



## Path Coefficient Analysis in Half Diallal Hybrids of some Glandless Cotton Cultivars (*Gossypium hirsutum* L.)

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### ABSTRACT

This study was carried out in 1992-93 in the Cukurova and South Eastern Anatolian Project (GAP) region to determine relationships between important agronomic and fiber characteristics in a population that contained parents and half diallel hybrids of ten glandless cotton cultivars. For characters that gave significant correlations with seed cotton yield, direct and indirect relationships were determined using path coefficient analysis. In the Cukurova region, the direct effect of plant height on the seed cotton yield was 63.6%, of boll weight 33% and of seed cotton weight per boll 51.3%. While the direct effect of fiber length on seed cotton yield was 16.5%, its indirect effect through seed cotton weight per boll was 41.8%. Similarly, in the GAP region, the direct effect of plant height on the seed cotton yield was 87.5% and of seed protein percentage 88.2%. While the direct effect of boll number on seed cotton yield was 5%, its indirect effect on plant height was 76%.

### Introduction

Generally path coefficients analyses have been used to determine relationships between one character and the other agents that create it because simple correlation coefficients between the investigated character and the other characters that effect it may not always show true results. Thus direct and indirect effects should be investigated (Efe *et al.*, 1993).

This study aimed at determining relationships between agronomic and technological characteristics in a population that contains parents and half diallel hybrids of ten glandless cotton cultivars.

### Materials and Methods

This study involved 10 glandless cotton cultivars (*Gossypium hirsutum* L), LY 1372, M 11, LA-G-75-21, LA-G-75-26, LA-G-70-18, TX-GN-8-76, LA-G-75-72, REX, LA-G-77-45 and RDC-10. Seeds of the cultivars were provided through the intervention of Cukurova University, Cotton Research and Application Centre (CRAC) from the "Institut de Recherches du Cotton et des Textiles Exotiques (IRCT)" (now CIRAD-CA) in France. In 1992, two sowing dates, April 23 and May 8, were used at the CRAC. Cultivars grown under normal conditions were crossed (Poelhman, 1959) as a half diallel (Griffing 1956) and were also inbred. In 1993, a trial was set in three randomized blocks in the same field using inbred seeds of 45 F<sub>1</sub> hybrids and parents.

Yield, yield components, earliness, and fiber properties were measured. Correlation and path coefficient analyses were applied using the statistical package Minitab (Efe *et al.*, 1993).

### Results and Discussion

In Cukurova, relationships between seed cotton yield and plant height, carpel number per boll, boll weight (including carpels), seed cotton weight per boll and fiber length were positive and statistically significant (Table 1). Similar results were obtained by other workers (Jagtab and Kolhe, 1984; Faizullaev and Gafurov, 1991). Negative, statistically significant relationships were determined between ginning percentage and 100-seed weight and fiber length and fiber fineness. Similar results were noted by Kholmatov *et al.*, (1990) and Amanturdiev and Ibragimov (1990). Direct and indirect relationships were determined for characters that gave significant correlations with seed cotton yield, using path coefficient analysis (Table 2).

The direct effect of plant height on seed cotton yield was 63.6%, of boll weight 33% and of seed cotton weight per boll 51.3%. While the direct effect of fiber length on seed cotton yield was 16.5%, the indirect effect of this character through seed cotton weight per boll was 41.8%, and through boll weight was 27.4%. While the direct effect of earliness on the seed cotton yield was 11%, the indirect effect of this character through plant height was 12.9%, through seed cotton weight per boll, 49.9%, and through boll weight was 29.9%. Similarly, the direct effect of boll weight on the seed cotton yield was 33%, the indirect effect of this character through seed cotton weight per boll was 50.6%. Also, the direct effect of seed protein percentage on the seed cotton yield was 15%, the indirect effect of this character through seed cotton weight per boll was 31%, through plant height was 27%, through boll weight was 17.2%.

In the South Eastern Anatolian Project (GAP) region, positive, statistically significant relationships were determined between seed cotton yield and plant height, boll number per plant and seed protein percentage but negative, statistically significant relationships were determined between seed cotton yield, earliness and carpel number per boll (Table 3). Other workers reported similar results (Khan *et al.*, 1985; Sangwan and Yadava, 1987; Mahla and Singh, 1988; Faizullaev and Gafurov, 1991).

The relationship between earliness and ginning percentage was positive and statistically significant but relationships between earliness, 100-seed weight and fiber length were negative and statistically significant. A negative, significant relationship was also determined between ginning percentage and 100-seed weight. Kholmatov *et al.*, (1990) reported similar results. Direct and indirect relationships were determined for characters that gave significant correlations with seed cotton yield, using path coefficient analysis (Table 4). The direct effect of plant height on the seed cotton yield was 87.5%. Tyagi *et al.*, (1988) noted similar results. While the direct effect of monopodia number on seed cotton yield was 1.7%, the indirect effect of this character through plant height was 47.9%, through seed protein percentage was 30.9% and through carpel number per boll was 13.9%. The direct effect of earliness on the seed cotton yield was 11% but the indirect effect of this character through plant height was 12.9%, through seed cotton weight per boll was 49.9%, and through boll weight was 29.9%. The direct effect of boll number on seed cotton yield was 5% but the indirect effect of this character through plant height was 76%. The direct effect of earliness on the seed cotton yield was 71.4% but the direct effect of carpel number per boll was 64.4%, and the direct effect of seed protein percentage was 88.2%.

## Conclusions

In the Cukurova region, plant height, seed cotton weight per boll and boll weight had the highest direct effect on seed cotton yield. Selection according to these characters is recommended in a breeding study that aims at increasing seed cotton yield. While the direct effect of earliness on seed cotton yield was lower, the indirect effect of this character through seed cotton weight per boll was higher. Therefore, selection for seed cotton weight per boll can be useful in cotton breeding studies in this region.

Similarly, in South Eastern Anatolian Project (GAP) region, the direct effect of earliness, carpel number per boll and seed protein percentage on the seed cotton yield was higher so selection for these characters was recommended in a breeding study aimed at increasing seed cotton yield. While the direct effect of boll

number on the seed cotton yield was lower, the indirect effect of this character through plant height was higher. Selection for plant height can also be more useful in cotton breeding studies in this region.

## References

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**Table 2. Direct and indirect effects of some characters on seed cotton yield in 10x10 half diallel hybrid population in the Cukurova region.**

Character	PH	ER	CN	BW	SCWB	FL	SP%
PH	[0.639]	-0.066	0.011	-0.065	0.071	-0.042	-0.112
Effect (%)	[0.636]	0.066	0.011	0.065	0.071	0.042	0.111
ER	-0.222	[0.190]	0.013	0.475	-0.664	-0.128	0.030
Effect (%)	0.129	[0.110]	0.008	0.276	0.386	0.075	0.017
CN	-0.014	-0.005	[-0.502]	-1.021	1.703	0.170	-0.001
Effect (%)	0.004	0.001	[0.147]	0.299	0.499	0.050	0.000
BW	0.030	-0.064	-0.364	[-1.406]	2.156	0.212	-0.032
Effect (%)	0.007	0.015	0.085	[0.330]	0.506	0.050	0.008
SCWB	0.021	-0.057	-0.388	-1.377	[2.201]	0.207	-0.037
Effect (%)	0.005	0.013	0.091	0.321	[0.513]	0.048	0.009
FL	-0.063	-0.057	-0.201	-0.704	1.073	[0.424]	-0.047
Effect (%)	0.024	0.022	0.078	0.274	0.418	[0.165]	0.018
SP%	-0.359	0.028	0.002	0.228	-0.411	-0.099	[0.199]
Effect (%)	0.270	0.021	0.001	0.172	0.310	0.075	[0.150]

PH:Plant height, ER:Earliness, CN:Carpel number, BW:Boll weight, SCWB:Seed cotton weight per boll, FL:Fiber length, SP%:Seed protein percentage.

**Table 4. Direct and indirect effects of some characters on seed cotton yield in 10x10 half diallel hybrid population in the GAP region.**

Character	PH	BN	ER	CN	SP%
PH	[0.498]	-0.017	0.009	0.028	0.014
Effect (%)	[0.875]	0.029	0.017	0.050	0.025
BN	0.355	[-0.023]	0.047	0.010	0.028
Effect (%)	0.760	[0.050]	0.102	0.022	0.061
ER	-0.020	0.005	[-0.238]	-0.046	-0.025
Effect (%)	0.059	0.014	[0.714]	0.137	0.075
CN	-0.056	0.001	-0.043	[-0.251]	-0.037
Effect (%)	0.144	0.002	0.111	[0.644]	0.096
SP%	0.017	-0.002	0.014	0.022	[0.422]
Effect (%)	0.036	0.003	0.029	0.046	[0.882]

PH:Plant height, BN:Boll number, ER:Earliness, CN:Carpel number, SP%:Seed protein percentage.

**Table 1. Correlation coefficients between investigated characters in 10x10 half diallel hybrid population in the Cukurova.**

CH	PH	BN	ER	CN	BW	SCWB	G%	HSW	FL	FS	FF	SO%	SP%
BN	.236												
ER	-.347Δ	.327Δ											
CN	-.021	-.052	-.026										
BW	.046	-.334Δ	-.338Δ	.726**									
SCWB	.032	-.295	-.302Δ	.774**	.979**								
G%	.134	.089	.098	-.274	-.293	-.198							
HSW	.054	-.346Δ	-.409*	.489**	.704**	.621**	-.616**						
FL	-.098	-.219	-.303Δ	.400*	.501**	.488**	-.378*	.334Δ					
FS	.083	-.015	.291	-.192	-.142	-.148	.079	-.410*	.274				
FF	.014	-.234	-.513**	.258	.506**	.479**	-.304Δ	.652**	.159	-.419*			
SO%	.216	-.188	-.461**	.161	.313Δ	.339Δ	.227	.311Δ	-.021	-.485**	.420*		
SP%	-.561**	-.201	.149	-.003	-.162	-.187	.013	.067	-.234	-.310Δ	.091	-.054	
SCY	.437*	-.149	-.306Δ	.331Δ	.532**	.569**	.181	.108	.426*	.130	.168	.256	-.412*

**Table 3. Correlation coefficients between investigated characters in 10x10 half diallel hybrid population in the GAP region.**

CH	PH	BN	ER	CN	BW	SCWB	G%	HSW	FL	FS	FF	SO%	SP%
BN	.713**												
ER	-.040	-.199											
CN	-.113	-.042	.182										
BW	-.359Δ	-.252	-.278	.420*									
SCWB	-.338Δ	-.234	-.199	.437*	.969**								
G%	.043	.027	.393*	-.093	-.169	-.079							
HSW	-.309Δ	-.213	-.610**	-.072	.599**	.506**	-.619**						
FL	.271	.212	-.350Δ	-.124	-.083	-.183	-.073	.086					
FS	.227	.317Δ	.083	-.374*	-.187	-.255	-.113	.121	-.019				
FF	.071	.215	-.104	-.108	.206	.309Δ	.078	.062	.070	-.135			
SO%	.054	.051	.164	-.140	-.143	-.104	-.084	.096	-.107	.186	.115		
SP%	.034	.067	-.059	-.088	-.011	-.041	.181	.047	.071	-.011	.033	.237	
SCY	.535**	.421**	-.324Δ	-.388*	-.105	-.078	.269	-.085	.132	.070	.078	.071	.475**

CH:Character, PH:Plant height, BN:Boll number, ER:Earliness, CN:Carpel number, BW:Boll weight, SCWB:Seed cotton weight per boll, G%:Ginning percentage, HSW:100-seed weight, FL:Fiber length, FS:Fiber strength, FF:Fiber fineness, SO%:Seed oil percentage, SP%:Seed protein percentage, SCY:Seed cotton yield.

(\*\* Significant at 0.01; \* Significant at 0.05; Δ Significant at 0.10)