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Association study for vegetable pod yield and yield contributing traits in cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] genotypes

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Abstract

An experiment was carried out to study the correlation between yield components and their direct and indirect effects on the vegetable pod yield in cluster bean using 15 genotypes. The correlation study revealed high significant positive association of pod yield per plant with plant height at 90 days after sowing (DAS) (0.51), number of branches per plant (0.54), number of branches per plant (0.54), days to first flowering (0.40) and days to first vegetable pod picking (0.39) and positive and significant correlation with plant height at 90 days after sowing (DAS) (0.37) while positively associated with days to 50 per cent flowering (0.27), number of cluster per plant (0.14), pod length (0.13) and ten pod weight (0.20), these were the characters responsible for maximum vegetable pod yield. The correlation was also positive for these characters. Hence, emphasis should be given for these characters, while making selection for high yielding genotypes in cluster bean.

Keywords: Cluster bean, *Cyamopsis tetragonoloba*, phenotypic correlation, selection

Introduction

Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub] ($2n = 14$) is an annual under exploited legume which is drought hardy, deep rooted, annual and summer grown. It is a potential vegetable and industrial crop grown for tender pods as a vegetable and for endospermic gum. Tender pods are rich in energy (16 Kcal), moisture (81 g), protein (3.2 g), fat (1.4 g), carbohydrate (10.8 g), vitamin A (65.3 IU), vitamin C (49 mg), calcium (57 mg) and iron (4.5 mg) for every 100 g of edible portion (Kumar and Singh, 2002) [8].

India is the leading country in the production of guar followed by Pakistan, Sudan, USA, South Africa, Brazil, Malawi, Zaire and Australia. In India, cluster bean occupies an area of 4.26 million hectares with a production of 2.42 million tonnes (Kushwah *et al*, 2016). In North Indian states like Rajasthan, Haryana, Gujarat and Punjab it is mainly cultivated for guar gum production and for forage, whereas, in South India it is being cultivated for vegetable purpose. 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 inter-dependence of the contributing factors affects their direct relationship with yield, thereby making correlation coefficients unreliable as selection indices (Shoran, 1982) [17].

Cluster bean is adaptable to arid drought conditions and, there is a need for its improvement. Evaluation of local or related genotypes was to determine variability and to study the association of characters. A study of correlation between quantitative characters provides an idea of association of characters. To have a clear picture of yield components for effective selection, it is desirable to consider the relative magnitude of various characters contributing towards yield. The present investigation was undertaken to determine the degree of association among characters of cluster bean genotypes and to measure direct and indirect effects of various component characters on yield.

Material and Methods

The material comprised of fifteen cluster bean genotypes collected from All India Coordinated Research Project on Dryland Agriculture, [AICRP (DLA)], Regional Agricultural Research

Station (RARS), Vijayapura. These were evaluated at College of Agriculture, Vijayapura (Karnataka, India) situated at an altitude of 593 m above mean sea level and is geographically positioned at 16° 49' N latitude, 75° 43' E longitude. Predominant soil type of experimental plot site is black clay soil (vertisols). The experiment was laid out in a Randomized Block Design with three replications during Kharif (June to October) 2017. Each genotype in each replication was represented by plot size of 2.4 m length and 3.6 m width, following a spacing of 45 cm row to row and 20 cm plant to plant. Five plants in each plot were selected at random and these plants were used for recording observation on yield and other important component traits. All other crop management practices were carried out as per the package of practices of University of Agricultural Sciences, Dharwad recommended to cluster bean crop.

Observation on growth parameters *viz.*, plant height, number of branches per plant, days to first vegetable pod picking, pod length, pod width and ten pod weight, earliness parameters like days to first flowering, days to 50% flowering and days to vegetable pod picking, and vegetable pod yield parameters *viz.*, number of clusters per plant, number of pods per cluster and number of pods per plant, pod length, pod width, ten pod weight, yield per plot and yield per hectare were recorded from five randomly selected plants in each genotypes.

Results and Discussion

Growth parameters

Plant height at 30 DAS had positive and highly significant association with plant height at 90 DAS (0.51**), number of branches of per plant (0.54**), days to first flowering (0.40**) and days to first vegetable pod picking (0.39**). Plant height at 60 DAS had highly positive significant association with plant height at 90 DAS (0.79**), days to first flowering (0.57**) and days to 50% flowering (0.58**). While, days to first vegetable pod picking (0.39**) had significant and positive association with pod length (0.29*), pod width (0.37*) and ten pod weight (0.36*). Whereas, plant height at 90 DAS had highly positive and significant association with plant height at 30 DAS (0.51**) and 60 DAS (0.79**), days first to flowering (0.59**), days to 50% flowering (0.67**) and days to first vegetable pod picking (0.40**). Similar results were also reported by Maria *et al.* (2012) [11] in cluster bean, Kalaiyarasi and Palanisamy (2000) [6] in cowpea and Joshi (1971) [5] in Dolichos bean.

Earliness parameters

Days to first flowering had highly significant and positive association with plant height at 30 DAS (0.40**), 60 DAS (0.57**) and 90 DAS (0.59**), days to 50 per cent flowering (0.63**) and days to vegetable pod picking (0.50**). Whereas, days to 50 per cent flowering also had positive and highly significant association with plant height at 60 DAS (0.58**) and 90 DAS (0.67**), days to first flowering (0.63**), days to first vegetable pod picking (0.41**) and ten pod weight (0.49**). But, days to vegetable pod picking had showed positive and highly significant association with plant height at 30 and 60 DAS (0.39** each), plant height at 90 DAS (0.40**), days to first flowering (0.50**) and days to 50 per cent flowering (0.41**). Whereas, it had positive correlation with ten pod weight (0.13) and all other parameters were negatively correlated. Similar results were

also confirmed by Kalaiyarasi and Palanisamy (2000) [6], Belhekar *et al.* (2003) [2] in cow pea and Ali *et al.* (2005) [1] in Dolichos bean.

Vegetative pod yield parameters

Number of clusters per plant had showed highly positive and significant correlation with number of pods per plant (0.76**) and ten pod weight (0.54**) and significant and positive correlation with number of pods per cluster (0.31*) and pod yield per plot (0.33*). Number of pods per cluster showed highly positive and significant correlation with yield per plot (0.48**) and yield per hectare (0.49**). Whereas, it had positive and significant correlation with number of clusters per plant (0.31*). Number of pods per plant showed highly positive and significant correlation with pod length (0.41**), number of clusters per plant (0.76**), ten pod weight (0.50**) and pod yield per plot (0.58**). Kalaiyarasi and Palanisamy (2000) [6] and Venkatesan *et al.* (2003) [18] were also recorded similar findings in case of cowpea.

Pod length had highly positive and significant correlation with number of pods per plant (0.41**), ten pod weight (0.62**) and pod yield per plot (0.41**). Whereas, it had significant and positive correlation with plant height at 60 DAS (0.29*) and pod width (0.35*). Pod width showed positive and significant correlation with plant height at 60 DAS (0.37*) and pod length (0.35*). While, ten pod weight had showed positive and highly significant correlation with number of clusters per plant (0.54**), number of pods per plant (0.50**), pod length (0.62**) and days to 50 per cent flowering (0.49**). Whereas, it had also positive and significant correlation with plant height at 60 DAS (0.36*), 90 DAS (0.35*) and yield per hectare (0.34*). Similar results were reported by Saini *et al.* (2010) [13] in cluster bean.

Therefore, by increasing the value of these desirable component traits, yield may easily Pushed up suggesting the selection for these characters will be useful in improving seed yield per plant. The results are in agreement with Sheela *et al.*, (2014) [15], reported positive association of vegetable pod yield with pod length, pod girth, pod weight, pods per plant and plant height. Positive association of pod yield with pod length and girth was reported by Hanchinamani (2003) [4] and pods per plant by Shabarish and Dharmatti (2014) [14] in cluster bean.

Yield per plot had highly significant and positive correlation with number of pods per cluster (0.48**), number of pods per plant (0.58**) and pod length (0.41**), whereas, it had a positive and significant correlation with number of clusters per plant (0.33*). Yield per hectare had positive and highly significant correlation with number of pods per cluster (0.49**), number of pods per plant (0.59**) and pod length (0.41**). But, it showed positive and significant correlation with number of clusters per plant (0.34*), pod width (0.29*) and ten pod weight (0.34*). Whereas, pod yield per plant had positively correlated with other parameters except number of branches per plant and days to first vegetable pod picking (-0.30 and -0.004 respectively), which was negatively correlated. Similar results were reported by Singh *et al.* (1979) [16] in Dolichos bean. The earlier reports of Kastoori *et al.*, (2009) [7] showed positive association of yield with pod clusters per plant and Buttar *et al.*, (2008) [3] supports positive association of yield with hundred seed weight.

Table 1: Phenotypic correlation coefficients analyses among growth, earliness and green pod yield.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1.00	0.37*	0.51**	0.54**	0.40**	0.27	0.39**	0.14	-0.12	-0.001	0.13	-0.005	-0.18	-0.18	0.20	0.02
2		1.00	0.79**	-0.28	0.57**	0.58**	0.39**	0.25	0.02	0.23	0.29*	0.37*	0.29	0.28	0.36*	0.36
3			1.00	-0.049**	0.59**	0.67**	0.40**	0.12	-0.10	0.11	0.22	0.15	0.15	0.15	0.35*	0.26
4				1.00	-0.49**	-0.53**	-0.39**	-0.09	-0.008	-0.10	-0.25	0.15	-0.12	-0.11	-0.36	-0.30
5					1.00	0.63**	0.50**	0.11	-0.05	0.11	0.24	0.26	-0.28	-0.06	0.36	0.11
6						1.00	0.41**	0.10	0.001	0.20	0.35*	0.13	0.14	0.14	0.49**	0.27
7							1.00	-0.06	-0.09	-0.09	-0.12	-0.10	-0.15	-0.18	0.13	-0.004
8								1.00	0.31*	0.76**	0.26	0.21	0.33*	0.34*	0.54**	0.41
9									1.00	0.67	0.23	0.05	0.48**	0.49**	0.24	0.46
10										1.00	0.41**	0.28	0.58**	0.59**	0.50**	0.60
11											1.00	0.35*	0.41**	0.41**	0.62**	0.51
12												1.00	0.26	0.29*	0.14	0.27
13													1.00	0.97	0.34	0.87
14														1.00	0.34*	0.87
15															1.00	0.61

Critical r_p value at 1%= 0.29Critical r_p value at 5%= 0.38** → Indicates significant at $p=0.01$ * → Indicates significant at $p=0.05$

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|------------------------------------|---------------------------------|----------------------------------|
| 1. Plant height at 30DAS (cm) | 2. Plant height at 60DAS (cm) | 3. Plant height at 90DAS (cm) |
| 4. Number of branches per plant | 5. Days to first flowering | 6. Days to 50 per cent flowering |
| 7. Days to first vegetable picking | 8. Number of clusters per plant | 9. Number of pods per cluster |
| 10. Number of pods per plant | 11. Pod length (cm) | 12. Pod width (mm) |
| 13. Yield per plot (g) | 14. Yield per hectare (Kg) | 15. Ten pod weight (g) |
| 16. Pod yield per plant (t) | | |

Conclusion

Correlation coefficient analysis measures the mutual relationship between various plant characters and to determine the component character on which selection can be used for genetic improvement in yield while selecting the suitable plant type. From the present investigation it was found that pod yield per plant has shown higher significant and positive correlation with plant height at 90 days after sowing (DAS), number of branches per plant, days to first flowering and days to first vegetable pod picking, whereas, positive and significant correlation with plant height at 90 days after sowing (DAS). While, it was positively associated with days to 50 per cent flowering, number of cluster per plant, pod length and ten pod weight.

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