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Correlation Studies and Path Analysis in Bottle Gourd

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Abstract

An experiment was conducted with 18 different characters in bottle gourd (*Lagenaria siceraria* (Molina) standl) comprising 36 hybrids obtained by crossing 9 lines and 4 testers by line x testers method to study the correlation and direct and indirect effects of different characters on fruit yield. The experiment was conducted in a randomized block design. The overall analysis reveals that fruit yield was positively and significant correlated with fruit flesh thickness, number of fruits per vine and number of fruit pickings. The path analysis indicated that number of fruits per vine, days to first female flower opening, fruit cavity and fruit weight had positive direct effect on fruit yield. Therefore emphasis should be given on fruit flesh thickness, number of fruits per vine, number of fruit pickings, days to first female flower opening, fruit cavity and fruit weight, while selecting a good hybrids for enhancing the yield of bottle gourd.

Keywords: Bottle gourd; Correlations; Path analysis; line tester

Introduction

Bottle gourd (*Lagenaria siceraria* (Molina) Standl) belongs to the family Cucurbitaceae having chromosome number 2n=22. It is one of the most important cucurbits cultivated in India. It is also known as a white flowered gourd. Bottle gourd is a valued vegetable for its nutritive and medicinal properties. The fruit is rich in moisture (96.1 g), protein (0.2 g), carbohydrate (2.5 g) and traces of minerals like calcium (20 mg), phosphorus (10 mg) and iron (0.7 mg) in 100 gm of fruit [1]. Its tender fruits are used as cooked vegetable and also for making sweets in Africa and Asia. The dried fruits are used as containers, utensils, fishing floats and some musical instruments. Genotypic correlation coefficient provides a measure of genotypic association between the characters and reveals the characters that might be useful as an index of selection. This also helps to decide the dependability of the characters that have little or no character could be hurtful for proper choice of parents for hybridization programme. The path analysis facilitates the partitioning of correlation coefficients into the direct and indirect effects of component characters on yield and any other attributes. Keeping in this view, the present investigation was conducted to determine the characters and their direct and indirect effects on yield.

Materials and Methods

The present investigation was carried out at the Department of Horticulture, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal during 2011 and 2012. Thirteen parents (Nine lines and four testers) of bottle gourd namely, NDBG–121 (L1), Narendra Jothi (L2), Kashi Ganga (L3), Narendra Jothi (L4), Punjab Long (L5), Kalyanpur Long Green (L6), Pusa Naveen (L7), DBG-6 (L8), Arka bahar (L9), Punjab Komal (T1), NDBG-164 (T2), Narendra Dharwar (T3), Samrat (T4) were selected for this study. These lines and testers were crossed in a L x T (line x tester) design. The parental materials crossing block were raised during August 2011 to December, 2011 to affect crosses in a line x tester mating system. A total of 36 F1 hybrids and their respective parents (evaluation block) were raised in a Randomized Block Design (RBD) with three replications during January, 2012 to April, 2012. An inter-row spacing of 2.0 m and intra-row spacing of 1.5 m was adopted. The observation were recorded on vine length, number of primary branches, node at first male and female flower appears, days to first male and female flower opening, sex ratio, days to first fruit harvest, fruit length, fruit cavity, fruit flesh thickness, fruit width, fruit weight, number of fruits per vine, number of pickings, number of seeds per fruit, 100 seed weight and yield per vine. The correlations were worked out and Path coefficient analysis was carried out by the method suggested to partition the genotypic correlation coefficient into measures of direct and indirect effects [2,3].

Result and Discussion

The genotypes correlation coefficients between yield and its components were estimated and presented in Table 1. Fruit flesh thickness, number of fruits per vine, number of pickings showed significant positive association with fruit yield per vine, while sex ratio, fruit length, fruit width, fruit cavity, fruit weight, 100 seed weight showed positive non-significant association with fruit yield per vine. Node at first male flower appears showed significant negative association with fruit yield per vine. vine length, number of primary branches, node at first female appears, days to first male flower opening, days to first female flower opening, days to first harvest, number of seeds per vine recorded negative non-significant correlation with fruit yield per vine. Number of fruits per vine recorded highest correlation (r=0.676) exhibited highly significant and positive correlations with yield. Similar results were obtained by Srivastava et al., Mangal et al., Khattra et al., and Rajeswari [4-7]. Fruit flesh thickness significantly influenced the fruit weight and hence the yield. The positive non-significant association was found in sex ratio, fruit length, fruit width, fruit cavity, fruit weight, 100 seed weight. The vine length, number of primary branches, node at first female flower appears, days to first male flower opening, days to first female flower

opening, days to first harvest and number of seeds per fruit recorded negative and non-significant association with fruit yield per vine. Node at first male flower appears showed significant negative association with fruit yield per vine. Similar findings were reported by Karuppiah et al., Lakshmi et al., and Parvathi et al. [8-10]. Doku suggested that inter correlation among the yield components need to be estimated because one component influences the other related components [11]. The fruit cavity had positive and highly significant correlation with the fruit flesh thickness and number of pickings. This is in line with the findings of Thamburaj et al. and Singh et al. [12,13]. The fruit flesh thickness exhibited positive and significant association with fruit yield per vine. Number of fruits per vine registered positive and highly significant with fruit yield per vine. This is in line with the findings of Choudhary et al. [14].

	X^1	X^2	X^3	X^4	X^5	X^6	X^7	X^8	X^9	X^{10}	X^{11}	X^{12}	X^{13}	X^{14}	X^{15}	X^{16}	X^{17}	X^{19}
X^1	1.000	0.396*	-0.166	-0.075	-0.332*	-0.402*	-0.023	-0.169	0.191	-0.402*	0.265	0.187	-0.122	-0.017	0.209	-0.091	-0.103	-0.031
X^2		1.000	0.033	0.351*	-0.301	-0.299	-0.149	-0.148	-0.185	-0.208	-0.111	0.001	-0.249	-0.192	-0.320*	-0.147	-0.310	-0.295
X^3			1.000	0.118	0.228	0.130	0.263	0.143	-0.226	0.066	0.033	-0.057	-0.080	-0.333*	-0.491**	0.168	-0.139	-0.354*
X^4				1.000	0.179	0.208	-0.037	0.096	-0.187	0.018	-0.504**	-0.164	-0.340*	0.117	-0.289	-0.062	-0.116	-0.297
X^5					1.000	0.952**	0.406*	0.850**	-0.303	0.056	-0.267	-0.366*	-0.247	0.040	-0.430**	-0.238	0.053	-0.242
X^6						1.000	0.369*	0.838**	-0.302	0.087	-0.335*	-0.318	-0.260	0.068	-0.377*	-0.252	0.060	-0.169
X^7							1.000	0.451**	-0.260	-0.387*	0.043	-0.327*	-0.240	0.308	-0.071	-0.214	-0.006	0.091
X^8								1.000	-0.248	-0.067	-0.130	-0.271	-0.394*	0.110	-0.236	-0.313	0.056	-0.149
X^9									1.000	-0.302	0.514*	0.181	0.069	0.027	0.356*	0.180	-0.167	0.045
X^{10}										1.000	-0.241	0.385*	0.138	-0.064	-0.186	-0.054	0.195	0.107
X^{11}											1.000	0.484*	0.013	-0.078	0.258*	-0.098	-0.267	0.270
X^{12}												1.000	0.090	0.002	0.240	-0.048	-0.219	0.381*
X^{13}													1.000	-0.259	0.196	0.302	0.041	0.226
X^{14}														1.000	0.302	-0.190	0.191	0.676**
X^{15}															1.000	0.134	0.184	0.415**
X^{16}																1.000	-0.187	-0.156
X^{17}																	1.000	0.081
X^{18}																		1.000

Table 1: Genotypic correlation coefficients between yield and yield components in bottle gourd. X^1-Vine length, X^2 –Number of primary branches, X^3 –Node number at first male flower appears, X^4-Node number at first female flower appears, X^5-Days to first male flower opening, X^6-Days to first female flower opening, X^7-Sex ratio, X^8-Days to first harvest, X^9 –Fruit length, X^{10} –Fruit width, X^{11} –Fruit cavity, X^{12} –Fruit flesh thickness, X^{13} –Fruit weight, X^{14}– Number fruits per vine, X^{15}-Number of picking, X^{16} –Number of seeds per fruit, X^{17}-100 seed weight, X^{18}-Yield per vine

Path co-efficient analysis was carried out to find out direct and indirect effects of eighteen characters of present study on fruit yield per vine and the results are presented in Table 2. In this present study, the highest positive direct effect on the fruit yield per vine was exerted by number of fruits per vine (0.9156) followed by days to first female flower opening (0.800), fruit cavity (0.38096), fruit weight (0.37378),

days to first harvest (0.19179). This is in confirmation with the work of Abusaleha and Dutta and Shanthipriya for days to first fruit harvest [15,16]. Fruit length (-0.37031) recorded high negative direct effect on fruit yield per vine. Number of primary branches (-0.1898), days to first male flower opening (-1.10344), sex ratio (-0.14104) and number of pickings (-0.12244) recorded negative low direct effect on fruit yield per vine. The residual effect observed is present study was 0.2976. The fruit weight exhibited positive direct effect on yield and indirectly influenced through days to first male flower opening and number of seeds per fruit. This result is in accordance with Rajendran and Thamburaj for number of seeds per fruit [17]. The indirect effects also showed that most of the characters influenced the yield through days to first male flower and female flower opening, sex ratio, days to first harvest, fruit length, fruit cavity, fruit flesh thickness, fruit weight, number of pickings and yield per vine this suggest that while selecting the best hybrids for yield, more emphasis should be given to these above mentioned traits. Similar results were obtained by Choudhary et al. [12]. The perusal of overall results has impact on yield although simultaneous selection of the number of fruits per vine, days to first female flower opening, fruit cavity and fruit weight are the principal component characters, which exhibited high positive direct effects. The indirect effects of most of the characters were through vine length, days to first male flower opening, fruit length, fruit flesh thickness and number of pickings will also be useful in bringing higher yields in bottle gourd.

	X^1	X^2	X^3	X^4	X^5	X^6	X^7	X^8	X^9	X^{10}	X^{11}	X^{12}	X^{13}	X^{14}	X^{15}	X^{16}	X^{17}
X^1	-0.02193	-0.07515	0.00046	0.0105	0.36649	-0.32177	0.00328	-0.03233	-0.07077	0.01096	0.101	0.01324	-0.04563	-0.01522	-0.02558	0.00601	0.00739
X^2	-0.00869	-0.1898	-0.00009	-0.04889	0.33244	-0.23941	0.02108	-0.02838	0.06862	0.00568	-0.04228	0.0001	-0.09307	-0.17612	0.03917	0.00971	0.02225
X^3	0.00364	-0.00631	-0.00274	-0.0164	-0.25111	0.10402	-0.03708	0.02745	0.08367	-0.00179	0.01265	-0.00405	-0.03005	-0.305	0.06016	-0.01112	0.00997
X^4	0.00165	-0.06662	-0.00032	-0.13928	-0.1979	0.1667	0.00517	0.01846	0.06921	-0.00048	-0.19197	-0.01162	-0.12699	0.10696	0.03543	0.00411	0.00836
X^5	0.00729	0.05718	-0.00062	-0.02498	-1.10344	0.76193	-0.0572	0.16298	0.11223	-0.00154	-0.10162	-0.0259	-0.09242	0.0364	0.05265	0.01575	-0.00383
X^6	0.00882	0.05678	-0.00036	-0.02901	-1.05049	0.80034	-0.05198	0.16081	0.11178	-0.00238	-0.12779	-0.02254	-0.09718	0.06268	0.04621	0.01669	-0.00432
X^7	0.00051	0.02836	-0.00072	0.0051	-0.44748	0.29497	-0.14104	0.08657	0.09626	0.01057	0.01628	-0.02314	-0.08985	0.28188	0.0087	0.01416	0.00043
X^8	0.0037	0.02808	-0.00039	-0.0134	-0.93765	0.67104	-0.06366	0.19179	0.09193	0.00181	-0.04938	-0.01921	-0.14721	0.10051	0.02892	0.02074	-0.00402
X^9	-0.00419	0.03517	0.00062	0.02603	0.33442	-0.2416	0.03666	-0.04761	-0.37031	0.00822	0.19593	0.01283	0.0257	0.02454	-0.04354	-0.01188	0.01198
X^{10}	0.00882	0.03953	-0.00018	-0.00244	-0.06211	0.06977	0.05465	-0.01276	0.11166	-0.02728	-0.09183	0.02731	0.05175	-0.05888	0.02283	0.00358	-0.01403
X^{11}	-0.00582	0.02106	-0.00009	0.07018	0.29434	-0.26847	-0.00603	-0.02486	-0.19045	0.00657	0.38096	0.03428	0.00494	-0.07156	-0.03161	0.00651	0.0192
X^{12}	-0.0041	-0.00026	0.00016	0.02284	0.4034	-0.25465	0.04605	-0.05199	-0.06706	-0.01051	0.18431	0.07085	0.03362	0.00151	-0.02941	0.00318	0.01574
X^{13}	0.00268	0.04726	0.00022	0.04732	0.27284	-0.20809	0.0339	-0.07554	-0.02546	-0.00378	0.00503	0.00637	0.37378	-0.23704	-0.02404	-0.01999	-0.00297
X^{14}	0.00036	0.0365	0.00091	-0.01627	-0.04386	0.05478	-0.04341	0.02105	-0.00992	0.00175	-0.02977	0.00012	-0.09675	0.91576	-0.03693	0.01255	-0.01372
X^{15}	-0.00458	0.06072	0.00135	0.0403	0.47452	-0.30207	0.01002	-0.04531	-0.13167	0.00509	0.09836	0.01702	0.07339	0.27623	-0.12244	-0.00888	-0.01323
X^{16}	0.00199	0.02784	-0.00046	0.00865	0.26249	-0.20186	0.03017	-0.06008	-0.06648	0.00148	-0.03745	-0.0034	0.1129	-0.17358	-0.01643	-0.06619	0.0134
X^{17}	0.00226	0.0588	0.00038	0.01622	-0.05881	0.04813	0.00085	0.01074	0.06175	-0.00533	-0.10183	-0.01553	0.01547	0.17494	-0.02256	0.01235	-0.07182

Table 2: Path coefficient analysis showing direct and indirect effects of yield components on fruit yield in bottle gourd. X^1-Vine length, X^2 – Number of primary branches, X^3 –Node number at first male flower appears, X^4-Node number at first female flower appears, X^5-Days to first

male flower opening, X^6-Days to first female flower opening, X^7-Sex ratio, X^8-Days to first harvest, X^9 –Fruit length, X^{10} –Fruit width, X^{11} –Fruit cavity, X^{12} –Fruit flesh thickness, X^{13} –Fruit weight, X^{14}– Number fruits per vine, X^{15}-Number of picking, X^{16} –Number of seeds per fruit, X^{17}-100 seed weight.

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