ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

A study on Character association and Path analysis in Pumpkin (*Cucurbita moschata* Duch. ex Poir.)

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Manuscript Info

Manuscript History:

Received: 15 November 2014
Final Accepted: 22 December 2014
Published Online: January 2015

Key words:

Pumpkin, correlation, path analysis, fruit yield

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Abstract

The present study was carried out on the Vegetable Research Station, Department of Horticulture, Allahabad Agriculture University, Allahabad during *kharif* season 2013-14. Correlation co-efficient between yields per plant had significant positive correlation with days to first female flower, average fruit weight, fruit length, seed cavity length, placenta weight, number of fruits per vine. But correlation between fruit yield and days to first fruit harvest were significantly negative. Path coefficient analysis revealed that the maximum direct contribution towards yield was obtained through fruit weight, fruit length, days to first female flower, no of fruits per vine showed high direct effect on fruit yield. Negative direct effect on yield was days to first male flower appearance, fruit diameter.

INTRODUCTION

Pumpkin (*Cucurbita moschata*) belongs to the family Cucurbitaceae having chromosome number 2n= 40. There are 27 species under the genus Cucurbita, five of which are in cultivation. These are *C. moschata*, *C. maxima*, *C. ficifolia, C. pepo and C. mixta,* commonly known as Pumpkin. *C. moschata* is probably the most widely grown species of Cucurbita and this species is cross compatible with *C. maxima, C.pepo and C. mixta* (Tindall, 1987). Pumpkin is relatively high in energy and carbohydrates and a good source of vitamins, especially high carotenoid pigments and minerals (Bose and Som, 1998). The nutrient per 100g edible portions of fruit is 90 ml water, 8 g carbohydrate, 1g protein, 0.5g fibers, 20 mg calcium, 0.8 mg iron, 210 mg beta-carotene, 0.05 mg thiamine, 0.05 mg riboflavin, 0.5 mg niacin and 15 mg ascorbic acid (Tindall, 1987). It may contribute to improve the nutritional status of the people, particularly the vulnerable groups in respect of vitamin A requirement. In India, the area under cultivation of pumpkin is 0.36 million ha, with a total production of 3.50 mt/annum, productivity is about 9.72 t/ha (NHB, 2013). Though a fairly common crop, to-date there is no released variety of pumpkin with high yield potential and good quality in India. For this, inbreed line should be developed through selfing and selection in local and exotic germplasm. There are number of local cultivars with wide range of variability in size, shape and color of fruits available in India that can be exploited for its improvement and by this we can easily fulfill the gap by developing high yielding hybrid varieties. Besides, information on quality aspects of fruits is very scanty in India. So it is the demand to a breeder to develop high yielding with high quality varieties through selection, either from the existing genotypes or from the segregates of a cross. Information on variability, character association and path coefficient analysis in respect of yield, its contributing characters and quality aspects required to be properly assessed for its improvement. Therefore, the present study was undertaken to estimate the genetic variation, the correlation coefficients and path-coefficient and to screen out the suitable parental groups with better performances for future breeding programme in the twenty five genotypes of pumpkin.

Materials and methods

Twenty five genotypes were taken into account while carrying out the present study. The experiment was conducted at Vegetable Research Station, Department of Horticulture, Allahabad Agriculture University, Allahabad during *kharif* season 2013-14. All the genotypes were sown in Randomized Block Design with three replications. All recommended packages and practices of the university were followed to raise healthy crop. Observations on morphological and fruit yield were recorded. Both genotypic and phenotypic co-efficients of correlation between two characters were determined by using the variance and co-variance components as suggested by Al-Jibouri *et al.,* (1958). Path coefficient analysis was carried out using genotypic correlation values of yield components on yield as illustrated by Dewey and Lu (1959).

Results and discussion

Mean square obtained from analysis of variance (ANOVA) for yield and quality traits are presented in Table 1. It revealed from mean square values that there were significant differences among the accessions for all the characters. The genotypic and phenotypic correlation coefficients were worked out among thirteen characters (Table 2). The values of genotypic correlation coefficients were greater than the values of phenotypic correlation coefficients for most of the characters, which indicated thereby a strong inheritant association between various traits that were quite influenced by the environment. Yield, the most important economic trait, exhibited positive and significant association with fruit length (0.4150), average fruit weight (0.3353) and seed cavity length (0.4150), number of fruits per vine (0.2953) and placenta weight (0.2398). Negative and significant association with days to first fruit harvest (-0.2867), indicating the importance of these traits in selection of yield. Direct selection based on these traits would result in simultaneous improvement of aforesaid traits and yield per se pumpkin.

Days to first female flower significant negative with fruit diameter (-0.2416), placenta weight (-0.3075), days to first fruit harvest (-0.6646), number of fruits per vine (-0.3119), number of primary branches per vine (-0.2582). Average fruit weight positive significant with fruit length (0.4561), seed cavity length (0.3773), seed cavity width (0.2365) and negative significant with number of fruits per vine (-0.2466). Fruit length is positively correlated with seed cavity length (0.4896), placenta weight (0.3356) and significantly negative correlation with flesh thickness (-0.2632). Fruit diameter had significant positive correlation with seed cavity length (0.4172), flesh thickness (0.2557), placenta weight (0.4233) and negative with days to first fruit harvest (-0.2491). Seed cavity length significantly positive with placenta weight (0.5192) and negative with flesh thickness (-0.2589). Seed cavity width significantlynegative with days to first fruit harvest (-0.3135). Flesh thickness significant negative with placenta weight (-0.2620). Days to first fruit harvest significant negative with no of fruits per vine (-0.2454). Number of fruits significantly positive with number of primary branches per vine (0.3267). Specifying their consideration during selection for high yield and for remaining character combinations the correlations were found non-significant similar results reported by Pandey *et al.*, 2003, 2008.

Table-1: Analysis of variance for yield and yield attributes in Pumpkin

Character	Mean sum of squares		
	Replications (2)	Genotypes (24)	Error (48)
Days to 1st male flower appearance	3.1152	2.7257*	1.3908
Days to 1st female flower appearance	3.0857	14.0518**	2.6594
Average fruit weight (Kg)	0.0356	0.1760**	0.0714
Fruit length (cm)	2.3689	1.8904**	0.4125
Fruit Diameter (cm)	1.4849	10.7380**	0.7746
Seed cavity length (cm)	0.2884	3.4787**	0.9124
Seed Cavity width (cm)	1.3178	1.7478**	0.4604
Flesh Thickness (cm)	0.6188	0.5271*	0.2649
Placenta weight (gm)	271.9372	15206.4522**	295.0503
Days to first fruit harvest	28.0017	72.3741**	5.0872
Fruits/ vine	0.2575	0.2077**	0.0399
Primary branches/ vine	0.0080	0.1471**	0.0236
Yield/ vine(Kg)	4.4485	5.7104**	0.6588
*, ** significant at 5 and 1% level respectively			

Table-2: Phenotypic (P), Genotypic (G) Correlation coefficient among thirteen characters of Pumpkin.

Characters		Days to first male flower	Days to first female flower	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Seed cavity length (cm)	Seed cavity width (cm)	Flesh thickness (cm)	Placenta weight per fruit (g)	Days to first fruit harvest	Number of fruits per vine	Number of primary branches per vine	Yield per Vine (kg)
Days to first male flower	**P**	-	0.1549	0.1206	0.1088	-0.1231	-0.0480	0.0101	0.1071	0.0021	0.2271	-0.2278*	-0.0202	-0.0087
	G	-	0.6456	0.4139	-0.0650	-0.1414	-0.2521	0.2575	-0.2032	0.0114	0.5291	-0.7546	-0.2139	-0.1559
Days to first female flower	**P**		-	-0.0415	-0.1578	-0.2416*	-0.2310*	-0.1922	0.0592	-0.3075**	0.6646**	-0.3119**	-0.2582**	0.3318**
	G		-	-0.3248	-0.3912	-0.3281	-0.2910	-0.6002	0.3620	-0.3975	0.8265	-0.4486	-0.2656	0.5073
Average Fruit weight (g)	**P**			-	0.4561**	0.1693	0.3773**	0.2365*	-0.0469	0.1475	-0.0921	-0.2446*	0.0902	0.3353**
	G			-	0.9751	0.2677	0.6531	0.3341	-0.8652	0.2762	-0.1292	-0.5313	0.2378	0.4587
Fruit length (cm)	**P**				-	0.2008	0.4896**	0.1483	-0.2632*	0.3350**	-0.0687	-0.1444	0.0636	0.4150**
	G				-	0.4412	0.8561	0.3618	-0.7448	0.4602	-0.2022	-0.1589	0.0217	0.4682
Fruit diameter (cm)	**P**					-	0.4172**	-0.0949	0.2557*	0.4233**	-0.2491*	-0.0310	-0.0712	0.1223
	G					-	0.5791	-0.2052	0.3676	0.4753	-0.2836	-0.0775	-0.0143	0.1927
Seed cavity length (cm)	**P**						-	0.0068	-0.2589*	0.5192**	-0.1029	-0.0623	-0.0669	0.2993**
	G						-	0.0598	-0.8830	0.7634	-0.1876	-0.1409	0.0011	0.4271
Seed cavity width (cm)	**P**							-	-0.1708	0.0695	-0.3135**	-0.0458	0.0842	0.1767
	G							-	-0.7325	0.0625	-0.5036	0.0962	0.1321	0.2633
Flesh thickness (cm)	**P**								-	-0.2620*	-0.0584	0.0619	-0.0297	-0.0527
	G								-	-0.5386	0.0536	-0.0497	-0.0206	-0.4798
Placenta weight per fruit (g)	**P**									-	-0.1017	0.1099	0.0111	0.2398*
	G									-	-0.1134	0.1912	0.0398	0.2453
Days to first fruit harvest	**P**										-	-0.2454*	-0.1850	-0.2867*
	G										-	-0.3764	-0.2209	-0.3821
Number of fruits per vine	**P**											-	0.3267**	0.2953*
	G											-	0.5875	0.3537
Number of primary branches per vine	**P**												-	0.2047
	G												-	0.3507
*, ** significant at 5 and 1% level respectively														

Table-3: Direct (diagonal) and indirect phenotypic path co efficient values of different characters on seed yield in Pumpkin.

Characters		Days to first male flower	Days to first female flower	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Seed cavity length (cm)	Seed cavity width (cm)	Flesh thickness (cm)	Placenta weight per fruit (g)	Days to first fruit harvest	Number of fruits per vine	Number of primary branches per vine	Phenotypic correlation coefficient with Yield per Vine (kg)
Days to first male flower	**P**	**-0.0496**	0.0077	0.0060	0.0054	-0.0061	-0.0024	0.0005	0.0053	0.0001	0.0113	-0.0113	-0.0010	-0.0087
Days to first female flower	**P**	-0.0232	**0.1497**	0.0062	0.0236	0.0362	0.0346	0.0288	-0.0089	0.0460	-0.0995	0.0467	0.0387	-0.3318**
Fruit weight (g)	**P**	0.0243	-0.0084	**0.2017**	0.0920	0.0341	0.0761	0.0477	-0.0095	0.0297	-0.0186	-0.0493	0.0182	0.3353**
Fruit length (cm)	**P**	0.0319	-0.0463	0.1338	**0.2932**	0.0589	0.1436	0.0435	-0.0772	0.0982	-0.0201	-0.0423	0.0186	0.4150** *
Fruit diameter (cm)	**P**	0.0203	0.0399	-0.0280	-0.0332	**-0.1653**	-0.0689	0.0157	-0.0423	-0.0700	0.0412	0.0051	0.0118	0.1223
Seed cavity length (cm)	**P**	-0.0019	-0.0092	0.0150	0.0194	0.0165	**0.0396**	0.0003	-0.0103	0.0206	-0.0041	-0.0025	-0.0027	0.2993**
Seed cavity width (cm)	**P**	0.0001	-0.0023	0.0029	0.0018	-0.0011	0.0001	**0.0121**	-0.0021	0.0008	-0.0038	-0.0006	0.0010	0.1767
Flesh thickness (cm)	**P**	0.0046	0.0025	-0.0020	-0.0112	0.0109	-0.0110	-0.0073	**0.0426**	-0.0112	-0.0025	0.0026	-0.0013	-0.0527
Placenta weight per fruit (g)	**P**	0.0003	-0.0501	0.0240	0.0546	0.0690	0.0846	0.0113	-0.0427	**0.1629**	-0.0166	0.0179	0.0018	0.2398*
Days to first fruit harvest	**P**	0.0140	0.0410	-0.0057	-0.0042	-0.0154	-0.0064	-0.0194	-0.0036	-0.0063	**0.0618**	-0.0152	-0.0114	-0.2867*
Number of fruits per vine	**P**	-0.0964	-0.1320	-0.1035	-0.0611	-0.0131	-0.0264	-0.0194	0.0262	0.0465	-0.1039	**0.4233**	0.1383	0.2953*
Number of primary branches per vine	**P**	-0.0002	-0.0024	0.0009	0.0006	-0.0007	-0.0006	0.0008	-0.0003	0.0001	-0.0018	0.0031	**0.0095**	0.2047
Residual effect = 0.0730**;** *, ** significant at 5 and 1% level respectively														

Path analysis helps in understanding the magnitude of direct and in direct contribution of each character on the dependent character i.e.yield .The results presented in the Table.3 revealed that fruit length, fruit weight, seed cavity length, vine length showed maximum direct effect on the yield at genotypic level indicating that these are the main contributor. This indicated that direct selectionbased on these characters results in an appreciable improvement in yield (Kumaran *et al.*, 1998 and Pandey *et al.*, 2002, 2003, 2008). In the light of above findings it may be concluded that improvement of fruit weight, fruit length, days to first female flower, number of fruits per vine will help in improving the yield in pumpkin both directly and in directly. Therefore these characters would be useful in improvement of pumpkin through selection as well as hybridization.

References

1. Al-Jibouri, H. A., Miller, P. A. and Robinson, H. F. (1958): Genetic and environmental variances and covariance in upland cotton cross of interspecific origin. *Agronomy Journal*. **50**: 633-37.
2. Anonymous (2013) Indian horticulture production at a glance. Indian Horticulture Database-2013. National Horticulture Board, Ministry of Agriculture, Government of India, 2012, http:nhb.gov.in/area%20_production.html.
3. Bose, T. K. and M. G. Som. (1998) .Vegetable crops in India. NayaProkash, Calcutta, India. pp. 92-95.
4. Dewey, D. K. and K. H. Lu. (1952). A correlation and path coefficient analysis of components of crested wheat grass and production. *Agronomy Journal*. **51**, 515-518.
5. Kumaran SS, Natarajan SS, Thamburaj S (1998). Correlation path analysis studies in pumpkin (*Cucurbita moschata* Duch. ex Poir.). South Indian Horticulture. **46** (3-6):138-142.
6. Lush, J. L. (1949). The characters studied in the path analysis. Press, Ames, Iowa. pp: 437.
7. Pandey, S., Kumar, S., Chowdary, B.R., Yadav, D. S., and Rai, M. M. (2008). Component analysis in pumpkin (*Cucurbita moschata* Duch. ex Poir.). Vegetable Science. **35** (1):35-37.
8. Pandey, S., Singh, J., Upadhya, A. K. Ram, D.and Rai, M. (2003).Ascorbate and carotenoid in Indian collection of pumpkin (*Cucurbita moschata* Duch. ex Poir.). Vegetable Science. **30** (1):64-67.
9. Pandey, S., Singh, J., Upadhya, A. K. and Ram, D. (2002). Genetic variability for antioxidants and yield components in pumpkin (*Cucurbita moschata* Duch. ex Poir.). Vegetable Science. **29** (2): 123-126.
10. Tindall, H. D. 1987. Vegetables in the Tropics. Macmillan Education, London. P.166.