STUDIES ON PATH-COEFFICIENT ANALYSIS IN SUNFLOWER

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Abstract

Studies on correlation and path-coefficient analysis in 22 entries comprising 21 hybrids and one variety were made for 15 different characters. Of the fifteen characters studied, six characters - harvest index, total dry matter, 100 seed weight, seed filling, head diameter and kernel oil content had significant correlation with the seed yield at genotypic level. Path analysis revealed that the harvest index had maximum direct effect through kernel oil content and husk percentage. Kernel oil content was the second highest with indirect effect through harvest index and husk percentage. The other four characters which had a strong correlation with seed yield showed very low or negative direct effect, but had a high positive indirect effect through harvest index and kernel oil content. This clearly suggests that the seed yield in sunflower can be increased by increasing the harvest index and kernel oil content.

Introduction

Information on the nature of and magnitude of variation present in the available material and association among the various morphological characters is a pre-requisite for any programme of breeding for high yields. Further, yield being a complex character, it is not only influenced by a number of other characters but also by environment to a great extent. Mutual association of plant characters which is determined by correlation coefficients is useful as a basis for selecting the desirable parents. This permits evaluation of relative influence of various characters on yield. Path co-efficient analysis is helpful in partitioning the correlation coefficients into direct and indirect effects, so that the relative contribution of each component character to the end product 'yield' could be assured. This paper presents information on the relative contribution of different metric units towards seed yield.

Materials and Methods

The material for the present study consisted of 22 genotypes comprising 21 hybrids and one released open pollinated

variety Armsvirieki 3497 (EC.68415). The hybrids were obtained by crossing a common female parent CMS.234 to 21 different male parents viz., RMA.17, 65, 83, 111(O), 111, 113, 128, 134, 152, 204, 210, 212, 223, 232, 235, 245, 274, 304, 361, 381 and 6D-1. The experiment was laid out in a randomized Complete Block Design with three replications. The crop was raised during rainy season of 1982 following all the recommended package of practices. Observations from five competitive random plants were recorded on the following fifteen characters. 1. Days to 50 per cent flowering, 2. No.of leaves per plant. 3. Leaf area, 4. Plant height, 5. Stem girth, 6. Capitulum diameter, 7. Days to maturity, 8. Seed filling, 9. Plant yield, 10. Test weight, 11. Hull content, 12. Total dry matter, 13. Harvest index, 14. Seed oil content and 15. Kernel oil content. The path co-efficient analysis was carried out as suggested by Dewey and Lu (1959).

Results

Studies on genotypic correlations were made between yield and fourteen other characters. Characters such as head diameter, seed filling, seed test weight (100 seed weight), total dry matter, harvest index and kernel oil content showed positive significant correlation (Table 1). The trend of direct and indirect effects of various component characters on seed yield were similar both at phenotypic and genotypic levels. However, the data at genotypic level only is presented. Harvest index showed the greatest direct effect on seed yield (1.970), followed by kernel oil content (1.852) and days to 50 per cent flowering (0.400). Number of leaves per plant, stem diameter and head diameter had low positive direct effects. The other characters such as number of leaves per plant, leaf area, husk percentage and kernel oil content showed negative direct effects. It was found that most of the component characters have exerted positive indirect effects through plant height, stem diameter, head diameter, and kernel oil content.

Discussion

Path-coefficient analysis at genotypic level reveals that harvest index exert the greatest influence both directly (1.970) and indirectly to seed yield. Further, this component has maximum positive correlation of 0.972. It also had the maximum indirect effect through kernel oil content. Kernel oil content itself had a very high direct effect on seed yield with a good amount of indirect effect through harvest index. Although the component characters viz., total dry matter and seed filling have significant correlation with seed yield, their direct effects are negative. But they have acted indirectly though harvest index and kernel oil content. Likewise, head diameter

is also significantly correlated with seed yield, but its direct effect is very low. This again has acted through harvest index. Earlier workers (Varshney and Basudeo Singh, 1977 and Giriraj et al., 1979) have reported that plant height, head diameter and seed filling influenced the seed yield directly. In the present study all these characters have influenced yield through harvest index and kernel oil content. A close scrutiny of genotypic correlation and path co-efficient clearly indicates that harvest index and kernel oil content contribute considerably to the seed yield, and, therefore, selection in the direction of increased harvest index and kernel oil content should be made to improve the seed yield in sunflower. A similar observation has been made by Putt (1943) and Russell (1953).

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Table 1. Direct (diagonal) and indirect effects of different quantitative traits on seed yield (X_9) at genotypic level

Characters	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	Genotypic correlation with yield
X_1	0.400	-0.086	-0.145	0.001	0.022	0.012	-0.012	0.036	-0.145	-0.130	-0.085	-0.098	-0.227	0.286	0.068
X_2	-0.116	0.297	0.093	0.003	-0.022	0.007	-0.003	-0.117	-0.104	0.206	-0.094	0.508	-1.498	1.041	0.221
X_3	0.481	-0.230	-0.121	-0.003	0.011	0.025	-0.0007	0.007	-0.069	-0.199	-0.222	0.398	0.531	-0.307	0.301
X_4	0.046	0.154	0.046	0.005	0.006	0.022	-0.0008	-0.146	-0.042	0.182	-0.114	0.355	-1.215	0.869	0.230
X_5	0.320	-0.025	-0.049	0.001	0.028	0.037	0.002	-0.031	-0.072	-0.080	-0.241	0.366	-0.037	0.110	0.372
X_6	0.061	0.036	-0.049	0.002	0.016	0.063	0.002	-0.172	-0.078	-0.141	-0.254	0.675	0.203	0.053	0.439
X_7	0.695	0.134	-0.013	0.0006	0.010	-0.018	-0.007	-0.015	0.040	0.035	0.007	-0.785	-0.914	0.856	-0.272
X_8	-0.042	0.173	0.004	0.004	0.004	0.054	-0.0005	-0.201	-0.130	0.121	-0.234	0.870	-0.839	0.730	0.485
X_{10}	0.020	0.075	-0.020	0.0005	0.001	0.012	0.0006	-0.063	-0.413	0.150	-0.301	1.822	-1.239	0.819	0.864
X_{11}	0.081	-0.095	-0.037	-0.001	0.003	0.013	0.0003	0.038	0.097	-0.641	0.023	-0.940	2.797	-1.706	-0.267
X_{12}	0.078	0.084	-0.061	0.001	0.015	0.036	0.0001	-0.108	-0.285	0.034	-0.436	1.716	-0.601	0.501	0.954
X_{13}	-0.020	0.076	-0.024	0.001	0.005	0.021	0.002	-0.088	-0.382	0.273	-0.380	1.970	-1.461	0.978	0.972
X_{14}	0.030	0.151	0.021	0.002	0.0003	-0.004	-0.002	-0.057	-0.174	0.610	-0.085	0.970	-2.939	1.847	0.377
X_{15}	0.061	0.167	0.020	0.002	0.001	0.001	-0.002	-0.079	-0.182	0.590	-0.118	1.041	-2.931	1.852	0.424

Residual = 0.0546

X_1 = Days to 50 per cent flowering
X_2 = Number of leaves per plant
X_3 = Mean leaf area
X_4 = Plant height
X_5 = Stem diameter
X_6 = Head diameter
X_7 = Days to maturity
X_8 = Seed filling
X_9 = Seed yield
X_{10} = 100 seed weight
X_{11} = Husk percentage
X_{12} = Total dry matter
X_{13} = Harvest Index
X_{14} = Seed oil content
X_{15} = Kernel oil content