Short Communication

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Correlation studies in watermelon [*Citrullus lanatus* (Thumb.) Mansf.]

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Watermelon [*Citrullus lanatus* (Thunb.) Mansf.] is one of the most important cucurbitaceous fruit crop grown in different parts of Rajasthan as well as in India. It is consumed as dessert fruit and very often known as thirst quencher. It is extensively cultivated both under irrigated and riverbeds. Watermelon is very low in cholesterol and sodium. It is rich source of lycopene, a powerful antioxidant. Its 100g edible portion contains 95.8g moisture, 0.2g protein, 0.2g fat, 0.2g fibre, 3.3g carbohydrate, 16 K cal energy, 11mg calcium, 12mg phosphorus, 7.9mg iron, 13mg magnesium, 0.02mg thiamine, 0.04mg riboflavin, 0.1mg niacin and 1mg vitamin C (Gopalan *et al*., 1999). Correlation is the important selection parameters in plant breeding. Correlation coefficient measures the mutual relationship between various plant characters and determines the component characters on which selection can be based for genetic improvement in yield. It has been widely used to identify traits that have significant effect on yield for potential use in selection. The present investigation was undertaken to explore the possibility of developing hybrids possessing resistance/ tolerance to prevailing abiotic stress with higher yield, better shelf-life, high lycopene, high carotenoids content and better fruit quality. In view of its wide variability and economic importance, the present investigation has been undertaken with the aim to estimate correlation analysis among different horticultural traits including yield and quality characters in watermelon.

The present field experiment was undertaken during the *kharif* 2012 and *zaid* 2013 at NICHE Area of Excellence, S.K. Rajasthan Agricultural University, Bikaner which is situated at $28^0$01' N and $73^0$22' E at an altitude of 234.70 meters above MSL. The experimental material comprised of eight genotypes of watermelon *viz*., Sugar Baby, Thar Manak, Asahi Yamato, RW-187-2 (Durgapura Kesar), AHW-19, Durgapura Lal (RW-177-3), IC-582909 and Arka Manik which were crossed in all possible combinations (excluding reciprocals) during *zaid* 2012. The resultant 28 F_1's along with parents were evaluated during *kharif* 2012 and *zaid* 2013 in Randomized Block Design (RBD) replicated thrice. All the recommended package of practices was followed for raising the crop. The *observations on 18 attributes including growth, yield attributes and quality parameters were recorded on five randomly selected plants from each replication during both the years. The collected data were averaged and correlation (*phenotypic and genotypic) *was computed* as described by Singh and Choudhary (1977) and as per formula (Johnson *et al*. 1955).

All possible phenotypic (above diagonal) and genotypic (lower diagonal) correlation coefficients between fruit yield and its components were worked out and presented in Table 1. The perusal of data indicated that the magnitude of genotypic correlation coefficients for most of the characters were higher than their respective value of the phenotypic correlation coefficients.

Highest positive and significant correlation at phenotypic level was exhibited by number of marketable fruits per plant (0.718) with marketable fruit yield per plant followed by fruit weight (0.557), number of primary branches per vine (0.392), fruit diameter (0.391), main vine length at harvest (0.356), TSS content in fruits (0.352), carotenoids content (0.315), lycopene content (0.271), fruit length (0.237) and flesh firmness (0.186). On the other hand marketable fruit yield per plant was significantly and negatively correlated with 100-seed weight (-0.377) followed by number of seeds per fruit (-0.289), days to opening of first female flower (-0.232), days to first fruit harvest (-0.156), internodal length (-0.145) and number of node at which first female flower appeared (-0.137).

The existence of association between different characters is usefully determined by studying correlation existing between these. For this purpose, it is important to know that genetic correlation among different characters, which may provide information regarding the correlated response to selection. In the present study, generally, the genotypic correlation coefficients were higher than the corresponding phenotypic ones indicating the inherent association among the various traits (Table 1), which may be ascribed to the low effect of environment on the character

expression. The association of characters such as marketable fruit yield, fruit weight and various quality parameters is very important, before sets out to develop hybrids or parental lines. The knowledge of correlation between these characters is also helpful in the choice of parents for developing better F_1 hybrids. Interestingly in the present study, marketable fruit yield per plant was found to be significantly and positively correlated with number of marketable fruits per plant, fruit weight, number of primary branches per vine, fruit diameter, main vine length at harvest, TSS content in fruits, carotenoids content, lycopene content, fruit length and flesh firmness in pooled analysis at phenotypic level, thus it would be easier to develop variety having all these characters. Marketable fruit yield per plant exhibited significant negative correlation with 100-seed weight, number of seeds per fruit, days to opening of first female flower, days to first fruit harvest, internodal length and number of node at which first female flower appeared. Similar results were earlier obtained for significant positive correlation of fruit yield with number of fruits per vine and TSS (Singh and Singh, 1988); with vine length, number of fruits per vine, fruit weight and fruit diameter (Sundaram *et al.*, 2011); with number of primary branches per plant, fruit weight, and number of fruits per plant (Choudhary *et al.*, 2012); with fruit weight and number of fruits per plant (Yadav *et al*., 2013) in bitter gourd and with fruit weight, number of fruits per cluster and fruit length (Choudhary *et al.*, 2014) in ridge gourd.

Table 1. Phenotypic (above diagonal) and genotypic (below diagonal) correlation coefficients among different characters in watermelon in pooled data

Characters	MVL (m)	PBs	INL (cm)	DOFFF	NFFFA	NMF/P	DFFH	FD (cm)	FL (cm)	FW (kg)
MVL (m)	1.000	0.247**	0.077	-0.151*	0.166*	0.095	0.181**	0.331**	0.207**	0.388**
PBs	0.246	1.000	-0.149*	-0.137*	-0.153*	0.303**	-0.194**	0.264**	0.186**	0.195**
INL (cm)	0.510	-0.012	1.000	0.076	0.307**	-0.321**	0.269**	0.186**	0.137*	0.200**
DOFFF	0.079	-0.509	0.662	1.000	0.407**	-0.270**	0.399**	-0.067	-0.054	-0.015
NFFFA	0.707	-0.193	0.769	0.758	1.000	-0.357**	0.600	0.073	0.162	0.224**
NMF/P	-0.206	0.625	-0.726	-0.728	-0.566	1.000	-0.352**	0.038	-0.076	-0.169*
DFFH	0.689	-0.335	0.607	0.740	0.977	-0.435	1.000	0.048	0.084	0.194**
FD (cm)	0.941	0.419	0.590	0.572	0.634	-0.275	0.563	1.000	0.502**	0.522**
FL (cm)	0.965	0.482	0.709	0.711	0.739	-0.588	0.488	0.983	1.000	0.435**
FW (kg)	0.986	0.303	0.654	0.339	0.781	-0.512	0.691	0.991	0.989	1.000
RT (cm)	0.973	0.335	0.333	0.068	0.718	-0.243	0.594	0.737	0.920	0.860
100 SW (g)	0.426	-0.175	0.351	0.208	0.430	-0.672	0.460	0.147	0.437	0.479
TSS (%)	0.343	0.627	-0.511	-0.009	0.044	0.169	-0.207	0.531	0.327	0.458
FF (g/cm^2)	0.216	0.207	0.078	-0.281	0.013	0.357	-0.147	0.148	0.280	0.067
LC (mg/100 g)	-0.567	-0.397	-0.540	-0.227	-0.343	0.541	-0.145	-0.881	-0.949	-0.867
CC (mg/100 g)	-0.460	0.115	-0.525	-0.299	-0.430	0.590	-0.379	-0.642	-0.738	-0.621
NS/F	0.280	0.249	0.435	0.407	0.512	-0.422	0.390	0.231	0.775	0.411
MFY/P (kg)	0.683	0.940	-0.245	-0.493	0.028	0.671	0.115	0.604	0.333	0.291

* Significant at p=0.05 and ** significant at p=0.01

Table 1 contd..

Characters	RT (cm)	100 SW (g)	TSS (%)	FF (g/cm^2)	LC (mg/100g)	CC (mg/100g)	NS/F	MFY/P (kg)
MVL (m)	0.194**	0.020	0.255**	0.242**	-0.075	-0.036	0.031	0.356**
PBs	0.079	-0.255**	0.145*	0.164*	0.054	0.273**	-0.171*	0.392**
INL (cm)	0.137*	0.264**	-0.001	-0.035	-0.301**	-0.271**	0.331**	-0.145*
DOFFF	-0.088	0.136*	-0.263**	-0.153*	-0.206**	-0.141*	0.199*	-0.232**
NFFFA	0.146*	0.332**	-0.246**	-0.061	-0.239**	-0.242**	0.295**	-0.137*
NMF/P	-0.203**	-0.544**	0.238**	0.134*	0.441**	0.436**	-0.370**	0.718**
DFFH	0.107	0.285**	-0.121	-0.084	-0.200**	-0.236**	0.285**	-0.156*
FD (cm)	0.259**	-0.099	0.246**	0.156*	-0.039	0.025	-0.100	0.391**
FL (cm)	0.297**	0.041	0.136*	0.155*	-0.119	-0.088	0.044	0.237**
FW (kg)	0.395**	0.109	0.227**	0.112	-0.172*	-0.087	0.030	0.557**
RT (cm)	1.000	0.253**	0.182**	0.084	-0.181**	-0.293**	0.072	0.107
100 SW (g)	0.621	1.000	-0.181**	-0.264**	-0.414**	-0.370**	0.605**	-0.377**
TSS (%)	0.352	-0.271	1.000	0.223**	0.007	0.107	-0.140*	0.352**
FF (g/cm^2)	0.063	-0.665	0.748	1.000	0.145*	0.141*	-0.150*	0.186**
LC (mg/100g)	-0.537	-0.384	-0.534	0.171	1.000	0.665**	-0.427**	0.271**
CC (mg/100g)	-0.319	-0.381	0.022	0.127	0.515	1.000	-0.305**	0.315**
NS/F	0.432	0.633	-0.208	-0.259	-0.411	-0.398	1.000	-0.289**
MFY/P (kg)	0.448	-0.331	0.609	0.440	-0.131	0.111	-0.126	1.000

* Significant at p=0.05 and ** significant at p=0.01

MVL= main vine length at harvest (m), **PBs**= number of primary branches per vine, **INL**= internodal length (cm), **DOFFF**= days to opening of first female flower, **NFFFA**= number of node at which first female flower appeared, **NMF/P**= number of marketable fruits per plant, **DFFH**= days to first fruit harvest, **FD**= fruit diameter at harvest (cm), **FL**= fruit length at harvest (cm), **FW**= fruit weight at harvest (kg), **RT**= rind thickness at harvest (cm), **100 SW**= 100-seed weight (g), **TSS**= TSS content in fruits at harvest (%), **FF**= flesh firmness (g/cm^2), **LC**= lycopene content (mg/100g), **CC**= carotene content (mg/100g), **NS/F**= number of seeds per fruit, **MFY/P**= total marketable fruit yield per plant (kg)

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