Table 2. The chlorophyll content in leaves of gerbera plant grown under shading nets permitting different intensity of light

Percentage of natural light intensity	Chlorophyll 'a' (mg/g)	Chlorophyll 'b' (mg/g)	Total Chlorophyll (mg/g)
100	0.826	0.725	1.551
85	1.057	1.034	2.091
75	1.123	1.294	2.417

plant growth and flower. In the present investigation, air temperature under shade did not differ from the open conditions because of free movement of air through the nets. It is therefore, logical to conclude that increased rate of plant growth and flower production could be the result of reduction in the intensity of natural light reaching on the plant. This observation derives support from the fact that plants under the shade had more chlorophyll than those grown in open. Destruction of chloroplast by very high intensity of light in some species of plants is a well known fact (Nelson, 1985).

No significant difference in the yield of flowers and their quality was observed from the plants, whether they were under complete cover, top cover or without cover. Normally day temperature inside the complete plastic cover remained comparatively higher than the open but no such difference was observed in the night temperature. Therefore, during the night period, growth activity of crown remained retarded irrespective of cover. The night temperature during this period dropped to 5°C-7°C and thus all the treatments failed to maintain the critical temperature of about 12°C (which is considered optimum for flower production by Leffring (1975) and Goldsberry (1989) and consequently resulted in reduced growth activity of crown.

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CHARACTER ASSOCIATION AND PATH COEFFICIENT ANALYSIS OF COMPONENTS OF SEED YIELD IN SESAME

K. THIYAGARAJAN AND T. RAMANATHAN

Department of Oilseeds
School of Genetics
Tamil Nadu Agricultural University
Coimbatore 641 003

ABSTRACT

Studies on association analysis revealed that seed yield per plant in sesame (*Sesamum indicum* L.) was positively correlated with number of capsules on branches, total dry matter production, plant height, oil content, capsule bearing portion of main stem, first capsule bearing node, harvest index, 1000 seed weight, and capsule length and possessed positive direct effect and positive indirect effect via other characters on seed yield.

KEY WORDS : Sesame, Genotypic Correlation, Path Coefficient Analysis, Seed Yield

Seed yield is a complex metric trait which is the end result of interrelated traits. Path analysis facilitates the partitioning of the correlation coefficients into direct and indirect effects of various characters on seed yield or any other attributes. It also permits the study of specific forces acting to produce a given correlation in correlated variables.

MATERIALS AND METHODS

The materials for the present study consisted of 60 hybrids and 23 parents. The hybrids were obtained by crossing 20 lines and 3 testers in L x T mating design. The 60 hybrids and 23 parents were studied in 6 different environments created by planting the experimental materials at three seasons, *kharif* 1991, *rabi* 1991 and summer 1992 in red soil and black soil conditions. The experiment was sown in randomised block design with three replications in each of the above environments. A single row of 4.5 m length was allotted to each genotype for each replication with a spacing of 45 cm between successive rows and 15 cm between plants within the row. Data were recorded on five randomly selected competitive plants from each plot. The pooled data over six environments were used for the estimation of genotypic correlation coefficients (Johnson *et al.*, 1955) and path coefficient analysis (Dewey and Lu, 1959).

RESULTS AND DISCUSSION

Seed yield was positively correlated with days to maturity, plant height, first capsule bearing node, capsule bearing portion of main stem, number of branches, number of capsules on main stem, number of capsules on branches, number of capsules per plant, capsule length, 1000 seed weight, total dry matter production (TDMP) and harvest index and days to fifty per cent flowering (Table 1). Similar findings were earlier reported for the positive correlation of seed yield with number of capsules per plant, plant height, number of branches, 1000 grain weight, number of capsules on main stem, capsule length and number of seeds per capsule. However, Rai *et al.*, (1981) reported that seed yield was negatively correlated with capsule length.

The characters showing strong positive correlation with seed yield such as plant height, first capsule bearing node, capsule bearing portion of main stem, number of nodes on main stem, number of branches, number of capsules on main stem, number of capsules on branches, number of capsules per plant, capsule length and TDMP also showed strong positive association among themselves. Similar positive inter relationships among the yield components have been observed by many workers including Omar Sheik (1989).

The direct and indirect contributions of 16 characters on seed yield per plant are presented in Table 2. Number of capsules on branches had the maximum positive direct effect on seed yield, followed by TDMP, plant height, oil content, capsule bearing portion of main stem, first capsule bearing node, harvest index, 1000 seed weight and capsule length. Of the characters studied, capsule bearing portion of main stem, first capsule bearing node, number of nodes on main stem and number of capsules on branches showed strong positive association with seed yield and also among themselves. Among these characters, number of capsules on branches, total dry matter production and plant height showed high positive direct effects as well as indirect effects through each other. However, number of nodes on main stem exhibited only negative direct effect. But the overall effect was found to be positive and significant and this may be attributed to high positive indirect effect, mainly through number of capsules on branches, capsule bearing portion of main stem, plant height and TDMP.

The direct positive effect of plant height on seed yield as observed in the present study was reported by Govinda Rasu (1982) and negative direct effect of plant height on seed yield was observed by Dixit (1975). The character, oil content exhibited a positive direct effect on seed yield but had no significant correlation with seed yield. This may be due to the neutralisation of this positive direct effect by the negative indirect effects through all the chracters except number of nodes on main stem, number of branches, number of capsules on main stem, number of capsules per plant and 1000 seed weight.

Table 1. Genotypic correlation coefficients among characters (pooled over environments)

Characters	Days to 50 per cent flowe ring	Days to maturity	Plant height	First capsule bearing node	Capsule bearing portion of main stem	No. of nodes on main stem	No. of bran ches	No. of capsules on main stem	No. of capsules on branches	No. of capsules per plant	Capsule length	Seeds per capsule	1000 seed weight	TDMP	Harvest index	Oil content	Geno typic 'r' with seed yield
Days to 50 per cent flowering	1.0000	0.8430**	0.3759**	0.2161*	0.1847	0.0665	-0.0224	0.0156	-0.1960	-0.1516	-0.1741	-0.1696	0.3502**	0.4544**	-0.4730*	0.2560*	0.2711*
Days to maturity		1.0000	0.6040**	0.6703**	0.3681**	0.1614	0.1471	0.2088	0.0226	0.0872	0.2568*	-0.0798	0.2220*	0.4892**	-0.2137*	0.1966	0.4286**
Plant height			1.0000	0.9281**	0.7047**	0.2461*	0.4824**	0.5962**	0.4601**	0.4857**	0.5314**	-0.0077	0.0636	0.5826**	-0.2081	0.1108	0.5330**
First capsule bearing node				1.0000	0.9081**	0.9616**	0.7243**	0.9101**	0.7673**	0.8137**	0.5631**	0.1238	0.1152	0.5910**	-0.1519	-0.1602	0.6494**
Capsule bearing portion of main stem					1.0000	0.5996**	0.6968**	0.7526**	0.6269**	0.7027**	0.9077**	0.0806	0.2629*	0.5698**	0.1067	-0.1838	0.8004**
No. of nodes on main stem						1.0000	0.8286**	0.5663**	0.5067**	0.5733**	0.9031**	0.0459	0.3277**	0.5185**	0.1384	-0.7905**	0.6188**
No. of branches							1.0000	0.6087**	0.7407**	0.7849*	-0.9459**	-0.0972	-0.0381	0.5146**	-0.2066	-0.3892**	0.4249**
No. of capsules on main stem								1.0000	0.4783**	0.6214**	0.9245**	0.0729	0.1957	0.1908	0.1156	-0.4747**	0.4801**
No. of capsules on branches									1.0000	0.9864**	0.9043**	-0.0098	0.0127	0.5477**	-0.0860	-0.2289*	0.5144**
No. of capsules per plant										1.0000	0.9242**	0.0376	0.0640	0.5063**	-0.0656	-0.2752*	0.5280**
Capsule length											1.0000	0.1561	0.1276	0.4616**	-0.1345	-0.3039**	0.6089**
Seeds per capsule												1.0000	0.4938**	0.0739	0.1972	-0.0223	0.2096
1000-seed weight													1.0000	0.3390**	0.0178	0.0082	0.4801**
TDMP														1.0000	-0.1271	-0.0328	0.7442**
Harvest index															1.0000	-0.2308*	0.4532**
Oil content																1.0000	-0.1620

* Significant at P=Five per cent ** Significant at P=One per cent

ble 2. Path coefficients - direct effect (Underlined) and indirect effects (pooled over environments)

Characters	Days to 50 per cent flowering	Days to maturity	Plant height	First capsule bearing node	Capsule bearing portion of main stem	No. of nodes on main stem	No. of branches	No. of capsules on main stem	No. of capsules on branches	No. of capsules per plant	Capsule length	Seeds per capsule	1000 seed weight	TDMP	Harvest index	Oil content	Genotypic 'r' with seed yield
ays to 50 per ..nt flowering	<u>-0.4954</u>	-0.2853	0.1421	0.0471	0.0660	0.0306	-0.0007	0.7078	-0.6542	0.0461	-0.0224	-0.2083	0.2898	0.5074	-0.0919	0.1947	0.2711*
ays to aturity	-0.5899	<u>-0.4584</u>	0.4407	0.0939	0.1578	-0.1849	-0.0099	-0.0818	0.3760	-0.0680	-0.0210	-0.1321	0.2443	0.5462	-0.0460	0.1490	0.4286**
lant height	-0.3557	-0.7590	<u>0.8075</u>	0.1798	0.2407	-0.6063	-0.0282	-1.6607	2.0967	-0.1408	-0.0010	-0.0378	0.1089	0.6505	-0.0448	0.0843	0.5330**
irst capsule earing node	-0.3947	-0.9322	0.6575	<u>0.2760</u>	0.9304	-0.9103	-0.0522	-2.7696	3.5107	-0.1492	-0.0163	-0.0685	0.0685	0.0327	-0.1218	0.6494	-0.1218
apsule aring rtion of ain stem	-0.2168	-0.5349	0.7111	0.2552	<u>0.5863</u>	-0.8758	-0.0356	-2.2629	3.0319	-0.2854	0.0106	-0.1564	0.0536	0.6362	0.0229	-0.1396	0.8004**
o. of nodes n main stem	-0.0950	-0.1869	0.6257	0.1530	0.9777	<u>-1.0414</u>	-0.0268	-1.8253	2.4735	-0.2734	0.0060	-0.1949	0.0192	0.5789	0.0297	-0.6013	0.6188**
o. of ranches	-0.0996	-0.3661	0.4762	0.1778	0.8102	-1.267	<u>-0.0288</u>	-2.6738	3.3866	-0.2507	-0.0128	0.0227	-0.0070	0.5746	-0.0444	-0.2960	0.4249**
o. of apsules on ain stem	-0.1230	-0.4525	0.7243	0.1921	0.5537	-0.7650	-0.0474	<u>-1.7265</u>	2.6811	-0.3510	0.0096	-0.1164	0.0045	0.2130	0.0249	-0.3611	0.4801**
o. of apsules on ranches	-0.0133	-0.3492	0.5045	0.1600	0.4944	-0.9310	-0.0226	-3.6094	<u>4.2558</u>	-0.3296	-0.0012	-0.0075	-0.0668	0.6115	-0.0185	-0.1726	0.5144**
o. of apsules per lant	-0.0514	-0.3687	0.5380	0.1793	0.5608	-0.9865	-0.0294	-3.5604	4.3143	<u>-0.3293</u>	0.0049	-0.0381	-0.0439	0.5654	-0.0141	-0.2096	0.5280**
apsule length	-0.1512	-0.4034	0.3703	0.2749	1.0087	1.1883	-0.0628	-4.4879	5.3618	-0.2650	<u>0.0205</u>	-0.0759	-0.0604	0.5154	-0.0289	-0.2312	0.6069**
eeds per apsule	0.0470	0.0058	-0.0814	0.0205	0.0449	0.1222	-0.0034	0.0355	0.1622	-0.0411	0.1321	<u>-02937</u>	-0.0491	0.0825	0.424	-0.0169	0.2096
000 seed eight	-0.1307	-0.0483	0.0757	0.0671	0.3204	0.0479	-0.0092	-0.0459	0.2763	-0.0338	0.0662	0.05949	<u>0.1015</u>	0.3786	0.0038	0.0062	0.4801**
TDMP	-0.2861	-0.4122	0.3386	0.1454	0.5069	-0.6468	-0.0090	-1.9769	2.1847	-0.1223	0.0097	-0.2017	0.1317	<u>1.1166</u>	-0.0273	-0.0250	0.7442**
arvest index	0.1258	0.1580	-0.0899	0.0272	0.1363	0.2596	-0.0064	0.3105	-0.2830	0.0356	0.0260	-0.0106	-0.1238	-0.1419	<u>0.2152</u>	-0.1756	0.4532**
il content	-0.1157	-0.0841	-0.1053	-0.0168	-0.7729	0.4892	0.0225	0.8192	-1.1890	0.0806	-0.0029	-0.0049	0.0742	-0.0367	-0.0496	<u>0.7606</u>	-0.1620

esidual effect = 0.2996 * Significant at P = Five per cent level ** Significant at P = One per cent level.

The path coefficient analysis revealed that yield was more influenced by capsule bearing portion of main stem, TDMP, number of first capsule bearing node, number of nodes on main stem, capsule length, plant height, number of capsules per plant, number of capsules on branches, 1000 seed weight, number of capsules on main stem, harvest index, days to maturity and number of branches. However, significant genotypic correlation possessed by number of capsules on main stem, number of nodes on main stem, days to maturity, number of capsules per plant and number of branches have turned out to a negative direct effect.

On the other hand, number of capsules on branches, TDMP, plant height, capsule bearing portion of main stem, first capsule bearing node, harvest index, 1000 seed weight and capsule length which had significant positive genotypic correlation with seed yield continued to have positive direct effect and positive indirect effect via other characters, indicating thereby that these attributes can be relied upon for selection in a breeding programme for yield improvement.

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COMBINING ABILITY STUDIES IN GROUNDNUT

S.KALAIMANI AND S.THANGAVELU

Regional Research Station
Tamil Nadu Agricultural University
Vridhachalam 606 001

ABSTRACT

Five rust resistant and four rust susceptible groundnut (*Arachis hypogaea* L.) genotypes were crossed in all possible combinations to study the nature of combining ability and gene action involved for 13 quantitative traits. Combining ability analysis showed the importance of GCA variance alone for number of primary branches and days to 50 per cent flowering while for the remaining characters, both the GCA and SCA variances were important with predominance of GCA indicating the scope for exploiting the available additive components. The rust resistant Virginia genotypes VG 78 and CS 31 were the best general combiners for yield and yield components while the two Spanish types CO 1 and VRI 1 for earliness, number of mature pods per plant and harvest index and VRI 1 for oil content also. Inter-subspecific hybridisation between the Spanish and Virginia genotypes followed by intermating is advocated to exploit both the additive and non-additive components.

KEY WORDS : Groundnut, Combining Ability

Rust caused by the *Puccinia arachidis* Speg. affects the yield and quality of ground nut *Arachis hypogaea*L. considerably. Therefore one of the objectives in groundnut breeding programmes is to develop disease resistant varieties. To breed resistant varieties, the most primary requisite is the identification of resistant sources. After identification of resistant genotypes, selection of donors possessing better combining ability for yield and yield attributes is necessary to produce superior