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Correlation and path analysis study for yield and its contributing traits in different horticultural groups of muskmelon (*Cucumis melo* L.)

BB Bhimappa, H Choudhary*, TK Behera and VK Sharma[1]

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Abstract

The present investigation was carried out to estimate the extent of character association between fruit yield and 23 yield contributing and other traits of economic importance among 67 genotypes of muskmelon (*Cucumis melo* L.) from three horticultural groups (*inodorous, cantaloupensis* and *momordica*). The experimental results revealed significant differences among the genotypes for all 24 traits under study. On the basis of yield and yield related attributes, 7 genotypes viz., DM-162, DM-159, DM-143, DM-145, DM-31, and DM-56 were identified as superior ones. The correlation coefficients (phenotypic and genotypic) among different quantitative traits along with fruit yield per plant exhibited highly significant and positive association with average fruit weight (0.92), fruit length (0.63), fruit width (0.58), flesh thickness (0.57) and cavity length (0.56).Total soluble solids showed highly significant and positive association with days to first male flower opening (0.37), days to first fruit harvest (0.36), total crop duration (0.36), days from pollination to harvest (0.35), days to first pistillate flower opening (0.29), vine length (0.27), flesh thickness (0.19) and negative association with node to first male flower (-0.36), cavity width (-0.33). Path coefficient analysis at genotypic level revealed that total soluble solids had a direct positive effect (0.003) and indirect effects via total crop duration (0.582), average fruit weight (0.143) and negative indirect effects via days to first fruit harvest (-0.529), cavity length (-0.381), and days to first male flower (-0.120).

Keywords: Correlation, Path analysis, Yield, TSS, *Cucumis melo* L.

Introduction

Muskmelon is an important cucurbitaceous vegetable which holds coveted position among the different vegetables. Itis highly relished as dessert because of its attractive and unique aromatic musky flavor, sweet taste and is being a rich source of vitamins and minerals and widely grown vegetable in India. African continent especially eastern region of south Sahara desert has been generally regarded as the center of origin of *Cucumis melo*, while India has been considered as an important secondary center of diversity. However, recent studies showed that cucumber and muskmelon both are of Asian origin and wide diversity of wild species of *Cucumis melo* L. exists in India and China as reported by Sebastean et al. (2010). Available information on the nature and magnitude of the genetic variation governing the inheritance of quantitative character like yield and its components is essential for effecting genetic improvement. Efforts are being made to increase its productivity by developing superior variety. Yield being a complex quantitative character, depends on a number of attributing traits. So the knowledge of association of different components together with their relative proportion indicates only the interrelationships of the characters but do not furnish information on cause and effects. This would aid in formation of efficient breeding programme. Thus, a required consideration should be given not only to yield but also to its contributing traits for increasing the productivity of new variety. Therefore, the present study was undertaken to generate the information on correlation coefficient in muskmelon genotypes which ultimately helps in developing the superior varieties. The study was carried out to know interrelations of 24 characters and to understand the nature of direct and indirect effects of these characters on yield.

Materials and Methods

The experimental materials consisted of 67 genotypes from 3 horticultural groups (*inodorous, cantaloupensis* and *momordica*) of melon including six commercial varieties namely Durgapura Madhu, Kashi Madhu, Pusa Madhuras, Hara Madhu, Arka Jeet and Punjab Sunheri.

Division of Vegetable Science, Indian Agricultural Research Institute, Pusa-110 012, New Delhi
[1]Division of Soil Science and Agricultural Chemistry, IARI, Pusa-110 012, New Delhi
*Corresponding author, Email: harshahit2001@yahoo.co.in

This experiment was conducted in a Randomized Block Design with three replications during the spring–summer season of 2014. The soil texture of the experimental field was sandy loam with alkaline reaction and medium fertility. Twenty plants per genotype in each replication were maintained. The seeds were sown at a spacing of 2.0 m from row to row and 0.6 m from plant to plant within a row. The recommended package of practices was followed. Necessary plant protection measures were carried out uniformly to safe guard the lines. The crop was maintained properly till last harvest and observations on growth, yield as well as yield contributing characters were noted on five randomly selected plants. Data was collected on five random plants per replication for 24 quantitative characters viz., node number of first staminate flower, days to first staminate flower anthesis, node number of first pistillate flower, days to first pistillate flower anthesis, node to first fruit set, number of fruits per plant, average fruit weight (kg), number of primary branches per vine, vine length (m), days from pollination to harvest, days to first fruit harvest, total growth duration, fruit length (cm), fruit width (cm), fruit shape index (cm), flesh thickness (cm), cavity width (cm), cavity length (cm), rind thickness (mm), seed length (mm), seed width (mm), seed shape index and yield per vine (kg). The mature fruits at physiological maturity were analysed for fruit and seed related traits. The analysis of variance was carried out according to the standard procedure suggested by Panse and Sukhatme (1967). The correlation coefficients at phenotypic and genotypic levels were estimated according to methods suggested by A1-Jibouri et al. (1958). The path analysis was done as per the procedure outlined by Dewey and Lu (1959). Means of the observations were subjected to correlation and path analysis using statistical package SPAR version 2.0.

Results and Discussion

The analysis of variance revealed that all the 24 quantitative characters under study were highly significant among the 67 genotypes. This indicates presence of sufficient amount of variation for all the traits and selection will be very effective in improving these characters of economic importance. The phenotypic and genotypic correlation coefficients between different characters studied are presented in Table 1. From the perusal of table in general the magnitudes of genotypic correlation coefficients were higher than phenotypic correlation coefficients in majority of cases suggesting that genotypic correlations were stronger, reliable and free from environmental factors.

Yield per plant showed highly significant and positive association for phenotypic and genotypic association with average fruit weight (0.92, 0.93), fruit length (0.63, 0.67), fruit width (0.58, 0.61), flesh thickness (0.57, 0.60), fruit shape index (0.46, 0.50), days to first pistillate flower opening (0.29, 0.33), days to first fruit harvest (0.26, 0.29), total growth duration (0.25, 0.28) and vine length (0.18, 0.22) but significant and positive association for phenotypic and genotypic association with TSS (0.14, 0.16). This suggests the possibility of simultaneous improvement of these traits in improving fruit yield per plant and higher yield with high TSS is also possible. Similar results were reported by earlier workers *viz*., Ramana (2000) in oriental pickling melon for days to first female flower, fruit weight and fruit length; total soluble solids; number of primary branches per vine were reported by Reddy et al. (2007) in snap melon, Hossein et al. (2012) in Iranian melon and Ibrahim and Ramadan (2013) in sweet melon for average fruit weight, flesh thickness, Choudhary et al. (2011) in muskmelon for fruit weight and Ibrahim and Ramadan (2013) in sweet melon for fruit length, and Yadav and Ram (2002) in muskmelon for fruit weight, length and girth and Reddy et al. (2007) in snap melon for node to first flowering, Prasad et al. (2004) in muskmelon for days to first flowering. TSS was positively correlated with days to male and pistillate flower opening (0.37, 0.39), days from pollination to fruit harvest (0.35, 0.37), days to first fruit harvest (0.36, 0.38), total growth duration (0.36, 0.38) and flesh thickness (0.19, 0.20) but significant and positive association for phenotypic and genotypic association with average fruit weight and negatively correlated with cavity width (-0.33, 0.34). It explained that late maturing genotypes had high TSS as all traits related to maturity indicators showed positive association with TSS and similar trend was also for yield. Most of the genetic correlations were slightly higher than the corresponding phenotypic correlation. This was expected, in part, because the heritability estimates were generally high which indicated the lesser role of environmental contributions to the phenotypic variation. Comparatively large difference between the genotypic correlation coefficient and phenotypic correlation coefficient was noted in some cases which involved number of fruits per plant with average fruit weight (-0.20, -0.11), days from pollination to fruit harvest (-0.35, -0.24) and vine length with days to first male flower (0.44, 0.59) and node to first male flower with node to first pistillate flower (0.18, 0.32). This was also obvious as number of fruits per plant had low heritability estimate of 47.02% (Bhimappa and Choudhary 2017). In these cases, the phenotypic correlations are determined by the environmental

Table 1: The phenotypic and genotypic correlation coefficients between different characters among 67 genotypes of muskmelon

	DFMF	NFMF	DFPF	NFPF	NFFS	NFPP	AFW	NPB	VL	DPFH	DFFH	TGD	FL	FW	FSI	FT	CW	CL	RT	SL	SW	SSI	TSS	YPP
DFMF	1.00																							
	1.00																							
NFMF	-0.16*	1.00																						
	-0.18*	1.00																						
DFPF	0.82**	-0.11	1.00																					
	0.90**	-0.14*	1.00																					
NFPF	0.00	0.19**	0.03	1.00																				
	-0.02	0.21**	0.01	1.00																				
NFFS	0.03	0.20**	0.06	0.69**	1.00																			
	0.04	0.23**	0.08	0.78**	1.00																			
NFPP	-0.15*	0.18*	-0.13	0.10	0.18**	1.00																		
	-0.27**	0.32**	-0.13	0.15*	0.25**	1.00																		
AFW	0.29**	0.09	0.29**	-0.05	-0.08	-0.11	1.00																	
	0.30**	0.11	0.32**	-0.06	-0.10	-0.20**	1.00																	
NPB	0.33**	-0.11	0.25**	0.00	-0.11	-0.08	0.18**	1.00																
	0.36**	-0.13	0.29**	-0.01	-0.14	-0.12	0.19**	1.00																
VL	0.44**	-0.22**	0.45**	-0.06	0.05	-0.07	0.16**	0.25**	1.00															
	0.59**	-0.29**	0.57**	-0.09	0.05	-0.15*	0.19**	0.33**	1.00															
DPFH	0.61**	-0.37**	0.61**	-0.02	0.01	-0.24**	0.21**	0.24**	0.32**	1.00														
	0.67**	-0.46**	0.66**	-0.03	0.00	-0.35**	0.24**	0.27**	0.41**	1.00														
DFFH	0.83**	-0.23**	0.87**	0.02	0.07	-0.17*	0.29**	0.27**	0.43**	0.79**	1.00													
	0.89**	-0.27**	0.93**	0.00	0.07	-0.27**	0.31**	0.30**	0.56**	0.87**	1.00													
TGD	0.80**	-0.22**	0.82**	0.07	0.11	-0.15*	0.27**	0.27**	0.38**	0.80**	0.91**	1.00												
	0.87**	-0.25**	0.91**	0.08	0.13	-0.25**	0.29**	0.30**	0.48**	0.87**	0.98**	1.00												
FL	0.25**	0.11	0.22**	-0.04	-0.01	-0.11	0.75**	0.14*	0.17*	0.23**	0.29**	0.24**	1.00											
	0.26**	0.12	0.23**	-0.05	0.00	-0.16*	0.78**	0.14*	0.22**	0.25**	0.30**	0.25**	1.00											
FW	0.02	-0.01	0.10	-0.04	-0.03	-0.12	0.58**	-0.06	-0.12	0.07	0.09	0.09	0.37**	1.00										
	0.02	0.00	0.10	-0.06	-0.03	-0.20**	0.59**	-0.07	-0.17*	0.08	0.09	0.11	0.37**	1.00										
FSI	0.29**	0.11	0.21**	0.00	0.01	-0.07	0.58**	0.20**	0.23**	0.24**	0.29**	0.22**	0.91**	-0.03	1.00									
	0.30**	0.11	0.22**	0.00	0.01	-0.11	0.61**	0.21**	0.30**	0.26**	0.31**	0.24**	0.91**	-0.02	1.00									
FT	0.25**	-0.14*	0.26**	0.07	0.04	-0.08	0.57**	0.05	0.08	0.20**	0.28**	0.23**	0.53**	0.67**	0.31**	1.00								
	0.27**	-0.16*	0.27**	0.08	0.05	-0.12	0.58**	0.07	0.09	0.22**	0.30**	0.25**	0.55**	0.67**	0.33**	1.00								
CW	-0.29**	0.24**	-0.14*	0.01	-0.07	-0.02	0.13	-0.06	-0.39**	-0.26**	-0.28**	-0.21**	-0.10	0.47**	-0.30**	0.01	1.00							
	-0.31**	0.27**	-0.15*	0.01	-0.09	-0.08	0.12	-0.07	-0.52**	-0.28**	-0.30**	-0.23**	-0.12	0.44**	-0.31**	-0.02	1.00							
CL	0.22**	0.16*	0.17*	-0.06	-0.02	-0.10	0.69**	0.15*	0.17*	0.21**	0.25**	0.20**	0.97**	0.23**	0.93**	0.33**	-0.11	1.00						
	0.22**	0.17*	0.19*	-0.07	-0.02	-0.16*	0.72**	0.14*	0.22**	0.22**	0.26**	0.21**	0.98**	0.23**	0.93**	0.35**	-0.13	1.00						
RT	0.10	-0.11	0.07	-0.08	-0.11	0.02	0.18**	-0.03	0.01	-0.05	0.01	-0.03	0.17*	0.13	0.13	0.25**	-0.03	0.12	1.00					
	0.10	-0.12	0.07	-0.10	-0.12	0.01	0.19**	-0.04	0.00	-0.06	0.02	-0.03	0.18*	0.14	0.14	0.26**	-0.04	0.13	1.00					
SL	-0.22**	0.22**	-0.13	0.08	0.06	0.20**	0.24**	0.07	-0.02	-0.42	-0.26**	-0.28**	0.10	0.12	0.09	0.08	0.13	0.09	0.22**	1.00				
	-0.23**	0.24**	-0.13	0.09	0.06	0.27**	0.25**	0.07	-0.01	-0.44**	-0.27**	-0.31**	0.10	0.12	0.10	0.09	0.14	0.09	0.23**	1.00				
SW	-0.05	0.20**	0.04	0.12	0.03	0.07	0.33**	0.15*	0.17*	-0.31**	-0.12	-0.17*	0.23**	0.17*	0.20**	0.21**	0.07	0.21**	0.22**	0.81**	1.00			
	-0.05	0.23**	0.05	0.14	0.03	0.08	0.35**	0.16*	0.21**	-0.33**	-0.12	-0.18*	0.23**	0.18*	0.21**	0.22**	0.07	0.21**	0.23**	0.83**	1.00			
SI	-0.24**	-0.06	-0.26**	-0.09	0.02	0.17*	-0.22**	-0.16*	-0.30**	-0.07	-0.19**	-0.13	-0.23**	-0.15*	-0.17*	-0.25**	0.04	-0.19**	-0.03	0.03	-0.56**	1.00		
	-0.28**	-0.08	-0.32**	-0.11	0.02	0.28**	-0.25**	-0.18*	-0.39**	-0.09	-0.21**	-0.17*	-0.24**	-0.16*	-0.18*	-0.27**	0.04	-0.20**	-0.04	0.01	-0.54**	1.00		
TSS	0.37**	-0.36**	0.29**	-0.05	-0.08	-0.13	0.15*	0.01	0.27**	0.35**	0.36**	0.36**	0.11	0.09	0.06	0.19**	-0.33**	0.08	0.16*	-0.14*	-0.09	-0.05	1.00	
	0.39**	-0.40**	0.30**	-0.05	-0.09	-0.19**	0.15*	0.01	0.36**	0.37**	0.38**	0.38**	0.11	0.10	0.07	0.20**	-0.34**	0.08	0.17*	-0.14*	-0.09	-0.06	1.00	
YPP	0.25**	0.04	0.29**	-0.03	-0.02	0.05	0.92**	0.13	0.18**	0.175*	0.26**	0.25**	0.63**	0.58**	0.46**	0.57**	0.13	0.56**	0.22**	0.30**	0.37**	-0.21**	0.14*	1.00
	0.26**	0.06	0.33**	-0.04	-0.03	-0.03	0.93**	0.15*	0.22**	0.19**	0.29**	0.28**	0.67**	0.61**	0.50**	0.60**	0.11	0.60**	0.23**	0.32**	0.40**	-0.24**	0.16*	1.00

DFMF (Days to first male flower opening), NFMF (Node to first male flower), DFPF (Days to first pistillate flower opening), NFPF (Node to first pistillate flower), NFFS (Node to first fruit set), NFPP (Number of fruits per plant), AFW (Average Fruit weight), NPB (Number of Primary branches), VL (Vine length), DPFH (Days from pollination to harvest), DFFH (Days to first fruit Harvest), TGD (Total crop duration), FL (Fruit length), FW (Fruit width), FSI (Fruit shape index), FT (Flesh thickness), CW (Cavity width), CL (Cavity length), RT (Rind thickness), SL (Seed length), SW (Seed width), SSI (Seed shape index), TSS (Total soluble solids), YPP (Yield per plant)

Table 2: Direct and indirect effects of component characters on fruit yield among 67 genotypes of muskmelon

	DFMF	NFMF	DFPF	NFPF	NFFS	NFPP	AFW	NPB	VL	DPFH	DFFH	TGD	FL	FW	FSI	FT	CW	CL	RT	SL	SW	SI	TSS	YPP
DFMF	-0.061	0.008	0.029	0.001	0.002	-0.025	0.274	-0.009	0.016	0.009	-0.041	0.056	-0.004	0.003	0.055	-0.011	0.003	-0.060	0.003	-0.009	-0.001	0.008	0.001	0.250**
	-0.305	0.011	0.164	0.003	0.001	-0.027	0.276	-0.014	0.094	-0.109	-1.244	1.333	1.206	0.006	0.199	-0.293	0.018	-1.066	0.001	0.039	-0.012	-0.018	0.001	0.261**
NFMF	0.010	-0.052	-0.004	-0.007	0.010	0.029	0.085	0.003	-0.008	-0.006	0.011	-0.016	-0.002	-0.002	0.021	0.006	-0.003	-0.045	-0.003	0.009	0.002	0.002	0.001	0.041
	0.055	-0.060	-0.026	-0.031	0.003	0.032	0.103	0.005	-0.046	0.074	0.381	-0.380	0.532	0.001	0.071	0.175	-0.016	-0.821	-0.001	-0.040	0.060	-0.005	-0.001	0.064
DFPF	-0.049	0.006	0.036	-0.001	0.003	-0.020	0.278	-0.007	0.017	0.009	-0.043	0.058	-0.003	0.014	0.040	-0.011	0.002	-0.048	0.002	-0.005	0.001	0.009	0.001	0.286**
	-0.275	0.008	0.182	-0.001	0.001	-0.013	0.294	-0.012	0.090	-0.108	-1.297	1.390	1.051	0.023	0.149	-0.295	0.009	-0.886	0.001	0.022	0.013	-0.021	0.001	0.327**
NFPF	0.001	-0.010	0.001	-0.035	0.034	0.016	-0.048	0.001	-0.002	0.001	-0.001	0.005	0.001	-0.006	0.001	-0.003	0.001	0.017	-0.003	0.003	0.001	0.003	0.001	-0.026
	0.005	-0.012	0.001	-0.152	0.009	0.015	-0.055	0.001	-0.014	0.005	-0.005	0.126	-0.226	-0.015	0.001	-0.081	0.001	0.344	-0.001	-0.015	0.035	-0.008	0.001	-0.043
NFFS	-0.002	-0.010	0.002	-0.024	0.050	0.029	-0.075	0.003	0.002	0.001	-0.003	0.008	0.001	-0.004	0.001	-0.002	0.001	0.006	-0.003	0.002	0.001	-0.001	0.001	-0.020
	-0.011	-0.014	0.015	-0.119	0.011	0.025	-0.088	0.006	0.007	0.001	-0.101	0.203	-0.014	-0.008	0.008	-0.052	0.005	0.099	-0.001	-0.009	0.007	0.001	0.001	-0.031
NFPP	0.009	-0.009	-0.005	-0.004	0.009	0.160	-0.108	0.002	-0.003	-0.004	0.008	-0.010	0.002	-0.016	-0.014	0.003	0.001	0.026	0.001	0.008	0.001	-0.006	0.001	0.052
	0.083	-0.019	-0.024	-0.023	0.003	0.100	-0.188	0.005	-0.023	0.057	0.375	-0.384	-0.750	-0.047	-0.071	0.125	0.004	0.752	0.001	-0.045	0.019	0.018	-0.001	-0.034
AFW	-0.017	-0.005	0.010	0.002	-0.004	-0.018	0.957	-0.005	0.006	0.003	-0.014	0.019	-0.010	0.077	0.111	-0.024	-0.002	-0.190	0.006	0.010	0.003	0.008	0.001	0.923**
	-0.091	-0.007	0.058	0.009	-0.001	-0.020	0.925	-0.008	0.030	-0.039	-0.437	0.443	3.573	0.136	0.407	-0.622	-0.007	-3.452	0.001	-0.041	0.090	-0.016	0.001	0.933**
NPB	-0.020	0.006	0.009	0.001	-0.005	-0.012	0.168	-0.028	0.009	0.004	-0.014	0.019	-0.002	-0.008	0.039	-0.002	0.001	-0.041	-0.001	0.003	0.002	0.006	0.001	0.131
	-0.109	0.008	0.053	0.001	-0.002	-0.012	0.176	-0.040	0.054	-0.044	-0.416	0.455	0.650	-0.016	0.137	-0.070	0.004	-0.693	0.001	-0.012	0.041	-0.012	0.001	0.152*
VL	-0.027	0.011	0.016	0.002	0.003	-0.012	0.156	-0.007	0.037	0.005	-0.021	0.027	-0.002	-0.016	0.045	-0.003	0.004	-0.047	0.001	-0.001	0.002	0.010	0.001	0.182**
	-0.179	0.017	0.103	0.013	0.001	-0.015	0.176	-0.014	0.160	-0.067	-0.779	0.740	1.016	-0.038	0.201	-0.100	0.030	-1.075	0.001	0.002	0.054	-0.025	0.001	0.221**
DPFH	-0.037	0.019	0.022	0.001	0.001	-0.038	0.200	-0.007	0.012	0.015	-0.039	0.056	-0.003	0.009	0.046	-0.008	0.003	-0.056	-0.002	-0.017	-0.003	0.002	0.001	0.175*
	-0.204	0.027	0.120	0.005	0.001	-0.035	0.219	-0.011	0.066	-0.163	-1.216	1.323	1.157	0.019	0.171	-0.232	0.017	-1.055	0.001	0.074	-0.085	-0.006	0.001	0.191**
DFFH	-0.051	0.012	0.031	-0.001	0.003	-0.027	0.278	-0.008	0.016	0.012	-0.049	0.064	-0.004	0.011	0.056	-0.011	0.003	-0.069	0.001	-0.011	-0.001	0.007	0.001	0.261**
	-0.272	0.016	0.169	-0.001	0.001	-0.027	0.290	-0.012	0.089	-0.142	-1.396	1.506	1.401	0.020	0.204	-0.325	0.018	-1.250	0.001	0.044	-0.030	-0.014	0.001	0.289**
TGD	-0.048	0.012	0.029	-0.003	0.006	-0.024	0.256	-0.007	0.014	0.012	-0.045	0.071	-0.003	0.013	0.043	-0.010	0.002	-0.055	-0.001	-0.012	-0.002	0.005	0.001	0.253**
	-0.266	0.015	0.165	-0.012	0.002	-0.025	0.268	-0.012	0.077	-0.141	-1.373	1.531	1.153	0.024	0.159	-0.271	0.013	-1.022	0.001	0.051	-0.046	-0.011	0.001	0.280**
FL	-0.015	-0.006	0.008	0.001	0.001	-0.018	0.715	-0.004	0.006	0.004	-0.015	0.017	-0.014	0.049	0.174	-0.022	0.001	-0.269	0.005	0.004	0.002	0.008	0.001	0.633**
	-0.080	-0.007	0.042	0.007	0.001	-0.016	0.718	-0.006	0.035	-0.041	-0.425	0.384	4.602	0.084	0.609	-0.587	0.007	-4.683	0.001	-0.017	0.060	-0.016	0.001	0.672**
FW	-0.001	0.001	0.004	0.002	-0.002	-0.020	0.551	0.002	-0.005	0.001	-0.004	0.007	-0.005	0.133	-0.005	-0.027	-0.005	-0.064	0.004	0.005	0.002	0.005	0.001	0.578**
	-0.007	0.001	0.018	0.010	0.001	-0.020	0.546	0.003	-0.026	-0.013	-0.121	0.161	1.686	0.230	-0.014	-0.719	-0.026	-1.115	0.001	-0.021	0.046	-0.011	0.001	0.606**
FSI	-0.018	-0.006	0.007	0.001	0.001	-0.012	0.553	-0.006	0.009	0.004	-0.014	0.016	-0.013	-0.004	0.192	-0.013	0.003	-0.257	0.004	0.004	0.002	0.006	0.001	0.460**
	-0.091	-0.006	0.041	0.001	0.001	-0.011	0.563	-0.008	0.048	-0.042	-0.426	0.364	4.190	-0.005	0.669	-0.350	0.018	-4.485	0.001	-0.016	0.053	-0.012	0.001	0.496**
FT	-0.015	0.007	0.009	-0.003	0.002	-0.013	0.546	-0.001	0.003	0.003	-0.014	0.017	-0.007	0.088	0.059	-0.041	0.001	-0.092	0.008	0.004	0.002	0.009	0.001	0.570**
	-0.083	0.010	0.050	-0.012	0.001	-0.012	0.536	-0.003	0.015	-0.035	-0.423	0.386	2.516	0.154	0.218	-1.074	0.001	-1.677	0.002	-0.015	0.057	-0.018	0.001	0.595**
CW	0.018	-0.012	-0.005	0.001	-0.004	-0.003	0.128	0.002	-0.015	-0.004	0.014	-0.015	0.001	0.062	-0.058	0.001	-0.011	0.031	-0.001	0.005	0.001	-0.001	0.001	0.134
	0.095	-0.016	-0.027	-0.001	-0.001	-0.008	0.107	0.003	-0.084	0.046	0.425	-0.350	-0.554	0.102	-0.209	0.020	-0.058	0.628	0.001	-0.023	0.017	0.003	-0.001	0.113
CL	-0.013	-0.008	0.006	0.002	-0.001	-0.015	0.659	-0.004	0.006	0.003	-0.012	0.014	-0.014	0.031	0.179	-0.014	0.001	-0.276	0.004	0.004	0.002	0.007	0.001	0.560**
	-0.068	-0.010	0.034	0.011	0.001	-0.016	0.665	-0.006	0.036	-0.036	-0.364	0.326	4.489	0.054	0.625	-0.375	0.008	-4.801	0.001	-0.015	0.053	-0.013	0.001	0.597**
RT	-0.006	0.006	0.002	0.003	-0.005	0.003	0.174	0.001	0.001	-0.001	-0.001	-0.002	-0.002	0.017	0.025	-0.010	0.001	-0.033	0.032	0.009	0.002	0.001	0.001	0.215**
	-0.031	0.007	0.013	0.015	-0.001	0.001	0.178	0.002	0.001	0.009	-0.006	-0.047	0.834	0.031	0.092	-0.284	0.002	-0.613	0.007	-0.038	0.059	-0.002	0.001	0.230**
SL	0.014	-0.011	-0.005	-0.003	0.003	0.032	0.229	-0.002	-0.001	-0.006	0.013	-0.020	-0.001	0.016	0.018	-0.004	-0.001	-0.025	0.007	0.041	0.008	-0.001	0.001	0.300**
	0.071	-0.014	-0.024	-0.014	0.001	0.027	0.228	-0.003	-0.002	0.072	0.370	-0.467	0.472	0.028	0.064	-0.094	-0.008	-0.440	0.002	-0.167	0.212	0.001	-0.001	0.315**
SW	0.003	-0.010	0.001	-0.004	0.001	0.011	0.319	-0.004	0.007	-0.005	0.006	-0.012	-0.003	0.023	0.039	-0.009	-0.001	-0.056	0.007	0.033	0.010	0.019	0.001	0.373**
	0.014	-0.014	0.010	-0.021	0.001	0.008	0.324	-0.007	0.034	0.054	0.164	-0.276	1.077	0.041	0.138	-0.238	-0.004	-0.988	0.002	-0.138	0.256	-0.036	0.001	0.399**
SI	0.015	0.003	-0.009	0.003	0.001	0.028	-0.212	0.005	-0.011	-0.001	0.009	-0.010	0.003	-0.020	-0.032	0.010	0.001	0.052	-0.001	0.001	-0.006	-0.034	0.001	-0.20**
	0.085	0.005	-0.058	0.017	0.001	0.028	-0.229	0.007	-0.062	0.014	0.292	-0.252	-1.086	-0.038	-0.121	0.292	-0.002	0.946	0.001	-0.002	-0.139	0.066	0.001	-0.23**
TSS	-0.023	0.019	0.010	0.002	-0.004	-0.020	0.139	0.001	0.010	0.005	-0.018	0.026	-0.002	0.011	0.012	-0.008	0.004	-0.021	0.005	-0.006	-0.001	0.002	0.001	0.143*
	-0.120	0.024	0.055	0.008	-0.001	-0.019	0.143	-0.001	0.057	-0.060	-0.529	0.582	0.526	0.022	0.045	-0.217	0.0198	-0.381	0.0012	0.024	-0.023	-0.004	0.004	0.156*

Phenotypic Residual effect = 0.09805; Genotypic Residual effect= 0.04453; Diagonal (under lined) values indicate direct effects G: Genotypic P: Phenotypic

DFMF (Days to first male flower opening), NFMF (Node to first male flower), DFPF (Days to first pistillate flower opening), NFPF (Node to first pistillate flower), NFFS (Node to first fruit set), NFPP (Number of fruits per plant), AFW (Average Fruit weight), NPB (Number of Primary branches), VL (Vine length), DPFH (Days from pollination to harvest), DFFH (Days to first fruit Harvest), TGD (Total crop duration), FL (Fruit length), FW (Fruit width), FSI (Fruit shape index), FT (Flesh thickness), CW (Cavity width), CL (Cavity length), RT (Rind thickness), SL (Seed length), SW (Seed width), SSI (Seed shape index), TSS (Total soluble solids), YPP (Yield per plant) contribution to the total variation in each trait and to the environmental correlation. A phenotypic correlation that is lower than the genetic correlation does not imply that a negative environmental correlation is involved. A negative environmental correlation is implied only when the ratio of the phenotypic correlation to the genetic correlation is less than the geometric mean of the stabilities for the two traits (Searle 1961).

Based on overall results of phenotypic and genotypic correlation, it is possible to breed desirable muskmelon varieties combining high fruit yield, desirable fruit size, round fruit shape, greater flesh thickness and above all the TSS content in higher range (> 12%). It is generally believed that large fruit size and high TSS content will not go together. However, in the present investigation a significant positive correlation was observed between fruit size and TSS and between fruit yield and TSS both at phenotypic and genotypic levels clearly demonstrated no hindrance in combining high fruit yield, larger fruit size and high TSS content in single genotype. It may be mentioned here that although these correlations were positive but the values were lower. Therefore, one has to exert a strong selection pressure simultaneously for these three characters in order to have a balanced combination in a variety. There cannot be two opinions of combining high yield and high TSS content in a single cultivar of muskmelon but the opinion might differ with respect to optimum fruit size which is largely determined by consumer's preference and most of the exotic genotypes from *inodorous* and *cantaloupensis* group had larger fruit size, high yield and TSS as well. In view of the positive correlation between fruit size and TSS content, it will be easier to combine high TSS content with larger fruit size.

The estimation of direct and indirect effects of different characters on fruit yield per vine is presented in Table 2. Genotypic and phenotypic path coefficient analysis was carried out taking yield per plant as dependent variable. The analysis revealed that number of fruitsin Path analysis was explained for those characters only which showed significant correlations with yield like average fruit weight, fruit length, fruit width, flesh thickness, cavity length, fruit shape index, seed width, seed length, days to first female flower opening, days to first fruit harvest, total growth duration and TSS. Days to first male flower opening, node to first male flower, node to first pistillate flower, number of primary branches/plant and cavity length had direct negative effect on fruit yield per plant. Hence, effects are nullified by indirect positive effect by average fruit weight, flesh thickness and made them to establish positive significant association. Average fruit weight had high positive direct effect on yield and also correlation was positive and in this situation direct selection for the trait should be practiced to reduce the undesirable indirect effect. It clearly indicates that direct selection based on these characters wouldbe effective for an increase in yield.Similar results were reported by previous workers viz., Ramana (2000) in oriental pickling melon for fruit weight and fruit length, Rukam et al. (2008) and Singh and Lal (2005) in musk melon for flesh thickness. Therefore, direct selection for these traits would be worthwhile for improvement of yield. In the present study, the genotypes DM-162, DM-159, DM-143, DM-145, DM-31, and DM-56 were found most promising for higher fruit yield and also performed better fruit quality traits under study. Correlation and path analysis revealed that the traits like average fruit weight, fruit length, fruit width, flesh thickness, cavity length, fruit shape index, seed width, seed length, days to first female flower opening, days to first fruit harvest, total growth duration and TSS components were the important yield contributing characters and should be given due importance during selection as these characters had positive direct effects on fruit yield and had significant positive association with fruit yield. Residual effect of 0.04 implies that the total genotypic variability in yield has been explained by the characters associated in the study.

सारांश

खरबूजा (कुकुमिस मेलो) के 3 औद्यानिक समूहों (*इन्ओडरस, कैन्टालुपेन्सिस* व *मोमोर्डिका*) से 67 प्रभेदों के मध्य उपज, उपज घटकों तथा आर्थिक महत्व वाले अन्य गुणों का सह सम्बन्ध स्तर ज्ञात करने के लिये वर्तमान अध्ययन किया गया। प्रायोगिक परिणाम से स्पष्ट हुआ कि प्रभेदों के मध्य सभी 24 गुणों हेतु सार्थक विविधता है। उपज एवं उपज से सम्बन्ध रखने वाले गुणों के आधार पर प्रभेदों जैसे– डी.एम.–162, डी.एम.–159, डी.एम.–143, डी.एम.–145, डी.एम.–31 तथा डी.एम.–56 को उत्तम पाया गया। सहसम्बन्ध गुणांक (लक्षण प्ररूप व जीन प्ररूप) विभिन्न मात्रात्मक गुणों के मध्य प्रति पौध उपज के साथ–साथ उच्च सार्थक एवं सकारात्मक सह सम्बन्ध ा फल भार (0.92), फल लम्बाई (0.63), फल की चौड़ाई (0.58, गुदा मोटाई (0.57) तथा गुहिका लम्बाई (0.56), उच्च सार्थक व सकारात्मक सम्बन्ध को प्रदर्शित किये। कुल विलेय ठोस ने मादा पुष्प के प्रथम पुष्पन (0.37), प्रथम फल तुड़ाई (0.36), कुल फसल अवधि (0.36), परागण से तुड़ाई के दिन (0.35), मादा पुष्पन के दिन (0.29), लता लम्बाई (0.27), गुदा मोटाई (0.19), उच्च सार्थकता व सकारात्मक सम्बन्ध प्रदर्शित किये तथा पार्श्व गांठ पर प्रथम नर पुष्पन (–0.36), गुहिका चौड़ाई (0.33) के साथ ऋणात्मक सम्बन्ध प्रदर्शित किये। जीन प्ररूप स्तर पर पथ गुणांक विश्लेषण ने स्पष्ट किया कि कुल विलेय ठोस प्रत्यक्ष सकारात्मक प्रभाव (0.003) व अप्रत्यक्ष प्रभाव द्वारा कुल फसल काल (0.582), औसत फल भार (0.143) एवं ऋणात्मक अप्रत्यक्ष प्रभाव द्वारा प्रथम फल तुड़ाई के दिन (–0.529), गुहिका लम्बाई (–0.381) तथा नर पुष्पन के दिन (–0.120) मूल्य प्राप्त हुए।

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