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Original Research Article

Correlation and Path Coefficient Analysis in *Kharif* Onion (*Aillum cepa* L.) Genotypes for Chhattisgarh Plains

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A B S T R A C T

The present study have conducted at Indira Gandhi Krishi Vishwavidyalaya, Raipur during *Kharif* 2016-17 under All India Network Research project on Onion and Garlic at Horticulture Instructional cum Research Farm, Department of Vegetable Science, with thirty seven genotypes of onion along with a check. To determine correlation and path coefficient analysis for fourteen contributing characters during the 2016-17. Correlation coefficient analysis revealed that total bulb yield had positive significant correlation with number of leaves per plant, leaf length (cm), polar diameter (cm), plant establishment (%), TSS (%), average weight of marketable bulb (g). Path coefficient analysis revealed that number of leaves per plant, leaf length (cm), leaf thickness (cm), pseudostem thickness (cm), polar and equatorial diameter (cm), neck length (cm), bolting (%), bulbfresh weight (kg/plot) exhibited positive direct effect on total bulb yield and could be utilized as selection criteria in onion improvement programme for Chhattisgarh plains condition.

Keywords

Kharif onion, Correlation, Path coefficient analysis.

Introduction

The onion (*Allium cepa* L.) is one of the most important vegetable crops grown throughout the world and is said to be native of Central Asia and Mediterranean region (McCollum, 1976). It is a monocot and belongs to the family *Alliaceae*, sub-family *Allioideae*, and order Asparagales having chromosome number 2n (2x) = 16. Onion is bulbous biennial or perennial herb which gives off a distinctive and pungent odour when the tissues are crushed. The characteristics of onion smell and taste are important diagnostic features of the genus *Allium.* Onion contains an enzyme known as 'Allinase'. The pungency in onion is due to volatile oil as *Allyl-propyl disulphide* ($C_6H_{12}S_2$). The colour of the outer skin of onion bulbs is due to quercetin. Anti-fungal factor in onion is phenolics compound known as 'catechol'. Tear inducing action in onion by lachymator factor *i.e.* 1-Propenyl sulfonic acid.

Onion is the one of the vegetable, which earn foreign exchange through export. India is the second largest producer of onion in the world occupying 1180.63 thousand ha area with a production and productivity of 18923.98 thousand tonne and 16.03 tonne/ ha, respectively (Anon, 2016). Maharashtra is leading one producing state whereas productivity is highest in Gujarat (Anon, 2016). In Chhattisgarh, area under onion is 20.06 thousand ha with production of 308.10

thousand tonne and productivity 15.36 tonne/ ha (Anon, 2016). In Chhattisgarh onion is mainly cultivated during rabi season, however with the appropriate cultivation technology *kharif* onion can also be cultivated, but the main limitation for *kharif* cultivation is less availabilities of *kharif* onion variety.

Onion is a very good source of vitamin C, B6, biotin, chromium, vanadium, calcium and dietary fibre. In addition, it contain a good amount of folic acid and vitamin B1 and K.

Onion bulb contains 86.6 gm moisture and food value per 100 gm of edible portion is protein (1.2 gm), fat (0.1 gm), mineral matter (0.4 gm), fibre (0.6 gm), carbohydrate (11.1 gm), calories (50 Kcal), phosphorus (50 mg), potassium (127 mg), calcium (46.9 mg), magnesium (16 mg), iron (0.6 mg), sodium (4 mg), copper (0.18 mg), vitamin C (119 mg), niacin (0.4 mg), thiamine (0.08 mg), riboflavin (0.01 mg), folic acid free (15 mg) (Anon, 2010). Correlation coefficients were partitioned into direct and indirect effects and their contribution towards bulb yield was studied.

Path coefficient analysis is the partitioning of total correlation into direct and indirect percentage contribution of various yield components to the final bulb yield in onion. The advantage of path-coefficient analysis is that it permits the partitioning of the correlation co-efficient into its components.

In agriculture, path analysis has been used by plant breeders to assist in identifying traits that are useful as selection criteria to improve crop yield. In this study, attempt was made to study the direct and indirect influences of some important yield components among themselves and to yield through path analysis.

Materials and Methods

The present investigation was carried out during the year 2016-17 in *kharif* season under All India Network Research project on Onion and Garlic at Horticulture Instructional cum Research Farm, Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The *Kharif* crop was transplanted in last week of August at a spacing of 15 x 10cm. The plot size was 2.25 x 2.0 m^2. The correlation coefficient were determined according to Millar *et al.*, (1958) and the path coefficient were calculated as suggested by Dewey and Lu (1959).Ten plants were taken at random in each plot to record the observation on Plant height (cm), Number of leaves per plant, Leaf length (cm), Leaf thickness (cm), Pseudostem thickness (cm), Equatorial diameter (cm), Polar diameter (cm), Neck length (cm), Plant establishment (%), Bolting (%), TSS (%), Bulb fresh weight (kg/plot), Average weight of marketable bulb (g) and Total bulb yield (q/ha).

Results and Discussion

The analysis of variance (Table 1) of onion genotypes for bulb yield and its contributing characters indicated that the mean sum of square due to genotypes were significant for all the traits viz., Plant height (cm), Number of leaves per plant, Leaf length (cm), Leaf thickness (cm), Pseudostem thickness (cm), Equatorial diameter (cm), Polar diameter (cm), Neck length (cm), Plant establishment (%), Bolting (%), TSS (%), Bulb fresh weight (kg /plot), Average weight of marketable bulb (g) and Total bulb yield (q/ha).

Analysis of variance indicated that the mean sum of square due to genotypes were significant for all the traits indicated the

presence of significant variation for most of the characters which are useful for onion improvement Mohanty and Prusti (2001), Golani *et al.,* (2006) and Khar *et al.,* (2007) also reported the similar results in onion.

Correlation coefficient analysis is a statistical measure which is used to find out the degree and direction of relationship between two or more variables. Association among different yield attributing characters with bulb yield was calculated in all possible phenotypic (P) and genotypic (G) which is presented in Table 2. Character wise results of the correlation study are explained at both phenotypic and genotypic levels.

The total bulb yield showed highly significant positive correlation with average weight of marketable bulb (0.564 and 0.281) at genotypic and phenotypic level respectively. TSS (%) showed highly significant positive correlation at genotypic level (0.248) and significant positive correlation (0.131), number of leaves per plant (0.108 and 0.106) and leaf length (0.149 and 0.078) showed significant positive correlation at genotypic and phenotypic level.

Plant establishment (%) showed significant positive correlation at phenotypic level (0.199). Bulb fresh weight (0.006) and polar diameter (0.208) showed significant positive correlation at genotypic level.

The total bulb yield showed highly significant negative correlation with neck length (-0.573 and -0.236), Bolting (%) (-0.527 and -0.264), leaf thickness (-0.416 and -0.245) at genotypic and phenotypic level respectively. However, total bulb yield showed significant negative correlation with pseudostem thickness (-0.089 and -0.081) and plant height (-0.063 and -0.033) at genotypic and phenotypic level and bulb fresh weight (-0.008) and equatorial diameter (-0.167) showed significant negative correlation at phenotypic level respectively.

Total bulb yield had positive and significant correlation with number of leaves per plant at phenotypic levels, similar finding was reported by Singh *et al.,* (2010), Mahanthesh *et al.,* (2008), Aliyu *et al.,* (2007), Gurjar and Singhania (2006), Trivedi *et al.,* (2006), Mohanty (2002), Rajalingam and Haripriya (2001), Singh (2001), Sindhu *et al.,* (1986) and Pandian *et al.,* (1982).

The path coefficient analysis which splits total correlation coefficient of different characters into direct and indirect effects on total bulb yield per plant in such a manner that the sum of direct and indirect effects is equal to total genotypic correlation as presented in Table 3. The phenotypic correlation coefficient of bulb yield and its components were broken down into direct and indirect effect and taking total bulb yield per hectare as depended variables and rest of the characters were taken as in depended variables. Direct and indirect effects of bulb yield contributing characters in onion are presented in Table 3.

The data revealed that bulb fresh weight (0.340) had the highest direct positive effect on total bulb yield. In addition to this leaf length (0.320), pseudostem thickness (0.300), and number of leaves per plant (0.210) contributed low direct positive effect on bulb yield. Neck length (0.070), equatorial diameter (0.050), polar diameter and Bolting (%) (0.040), leaf thickness (0.010) contributed negligible direct positive effect on bulb yield. In contrary to this, Plant establishment (%) (-0.380), plant height (-0.070), average weight of marketable bulbs (-0.030) and TSS (%) (-0.020) showed negligible negative direct effect on bulb yield.

Table.1 Analysis of variance for bulb yield and its component in onion genotypes

S. No.	Characters	Mean sums of square		
		Replication	**Treatment**	**Error**
	Degree of freedom	**2**	**37**	**74**
01.	Plant height (cm)	84.533	35.098**	26.90
02.	Number of leaves per plant	0.258	3.794**	1.165
03.	Leaf length (cm)	6.006	40.235**	20.479
04.	Leaf thickness (cm)	0.036	0.123**	0.028
05.	Pseudostem thickness (cm)	0.621	0.669**	0.256
06.	Equatorial diameter (cm)	0.009	0.236**	0.158
07.	Polar diameter (cm)	0.088	1.093**	0.121
08.	Neck length (cm)	0.083	6.589**	0.872
09.	Plant Establishment (%)	211.67	293.895**	47.538
10.	Bolting (%)	0.990	13.886**	0.273
11.	TSS (%)	1.276	1.604**	0.538
12.	Bulb fresh weight (kg/ plot)	16.655	138.281**	4.188
13.	Average weight of marketable bulb (g)	2485.04	4793.34**	336.58
14.	Total bulb yield (q/ha)	4532.47	14003.41**	1572.43

Table.2 Genotypic and phenotypic correlation coefficient of bulb yield and its component in onion

Character		01 Plant height (cm)	02 No. of leaves per plant	03 Leaf length (cm)	04 Leaf thickness (cm)	05 Pseudostem thickness (cm)	06 Equatorial diameter (cm)	07 Polar diameter (cm)	08 Neck length (cm)	09 Plant establishment (%)	10 Bolting (%)	11 TSS (%)	12 Bulb fresh weight (kg /plot)	13 Average weight of marketable (g)	14 Total bulb yield (q/ha)
1.	G	1.000	1.036**	0.087	0.627**	0.122	0.327**	0.393**	0.205*	0.378**	-0.798**	0.141	-0.103	0.808**	-0.063
	P	1.000	0.300**	0.089	0.189*	0.155	0.073	0.178	0.170	0.306**	-0.538**	0.114	-0.008	0.684**	-0.033
2.	G		1.000	-0.001	0.178	-0.242**	0.115	0.187*	-0.566**	-0.004	0.083	0.174	-0.157	-0.067	0.108
	P		1.000	0.060	0.155	-0.016	0.110	0.088	-0.070	0.004	0.061	0.082	-0.125	-0.104	0.106
3.	G			1.000	1.129**	0.327**	0.587**	0.386**	0.032	0.140	0.353**	0.486**	-0.594**	0.106	0.149
	P			1.000	0.340**	0.203*	0.284**	0.279**	0.004	0.046	0.269**	0.418**	-0.449**	0.099	0.078
4.	G				1.000	0.453**	0.482**	0.364**	0.607**	-0.624**	0.314**	-0.076	0.047	0.359**	-0.416**
	P				1.000	0.130	0.326**	-0.028	0.197*	-0.394**	0.054	-0.118	0.106	0.104	-0.245**
5.	G					1.000	0.034	-0.352**	0.116	-0.106	0.185*	-0.001	0.103	0.057	-0.089
	P					1.000	0.007	-0.177	0.072	-0.108	0.098	0.007	0.097	0.064	-0.081
6.	G						1.000	-0.042	0.346**	-0.416**	-0.013	-0.411**	-0.022	-0.106	-0.268**
	P						1.000	-0.103	0.135	-0.102	-0.052	-0.137	-0.019	0.016	-0.167
7.	G							1.000	0.362**	0.275**	0.225*	0.325**	-0.155	-0.501**	0.208*
	P							1.000	0.117	0.207*	0.127	0.207*	-0.070	-0.147	0.132
8.	G								1.000	0.479**	0.361**	0.106	0.235*	-0.225*	-0.573**
	P								1.000	0.029	0.156	0.085	0.119	-0.030	-0.236*
9.	G									1.000	1.356**	0.069	1.214**	-0.017	0.093
	P									1.000	0.233*	-0.067	0.259**	-0.090	0.199*
10.	G										1.000	0.395**	-0.265**	-0.174	-0.527**
	P										1.000	0.059	-0.302**	0.071	-0.264**
11.	G											1.000	0.487**	0.386**	0.248**
	P											1.000	0.152	0.159	0.131
12.	G												1.000	1.144**	0.006
	P												1.000	0.205*	-0.008
13.	G													1.000	0.564**
	P													1.000	0.281**
14.	G														1.000
	P														1.000

Table.3 Path coefficient for total bulb yield- contributing characters of onion

Character	01 Plant height (cm)	02 No. of leaves per plant	03 Leaf length (cm)	04 Leaf thickness (cm)	05 Pseudostem thickness (cm)	06 Equatorial diameter (cm)	07 Polar diameter (cm)	08 Neck length (cm)	09 Plant establishment (%)	10 Bolting (%)	11 TSS (%)	12 Bulb fresh weight (kg/ plot)	13 Average weight of marketable bulb (g)
Plant height (cm)	**-0.070**	0.120	0.360	0.000	0.120	0.060	0.020	0.020	0.020	0.000	-0.010	0.380	0.000
Number of leaves per plant	-0.040	**0.210**	0.000	0.000	-0.080	0.000	0.010	0.020	-0.130	-0.010	-0.010	0.110	0.000
Leaf length (cm)	-0.080	0.000	**0.320**	0.000	-0.050	0.060	0.000	0.010	0.160	0.000	-0.010	0.200	0.010
Leaf thickness (cm)	-0.030	0.080	0.080	**0.010**	-0.160	0.000	0.010	0.020	0.000	0.000	-0.010	0.130	0.000
Pseudostem thickness (cm)	-0.030	-0.060	-0.060	0.000	**0.300**	0.000	-0.010	-0.010	0.160	0.010	0.020	0.010	0.000
Equatorial diameter (cm)	-0.090	0.010	0.390	0.000	0.030	**0.050**	-0.020	-0.030	0.010	0.000	-0.010	0.050	0.020
Polar diameter (cm)	-0.030	0.080	0.030	0.000	-0.070	-0.030	**0.040**	0.010	0.040	0.000	0.000	0.120	0.000
Neck length (cm)	-0.020	0.060	0.070	0.000	-0.050	-0.020	0.010	**0.070**	0.100	0.000	0.000	0.160	0.000
Plant establishment (%)	0.000	0.070	-0.130	0.000	-0.120	0.000	0.000	-0.020	**-0.380**	0.000	-0.010	-0.200	0.000
Bolting (%)	0.000	-0.070	0.040	0.000	0.060	0.000	0.000	0.000	0.030	**0.040**	0.010	0.040	0.000
TSS (%)	-0.030	0.100	0.120	0.000	-0.190	0.010	0.000	0.000	-0.140	-0.010	**-0.020**	0.050	0.000
Bulb fresh weight (kg/ plot)	-0.070	0.070	0.190	0.000	0.010	0.010	0.010	0.030	0.220	0.000	0.000	**0.340**	0.000
Average weight of marketable bulb (g)	0.000	0.040	-0.080	0.000	0.060	-0.030	0.000	0.010	-0.070	-0.010	0.000	0.040	**-0.030**

Residual = 0.11519

The path analysis would help to identify those important components of bulb yield by establishing the cause and effect relationship among yield and its contributing characters.

The result in Table 3 which revealed that number of leaves per plant and bulb diameter had positive direct effect on bulb yield, similar finding was reported by Aliyu *et al.*, (2007), Gurjar and Singhania (2006) and Mohanty (2002). While, Pandian *et al.*, (1982) reported number of leaves per plant. On the other hand Rajalingam and Haripriya (2001) also reported that the leaf thickness had shown direct positive effect on bulb yield.

Correlation coefficient analysis revealed that total bulb yield had positive significant correlation with number of leaves per plant, leaf length (cm), polar diameter (cm), plant establishment (%), TSS (%), average weight of marketable bulb (g). Path coefficient analysis revealed that number of leaves per plant, leaf length (cm), leaf thickness (cm), pseudostem thickness (cm), polar and equatorial diameter (cm), neck length (cm), bolting (%), bulb fresh weight (kg/plot) exhibited positive direct effect on total bulb yield and could be utilized as selection criteria in onion improvement programme for Chhattisgarh plains condition.

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