GENOTYPIC AND PHENOTYPIC CORRELATION IN MAIZE AND PATH COEFFICIENT I- Agronomic Traits

K. M. Wuhaib B. H. Hadi W. A. Hassan
Prof. Assist. Prof. Assist. Prof.
Crops Dept. - College of Agriculture-University of Baghdad
Kareema522@yahoo.com bhd.1970@yahoo.com Wa.hassan69@yahoo.com

ABSTRACT

To estimate the genetic parameters and path coefficient of plant traits that correlate with yield to rely on them as selection criteria for maize breeding. Seeds of four genotypes selected from cv. Buhoth were planted at the field of Field Crop Dept. College of Agriculture Univ. of Baghdad during spring and fall season 2013, under two levels of nitrogen fertilizer (200 and 400kgN.ha^{-1}.). Data were analyzed, and genotypic and phenotypic correlation and path coefficient were estimated. The results revealed that these traits contributed 44% and 48% of yield variance at spring under 200 and 400 kg N.ha^{-1}, and 56% and 73% of yield variance at fall season, under 200,400 kg N.ha^{-1} respectively.The results showed that the studied traits, plant height and ear height, number of ears (spring) and number of leaves, leaf area and number of ears (fall) under 200 kg N.ha^{-1}., exhibited positive and highly significant genetic and phenotypic correlations; days to tasseling, number of leaves, and leaf area (spring), number of leaves and number of ears at fall, under 400 kg N.ha^{-1}. At 200 kg N.ha^{-1}, days to silking and number of leaves(spring), ear height and number of leaves (fall); days to tasseling , leaves area, and ears height (spring); plant height and number of ears (fall) under 400 kg N.ha^{-1} had the highest positive direct effect on grain yield. It can be conclude that number of ears and number of leaves can be use as selection criteria in breeding and improvement programs of yield in maize.

Key words: path coefficient ,direct effect, yield , phenotypic correlation,maize.

الارتباطات الوراثية والمظهرية في الذرة الصفراء و معامل المسار1 – (الصفات الحقلية)

كريمة محمد وهيب بنان حسن هادي وجيهة عبد حسن
أستاذ استاذ مساعد استاذ مساعد
جامعة بغداد كلية الزراعة/ قسم المحاصيل الحقلية
Kareema522@yahoo.com bhd.1970@yahoo.com Wa.hassan69@yahoo.com

المستخلص

لتقدير المعالم الوراثية ومعامل المسار لبعض الصفات التي ترتبط بالحاصل لاعتمادها معايير انتخاب في برامج تربية الذرة الصفراء، تم زراعة بذور أربعة تراكيب وراثية منتخبة من الصنف التركيبي بحوث 106 في حقل قسم المحاصيل الحقلية–كلية الزراعة–جامعة بغداد خلال الموسمين الربيعي والخريفي لسنة 2013، تحت مستويين من سماد النيتروجين (200 و400 كغمN.هكتار$^{-1}$). أوضحت نتائج التحليل الإحصائي أن الصفات التي درست أسهمت في تغاير الحاصل بنسبة 44% و48% في الموسم الربيعي تحت مستوى النيتروجين 200 و 400 كغمN. هكتار$^{-1}$ على الترتيب، و56% و73% من تغاير الحاصل في موسم الخريف لمستويي النيتروجين أيضا. أظهرت النتائج أن صفات ارتفاع النبات والعرنوص وعدد العرانيص (في الموسم الربيعي) وعدد الأوراق ومساحتها وعدد العرانيص (موسم الخريف) تحت مستوى نيتروجين 200كغمN.هكتار$^{-1}$أظهرت ارتباطا موجبا وراثيا ومظهريا عال المعنوية مع الحاصل،أما تحت مستوى 400 كغمN.هكتار$^{-1}$ فكانت لصفات عدد الأيام للتزهير الذكري وعدد الأوراق ومساحتها (في الربيع)، وعدد الأوراق وعدد العرانيص (في الخريف). كان لصفات عدد الأيام للتزهير الأنثوي وعدد الأوراق (في الربيع) وعدد الأوراق وارتفاع العرنوص (في الخريف) تحت مستوى 200 كغمN.هكتار$^{-1}$، وعدد الأيام للتزهير الذكري وارتفاع العرنوص ومساحة الأوراق (في الربيع) وارتفاع النبات وعدد العرانيص (في الخريف) تحت مستوى400 كغمN. هكتار$^{-1}$أعلى تأثير مباشر موجب في حاصل حبوب الذرة الصفراء. لذا يمكن اعتماد الصفات عدد الأوراق وعدد العرانيص معايير انتخاب في برامج تربية وتحسين حاصل الذرة الصفراء.

كلمات مفتاحية: معامل المسار، التأثير المباشر، الحاصل، الارتباطات المظهرية، الذرة الصفراء.

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INTRODUCTION

Path coefficient analysis has been useful to estimate the direct and indirect relationship among yield, yield components and other traits. The correlation are believed to be development rather than genetic per se, and are postulated to be caused by genetically independent components, developing in sequential pattern, that are free to vary in response to either, a limited constant input of metabolites, or an oscillatory in input of these substance such that input is limiting at critical stages in the development at sequence (1). Path analysis is used to estimate the amount of direct and indirect effects of the variables on the dependent variable (7,8,12). Correlation and path coefficient analysis can use to determine certain traits to be used in the improvement of the complex traits such as yield (10). Amini et al. (3) found that the most of cases the values of genotypic correlation between traits were greater than phenotypic values. Plant height, had high positive genotypic correlation with yield. The phenotypic correlation was high (0.78) between yield and ear number per plant. All genotypic values were higher than phenotypic, for this , phenotypic controlled by genotype (5).The grain yield correlated positive significantly with ear height and number of leaves (4). Path analysis showed high positive direct effects of yield components on grain yield per plant. Positive and significant phenotypic and genotypic correlation were found for days to 50% tasseling with plant and ear height, and grain yield with plant height and ear height. Positive and significant environmental correlation was also revealed for grain yield with plant and ear height. The path analysis revealed that days to 50% silking had the highest direct effect on grain yield. Days to anthesis, plant and ear height could be the important selection criteria in improving open pollinated maize varieties and hybrids for high grain yield (6,9,10). Traits plant and ear height had positive effects on yield (13). Kumar et al. (11) illustrated that days to silking revealed negative direct effect on grain yield. Alvi et al. (2) concluded that ear height had negative direct effect on grain yield, and indicated that grain yield was positive and significantly associated with all parameters studies. Ear height and days to silking had positive direct effect on grain yield, and contributed primarily to yield and could be relied upon for selection of genotypes to improve genetic yield potential of corn (14). The objectives of this experiment were to estimate phenotypic, genotypic and environmental in maize and path coefficient to determine the best selection criteria to improve the yield and yield components of maize.

MATERIAL AND MEHODES

This experiment was conducted at the fields of the Field Crops Sci. Dept. Coll. of Agric. Univ. of Baghdad. Seeds of four genotypes selected from synthetic cultivar Buhoth106 were planted in the spring and fall seasons, 2013. The distance between rows 75cm and within row 25cm.Two levels of nitrogen (200 and 400 kg N.ha^{-1}) were used, which added for three times, at seeding, at stem elongation(30 days after emergency) and at flowering (60 days after emergency). Randomize Complete Block Design with four replications was used within a split plot arrangement. At harvesting, ten plants were taken to determine the grain yield and some other traits to estimate the phenotypic, genotypic and environment correlation for each studies traits and path coefficient was analyzed, using Singh and Chaudhary Parameters (15) parameters.

RESULT AND DISCUSSION

Genotypic, phenotypic and environmental correlation under 200 kg N level for the spring season: Table 1and 2. illustrate the genotypic, phenotypic and environmental correlation between yield and other traits under 200 kg N.ha^{-1} level in spring season. The days to tasseling and days to silking exhibited negative and highly significant genotypic and phenotypic correlation with yield. These two traits exhibited positive and highly significant genotypic and phenotypic correlation between them. Days to tasseling exhibited negative and significant genetic and phenotypic correlation with plant height, significant genetic correlation with number of ears. Days to silking were highly significant positive genotypic correlation with days to tasseling and number of ear (o.875, 0.755) and negative significant phenotypic with number of ears. Plant height was positive significant genotypic and phenotypic correlation with yield, ear height and days to tasseling. The ear height was positive significant genotypic and phenotypic correlated with yield, and positive significant genotypic with leaves number. Number of leaves associated positive and highly significant genotypic and phenotypic with leaves area and only genotypic with number of ear, and non-significant with plant yield. Leaf area was associated positive highly significant phenotypic with number of leaves and highly positive significant genetic with number of ears and non-significant with yield. Number of ears genetic associated positive highly significant with yield only. It can be conclude from this results that the more effective traits and high positive significant genetic correlation are; plant height, ear height and number of ears, that is less effected by environmental effects due to less and non significant correlations as illustrate in table 2. In contrast there were highly negative correlation between yield and days to tasseling and silking(-0.763 and -0.631), because the environmental correlation for these traits were positive and significant (0.344 and 0.394).

Table 1. Genotypic and phenotypic correlation between yield and other traits under 200 kg N level for the spring season 2013

TRAITS*	DTT	DTS	PH	EH	LN	LA	EN	Y
DTT	1.000	0.879**	-0.512**	-0.301	0.255	0.112	-0.352*	-0.763**
DTS	0.875**	1.000	-0.304	-0.154	-0.094	-0.287	0.755**	-0.631**
PH	0.409*	-0.251	1.000	0.936**	-0.303	-0.159	-0.242	0.563**
EH	-0.232	-0.157	0.855	1.000	0.3445	-0.165	-0.160	0.534**
LN	0.163	-0.084	-0.268	-0.243	1.000	0.940**	0.718**	-0.048
LA	0.231	-0.132	-0.148	-0.093	0.746**	1.000	0.843**	0.059
EN	-0.307	-0.394*	-0.081	-0.082	0.275	0.349*	1.000	0.517**
Y	-0.476**	-0.406*	0.512**	0.486**	-0.045	0.115	0.267	1.000

Table 2. Environment correlation between yield and other traits under 200 kg N level for the spring season 2013.

TRAITS*	DTT	DTS	PH	EH	LN	LA	EN	Y
DTT	1.000	0.876**	-0.117	-0.038	-0.033	0.572**	-0.299	0.344*
DTS		1.000	-0.044	-0.180	-0.058	0.369*	-0.084	0.394*
PH			1.000	0.279	-0.138	-0.091	0.171	0.185
EH				1.000	0.148	0.277	0.005	0.211
LN					1.000	0.124	-0.149	-0.037
LA						1.000	-0.203	0.377*
EN							1.000	0.005
Y								1.000

***DTT: days to tasseling; DTS: days to silking, PH :plant height; EH: Ear height; LN: Leaves number; LA: leaf area; EN: Ear number; Y:grain yield**

Genotypic, phenotypic and environment correlation under 200 kg N level for fall season: In the fall season , the genotypic and phenotypic correlation coefficients among yield and other traits are shows in Table 3 and 4. The traits day to tasseling, silking, plant height and ear height were non-significant associated with yield. Days to tasseling was positive genetic and phenotypic correlated with days to silking and positive genetic significant with number of ears, highly negative genetic with number of leaves and leaf area. Days to silking genetically was associated highly negative significant with number of leaves and leaf area, highly positive significant with number of ears, phonotypical negative significant with number of leaves. Plant height was associated highly positive significant genotypic and phenotypic with ear height, and negatively with number of leaves, significant negative genetically with number of ears. The ear height genotypic was highly negative significant and phenotypic correlation with number of leaves, and genetic negative significant with number of ears. The number of leaves were highly positive significant phenotypic and genotypic correlation with yield, number of ears and leaves area. Leaves area was genetic and phenotypic positive significant associated with yield. Number of ears per plant were positive significant correlated with yield at genetic and phenotypic level. Wuhaib (16) found no significant genetic correlation between yield and number of ears per plant.

Table 3. The genotypic and phenotypic correlation between yield and other traits under 200 kg N level for the fall season 2013

TRAITS*	DTT	DTS	PH	EH	LN	LA	EN	Y
DTT	1.000	0.998**	0.153	0.259	-0.504**	-0.687**	0.329*	-0.264
DTS	0.963**	1.000	0.189	0.293	-0.451**	-0.594**	0.456**	-0.193
PH	0.119	0.144	1.000	0.871**	-0.727**	-0.043	-0.374*	-0.122
EH	0.207	0.215	0.805**	1.000	-0.524	-0.096	-0.332*	0.101
LN	0.396*	-0.339*	-0.538**	-0.423**	1.000	0.508**	0.517**	0.609**
LA	-0.643**	-0.552**	0.021	-0.040	0.411**	1.000	0.272	0.610**
EN	0.197	0.202	-0.153	-0.203	0.407*	0.143	1.000	0.528**
Y	-0.230	0.169	-0.104	0.028	0.522**	0.435**	0.392*	1.000

Table 4. Environment correlation between yield and other traits under 200 kg N level for the fall season 2013.

TRAITS*	DTT	DTS	PH	EH	LN	LA	EN	Y
DTT	1.000	0.753**	-0.125	-0.181	0.231	-0.589**	-0.006	0.043
DTS		1.000	-0.107	-0.249	0.191	-0.451**	-0.213	-0.016
PH			1.000	0.398*	0.387*	0.248	0.228	0.017
EH				1.000	0.085	0.161	-0.025	-0.474
LN					1.000	0.139	0.328*	0.057
LA						1.000	0.002	-0.198
EN							1.000	0.286
Y								1.000

***DTT: days to tasseling; DTS: days to silking, PH :plant height; EH: Ear height; LN: Leaves number; LA: leaf area ;EN: Ear number; Y:grain yield**

Genotypic, phenotypic and environment correlation under 400 kg N level for the spring season: The genotypic and phenotypic correlation coefficient between yield and some phenotypic traits under 400 kg N in spring season are shown in Table 5 and 6 .The correlation between traits in this level of nitrogen were differed from correlation under 200 kg N level . Under this level , days to tasseling exhibited positive and highly significant genotypic correlation and negative phenotypic correlation with yield. as well as positive phonotypic and genotypic associated with days to silking and plant height, high negative genotypic and phenotypic associated with leaves area. Days to silking were highly negative genotypic correlation with yield and its positive phenotypic (0.755), also positive genotypic with plant height, and negative genotypic and phenotypic with leaves area. Plant height associated genetically and phenotypical positive significant with ear height , and negatively significant genetically and phenotypical with leaf area and number of ears, only positive genotypic with yield. There were non-significant correlation between ear height and yield, but it negative genotypic associated with leaves area, while phenotypic was positive. Number of leaves correlated positive significant genetic and phenotypic with yield, and number of ears . Leaf area associated positively significant genetica and phenotypic with yield only. There were non-significant correlation between number of ears and yield at genotypic and phenotypic levels.

Table 5. Genotypic and phenotypic correlation between yield and other traits under 400 kg N level for the spring season 2013

TRAITS	DTT	DTS	PH	EH	LN	LA	EN	Y
DTT	1.000	0.928**	0.504**	0.287	-0.043	-0.614**	0.204	0.744**
DTS	0.862**	1.000	0.385*	0.236	-0.229	-0.611**	0.215	-0.893**
PH	0.338*	0.247	1.000	0.843**	0.304	-0.755**	-0.573**	-0.555**
EH	0.205	0.188	0.645**	1.000	0.086	-0.736**	-0.166	-0.214
LN	-0.023	-0.179	-0.185	0.053	1.000	-0.212	0.715**	0.439**
LA	-0.481**	-0.516**	-0.377*	0.529**	-0.271	1.000	-0.175	0.695**
EN	0.125	0.171	-0.450**	-0.124	0.508**	-0.171	1.000	0.124
Y	-0.577**	0.755**	0.372*	-0.205	0.388*	0.518**	0.095	1.000

Table 6. Environment correlation between yield and other trait under 400 kg N level for the spring season 2013

TRAITS*	DTT	DTS	PH	EH	LN	LA	EN	Y
DTT	1.000	0.606**	-0.058	-0.072	0.033	-0.107	-0.131	0.201
DTS		1.000	-0.192	-0.031	0.008	-0.179	-0.021	0.211
PH			1.000	0.159	0.071	0.439**	-0.159	0.245
EH				1.000	-0.047	0.079	0.019	-0.170
LN					1.000	-0.419**	-0.083	0.216
LA						1.000	-0.163	-0.194
EN							1.000	0.044
Y								1.000

***DTT: days to tasseling ;DTS: days to silking ,PH :plant height ; EH: Ear height; LN: Leaves number; LA: leaf area ; EN: Ear number**

Genotypic, phenotypic and environment correlation under 400kg N level for the fall season: In the fall season the correlation among traits were different from correlation for same trait at spring season(Table7and 8) . The days to tasseling, silking and plant height showed negative and highly significant genotypic and phenotypic correlation with yield. the days to tasseling associated positive and highly significant genotypic and phenotypic with days to silking, and negative with leaves area. The days to silking showed negative with leave area, either height of plant was positive with ear height and negative with number of leaves and number of ears. There were no associated between ear height and yield. Non-significant phenotypic correlation exist between number of leaves and yield, but genotypic correlation was positive and highly significant, positive highly significant genotypic and phenotypic with number of ears. The correlation between leaves area and yield was non- significant. Either number of ears was positive and highly significant genotypic and phenotypic with yield of maize plant. Generally the highest values of genotypic correlation than their corresponding phenotypic correlation coefficient in most of the traits indicating the traits controlled by genetic and less affected by environment effects (table 8). As the result shows, the positive and higher significant genetic correlation with yield at level 200 kg N were plant height, ear height and number of ears with yield, in spring. Number of leaves, leaves area and number of ears, in fall. These illustrate that these traits can used as selection criteria for high grain yield of maize. At level 400 kg N, the positive and higher significant genetic correlation with grain yield were days to tasseling, number of leaves and leaves area, in spring; number of leaves and number of ears per plant in fall

Table 7. Genotypic and phenotypic correlation between yield and other traits under 400 kg N level for the fall season 2013

TRAITS*	DTT	DTS	PH	EH	LN	LA	EN	Y
DTT	1.000	0.954**	-0.042	-0.262	0.165	-0.578**	0.034	-0.752**
DTS	0.944	1.000	0.228	-0.056	0.061	-0.625	-0.105	-0.806**
PH	-0.049	0.182	1.000	0.663**	-0.523**	0.100	-0.596**	-0.505**
EH	-0.216	-0.559**	0.546**	1.000	-0.055	-0.260	-0.042	0.019
LN	0.157	0.060	-0.423	0.014	1.000	-0.296	0.914**	0.421**
LA	-0.559**	-0.608**	0.089	-0.197	0.226	1.000	-0.254	0.268
EN	0.044	-0.078	-0.589**	-0.025	0.741**	-0.231	1.000	0.582**
Y	-0.644**	-0.688**	-0.385*	0.076	0.285	0.214	0.443**	1.000

Table 8. Environment correlation between yield and other traits under 400 kg N level for the fall season 2013.

TRAITS*	DTT	DTS	PH	EH	LN	LA	EN	Y
DTT	1.000	0.539**	-0.256	0.031	0.205	0.082	0.274	0.052
DTS		1.000	-0.380*	-0.105	0.092	-0.156	0.277	0.0261
PH			1.000	0.162	0.023	-0.004	-0.546**	0.093
EH				1.000	0.225	0.152	0.036	0.229
LN					1.000	0.355*	-0.069	-0.176
LA						1.000	0.007	-0.139
EN							1.000	-0.134
Y								1.000

***DTT: days to tasseling ;DTS: days to silking ,PH :plant height ;EH: Ear height; LN: Leaves number; LA: leaf area ;EN: Ear number; Y:grain yield**

Path coefficient at level of 200 kg N for the spring and fall season: selection is widely used and successful method in plant breeding. Response to selection depends on many factors such as the interrelationship of the traits. Plant breeders work with some yield components related to the yield in the selection programs and it is important to determine relative importance of such traits contributed to grain yield directly or indirectly. table 9 illustrate the path coefficient of some traits of maize with yield at level of 200 kg N in two season. In spring, the direct and total effects for days to tasseling was negative in maize yield, the in direct effects also negative via plant height, number of leaves, leaves area and number of ears, positive via days to silking and ear height. The direct effect for days to silking was positive and high value (1.555), but the total effects were negative due to negative indirect effect via all traits except ear height was positive. The direct and total effects for plant height were negative, the positive indirect effects via days to silking , ear height and number of ears. There were positive and high value for direct effect (0.459)and for total effects for ear height, due to positive indirect effect via days to silking and number of ears. The number of leaves contribute positive and high value (0.661 and 0.609)for direct and total effects in yield of maize, and positive indirect effect via four traits, just two traits were negative. Leaves area showed positive and high value of direct and total effects (0.467 and 0.610) in yield of maize, due to positive high value of indirect via days to tasseling (0.817)and number of leaves. The direct effect for number of ears was negative, but the total effects were positive due to positive high value of indirect effect via days to tasseling (0.709), followed by number of leaves (0.342), then the leaves area(0.127). At fall season, days to tasseling showed negative and high value of direct and total effect (-0.549 and -0.703), and indirect via most traits. The direct and total effects for days to silking were negative due to negative high value of indirect via days to tasseling and three other traits. In spite of negative and high value of direct effect of plant height, the total effect were positive due to positive high value for indirect effect via ear height (1.586) and other positive indirect effect via days to tasseling ,silking and leave area. Ear height have positive and high direct effect (1.695)and total effect (0.534). In spite of positive and high value (1.587)of direct effect for number of leaves, but the total effects were negative because the negative high value for indirect effects for leaves area (-1.407) followed by ear height (-0.584) and days to tasseling (-0.134). The direct effect for leaves area was negative and high value (-1.496), total effect were very low. Number of ears have positive direct and total effects and positive indirect effect via days to tasseling ,plant height, days to tasseling, and negative via ear height and leaves area.

Path coefficient at level 400 kg N in the spring and fall seasons: The result of path coefficient at each season at levels 400 kg $N.ha.^{-1}$ are presented in table 10. In spring, days to tasseling and number of ears had the highest positive direct effect on grain yield of maize (1.242 and 1.119) followed by leaves area and ear height (0.688 and 0.615). on the other hand, days to silking showed high negative direct effect (-2.209) followed by number of leaves (-0.689). In spite of positive high value of direct effect for days to tasseling, the total effects were negative because high negative value indirect effect via days to silking(-2.051) followed by leaves area (-0.423). The total effect for days to silking was negative due to negative high value of direct effect (-2.209). Plant height showed positive direct effect, but the total effects were negative due to high negative value of indirect effect via days to silking, leaves area and number of ears per plant. As well as ear height, the total effects were negative (-0.214) in spite of positive value of direct effect (0.615), this due to indirect effect via days to silking, leaves area, number of ears and number of leaves. In contrast, the total effects for number of leaves were positive (0.440), but the direct effect was negative(-0.689). The positive value of total effects attributable to positive high value of indirect effects via number of ears per plant, days to silking and ear height. Leaves area exhibited positive high value of direct effect (0.688) and total effects (0.696), this according to positive high value of indirect

Table9. Path coefficient of some traits of maize with yield at level of 200 kg nitrogen in two season 2013

Spring season								
Traits	DTT	DTS	PH	EH	LN	LA	EN	Total effects
DTT	-1.189	1.552	-0.032	0.119	-0.334	-0.321	-0.059	-0.264
DTS	-1.186	1.555	-0.038	0.135	-0.298	-0.277	-0.083	-0.193
PH	-0.181	0.294	-0.202	0.400	-0.481	-0.019	0.068	-0.122
EH	-0.308	0.456	-0.175	0.459	-0.346	-0.044	0.060	0.1007
LN	0.600	-0.701	0.147	-0.241	0.661	0.237	-0.094	0.609
LA	0.817	-0.925	0.008	-0.044	0.335	0.467	-0.049	0.610
EN	-0.392	0.709	0.075	-0.153	0.342	0.127	-0.181	0.528
R Effect	0.569							

Fall season								
Traits*	DTT	DTS	PH	EH	LN	LA	EN	Total effects
DTT	-0.549	-0.336	0.545	-0.485	0.388	-0.207	-0.059	-0.703
DTS	-0.499	-0.369	0.342	-0.263	-0.150	0.429	-0.121	-0.631
PH	0.267	0.113	-1.122	1.586	-0.482	0.238	-0.038	0.563
EH	0.157	0.057	-1.050	1.695	-0.546	0.247	-0.025	0.534
LN	-0.134	0.035	0.341	-0.584	1.587	-1.407	0.115	-0.0485
LA	-0.076	0.106	0.178	-0.279	1.492	-1.496	0.135	0.059
EN	0.203	0.279	0.271	-0.272	1.139	-1.263	0.159	0.518
R Effect	0.437							

***DTT: days to tasseling ; DTS: days to silking , PH : plant height ; EH: Ear height; LN: Leaves number; LA: leaf area ; EN: Ear number; Y:grain yield.**

effect via days to silking (1.351) and via number of leaves (0.146). The direct effect for number of ears for plant was positive and high (1.119), but the total effects was low (0.124) because of negative indirect effect via all traits except days to tasseling was positive. In the fall season the values of path coefficient were different from spring. The direct effect for days to tasseling was positive (0.175), but the total effects were negative (-0.744) because high negative value indirect effect via days to silking (-1.694). The both values of direct and total effect for days to silking were negative. The high positive direct effect for plant height was (1.036), however, the total effects were negative because the high negative indirect effects through all other traits. In contrast, the traits ear height and leaves area have negative direct effects (-0.910 and -0.870), but the total effect were positive due to high positive indirect effects through plant height (0.687), and leaves area (0.226) for plant height, and days to silking (1.109) and height of ear (0.237) followed by plant height (0.104) and ears number (0.118).The direct effect (0.464) and total effect (0.582), and all indirect effect for ears number were positive, except the indirect effect via plant height was negative. It can be conclude from these results that the improvement of yield of maize achieved by improvement its components and other traits affected these components, for that ,must be emphasized the traits positive and high associated with these components to improve them in order improve the yield. Negative correlations among yield components are wide spread among the major crop particularly under various kind of environmental stress. Path coefficient analysis for yield confirm the direct positive contributions of ear height and number of leaves under 200 kg N.ha.$^{-1}$ at spring, in the fall the days to silking and number of leaves contributed in grains yield, under the 400kg N.ha.$^{-1}$ .In the spring, the highest contribution for direct effect, days to tasseling and number of ears. In the fall the highest positive direct effect were plant height and number of ears. The contribution of all study traits in yield variance were 44% and 56% under200 kg N.ha.$^{-1}$ in spring and fall seasons, and 48% ,73% in the spring and fall seasons, under 400kg N.ha.$^{-1}$. These traits could be used as criteria for yield improvement of maize.

Table10. Path coefficient of some traits of maize with yield at level of 400 kg nitrogen for two season 2013.

Spring season								
Traits*	**DTT**	**DTS**	**PH**	**EH**	**LN**	**LA**	**EN**	**Total effects**
DTT	**1.242**	**-2.051**	**0.052**	**0.177**	**0.030**	**-0.423**	**0.229**	**-0.744**
DTS	**1.153**	**-2.209**	**0.040**	**0.145**	**0.158**	**-0.421**	**0.241**	**-0.893**
PH	**0.627**	**-0.852**	**0.103**	**0.519**	**0.210**	**-0.520**	**-0.642**	**-0.555**
EH	**0.357**	**-0.522**	**0.087**	**0.615**	**-0.060**	**-0.507**	**-0.186**	**-0.214**
LN	**-0.054**	**0.507**	**-0.031**	**0.053**	**-0.689**	**-0.146**	**0.800**	**0.440**
LA	**-0.763**	**1.351**	**-0.078**	**-0.453**	**0.146**	**0.688**	**-0.195**	**0.696**
EN	**0.254**	**-0.474**	**-0.059**	**-0.102**	**-0.492**	**-0.120**	**1.119**	**0.124**
R Effect	**0.052**							

Fall season								
Traits	**DTT**	**DTS**	**PH**	**EH**	**LN**	**LA**	**EN**	**Total effects**
DTT	**0.175**	**-1.694**	**-0.042**	**0.239**	**0.051**	**0.503**	**0.016**	**-0.752**
DTS	**0.167**	**-1.775**	**0.236**	**0.051**	**0.019**	**0.544**	**-0.049**	**-0.806**
PH	**-0.007**	**-0.405**	**1.036**	**-0.603**	**-0.162**	**-0.087**	**-0.276**	**-0.505**
EH	**-0.046**	**0.099**	**0.687**	**-0.910**	**-0.017**	**0.226**	**-0.020**	**0.020**
LN	**0.029**	**-0.108**	**-0.542**	**0.050**	**0.309**	**0.258**	**0.424**	**0.421**
LA	**-0.101**	**1.109**	**0.104**	**0.237**	**-0.092**	**-0.870**	**0.118**	**0.269**
EN	**0.006**	**0.188**	**-0.618**	**0.039**	**0.283**	**0.222**	**0.464**	**0.582**
R Effect	**0.275**							

***DTT: days to tasseling ;DTS: days to silking ,PH :plant height ;EH: Ear height; LN: Leaves number; LA: leaf area ; EN: Ear number; Y:grain yield**

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