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Research article

**CHARACTER ASSOCIATION AND PATH ANALYSIS FOR YIELD AND YIELD ATTRIBUTES
IN SUNFLOWER (*HELIANTHUS ANNUUS* L.)**

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ABSTRACT: Character association and path analysis between yield and its contributing traits were studied in 71 genotypes (15 parents, 54 hybrids and two checks) of sunflower. Analysis of variance revealed that existence of significant differences among genotypes for all the characters studied. Seed yield was significant positively correlated with number of filled seeds per head, head diameter, hundred seed weight, seed filling per cent and plant height. Path coefficient analysis indicated that highest direct effects on seed yield were observed in the traits, number of filled seeds per head and hundred seed weight and hence emphasis can be laid out on these traits during selection for further improvement in seed yield in sunflower.

Key words: Correlation, path analysis and Sunflower

INTRODUCTION

Sunflower is versatile crop. Its adaptability to a wide range of soil and climatic conditions are the oft-cited phenomenon which makes its cultivation possible during any part of the year in the tropical and sub tropical regions of the country (Reddy and Kumar, 1996). Sunflower is the second major oilseed crop having a potential source of vegetable oil and protein. The crop is grown under diverse agro-production situations, crossing climatic and geographic boundaries. Though the crop is considered as thermo and photo insensitive (Kavi *et al.*, 1994) but the productivity of sunflower in the country is one of the low in the world. Yield is a complex character and influenced by several yield component characters. The knowledge on the association of several characters with yield and interrelationship among these characters is essential for planning a successful plant breeding program. Correlation studies enable breeders to know the strength of the relationship between various characters as well as direction of changes expected during selection. The path coefficient analysis provides a more realistic picture of the relationship as it considers direct as well as indirect effects of the variables by partitioning the correlation coefficients. An attempt was made in the present investigation to assess the variability, heritability and genetic advance of some quantitative characters and understand the relationship between these characters and their contribution to yield in a set of genotypes.

MATERIALS AND METHODS

In the present study 71 genotypes (15 parents, 54 hybrids and two checks) were sown in randomized complete block design (RBD) with two replications at Acharya N.G Ranga Agricultural University, College farm, College of Agriculture, Rajendranagar during *summer* 2004. Each genotype was raised in 4.50 m length with spacing of 60 X 30 cm. Recommended agronomic practices were followed to raise a good crop. Observations were recorded on days to 50% flowering, days to maturity, plant height(cm), head diameter(cm), stem diameter(cm), number of filled seeds per head, number of unfilled seeds per head, seed filling per cent, 100 seed weight(g), seed yield per plant(g) and oil content(%). The data were recorded on five randomly selected plants in each entry in each replication. The mean values were used for analysis of variance. The correlation coefficients and path analysis were carried out following the methods of Al-Jibouri *et al.*, (1958) and Dewey and Lu (1959) respectively.

RESULTS AND DISCUSSION

Seed yield is a complex character and it is the end product of action and interaction among number of traits, hence it is important to understand the association of different characters with seed yield. Plant breeder has to find simple correlations and the extent of direct and indirect effects of attributes with seed yield that could be useful to predict the superior cross combinations and to identify traits for ideal plant type and aid in indirect selection. The present study revealed the phenotypic and genotypic correlations between several characters and seed yield. The genotypic correlations were higher than the corresponding phenotypic correlations, which indicate that the traits were inherently associated among themselves. The results of positive association of number of filled seeds with seed yield is in conformity with other workers (Tecklewold *et al.*, 2000; Ayub Khan, 2001). The positive association of head diameter, stem diameter and 100 seed weight with seed yield is in accordance with earlier findings (Ayub Khan, 2001). Seed filling per cent and number of filled seeds were positively associated with seed yield which is in agreement with earlier reports of Nehru and Manjunath (2003) and Rao *et al.* (2003). The positive correlation of plant height with seed yield is in agreement with earlier reports (Tecklewold, 2000; Dagustu, 2002; Nehru and Manjunath, 2003). Positive association of oil content with seed yield was observed which is in consonance with Suma and Virupakshappa (1994). The possible reason for the deviation may be due to different material used in the investigation and also due to low direct and indirect effects.

Table 1: Phenotypic (P) and Genotypic (G) correlation coefficients in sunflower

		Days to 50 per cent flowering	Days to maturity	Plant height (cm)	Head diameter (cm)	Stem diameter (cm)	Number of filled seeds per head	Number of unfilled seeds per head	Seed filling per cent	100 seed weight (g)	Oil content (%)	Seed yield per plant (g)
Days to 50 per cent flowering	P	0.935**	0.366**	-0.059	0.193	-0.043	0.128	-0.182	-0.357**	-0.216	-0.215	
	G	0.948**	0.374**	-0.083	0.207	-0.061	0.151	-0.210	-0.392**	-0.241*	-0.245*	
Days to maturity	P		0.389**	-0.004	0.242*	0.089	0.226	-0.153	-0.345**	-0.217	-1.000	
	G		0.398**	-0.000	0.267*	0.082	0.274*	-0.179	-0.367**	-0.237*	-0.110	
Plant height (cm)	P			0.406**	0.404**	0.437**	0.090	0.325**	0.036	0.147	0.381**	
	G			0.426**	0.475**	0.454**	0.112	0.346**	0.039	0.155	0.399**	
Head diameter (cm)	P				0.543**	0.502**	0.482**	0.051	0.434**	0.067	0.613**	
	G				0.552**	0.525**	0.509**	0.079	0.460**	0.080	0.633**	
Stem diameter (cm)	P					0.208	0.285*	-0.049	0.122	0.086	0.204	
	G					0.209	0.260*	-0.034	0.113	0.099	0.202	
Number of filled seeds per head	P						0.330**	0.579**	0.062	-0.085	0.858**	
	G						0.343**	0.618**	0.098	-0.099	0.876**	
Number of unfilled seeds per head	P							-0.518**	0.122	-0.119	0.331**	
	G							-0.492**	0.115	-0.117	0.332**	
Seed filling per cent	P								0.025	0.088	0.484**	
	G								0.070	0.080	0.538**	
100 seed weight (g)	P									0.267*	0.534**	
	G									0.301*	0.550**	
Oil content (%)	P										0.045	
	G										0.048	

* : Significant at 5 % level; ** : Significant at 1 % level.

Path analysis a standardized partial regression, permits separation of correlations into measure of direct and indirect effects. The cause and effect relationship between different pairs of characters is given by the combination of correlations and path analysis. The direct effect of 100 seed weight, number of filled seeds per head on seed yield are in conformity with earlier reports (Tecklewold, 2000; Dagustu, 2002; Nehru and Manjunath, 2003; Rao *et al.*, 2003). The head diameter though had direct negative effect on seed yield, their correlations with yield were positive and significant due to high positive indirect effect on seed yield through other associated characters. The plant height showed low positive direct effect on seed yield which is in conformity with the findings of Patil *et al.*, (1996). Days to 50 per cent flowering showed direct positive effect on seed yield which is in accordance with Murthy and Shambulingappa (1989). Oil content showed negative direct effect on seed yield which is in conformity with the results of Rao *et al.*, (2003). Maximum direct effects of number of filled seeds and 100 seed weight were observed on seed yield. Hence it may be concluded that these traits contributed maximum to higher seed yield compared to other characters, thus simultaneous selection for these characters is expected to improve seed yield in sunflower.

Table 2: Phenotypic (P) and Genotypic (G) Path coefficients in sunflower

		Days to 50 per cent flowering	Days to maturity	Plant height (cm)	Head diameter (cm)	Stem diameter (cm)	Number of filled seeds per head	Number of unfilled seeds per head	Seed filling per cent	100 seed weight (g)	Oil content (%)	Correlation with yield
Days to 50 per cent flowering	P	(-0.014)	-0.005	0.012	0.001	-0.006	-0.039	-0.008	0.018	-0.177	0.003	-0.215
	G	(-0.122)	0.085	0.025	0.002	-0.009	-0.065	-0.033	0.061	-0.191	0.002	-0.245*
Days to maturity	P	-0.013	(-0.006)	0.013	-0.000	-0.007	0.080	-0.015	0.015	-0.171	0.003	-0.100
	G	-0.116	(0.090)	0.026	0.000	-0.011	0.087	-0.060	0.052	-0.180	0.002	-0.110
Plant height	P	-0.005	-0.002	(0.034)	-0.008	-0.012	0.396	-0.006	-0.033	0.018	-0.002	0.381**
	G	-0.046	0.036	(0.066)	-0.012	-0.020	0.481	-0.025	-0.100	0.019	-0.001	0.399**
Head diameter	P	0.001	-0.000	0.014	(-0.019)	-0.016	0.455	-0.031	-0.005	0.215	-0.001	0.613**
	G	0.010	-0.000	0.028	(-0.028)	-0.023	0.556	-0.112	-0.023	0.225	-0.008	0.633**
Stem diameter	P	-0.003	-0.001	0.014	-0.010	(-0.029)	0.189	-0.019	0.005	0.060	-0.001	0.204
	G	-0.025	0.024	0.031	-0.016	(-0.041)	0.222	-0.057	0.010	0.055	-0.001	0.202
Number of filled seeds per head	P	0.001	-0.001	0.015	-0.009	-0.006	(0.906)	-0.022	-0.058	0.031	0.001	0.858**
	G	0.007	0.007	0.030	-0.015	-0.009	(1.060)	-0.076	-0.179	0.048	0.001	0.876**
Number of unfilled seeds per head	P	-0.002	-0.001	0.003	-0.009	-0.008	0.299	(-0.065)	0.052	0.061	0.002	0.331**
	G	-0.018	0.025	0.007	-0.014	-0.011	0.364	(-0.220)	0.143	0.056	0.001	0.332**
Seed filling per cent	P	0.003	0.001	0.011	-0.001	0.001	0.524	0.034	(-0.100)	0.013	-0.001	0.484**
	G	0.026	-0.016	0.023	-0.002	0.001	0.655	0.108	(-0.290)	0.034	-0.001	0.538**
100 seed weight	P	0.005	0.002	0.001	-0.008	-0.004	0.056	-0.008	-0.003	(0.497)	-0.004	0.534**
	G	0.048	-0.036	0.003	-0.013	-0.005	0.104	-0.025	-0.020	(0.489)	-0.003	0.550**
Oil content (%)	P	0.003	0.001	0.005	-0.001	-0.003	-0.077	0.008	-0.009	0.133	(-0.015)	0.045
	G	0.029	-0.021	0.010	-0.002	-0.004	-0.105	0.026	-0.023	0.147	(-0.009)	0.048

Values in parenthesis are direct effects; Phenotypic residual effect = 0.1689; Genotypic residual effect = 0.1190;

* : Significant at 5 % level; ** : Significant at 1 % level.

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