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Character association and path analysis for seed yield in sunflower (*Helianthus annuus* L.)

V.K. KALUKHE, M.K. MOON, N.M. MAGAR AND S.S. PATIL

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SUMMARY

The character association and path coefficient analysis was studied in sunflower (*Helianthus annuus*) comprising 26 germplasm lines and one check (TAS-82) for 13 different yield contributing characters, grown during *Kharif* 2007. The seed yield per plant showed highly significant and positive association with volume weight, oil content, head diameter, 100 seed weight, hull content, number of seeds per head, number of filled seeds per head, days to maturity and plant height both at genotypic and phenotypic levels. The path analysis indicated that 100 seed weight had the highest positive direct effect on seed yield per plant followed by number of seeds per head, number of filled seeds per head, plant height, volume weight, days to maturity, head diameter and hull content. The indirect effect revealed that most of the characters had maximum positive indirect effect on seed yield per plant through 100 seed weight followed by number of seeds per head. As such improvement of sunflower crop through yield component traits would be rewarding.

Key words : Sunflower, *Helianthus annuus*, Genotypic and phenotypic association, Path analysis

Sunflower which was used as an ornamental plant in India, but in recent times has become an important source of edible oil. Sunflower crop is one of the important in four major edible oilseed crops in world, others being soybean, rapeseed and groundnut. In most of the breeding program, yield is ultimate object which has highly variable expression. The yield is determined by the interaction of a number of characters among themselves and with the environment. Thus, a knowledge of association of various characters with yield and among themselves would provide criteria for indirect selection through components for improvement in yield. Therefore, genotypic and phenotypic associations among important quantitative characters were analyzed. The path coefficient analysis of Wright (1921) was also undertaken to understand the direct and indirect effect of various traits on seed yield.

Sunflower being a newer commercial out breeding crop, where seed yield is the effect of even more complex characters, lack of such information in this respect. This is why, the present investigation was undertaken to study the character association and path analysis for seed yield and yield contributing characters in sunflower.

Correspondence to:
V.K. KALUKHE, M.P.K.V., Agriculture Research Station, JALGAON (M.S.) INDIA
Authors' affiliations:
M.K. MOON, Oilseeds Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, AKOLA (M.S.) INDIA
N.M. MAGAR AND S.S. PATIL, Agriculture Research Unit, Mahatma Phule Krishi Vidyapeeth, JALGAON(M.S.) INDIA

MATERIALS AND METHODS

The material for present study consisted of 26 germplasm lines and one check *i.e.* TAS-82. These were sown during July 2007 in a randomized block design with three replications. A distance of 60 cm between rows and 30 cm between plants was maintained. Each plot comprised of four rows, each of 3 meters length. Five random plants were taken from the two central rows of each plot to record observations on different quantitative characters except for days to 50% flowering and days to maturity, where the plant population in two central rows of each plot was considered. The various quantitative characters were studied namely days to 50% flowering, days to maturity, plant height (cm), head diameter (cm), number of filled seeds per head, number of unfilled seeds per head, number of seeds per head, 100 seed weight (g), volume weight (g/100 ml), hull content (%), oil content (%), autogamy (%) and seed yield per plant (g). The data obtained in respect of above characters has been first subjected to analysis of variance as per standard method (Panse and Sukhatme, 1954). Then data were analyzed by using variance-covariance technique. In order to determine the association between two or more quantitative characters, the phenotypic and genotypic association coefficients were worked out as per the formulae given by Al-Jibouri *et al*. (1958). The path coefficient analysis were calculated from genotypic correlation coefficient by solving simultaneous equations as given by Dewey *et al*. (1959).

RESULTS AND DISCUSSION

The results of analysis of variance (Table 1) revealed highly significant differences among the genotypes for all the characters under study. This observation indicated that presence of substantial amount of genetic variability in the genotypes for all the characters under study. These results are in general agreement with those of Rao *et al.* (2003) and Prasad *et al*. (2006).

The genotypic and phenotypic correlation coefficient between all pairs of 13 characters are presented in Table 2. The genotypic correlation coefficients were in general, higher than their corresponding phenotypic correlation coefficients, demonstrating that the observed relationship among various characters were due to genetic cause. Similarly, both types of correlations were comparable in respect of their directions. Seed yield per plant showed highly significant and positive association with volume weight (r=0.974), oil content (r=0.805), head diameter (r=0.757), 100 seed weight (r=0.666), hull content (r=0.666), number of seeds per head (r=0.601), number of filled seeds per head (r=0.575), days to maturity (r=0.574) and plant height (r=0.569) both at genotypic and phenotypic levels. This indicates that strong association of these characters with seed yield per plant could be fruitfully exploited for enhancing the yield potential in sunflower. This also indicated that simultaneous selection for these characters might bring an improvement in seed yield. Similar results were also reported by Dhaduk *et al*. (1985), Murthy and Shambulingappa (1989), Singh and Labana (1990), Marinkovic (1992), Mogali and Virupakshappa (1994), Nehru and Manjunath (2003) and Prasad *et al*. (2006).

Seed yield per plant also showed a positive association with days to 50% flowering (r=0.319), per cent autogamy (r=0.319) and number of unfilled seeds per head (r=0.242) both at genotypic and phenotypic levels. All these correlations were found to be non-significant. It was suggested that contribution of these characters towards high seed yield is negligible. This was also observed by Dhaduk *et al*. (1985), Chikkhadevaiah *et al*. (2002), Nehru and Manjunath (2003) and Prasad *et al*. (2006).

It is an established fact that, the association between two characters is not a simple relationship, but is rather the product of the interaction of direct and indirect causes. Therefore, to obtain a realistic picture of the components which would effectively contribute the seed yield, the path coefficient analysis was performed. The genotypic correlations were partitioned into direct and indirect effects. The characters which emerged as the major component of seed yield per plant in path coefficient analysis (Table 3) was the 100 seed weight (0.748) followed by number of seeds per head (0.704) which had the positive direct effect of very high magnitude on seed yield per plant. Besides this, number of filled seeds per head (0.111), plant height (0.097), volume weight (0.076), days to maturity (0.038), head diameter (0.006) and hull content (0.004) also contributed directly to seed yield per plant in positive direction. It indicated that the direct selection for these characters will be rewarding to obtain the high yielding genotypes as revealed by their close association with seed yield per plant. Similar results were also obtained by Singh and Labana (1990), Marinkovic (1992) and Nehru and Manjunath (2003). The direct effect

Table 1 : Analysis of variance for various characters in sunflower

Source of variation		Replication	Treatments	Error
d.f.		2	26	52
Days to 50% flowering	1	0.35	59.99**	0.61
Days to maturity	2	0.65	92.59**	0.56
Plant height (cm)	3	0.08	2156.57**	0.17
Head diameter (cm)	4	0.06	11.62**	0.03
Number of filled seeds /head	5	76.15	30059.59**	436.20
Number of unfilled seeds/head	6	19.62	10335.88**	31.95
Number of seeds per head	7	148.89	42834.36**	674.71
Hundred seed weight (g)	8	0.003	2.83**	0.001
Volume weight (g/100 ml)	9	0.06	94.98**	0.17
Hull content (%)	10	0.05	9.87**	0.09
Oil content (%)	11	0.009	52.69**	0.01
Autogamy (%)	12	0.43	155.73**	0.23
Seed yield per plant (g)	13	0.16	104.24**	1.03

** indicates significance of value at P=0.01

of rest of the characters *viz*., per cent autogamy (-0.012), oil content (-0.049), days to 50% flowering (-0.097) and number of unfilled seeds per head (-0.345) are negative in magnitude. Similar results were obtained by Dhaduk *et al*. (1985) and Murthy and Shambulingappa (1989). The oil content had negative direct effect, this is in contrast to the correlation result in which oil content was noticed to be significantly and positively associated with seed yield per plant. Considering the indirect effect, it was observed that most of the characters under study had the maximum positive indirect effect through 100 seed weight followed by number of seeds per head. The indirect effect also revealed that the characters hull content had maximum positive indirect effect via 100 seed weight (0.697) and number of filled seeds per head via number of seeds per head (0.612). The residual effect (0.1198) was low suggesting that almost all the yield contributing characters have been included in path analysis.

In general, character association and path coefficient analysis carried out in this study suggest that 100 seed weight, followed by number of seeds per head and volume weight influence the seed yield more than any of the characters taken for study. Hence, more emphasis would be given to these characters during selection to improve the seed yield. Also the narrow differences between a genotypic and phenotypic values indicates that the environment does not play a major role in the relationship between traits. Hence, selection based on phenotypic performance of different traits will be fairly effective.

REFERENCES

Al-Jibouri, H.A., Miller, P.A. and Robinson, H.F. (1958). Genotypic and environmental variances and covariances in an upland cotton cross of interspecific origin. *Agron. J.*, **50** (10) : 633-637.

Chikkadevaiah, H.L., Sujatha and Nandini (2002). Correlation and path analysis in sunflower. *Helia.*, **25**(37):109-118.

Dewey, O.R., Lu, K.H. and Douglas, R. (1959). A correlation and path coefficient analysis of components of crested wheatgrass seed production. *Agron. J.*, **57**:515-518.

Dhaduk, L.K; Desai, N.D., Patel, R.H. and Kukadia, M.V. (1985). Correlation and path coefficient analysis in sunflower. *Indian J. Agric. Sci.*, **55**(1):52-54.

Marinkovic, R. (1992). Path coefficient analysis of some yield components of sunflower. *Euphytica.*, **60**(3):201-205.

Mogali, S.C. and Virupakshappa, K. (1994). Intercharacter association and path coefficient analysis in sunflower (*Helianthus annuus* L.). *Indian J. Genet.*, **54** (4):366-370.

Murthy, N. and Shambulingappa, K.G. (1989). Path analysis for seed yield in sunflower. *J. Oilseeds Res.*, **6** (1) : 22-25.

Nehru, S.D. and Manjunath, A. (2003). Correlation and path analysis in sunflower (*Helianthus annuus* L.). *Karnataka J. agric. Sci.*, **16**(1):39-43.

Panse, V.G. and Sukhatme,P.V. (1954). *Statistical methods for agricultural workers*, ICAR Publication, New Delhi. pp.72-96.

Prasad, B.V., Reddy, A.V., Sridhar, V. and Shankar, V.G. (2006). Character association studies for yield and its components in sunflower. *Crop Res.*, **32**(3):146-151.

Rao, N.V., Mohan, Y.C. and Reddy, S.S. (2003). Variability and character associations in elite lines of sunflower (*Helianthus annuus* L.). *Res. Crops*, **4**(1):104-109.

Singh, S.B. and Labana, K.S. (1990). Correlation and path analysis in sunflower. *Crop Improv.*, **17**(1):49-53.

Wright. S. (1921(. Correlation and causation. *J. agric. Res.*, **1**(20):557-585.

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