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Research Note

Character association for fruit yield and yield traits in Cucumber (*Cucumis sativus L.*)

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Abstract
An Experiment was undertaken to study the correlation and path analysis in 38 advanced cucumber lines. Correlation study revealed that 100-seed weight had maximum positive correlation with yield per plant. Similarly, number of fruits per plant, average fruit weight, fruit length, flesh thickness and seed cavity length had significant positive correlation with yield per. According to path analysis, seed cavity breadth, flesh thickness, average fruit weight, days to first female flower opening and number of fruits per plant had high positive direct effects on yield per plant. Node at which first female appears, days to first male flower opening, days to first harvest and fruit breadth had negative direct effects on yield. Thus based on correlation and path analysis, the traits viz., seed cavity breadth, flesh thickness, average fruit weight, days to first female flower opening, number of fruits per plant, node at which first female appears, days to first male flower opening and days to first harvest and fruit breadth may be considered as selection indices for high yield.

Key words*:*
Cucumber, Correlation, path analysis, fruit yield.

Cucumber (*Cucumis sativus* L.) is an important salad vegetable crop grown throughout India. It is a highly cross pollinated crop and usually monecious in nature. It prefers warm weather and bright light for better growth and development. Though India is the primary centre of origin, very less attention has been paid for its improvement. Crop improvement through selection depends not only on fruit yield alone but depends upon the interrelationship of number of component characters. In the present study an attempt was made to evaluate the direct and indirect association among the various variables of 38 cucumber lines through correlation and path analysis.

The material for the present study consist of 38 advanced cucumber lines *viz.*, Swarna Ageti, Japanese Long Green, Sangeeta, Nandini, Barsati, Sweet Market More, Ajax, VR-101, VR-06-07, Local line, IIHR-405, Karur local, IIHR-407-1, IIHR0409-2, Punjab Naveen, IIHR-34, Himangi, Peb Kamal, VS-474, Poinsettia, 595920, IIHR-285, IIHR-304, IIHR-81, IIHR-82, IIHR-36, Gadag Local, IIHR-177, Phule Shubangi, Tender Green Burbless, VRC-06-08, IIHR-306, IIHR-34-S4, IIHR-337, Pilibhat Local, IIHR-384, *Cucumis sativus var. hardwickii* and IIHR-338. The experiment was conducted at the Division of vegetable crops, Indian Institute of Horticultural Research (IIHR), Bengaluru during *Kharif* season, 2010. The seedlings were transplanted at true leaf stage with an adequate spacing of 2.0X0.6 m^2. Application of fertilizers (30: 50: 80 kg NPK ha-1) and the plant protection measures were taken up as per the recommended package of practices of UAS, Bengaluru.

The observations were recorded on 17 economic traits from five randomly selected competitive plants from each of the genotypes and its replications. The characters viz.,, days to first male flower, days to first female flower, vine length, number of branches per vine, number of nodes per vine, number of female flowers per vine, number of male flowers per vine, days to first fruit harvest, fruit length, fruit diameter, average fruit weight, number of good fruits per vine, number of misshaped fruits per vine, total number of fruits per vine and total fruit yield per vine were studied. The recorded data were analyzed as suggested by Al-jibouri *et al.* (1958) for correlation coefficient analysis and by Deway and Lu (1959) for path coefficient analysis.

The correlation study indicates the degree of inter-relationship of plant characters for improvement of yield as well as important quality parameters in any breeding programme. In the present study, genotypic correlations among characters were higher than phenotypic correlations indicating high heritable nature of characters (Table 1 and 2). Yield per plant showed a positive and significant correlation with number of fruits per plant (0.369), average fruit weight (0.746), fruit length (0.480), flesh thickness (0.362), seed cavity length (0.417) and 100 seed weight(0.594).

Linear relationship between fruit characters and yield per plant suggest that selection method of crop improvement should mainly be focussed over fruit characteristics. Similar results have been reported for number of fruits per plant and fruit length by Choudary and Mandal (1987), Abusaleha and Dutta (1988), Arunkumar *et al*., (2011) and

Hanchinamani (2006). Average fruit weight got a positive correlation with yield which is in conformity with previously report by Choudry and Manadal (1987), Prasad and Singh (1994) and Reshmi (2006). Seed cavity length reported a positive correlation with yield per plant. Similar kind of positive correlation was reported by Choudary and Mandal (1987), Abusaleha and Dutta (1988).

The path analysis indicates that the association of the independent character with dependent variable is due to their direct effect on it or is a consequence of their indirect effect through some other traits. If the correlation between dependent variable and independent character is due to direct effects of the character, it reflects a true relationship between them and selection can be practiced for such a character in order to improve dependent variable. But, if the association is mainly through indirect effect of the character *i.e.*, through another component character, the breeder has to select for the later through which the direct effect is exerted. In the present study, path analysis was performed for total yield per plant. Both genotypic and phenotypic paths were worked out, but genotypic path was given more importance (Table 3). Seed cavity breadth (4.476) had highest positive effect on yield per plant followed by flesh thickness (3.434), average fruit weight (0.728), days to first female flower opening (0.696) and number of fruits per plant (0.466). The results obtained were in agreement with the previous report of Choudry and Mandal (1987), Abusaleha and Dutta (1988), Prasad and Singh (1992), Arunkumar *et al*. (2011) and Dhiman and Chander Prakash (2005).

The fruit breath (-6.356) had highest direct negative effect on yield per plant followed by days to first harvest (-0.632). This observation was in agreement with the results of Choudry and Mandal (1987), Dhiman and Chander Prakash (2005) and Rao *et al*.(2004). . Thus based on correlation and path analysis, the traits viz., seed cavity breadth, flesh thickness, average fruit weight, days to first female flower opening, number of fruits per plant, node at which first female appears, days to first male flower opening and days to first harvest and fruit breadth may be considered as selection indices for high yield.

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Table 1. Genotypic correlation co-efficient among important quantitative character in cucumber

Characters	Vine Length (m)	Number of nodes per plant	Node at first female flower appearance	Node at first male flower appearance	Days to first female flower opening	Days to first male flower opening	Days to first harvest	Number of fruits per plant	Average fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Flesh thickness (cm	Seed cavity length (cm)	Seed cavity breadth (cm)	Number of seeds per fruit	100 seed weight (g)	Yield per plant (kg)
	VL	NNP	NFFFA	NFMFA	DFFFO	DFMFO	DFH	NFPP	AFW	FL	FB	FT	SCL	SCB	NSF	HUN	YPP
VL	1	0.311*	0.053	0.138	-0.217	-0.093	-0.16	-0.196	0.375**	0.455**	0.201	-0.023	0.595**	0.295*	-0.17	0.206	0.320*
NNP			0.047	0.064	-0.091	-0.019	-0.086	0.239	-0.074	0.071	0.305*	0.326*	0.058	0.191	-0.04	-0.064	0.183
NFFFA				0.798**	0.472**	0.446**	0.345*	-0.316*	-0.022	0.135	-0.142	-0.172	0.054	-0.068	0.147	-0.079	-0.135
NFMFA					0.384**	0.542**	0.312*	-0.376*	0.032	0.086	-0.267	-0.347*	0.054	-0.112	0.117	-0.044	-0.095
DFFFO						0.753**	0.973**	-0.251	-0.025	-0.297*	-0.059	-0.185	-0.264	0.04	0.097	-0.258	-0.289*
DFMFO							0.818**	-0.387**	0.125	-0.013	0.022	-0.11	0.002	0.101	0.267	-0.118	-0.176
DFH								-0.345*	0.029	-0.262	-0.008	-0.13	-0.216	0.067	0.162	-0.27	-0.303*
NFPP									-0.325*	-0.234	-0.379*	-0.6	-0.228	-0.467**	-0.198	-0.005	0.339*
AFW										0.686**	0.335*	0.505**	0.643**	0.076	-0.018	0.669**	0.705**
FL											0.354*	0.301*	0.933**	0.257	0.153	0.354*	0.524**
FB												0.696**	0.423**	0.859**	0.013	0.178	0.03
FT													0.300*	0.231	-0.169	0.329*	0.399**
SCL														0.356*	0.087	0.359*	0.510**
SCB															0.136	0.004	-0.248
NSF																0.158	-0.029
HUN																	0.730**

*,** Significant at 5 and 1% respectively

Table 2. Phenotypic correlation co-efficient among important quantitative character in cucumber

Characters	Vine Length (m)	Number of nodes per plant	Node at first female flower appear	Node at first male flower appear	Days to first female flower opening	Days to first male flower opening	Days to first harvest	Number of fruits per plant	Average fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Flesh thickness (cm)	Seed cavity length (cm)	Seed cavity breadth (cm)	Number of seeds per fruit	100 seed weight (g)	Yield per plant (kg)
	VL	NNP	NFFFA	NFMFA	DFFFO	DFMFO	DFH	NFPP	AFW	FL	FB	FT	SCL	SCB	NSF	HUN	YPP
VL	1.000	0.271	0.040	0.117	-0.086	-0.041	-0.052	-0.043	0.174	0.257	0.107	-0.016	0.338*	0.163	-0.084	0.160	0.214
NNP		1.000	0.047	0.098	-0.091	-0.023	-0.085	0.249	-0.062	0.051	0.248	0.226	0.051	0.166	-0.040	-0.070	0.172
NFFFA			1.000	0.722**	0.364*	0.392**	0.329*	-0.248	-0.002	0.112	-0.126	-0.157	0.062	-0.036	0.140	-0.066	-0.089
NFMFA				1.000	0.241	0.409**	0.222	-0.230	-0.030	0.047	-0.190	-0.216	0.034	-0.075	0.101	-0.015	-0.024
DFFFO					1.000	0.750**	0.902**	-0.194	-0.006	-0.246	-0.056	-0.150	-0.218	0.025	0.096	-0.231	-0.023
DFMFO						1.000	0.793**	-0.338*	0.107	-0.013	0.009	-0.102	-0.004	0.080	0.260	-0.107	-0.133
DFH								-0.275*	0.036	-0.235	-0.031	-0.153	-0.190	0.066	0.157	-0.242	-0.214
NFPP									-0.242	-0.187	-0.330*	-0.050	-0.184	-0.398**	-0.190	-0.029	0.369*
AFW										0.613**	0.336*	0.428**	0.587**	0.108	-0.035	0.563**	0.746**
FL											0.377*	0.280*	0.918**	0.281*	0.135	0.333*	0.480**
FB												0.675**	0.424**	0.818**	0.001	0.179	0.090
FT													0.253	0.132	-0.165	0.283*	0.362*
SCL														0.369*	0.070	0.327*	0.417**
SCB															0.131	0.017	-0.158
NSF																0.172	-0.052
HUN																	0.594**

*,** Significant at 5 and 1% respectively

Table 3. Genotypic path analysis among important quantitative characters on yield per plant in cucumber

Characters	Vine length (m)	Number of nodes per plant	Node at first female flower appearance	Node at first male flower appearance	Days to first female flower opening	Days to first male flower opening	Days to first harvest	Number of fruits per plant	Average fruit weight (g)	Fruit length (cm)	Fruit breadth (cm)	Flesh thickness (cm	Seed cavity length (cm)	Seed cavity breadth (cm)	Number of seeds per fruit	100 seed weight (g)
	VL	NNP	NFFFA	NFMFA	DFFFO	DFMFO	DFH	NFPP	AFW	FL	FB	FT	SCL	SCB	NSF	HUN
VL	0.143	0.019	-0.012	0.016	-0.151	0.001	0.101	-0.091	0.273	0.027	-1.279	-0.079	0.036	1.318	-0.031	0.027
NNP	0.044	0.062	-0.01	0.008	-0.063	0	0.054	0.111	-0.054	0.004	-1.936	1.119	0.004	0.856	-0.007	-0.009
NFFFA	0.008	0.003	-0.219	0.093	0.0329	-0.006	-0.218	-0.147	-0.016	0.008	0.905	-0.59	0.003	-0.304	0.026	-0.01
NFMFA	0.02	0.004	-0.175	0.117	0.267	-0.008	-0.197	-0.175	0.023	0.005	1.697	-1.192	0.003	-0.499	0.021	-0.006
DFFFO	-0.031	-0.006	-0.103	0.045	0.696	0.01	-0.615	-0.117	-0.018	-0.018	0.378	-0.635	-0.016	0.18	0.017	-0.034
DFMFO	-0.013	-0.001	-0.098	0.063	0.524	-0.014	-0,517	-0.18	0.091	-0.001	-0.138	-0.379	0	0.453	0.048	-0.016
DFH	-0.023	-0.005	-0.076	0.036	0.677	-0.011	-0.632	-0.16	0.021	-0.016	0.053	-0.447	-0.013	0.3	0.029	-0.036
NFPP	-0.028	0.015	0.069	-0.044	-0.175	0.005	0.218	0.466	-0.237	-0.014	2.41	-0.207	-0.014	-2.089	-0.036	-0.001
AFW	0.054	-0.005	0.005	0.004	-0.018	-0.002	-0.019	-0.151	0.728	0.041	-2.132	1.735	0.039	0.341	-0.003	0.088
FL	0.065	0.004	-0.03	0.01	-0.207	0	0.165	-0.109	0.499	0.06	-2.252	1.034	0.057	1.151	0.028	0.047
FB	0.029	0.019	0.031	-0.031	-0.041	0	0.005	-0.177	0.244	0.021	-6.356	2.391	0.026	3.843	0.002	0.024
FT	-0.003	0.02	0.038	-0.041	-0.129	0.002	0.082	-0.028	0.368	0.018	-4.426	3.434	0.018	1.034	-0.03	0.043
SCL	0.085	0.004	-0.012	0.006	-0.184	0	0.137	-0.106	0.468	0.057	-2.69	1.03	0.061	1.592	0.016	0.047
SCB	0.042	0.012	0.015	-0.013	0.028	-0.001	-0.042	-0.217	0.055	0.016	-5.457	0.793	0.022	4.476	0.024	0
NSF	-0.024	-0.002	-0.032	0.014	0.068	-0.004	-0.102	-0.092	-0.013	0.009	-0.085	-0.58	0.005	0.609	0.18	0.021
HUN	0.029	-0.004	0.017	-0.005	-0.18	0.002	0.17	-0.002	0.487	0.021	-1.134	1.13	0.022	0.016	0.028	0.132

Residual effect = 0.0332