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STUDIES ON CORRELATIONS AND PATH COEFFICIENT ANALYSIS IN CLUSTERBEAN UNDER RAINFED CONDITIONS

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ABSTRACT

Correlation and path coefficient analysis for grain yield and its eomponents were studied in two environments in case of clusterbean (*Cyamopsis tetragonoloba* (Linn.) Taub). Seed yield per plot and seed yield per plant were positively associated with number of pods per plant. Plant height had negative association with number of branches while number of branches had positive association with number of clusters per plant in both the environments. Path analysis at genotypic level revealed that characters like higher number of pods per plant with more number of branches, 100 seed weight and number of seeds per pod with medium early maturing and medium dwarf plant type will give more seed yield per plot in seasons having early cessation of rains. In environment with relatively better distribution of rains, the plant type which have medium tall in plant height, late in maturity and high seed yield per plant together with more number of pods/plant, clusters/plant, seeds/pod and 100 seed weight will result in higher level of seed yield per plot in case of clusterbean.

INTRODUCTION

Path coefficient analysis provides an effective means of partitioning direct and indirect causes of association. Information on these aspects is available in clusterbean (Sanghi and Sharma, 1964; Mital and Thomas, 1969; Tikka, 1975 and Nath and Saini, 1980), but for single environment only. Clusterbean is largely a dryland crop grown under fluctuating environmental conditions. The present study was undertaken to find the type of association and to judge the direct and indirect effects of various quantitative traits on seed yield under different environmental conditions.

MATERIALS AND METHODS

Twenty and twenty seven genotypes of clusterbean collected from its major growing areas of the country, were evaluated in a randomized block design with 3 replications under rainfed conditions during monsoon seasons of 1979 (Environment E 1) and 1980 (Environment E2). Among these, 19 genotypes tried were common during both seasons. In year 1979, the total rainfall received was 691.3 mm. However bulk of the rainfall received was upto 32nd meteorological week and thereafter

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drought conditions prevailed upto maturity of the crop. In year 1980, although quantum of rainfall received was less (228.5 mm) yet had a relatively better distribution in the season. The plot size was $10m^2$. The row to row and plant to plant distances were kept at 45 cm and 15 cm, respectively. The crop received a basal dressing of 20 kg N/ha and 40 kg P_2O_5/ha during both the seasons. Five plants were selected at random from each plot for recording observations on important characters, viz. plant height (cm), number of branches per plant, number of clusters per plant, number of pods per plant, number of seeds per pod, 100 seed weight (g) and seed yield per plant (g). In addition to these, characters like days to flower initiation, days to 50 per cent flowering, days to maturity and seed yield (g) were recorded on plot basis. Phenotypic and genotypic correlation coefficients for all possible combinations were computed according to method given by Al-Jibouri et al. (1958), path coefficients were worked out following Dewey and Lu (1959). The significance of phenotypic correlations were tested according to Fisher and Yates (1963).

RESULTS AND DISCUSSION

The analysis of variance indicated highly significant differences among the genotypes for all the characters (Table 1). The genotypic and phenotypic correlation coefficients of grain yield and 9 other metric traits have been presented in Table 2. Seed yield per plot and per plant were found to be positively and significantly associated with number of pods per plant in both the environments (E1 and E2), while number of clusters per plant in E1. These findings are in agreement with the earlier reports by Sanghi and Sharma (1964), Mital and Thomos (1969), Tikka (1975), Chaudhary and Singh (1976) and Nath and Saini (1980). The low positive association of number of branches per plant, days to flowering and maturity was observed in E1, whereas the latter two traits were significantly and negatively associated with seed yield per plant in E2. Plant height was positively and significantly associated with seed yield per plot in E2. Mital and Thomas (1969) reported positive association between plant height and seed yield while low negative association was reported by Nath and Saini (1980). Days to maturity had significant positive correlation with plant height in E1 and with number of branches per plant in E2 but significant negative association with 100 seed weight and seed yield per plant in E2. Plant height had significant negative association with number of branches per plant in both E1 & E2. Number of branches was positively and significantly associated with number of clusters per plant in both E1 & E2. The significant association of days to maturity with plant height and number of branches per plant with number of clusters per plant is also reported by Nath and Saini (1980).

Path coefficient analysis for seed yield per plot was carried out at genotypic level and is presented in Table 3. In E1, number of pods per plant had the highest positive direct effect, followed by number of branches per plant, initiation of flowering, number of seeds per pod and 100 seed weight, whereas number of clusters per plant and plant height had substantial direct negative effect although these two characters were positi-

Table 1. Analysis of variance of 11 characters of clusterbean in environments E1 (kharif 1979) and E2 (kharif 1980)

Character	Environment	Mean squares	
		Error (df : E1=38, E2=52)	Varieties (df : E1=19, E2=26)
Initiation of flowering	E1	0.41	21.60**
	E2	1.56	8.21**
Days to 50% flowering	E1	0.53	28.03**
	E2	1.30	6.75**
Days to maturity	E1	0.77	101.42**
	E2	1.66	38.75**
Plant height (cm)	E1	4.19	53.27**
	E2	16.11	251.78**
Branches/plant	E1	0.34	7.01**
	E2	0.29	4.60**
Clusters/plant	E1	2.19	7.76**
	E2	0.31	1.35**
Pods/plant	E1	4.78	30.14**
	E2	3.87	58.66**
Seeds/pod	E1	0.14	0.47**
	E2	0.09	0.26**
100-seed wt (g)	E1	0.05	0.36**
	E2	0.03	0.20**
Seed yield/ plant (g)	E1	0.08	2.70**
	E2	0.25	3.40**
Seed yield/ plot (g)	E1	1524.96	5172.62**
	E2	1083.21	17893.83**

**P = 0.01.

vely associated with seed yield per plot. However, these traits contributed to seed yield via no. of pods per plant. Similarly, 100 seed weight, with low negative association in E1, exhibited substantial direct positive effect on seed yield. These findings are in agreement with the findings of Sanghi and Sharma (1964), Tikka (1975), Chaudhary and Singh (1976). Thus the selection programme based on mainly number of pods/plant followed by moderate number of branches, number of seeds per pod & 100 seed weight will lead to further improvement in the productivity of clusterbean in environment like E1. In E2, days to maturity had the highest direct effect, followed by seed yield per plant and plant height. The characters like days to flower initiation, number of seed per pod, number of pods per plant, number of clusters per plant and days to 50 per cent flowering had direct negative effect on seed yield per plot. However, these characters contributed positively via days to maturity, seed yield per plant and plant height. Henry

Table 2. Genotypic (upper right) and phenotypic (lower left) correlation coefficients of eleven quantitative attributes in environment E1 (kharif 1979) and environment E2 (Kharif 1980) in clusterbean.

Characters		Days to initiation of flowering	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches/ plant	No. of clusters/ plant	No. of pods/ plant	No. of seeds/ pod	100 seed weight (g)	Seed yield/ plant (g)	Seed yield/ plot(g)
Initiation of flowering (days)	E1	—	0.97	0.49	−0.07	0.48	1.03	0.57	−0.22	−0.31	0.15	0.27
	E2	—	1.30	1.01	0.01	0.10	0.07	0.11	0.04	0.20	0.04	−0.26
Days to 50% flowering	E1	0.93**	—	0.54	−0.05	0.44	0.45	−0.12	−0.30	−0.19	0.04	0.16
	E2	0.83**	—	0.61	−0.19	0.19	0.05	0.02	−1.27	0.31	0.11	−0.07
Days to maturity	E1	0.46**	0.52**	—	0.55	0.02	0.12	0.24	−0.04	0.24	2.00	0.48
	E2	0.20	0.21	—	0.14	0.34	−0.25	−0.05	0.31	0.31	0.11	−0.07
Plant height	E1	−0.11	−0.09	0.43**	—	−0.66	−0.41	0.22	0.02	0.24	0.21	0.28
	E2	0.09	0.06	0.13	—	−0.34	−0.36	0.26	−0.07	0.16	0.22	2.11
No. of branches/plant	E1	0.44**	0.39*	0.02	−0.56**	—	0.84	0.09	0.23	0.11	0.17	0.26
	E2	0.18	0.15	0.28*	−0.27*	—	0.09	−0.23	−0.02	−0.03	−0.28	−0.22
No. of clusters/plant	E1	−0.35*	0.31*	0.08	−0.25	0.66**	—	0.43	0.08	−0.32	0.43	0.49
	E2	0.15	0.12	−0.07	−0.07	0.93**	—	0.01	−0.35	0.32	−0.85	−2.12
No. of pods/ plant	E1	−0.91**	−0.08	0.22	0.10	0.02	0.24	—	0.32	−0.32	0.85	1.11
	E2	−0.03	−0.03	−0.07	0.20	−0.23	−0.04	—	0.14	−0.64	0.98	0.76
No. of seeds/ pod	E1	−0.16	−0.24	−0.02	−0.03	−0.13	−0.14	0.09	—	−0.48	0.40	0.48
	E2	0.02	0.98**	−0.22	−0.10	−0.01	0.10	0.07	—	0.43	0.40	−0.03
100 seed weight (g)	E1	−0.26	−0.16	0.17	0.16	−0.13	−0.20	−0.20	−0.24	—	−0.06	−0.09
	E2	−0.29*	−0.41**	−0.29*	−0.04	−0.09	−0.16	−0.08	0.27*	—	0.01	−0.06
Seed yield/ plant (g)	E1	0.12	0.03	0.24	0.01	0.17	0.33*	0.68**	−0.21	−0.02	—	1.15
	E2	−0.39**	−0.47**	0.32*	−0.09	−0.26	−0.18	0.68**	0.16	−0.02	—	0.93
Seed yield/ plot (g)	E1	0.12	0.10	0.26	0.05	0.18	0.38*	0.60**	0.07	−0.13	0.72**	—
	E2	−0.06	−0.09	0.17	0.35**	−0.24	−0.05	0.50**	0.14	−0.12	0.72**	—

*P=0.05; **P=0.01

Table 3. Genotypic direct (diagonal) and indirect effect of yield components on yield in environment E 1 (kharif 1979) and environment E2 (kharif 1980) in clusterbean.

Characters		Effect via										Genotypic correlation with yield/plot (g)
		Initiation of flowering (days)	Days to 50% flowering	Days to maturity	Plant height (cm)	No of branches/ plant	No. of clusters/ plant	No. of pods/ plant	No. of seeds/ pod	100 seed wt (g)	Seed yield/ plant (g)	
Initiation of flowering (days)	E1	0.6828	—0.0022	0.1060	0.0151	0.3787	—1.4770	0.7495	—0.0734	—0.0971	—0.0128	0.2698
	E2	—2.0732	—0.4520	2.3318	0.0139	0.0016	—0.0130	—0.0518	—0.0619	0.0132	—0.0572	—0.2606
Days to 50% flowering	E1	0.6620	—0.0023	0.1155	0.0109	0.3467	—0.6533	—0.1580	—0.0989	—0.0593	0.0033	0.1666
	E2	—2.6952	—0.3477	1.4083	—0.2644	0.0015	—0.0093	—0.0094	1.9657	—0.0204	0.1858	0.2149
Days to maturity	E1	0.3356	—0.0012	0.2157	—0.1166	0.0126	—0.1738	0.3180	—0.0148	0.0735	—0.1744	0.4746
	E2	—2.0939	—0.2121	2.3087	0.1949	0.0055	0.0465	0.0235	—0.4798	—0.0204	0.1572	—0.0699
Plant height (cm)	E1	—0.0487	0.0001	0.1190	—0.2113	—0.5134	0.5919	0.2907	0.0081	0.0748	—0.0184	0.2928
	E2	—0.0207	0.0661	0.3232	1.3918	—0.0055	0.0670	—0.1223	0.1083	—0.0105	0.3144	2.1118
No. of branches/plant	E1	0.3307	—0.0010	0.0035	0.1387	0.7822	—1.2001	0.1121	0.0776	0.0350	—0.0149	0.2568
	E2	—0.2073	—0.0661	0.7850	—0.4732	0.0162	—0.0167	0.1082	0.0310	0.0020	—0.4001	—0.2210
No. of clusters/plant	E1	0.7022	—0.0010	0.0261	0.0871	0.6536	—1.4362	0.5708	0.0280	—0.0976	—0.0372	0.4958
	E2	—0.1451	—0.0174	—0.5772	—0.5010	0.0015	—0.1860	—0.0047	0.5417	—0.0211	—1.2147	—2.1240
No. of pods/ plant	E1	0.3884	0.0003	0.0520	—0.0466	0.0666	—0.6220	1.3177	0.1054	—0.0925	—0.0744	1.0950
	E2	—0.2281	—0.0070	—0.1154	0.3619	—0.0037	—0.0019	—0.4705	—0.2167	0.0421	1.4007	0.7611
No. of seeds/ pod	E1	—0.1501	0.0007	—0.0095	0.0051	0.1819	—0.1204	0.4160	0.3338	—0.1475	—0.0344	0.4756
	E2	—0.0829	0.4416	0.7157	—0.0974	—0.0003	0.0651	—0.0659	—1.5478	—0.0283	0.5716	—0.0286
100 seed weight (g)	E1	—0.2149	0.0004	0.0514	—0.0512	0.0886	0.4544	—0.3949	—0.1596	0.3086	0.0055	0.0883
	E2	—0.4164	—0.1078	0.7157	0.2227	—0.0005	—0.0595	0.3011	—0.6655	—0.0658	0.0143	—0.0617
Seed yield/ plant (g)	E1	0.1006	—0.0001	0.4324	—0.0448	0.1344	—0.6145	1.1265	0.1319	—0.0196	—0.0870	1.1598
	E2	—0.0829	—0.0452	0.2540	0.3062	0.0045	0.1581	—0.4611	0.6191	—0.0007	1.4290	0.9338

Residual effect : Environment E1 = -0.514 Environment E2 = -1.910

et al. (1984) working with the same varieties in E1 and E2 (kharif 1979 and kharif 1980) reported also the important contribution of attributes like seed yield, number of pods per plant, number of clusters per plant, no. of branches per plant, plant height, days to maturity and 100 weight in E1, while seed yield, days to maturity and 100 seed weight in E2, towards genetic divergence in clusterbean.

The present investigations point to the fact that for working out a suitable plant ideotype for rainfed situations, it will mostly depend upon the type of the environmental conditions confronted within a growing season. Hence, there is need to carry out this type of study under different rainfall situations for establishing a suitable plant type for bringing about the improvement in the productivity in the case of clusterbean.

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