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RESEARCH PAPER

Relationship between seed yield and its component characters of cluster bean [C*yamopsis tetragonoloba* (L.) Taub.]

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Abstract : Relationship between seed yield and its component characters of sixty seven cluster bean (*Cyamopsis tetragonoloba* L.) genotypes were studied during February, 2011 to May, 2011. The seed yield and its twelve component characters were studied to know their relationship. cluster bean seed yield per plant showed positive and significant correlation with number of clusters per plant, number of pods per cluster, ten dry pod weight, ten dry pod seed weight, number of seeds in ten dry pod, fifty seed weight, number of dry pods per plant and dry pod yield per plant at both genotypic and phenotypic level. The path analysis revealed ten dry pod seed weight, dry pods per plant and dry pod yield per plant had high direct effect on seed yield per plant, hence, these parameters are effective for selection to increase seed yield in cluster bean.

Key Words : Cluster bean, Seed yield, Correlation, Path analysis

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INTRODUCTION

Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] is commonly known as guar, chavli kayi, guari, khutti etc. is one of the most important and potential vegetables cum industrial crops grown for its tender pods for vegetable and seed for endospermic gum (30-35 %). Guar seeds are mainly used for extraction of endospermic gum having good binding properties and have high demand in food industry as an ingredient in products like sauces and ice creams etc. In general, guar gum is used as water retainer, soil aggregate and anti-crusting agent. In petroleum industry, it is used as gelling and thickening agent. Further, in textile and juice industry, guar gum is used for sizing and as a thickener and stabilizer. Guar gum has also a greater utility in pollution control and acts as an absorbent in waste water treatment, in textile industry as a flocculating and exchanging agent.

In the present investigation, correlation between seed yield and its component traits were studied to extract factors comprising important traits for improving seed yield of cluster bean in breeding programme. The selection of desirable types should, therefore be, based on seed yield as well as on other seed yield components. Information on mutual association between seed yield and seed yield components is necessary for efficient utilization of the genetic stock in crop improvement programme.

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Material and Methods

The material comprised of sixty seven cluster bean genotypes. These were evaluated at College of Horticulture, Bagalkot, Karnataka, India. The experiments was laid out in a Randomized Block Design with two replications during summer (February to May, 2011).

The distance between the rows and plants were 45 cm and 20 cm, respectively. Each genotype in each replication was represented by a single row of 3 meters length. Three plants in each plot were selected at random and these plants were used for recording observation on seed yield and its twelve other important component traits *viz.*, number of clusters per plant, number of pods per cluster, ten dry pod weight (g), ten dry pod seed weight (g), number of seeds in ten dry pod, fifty seed weight (g), seed protein content (%), seed gum content (%), seed potash content (%), seed phosphorus content (%), number of dry pods per plant and dry pod yield per plant (g). The data were analyzed for estimation of simple correlation co-efficients among the characters at phenotypic and genotypic levels by following Al-Jibouri *et al.* (1958). Path analysis at genotypic level was done following Wright (1921) and Dewey and Lu (1959).

Results and Discussion

It is evident that the genotypic correlation co-efficients, in majority of the cases, were higher than the corresponding phenotypic correlation co-efficients (Table 1 and 2), indicating an apparent association due to genetic reason. Nandpuri *et al.* (1973) and Singh *et al.* (1979) had also indicated the existence of an inherent association between seed yield and its various component characters.

Positive and highly significant correlation of seed yield/ plant was found with dry pod yield per plant (0.966 and 0.962), number of dry pods/plant (0.846 and 0.868), number of clusters/plant (0.558 and 0.478), number of pods /cluster (0.498 and 0.347), ten dry pod seed weight (0.447 and 0.375), ten dry pod weight (0.407 and 0.302), number of seeds in ten dry pod (0.327 and 0.208) and fifty seed weight (0.239 and 0.216) at genotypic and phenotypic level, respectively (Table 1 and 2). The results are in agreement with the earlier findings in cluster bean by Girish *et al.* (2012), for number of clusters per plant, number of pods per cluster, dry pod yield per plant and hundred seed weight and Rakesh *et al.* (2011) for seeds/ pod. In cow pea Manggoel *et al.* (2012) also reported similar result for number of pods/plant and 100 seed weight. Seed protein content had positive and highly significant association with, ten dry pod weight, ten dry pod seed weight and fifty seed weight at genotypic as well as phenotypic level. This indicated that selection for higher dry pod weight, seed weight would result in selection of genotypes with higher the seed protein content.

Number of clusters per plant showed positive and highly significant association with number of pods per cluster, number of dry pods per plant, dry pod yield per plant and seed yield per plant both as phenotypic and genotypic level. Similar results were reported by Singh *et al.* (2004) and Saini *et al.* (2010). Number of pods per cluster had positive and highly significant association with number of dry pods per plant, dry pod yield per plant, seed yield per plant and number of clusters per plant at both phenotypic and genotypic level. Similar results were obtained by Saini *et al.* (2010). This indicated that selection of genotypes with higher number of cluster per plant and higher number of pods per cluster would result in

Table 1 : Matrix of genotypic correlations for seed yield and component characters in cluster bean

@	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	1.000	0.422**	0.012	0.022	0.018	0.060	-0.008	0.090	-0.046	0.065	0.622**	0.532**	0.558**
2.		1.000	-0.043	-0.032	-0.059	-0.074	0.029	0.064	-0.080	0.122	0.521**	0.460**	0.498**
3.			1.000	0.893**	0.677**	0.824**	0.429**	0.093	0.339**	-0.004	-0.061	0.521**	0.407**
4.				1.000	0.794**	0.748**	0.290**	0.141	0.435**	0.048	-0.083	0.448**	0.447**
5.					1.000	0.439**	0.130	0.165	0.465**	0.119	-0.105	0.308**	0.327**
6.						1.000	0.430**	0.051	0.172*	-0.070	-0.151	0.302**	0.239**
7.							1.000	-0.041	0.213*	-0.084	-0.108	0.119	0.023
8.								1.000	0.108	0.048	0.092	0.132	0.152
9.									1.000	0.555**	-0.140	0.035	0.059
10.										1.000	0.053	0.057	0.066
11.											1.000	0.819**	0.846**
12.												1.000	0.966**
13.													1.000

Critical r- 1% =0.222 5% = 0.170 * and ** indicate significance of values at P=0.05 and 0.01, respectively

1. Number of clusters tper plant 2. Number of pods per cluster 3. Ten dry pod weight (g) 4. Ten dry pod seed weight (g)
5. Number of seeds in ten dry pod 6. Fifty seed weight (g) 7. Seed protein content (%) 8. Seed gum content (%)
9. Seed potash content (%) 10. Seed phosphorus content (%) 11. Number of dry pods per plant. 12. Dry pod yield per plant (g)
13. Seed yield per plant (g)

selection of genotypes with high seed yield.

Considering the correlation between dry pod yield per plant and other characters, it was found that dry pod yield per plant was positively and significantly correlated with number of clusters per plant, number of pods per cluster, ten dry pod weight, ten dry pod seed weight, number of seeds in ten dry pod, fifty seed weight, seed phosphorus content and seed yield per plant both in phenotypic and genotypic level. Similar findings were reported by Girish *et al.* (2012) for number of cluster per plant, number of pods per cluster and seed yield per plant. Similar findings were also reported by Hanchinmani (2003) for 100 seed weight and seeds per pod. Hence, these characters namely number of clusters per plant, number of pods per cluster, number of seeds in ten dry pod, fifty seed weight, seed yield per plant have to be given importance during selection to improve the yield potential of the crop.

Path analysis :

Association of characters determined by correlation co-efficients may not indicate properly the relative importance of direct and indirect effect of each individual yield contributing character on yield. Therefore, the direct and indirect effects were worked out using path analysis at genotypic level, which also expresses the relative importance of each character on seed yield. The results of path analysis as in Table 3 revealed that dry pods per plant (0.640) had the maximum direct effect followed by ten dry pod seed weight (0.518) and dry pod yield per plant (0.257) and negligible effect by number of pods per cluster (0.061), number of seeds in ten dry pod (0.022) and seed phosphorus content (0.004). The

Table 2 : Matrix of phenotypic correlations for seed yield and component characters in cluster bean

@	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	1.000	0.312 **	-0.005	0.003	-0.015	0.042	-0.029	0.099	-0.042	0.055	0.524 **	0.459 **	0.478 **
2.		1.000	-0.042	-0.054	-0.077	-0.053	0.047	0.058	-0.061	0.092	0.389 **	0.331 **	0.347 **
3.			1.000	0.877 **	0.655 **	0.735 **	0.402 **	0.076	0.316 **	0.003	-0.099	0.397 **	0.302 **
4.				1.000	0.773 **	0.660 **	0.267 **	0.108	0.407 **	0.048	-0.091	0.361 **	0.375 **
5.					1.000	0.362 **	0.113	0.143	0.416 **	0.106	-0.156	0.181 *	0.208 *
6.						1.000	0.408 **	0.043	0.160	-0.061	-0.098	0.268 **	0.216 *
7.							1.000	-0.041	0.203 *	-0.073	-0.084	0.104	0.026
8.								1.000	0.108	0.049	0.054	0.086	0.104
9.									1.000	0.523 **	-0.116	0.030	0.051
10.										1.000	0.014	0.024	0.032
11.											1.000	0.855 **	0.868 **
12.												1.000	0.962 **
13.													1.000

Critical r- 1% =0.222 5% = 0.170 * and ** indicate significance of values at P=0.05 and 0.01, respectively

1. Number of clusters tper plant 2. Number of pods per cluster 3. Ten dry pod weight (g) 4. Ten dry pod seed weight (g)
5. Number of seeds in ten dry pod 6. Fifty seed weight (g) 7. Seed protein content (%) 8. Seed gum content (%)
9. Seed potash content (%) 10. Seed phosphorus content (%) 11. Number of dry pods per plant. 12. Dry pod yield per plant (g)
13. Seed yield per plant (g)

Table 3 : Genotypic path co-efficient analysis for seed yield and its component characters

@	1	2	3	4	5	6	7	8	9	10	11	12	rG
1.	-0.013	0.026	-0.002	0.011	0.000	0.000	0.000	0.000	0.002	0.000	0.398	0.137	0.558**
2.	-0.006	0.061	0.006	-0.017	-0.001	0.001	-0.001	0.000	0.003	0.000	0.333	0.118	0.498**
3.	0.000	-0.003	-0.131	0.463	0.015	-0.007	-0.010	0.000	-0.014	0.000	-0.039	0.134	0.407**
4.	0.000	-0.002	-0.117	0.518	0.017	-0.006	-0.007	-0.001	-0.019	0.000	-0.039	0.134	0.447**
5.	0.000	-0.004	-0.089	0.412	0.022	-0.004	-0.003	-0.001	-0.020	0.000	-0.067	0.079	0.327**
6.	-0.001	-0.005	-0.108	0.388	0.010	-0.008	-0.010	0.000	-0.007	0.000	-0.097	0.078	0.239**
7.	-0.001	-0.005	-0.108	0.388	0.010	-0.008	-0.010	0.000	-0.007	0.000	-0.069	0.031	0.023
8.	-0.001	0.004	-0.012	0.073	0.004	0.000	0.001	-0.005	-0.005	0.000	0.059	0.034	0.152
9.	0.001	-0.005	-0.044	0.226	0.010	-0.001	-0.005	0.000	-0.043	0.002	-0.090	0.009	0.059
10.	-0.001	0.007	0.000	0.025	0.003	0.001	0.002	0.000	-0.024	0.004	0.034	0.015	0.066
11.	-0.008	0.032	0.008	-0.043	-0.002	0.001	0.003	0.000	0.006	0.000	0.640	0.210	0.846**
12.	-0.007	0.028	-0.068	0.232	0.007	-0.002	-0.003	-0.001	-0.001	0.000	0.524	0.257	0.966**

Bold diagonal values indicate direct effect * and ** indicate significance of values at P=0.05 and 0.01, respectively
Residual = 0.0079 rG. Genotypic correlation with seed yield per plant

1. Number of clusters per plant 2. Number of pods per cluster 3. Ten dry pod weight (g) 4. Ten dry pod seed weight (g)
5. Number of seeds in ten dry pod 6. Fifty seed weight (g) 7. Seed protein content (%) 8. Seed gum content (%)
9. Seed potash content (%) 10. Seed phosphorus content (%) 11. Dry pods per plant 12. Dry pod yield per plant (g)

contribution of yield components like dry pods per plant, ten dry pod seed weight, dry pod yield per plant was relatively higher in the present study, which was in accordance with the findings of Usha *et al.* (2010) and Singh and Verma (1998) in their studies on cow pea.

Number of clusters per plant had negative direct effects (-0.013) but positive and significant genotypic correlation (0.558) with seed yield. This is due to positive indirect effect via dry pods per plant (0.398) and dry pod yield per plant (0.137) (Table 3). Number of pods per cluster showed lower positive direct effect (0.061), though it had the significant positive genotypic correlation (0.498) with seed yield. Ten dry pod weight showed negative direct effect (-0.131) and positive significant correlation (0.407) with seed yield is due to indirect positive effect of dry pod yield per plant on seed yield. High positive direct effect (0.518) and correlation co-efficients (0.447) with seed yield was exhibited. Indirect effect via number of seeds in ten dry pods (0.017) and dry pod yield per plant (0.134) were positive though other characters showed negative indirect effect on seed yield, which cannot influence the total effect. Considering high positive direct effect and significant correlation with seed yield, the number of dry pods per plant (0.640) is the main important character which can help to select better plant type for higher seed yield Rakesh *et al.* (2011) in cluster bean and Singh and Ram (1988) in garden pea also reported a high direct effect of pods per plant on seed yield.

Direct positive effect of dry pod yield per plant (0.257) is one of the important contributors to seed yield. Positive indirect effect via dry pods per plant (0.524) and ten dry pod seed weight (0.232) might be due to the significant positive correlation with seed yield/ plant (0.966). Strong direct effect of dry pod yield per plant on seed yield was also reported by Hanchinamani *et al.* (2003). Though number of seeds in ten dry pod (0.022) showed positive direct effect on seed yield, its indirect effect via ten dry pod seed weight (0.412) and dry pod yield per plant (0.079) were positive, which consequently resulted in the significant positive correlation of this character with seed yield (0.327). Rakesh *et al.* (2011) also found similar result in cluster bean.

Seed yield was significantly and positively correlated with number of dry pods/ plant, dry pod yield per plant, number of clusters per plant, ten dry pod seed weight, and number of pods per cluster. Ten dry pod seed weight, dry pods per plant and dry pod yield per plant showed the maximum positive effect on seed yield/plant. Also, ten dry pod seed weight, dry pods per plant and dry pod yield per plant had sizeable indirect effect on seed yield. Ten dry pod seed weight, dry pods per plant and dry pod yield per plant may be considered effective parameters of selection to increase seed yield in cluster bean.

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