Mesopotamia J. Agric. Vol.(3 3) No.(3) 2005

PATH COEFFICIENT ANALYSIS IN UPLAND COTTON (*Gossypium hirsutum* L.)

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ABSTRACT

Six parents and 15 F1 hybrids of a diallel cross were grown in Sallamiya region in 1998 using randomized complete block design with three replication. Boll weight, boll number, plant height and seed index exhibited significant correlation with seed cotton yield. Path coefficient analysis revealed that the number and weight of the boll contributed most to seed cotton yield. The estimates of determination coefficient as percent were arranged as follows: boll number (27,03%), boll weight (18,13%) and the joint effects of boll number with boll weights (2,84%).

INTRODUCTION

Yield is a very complex attribute. It is the total sum of a number of components which are pologyenetically controlled and have a complex type of gene action. Hence it is necessary to know the traits that influence the seed cotton yield, directly or indirectly (Al-Rawi *et al.*, 1986). The correlation studies give the amount of association between any pair of characters. Path coefficient analysis developed by Wright(1921), followed by many workers in different crops, facilitates the partitioning of the correlation coefficients into direct and indirect effects, thereby providing the relation importance of each of the causal factors.

The correlation coefficient between yield and other characters have been estimated by Mald *et al.*, (1979), Al-Rawi and Ahmed (1984), Al-Bayaty (1982, 1989, 1999), Dawod and Al- Bayaty (2003), in general they found that yield was highly positively correlated with No. of bolls / plant, boll weight, seed index and No. of seeds / boll.

Path coefficient analysis has been used by many workers(Reiad, 1978, Al-kafaijy, 1980, Khorgade and Ekobote, 1980, Waldia and Jatasra, 1980, Dawod and Al – Fahady, 1989, and Dawod, 1992).

This study was carried out in a number of cotton crosses to identify those correlation relationships between the studied characters and the direct and indirect effects of these characters on seed cotton yield.

MATERIALS AND METHODS

Phenotypic correlation coefficient were studied in a diallel cross between six cotton cultivars including, Coker 310, 460 F, Dunn 120, Dunn 1517, Acala Sj1 and Stonville 213. The six parents and their fifteen F_1 hybrids were grown in a randomized complete block design with three replication in 1998 in Sallamiya region. Each plot contained 3 rows, 4 meters long and 75cm apart at 30cm between plants. Data on boll weight (X_1), bolls / plant (X_2),

ginning outtern (X_3), plant height (X_4), seed index (X_5) and seedcotton yield (Y) were recorded on individual plant basis using 6 random plants in each row.

Path–coefficient analysis of the various characters were computed following the method as used by Wright's (1921) and described by Dewey and Lu (1959).

Received 23/3/2005 accepted 3/8/2005

The following model with 5 independent variables (X_1, X_2, X_3, X_4, and X_5) was examined in the path – diagrams (Fig 1).The path coefficient (Piy) were calculated using matrix notation, as follows:

$\underline{P} = R^{-1} r$ where:

$\underline{P}$ = the vector of the direct effects.

R^{-1} = the invers of the correlation matrix between all possible pairs of the traits.

r = the vectors of the correlation between triats and yield.

The following formula was used in calculating coefficient of determinations (C.D) and percent contributed (P.C%) as explained by Al – Bayaty (1999).

R^2 (xi) Y = $(PiY)^2$; i = 1,2,…..,5.

R^2 (xi xj) Y = PiY [rij PjY] + PjY [rji PiY] ; i = j = 1,2,……,5

Where:

xi = independent variables.

xi xj = interactions between independent variables.

P.C % : by using the absolute values of the R^2 for any source of variation

1. P.C % (xiY) = $\frac{R^2 xiY}{TotalR^2} \times 100$

2. P.C % (xixj) Y = $\frac{R^2 (xixj)Y}{TotalR^2} \times 100$

3. P.C % (Pwy) = $\frac{R^2 (residuals)}{TotalR^2} \times 100$

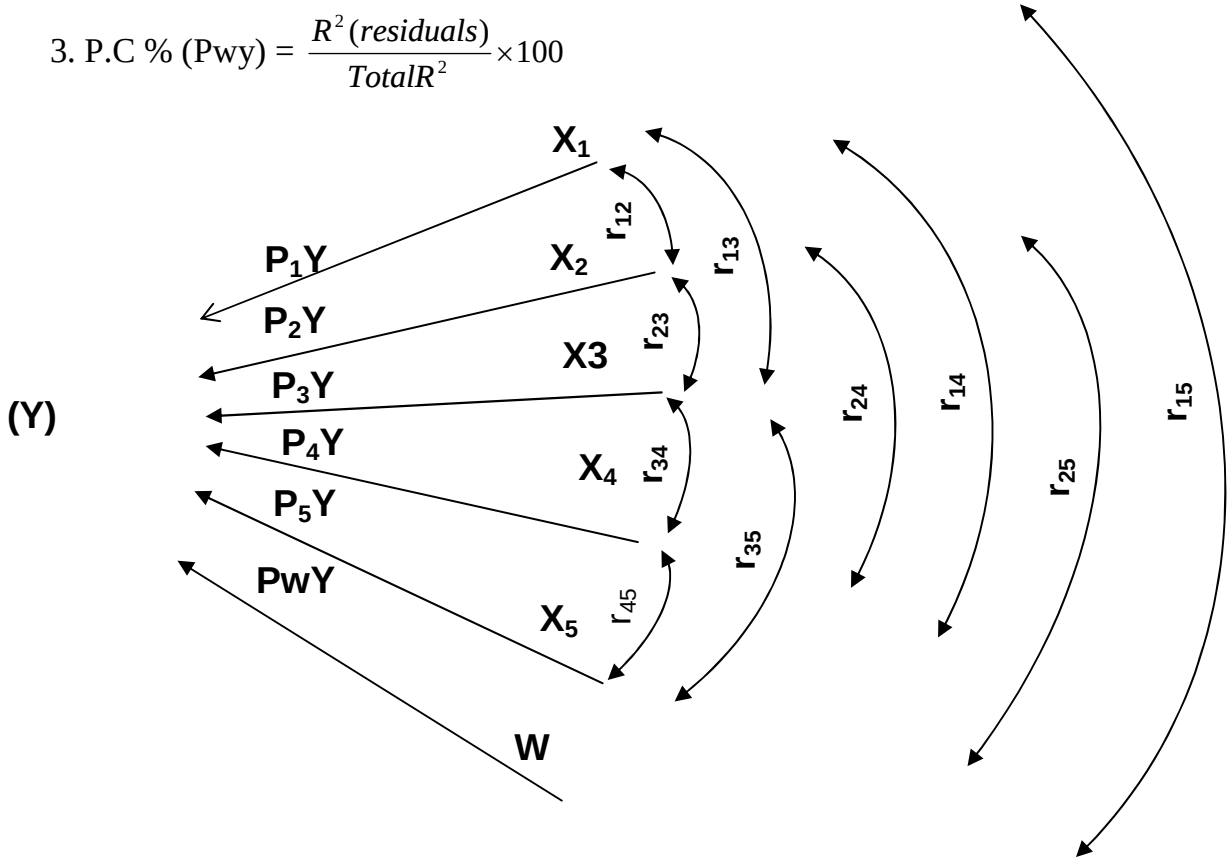

Figure (1) : A Path diagram and coefficient of factors affecting seedcotton yield.

r : simple correlation coefficient. P : path coefficient.

X_1 : Boll weight. X_2 : Boll number.

X_3 : Ginning outtern. X_4 : Plant height.

X_5 : seed index. W : Residual factors.

Y : Seedcotton yield.

RESULTS AND DISCUSSION

Table (1) showed phenotypic correlation coefficient for the studied characters, seed cotton yield had significant and positive correlation with boll weight, boll number, plant height and seed index.

The phenotypic correlation coefficient of boll weight were positive significant and negative with plant height and seed index respectively. The relationship between boll number and each of ginning outtern and plant height were positive and significance. Positive significant correlation coefficient was noticed for the relationship between ginning outtern and plant height.

Table (1): Coefficient of phenotypic correlation between the studied characters in upland cotton

Characters	Characters correlated	Correlation coefficient
Seed cotton Yield	Vs boll weight	0.4462**
	Vs boll number	0.7876**
	Vs ginn. outtern	0.2786
	Vs plant height	0.3819**
	Vs seed index	0.3406*
Boll weight	Vs boll number	0.0641
	Vs ginn. outtern	-0.0400
	Vs plant height	0.3571**
	Vs seed index	-0.2667*
Boll number	Vs ginn. outtern	0.4479**
	Vs plant height	0.4919**
	Vs seed index	0.1875
Gjnn. Outtern	Vs plant height	0.4774**
	Vs seed index	-0.1389
Plant height	Vs seed index	0.0093

*, **, - significant at 0.05 and 0.01 level, respectively.

The simple correlation coefficient between seed cotton yield and each of boll weight, boll number, ginning outtern, plant height and seed index were individually partitioned into their components of direct and indirect effects (Table 2).

Boll weight showed a high direct effect on seed cotton yield. The indirect effect through boll number, ginning outtern, plant height and seed index were low.

It was clear that number of bolls per plant had the highest direct path to the seed cotton yield. The indirect effects through the other four triats were so small. For the ginning outtern vs. seed cotton yield; the results showed that ginning outtern had small direct effects on seed cotton yield. The indirect effects through boll weight, plant height and seed index were small and unimportant. The only value of the indirect effect through the number of bolls per plant (0.3326) was relatively high. For the plant height vs. seed cotton yield; the plant height has a negative direct effect (-0.2794). The simple correlation between height and yield was relatively high (0.3819). The last value was due to the indirect positive via boll number per plant (0.3653). And

finally for seed index vs. seed cotton yield; seed index showed a moderate positive effect on seed cotton yield. The indirect path coefficient via boll weight was small and negative (-0.1622), and via boll number was small and positive (0.1392), the remaining indirect effects was small and unimportant. Similar results were reported by (Al – Rawi *et al.*(1986), Dawod *et al.* (1989) and Al- Bayaty (1999). The relative importance of each character to seed cotton yield is presented in Table (3).

Table (2): Partitioning of simple correlation coefficient between seed cotton yield and it's components.

Pathways of association		Portions of correlation coefficients
1-	Boll weight vs. yield	
	Direct effect (P_1Y)	0.608177
	Indirect effect via boll number	0.047605
	Indirect effect via ginn. outtern	- 0.006305
	Indirect effect via plant height	- 0.099788
	Indirect effect via seed index	- 0.103504
	Total (r_1Y)	0.4462
2-	Boll number vs. yield	
	Direct effect (P_2Y)	0. 742661
	Indirect effect via boll weight	0.038984
	Indirect effect via ginn. outtern	0.070603
	Indirect effect via plant height	- 0.137456
	Indirect effect via seed index	0.072767
	Total (r_2Y)	0.7876
3-	Ginning outtern vs. yield	
	Direct effect (P_3Y)	0.157631
	Indirect effect via boll weight	- 0.024327
	Indirect effect via boll number	0.332638
	Indirect effect via plant height	- 0.133404
	Indirect effect via seed index	- 0.053905
	Total (r_3Y)	0.2786
4-	Plant heigh vs. Yield	
	Direct effect (P_4Y)	- 0.279439
	Indirect effect via boll weight	0.217180
	Indirect effect via boll number	0.365315
	Indirect effect via ginn. outtern	0.075253
	Indirect effect via seed index	0.003609
	Total (r_4Y)	0.3819
5-	Seed index vs. Yield	
	Direct effect (P_5Y)	0.388090
	Indirect effect via boll weight	- 0.162201
	Indirect effect via boll number	0.139249
	Indirect effect via ginn. outtern	- 0.021895
	Indirect effect via plant height	- 0.002599
	Total (r_5Y)	0.3406
6-	Residual effect (P_wY)	0.272635

The table included the percentage and of variation determined by each character and its interaction with other characters. It is clear that the five traits and their interactions as sources of total seed cotton yield variation were responsible for 96.36%.

The residual effects of the other seed cotton yield components not included in the present study amounted to 3.64%. This residual effects were of small magnitude, indicating that the main characters contributing to seed cotton yield were actually investigated in the present study.

The main sources of seed cotton yield arranged according to their important were boll number per plant, boll weight, the joint effect of boll number with ginning outtern, plant height, seed index, the joint effects of boll weight with plant height and seed index. These main sources are responsible for about 77.73%, whereas the other sources made a slight contributions to seed cotton yield.

Table (3): Components (direct and Joint effects) in percentage of seed cotton yield variation.

Source of variation		C.D	P.C%
1-	Bolll weight	+ 0.3699	18.13
2-	Boll number	+ 0.5515	27.03
3-	Ginning outtern	+ 0.0248	1.22
4-	Plant height	+ 0.0781	3.83
5-	Seed index	+ 0.1506	7.38
6-	Boll weight x Boll number	+ 0.0579	2.84
7-	Boll weight x Ginn. outtern	- 0.0077	0.38
8-	Boll weight x plant height	- 0.1214	5.95
9-	Boll weight x seed index	- 0.1259	6.17
10-	Boll number x Ginn. outttern	+ 0.1049	5.14
11-	Boll number x plant height	- 0.2042	10.01
12-	Boll number x seed index	+ 0.1081	5.30
13-	Ginning outtern x plant height	- 0.0420	2.06
14-	Ginning outtern x seed index	- 0.0169	0.83
15-	plant height x seed index	- 0.0020	0.09
16-	Residual	+ 0.0743	3.64
	Total	1.0000	100.00

C. D. = Coefficient of determination. P. C. % = Percent contributed.

تحليل معامل المسار في قطن الابلاند (*Gossypium hirsutum* L.)

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الخلاصة

استهدفت هذه الدراسة تحديد الصفات المرتبطة مع حاصل القطن الزهر إضافة إلى تقدير الأهمية النسبية لمساهمة كل صفة في اختلافات الحاصل وذلك باستخدام التهجين التبادلي بين ستة

أصناف من قطن الابلاند في تصميم القطاعات العشوائية الكاملة بثلاثة مكررات. أظهرت نتائج الدراسة إن هناك علاقة ارتباط عالية المعنوية الإحصائية بين صفة حاصل القطن الزهر وصفات عدد الجوز ووزن الجوزة وارتفاع النبات ومعنوية مع صفة دليل البذور ولم تصل علاقة الارتباط إلى حد المعنوية الإحصائية مع صفة صافي الحلج . أظهرت دراسة تحليل معامل المسار إن صفتي عدد الجوز ووزن الجوزة كان لها أكبر تأثير مباشر على كمية حاصل القطن الزهر. وبينت تقديرات معامل التحديد Coefficient of determination كنسبة مئوية ، أن صفة عدد الجوز في النبات تحدد (٣٠ ٢٧%) من تباين محصول القطن الزهر يليها صفة وزن الجوزة(٣١ ١٨%) وبلغ التأثير المشترك لهاتين الصفتين(٤/ ٢%) ، وأن هاتين الصفتين بالإمكان استخدامهم كدليل انتخابي لتحسين الحاصل في برامج تربية وتحسين القطن .

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