Correlation and path coefficient analysis for quantitative traits in early season bottle gourd (Lagenaria siceraria (Mol.) standl)

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Bottle gourd is a cultivated annual monoecious belonging to cucurbitaceace family. It is grown for its tender fruits, basically used as vegetable. In many cases of ailments, it is a preferred vegetable because of its cooling effects and easy digestibility. This crop is also known as the poor mans vegetable in India. Bottle gourd is now attaining fast popularity among the health conscious urban elites, which has encouraged round the year cultivation of this potentially important cucurbitaceous vegetable except in very cool regions during winter. Growing of bottle gourd in plastic mulches during October in eastern plateaus fetches an early summer crop which is highly remunerative. It is highly cross pollinated crop with large amount of variation for many economically important traits. Studies on variability along with heritability and genetic gain helps in predicting inheritance pattern of various characters. Correlation studies between yield and its components and their relative contributions to yield will be of great value in planning sound breeding program. Therefore, the present investigation was undertaken with a view to work out phenotypic and genotypic coefficients of variation, heritability, genetic gain, association of important genetic traits and path analysis between components of yield in bottle gourd, so as to make effective selection for improvement of this crop.

Fourteen genotypes of bottle gourd were grown under plastic mulching (100µ thickness, transparent) with three replications in a randomized block design at ICAR RCER Research Centre, Ranchi during last week of October 2009. Plot size was 2.5m x 3m and plastic mulching was done along the length of the row (2.5m) covering a width of 0.6m. Hill-to-hill spacing was 0.5m with two plants per hill. First harvest was obtained during last week of January 2009 and last harvest during 2nd week of April 2009. Data was collected on five random plants for yield per plant (kg), number of fruits per plant, node at which first female flower appears, days to 50 percent flowering, fruit weight (kg), fruit length (cm) and fruit breadth (cm). Means of the observations were subjected to variability, correlation and path analysis using statistical package SPAR version 2.0.

The analysis of variance revealed that all the seven quantitative characters under study were highly significant among the fourteen genotypes. This indicates presence of sufficient amount of variation for all the traits and selection will be very effective in improving them. Range of variation was highest for fruit length (11.33- 44). Phenotypic and genotypic coefficient of variation was highest for fruit breadth (30.04, 28.39). High genotypic coefficient of variation values for yield per plant, number of fruits per plant, fruit length and fruit breadth and wider range of variation indicate more opportunity for selection of better genotypes. Similar results were reported by Rajesh *et al* (1999), Ram *et al* (2005). Phenotypic coefficients of variation were greater than genotypic coefficients of variation indicating influence of environment. Days to 50 percent flowering, fruit length and fruit breadth showed high heritability values. All characters recorded high genetic gain except days to 50 percent flowering and node at which first female flower appears. Hence characters with high genotypic coefficients of variation, high heritability and high genetic gain are controlled by additive gene action and hence direct selection is effective. Days to 50 percent flowering and node at which first female flower appears showed low genotypic coefficient of variation, moderate heritability and low genetic gain indicating preponderance of non additive gene action and influence of environment.

Genotypic correlation (Table 1) revealed that yield per plant showed significant positive correlation with number of fruits per plant. Similar results were reported by Prakash *et al.* (2000), Ram *et al.* (2005) and Raja *et a.l*

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Table 1. Estimates of genotypic and phenotypic correlation coefficients

Genotypes	Yield/ plant (kg)	No. of fruits/ plant	Node at which first female flower	Days to 50% flowering	Fruit weight (Kg)	Fruit length (cm)	Fruit breadth (cm)
Yield/plant (kg)	1.000	0.942**	-0.425	-0.685**	-0.263	0.428	-0.651*
		0.923**	-0.112	-0.335	-0.024	0.320	-0.410
No. of fruits/plant		1.000	-0.461	-0.739**	-0.387	0.575*	-0.706**
			-0.136	-0.415	-0.053	0.453	-0.470
Node at which first female flower			1.000	1.050**	0.108	-0.357	0.691**
				0.551*	0.037	-0.245	0.438
Days to 50% flowering				1.000	0.275	-0.467	0.727**
					0.210	-0.358	0.585*
Fruit weight (Kg)					1.000	-0.053	0.283
						0.041	0.332
Fruit length (cm)						1.000	-0.861**
							-0.764**
Fruit breadth (cm)							1.000

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

(2006). Therefore this single trait should be taken into consideration while making selection for improvement in fruit yield. Days to 50 percent flowering and fruit breadth exhibited negative significant correlation with fruit yield implying selection for earliness leads to lower yield. Node at which the first female flower appeared, showed positive significant correlation with days to 50 percent flowering and fruit breadth. Fruit length and fruit breadth are negatively correlated indicating selection for long fruits results in narrow width fruits. Phenotypic correlation coefficients for all the characters under study were lower in magnitude compared to genotypic coefficients indicating influence of environment on their expression and they were following the same trend as that of genotypic correlations.

Table 2. Direct and indirect effects of yield components on yield per plant

Characters	No. of fruits/plant	Node at which first female flower	Days to 50% flowering	Fruit weight (Kg)	Fruit length (cm)	Fruit breadth (cm)
No. of fruits/plant	<u>1.212</u>	-0.559	-0.896	-0.469	0.697	-0.856
	<u>0.976</u>	-0.132	-0.405	-0.052	0.443	-0.459
Node at which first female flower	0.033	<u>-0.072</u>	-0.076	-0.008	0.026	-0.050
	-0.001	<u>0.013</u>	0.007	0.0004	-0.003	0.006
Days to 50% flowering	-0.317	0.450	<u>0.429</u>	0.118	-0.200	0.312
	-0.040	0.054	<u>0.097</u>	0.020	-0.035	0.057
Fruit weight (Kg)	-0.108	0.030	0.077	<u>0.279</u>	-0.015	0.079
	-0.006	0.004	0.024	<u>0.116</u>	0.005	0.038
Fruit length (cm)	-0.437	0.271	0.355	0.041	<u>-0.761</u>	0.655
	-0.141	0.076	0.111	-0.013	<u>-0.310</u>	0.237
Fruit breadth (cm)	0.558	-0.546	-0.575	-0.223	0.681	<u>-0.791</u>
	0.136	-0.126	-0.169	-0.096	0.221	<u>-0.289</u>
'r' values	0.942**	-0.425	-0.685**	-0.263	0.428	-0.651*
Yield/plant (kg)	0.923**	-0.112	-0.335	-0.024	0.320	-0.410

Underlined values are direct effects and all other values are indirect effects

Genotypic and phenotypic path coefficient analysis (Table 2) was carried out taking yield per plant as dependent variable. The analysis revealed that number of fruits per plant had highest direct effect on yield per plant at both genotypic and phenotypic levels. At genotypic level, days to 50 percent flowering was ranking second with respect to direct effect on yield followed by fruit weight. At phenotypic level fruit weight was ranking second followed by days to 50 percent flowering. Number of fruits per plant and fruit weight exhibited highest direct effects as reported by the findings of Kumar and Singh (1998), Ram *et al.* (2005), Raja *et al*. (2006) and Nikhil and Hossain (2007). Number of fruits per plant also showed positive and highly significant correlation with yield. The direct effects of fruit weight and days to 50 percent flowering were nullified by low and indirect effects resulting in negative correlation. In case of indirect effects, fruit length has highest indirect effect *via* number of frits per plant followed by fruit length *via* fruit breadth at both genotypic and phenotypic level. The highest negative indirect effect was recorded by days to 50 percent flowering *via* number of fruits per plant and fruit breadth *via* number of fruits per plant. Fruit length exhibited positive association with negative direct effects on yield indicating contributions of this character through number of fruits per plant and fruit breadth. Residual effect of 0.07 implies that the total genotypic variability in yield has been explained by the characters associated in the study.

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