

Original Research Article

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Studies on Association between Yield and Yield Attributing Traits in Cluster Bean [*Cyamopsis tetragonoloba* (L.) TAUB.] Genotypes

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ABSTRACT

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The experiment was conducted on 56 cluster bean genotypes to study the correlation among pod yield per plant components and their direct and indirect effects on pod yield per plant. This study helps in identifying the characters which mainly contributed towards pod yield. Plant height, number of clusters per plant, average weight of 50 pods, pod length, pod girth and 100 seed weight had positive association with pod yield per plant at phenotypic and genotypic levels. Significant positive direct effect at genotypic level were shown by number of branches per plant, internodal length, days to first harvest, number of clusters per plant, number of pods per cluster and average weight of 50 pods.

Introduction

Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub] is also known as guar bean, has a chromosome number of $2n=2x=14$. It is an arid legume crop, mostly cultivated in the arid and semi-arid areas as it is drought tolerant. The long deep taproot system enables the plant to grasp maximum water from the soil making it an ultimate drought resistant crop. It has the freedom from serious pests and diseases and long storage life of the harvested pods.

It is a self-pollinated crop belonging to family *leguminosae*. Guar is characterized as a short

day erect or bushy annual plant. It has been reported that the cultivated species *C. tetragonoloba* was developed from a drought tolerant wild African species *C. senegalensis* (Mudgil *et al.*, 2014), while Vavilov (1951) suggested India to be the centre of variability for cluster bean. The crop is widely grown in countries like India, Pakistan, Indonesia and other parts of Southern and South eastern Asia as a vegetable and fodder crop for a long time.

Cluster bean is rich in dietary fibre, potassium and folate which protect the heart from various cardiovascular complications. It is a reservoir of different amino acids including glutamine, arginine, aspartic acid and leucine.

Iron and calcium present in cluster bean helps in strengthening the bones. It also works as a good laxative, stimulating bowel movement, improving digestive system and help in flushing out unwanted chemicals.

Yield is a complex character and is known to be associated with a number of component characters and is highly affected by environmental variations. These characters are themselves interrelated. Such interdependence of the contributing factors affects their direct relationship with yield, thereby making correlation coefficients unreliable as selection indices. An understanding of correlation between yield and its attributing characters is essential to formulate guide lines for crop selection. Partitioning of total correlation into direct and indirect effect by path coefficient analysis helps in making the selection more effective. The path coefficient analysis reveals that, whether the association of the component characters with pod yield per plant is due to their direct effect on pod yield per plant, or is a consequence of their indirect effect via some other trait(s). Several path coefficient analysis have been conducted in cluster bean (Singh *et al.*, 2005). Correlation alone may not give complete information but when used in conjunction with path coefficient analysis will give a better measure of cause and effect relationship existing between different pairs of characters (Rai and Dhamati, 2014)

To provide basis for selection and yield improvement in cluster bean, the present investigation was undertaken to determine the degree of association among characters and to measure direct and indirect effects of various component characters on pod yield per plant.

Materials and Methods

An investigation comprised of 56 genotypes of cluster bean (Table 1) was carried out at

College of Horticulture, Dr. Y. S. R. Horticultural University, Venkataramannagudem, West Godavari district during *kharif* season of 2018. Genotypes were evaluated with two replications with spacing of 45 cm x 15 cm. Optimum management practices were followed uniformly for raising the crop.

The mean values of the genotypes in each replication were used for analysis of variance. Results and values were subjected to randomized complete block design. Critical differences were calculated at five per cent level.

Observations were recorded on five competitive and randomly selected plants from each plot in each replication for all the genotypes viz., plant height (cm), plant spread (cm), number of branches per plant, leaf area (cm²) internodal length (cm), days to Flower Initiation, days to 50% flowering, days to first harvest, number of clusters per plant, number of pods per cluster, average weight of 50 pods (g), pod length (cm), pod girth (mm), number of seeds per pod, 100 seed weight (g), protein content of pods (%) and pod yield per plant (g).

The correlation co-efficient among all character combinations at phenotypic and genotypic levels were analysed employing formula suggested by Al-Jibouri *et al.*, (1958) and path co-efficient analysis was done by following Dewey and Lu (1959).

Results and Discussion

The results of the analysis of variance for 17 characters of 56 cluster bean genotypes are presented in Table 2. The results indicated that there is highly significant variation among the genotypes for almost all the characters under study. The presence of genotypic correlation may be either due to pleiotropic action of genes

or due to linkage or more likely both. If a positive genotypic correlation was observed for pair of characters, certainly the improvement in one character will in turn improve the correlated character. If the improvement in one character results in a decrease in other character, this will also help the breeder in the selection of characters if necessary.

In the present study (Table 3 and 4), plant height, leaf area, number of clusters per plant, average weight of 50 pods, pod length, pod girth and 100 seed weight had positive association with pod yield per plant at phenotypic and genotypic levels. Similar result was found by Singh *et al.*, (2005), Rai and Dharmati (2014) and Divya and Abdul (2016). Number of branches per plant had negative non-significant correlation with pod yield per plant. This suggests that selection of non-branching types would result in better yielding genotypes. Characters that showed negative phenotypic and genotypic correlation with pod yield per plant were days to 50% flowering and days to first harvest. Days to flower initiation showed significant negative association only at genotypic level with pod yield per plant. These were in agreement with the results reported by Patil *et al.*, (2016).

Plant spread, number of branches per plant, internodal length, number of pods per cluster, number of seeds per pod and protein content of pods had no significant association with pod yield per plant indicating that improvement of these characters might have not affected the pod yield per plant of cluster bean.

As a guideline for the interpretation of the results of path analysis, the following broad points may be kept in view (Singh and Chaudhary, 1977). If the correlation coefficient between a causal factor and the effect is almost equal to its direct effect, then

the correlation explains the true relationship and a direct selection through this trait will be effective.

If the correlation coefficient is positive, but the direct effect is negative or negligible, the indirect effects seem to be the cause of the positive correlation. In such situations, the indirect causal factors are to be considered simultaneously for selection. Correlation coefficient may be negative but the effect is positive and high. Under these circumstances, restricted simultaneous selection model is to be followed *i.e.*, restrictions are to be imposed to nullify the undesirable indirect effects to make use of the direct effect. If the correlation coefficient is negative and direct effect is also negative, then we have to drop selection based on that character.

The residual effect determines how best the causal factors account for the variability of the dependent factor. If the residual effect is high, some other factors which have not been considered here need to be included in this analysis to account fully for the variation in yield.

In the present study (Table 5 and 6), significant positive direct effect at genotypic level were shown by number of branches per plant, internodal length, days to first harvest, number of clusters per plant, number of pods per cluster and average weight of 50 pods. Plant height, number of clusters per plant and 100 seed weight exhibited significant positive direct effect at phenotypic level. These results were in accordance with the findings of Patil *et al.*, (2016).

Significant negative direct effect was exhibited by plant spread, leaf area, days to 50% flowering, pod length and protein content at genotypic level. Leaf area displayed significant negative direct effect at phenotypic level.

Table.1 List of cluster bean genotypes used in the present study

Treatment	Genotypes	Source	Treatment	Genotypes	Source
T ₁	IC-113272	NBPGR, Jodhpur	T ₂₉	IC-116626	NBPGR, Jodhpur
T ₂	IC-113277	NBPGR, Jodhpur	T ₃₀	IC-116652	NBPGR, Jodhpur
T ₃	IC-113278	NBPGR, Jodhpur	T ₃₁	IC-116660	NBPGR, Jodhpur
T ₄	IC-113281	NBPGR, Jodhpur	T ₃₂	IC-116779	NBPGR, Jodhpur
T ₅	IC-113308	NBPGR, Jodhpur	T ₃₃	IC-116705	NBPGR, Jodhpur
T ₆	IC-113374	NBPGR, Jodhpur	T ₃₄	IC-116825	NBPGR, Jodhpur
T ₇	IC-113376	NBPGR, Jodhpur	T ₃₅	IC-116925	NBPGR, Jodhpur
T ₈	IC-113377	NBPGR, Jodhpur	T ₃₆	IC-116930	NBPGR, Jodhpur
T ₉	IC-113378	NBPGR, Jodhpur	T ₃₇	IC-116932	NBPGR, Jodhpur
T ₁₀	IC-113379	NBPGR, Jodhpur	T ₃₈	IC-384974	NBPGR, Jodhpur
T ₁₁	IC-113380	NBPGR, Jodhpur	T ₃₉	IC-384986	NBPGR, Jodhpur
T ₁₂	IC-113382	NBPGR, Jodhpur	T ₄₀	IC-522399	NBPGR, Jodhpur
T ₁₃	IC-113383	NBPGR, Jodhpur	T ₄₁	IC-522389	NBPGR, Jodhpur
T ₁₄	IC-113390	NBPGR, Jodhpur	T ₄₂	IC-522511	NBPGR, Jodhpur
T ₁₅	IC-113393	NBPGR, Jodhpur	T ₄₃	IC-522421	NBPGR, Jodhpur
T ₁₆	IC-113394	NBPGR, Jodhpur	T ₄₄	IC-522487	NBPGR, Jodhpur
T ₁₇	IC-113395	NBPGR, Jodhpur	T ₄₅	IC-522506	NBPGR, Jodhpur
T ₁₈	IC-113396	NBPGR, Jodhpur	T ₄₆	IC-52249	NBPGR, Jodhpur
T ₁₉	IC-113399	NBPGR, Jodhpur	T ₄₇	RGC-986	NBPGR, Jodhpur
T ₂₀	IC-113503	NBPGR, Jodhpur	T ₄₈	PLG-85	NBPGR, Jodhpur
T ₂₁	IC-113506	NBPGR, Jodhpur	T ₄₉	RGC-1038	NBPGR, Jodhpur
T ₂₂	IC-113523	NBPGR, Jodhpur	T ₅₀	IC-421850	NBPGR, Jodhpur
T ₂₃	IC-113568	NBPGR, Jodhpur	T ₅₁	IC-421855	NBPGR, Jodhpur
T ₂₄	IC-113513	NBPGR, Jodhpur	T ₅₂	IC-51063	NBPGR, Jodhpur
T ₂₅	IC-116569	NBPGR, Jodhpur	T ₅₃	Thar Bhadavi	CIAH, Bikaner, Rajasthan
T ₂₆	IC-116607	NBPGR, Jodhpur	T ₅₄	MDU-1	TNAU, Coimbatore
T ₂₇	IC-116608	NBPGR, Jodhpur	T ₅₅	Chitra Gold	Vagro seeds Pvt. Ltd, Hyderabad
T ₂₈	IC-116619	NBPGR, Jodhpur	T ₅₆	Pusa Navbahar (Check)	IARI, New Delhi

Table.2 Analysis of variance for different characters in cluster beangenotypes

S. No	Characters	Mean sum of squares		
		Replications df= 1	Treatments df= 55	Error df= 55
1	Plant height (cm)	5.99	12935.65 **	1305.46
2	Plant spread (cm)	10.78	11345.61 **	210.50
3	Number of branches per plant	0.0027	178.19 **	1.23
4	Leaf area (cm ²)	17.004	48135.68 **	1135.00
5	Internodal length (cm)	0.065	102.59 **	15.14
6	Days to flower initiation	0.009	70.06 *	43.49
7	Days to 50 % flowering	0.57	119.96 **	59.43
8	Days to first harvest	0.08	522.56 **	29.42
9	Number of clusters per plant	0.0013	12.24 **	5.83
10	Number of pods per cluster	0.0063	12.26 **	0.34
11	Average weight of 50 pods (g)	70.72	165194.78 **	8365.78
12	Pod length (cm)	0.041	242.88 **	10.76
13	Pod girth (mm)	44.13	1556.75 *	939.96
14	Number of seeds per pod	0.000057	4.66 **	0.040
15	100 seed weight (g)	0.000072	27.73 **	0.0053
16	Pod yield per plant (g)	1391.67	167535.80 **	32512.89
17	Protein content of pods (%)	0.0053	1064.49 **	0.28
* Significant at 5 % level of significance ** Significant at 1 % level of significance				

Table.3 Genotypic correlation coefficients for different characters of cluster bean genotypes

Characters	PH	PS	NB	LA	INL	DFI	DFF	DFH	NCPP	NPPC	AWP	PL	PG	NSPP	HSW	PC	PYP
PH	1.000	-0.410**	-0.536**	0.421**	0.062	-0.415**	-0.194*	-0.290**	-0.050	0.156	0.448**	0.309**	0.187*	-0.222*	0.308**	-0.103	0.477**
PS		1.000	0.934**	-0.122	0.176	0.143	-0.288**	0.423**	0.543**	-0.079	-0.170	-0.036	0.152	0.060	-0.180	-0.057	-0.057
NB			1.000	-0.307**	0.170	0.192*	-0.035	0.437**	0.428**	-0.144	-0.338**	-0.173	0.036	-0.049	-0.262**	-0.085	-0.181
LA				1.000	0.016	-0.333**	-0.246**	-0.144	0.373**	-0.088	0.880**	0.695**	0.505**	0.194*	0.528**	-0.015	0.376**
INL					1.000	-0.029	0.289**	-0.022	-0.118	0.076	-0.035	-0.034	0.305**	-0.051	0.225*	0.029	0.182
DFI						1.000	0.668**	-0.125	-0.048	-0.098	-0.274**	-0.344**	-0.364**	0.155	-0.472**	0.022	-0.643**
DFF							1.000	-0.169	-0.458**	0.146	-0.105	-0.052	0.252**	-0.156	-0.276**	-0.173	-0.384**
DFH								1.000	-0.091	-0.092	-0.368**	-0.160	-0.175	-0.147	-0.254**	-0.128	-0.289**
NCPP									1.000	-0.061	0.430**	0.547**	0.720**	0.251**	0.278**	0.220	0.638**
NPPC										1.000	-0.155	-0.172	0.040	0.058	-0.111	0.050	0.102
AWP											1.000	0.803**	0.584**	0.264**	0.524**	-0.086	0.479**
PL												1.000	0.678**	0.218*	0.438**	-0.067	0.425**
PG													1.000	0.289**	0.230*	0.115	0.585**
NSPP														1.000	0.160	-0.018	0.100
HSW															1.000	0.061	0.556**
PC																1.000	0.169

*, ** significant at 5% and 1% level, respectively

PH Plant height (cm); PS Plant spread (cm); NB Number of branches per plant
 LA Leaf area (cm²); INL Internodal length (cm); DFI Days to Flower Initiation
 DFF Days to 50% flowering; DFH Days to first harvest; NCPP Number of clusters per plant
 NPPC Number of pods per cluster; AWP Average weight of 50 pods (g); PL Pod length (cm)
 PG Pod girth (mm); NSPP Number of seeds per pod; HSW 100 seed weight (g),
 PC Protein content of pods (%); PYP Pod yield per plant (g)

Table.4 Phenotypic correlation coefficients for different characters of cluster bean genotypes

Characters	PH	PS	NB	LA	INL	DFI	DFE	DFH	NCPP	NPPC	AWP	PL	PG	NSPP	HSW	PC	PYP
PH	1.000	-	-	0.387**	0.046	-	-0.099	-	-0.033	0.138	0.382**	0.233*	0.031	0.031	0.280**	-	0.434**
PS		1.000	0.903**	-0.125	0.179	0.044	-0.121	0.389**	0.309**	-0.075	-0.166	-0.040	0.043	0.050	-0.176	-	-0.036
NB			1.000	-	0.149	0.087	-0.027	0.409**	0.248**	-0.145	-	-0.167	0.033	-0.050	-	-	-0.158
LA				1.000	0.019	-0.174	-0.157	-0.131	0.196*	-0.085	0.821**	0.664**	0.203*	0.186*	0.516**	-	0.300**
INL					1.000	0.035	0.263**	-0.045	-0.066	0.056	-0.057	-0.026	0.057	-0.050	0.193*	0.025	0.088
DFI						1.000	0.189*	-0.061	-0.042	-0.073	-0.102	-0.153	0.107	0.088	0.229*	0.008	-0.147
DFE							1.000	-0.097	-0.223*	0.104	-0.101	-0.090	0.030	-0.102	-0.158	-	-0.230*
DFH								1.000	-0.140	-0.079	-	-0.147	-0.036	-0.138	-0.240*	-	-
NCPP									1.000	-0.086	0.173	0.311**	0.240*	0.152	0.166	0.131	0.423**
NPPC										1.000	-0.138	-0.167	0.005	0.062	-0.107	0.048	0.068
AWP											1.000	0.750**	0.283	0.253**	0.499**	-	0.347**
PL												1.000	0.338**	0.201*	0.418**	-	0.357**
PG													1.000	0.119	0.110	0.058	0.203*
NSPP														1.000	0.159	-	0.077
HSW															1.000	0.061	0.458**
PC																1.000	0.139

*, ** significant at 5% and 1% level, respectively

PH Plant height (cm); PS Plant spread (cm); NB Number of branches per plant
 LA Leaf area (cm²); INL Internodal length (cm); DFI Days to Flower Initiation
 DFE Days to 50% flowering; DFH Days to first harvest; NCPP Number of clusters per plant
 NPPC Number of pods per cluster; AWP Average weight of 50 pods (g); PL Pod length (cm)
 PG Pod girth (mm); NSPP Number of seeds per pod; HSW 100 seed weight (g)
 PC Protein content of pods (%); PYP Pod yield per plant (g)

Table.5 Path coefficient analysis for different characters of cluster bean genotypes at genotypic level

Character	PH	PS	NB	LA	INL	DFI	DFE	DFH	NCPP	NPPC	AWP	PL	PG	NSPP	HSW	PC	PYP
PH	-0.030	0.013	0.016	-0.013	-0.002	0.013	0.006	0.009	0.002	-0.005	-	-	-	0.007	-	0.003	0.477
PS	0.801	-1.952	-1.824	0.237	-0.343	-0.279	0.562	-0.825	-1.060	0.153	0.333	0.069	-	-	0.352	0.111	-0.057
NB	-0.367	0.641	0.686	-0.211	0.117	0.131	-0.024	0.299	0.294	-0.099	-	-	0.025	-	-	-	-0.181
LA	-0.364	0.105	0.266	-0.865	-0.014	0.288	0.213	0.125	-0.322	0.076	-	-	-	-	-	0.013	0.376
INL	0.052	0.150	0.145	0.014	0.850	-0.024	0.246	-0.019	-0.101	0.065	-	-	0.259	-	0.191	0.025	0.182
DFI	-0.005	0.002	0.002	-0.004	0.000	0.012	0.008	-0.002	-0.001	-0.001	-	-	-	0.002	-	0.000	-0.643
DFE	0.149	0.221	0.027	0.189	-0.222	-0.513	-0.767	0.130	0.352	-0.112	0.081	0.040	-	0.120	0.212	0.133	-0.384
DFH	-0.112	0.164	0.169	-0.056	-0.009	-0.049	-0.065	0.387	-0.035	-0.035	-	-	-	-	-	-	-0.289
NCPP	-0.069	0.749	0.591	0.514	-0.163	-0.067	-0.632	-0.126	1.379	-0.084	0.594	0.755	0.993	0.346	0.383	0.303	0.638
NPPC	0.039	-0.020	-0.036	-0.022	0.019	-0.024	0.036	-0.023	-0.015	0.248	-	-	0.010	0.015	-	0.012	0.102
AWP	0.483	-0.184	-0.365	0.950	-0.038	-0.295	-0.114	-0.397	0.465	-0.167	1.080	0.867	0.630	0.285	0.566	-	0.479
PL	-0.116	0.013	0.065	-0.259	0.013	0.129	0.020	0.060	-0.204	0.064	-	-	-	-	-	0.025	0.425
PG	0.008	0.007	0.002	0.022	0.013	-0.016	0.011	-0.008	0.031	0.002	0.025	0.029	0.043	0.012	0.010	0.005	0.585
NSPP	0.036	-0.010	0.008	-0.032	0.008	-0.025	0.026	0.024	-0.041	-0.010	-	-	-	-	-	0.003	0.100
HSW	-0.054	0.032	0.046	-0.093	-0.039	0.083	0.048	0.045	-0.049	0.019	-	-	-	-	-	-	0.556
PC	0.026	0.014	0.021	0.004	-0.007	-0.006	0.044	0.032	-0.055	-0.013	0.022	0.017	-	0.004	-	-	0.169
													0.029	0.015	0.252		
Residual effect = 0.699																	

PH Plant height (cm); PS Plant spread (cm); NB Number of branches per plant
 LA Leaf area (cm²); INL Internodal length (cm); DFI Days to Flower Initiation
 DFE Days to 50% flowering; DFH Days to first harvest; NCPP Number of clusters per plant
 NPPC Number of pods per cluster; AWP Average weight of 50 pods (g); PL Pod length (cm)
 PG Pod girth (mm); NSPP Number of seeds per pod; HSW 100 seed weight (g)
 PC Protein content of pods (%); PYP Pod yield per plant (g)

Table.6 Path coefficient analysis for different characters of cluster bean genotypes at phenotypic level

Character	PH	PS	NB	LA	INL	DFI	DFE	DFH	NCPP	NPPC	AWP	PL	PG	NSPP	HSW	PC	PYP
PH	0.378	-0.135	-0.182	0.146	0.017	-0.079	-0.038	-0.099	-0.012	0.052	0.144	0.088	0.012	-0.073	0.106	-0.035	0.434
PS	-0.048	0.135	0.121	-	0.024	0.006	-0.016	0.052	0.042	-0.010	-0.022	-0.005	0.006	0.007	-0.024	-0.008	-0.036
NB	0.059	-0.111	-0.123	0.037	-	-0.011	0.003	-0.050	-0.031	0.018	0.039	0.021	-0.004	0.006	0.032	0.010	-0.158
LA	-0.106	0.034	0.082	-	-	0.048	0.043	0.036	-0.054	0.023	-0.224	-0.182	-0.055	-0.051	-0.141	0.004	0.300
INL	0.003	0.011	0.009	0.001	0.061	0.002	0.016	-0.003	-0.004	0.003	-0.004	-0.002	0.004	-0.003	0.012	0.002	0.088
DFI	-0.003	0.001	0.001	-	0.001	0.014	0.003	-0.001	-0.001	-0.001	-0.001	-0.002	0.002	0.001	-0.003	0.000	-0.147
DFE	0.010	0.012	0.003	0.015	-	-0.018	-0.096	0.009	0.021	-0.010	0.010	0.009	-0.003	0.010	0.015	0.010	-0.230
DFH	0.001	-0.001	-0.001	0.000	0.000	0.000	0.000	-0.003	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	-0.254
NCPP	-0.011	0.103	0.083	0.066	-	-0.014	-0.075	-0.047	0.335	-0.029	0.058	0.104	0.080	0.051	0.055	0.044	0.423
NPPC	0.011	-0.006	-0.012	-	0.005	-0.006	0.009	-0.006	-0.007	0.081	-0.011	-0.014	0.000	0.005	-0.009	0.004	0.068
AWP	0.043	-0.019	-0.036	0.093	-	-0.012	-0.012	-0.038	0.020	-0.016	0.114	0.085	0.032	0.029	0.057	-0.009	0.347
PL	0.027	-0.005	-0.020	0.078	-	-0.018	-0.011	-0.017	0.037	-0.020	0.088	0.117	0.040	0.024	0.049	-0.007	0.357
PG	0.002	0.002	0.002	0.010	0.003	0.005	0.002	-0.002	0.012	0.000	0.014	0.017	0.049	0.006	0.005	0.003	0.203
NSPP	-0.004	0.001	-0.001	0.004	-	0.002	-0.002	-0.003	0.003	0.001	0.005	0.004	0.002	0.020	0.003	0.000	0.077
HSW	0.082	-0.052	-0.076	0.151	0.057	-0.067	-0.046	-0.070	0.049	-0.031	0.146	0.123	0.032	0.047	0.293	0.018	0.458
PC	-0.010	-0.006	-0.009	-	0.003	0.001	-0.011	-0.013	0.014	0.005	-0.008	-0.007	0.006	-0.002	0.006	0.104	0.139

Residual effect = 0.699

PH Plant height (cm); PS Plant spread (cm); NB Number of branches per plant
 LA Leaf area (cm²); INL Internodal length (cm); DFI Days to Flower Initiation
 DFE Days to 50% flowering; DFH Days to first harvest; NCPP Number of clusters per plant
 NPPC Number of pods per cluster; AWP Average weight of 50 pods (g); PL Pod length (cm)
 PG Pod girth (mm); NSPP Number of seeds per pod; HSW 100 seed weight (g)
 PC Protein content of pods (%); PYP Pod yield per plant (g)

Plant height, number of branches per plant, internodal length, days to first harvest, number of clusters per plant, number of pods per cluster and average weight of 50 pods and 100 seed weight can be identified as the major characters contributing towards pod yield and selection based on these characters can be effective for developing high yielding varieties of cluster bean genotypes.

Earlier findings of Saini *et al.*, (2005) supported the above conclusion.

The present study indicated that, character association and path analysis prompted that selection for improvement in respect to pod yield would be more effective based on characters like plant height, leaf area, internodal length, days to first harvest, number of clusters per plant, number of pods per cluster, average weight of 50 pods, pod length, pod girth and 100 seed weight. Since these characters recorded significant genotypic and phenotypic correlation with high direct effect on pod yield.

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