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Study on correlation coefficient analysis of the yield contributing characters of different pumpkin cultivars under coastal A.P conditions

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Abstract

Present investigation was carried out at College of Horticulture, Dr. Y.S.R Horticultural University, Venkataramannagudem, West Godavari district of Andhra Pradesh during *khariif*, 2016-2017. The experimental material comprised of 14 cultivars of (*Cucurbita moschata* Duch. ex Poir) pumpkin collected from different part of India. A wide range of variability was reported in all the characters. Correlation coefficient analysis revealed that number of primary branches per vine, number of fruits per vine, fruit length, average fruit weight, and vine length had significant positive association with fruit yield per vine at genotypic level. Hence, direct selection for these traits may lead to the development of high fruit yielding pumpkin cultivars.

Keywords: pumpkin, coastal andhra, coefficient

Introduction

Pumpkin is the most widely grown species of *Cucurbita* genus and this species is cross compatible with *C. maxima*, *C. pepo* and *C. mixta*. In spite of its high carotene content in fruits, its capacity as a potential supplier of carotene has not been exploited till now (Rajan and Markose, 2013) [8]. It may contribute to improve the nutritional status of the people, particularly the vulnerable groups with respect to vitamin -A requirement. Great range of variation exists in the plant and yield characters among the cultivars grown all over the country. Among the quantitative characters, yield is a complex character, which is dependent on a number of yield contributing characters. The study of the association between pairs of characters and yield provides basis for further breeding programme. Therefore, the present studies were aimed at to study correlation among 14 cultivars of pumpkin.

Materials and Methods

Pumpkin cultivars of 14 number were procured from different sources. Out of 14 cultivars 13 cultivars were procured from NBPGR (National Bureau of Plant Genetic Resources), New Delhi and one cultivar *i.e* check from local region Andhra Pradesh. The experiment was laid out in Randomized Complete Block Design (RCBD) with two replications. The distance between plant to plant was 1 m and row to row was 1.5 m. The experimental bed was 5.18 m x 3.80 m in size. Manure and fertilizers were applied in the experimental plot for pumpkin cultivation.

Correlation coefficient analysis

The genotypic and phenotypic correlations were calculated by the formulae given below as suggested by Al-ji-Bouri *et al.* (1958) [1]. The correlation coefficients were worked out to determine the degree of association of a character with yield and also among the yield components.

Phenotypic coefficient of correlation (r_p)

$$r_p = \frac{\text{Cov}_p(XY)}{\sqrt{\sigma^2_p(X) \sigma^2_p(Y)}}$$

Genotypic coefficient of correlation (r_g)

$$r_g = \frac{\text{Cov}_g(XY)}{\sqrt{\sigma^2_g(X) \sigma^2_g(Y)}}$$

Where,

r_p = Phenotypic correlation

r_g = Genotypic correlation

$Cov_p(XY)$ = Phenotypic covariance between the characters 'X' and 'Y'.

$Cov_g(XY)$ = Genotypic covariance between the characters 'X' and 'Y'

$\sigma_p^2(X)$ = Phenotypic variance of character 'X'

$\sigma_p^2(Y)$ = Phenotypic variance of character 'Y'

$\sigma_g^2(X)$ = Genotypic variance of character 'X'

$\sigma_g^2(Y)$ = Genotypic variance of character 'Y'

Results and Discussion

The results of the experiment have been presented and interpreted under the following headings.

Days to 50% germination

This trait had significant negative correlation at genotypic level (r_g : - 0.56) and significant positive correlation at phenotypic level with TSS (r_p : 0.49) (Table 1 and table 2). These findings are in agreement with the earlier findings of Pandey *et al.* (2002)^[7] in pumpkin.

Node number of first male flower appearance

This character exhibited significant positive correlation with fruit diameter (r_g : 0.40, r_p : 0.37), flesh thickness (r_g : 0.55, r_p : 0.49) and TSS (r_g : 0.41, r_p : 0.38) at both genotypic and phenotypic levels (Table 4.13 and 4.14). The trait showed significant negative correlation with number of primary branches per vine (r_g : -0.53, r_p : -0.35) at both genotypic and phenotypic levels. The values of genotypic correlation coefficients were greater than the values of phenotypic correlation coefficients for most of the characters, which indicate a strong inheritant association between various traits that were quite influenced by the environment.

These findings are in agreement with the earlier findings reported by Kumaran *et al.* (1998) in pumpkin.

Node number of first female flower appearance

This character exhibited significant and positive correlation with flesh thickness (r_g : 0.44, r_p : 0.40) at both genotypic and phenotypic levels (Table 4.13 and 4.14). The trait showed significant negative correlation with number of primary branches per vine (r_g : -0.52, r_p : -0.36), fruit length (r_g : -0.50, r_p : -0.41), and placenta weight (r_g : -0.42, r_p : -0.35) at genotypic and phenotypic levels. These findings are in agreement with the earlier findings reported by Mohanty (2001)^[6] in pumpkin.

Days to first male flower appearance

This trait had significant and positive correlation with days to first female flower appearance (r_g : 0.58, r_p : 0.54), and days to first fruit harvest (r_g : 0.53, r_p : 0.50) at genotypic as well as phenotypic levels (Table 4.13 and 4.14). It showed significant negative correlation with number of fruits per vine (r_g : -0.54, r_p : -0.44) and fruit diameter (r_g : -0.46, r_p : -0.42) at both genotypic and phenotypic levels. These findings are in agreement with the earlier findings reported by Mohanty (2001)^[6] in pumpkin.

Days to first female flower appearance

This trait had significant and positive correlation with days to first male flower appearance (r_g : 0.58, r_p : 0.54). It showed significant negative correlation with number of primary branches per vine (r_g : - 0.49, r_p : - 0.41), number of fruits per

vine (r_g : -0.53, r_p : -0.48), average fruit weight (r_g : - 0.56, r_p : - 0.47), fruit length (r_g : -0.51, r_p : -0.49), placenta weight (r_g : - 0.47, r_p : - 0.47) at genotypic as well as phenotypic levels (Table 4.13 and 4.14). These findings are in agreement with the earlier findings reported by Kumaran *et al.* (1998) in pumpkin.

Number of primary branches per vine

The character exhibited significant and positive correlation with number of fruits per vine (r_g : 0.56, r_p : 0.44) at genotypic as well as phenotypic levels (Table 2 and 3). The character showed significant negative correlation with node number of first male flower appearance (r_g : - 0.53, r_p : - 0.35), node number of first female flower appearance (r_g : - 0.52, r_p : - 0.36), days to first female flower appearance (r_g : - 0.49, r_p : - 0.41), days to first fruit harvest (r_g : - 0.55, r_p : - 0.47) at both genotypic and phenotypic levels. These findings are in agreement with the earlier findings reported by Kumaran *et al.*, 1998 in pumpkin.

Vine length (cm)

The character exhibited significant and positive correlation with average fruit weight (r_g : 0.55, r_p : 0.42), flesh thickness (r_g : 0.44, r_p : 0.40), and TSS (r_g : 0.44, r_p : 0.43), at genotypic as well as phenotypic levels. The trait showed significant negative correlation with days to first fruit harvest (r_g : -0.47, r_p : -0.46), and placenta weight (r_g : -0.41, r_p : -0.40) at both genotypic and phenotypic levels (Table 4.13 and 4.14). These findings are in agreement with the earlier findings reported by Kumaran *et al.* (1998) in pumpkin.

Days to first fruit harvest

This trait had significant and positive correlation with days to first male flower appearance (r_g : 0.53, r_p : 0.50) at genotypic as well as phenotypic levels (Table 4.13 and 4.14). It showed significant negative correlation with number of primary branches per vine (r_g : -0.55, r_p : -0.47), vine length (r_g : -0.47, r_p : -0.46), number of fruits per vine (r_g : -0.41, r_p : -0.38), average fruit weigh (r_g : -0.46, r_p : -0.39), and fruit diameter (r_g : -0.39, r_p : -0.39) at both genotypic and phenotypic levels. These findings are in agreement with the earlier findings reported by Sarkar *et al.* (1999)^[10] in pointed gourd.

Number of fruits per vine

The character exhibited significant and positive correlation with number of primary branches per vine (r_g : 0.56, r_p : 0.44), placenta weight per fruit (r_g : 0.41, r_p : 0.38), at genotypic as well as phenotypic levels. It showed significant negative correlation with days to first male flower appearance (r_g : - 0.54, r_p : -0.44), days to first female flower appearance (r_g : - 0.53, r_p : -0.49) at both genotypic and phenotypic levels (Table 2 and 3). These findings are in agreement with the earlier findings reported by Reddy *et al.* (2007)^[9] in snap melon.

Average Fruit weight (kg)

The character exhibited significant and positive correlation with vine length (r_g : 0.55, r_p : 0.42), and fruit length (r_g : 0.55, r_p : 0.55), at genotypic as well as phenotypic levels. It showed significant negative correlation with days to first female flower appearance (r_g : -0.56, r_p : -0.47) days to first fruit harvest (r_g : -0.46, r_p : -0.39), and flesh thickness (r_g : -0.53, r_p : -0.39), at both genotypic and phenotypic levels (Table 2 and 3). These findings are in agreement with the earlier findings reported by Kumaran *et al.*, 1998 in pumpkin.

Fruit length (cm)

The character exhibited significant and positive correlation with average fruit weight (r_g : 0.55, r_p : 0.55) at genotypic as well as phenotypic levels. It showed significant negative correlation with node number of first female flower appearance (r_g : -0.50, r_p : -0.41), days to first female flower appearance (r_g : -0.51, r_p : -0.49) at genotypic and phenotypic levels (Table 2 and 3). These findings are in agreement with the earlier findings reported by Jabbar *et al.* 2010 [4] in summer squash.

Fruit diameter (cm)

The character exhibited significant and positive correlation with node number of first male flower appearance (r_g : 0.40, r_p : 0.37) and flesh thickness (r_g : 0.53, r_p : 0.51) at genotypic as well as phenotypic levels (Table 4.13 and 4.14). It showed significant negative correlation with days to first male flower appearance (r_g : -0.46) (r_p : -0.42), days to first fruit harvest (r_g : -0.39) (r_p : -0.39), at genotypic and phenotypic levels. These findings are in agreement with the earlier findings reported by Mohanty (2001) [6] in pumpkin.

Flesh thickness (cm)

The character exhibited significant and positive correlation with node number of first male flower appearance (r_g : 0.55, r_p : 0.49), node number of first female flower appearance (r_g : 0.44, r_p : 0.40), fruit diameter appearance (r_g : 0.53, r_p : 0.51) at genotypic as well as phenotypic levels (Table 4.13 and 4.14). It showed significant negative correlation with fruit weight (r_g : -0.53, r_p : -0.39), Placenta weight per fruit (r_g : -0.48, r_p : -0.46) at both genotypic and phenotypic levels. These findings are in agreement with the earlier findings reported by Blessing *et al.* (2012) [2] in pumpkin.

Placenta weight per fruit (gm)

The character exhibited significant and positive correlation with number of fruits per vine (r_g : 0.41, r_p : 0.38) at genotypic

as well as phenotypic levels. It showed significant negative correlation with node number of first female flower appearance (r_g : -0.42, r_p : -0.35), days to first female flower appearance (r_g : -0.47, r_p : -0.47), vine length (r_g : -0.41, r_p : -0.40), flesh thickness (r_g : -0.48, r_p : -0.46), at both genotypic and phenotypic levels (Table 4.13 and 4.14). Similar results were found by Emina *et al.* (2012) [3] in bottle gourd.

100 Seed weight (gm)

The character exhibited significant and negative correlation with TSS (r_g : -0.38, r_p : -0.38) at genotypic as well as phenotypic levels (Table 4.13 and 4.14). Similar results were found by Kumaran *et al.* (1998) in pumpkin.

Total soluble solids (°)

This trait had significant and positive correlation with node number of first male flower appearance (r_g : 0.41, r_p : 0.38), vine length (r_g : 0.44, r_p : 0.43), flesh thickness (r_g : 0.46, r_p : 0.45) at genotypic as well as phenotypic levels. It showed significant negative correlation with days to 50% germination (r_g : -0.56, r_p : -0.49), 100 Seed weight (r_g : -0.38, r_p : -0.38) at both genotypic and phenotypic levels (Table 4.13 and 4.14). Similar results were found by Kumaran *et al.* (1998) in pumpkin.

Fruit yield per vine (Kg)

The character exhibited significant and positive correlation with number of primary branches per vine (r_g : 0.62), fruit length (0.60), number of fruits per vine (r_g : 0.57), average fruit weight (r_g : 0.45), vine length (r_g : 0.30) at genotypic level. It showed significant negative correlation with node number of first female flower appearance (r_g : -0.48), days to first male flower appearance (r_g : -0.35), days to first female flower appearance (r_g : -0.50), days to first fruit harvest (r_g : -0.50) at genotypic level.

Table 1: Genotypic correlation coefficients between yield and its attributes in pumpkin

S. No.	Character	D50G	NFM	NFF	DFM	DFE	NPBV	V L	DFFH	FV	AFW	F L	F D	F T	P W	100SW	TSS
1	D50G	1.00															
2	NFM	-0.36	1.00														
3	NFF	-0.15	0.33	1.00													
4	DFM	0.04	-0.22	0.10	1.00												
5	DFE	-0.27	0.04	0.34	0.58**	1.00											
6	NPBV	0.08	-0.53**	-0.52**	-0.69	-0.49*	1.00										
7	V L	-0.34	0.04	0.11	-0.11	-0.13	0.26	1.00									
8	D F F H	-0.22	-0.14	0.29	0.53**	0.81	-0.55**	-0.47*	1.00								
9	FV	0.25	-0.12	-0.74	-0.54**	-0.53**	0.56**	-0.33	-0.41*	1.00							
10	A F W	-0.13	-0.33	-0.32	-0.15	-0.56**	0.31	0.55**	-0.46*	-0.22	1.00						
11	F L	0.28	-0.76	-0.50**	-0.24	-0.51**	0.75	0.03	-0.29	0.37	0.55**	1.00					
12	F D	-0.22	0.40*	0.37	-0.46*	-0.27	-0.06	0.35	-0.39*	0.01	-0.08	-0.24	1.00				
13	F T	-0.17	0.55**	0.44*	-0.10	0.26	-0.11	0.44*	-0.17	-0.22	-0.53**	-0.69	0.53**	1.00			
14	P W	0.08	0.02	-0.42*	-0.12	-0.47*	-0.11	-0.41*	-0.20	0.41*	0.18	0.33	0.26	-0.48*	1.00		
15	100 S W	0.13	-0.15	-0.02	-0.12	0.00	-0.10	-0.35	0.30	0.19	-0.10	0.07	0.22	-0.12	0.31	1.00	
16	TSS	-0.56**	0.41*	0.32	0.22	0.32	-0.37	0.44*	0.04	-0.32	-0.02	-0.62	-0.06	0.46*	-0.60	-0.38*	1.00
17	YV	-0.22	-0.19	-0.48	-0.35	-0.50	0.62	0.30	-0.50	0.57	0.45	0.60	-0.03	-0.24	0.16	-0.11	0.06

*5% level of significance, ** 1% level of significance

D50G	Days to 50% germination	V L	Vine length (cm)	F T	Flesh thickness (cm)
NFM	Node number of first male flower appearance	DFFH	Days to first fruit harvest	P W	Placenta weight per fruit (g)
NFF	Node number of first female flower appearance	FV	Number of fruits per vine	100 S W	100 Seed weight (g)
DFM	Days to first male flower appearance	A F W	Average fruit weight (kg)	TSS	TSS (o)
DFE	Days to first female flower appearance	F L	Fruit length (cm)	YV	Yield per vine (kg)
NPBV	Number of primary branches per vine	FD	Fruit diameter		

Table 2: Phenotypic correlation coefficients between yield and its attributes in pumpkin

S.No.	Character	D50G	NFM	NFF	DFM	DFE	NPBV	V L	DFFH	FV	AFW	FL	FD	FT	P W	100SW	TSS
1	D50G	1.00															
2	NFM	-0.13	1.00														
3	NFF	-0.14	0.25	1.00													
4	DFM	0.05	-0.18	0.10	1.00												
5	DFE	-0.24	0.04	0.31	0.54**	1.00											
6	NPBV	0.15	-0.35*	-0.36	-0.41*	-0.41*	1.00										
7	V L	-0.26	0.06	0.04	-0.10	-0.13	0.25	1.00									
8	DFFH	-0.20	-0.12	0.25	0.50**	0.81	-0.47*	-0.46*	1.00								
9	FV	0.16	-0.15	-0.57**	-0.44*	-0.48**	0.44*	-0.31	-0.38*	1.00							
10	AFW	-0.12	-0.29	-0.17	-0.05	-0.47*	0.24	0.42*	-0.39*	-0.12	1.00						
11	FL	0.22	-0.70	-0.41*	-0.21	-0.49*	0.58**	0.00	-0.27	0.33	0.55**	1.00					
12	FD	-0.19	0.37*	0.32	-0.42*	-0.27	-0.05	0.34	-0.39*	0.01	-0.07	-0.22	1.00				
13	FT	-0.15	0.49**	0.40*	-0.04	0.26	-0.01	0.40*	-0.16	-0.18	-0.39*	-0.61	0.51**	1.00			
14	P W	0.07	0.02	-0.35*	-0.11	-0.47*	-0.09	-0.40*	-0.20	0.38*	0.16	0.31	0.26	-0.46*	1.00		
15	100 S W	0.11	-0.14	0.00	-0.10	0.00	-0.07	-0.34	0.30	0.18	-0.07	0.07	0.22	-0.11	0.31	1.00	
16	TSS	0.49**	0.38*	0.27	0.23	0.32	-0.28	0.43*	0.04	-0.30	-0.01	-0.59	-0.06	0.45*	-0.60	-0.38*	1.00
17	YV	1.00	-0.13	-0.14	0.05	-0.24	0.15	-0.26	-0.20	0.16	-0.12	0.22	-0.19	-0.15	0.07	0.11	-0.49

*5% level of significance, **1% level of significance

D50G	Days to 50% germination	V L	Vine length (cm)	FT	Flesh thickness (cm)
NFM	Node number of first male flower appearance	DFFH	Days to first fruit harvest	P W	Placenta weight per fruit (g)
NFF	Node number of first female flower appearance	FV	Number of fruits per vine	100 S W	100 Seed weight (g)
DFM	Days to first male flower appearance	AFW	Average fruit weight (kg)	TSS	TSS (o)
DFE	Days to first female flower appearance	FL	Fruit length (cm)	YV	Yield per vine (kg)
NPBV	Number of primary branches per vine	FD	Fruit diameter		

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