CORRELATION AND PATH COEFFICIENT ANALYSIS OF COMPONENTS OF SEED YIELD IN SUNFLOWER (HELIANTHUS ANNUUS L.)

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ABSTRACT

Genotypic, phenotypic and environmental correlations were computed in a collection of 37 diverse sunflower (Helianthus annuus L.) varieties grown under semi-arid conditions of Rajasthan. The genotypic correlations were generally higher than corresponding phenotypic and environmental correlations. Seed yield per plant was significantly and positively correlated with stem girth, head weight, shelling percentage and 100-seed weight. Path coefficient analysis revealed the maximum direct effect of head diameter followed by head weight, days to flowering, days maturity and 100-seed weight on seed yield per plant. Plant height, stem girth, leaves per plant and shelling percentage influenced the yield mostly through other characters.

KEY WORDS : Sunflower, Correlation, Path analysis.

An Investigation was undertaken to estimate genotypic, phenotypic and environmental correlations and path coefficients to understand the nature of association of characters in diverse genotypes of sunflower.

MATERIALS AND METHODS

Thirty seven diverse genotypes of sunflower maintained at Regional Station of Agricultural Research, Sumerpur (Rajasthan) were raised in a randomized block design with four replications, during Rabi 1973-74. The plot size consisted of single row of 6 m length with a spacing of 60 cm x 30 cm. Five competitive plants were randomly selected from each genotype per replication for recording observations. Genotypic, phenotypic and environmental correlation coefficients were worked out according to the method suggested by Johnson et al. (1955), where as the path coefficient analysis for seed yield per plant was done according to Dewey and Lu (1959).

RESULTS AND DISCUSSION

The results indicated that the genotypic correlation coefficients were generally higher than their corresponding phenotypic and environmental correlation coefficients. (Table 1) revealing the influence of environments.

The genotypic and phenotypic correlations showed the same trend. At phenotypic level, seed yield per plant was significantly and positively correlated with stem girth, head weight, shelling percentage and 100 seed weight. Days to flowering was strongly and positively correlated with days to maturity, while it was significantly and negatively correlated with head weight. Plant height showed strong and positive correlations with stem girth, leaves per plant, head diameter and head weight, stem girth with leave per plant, head diameter and head weight, and head weight with 100 seed weight. The results are in conformity to the findings of earlier reports on sunflower (Putt, 1943; Russell, 1953, Burns, 1970; Fick et al. 1974; Singh et al. 1977; Varshney and Singh, 1977 and Laxmanaiah, 1978). Alba and Greco (1979) reported significant positive correlation of seed yield with head diameter, plant height and 1000 seed weight in sunflower. Giriraj et al.

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Table 1. Estimates of Phenotypic (P), Genotypic (G) and Environmental (E) correlation coefficients between difference pairs of quantitative characters in sunflower

Characters		Days to flowering	Days to maturity	Plant height	Stem girth	Leaves/plant	Head diameter	Head weight	Shelling %	100 seed weight
Yield/Plant	P	-0.305	-0.078	0.316	0.382*	0.185	0.260	0.947**	0.338*	0.490**
	G	-0.311	0.007	0.499	1.067	0.972	0.577	0.988	0.208	0.832
	E	-0.123	-0.229	0.091	0.152	0.086	0.162	0.829	0.561	0.194
Days to flowering	P		0.400	-0.044	0.243	0.066	-0.259	-0.352*	0.017	-0.121
	G		0.626	-0.161	-1.088	0.004	-0.743	-0.537	-0.019	0.272
	E		0.244	0.030	-0.039	0.081	-0.133	-0.174	0.029	-0.047
Days to maturity	P			0.172	-0.056	0.030	-0.075	-0.046	-0.127	-0.060
	G			0.312	-0.265	0.497	-0.275	0.013	-0.049	0.038
	E			0.045	0.014	-0.045	-0.003	-0.167	-0.179	-0.134
Plant height	P				0.451**	0.556**	0.419**	0.355*	-0.008	0.130
	G				0.641	1.581	0.790	0.535	-0.166	0.151
	E				0.435	0.511	0.339	0.068	0.049	0.118
Stem girth	P					0.407*	0.671**	0.419**	-0.039	0.182
	G					0.810	1.009	1.070	0.267	0.671
	E					0.385	0.623	0.226	-0.086	0.063
Leaves/plant	P						0.276	0.194	-0.003	0.129
	G						1.223	0.898	0.523	0.332
	E						0.218	0.127	-0.041	0.059
Head diameter	P							0.263	0.032	0.117
	G							0.606	0.087	0.224
	E							0.152	0.023	0.091
Head weight	P								-0.027	-0.405**
	G								0.057	0.765
	E								0.017	0.256
Shelling %	P									0.068
	G									0.501

(1979) also reported significant and positive phenotypic correlations between seed yield and head diameter, 100 seed weight, plant height and number of leaves per plant in 392 elite lines of sunflower variety EC 68415. These results are in close agreement with those obtained under the present investigation.

At genotypic level, seed yield had high positive correlation with plant height, stem girth, leaves per plant, head diameter, head weight and 100 seed weight. Days to flowering had strong positive genotypic correlation with days to maturity but very strong negative correlation with stem girth, head diameter and head weight. Days to maturity exhibited high positive genotypic correlation with leaves per plant; plant height with stem girth, leaves per plant, head diameter and head weight; stem girth with leaves per plant, head diameter, head weight and 100 seed weight; leaves per plant with head diameter, head weight, shelling percentage and 100 seed weight. Head diameter showed strong positive genotypic correlation with head weight; head weight and shelling percentage with 100 seed weight.

The environmental correlations which are not strictly reflecting the correlation of environmental deviations, but the correlation of environmental deviations together with non-additive genetic deviations revealed that seed yield per plant had high and positive correlations with head weight and shelling percentage; plant height exhibited strong positive correlations with stem girth and leaves per plant, while stem girth showed high and positive correlation with head diameter.

The results on the path coefficient analysis indicated that the head diameter had the highest and positive direct effect followed by head weight and days to flowering (Table 2). The characters days to

Table 2. Path coefficient analysis showing the direct and indirect effects of the yield components in sunflower

Characters	Days to flowering	Days to maturity	Plant height	Stem girth	Leaves/ plant	Head diameter	Head weight	Shelling %	100 seed weight	rg with seed yield
Days to flowering	0.7122	0.2187	0.2345	0.3269	0.0003	-1.3352	-0.5979	0.0061	-0.0766	-0.5100
Days to maturity	0.4460	0.3492	-0.4555	0.0787	0.0353	-0.4901	0.0139	0.0156	0.0107	0.0071
Plant height	-0.1150	0.1089	-1.4529	-0.1926	0.1124	1.3469	0.5959	0.0532	0.0424	0.4991
Stem girth	-0.7750	-0.0927	-0.9315	-0.3004	0.0576	1.8135	1.1923	-0.0857	0.1889	1.0673
Leaves / plant	0.0026	0.1734	-2.2969	-0.2435	0.0711	2.1977	1.0009	-0.1677	0.2943	0.9721
Head diameter	-0.5294	-0.0952	-1.0893	-0.3032	0.0870	1.7966	0.5755	-0.0279	0.0650	0.5770
Head weight	-0.3821	0.0044	-0.7769	-0.3216	0.6939	1.0891	1.1144	-0.0182	0.2149	0.9878
Shelling %	-0.0135	-0.0169	0.2409	-0.0803	0.0571	0.1566	0.0632	-0.3208	0.1410	0.2075
100 seed weight	-0.1937	0.0135	-0.2187	-0.2016	0.0592	0.4023	0.3507	-0.1607	-0.2816	0.8324

Underlined figures denote the direct effects

Residual effect = 0.1815

maturity and 100 seed weight also influenced the seed yield directly.

It was interesting to note that the plant height and stem girth which had strong positive correlations exhibited their negative direct effects on seed yield. The results further indicated that the indirect contributions of days to flower *via* days to maturity, plant height and stem girth were positive, while those with head diameter and head weight were negative; similarly, days to maturity influenced the seed yield per plant mainly by its indirect effects through days to flowering. The indirect contribution of plant height, stem girth and leaves per plant, were found to be the highest through head diameter and head weight. The indirect effects of plant height, stem girth, leaves per plant, head diameter, head weight, shelling percentage and 100 seed weight *via* days to flowering and days to maturity were either negative or negligible. The indirect contribution of all but days to flowering through plant height was high but negative, through leaves per plant and shelling percentage were low. The component characters *viz*. stem girth, leaves per plant, head weight and shelling percentage showed positive indirect contribution towards seed yield per plant through 100 seed weight.

Varshrey and Singh (1977), Alba and Greco (1979) and Giriraj *et al*. (1979) reported that head diameter directly influenced the seed yield which is in conformity with the present results. However, their observation of plant height influencing seed yield directly was not in agreement with our results. Laxmanaiah (1978) reported that capitutum diameter exerted its greatest influence both directly and indirectly while plant height, though had negative direct effect, had much indirect effect *via* head diameter, as also observed in the present study.

A perusal of overall results obtained thus indicated that the head diameter, head weight, days to flowering, days to maturity and 100 seed weight are directly related to seed yield per plant whereas plant height, stem girth, leaves per plant influenced seed yield indirectly through head diameter, head weight and 100 seed weight and these traits should be utilized while formulating selection indices.

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