

## Genetic Variability and Path Coefficient Analysis for Yield Related Traits in *Helianthus Annus*

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### Abstract

The experiment was conducted in the research area of the department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. The research material were comprised of 20 genotypes of sunflower (G-16, G-30, G-32, G-36, G-44, G-45, G-61, G-64, G-66, G-68, G-86, A-2, A-14, A-23, A-56, A-60, A-61, A-79, A-133 and A-185). The experiment was laid out in a randomized complete block design with three replications in the year 2013. Results revealed that the strongest correlation of seed yield was observed with 1000-grain weight at genotypic level, 1000 grain weight and oil contents were positively and significantly correlated at phenotypic and genotypic levels with total achene weight. So the 1000-seed weight and oil contents are important yield components and could be used as selection criteria to improve seed yield. In path coefficient, highest positive indirect effect of chlorophyll was through oil content. While that direct selection for oil contents, Fresh head diameter, Plant height and days to 50% flowering will give the best results for total achene weight per plant.

**Keywords:** G-16, sunflower, 1000 grain weight, chlorophyll and oil contents.

### INTRODUCTION:

Pakistan is facing tremendous deficiency of edible oils. The domestic edible oil production does not meet the need of the country and a huge amount of foreign exchange is spent on its import. Pakistan is chronically deficient in its production and large amount of the country's edible oil requirements are met through imports. Total demand of edible oil during 2012-13 was 1.749 million tones, whereas local production stood at 0.680 million tones which accounted for 24% of the total availability while the remaining 1.246 million tons was made available through imports. (Anonymous, 2012-13). There is a dire need to increase local edible oil production by increasing the area and production of conventional oilseed crops and also paying attention to the non-conventional oilseed crops. Among the non-conventional oilseed crops, sunflower has a maximum potential for bridging the gap in the demand and production of edible oil in the country. Its seed contain high oil content ranging from 35-40% with some types yielding up to 50% (Skoric & Marinkovic, 1986). Correlation of a particular character with other characters contributing to seed yield is of great importance in indirect selection of genotypes for higher seed yield. This necessitates developing locally well adapted, high yielding sunflower genotypes under local agro-ecological conditions. Keeping in view these facts the present work was carried out to develop selection criteria for genotypes of sunflower with high achene yield. Yield generally exhibit positive and significant correlation with number of filled seeds, head diameter and 1000-seed weight (Lakshmaniah, 1978; Niranjanmurthy & Shambulingappa, 1989; Mogali & Virupakshappa, 1994). Path coefficient analysis is a statistical technique of partitioning the correlation coefficients into its direct and indirect effects, so that the contribution of each character to yield could be estimated. Therefore, path coefficient analysis has extensively been used by many researchers (Kaya and Atakisi, 2003; Kaya *et al.*, 2003; Vidhyavathi, *et al.*, 2005; Göksoy and Turan, 2007). The present work was carried out to estimate the genotypic and phenotypic correlation between different morphological traits and to work out path coefficients to know direct and indirect contribution of different traits to seed yield.

### MATERIAL AND METHODS:

The present work was conducted in the research area of the department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. The research material were comprised of 20 genotypes of sunflower (G-16, G-30, G-32, G-36, G-44, G-45, G-61, G-64, G-66, G-68, G-86, A-2, A-14, A-23, A-56, A-60, A-61, A-79, A-133 and A-185). Seed were sown keeping plant to plant and row to row distances of 30 and 75 cm, respectively. The experiment was laid out in a randomized complete block design with three replications in the year 2013. At maturity, ten plants of each entry were taken at random in each replication and data were recorded on pre- and post-harvest plant characters including days to 50 % flowering, plant height (cm), chlorophyll contents, fresh head diameter (cm), Dry head diameter(cm), Oil contents in seed (%), 1000-seed weight (g), Total achene weight per plant (g). The recorded data were subjected to correlation analysis to estimate the correlation between different traits at phenotypic and genotypic levels following statistical techniques developed by Kown and Torrie (1964). Path coefficients were determined following Dewey and Lu (1957) to study direct and indirect effects of different morphological traits under study on the seed yield. This method has been extensively used by the sunflower researchers (Lakshmanrao *et al.*, 1985; Marinkovic, 1992; Punia & Gill, 1994; Joksimovic *et al.*,

1999).

## RESULTS AND DISCUSSION:

The strongest correlation of seed yield was observed with 1000-Grain weight at genotypic ( $r = 0.762$ ) level (Table I). 1000 Grain weight and Oil contents were positively and significantly correlated, at phenotypic ( $r = 0.511$  and  $0.369$  respectively) and genotypic ( $r = 0.762$  and  $0.447$  respectively) levels with Total achene weight, which is in earlier finding of Kaya *et al.*, (2008). 1000-Grain weight revealed significant and positive correlation with oil contents and Total achene weight per plant under discussion at both genotypic and phenotypic levels. Total achene weight per plant exhibited a high correlation with 1000 Grain weight ( $r = 0.511$ ) at phenotypic level.

The highest and positive correlation of total achene weight per plant was observed with 1000 Grain weight followed by Oil Contents, Fresh head diameter, Plant height and Days to 50 % flowering. Plant height was positively but non-significantly correlated with total achene weight per plant and Chlorophyll except dry head diameter and Oil contents at both levels.

Chlorophyll was positively but non-significantly correlated with Dry head diameter, 1000-grain weight, and oil content except fresh head diameter and total achene weight per plant at both levels. Fresh head diameter was positively but non-significantly correlated with total weight per plant while dry head diameter was negatively but non-significantly correlated with total achene weight per plant. Days to 50 % flowering showed negative genotypic association with plant height and fresh head diameter at both genotypic and phenotypic levels. Habib *et al.* (2007) also reported similar results in their respective studies. The results suggest that 1000-seed weight and oil contents are important yield components and could be used as selection criteria to improve seed yield.

**Table: I Genotypic ( $r_g$ ) and phenotypic ( $r_p$ ) correlation coefficient among eight yield characters of sunflower.**

		Days to (50%) Flowering	Plant height	Chlorophyll	Fresh Head Diameter	Dry Head Diameter	1000-grain weight	Oil Content	Total weight
Days to 50% flowering	r(g)	1	-0.12442	0.165906	-0.42936	0.085064	0.010228	0.246103	0.082045
	r(p)	1	0.045828	0.205996	-0.22609	0.057014	-0.05967	0.217259	0.100227
Plant Height	r(g)		1	0.205536	-0.17849	-0.27084	0.018488	-0.27358	0.219557
	r(p)		1	0.130963	0.051382	-0.14829	-0.05049	-0.15186	0.142587
Chlorophyll	r(g)			1	-0.16324	0.232316	0.321855	0.254884	-0.10247
	r(p)			1	-0.04302	0.114786	0.142471	0.175251	-0.10106
Fresh Head Diameter	r(g)				1	-0.10434	0.154038	-0.4079	0.310418
	r(p)				1	0.007261	0.125599	-0.23155	0.197946
Dry Head Diameter	r(g)					1	-0.17646	0.159699	-0.272
	r(p)					1	-0.11011	0.107439	-0.24756
1000 Grain Weight	r(g)						1	0.659684*	0.762426*
	r(p)						1	0.408677*	0.511395**
Oil Content	r(g)							1	0.447272*
	r(p)							1	0.369817*

\* = Significant ( $P \leq 0.05$ )

\*\*= Highly significant ( $P \leq 0.01$ )

Path coefficients (Table II) revealed that Oil contents exerted positive direct effect on total achene weight along with its positive indirect effects through days to 50% flowering. Oil contents has negative indirect effect through plant height, chlorophyll, fresh head diameter, dry head diameter, 1000 grain weigh. Habib *et al.* (2007) also reported similar results in their respective studies. Highest positive indirect effect after its direct effect was through days to 50% flowering. Highest negative indirect effect of oil contents was exerted through fresh head diameter.

Days to 50% flowering exerted positive direct effect on total achene weight along with its positive indirect effects through oil content. Days to 50% flowering has negative indirect effect through plant height, chlorophyll, fresh head diameter, dry head meter, 1000 grain weight. Highest positive indirect effect of days to 50% flowering was exerted through oil content. Highest negative indirect effect of days to 50% flowering was exerted through fresh head diameter .

Plant height exerted positive direct effect on total achene weight along with its positive indirect effects through dry head diameter. The positive direct effects of Plant height and Head diameter established in this study supports the statements of Kaya and Atakisi (2003), Kaya *et al.* (2003), Vidhyavathi, *et al.* (2005), Göksoy and Turan (2007) that breeding for increased Seed yield seems to the most effective method to get higher sunflower yields. Plant height has negative indirect effect through days to 50% flowering, chlorophyll, fresh head diameter, 1000 grain weight, oil content. Highest positive indirect effect plant height was exerted through dry head diameter. Highest negative indirect effect of plant height was exerted through oil contents .

Chlorophyll exerted positive direct effect on total achene weight along with its positive indirect effects through days to 50% flowering, plant height, oil contents. Chlorophyll has negative indirect effect through fresh head

diameter, dry head diameter, 1000 grain weight. Highest positive indirect effect of chlorophyll was through oil content followed by plant height. Highest negative indirect effect of chlorophyll was exerted through fresh head diameter

Fresh head diameter exerted positive direct effect on total achene weight along with its positive indirect effects through chlorophyll and dry head diameter. Fresh head diameter has negative indirect effect through days to 50% flowering, plant height, 1000 grain weight and oil contents. Highest positive indirect effect after its direct effect was through chlorophyll followed by dry head diameter. Highest negative indirect effect of fresh head diameter was exerted through oil contents .

Dry head diameter exerted negative direct effect on total achene weight along with its positive indirect effects through days to 50% flowering, 1000 grain weight and oil contents. Dry head diameter has negative indirect effect through plant height, chlorophyll, fresh head diameter. Highest positive indirect effect of dry head diameter was through oil contents followed by days to 50% flowering. Highest negative indirect effect of dry head diameter was exerted through plant height

1000 grain weight exerted negative direct effect on total achene weight. Direct negative effects were reported (Alba & Greco, 1979, Lakshmanrao *et al.*, 1985). However, direct positive effects of the weight of 1000 seeds on seed yield were also discussed by Alba *et al.* (1979), Giriraj *et al.* (1979), Varshney *et al.* (1977) . In addition to the 1000-grain weight had its positive indirect effects through days to 50% flowering, plant height, fresh head diameter, dry head diameter and oil contents. 1000 grain weight has negative indirect effect through chlorophyll. Highest positive indirect effect of 1000 grain weight was exerted through oil contents followed by fresh head diameter. Highest negative indirect effect of 1000 grain weight was exerted through chlorophyll.

Direct selection for Oil contents, Fresh head diameter, Plant height and Days to 50% flowering will give the best results for total achene weight per plant.

**Table: II Direct (Diagonal Bold) and Indirect Path Effects of Yield Character in Sunflower.**

	Days to 50% Flowering	Plant height	Chlorophyll	Fresh Head Diameter	Dry Head Diameter	1000-grain weight	Oil Contents	Total Achene weight	rg
<b>Days to 50% Flowering</b>	<b>0.434161</b>	-0.10661	-0.07347	-0.45333	-0.00513	-0.00059	0.28702	0.082045	0.082045
<b>Plant Height</b>	-0.05402	<b>0.856863</b>	-0.09102	-0.18845	0.016327	-0.00107	-0.31907	0.219557	0.219557
<b>Chlorophyll</b>	0.07203	0.176117	<b>-0.44286</b>	-0.17235	-0.01401	-0.01865	0.29726	-0.10247	-0.10247
<b>Fresh Head Diameter</b>	-0.18641	-0.15294	0.072293	<b>1.055828</b>	0.00629	-0.00893	-0.47572	0.310418	0.310418
<b>Dry Head Diameter</b>	0.036931	-0.23207	-0.10288	-0.11017	<b>-0.06028</b>	0.010227	0.186249	-0.272	-0.272
<b>1000-grain weight</b>	0.00444	0.015842	-0.14254	0.162638	0.010638	<b>-0.05795</b>	0.769361	0.762426	0.762426
<b>Oil Content</b>	0.106849	-0.23442	-0.11288	-0.43067	-0.00963	-0.03823	<b>1.166256</b>	0.447272	0.447272

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