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Path Coefficient Analysis between seed cotton yield and some characters in cotton (*Gossypium hirsutum* L.)

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Abstract: *This study was carried out to determine direct and indirect effects of some characters (single leaf area, leaf SPAD value, number of nods, number of sympodial branches, number of monopodial branches, single boll weight, number of bolls) on seed cotton yield. The experiment was carried out with four cotton varieties, two of which okra-leaf (Adana 98, Siokra 1/4) and two of which normal-leaf (Teks and Stoneville 453) cotton (Gossypium hirsutum* L.*) and was conducted the randomized block design with 4 replications. In order to increase seed cotton yield in the studies of breeding program and selection orderly leaf SPAD value, number of sympodial branches, single boll weight, number of monopodial branches and number of bolls characters determined that must be high. Results showed that in order to increase seed cotton yield in the studies of breeding program and selection the highness of leaf SPAD value, number of sympodial branches, single boll weight, number of monopodial branches and number of bolls characters should be considered important.*

Key words: *Yield, Path Coefficient, Correlation, Cotton*
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Introduction

There have been many factors which effect the cotton yield, like all plants. With regard to plant breeding studies, it is important that locations where plants are grown and determination of some traits which effect morphological and physiological characters of plants. Therefore, determination of direct and indirect relations among the traits is important in order to determine aspect of plant selection criteria.

Correlation coefficient determines simple relations among the traits, so it doesn't determine always decisive results about determination of plant selection criteria (Cakmakci *et al*., 1998). Path coefficient analysis as to correlation coefficient gives more detailed information on the relations so it is commonly used by researches in plant breeding to determine seed cotton yield and seed cotton yield criteria relations (Williams *et al*., 1990; Kang *et al*., 1993; Board *et al*., 1997).

Path coefficients have been used for complex characters in several crop species to provide information on interrelations of complex characters and to develop selection criteria (Kang *et al*., 1993; Gravois *et al*., 1991; Diz *et al*., 1994).

This present study was conducted with four cotton varieties to provide information on interrelationships of seed cotton yield with some characters (single leaf area, leaf SPAD value, number of nods, number of sympodial branches, number of monopodial branches, single boll weight and number of bolls) and to partition the observed correlations into their direct and indirect effects.

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Materials and Methods

This experiment was carried out in The Southeast Anatolia Agriculture Research Institute trial areas in Turkey (lat. 37°94' N; long. 40°25' E; 630 m msl), with four cotton (*Gossypium hirsutum* L.) varieties, two okra-leaf (Adana 98, Siokra 1/4) and two normal-leaf (Teks and Stoneville 453).

The trial areas soil at the depth 0-150 cm has low organic material and phosphorus, adequate calcium and high clay content (49-67%). The average temperature is 15.8°C, rainfall is 483.6 mm and the average relative humidity is about 29.9%.

The experiment was conducted the randomized block design with 4 replications. Plots were 12 m in length with 4 rows 0.70 m apart. The fertilizer was applied with 70 kg of N and 70 kg of P kg ha^{-1} at sowing, and ammonium nitrate, as an additional N, was applied with 70 kg N kg ha^{-1} at the first irrigation. The experiment was thinned and hoed twice by hand and hoed 3 times with tractor and only one time total herbicide was used before sowing. Weed and insect control were not applied during growing season. Irrigation was repeated seven times by furrow irrigation. The harvest was made by hand at two times.

In the study, the observations for single leaf area (SLA), leaf SPAD value (LSV), seed cotton yield (SCY), number of nod (NN), number of sympodial branches (SB), number of monopodial

branches (MB), single boll weight (SBW), and number of bolls (NB), were taken on ten marked plants, in the each parcel.

LSV was determined by using a handheld portable SPAD 502 Chlorophyllmeter (Minolta, Osaka, Japan). SLA was determined using by a handheld portable leaf area meter. The statistical results were evaluated with TarPOPGEN statistical software (Ozcan and Acikgoz, 1999).

Results and Discussion

Correlation coefficients and indirect effects of evaluated characters on SCY were given in Table 1 and diagrammatic representation of direct effects and correlation coefficients of variable on dependent variable were given in Fig. 1.

The simple correlation coefficients were determined for six morphological character combinations with the objective to drive information about the relationship among different character combinations.

The data presented that SCY had a significantly negative correlation with the NN (r=-0.567; p=0.003), the LSV (r=-0.536; p=0.006), the MB (r=-0.480; p=0.017) in contrast had a significantly positive correlation with the SBW (r=+0.699; p=0.0001), the NB (r=+0.682; p=0.0002), the SB (r=+0.698; p=0.0001) (Table 1). The correlation of seed cotton yield with SLA was positive (r=+0.348) but not significant although probability level (p=0.0952) was nearly significant (Table 1).

However the correlation of SLA with the SCY was positive r=+0.348 (p=0.09), its direct effect on SCY was negative -0.08 (Fig. 1). As the contribution of positive indirect effect of LSV, SBW, NB, SB more than the contribution of negative indirect effect of MB, NN, the correlation coefficient has been positive. Even though direct effect was negative, due to more positive indirect effects contribution of LSV, SBW, NB, SB negative relation turned out to be positive (Table 1).

The correlation of NN, with SCY was significantly negative r=-0.567 (p=0.0039) and the direct effect of NN, was also negative -0.83 (Fig. 1). The negative correlation coefficient was occurred due to the contribution negative indirect effects result of SLA, SBW, NB, SB. The positive indirect effects were obtained with MB and LSV.

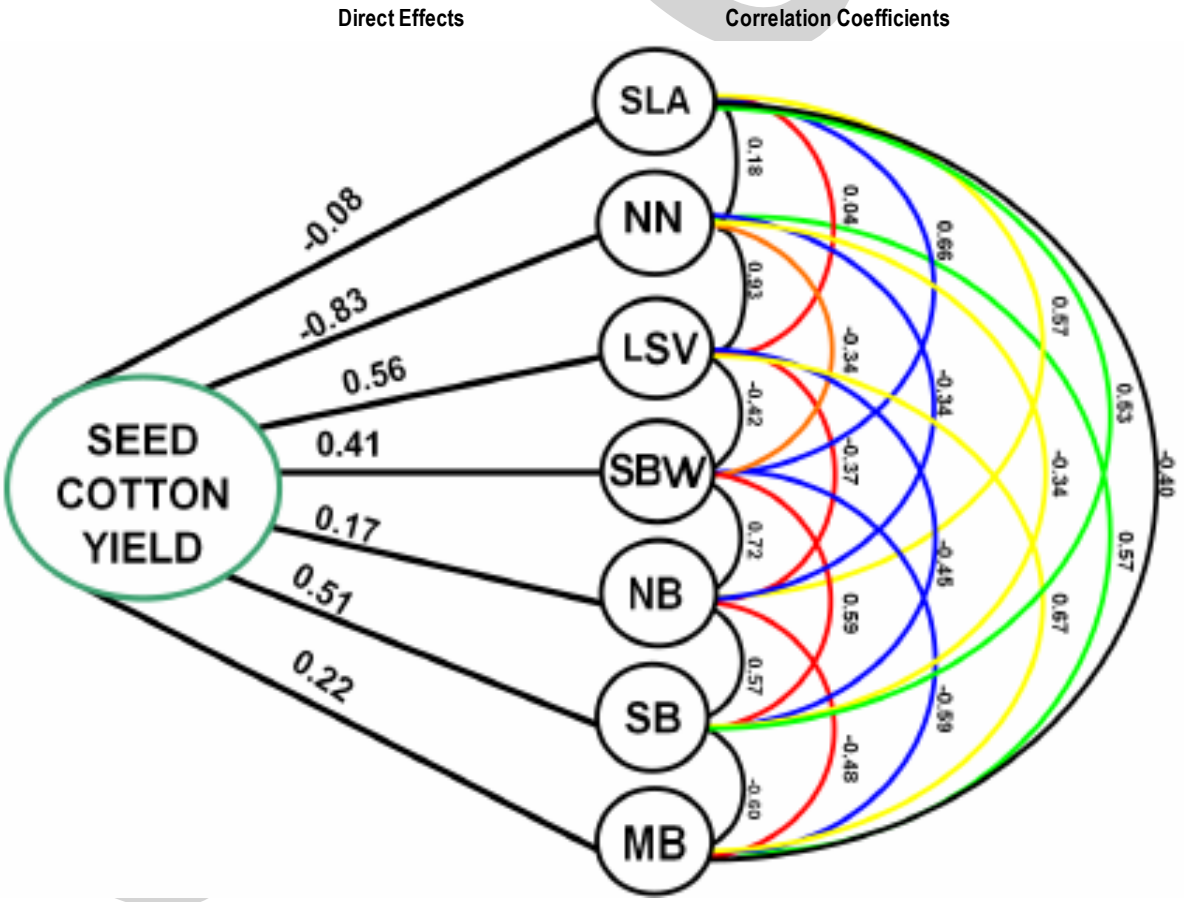

Fig. 1: Diagrammatic representation of direct effects and correlation coefficients of variable on dependent variable, SLA = Single leaf area, NN = No. of nods, LSV = Leaf SPAD value, SBW = Single boll weight, NB = Number of bolls, SB = No. of sympodial branches, MB = Number of monopodial brnaches

Table - 1: Correlation coefficients and indirect effects of evaluated characters on seed cotton yield

Characters	SLA	NN	LSV	SBW	NB	SB	MB
Single leaf area (SLA)	---	-0.02	0.00	-0.06	-0.05	-0.04	0.03
Number of nods (NN)	-0.15		-0.77	0.28	0.28	0.28	-0.47
Leaf SPAD value (LSV)	0.02	0.52		-0.23	-0.21	-0.25	0.37
Single boll weight (SBW)	0.27	-0.14	-0.17		0.30	0.25	-0.25
Number of bolls (NB)	0.10	-0.06	-0.06	0.13		0.10	-0.08
Number of sympodial branches (SB)	0.27	-0.17	-0.23	0.30	0.29		-0.31
Number of monopodial branches (MB)	-0.09	0.13	0.15	-0.13	-0.11	-0.13	
Correlation coefficient (r)	0.348	-0.567	-0.536	0.699	0.682	0.698	-0.480
Probability	0.0952	0.0039	0.0069	0.0001	0.0002	0.0001	0.0176

SLA = Single leaf area, NN = No. of nods, LSV = Leaf SPAD value, SBW = Single boll weight, NB = Number of bolls, SB = No. of sympodial branches, MB = Number of monopodial brnaches

However the correlation of LSV with the SCY was negative r=-0.536 (p=0.006), its direct effect on SCY was positive +0.56 (Fig. 1). As the contribution of negative indirect effect of NN, SBW, NB, SB more than the contribution of positive indirect effect of SLA MB the correlation coefficient has been negative. Even though direct effect was positive, due to more negative indirect effects contribution of NN, SBW, NB, SB positive relation turned out to be negative (Table 1).

The correlation of SBW with SCY was significantly positive r=+0.699 (p=0.0001) and the direct effect of SBW was also positive +0.41 (Fig. 1) as reported by Iqbal *et al.* (2006), Ahuja *et al.* (2006), Rajarathinam *et al.* (1993), Dedaniya and Pethania (1994), Amudha *et al.* (1996), Altaher and Singh (2003), Gururajan and Sunder (2004), Rauf *et al.* (2004), (Table1).

The correlation of NB with SCY was significantly positive r=+0.682 (p=0.0002) as reported by Iqbal *et al.* (2006), Amudha *et al.* (1996), Altaher and Singh (2003), Ahuja *et al.* (2006), Rauf *et al.* (2004) and the direct effect of NB was also positive +0.17 (Fig. 1) as reported by Iqbal *et al.*(2006), Amudha *et al.* (1996), Altaher and Singh (2003), Ahujas *et al.* (2006), Rauf *et al.* (2004), Karademir *et al.* (1999).

The correlation of SB with SCY was significantly positive r=+0.698 (p=0.0001) as reported by Ahuja *et al.* (2006), Rauf *et al.* (2004). The direct effect of SB was found positive +0.51 (Fig. 1), but according to earlier studies made by Ahuja *et al.* (2006), Rauf *et al.* (2004) had been found negative.

However the correlation of MB with the SCY was negative r=-0.480 (p=0.017), as reported by Rauf et al. (2004), Karademir *et al.* (1999), its direct effect on SCY was positive +0.22 (Fig. 1), as reported by Iqbal *et al.* (2006), Rauf *et al.* (2004), Choudhary *et al.* (1998) and Kaushik *et al.* (2003). The contribution of negative indirect effect of NN, SBW, NN and SB (-0.31) more than the contribution of positive indirect effect of SLA, LSV the correlation coefficient has been negative. Even though direct effect was positive, due to more negative indirect effects contribution of NN, SBW, NB and SB positive relation turned out to be negative (Table 1).

In case of different marks of correlation coefficient and direct effect then indirect effect might be explained the cause of correlation coefficient. In this case of indirect effects also should be considered (Sing and Chaudhary, 1977).

The results discussed above indicate that correlation and direct and indirect effect estimates vary for different traits with variation in genetic material based on seed cotton yield. It was reached these results that in order to increase seed cotton yield in the studies of breeding program and selection the highness of LSV, SB, SBW, MB and NB characters should be considered important.

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