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CORRELATION AND PATH - COEFFICIENT ANALYSIS IN SUNFLOWER (*Helianthus annuus* L.)

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ABSTRACT

Genotypic and Phenotypic correlations among seed yield and 10 component characters were studied in 65 genotypes (15 parents and 50 crosses) of sunflower (*Helianthus annuus* L.). Pooled analysis of parents and crosses revealed that head diameter, leaves per plant, hundred seed weight and stem girth had significant and positive correlations with yield. Head diameter, stem girth, hundred seed weight, number of leaves and oil content had significant and positive intercorrelation among themselves. Head diameter, days to first flowering and number of leaves influenced the yield directly. Improvement of this crop through the component traits is significant.

KEY WORDS: Sunflower, Correlation, Path analysis, Yield components

Yield is determined by the interaction of a number of characters among themselves and with the environment. 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 correlations among 11 important quantitative characters were analysed. The path co-efficient analysis of Wright (1921) was also undertaken to understand the direct and indirect effects of various traits on yield of sunflower.

MATERIALS AND METHODS

The material for present study consisted of 65 genotypes comprising 15 parents and their 50 direct crosses without reciprocals. These were grown in summer, 1995 in a randomized block design with four replications. A distance of 60 cm between rows and 30 cm between plants was maintained. Data were collected on five random competitive plants in each genotype for days to first flowering, days to fifty per cent flowering, plant height (cm), head-diameter (cm), stem girth (cm), number of leaves, husk content (%), hundred seed weight (g) days to maturity, oil-content (%) and seed yield per plant (g). Phenotypic and genotypic correlations were worked out according to Johnson *et al.* (1955) and path analysis according to Dwey and Lu (1959).

RESULTS AND DISCUSSION

Genotypic correlation coefficients (Table 1), were in general, higher than phenotypic correlation coefficients. Stem girth, head-diameter, number of leaves, hundred seed weight had significant positive correlation with yield per plant. This suggested that a simultaneous selection for these traits might bring an improvement in seed yield. Similar reports of association of these component characters with yield were given by Caylok and Emirogly (1984), and Chidambaram and Sundaresan (1990). Days to first flowering, days to fifty per cent flowering and days to maturity were highly intercorrelated. Head diameter was positively correlated with stem girth, hundred seed weight, number of leaves and oil per cent.

The genotypic correlation were partioned into direct and indirect effect (Table 2). The correlation co-efficient between days to flowering and seed yield were negative (-0.089) but the direct effect was positive which offers scope for selecting early flowering varieties to increase the yield.

The correlation co-efficient between days to fifty percent flowering and seed yield was high but negative and the direct effect was also high and negative (-0.462). The head-diameter, hundred seed weight and husk content also influenced negatively through this character. This negative direct effect implies that the high yielding genotypes would be late in their maturity period as reported by Singh and Labana (1990).

The correlation co-efficient between days to maturity and seed yield per plant was high and negatively correlated inspite of the direct effect being positive. As the traits days to flowering,

Table 1. Correlation between yield and yield components

Characters	Days to first flowering	Days to 50 % flowering	Plant height	Stem girth	Head diameter	Number of leaves	Hundred seed weight	Husk content (Percent)	Days to maturity	Oil percent	Yield per plant
Days to first flowering	-	0.787*	0.253**	-0.080	-0.017	-0.066	-0.157	0.068	0.381**	0.060	-0.065
Days to fifty per cent flowering	0.826**	-	0.327**	0.043	-0.103	0.039	-0.140	0.031	0.346**	-0.008	-0.181**
Plant height	0.256**	0.360**	-	0.413**	-0.039	0.269**	0.071	0.157*	0.158*	-0.183**	0.065
Stem girth	-0.104	0.052	0.428**	-	0.166**	0.158*	0.109	-0.005	-0.061	-0.313**	0.214**
Head diameter	-0.016	-0.130*	-0.033	0.261**	-	0.026	0.071	0.165**	-0.177**	0.074	0.345**
Number of leaves	-0.141*	0.005	0.266**	0.169**	0.054	-	0.199**	-0.060	-0.144*	-1.144*	0.181**
Hundred seed weight	-0.250**	-0.183**	0.076	0.118	0.117	0.234**	-	0.010	-0.120	-0.001	0.167**
Husk content (Per cent)	0.079	0.035	0.163**	-0.005	0.258**	-0.066	0.014	-	-0.050	0.060	0.069
Days to maturity	0.586**	0.551**	0.196**	-0.070	-0.308**	-0.186**	-0.177**	-0.062	-	-0.029	-0.186**
Oil per cent	0.084	-0.016	-0.196**	-0.322**	0.125*	-0.162**	-0.003	-0.061	-0.038	-	-0.027
Yield per plant	-0.089	-0.226**	-0.067	0.216**	0.534**	0.194**	0.173**	0.071	-0.219**	-0.029**	-

Phenotypic correlations - above diagonal, genotypic correlations - below diagonal

** Significant at 1% level.

* Significant at 5% level.

days to fifty per cent flowering and days to maturity are interrelated and since the results of these three traits implies contradictory inference, it would therefore be possible to arrive at a compensation by selecting for intermediate maturity type without significant alteration in the grain yield.

The direct effect between plant height and yield was positive although the correlation co-efficient was not significant. This relationship can be fruitfully exploited to breed for taller plants which will be highly productive on account of more number of leaves. This finding is in agreement with reports of Chaudhary and Anand (1984).

The traits stem girth and number of leaves exhibited significant positive effect with yield. This signifies that there is scope for yield improvement by improving these traits.

The association between the head-diameter and seed yield per plant was very high and positively correlated (r = 0.524) by a high direct effect (0.479) and through other traits. This implies that the yield can be increased widely by improvement of this trait. The direct effect of head-diameter was more or less similar to its total genotypic correlation co-efficient which indicated that the variability for this character is not much influenced by the change in the variability in other characters. Similar reports were also produced by Singh *et al.*, (1985) and Kandil and Mohandas (1988).

The correlation co-efficient between hundred seed weight and yield per plant was significant. The direct and indirect effects via days to fifty per cent flowering, plant height, stem girth, head-diameter and number of leaves were positive offering scope for the improvement in yield.

Husk content was positively correlated to yield by negative direct effect, which was owing

Table 2. Path analysis for yield and yield components

Characters	Days to first flowering	Days to 50 % flowering	Plant height	Stem girth	Head diameter	Number of leaves	Hundred seed weight	Husk content (Percent)	Days to maturity	Oil percent	Yield per plant
Days to first flowering	**0.322**	-0.381	0.023	-0.006	-0.008	-0.022	-0.016	-0.005	0.009	-0.005	-0.089
Days to fifty per cent flowering	0.266	**-0.462**	0.033	0.003	-0.062	0.001	-0.012	-0.002	0.009	0.001	-0.264**
Plant height	0.082	-0.166	**0.091**	0.025	-0.016	0.042	0.005	-0.010	0.003	0.011	0.067
Stem girth	-0.033	-0.024	0.039	**0.058**	0.125	0.026	0.008	0.000	-0.001	0.018	0.216**
Head diameter	-0.005	0.060	-0.003	0.015	**0.479**	0.008	0.008	-0.016	-0.005	-0.007	0.534**
Number of leaves	-0.045	-0.002	0.024	0.010	0.026	**0.156**	0.015	0.004	-0.003	0.009	0.194**
Hundred seed weight	-0.080	0.084	0.007	0.007	0.056	0.037	**0.066**	-0.001	-0.003	0.000	0.173**
Husk content (Per cent)	0.025	-0.016	0.015	0.000	0.124	-0.010	0.001	**-0.063**	-0.001	-0.003	0.071
Days to maturity	0.188	-0.254	0.018	-0.004	-0.147	-0.029	-0.012	0.004	**0.016**	0.002	-0.219**
Oil per cent	0.027	0.008	-0.018	-0.019	0.060	-0.025	0.000	-0.004	-0.001	**-0.057**	-0.029

Residual effect = 0.4347

to the contributions of days to flowering, plant height, head-diameter and hundred seed weight. This indicated that low husk content varieties could be developed by improvement of the above said traits.

Oil per cent was negatively correlated to yield with a negative direct effect indicating their limited role in yield improvement. Similar reports were given by Vanishree (1988).

Correlation studies between yield and its components indicate that head-diameter, stem girth, hundred seed weight, number of leaves per plant, plant height and husk content had positive correlation with yield and among themselves.

Hence selection of any one of these traits will simultaneously improve the other characters along with increase in yield. However head diameter, stem girth, number of leaves, hundred seed weight had contributed significantly to increase the yield in both direct and indirect effects. Therefore maximum weightage should be given to the afore mentioned traits while selecting improved genotypes with high seed yield in sunflower. Least or no importance should be given to the traits like days to flowering, days to fifty per cent flowering, days to maturity, oil content.

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NITROGEN LEVELS AND SOURCES ON HERB, OIL YIELD AND SOIL FERTILITY OF RAINFED PALMAROSA

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ABSTRACT

Field experiments were conducted during rabi seasons of 1992 - 1993, to 1994 - 1995 to study the effect of different N sources with various levels on the oil yield and soil fertility of palmarosa in vertisol under rainfed condition. The application of urea at 75 kg ha^{-1} registered the highest herb yield (10,606 kg ha^{-1}) and oil yield (392 kg ha^{-1}). The combined application of organic (FYM) and inorganic(urea) fertilisers to supply N in equal proportion at 100 kg ha^{-1} recorded the maximum oil recovery. Reduction in the herb yield was observed with the application of organic N source, The application of 75 kg N ha^{-1} recorded the highest available nutrients viz., N, P, and K in the soil.

KEY WORDS: N Level, N source, Herb yield, Oil yield, Soil Fertility, Palmarosa

Palmarosa (*Cymbogon martini*) is an aromatic and essential oil bearing crop, which is widely grown in varied agroclimatic conditions in India. Generally, the poor fertility status of the soils and erratic distribution of rainfall resulted in poor returns to the rainfed farmers. Thus the commercial value of crops like Palmarosa can be included in the rainfed cropping system to increase the income of the farmers. The low cost of cultivation, resistance to pest and diseases and drought tolerant nature of this crop lead to wider cultivation of this crop. Besides its use in perfumery, flavouring and cosmetic industries, it fetches foreign exchange through export. The herb yield of the crop can be increased with N fertilization. Very limited research was carried out with N requirement for this crop. Hence, this experiment was undertaken to study the effect of different sources and levels of N on the yield and soil properties of palmarosa under rainfed vertisol.

MATERIALS AND METHODS

Field experiments were conducted during the rabi seasons of 1992 - 1993, 1993 - 1994 and 1994 - 1995 with palmarosa at Agricultural Research Station, Kovilpatti. The soil (vertisol) of the experimental site had the following characteristics: heavy textured with clay 54.2 per cent, silt 20.8 per cent, sand 25.0 per cent, pH 8.0, Ec.0.30 dSm^{-1}, organic C.O. 40 %. The soil is low in available N (alkaline KMO4-N 92 Kg ha^{-1}), and P (olsen P - 6.0 kg ha^{-1}) and high in K (NH_4 OAc-K-358 kg ha^{-1}). The treatment structure composed of five levels of N (0, 25, 50, 75 and 100 kg ha^{-1}) which was applied as urea and in combination with FYM as organic source on equal N basis. The experiment was laid out in randomised block design with three replications. Basally half dose of N, along with full dose of Phosphorous and Potassium at 20 kg P ha^{-1} as single super phosphate and muriate of potash respectively were applied uniformly to all the plots. The remaining half of N as per treatments was applied to the ratoon crop immediately after the harvest.

Seeds at the rate of 12.5 kg ha^{-1} were mixed with 5 kg of wet sand and sown during last week of September (42nd standard week) in all three