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Research Note

Comparison between correlation and path analysis studies in the full sib progenies and F_3 bulk population among yield and its attributes in two crosses of greengram (*Vigna radiata* L. Wilczek)

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Abstract:
Investigations to know the nature and magnitude of associations among 11 quantitative traits and their contribution towards seed yield was carried out in 30 full sib progenies of 2 crosses *viz.,* LGG 410 x LGG 450 and RMG 406 x MGG 330 and their corresponding F_3 bulk populations of greengram. The results revealed that number of pods per plant, number of clusters per plant and number of seeds per pod had positive and significant association with seed yield in the FSII (RMG 406 x MGG 330) progenies. While, plant height with seed yield, seeds per pod and pods per plant with pod length in FS I (LGG 410 x LGG 450) progenies compared to non- significant positive correlation were observed in their respective F_3 bulk population. Path analysis revealed that positive direct effect of clusters per plant and seeds per pod in FS I and days to 50% flowering , plant height, pods per plant and 100- seed weight in FS II were strengthened over their F_3 bulk population.

Key words: Greengram, full sib progenies, association and path analysis

Greengram (*Vigna radiata* L.Wilczek) is third most important pulse crop in India after chickpea and pigeonpea because of its high protein content (25%). Being a short duration, photo and thermo insensitive grain legume, it can be easily fit in relay and multiple cropping systems. Autogamous species like greengram place a restriction on genetic recombination since selfing and repeated selections lead to rapid fixation of linked genes, preclude free exchange of favourable gene constellations, there by limits the genetic variability. To overcome these limitations, various plant breeders attempted the intermating to elevate population mean and genetic variability in self pollinated crops (Srivastava *et al.,* 1989). Though conventional breeding methods were significant and productive in their own light, but impose restriction on the chance of recombination because of larger linkage blocks. Hence, the present investigation was planned to compare the performance of full sib and selfed progenies of selected crosses in F_3 with a view to establish the relative superiority of the intermated progenies, if any over the conventionally bred progenies in terms of the shift in character associations.

Experimental material for the present study comprised 60 full sib progenies of two crosses *viz.,* LGG 410 x LGG 450 (FS I) and RMG 406 x MGG 330 (FS II), their two F_3 bulk populations and their four parents were sown in a randomized block design with three replications at S.V.Agricultural college farm, Tirupati.

Two F_2 crosses *viz.,* LGG 410 x LGG 450 and RMG 406 x MGG 330 were selected based on their yield performance in F_2 generation with high x high and high x low gca performance, respectively and were used for generating full sib progenies. In each cross 60 plants were randomly selected and full sibs were produced by making pair selection of female and male plants respectively, each female plant was crossed with corresponding selected male plant only. Thus, totally 60 full sib progenies were obtained i.e., 30 progenies from each of the F_2 generation of above mentioned crosses.

Each full sib progeny and parents were sown in three rows of 3 m length, while, F_3 bulk population was sown in 8 rows with 3 m length. The spacing adopted between rows was 45 cm and 15 cm between plants.

All the recommended package of practices were followed to raise a normal crop. Randomly selected 10, 20 and 5 plants were tagged in each entry of F_3 bulk, full sib progenies and parents, respectively for recording the data on 11 quantitative characters. The genotypic correlations were worked out by using the formula suggested by Johnson *et al.* (1955) and path analysis in accordance with Dewey and Lu (1959).

The nature and magnitude of genotypic correlation coefficient obtained among 11 quantitative characters in full sib progenies of two crosses *viz.,* LGG 410 x LGG 450 (FS I) and RMG 406 x MGG 330 (FS II) and their F_3 bulk population (CI and CII) are given in Table 1. The results revealed that two new significant positive correlations were established among the characters *viz.,* pods per plant with harvest index and clusters per plant with seed yield per plant in the full sib progenies of the cross LGG 410 x LGG 450 than their corresponding F_3 bulk population. It was observed that the association between plant height with days to 50% flowering and days to maturity found to be negative and significant in CI bulk population were found to be positive and non-significant in full sib progenies which indicated the possibility of improvement of full sib progenies through the selection of dwarf plants with late maturity.

In full sib progenies the magnitude of positive correlation was further strengthened than in CI bulk population for the character pair associations between pods per cluster and days to 50% flowering, clusters per plant and pod length with days to maturity, pod length with clusters per plant, pod length with seeds per pod, harvest index with seed yield. Similar results were reported by Srivastava *et al*, (1989) and Pooranchand (1997).

In full sib progenies of RMG 406 x MGG 330, 10 new positive significant associations were established among the character pairs than in CII. This shows the possibility of simultaneous selection of these character pairs. The association between the character pairs *viz.,* days to maturity and plant height with harvest index, and clusters per plant with pods per cluster turns into negative and significant association in full sib progenies. In FSII progenies, the magnitude of positive correlation increased than that of CII bulk population for 13 character pairs.

Significant positive association of pods per plant and clusters per plant with seed yield were strengthened, which was the main cause for increase in the yield in F_3 bulk populations than in full sib progenies of LGG 410 x LGG 450. This kind of positive and desirable shifts are the evidences of breakage of linkage and release of latent variability. But in case of RMG 406 x MGG 330 the yield was high in F_3 bulk population than in full sib progenies due to negative effects of yield contributing characters in full sib progenies. But the individual progenies were obtained with high yield over its base population.

The path coefficients of FS I and CI populations, revealed the impact of full sib mating in F_3 and were apparent in changing the direct effects of majority of the characters on seed yield in favourable direction (Table 2). The significant impact of full sib mating resulted in the increase in the magnitude of direct effects of clusters per plant and seeds per pod from C I to FSI progenies. The negative direct effects of pods per plant and harvest index weakened and resulted in positive correlation with seed yield. These results indicated the prevalence of coupling phase linkage of these characters with seed yield in FS I. Contrary to this, a considerable decrease in the direct effect of plant height, pod length and 100- seed weight on seed yield was observed from CI to FSI, which could be attributed to breakage of coupling phase linkages between these traits.

As for as indirect effects were concerned , as many as 32 character pairs turned from negative in CI bulk population to positive in full sib progenies. However, reverse was the case that was observed for 15 character combinations in FSI progenies. Further, it was observed that the magnitude of indirect effects of about 36 character pairs were weakened and 37 character pairs were strengthened in full sib progenies in both negative and positive directions but the indirect effects of 9 character pairs were strengthened and 8 character pairs were weakened in FSI than the CI, in positive direction.

The path coefficients among FS II progenies and CII populations revealed that intermating in F_3 was found to be effective in shifting of direct effects of 100-seed weight, pods per plant and plant height on seed yield from a negative value in CII to a positive value in FSII. This is a clear instance of favourable impact of full sib mating in altering the nature and magnitude of the direct effects of component characters on seed yield that could be attributed to the breakage of repulsion phase of linkages. However, the direct effects of clusters per plant, harvest index and pods per cluster were decreased in FS II in comparison with C II. These results are in conformity with the earlier findings of Neemathullah and Jha (1993) and Pooranchand (1997).

Indirect effects of 27 characters were turned into positive effects in FSII from that of negative effects in CII bulk population while, the direction of indirect contribution of 16 characters were changed from positive in CII bulk population to negative in FS II progenies. Further it was observed that the magnitude of indirect effect of about 12 character pairs were weakened and 16 character pairs were strengthened in full sib progenies.

To conclude full sib mating of F_3 progenies were effective in changing the negative direct effects of the characters *viz.,* days to 50% flowering, pods per plant, 100- seed weight and harvest index in FS II, pods per cluster in FS I on grain yield in favourable direction compared to their respective F_3 bulk populations. This increase in direct effects might have resulted from breakage of linkages in repulsion phase. Further these changes will have a bearing on selection, as these characters are more suitable for visual selection at field level.

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Table 1. Genotypic correlation coefficients of different traits towards seed yield in two full sib progenies and F_3 populations in green gram

Character	Population	Days to maturity	Plant height (cm)	*Number of clusters /plant*	Number of pods per plant	Number of pods /cluster	Number of seeds/ pod	Pod length (cm)	100-seed weight (g)	Harvest index	Seed yield (g)
Days to 50% floweri	C I	0.8288**	-0.5188**	*-0.4548**	-0.4855*	-0.2937	0.0038	0.2366	-0.6837**	-0.2206	0.3525
	FS I	0.9007**	0.0878	*-0.0218*	-0.3579	0.4253*	-0.2448	0.0268	0.3915*	-0.0210	-0.4378*
	C II	0.9517**	0.4424*	*0.2502*	-0.2971	-0.4544*	0.0933	0.2508	0.3264	-0.2152	-0.0116
	FS II	0.3686*	-0.0663	*0.0292*	0.0670	0.2667	-0.1622	-0.0367	-0.1245	0.0454	-0.0691
Days to maturit y	C I		-0.4517*	*-0.6628***	-0.6647**	-0.3581	0.1758	0.2955	-0.8285**	-0.3997	-0.5465**
	FS I		0.1252	*0.0150*	-0.3890*	0.2060	-0.0810	0.1849	0.4958**	-0.0166	-0.3201
	C II		0.5687**	*0.1363*	-0.6645*	0.7659*	-0.0396	0.2016	0.5704**	-0.5438**	-0.3896
	FS II		-0.3020	*-0.0798*	0.0535	0.3786*	-0.0813	-0.1772	0.2024	0.2022	0.0202
Plant height (cm)	C I			*0.5648***	-0.2057	-0.6781**	0.0508	-0.1621	-0.1538	-0.8980**	0.3140
	FS I			*4692***	0.2316	0.0074	0.1542	0.0496	0.1949	0.4903**	0.2970
	C II			*0.3525*	-0.1076	-0.2017	-0.7041**	0.0583	-0.2507	-0.6476**	-0.3155
	FS II			*0.3712**	0.5039**	0.2000	0.1599	0.3025	-0.3788*	0.2623	0.4463*
Numbe r of clusters	C I				-0.1972	-0.5764**	0.8025**	0.0575	-0.0936	-0.4964*	0.4264**
	FS I				0.2005	0.0537	0.3137	0.2578	0.1090	0.4003*	0.4140*
	C II				0.1462	-0.3588	0.5673	0.1009	0.3059	0.4823*	0.8123**
	FS II				0.5688**	0.0949	0.1883	0.1321	-0.1087	0.2429	0.5317**
Numbe r of pods	C I					0.9376**	-0.1052	-0.5854**	0.5067*	0.3352	0.2609
	FS I					0.1667	0.1769	-0.0859	-0.2621	0.7168**	0.3690*
	C II					0.9213**	-0.6686**	0.4433	-0.8703**	0.5292**	0.5555*
	FS II					0.6255**	0.2091	0.4489*	-0.2723	0.6308**	0.8322**
Numbe r of pods	C I						-0.4195*	-0.4426*	0.5698**	0.4961*	0.0971
	FS I						-0.8140**	-0.1189	-0.2790	-0.3190	-0.3835*
	C II						-0.8697**	0.4929*	-0.6664**	0.4225*	0.2665
	FS II						0.1141	0.2984	-0.3031	0.4137	0.4779**
Numbe r of seeds	C I							0.1118	-0.4925*	0.1556	0.3625
	FS I							0.2855	-0.3468	0.3642*	0.5557**
	C II							-0.2081	0.7694**	0.7283**	0.5868**
	FS II							0.5511**	0.2903	0.5340**	0.6273**
Pod length (cm)	C I								-0.4136*	0.9176**	0.3054
	FS I								0.1170	0.0982	0.3042
	C II								-0.3774	0.2563	0.3825
	FS II								0.0459	0.5034**	0.6464**
100-seed weight	C I									0.9327**	0.4572*
	FS I									-0.5454**	0.0171
	C II									-0.2003	-0.2104
	FS II									0.0227	0.1460
Harves t index	C I										0.3006
	FS I										0.1233
	C II										0.9075**
	FS II										0.7024**

C I: F3 bulk population of LGG 410 x LGG 450
FS I : Full sib progenies of LGG 410 x LGG 450
C II : F3 bulk population of RMG 406 x MGG 330
FS II: Full sib progenies of RMG 460 x MGG 330

Table 2. Direct and Indirect effects of different traits towards seed yield in two full sib progenies and F3 populations of green gram

Character	Population	Days to flowering	Days to maturity	Plant height (cm)	Number of clusters per plant	Number of pods per plant	Number of pods per cluster	Number of seeds per pod	Pod length (cm)	100-seed weight (g)	Harvest index	Seed yield (g)
Days to 50% flowering	C I	0.093	-0.616	-0.045	0.221	-0.821	0.803	0.000	-0.056	-0.348	-0.138	0.3525
	FS I	0.233	-0.514	0.026	-0.003	0.021	-0.114	-0.127	0.005	0.034	0.004	-0.4378*
	C II	-0.324	0.487	0.173	0.012	-0.007	-0.134	-0.103	-0.022	0.072	-0.254	-0.0116
	FS II	-0.033	-0.004	-0.006	0.002	0.047	0.018	-0.050	-0.004	-0.038	-0.001	-0.0691
Days to maturity	C I	0.103	-0.056	-0.039	0.322	-1.124	0.979	0.009	-0.070	-0.421	-0.250	-0.5465**
	FS I	0.210	-0.571	0.037	0.002	0.022	-0.055	-0.042	0.033	0.043	0.004	-0.3201
	C II	-0.309	0.512	0.145	0.039	-0.016	-0.226	-0.008	-0.018	0.125	-0.642	-0.3896
	FS II	-0.012	-0.012	-0.029	-0.005	0.038	0.026	-0.025	-0.018	0.062	-0.005	0.0202
Plant height (cm)	C I	-0.048	0.025	0.087	-0.489	-0.348	1.690	-0.003	0.038	-0.078	-0.561	0.3140
	FS I	0.020	-0.072	0.292	0.070	-0.013	-0.002	0.080	0.009	0.017	-0.104	0.2970
	C II	-0.144	0.291	0.255	0.102	-0.003	-0.060	0.099	-0.005	-0.055	-0.796	-0.3155
	FS II	0.002	0.004	0.094	0.022	0.353	0.014	0.049	0.031	-0.116	-0.006	0.4463*
Number of clusters per	C I	-0.042	0.037	0.088	-0.486	-0.333	1.576	-0.042	-0.014	-0.048	-0.310	0.4264*
	FS I	-0.005	-0.006	0.137	0.149	-0.012	0.014	0.163	0.045	0.009	-0.085	0.4104*
	C II	-0.081	0.070	0.090	0.288	0.004	-0.106	-0.079	-0.009	0.067	0.569	0.8123**
	FS II	-0.001	0.001	0.035	0.059	0.398	0.006	0.057	0.014	-0.033	-0.006	0.5307**
Number of pods per	C I	-0.027	0.020	-0.054	0.280	1.585	-2.734	0.022	0.104	0.592	0.310	0.0971
	FS I	-0.083	0.222	0.068	0.030	-0.057	-0.045	0.092	-0.015	-0.022	-0.152	0.0369
	C II	0.097	-0.340	-0.028	0.042	0.025	0.272	0.094	-0.039	-0.191	0.624	0.5555**
	FS II	0.002	-0.001	0.048	0.034	0.700	0.042	0.064	0.046	-0.083	-0.015	0.8322**
Number of pods per	C I	-0.027	0.020	-0.054	0.280	1.585	-2.734	0.022	0.104	0.592	0.310	0.0971
	FS I	0.099	-0.118	0.002	-0.008	-0.010	-0.269	-0.042	-0.021	-0.024	0.007	-0.3835
	C II	0.148	-0.392	-0.052	-0.103	0.023	0.295	0.122	-0.044	-0.229	0.499	0.2665
	FS II	-0.009	-0.004	0.019	0.006	0.436	0.068	0.035	0.031	-0.092	-0.010	0.4779**
Number of seeds per pod	C I	0.000	0.010	0.006	-0.390	-0.178	1.147	-0.052	-0.026	-0.251	0.097	0.3625
	FS I	-0.057	0.046	0.045	0.047	-0.010	0.022	0.519	0.050	-0.030	-0.077	0.5557*
	C II	-0.030	0.009	-0.180	0.164	-0.017	-0.257	-0.140	0.018	0.169	0.860	0.5868*
	FS II	0.005	0.001	0.015	0.011	0.147	0.008	0.305	0.056	0.089	-0.013	0.6237**
Pod length (cm)	C I	0.022	-0.016	-0.014	-0.028	-0.990	1.210	-0.006	-0.235	-0.210	0.573	0.3054
	FS I	0.006	-0.106	0.015	0.038	0.005	0.032	0.148	0.176	0.100	-0.021	0.3042
	C II	-0.082	0.103	0.015	0.029	0.011	0.146	0.029	-0.088	-0.083	0.302	0.3825
	FS II	0.001	0.002	0.029	0.008	0.314	0.020	0.168	0.102	0.014	-0.012	0.6464**
100-seed weight (g)	C I	-0.063	0.046	-0.013	0.046	2.364	-3.180	0.025	0.097	0.509	0.645	0.4752*
	FS I	0.091	-0.284	0.057	0.016	0.015	0.075	-0.180	0.021	0.086	0.115	0.0111
	C II	-0.106	0.292	-0.064	0.088	-0.022	-0.308	-0.108	0.033	0.220	-0.236	-0.2104
	FS II	0.004	-0.002	-0.036	-0.006	-0.191	-0.021	0.089	0.005	0.305	-0.001	0.1460
Harvest index	C I	-0.020	0.022	-0.078	0.241	0.567	-1.356	-0.008	-0.216	0.525	0.625	0.3006
	FS I	-0.005	0.010	0.143	0.060	-0.041	0.009	0.189	0.017	-0.046	-0.211	0.1233
	C II	0.070	-0.279	-0.172	0.139	0.013	0.125	-0.102	-0.023	-0.044	1.180	0.9075**
	FS II	-0.002	-0.002	-0.002	0.014	0.442	0.028	0.163	0.051	0.007	-0.024	0.7024**

Diagonal (bold) – Direct effects, Off diagonal – Indirect effects, Genotypic residual effect - 0.8171(LGG 410 x LGG 450), 0.2024 (RMG 406 x MGG 330)

C I: F3 bulk population of LGG 410 x LGG 450

FS I : Full sib progenies of LGG 410 x LGG 450

C II : F3 bulk population of RMG 406 x MGG 330

FS II: Full sib progenies of RMG 460 x MGG 330