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## Determining relationships between different growth and yield traits in pumpkin with path coefficient analysis

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### Abstract

The objective of this study was to determine the relationships among fruit yield per plant (Kg), growth and economic traits using twenty one genotypes (15 F<sub>1</sub> hybrids and 6 Parents) of pumpkin during three seasons (E<sub>1</sub>, E<sub>2</sub>, E<sub>3</sub>) and pooled analysis worked out. The observations were measured on growth and yield attributing traits. The present investigation revealed that the fruit yield per plant had exhibited significant and positive phenotypic correlation with number of fruits per plant, average fruit weight, total soluble solids, vine length, flesh thickness, number of primary branches per plant, equatorial circumference of fruit and negative significant association with days to first male flower anthesis, days to first female flower anthesis, days to first fruit harvest, inter nodal length and node number to first male flower appearance at phenotypic level during all three seasons and over seasons (pooled) except node number to first male flower appearance during E<sub>1</sub> and E<sub>2</sub>. Analysis of path coefficient revealed that highest positive direct effect on fruit yield per plant was exerted by number of fruit per plant followed by average fruit weight at phenotypic level. Whereas, higher negative direct effects exerted by days to first fruit harvest.

**Keywords:** Pumpkin, correlation, fruit yield per plant, path analysis

### Introduction

Pumpkin (*Cucurbita moschata* Duch. ex. Poir) is one of the most important vegetable crops of family cucurbitaceae grown throughout the world not only for providing better nutrition to the consumers but also higher returns to the farmers. It is originated from central Mexico. Pumpkin is a herbaceous annual, sexually propagated vegetable with chromosome number  $2n=2x=40$ . The word pumpkin was originated from the Greek word *pepon*, which means "large melon", something round and large.

Pumpkin is relatively high in energy and carbohydrates and a good source of vitamins, especially high carotenoid pigments and minerals. It may certainly contribute to improve nutritional status of the people, particularly the vulnerable groups in respect of vitamin A requirement. Night-blindness is a serious problem of South Asian countries. Encouraging the mass people to take more pumpkin can easily be solved the problem.

Pumpkin exhibits great variability in its fruit shape, size, colour and yield along with other agronomic attributes (Singh, 2005 and Singh *et al.*, 2005) [16]. Like other cucurbits pumpkin is warm season crop and hence it may be cultivated round the year in central and southern states of the country, whereas, in northern parts of the country which face cooler winter months, it is generally cultivated during summer and rainy seasons for which sowing is generally done from January to July. Villagers in north India plant it in month of July-August after onset of monsoon in the mounds or hills in the vicinity of house and the growing plants are trained on thatches, hutments and other abandoned spaces. These genotypes used for planting in the vicinity of household are usually land races traditionally maintained by villagers and locally termed as *Bhadhava Kohara* (rainy season type pumpkin). *Bhadhava Kohara* is considered relatively tolerant to cool temperature and performs well during rainy season and extends fruiting in offing winter months. Hence, these genotypes are also referred to as winter type pumpkin. The rainy season or winter season type genotypes produce adequate number of both staminate and pistillate flowers from late August to early September (which happens to be *Bhadrapada* month or *Bhadhau* month of Hindi calendar year) and bear prolific fruits during September-October and also in short days of November-December. If not damaged by frost they may remain productive with very shy bearing in forthcoming January-February.

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## Materials and Methods

The experimental materials for the present study comprised of six promising and diverse inbreds and varieties of pumpkin selected on the basis of genetic variability from the germplasm stock maintained in the Department of Vegetable Science, N.D. University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) India. The selected parental lines *i.e.* Narendra Upkar (P<sub>1</sub>), NDPK-120 (P<sub>2</sub>), Narendra Agrim (P<sub>3</sub>), NDPK-39-2 (P<sub>4</sub>), Kashi Harit (P<sub>5</sub>) and NDPK-11-3 (P<sub>6</sub>) were raised and crossed in the all possible combinations, excluding reciprocals, during *Zaid*, 2015 to get 15 F<sub>1</sub> hybrid seeds for the study of character association for fourteen quantitative traits. The experiments were conducted in Randomized Block Design (RBD) with three replications to assess the performance of 15 F<sub>1</sub> hybrids and 6 parents. The treatments were planted in rows spaced at 3.0 meters apart with a plant to plant spacing of 0.5 meter. The seeds were sown on 23<sup>th</sup> July, 2015 and 7<sup>th</sup> November 2015, 26<sup>th</sup> March, 2016 for *Kharif*, *Rabi* and *Zaid* crops, respectively. All the recommended agronomic package of practices and plant protection measures were followed to raise good crop.

## Statistical Analysis

Phenotypic and genotypic correlation coefficients were worked out to study the relationship of various pairs of characters as suggested by Al-Jibouri *et al.* (1958) <sup>[1]</sup>. Path-coefficient is a standardized partial regression coefficient. It permits the partitioning of coefficients of correlation into direct and indirect effects. The path coefficient analysis of component traits of marketable green fruit yield per plant was carried out by following Dewey and Lu (1959) <sup>[4]</sup>.

## Results and Discussion

### Correlation coefficients

Correlation studies provides information that selection for one character will result in progress for all positively correlated characters. Many of the characters are correlated, because of natural association, positive or negative with other characters. As more variables are considered in correlation tables, their indirect correlation becomes more complex.

The phenotypic and genotypic correlation coefficient computed among the fourteen characters under study had been presented in Table 1 and 2 for E<sub>1</sub>, 3 and 4 for E<sub>2</sub>, 5 and 6 for E<sub>3</sub> and 7 and 8 for pooled.

Fruit yield per plant had exhibited significant and positive phenotypic correlation with number of fruits per plant, average fruit weight, vine length, flesh thickness, number of primary branches per plant, equatorial circumference of fruit and negative significant association with days to first male flower anthesis, days to first female flower anthesis, days to first fruit harvest, inter nodal length and node number to first male flower appearance at phenotypic level during all three seasons and also over seasons (pooled) which are desirable except node number to first male flower appearance during E<sub>1</sub> and E<sub>2</sub>. Many earlier researchers had also reported positive and significant correlation of most of the above traits with fruit yield per plant namely, Rana *et al.* (1985) <sup>[13]</sup>; Doijode and Sulladmath (1986) <sup>[5]</sup>; Amaral *et al.* (1994) <sup>[2]</sup>; Kumaran *et al.* (1998) <sup>[8]</sup>; Mohanty (2001) and Pandey *et al.* (2002), thereby, they also supported present findings.

Looked at these associations from findings of present research it appears that for improvement of pumpkin, number of fruits per plant, average fruit weight, vine length, flesh thickness, number of primary branches per plant, equatorial

circumference of fruit, days to first male flower anthesis, days to first female flower anthesis, days to first fruit harvest, inter nodal length and node number to first male flower appearance need to be given more consideration.

A positive association of days to first male flower anthesis, days to first female flower anthesis and node number to first male flower appearance with days to first fruit harvest suggests that early flowering and flower appearance at lower node would be appropriate selection criteria to get early yield. The presence of positive correlation of number of fruits per plant with vine length and primary branches per plant revealed that longer vine length can be selected for harvesting more marketable fruits.

### Path coefficient analysis

It helps to find out the direct and indirect effects of yield attributes that which is one of great importance to select the superior genotypes. The estimates of correlation coefficients indicate only the inter-relationship of the character but, do not furnish information on the cause and effect relationships. Wright (1921) has devised the analysis of path coefficient to provide effective means of finding out direct and indirect causes of association which permits the critical examination of specific forces acting to produce a given correlation and measures the relative importance of each causal factor. Dewey and Lu (1959) <sup>[4]</sup> were the first to demonstrate the utility of path coefficient analysis in breeding programme using crested wheat grass progenies.

Due to the mutual association, the development of dependent variable is determined by the degree of direct effect of independent variables and direct effects exerted via other characters, arising inevitably as an integral part of the growth pattern. Under such complex situations, the total correlation is insufficient to explain the real association for an effective and fruitful manipulation of the characters.

The path coefficient analysis was carried out from phenotypic and genotypic correlation coefficients to resolve direct and indirect effect of different characters on fruit yield.

The direct and indirect effect of different characters on fruit yield at phenotypic level is presented in tables 9, 11, 13 and 14.

Analysis of path coefficient revealed that the highest positive direct effect on fruit yield per plant was exerted by number of fruit per plant followed by average fruit weight at phenotypic level. Whereas, negative direct effect by days to first fruit harvest.

At phenotypic level, number of primary branches per plant via number of fruits per plant exhibited positive association with fruit yield per plant. However, this association was affected by negative indirect effects via average fruit weight. Equatorial circumference of fruit had positive association with fruit yield per plant which, was mainly due to indirect positive effect via number of fruits per plant. Polar circumference of fruit via number of fruits per plant exhibited positive association with fruit yield per plant. Flesh thickness via number of fruits per plant exhibited positive association with fruit yield per plant. Vine length via number of fruits per plant and average fruit weight exhibited positive association with fruit yield per plant. Average fruit weight had substantial positive direct effect on fruit yield per plant at phenotypic level which was major component of the significant positive association. Days to first male flower anthesis had significant negative association with fruit yield per plant. Break up this association revealed that the indirect effects via number of

fruits per plant was mainly responsible for this association. Days to first female flower via number of fruits per plant had significant negative association with fruit yield per plant. Node number to first male flower appearance had significant negative association with fruit yield per plant, which was mainly due to indirect effect of number of fruits per plant. Days to first fruit harvest exhibited negative significant correlation with fruit yield per plant. Break up of this negative correlation revealed that the negative indirect effect via number of fruits per plant was mainly responsible for this association. Internodal length via indirect effect of number of fruits per plant had negative significant association with fruit yield per plant at phenotypic level. Positive direct effect of various traits on fruit yield has also been reported by earlier workers viz., for average fruit weight (Gopalkrishnan *et al.* 1980; Rana *et al.* 1985 ; Mohanty 2001; Shivananda *et al.* 2013; Yadegari *et al.* 2012; Murlidharan *et al.* 2015; Naik *et al.* 2015) for number of fruits per plant (Kumaran *et al.* 1998;

Mohanty 2001; Pandey *et al.* 2002; Camacho *et al.* 2006; Shivananda *et al.* 2013; Grisales *et al.* 2013; Murlidharan *et al.* 2015; Naik *et al.* 2015; Sulatana *et al.* 2015) for stem length (Gopalkrishnan *et al.* 1980; Mohanty 2001; Murlidharan *et al.* 2015) [13] for flesh thickness (Rana *et al.* 1985; Yadav *et al.* 2006) [13] for equatorial and polar circumference of fruit (Pandey *et al.* 2002; Yadav *et al.* 2006) for number of branches (Murlidharan *et al.* 2015) which substantiate the present findings. The path coefficient analysis revealed that direct and indirect effect obtained at genotypic level were markedly different from those at phenotypic level which might be due to varying degree influence of environment on various traits studied and these were also observed in component variance analysis and correlation studies during all three seasons and over environments. Finally the path coefficient analysis revealed that focusing on number of fruits per plant and average fruit weight could improve total yield per plant in pumpkin.

**Table 1:** Estimates of correlation coefficient at phenotypic level for growth, yield traits in pumpkin during *Kharif*, 2015 (E<sub>1</sub>)

Traits	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit (cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Fruit yield per plant (kg)
Days to first male flower anthesis	0.842**	0.294**	0.070	0.801**	-0.607**	-0.404**	-0.247**	-0.401**	0.189	-0.285**	0.133	-0.646**	-0.550**
Days to first female flower anthesis		0.072	-0.040	0.817**	-0.425**	-0.221**	-0.186	-0.451**	0.300**	-0.025	0.225**	-0.586**	-0.458**
Node number to first male flower			0.347**	0.056	-0.353**	-0.304**	-0.046	0.192	0.160	-0.154	0.081	-0.176	-0.146
Node number to first female flower				0.067	-0.255**	0.132	0.148	0.125	0.205**	-0.055	0.322**	0.024	0.153
Days to first fruit harvest					-0.416**	-0.111	-0.258**	-0.423**	0.330**	-0.120	0.047	-0.557**	-0.508**
Number of primary branches per plant						0.537**	0.343**	0.370**	-0.298*	0.203	-0.148	0.523**	0.414**
Equatorial circumference of fruit (cm)							0.607**	0.301**	0.068	0.360**	0.104	0.279**	0.294**
Polar circumference of fruit (cm)								0.240**	0.192	0.157	0.060	0.139	0.146
Flesh thickness (cm)									-0.365**	0.204**	-0.083	0.443**	0.366**
Internodal length (cm)										-0.049	0.001	-0.399**	-0.379**
Vine length (m)											0.486**	0.249**	0.434**
Average fruit weight (kg)												0.008	0.409**
No. of fruits per plant													0.890**

\*, \*\* Significant at 5 percent and 1 percent probability levels, respectively.

**Table 2:** Estimates of correlation coefficient at genotypic level for growth, yield traits in pumpkin during *Kharif*, 2015 (E<sub>1</sub>)

Traits	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit (cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Fruit yield per plant (kg)
Days to first male flower anthesis	0.859	0.292	0.062	0.806	-0.637	-0.447	-0.311	-0.612	0.182	-0.330	0.128	-0.684	-0.597
Days to first female flower anthesis		0.035	-0.053	0.829	-0.466	-0.248	-0.246	-0.682	0.299	-0.045	0.236	-0.645	-0.520
Node number to first male flower			0.346	0.016	-0.417	-0.352	-0.111	0.130	0.114	-0.222	0.063	-0.235	-0.198
Node number to first female flower				0.053	-0.286	0.122	0.164	0.121	0.175	-0.042	0.369	0.011	0.171
Days to first fruit harvest					-0.447	-0.135	-0.333	-0.641	0.322	-0.151	0.022	-0.601	-0.559
Number of primary branches per plant						0.567	0.341	0.436	-0.332	0.194	-0.199	0.524	0.423
Equatorial circumference of fruit (cm)							0.638	0.406	0.056	0.426	0.124	0.280	0.334
Polar circumference of fruit (cm)								0.224	0.191	0.153	0.017	0.130	0.136
Flesh thickness (cm)									-0.576	0.189	-0.213	0.553	0.457
Internodal length (cm)										-0.059	-0.029	-0.451	-0.426
Vine length (m)											0.598	0.266	0.470
Average fruit weight (kg)												-0.024	0.359
No. of fruits per plant													0.932

**Table 3:** Estimates of correlation coefficient at phenotypic level for growth, yield traits in pumpkin during *Rabi*, 2015-16 (E<sub>2</sub>)

Traits	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit (cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Fruit yield per plant (kg)
Days to first male flower anthesis	0.973**	0.666**	0.430**	0.950**	-0.133	-0.312**	-0.592**	-0.148	0.432**	0.061	-0.447**	-0.484**	-0.658**
Days to first female flower anthesis		0.682**	0.343**	0.951**	-0.144	-0.373**	-0.567**	-0.156	0.378**	0.100	-0.434**	-0.474**	-0.646**
Node number to first male flower			0.321**	0.588**	-0.366**	-0.387**	-0.694**	-0.387**	0.434**	0.211**	-0.010	-0.458**	-0.407**
Node number to first female flower				0.274**	-0.086	-0.040	-0.465**	-0.195	0.183	0.064	-0.287**	0.086	-0.058
Days to first fruit harvest					-0.054	-0.387**	-0.508**	-0.126	0.383**	-0.038	-0.456**	-0.428**	-0.614**
Number of primary branches per plant						0.083	0.428**	0.199	-0.174	-0.330**	-0.397**	0.313**	0.079
Equatorial circumference of fruit (cm)							0.616**	0.044	0.104	0.279**	-0.071	0.346**	0.272**
Polar circumference of fruit (cm)								0.190	-0.163	-0.038	0.008	0.431**	0.368**
Flesh thickness (cm)									-0.045	0.106	-0.021	-0.035	-0.012
Internodal length (cm)										0.304**	-0.234**	-0.388**	-0.467**
Vine length (m)											-0.043	-0.173	-0.169
Average fruit weight (kg)												0.016	0.494**
No. of fruits per plant													0.869**

\*, \*\* Significant at 5 percent and 1 percent probability levels, respectively.

**Table 4:** Estimates of correlation coefficient at genotypic level for growth, yield traits in pumpkin during *Rabi*, 2015-16 (E<sub>2</sub>)

Traits	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit (cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Fruit yield per plant (kg)
Days to first male flower anthesis	0.980	0.691	0.481	0.962	-0.146	-0.318	-0.615	-0.176	0.445	0.071	-0.472	-0.504	-0.689
Days to first female flower anthesis		0.715	0.395	0.968	-0.166	-0.381	-0.603	-0.195	0.401	0.139	-0.460	-0.499	-0.681
Node number to first male flower			0.398	0.610	-0.412	-0.413	-0.756	-0.450	0.469	0.281	-0.032	-0.483	-0.443
Node number to first female flower				0.309	-0.082	-0.027	-0.513	-0.228	0.192	0.066	-0.345	0.059	-0.105
Days to first fruit harvest					-0.067	-0.392	-0.540	-0.163	0.386	-0.065	-0.469	-0.453	-0.640
Number of primary branches per plant						0.092	0.423	0.179	-0.183	-0.477	-0.426	0.332	0.083
Equatorial circumference of fruit (cm)							0.646	0.062	0.106	0.359	-0.086	0.370	0.290
Polar circumference of fruit (cm)								0.177	-0.174	-0.070	0.019	0.459	0.398
Flesh thickness (cm)									-0.060	0.160	-0.020	-0.053	-0.025
Internodal length (cm)										0.380	-0.242	-0.417	-0.495
Vine length (m)											-0.068	-0.188	-0.195
Average fruit weight (kg)												0.009	0.483
No. of fruits per plant													0.872

**Table 5:** Estimates of correlation coefficient at phenotypic level for growth, yield traits in pumpkin during *Zaid*, 2016 (E<sub>3</sub>)

Traits	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit (cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Fruit yield per plant (kg)
Days to first male flower anthesis	0.838**	0.294**	0.066	0.840**	-0.607	-0.404**	-0.245**	-0.400**	0.190	-0.282**	0.135	-0.641**	-0.535**
Days to first female flower anthesis		0.051	-0.054	0.872**	-0.440**	-0.234**	-0.215	-0.479**	0.293**	-0.033	0.210	-0.595**	-0.458**
Node number to first male flower			0.360**	0.044	-0.353**	-0.305**	-0.043	0.194	0.162	-0.150	0.083	-0.170	-0.126
Node number to first female flower				-0.092	-0.258**	0.127	0.162	0.124	0.201	-0.046	0.328**	0.030	0.171
Days to first fruit harvest					-0.453**	-0.242**	-0.320**	-0.518**	0.296**	-0.187**	-0.016	-0.563**	-0.536**
Number of primary branches per plant						0.537**	0.344**	0.373**	-0.297**	0.203**	-0.144*	0.523**	0.420**
Equatorial circumference of fruit (cm)							0.605**	0.301**	0.068	0.360**	0.103	0.281**	0.299**
Polar circumference of fruit (cm)								0.249**	0.194**	0.160**	0.068	0.145*	0.149*
Flesh thickness (cm)									-0.362**	0.208**	-0.077	0.453**	0.362**
Internodal length (cm)										-0.047	0.004	-0.391**	-0.360**
Vine length (m)											0.485**	0.252**	0.446**
Average fruit weight (kg)												0.012	0.373**
No. of fruits per plant													0.893**

\*, \*\* Significant at 5 percent and 1 percent probability levels, respectively.

**Table 6:** Estimates of correlation coefficient at genotypic level for growth, yield traits in pumpkin during *Rabi*, 2016 (E<sub>3</sub>)

Traits	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit(cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Fruit yield per plant (kg)
Days to first male flower anthesis	0.862	0.292	0.060	0.856	-0.637	-0.447	-0.312	-0.612	0.182	-0.332	0.126	-0.687	-0.072
Days to first female flower anthesisv		0.046	-0.050	0.892	-0.458	-0.240	-0.230	-0.662	0.303	-0.041	0.244	-0.641	-0.046
Node number to first male flower			0.363	0.038	-0.417	-0.351	-0.113	0.129	0.114	-0.224	0.061	-0.238	0.306
Node number to first female flower				-0.109	-0.288	0.120	0.171	0.132	0.172	-0.036	0.372	0.011	0.092
Days to first fruit harvest					-0.461	-0.254	-0.344	-0.719	0.304	-0.191	-0.026	-0.599	-0.062
Number of primary branches per plant						0.567	0.434	0.434	-0.332	0.194	-0.201	0.524	0.127
Equatorial circumference of fruit (cm)							0.639	0.406	0.056	0.426	0.126	0.278	0.244
Polar circumference of fruit (cm)								0.218	0.190	0.152	0.013	0.126	0.395
Flesh thickness(cm)									-0.578	0.185	-0.218	0.546	0.014
Internodal length (cm)										-0.061	-0.032	-0.455	-0.168
Vine length (m)											0.599	0.264	0.351
Average fruit weight (kg)												-0.026	0.370
No. of fruits per plant													0.010
													0.134

**Table 7:** Estimates of correlation coefficient at phenotypic level for growth, yield and biochemical traits in pumpkin over environments (pooled)

Traits	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit(cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Fruit yield per plant (kg)
Days to first male flower anthesis	0.904**	0.491**	0.203**	0.871**	-0.411**	-0.359**	-0.420**	-0.285**	0.272**	-0.180*	-0.097	-0.568**	-0.557**
Days to first female flower anthesisv		0.378**	0.096	0.886**	-0.318**	-0.277**	-0.378**	-0.331**	0.318**	-0.001	-0.033	-0.538**	-0.503**
Node number to first male flower			0.327**	0.296**	-0.345**	-0.326**	-0.386**	-0.081	0.258**	-0.055	0.041	-0.290**	-0.223**
Node number to first female flower				0.079	-0.208**	0.081	-0.082	0.017	0.197*	-0.032	0.145*	0.045	0.106
Days to first fruit harvest					-0.307**	-0.248**	-0.383**	-0.338**	0.332**	-0.124	-0.146*	-0.512**	-0.542**
Number of primary branches per plant						0.406**	0.368**	0.311**	-0.263**	0.116	-0.221**	0.458**	0.329**
Equatorial circumference of fruit (cm)							0.595**	0.212**	0.078	0.333**	0.052	0.300**	0.289**
Polar circumference of fruit (cm)								0.219**	0.058	0.101	0.041	0.257**	0.215**
Flesh thickness(cm)									-0.258**	0.172*	-0.059	0.273**	0.246**
Internodal length (cm)										0.003	-0.064	-0.392**	-0.392**
Vine length (m)											0.383**	0.171*	0.351**
Average fruit weight (kg)												0.012	0.415**
No. of fruits per plant													0.879**

\*, \*\* Significant at 5 percent and 1 percent probability levels, respectively.

**Table 8:** Estimates of correlation coefficient at genotypic level for growth, yield and quality traits in pumpkin pooled (over environments)

Traits	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit(cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Fruit yield per plant (kg)
Days to first male flower anthesis	0.953	0.683	0.202	0.944	-0.739	-0.573	-0.562	-0.725	0.487	-0.560	-0.126	-0.747	-0.167
Days to first female flower anthesisv		0.606	0.098	0.943	-0.726	-0.537	-0.517	-0.740	0.455	-0.366	-0.039	-0.750	-0.115
Node number to first male flower			0.428	0.600	-0.777	-0.567	-0.602	-0.406	0.403	-0.250	0.031	-0.453	0.106
Node number to first female flower				0.107	-0.437	0.000	-0.327	-0.133	0.233	-0.099	0.162	0.035	-0.049
Days to first fruit harvest					-0.583	-0.428	-0.524	-0.716	0.576	-0.428	-0.195	-0.723	-0.120
Number of primary branches per plant						0.576	0.661	0.496	-0.325	0.111	-0.309	0.562	0.106
Equatorial circumference of fruit (cm)							0.766	0.620	-0.081	0.481	0.046	0.379	0.282
Polar circumference of fruit (cm)								0.516	-0.327	0.364	-0.032	0.395	0.352
Flesh thickness(cm)									-0.365	0.128	-0.200	0.470	-0.067
Internodal length (cm)										-0.143	-0.164	-0.492	-0.298
Vine length (m)											0.603	0.236	0.428
Average fruit weight (kg)												0.013	0.461
No. of fruits per plant													0.009

**Table 9:** Estimates of direct and indirect effects of different growth and yield traits on fruit yield per plant of pumpkin at phenotypic level during *Kharif* 2015 (E<sub>1</sub>)

Traits	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit (cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Correlation with fruit yield per plant (kg)
Days to first male flower anthesis	0.033	-0.034	-0.001	0.003	0.016	-0.028	-0.018	0.010	0.013	-0.005	-0.012	0.047	-0.59	-0.550**
Days to first female flower anthesis	0.027	-0.049	-0.000	-0.003	0.016	-0.020	-0.010	0.008	0.015	-0.008	-0.001	0.080	-0.542	-0.458**
Node number to first male flower	0.009	-0.002	-0.003	0.019	0.001	-0.017	-0.014	0.003	-0.003	-0.003	-0.007	0.022	-0.184	-0.146*
Node number to first female flower	0.002	0.002	-0.001	0.058	0.001	-0.012	0.005	-0.005	-0.003	-0.005	-0.002	0.124	0.017	0.153*
Days to first fruit harvest	0.026	-0.033	-0.000	0.003	0.027	-0.019	-0.005	0.019	0.014	-0.008	-0.005	0.010	-0.051	-0.508**
Number of primary branches per plant	-0.020	0.018	0.001	-0.015	-0.008	0.046	0.023	-0.012	-0.010	0.008	0.008	-0.639	0.463	0.414**
Equatorial circumference of fruit (cm)	-0.138	0.009	0.001	0.006	-0.002	0.024	0.044	-0.023	-0.008	-0.001	0.0160	0.040	0.238	0.294**
Polar circumference of fruit (cm)	-0.009	0.008	0.000	0.008	-0.005	0.015	0.026	-0.038	-0.005	-0.004	0.007	0.011	0.107	0.146*
Flesh thickness(cm)	-0.014	0.021	-0.001	0.001	-0.001	0.016	0.012	-0.006	-0.030	0.011	0.006	-0.057	0.378	0.366**
Internodal length (cm)	0.001	-0.011	-0.001	0.010	0.006	-0.014	0.002	-0.006	0.012	-0.028	-0.002	-0.007	-0.378	-0.379**
Vine length (m)	-0.100	0.001	0.001	-0.003	-0.002	0.001	0.016	-0.006	-0.004	0.001	0.042	0.187	0.221	0.434**
Average fruit weight (kg)	0.004	-0.008	-0.000	0.019	0.001	-0.008	0.004	-0.001	0.004	0.001	0.0216	0.369	-0.004	0.409**
No. of fruits per plant	-0.021	0.024	0.001	0.001	-0.011	0.0240	0.011	-0.004	-0.013	0.011	0.010	-0.002	0.895	0.890**

\*, \*\* Significant at 5 percent and 1 percent probability levels, respectively.

**Table 10:** Estimates of direct and indirect effects of different growth and yield traits on fruit yield per plant of pumpkin at phenotypic level during *Kharif* 2015 (E<sub>1</sub>)

Traits	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit (cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Correlation with fruit yield per plant (kg)
Days to first male flower anthesis	-0.136	-0.153	0.033	0.003	0.290	-0.078	-0.030	-0.012	0.045	-0.022	-0.018	0.052	-0.666	-0.597
Days to first female flower anthesis	-0.117	-0.117	0.005	-0.002	0.298	-0.057	-0.017	-0.009	0.049	-0.036	-0.002	0.096	-0.625	-0.520
Node number to first male flower	-0.041	-0.008	0.111	0.017	0.01	-0.049	-0.023	-0.003	-0.013	-0.015	-0.116	0.030	-0.214	-0.198
Node number to first female flower	-0.009	0.009	0.039	0.050	0.021	-0.035	0.009	0.007	-0.010	-0.023	-0.002	0.144	0.014	0.171
Days to first fruit harvest	-0.110	-0.148	0.003	0.003	0.359	-0.055	-0.009	-0.014	0.047	-0.040	-0.008	0.013	-0.585	-0.559
Number of primary branches per plant	0.086	0.081	-0.044	-0.014	-0.158	0.125	0.040	0.015	-0.035	0.039	0.011	-0.074	0.519	0.423
Equatorial circumference of fruit (cm)	0.060	0.043	-0.037	0.006	-0.047	0.071	0.070	0.027	-0.033	-0.008	0.023	0.049	0.282	0.334
Polar circumference of fruit (cm)	0.060	0.043	-0.037	0.006	-0.047	0.071	0.070	0.027	-0.033	-0.008	0.023	0.049	0.282	0.136
Flesh thickness(cm)	0.078	0.113	0.019	0.006	-0.214	0.055	0.029	0.012	-0.079	0.064	0.012	-0.063	0.551	0.457
Internodal length (cm)	0.040	0.041	-0.009	0.008	-0.114	0.044	0.045	0.043	-0.022	-0.024	0.008	0.014	0.138	-0.426
Vine length (m)	0.044	0.006	-0.023	-0.002	-0.051	0.025	0.029	0.006	-0.017	0.007	0.056	0.234	0.262	0.470
Average fruit weight (kg)	0.078	0.113	0.019	0.006	-0.214	0.055	0.029	0.012	-0.079	0.064	0.012	-0.063	0.551	0.359
No. of fruits per plant	0.092	0.113	-0.024	0.001	-0.213	0.066	0.020	0.006	-0.044	0.053	0.015	-0.006	0.985	0.932

**Table 11:** Estimates of direct and indirect effects of different growth and yield traits on fruit yield per plant of pumpkin at phenotypic level during *Rabi* 2015-16 (E<sub>2</sub>)

Traits	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit (cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Correlation with fruit yield per plant (kg)
Days to first male flower anthesis	-0.215	-0.001	0.021	0.022	0.143	0.001	-0.011	0.059	-0.003	-0.008	-0.002	-0.187	-0.408	-0.658**
Days to first female flower anthesis	-0.209	-0.001	0.022	0.018	0.143	0.001	-0.013	0.057	-0.003	-0.007	-0.003	-0.182	-0.404	-0.646**
Node number to first male flower	-0.143	-0.001	0.031	0.017	0.088	0.003	-0.014	0.070	-0.008	-0.007	-0.006	-0.005	-0.381	-0.407**
Node number to first female flower	-0.094	0.000	0.010	0.051	0.041	0.001	-0.001	0.046	-0.004	-0.003	-0.002	-0.120	0.072	-0.058
Days to first fruit harvest	-0.204	-0.001	0.018	0.014	0.150	0.001	-0.014	0.052	-0.003	-0.006	0.001	-0.187	-0.364	-0.614**
Number of primary branches per plant	0.030	0.000	-0.012	-0.004	-0.009	-0.008	0.003	-0.042	0.003	0.003	0.011	-0.167	0.260	0.079
Equatorial circumference of fruit (cm)	0.067	0.000	-0.012	-0.002	-0.058	-0.001	0.036	-0.062	0.001	-0.002	-0.009	-0.030	0.290	0.272**
Polar circumference of fruit (cm)	0.129	0.001	-0.022	-0.024	-0.078	-0.004	0.022	-0.099	0.003	0.003	0.001	0.003	0.363	0.368**
Flesh thickness(cm)	0.035	0.000	-0.013	-0.010	-0.022	-0.002	0.002	-0.017	0.019	0.001	-0.004	-0.010	-0.033	-0.012
Internodal length (cm)	-0.093	0.000	0.014	0.009	0.056	0.001	0.004	0.017	-0.001	-0.017	-0.009	-0.091	-0.324	-0.467**
Vine length (m)	-0.012	0.000	0.006	0.004	-0.005	0.003	0.010	0.003	0.002	-0.005	-0.032	-0.025	-0.140	-0.169*
Average fruit weight (kg)	0.096	0.001	0.000	-0.015	-0.067	0.003	-0.003	-0.001	0.000	0.004	0.002	0.418	0.013	0.494**
No. of fruits per plant	0.104	0.001	-0.014	0.004	-0.065	-0.003	0.012	-0.043	-0.001	0.007	0.005	0.007	0.839	0.869**

\*, \*\* Significant at 5 percent and 1 percent probability levels, respectively.

**Table 12:** Estimates of direct and indirect effects of different growth and yield traits on fruit yield per plant of pumpkin at phenotypic level during *Rabi* 2015-16 (E<sub>2</sub>)

Traits	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit (cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Correlation with fruit yield per plant (kg)
Days to first male flower anthesis	-0.922	0.151	0.049	0.082	0.635	-0.002	-0.051	0.086	-0.015	-0.041	-0.002	-0.204	-0.406	-0.689
Days to first female flower anthesis	-0.903	0.154	0.051	0.067	0.638	-0.002	-0.061	0.084	-0.017	-0.037	-0.004	-0.199	-0.400	-0.681
Node number to first male flower	-0.638	0.109	0.071	0.067	0.403	-0.005	-0.066	0.105	-0.040	-0.044	-0.007	-0.014	-0.391	-0.443
Node number to first female flower	-0.441	0.060	0.028	0.171	0.205	-0.001	-0.004	0.072	-0.021	-0.018	-0.002	-0.149	0.047	-0.105
Days to first fruit harvest	-0.886	0.149	0.044	0.053	0.660	-0.001	-0.063	0.075	-0.014	-0.036	0.002	-0.205	-0.363	-0.640
Number of primary branches per plant	0.131	-0.024	-0.029	-0.015	-0.042	0.013	0.014	-0.060	0.017	0.017	0.012	-0.184	0.269	0.083
Equatorial circumference of fruit (cm)	0.295	-0.059	-0.030	-0.005	-0.260	0.001	0.159	-0.090	0.005	-0.010	-0.009	-0.037	0.298	0.290
Polar circumference of fruit (cm)	0.562	-0.092	-0.053	-0.088	-0.352	0.005	0.102	-0.141	0.017	0.016	0.002	0.008	0.369	0.398
Flesh thickness (cm)	0.155	-0.028	-0.031	-0.039	-0.101	0.002	0.009	-0.026	0.092	0.005	-0.004	-0.008	-0.040	-0.025
Internodal length (cm)	-0.409	0.061	0.034	0.033	0.258	-0.002	0.017	0.024	-0.005	-0.092	-0.010	-0.108	-0.336	-0.495
Vine length (m)	-0.071	0.022	0.021	0.011	-0.045	-0.006	0.057	0.010	0.013	-0.036	-0.026	-0.025	-0.156	-0.195
Average fruit weight (kg)	-0.071	0.022	0.021	0.011	-0.045	-0.006	0.057	0.010	0.013	-0.036	-0.026	-0.025	-0.156	0.483
No. of fruits per plant	0.464	-0.076	-0.035	0.010	-0.297	0.004	0.059	-0.065	-0.005	0.039	0.005	0.004	0.806	0.872

**Table 13:** Estimates of direct and indirect effects of different growth and yield traits on fruit yield per plant of pumpkin at phenotypic level during *Zaid*, 2016 (E<sub>3</sub>)

Traits	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit (cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Correlation with fruit yield per plant (kg)
Days to first male flower anthesis	0.069	-0.014	-0.005	0.003	-0.035	-0.020	-0.018	0.014	0.013	-0.003	-0.011	0.046	-0.594	-0.535**
Days to first female flower anthesis	0.058	-0.017	-0.001	-0.003	-0.037	-0.015	-0.010	0.011	0.015	-0.004	-0.002	0.078	-0.543	-0.458**
Node number to first male flower	0.019	-0.001	-0.017	0.018	-0.002	-0.013	-0.015	0.005	-0.004	-0.002	-0.007	0.021	-0.185	-0.126
Node number to first female flower	0.004	0.001	-0.006	0.052	0.004	-0.009	0.005	-0.008	-0.003	-0.003	-0.002	0.121	0.020	0.171
Days to first fruit harvest	0.058	-0.015	-0.001	-0.005	-0.042	-0.015	-0.011	0.016	0.015	-0.005	-0.007	-0.009	-0.515	-0.536**
Number of primary branches per plant	-0.043	0.008	0.007	-0.014	0.019	0.033	0.024	-0.016	-0.010	0.005	0.007	-0.062	0.465	0.420**
Equatorial circumference of fruit (cm)	-0.029	0.004	0.006	0.006	0.010	0.018	0.044	-0.030	-0.008	-0.001	0.014	0.039	0.239	0.299**
Polar circumference of fruit (cm)	-0.019	0.004	0.002	0.008	0.014	0.011	0.027	-0.049	-0.005	-0.003	0.006	0.011	0.107	0.149*
Flesh thickness (cm)	-0.031	0.009	0.002	0.006	0.022	0.012	0.012	-0.008	-0.029	0.006	0.006	-0.056	0.380	0.362**
Internodal length (cm)	0.013	-0.005	-0.002	0.009	-0.013	-0.010	0.002	-0.009	0.012	-0.015	-0.002	-0.008	-0.379	-0.360**
Vine length (m)	-0.021	0.001	0.003	-0.003	0.008	0.006	0.017	-0.008	-0.005	0.001	0.037	0.182	0.222	0.446**
Average fruit weight (kg)	0.009	-0.004	-0.001	0.018	0.001	-0.006	0.005	-0.002	0.005	0.000	0.019	0.359	-0.004	0.373**
No. of fruits per plant	-0.045	0.010	0.004	0.001	0.024	0.017	0.012	-0.006	-0.012	0.006	0.009	-0.002	0.898	0.893**

\*, \*\* Significant at 5 percent and 1 percent probability levels, respectively.

**Table 14:** Estimates of direct and indirect effects of different growth and yield traits on fruit yield per plant of pumpkin at phenotypic level during *Zaid*, 2016 (E<sub>3</sub>)

Traits	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit (cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Correlation with fruit yield per plant (kg)
Days to first male flower anthesis	0.332	0.318	-0.074	-0.011	-0.554	0.022	0.034	0.012	-0.093	0.024	0.039	0.053	-0.544	-0.072
Days to first female flower anthesis	0.286	0.369	-0.011	0.009	-0.578	0.016	0.019	0.009	-0.103	0.039	0.004	0.098	-0.510	-0.046
Node number to first male flower	0.099	0.017	-0.248	-0.062	-0.025	0.014	0.026	0.003	0.028	0.016	0.025	0.031	-0.175	0.306
Node number to first female flower	0.021	-0.019	-0.092	-0.168	0.069	0.010	-0.010	-0.007	0.022	0.023	0.004	0.149	0.012	0.092
Days to first fruit harvest	0.284	0.330	-0.010	0.018	-0.648	0.016	0.019	0.014	-0.114	0.038	0.023	-0.009	-0.477	-0.062
Number of primary branches per plant	-0.209	-0.169	0.099	0.047	0.299	-0.035	-0.044	-0.014	0.072	-0.041	-0.024	-0.075	0.423	0.127
Equatorial circumference of fruit (cm)	-0.146	-0.090	0.083	-0.021	0.164	-0.020	-0.076	-0.026	0.068	0.008	-0.051	0.050	0.230	0.244
Polar circumference of fruit (cm)	-0.098	-0.085	0.020	-0.030	0.219	-0.012	-0.049	-0.041	0.045	0.026	-0.018	0.014	0.113	0.395
Flesh thickness (cm)	-0.190	-0.235	-0.043	-0.023	0.456	-0.015	-0.032	-0.011	0.162	-0.068	-0.027	-0.064	0.450	0.014
Internodal length (cm)	0.062	0.113	-0.031	-0.031	-0.196	0.011	-0.005	-0.008	-0.086	0.127	0.007	-0.007	-0.352	-0.168
Vine length (m)	-0.107	-0.013	0.052	0.006	0.122	-0.007	-0.032	-0.006	0.036	-0.007	-0.122	0.238	0.214	0.351
Average fruit weight (kg)	0.043	0.088	-0.019	-0.061	0.014	0.006	-0.009	-0.001	-0.025	-0.002	-0.071	0.409	-0.012	0.370
No. of fruits per plant	-0.225	-0.234	0.054	-0.003	0.384	-0.018	-0.022	-0.006	0.091	-0.056	-0.033	-0.006	0.804	0.010

**Table 15:** Estimates of direct and indirect effects of different growth and yield traits on fruit yield per plant of pumpkin at phenotypic level over environments (pooled)

Traits	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit(cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Correlation with fruit yield per plant (kg)
Days to first male flower anthesis	0.038	0.026	0.001	-0.002	-0.096	-0.007	-0.013	0.021	-0.001	-0.005	-0.005	-0.045	-0.477	-0.557**
Days to first female flower anthesis	0.035	0.029	0.000	-0.001	-0.098	-0.005	-0.010	0.018	-0.002	-0.005	0.000	-0.017	-0.453	-0.503**
Node number to first male flower	0.019	0.011	0.001	-0.003	-0.032	-0.006	-0.012	0.020	-0.001	-0.004	-0.002	0.012	-0.253	-0.223**
Node number to first female flower	0.008	0.003	0.000	-0.008	-0.008	-0.004	0.002	0.004	0.000	-0.003	-0.001	0.062	0.034	0.106
Days to first fruit harvest	0.034	0.026	0.000	-0.001	-0.111	-0.005	-0.009	0.019	-0.002	-0.005	-0.003	-0.066	-0.430	-0.542**
Number of primary branches per plant	-0.016	-0.010	0.000	0.002	0.035	0.016	0.014	-0.017	0.001	0.005	0.003	-0.102	0.373	0.329**
Equatorial circumference of fruit (cm)	-0.014	-0.008	0.000	-0.001	0.028	0.007	0.035	-0.028	0.001	-0.001	0.008	0.023	0.240	0.289**
Polar circumference of fruit (cm)	-0.017	-0.011	0.000	0.001	0.044	0.006	0.021	-0.047	0.001	-0.001	0.003	0.009	0.203	0.215**
Flesh thickness(cm)	-0.012	-0.011	0.000	0.000	0.040	0.005	0.007	-0.008	0.005	0.005	0.003	-0.046	0.208	0.246**
Internodal length (cm)	0.010	0.009	0.000	-0.001	-0.036	-0.005	0.002	-0.002	-0.001	-0.017	0.000	-0.033	-0.338	-0.392**
Vine length (m)	-0.007	0.000	0.000	0.000	0.015	0.002	0.012	-0.005	0.001	0.000	0.024	0.165	0.138	0.351**
Average fruit weight (kg)	-0.004	-0.001	0.000	-0.001	0.017	-0.004	0.002	-0.001	-0.001	0.001	0.009	0.423	0.002	0.415**
No. of fruits per plant	-0.022	-0.016	0.000	0.000	0.058	0.007	0.010	-0.012	0.001	0.007	0.004	0.001	0.823	0.879**

\*, \*\* Significant at 5 percent and 1 percent probability levels, respectively.

**Table 16:** Estimates of direct and indirect effects of different growth and yield traits on fruit yield per plant of pumpkin at genotypic level over environments (pooled)

Traits	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Days to first fruit harvest	Number of primary branches per plant	Equatorial circumference of fruit (cm)	Polar circumference of fruit(cm)	Flesh thickness (cm)	Internodal length (cm)	Vine length (m)	Average fruit weight (kg)	No. of fruits per plant	Correlation with fruit yield per plant (kg)
Days to first male flower anthesis	0.550	-0.084	0.009	-0.006	-0.320	-0.019	-0.031	0.086	0.027	-0.048	-0.013	-0.040	-0.661	-0.167
Days to first female flower anthesis	0.524	-0.088	0.008	-0.003	-0.320	-0.018	-0.029	0.079	0.028	-0.045	-0.009	-0.012	-0.664	-0.115
Node number to first male flower	0.376	-0.054	0.014	-0.012	-0.204	-0.020	-0.030	0.091	0.015	-0.040	-0.006	0.011	-0.399	0.106
Node number to first female flower	0.111	-0.009	0.006	-0.028	-0.037	-0.011	0.000	0.050	0.005	-0.024	-0.002	0.052	0.032	-0.049
Days to first fruit harvest	0.519	-0.083	0.008	-0.003	-0.339	-0.015	-0.023	0.080	0.027	-0.057	-0.010	-0.062	-0.640	-0.120
Number of primary branches per plant	-0.405	0.064	-0.011	0.012	0.197	0.026	0.031	-0.102	-0.019	0.032	0.003	-0.098	0.500	0.106
Equatorial circumference of fruit (cm)	-0.315	0.047	-0.008	0.000	0.145	0.015	0.054	-0.118	-0.024	0.008	0.011	0.015	0.338	0.282
Polar circumference of fruit (cm)	-0.306	0.045	-0.008	0.009	0.177	0.017	0.041	-0.154	-0.020	0.032	0.009	-0.009	0.352	0.352
Flesh thickness(cm)	-0.392	0.064	-0.005	0.004	0.239	0.013	0.033	-0.081	-0.038	0.035	0.003	-0.060	0.418	-0.067
Internodal length (cm)	0.268	-0.040	0.006	-0.007	-0.196	-0.008	-0.004	0.049	0.014	-0.099	-0.003	-0.051	-0.434	-0.298
Vine length (m)	-0.306	0.032	-0.003	0.003	0.145	0.003	0.026	-0.056	-0.005	0.014	0.023	0.192	0.210	0.428
Average fruit weight (kg)	-0.068	0.003	0.001	-0.005	0.066	-0.008	0.003	0.004	0.007	0.016	0.014	0.320	0.013	0.461
No. of fruits per plant	-0.410	0.066	-0.006	-0.001	0.245	0.014	0.020	-0.061	-0.018	0.048	0.006	0.005	0.888	0.009

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