Systematic crop breeding programs aims to manipulate the yield components to increase the seed cotton yield. Selection efficiency is the key parameter which measures the success of any breeding programme and in order to increase the efficiency, we need to study the association among the various yield components. While the phenotypic correlation indicates the extent of the relation among two characters the genotypic correlation provides an estimate of inherent genetic relationship / association between the genes controlling them. The cause for negative effect of the trait is very essential for formulating selection indices by path analysis [3] and [4]. Hence, the present study was taken up to study the correlation and path analysis for various yield and yield contributing characters in a set of three crosses of cotton with the idea that such information would increase the selection efficiency during synthesis and development of superior cotton varieties.

Materials and Methods

The present study was conducted at Cotton Research Station, Veppanthattai, Tamil Nadu Agricultural University, Tamil Nadu, India during 2018-19. The experimental site is located at $11^0 32'$N latitude, $78^0 83'$E longitude and an altitude of 149 m above the mean sea level. The F_4 populations of three crosses were studied to identify the inter-relationship and to advance superior plant progenies suitable for rainfed conditions. Three crosses *viz.,*

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F489 x KC3, F484 x Surabhi and C-10-3 x COD - 5-1-2 were selected for association analysis as the number of single plant progenies of these crosses were higher for studying association analysis and exhibited jassid resistance. Biometrical characters *viz.,* plant height (cm), number of monopodial branches per plant, number of sympodial branches per plant, number of bolls per plant and single plant yield (g) were recorded in each generation on single plant basis for advancement. The data from single plants were used to estimate correlation co-efficient as per the method suggested by [5] to find out the relationship between yield and its components. The significance of correlation co- efficient was tested with reference to the 't' table given by [6].

Results and Discussion

Seed cotton yield/plant ranged from 125.3 g to 215.4 g in the cross F489 x KC3, 94.6 g to 230.2 g in F484 x Surabhi and 105.6 g to 182.3 in the cross C-10-3 x COD - 5-1-2 (Table 1). The highest mean seed cotton yield was observed in F484 x Surabhi followed by C-10-3 x COD - 5-1-2 and F489 x KC3. The amount of contribution and of various quantitative traits on yield can be studied from correlation analysis. Estimates of correlation coefficients for five quantitative traits in F_4 generation of cotton are given in the Table 2.

Significant positive association of the seed cotton yield with plant height (r = 0.612) was observed in the cross F484 x Surabhi while non-significant negative, and positive associations were observed in C-10-3 x COD - 5-1-2 and F489 x KC3, respectively. In all cross combinations studied, significant positive association between plant height and number of sympodial branches per plant was observed, The present results are in conformity with those of [7], [8], [9] and [10]. Significant positive correlation was observed for number of monopodial branches per plant with number of bolls per plant in two crosses *viz*., C-10-3 x COD - 5-1-2 (r=0.505) and F489 x KC3 (r=0.612). The present results are in conformity with those of [11]. In F_4 progenies of all the crosses studied, number of sympodial branches per plant had significant and positive association on number of bolls per plant and seed cotton yield (Table 2). Invariably, in all three crosses it was observed that no. of bolls had significant positive association with seed cotton yield. Hence, the selection for these traits will help in selecting genotypes with higher seed cotton yield per plant. Such positive association of seed cotton yield per plant with these traits was also observed by [12], [13], and [14].

The study of path coefficients enable breeder to concentrate on the variable which show a high direct effect on seed cotton yield. The genotypic correlation coefficient of seed cotton yield with other yield contributing and fibre quality traits were further partitioned into direct and indirect effects (Table 3). Out of three crosses, in two crosses *viz*., F484 x Surabhi and F489 x KC3, the plant height had direct effect on seed cotton yield corresponding to the values of 0.146 and 0.107, respectively. It could be due to the increase in no. of sympodial branches significantly lead to an increase in no. of bolls / plant. Number of sympodial branches, number of bolls per plant and number of monopodial branches had direct effect on seed cotton yield in all the crosses studied (Table 3). It is clear from the results that the vegetative character plant height exhibit effect on seed cotton yield as the possibilities of increase in no. of branches and no. of bolls are increased as the growth and height increases. In indirect effects, highest positive indirect effect (0.632) was recorded for number of sympodial branches per plant on plant height in the cross F484 x Surabhi. Number of monopodial branches per plant had positive indirect effect on plant height and number of bolls per plant while plant height exhibited positive indirect effect on number of bolls per plant (0.074, 0.034 and 0.065). Similar results were observed by Tulasi *et al.* (2012) and Santoshkumar *et al.* 2014. The observed results could be due to the strong correlation of plant height with vegetative and fruiting branches, and number of bolls per plant expressed in certain crosses. Hence, selection by increasing the plant height will increase the number of sympodial branches per plant and number of bolls per plant. The residual values of 0.69, 0.78 and 0.62 indicate that other characters also contribute to yield.

Table 1. Mean, range of variability for yield and component traits of F_4 progenies in cotton

Cross combination	Plant height (cm)	No. of monopodia per plant	No. of sympodia per plant	No. of bolls per plant	Single plant yield (g)
F489 x KC3	145.8	2.3	24.2	61.2	158.9
	(145 - 150)	(2 - 3)	(24 - 25)	(41 - 55)	(125.3 - 215.4)
F484 x Surabhi	163.8	3.0	26.6	44.6	186.5
	(135 - 155)	(1 - 4)	(20 - 32)	(39 - 65)	(94.6 - 230.2)
C-10-3 x COD - 5-1-2	158.6	2.6	27.6	43.8	161.8
	(155-162)	(1 - 3)	(22 - 42)	(42 - 50)	(105.6 - 182.3)

Range is given in parenthesis

Table 2. Correlation Coefficient for Seed cotton yield and yield components in F_4 generation in cotton

Character	Cross	PHT	MONO	SYM	BOLLS	YIELD
PHT	Cross 1	1.000	0.345	0.593*	0.311	0.271
	Cross 2		-0.108	0.542*	0.287	-0.130
	Cross3		0.114	0.554*	0.217	0.214
Mono	Cross 1		1.000	-0.99	0.189	0.056
	Cross 2			-0.111	0.505*	0.309
	Cross 3			-0.178	0.612*	0.164
SYM	Cross 1			1.000	0.524*	0.556*
	Cross 2				0.662*	0.505*
	Cross 3				0.510*	0.587*
BOLLS	Cross 1				1.000	0.636*
	Cross 2					0.589*
	Cross 3					0.557*

Cross 1- F484 x Surabhi; Cross 2- C-10-3 x COD - 5-1-2; Cross 3 - F489 x KC3. PHT-Plant height, MONO –No. of monopodial branches/plant, SYM - No. of sympodial branches per plant, BOLLS- No. of bolls/plant and YIELD - seed cotton yield/ per plant

Conclusion

The present study probed the association of yield with its contributing characters in the breeding materials developed for rainfed conditions of Tamil Nadu. Number of bolls per plant, number of monopodial branches, and number of sympodial branches found to be associated with seed cotton yield in all the crosses studied. This study helped to identify

the characters to be given importance, due to its association with yield, in the selection programme to get higher seed cotton yield under rainfed conditions.

Table 3. Direct and indirect effects of various characters on cotton yield in F_4 generation

Character	Cross	PHT	MONO	SYM	BOLLS	Correlation
						YIELD
PHT	Cross 1	0.146	-0.039	-0.218	0.074	0.271
	Cross 2	-0.198	-0.056	0.049	0.034	-0.130
	Cross 3	0.107	-0.044	0.045	0.065	0.214
MONO	Cross 1	0.113	0.254	0.054	0.082	0.056
	Cross 2	0.078	0.312	-0.013	0.119	0.309
	Cross 3	0.143	0.219	-0.028	0.187	0.164
SYM	Cross 1	0.632	0.070	0.289	0.024	0.556*
	Cross 2	0.138	-0.084	0.142	-0.046	0.505*
	Cross 3	0.567	0.061	0.322	-0.104	0.587*
BOLLS	Cross 1	0.194	-0.089	-0.103	0.325	0.636*
	Cross 2	-0.083	0.124	-0.115	0.295	0.589*
	Cross 3	0.154	0.270	0.040	0.284	0.557*
Direct effect values are given in bold Residue value – F484 x Surabhi = 0.69; Residue value - C-10-3 x COD - 5-1-2 = 0.78; Residue value - F489 x KC3 = 0.62						

Cross 1- F484 x Surabhi; Cross 2- C-10-3 x COD - 5-1-2; Cross 3 - F489 x KC3. PHT-Plant height, MONO –No. of monopodial branches/plant, SYM - No. of sympodial branches per plant, BOLLS- No. of bolls/plant and YIELD - seed cotton yield/ per plant

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Author contribution

KS evaluated the materials and generated data and carried out the study. KB generated / assembled the experimental materials and advanced them

Conflict of interest

The authors declare that they have no competing conflict of interest in this research.

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