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Correlation and Path Analysis in Rabi Onion (*Allium cepa* L.) Genotypes

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ABSTRACT: The experiment was carried out at instructional farm of vegetable science, Department of vegetable science, Dr. PDKV, Akola during rabi season of (2018-19), with 19 genotypes along with a 3 check of onion. To determine correlation and path coefficient analysis for 10 contributing characters. Genotypic and Phenotypic correlation coefficient analysis revealed that yield per hectare had positive significant correlation with number of leaves, plant height, leaf length, leaf area, neck thickness, bulb diameter, bulb weight, yield per plot and total soluble solid except phenotypic correlation coefficient of neck thickness was positive but non-significant. Path analysis revealed positive direct effect on yield per hectare through number of leaves (0.53284), leaf length (0.24280), leaf area (0.34598), yield per hectare (1.48320). Hence, these characters may be given consideration while formulating selection indices for the improvement of onion.

Keywords: Correlation coefficient, Path analysis, Genotype, Rabi onion.

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important bulb crops cultivated all over the world on commercial scale both for local consumption and export. It belongs to family 'Alliaceae' and it has chromosome number 2n=2x=16. The pungency in onion is due to Sulphur-bearing compound in very small quantity (about 0.005%) in the volatile oil allyl propyl disulphide ($C_6H_{12}O_2$). Onion has got good medicinal value and therapeutic properties it is effective against common cold, diabetes, heart disease, osteoporosis and other diseases. Onion is known for antiplatelet aggregation, anti-rheumatic, diuretic and fibrinolytic effects as well as it lowers the blood sugar. India is the second largest producer of vegetables after China in the world. Total area, production and productivity of vegetable crops in India is 10.26 million ha, 184.40 MT and 17.97 MT/ha respectively. In the world, India ranks first in total area i.e. 1285 in '000 Ha and second in production i.e. 23262 '000MT for onion production after China (Anonymous, 2018). Indian onion is being exported to Malaysia, Singapore, Gulf Countries, Sri Lanka, Bangladesh, Pakistan and Nepal. To breed for higher yield and quality it is important to have desirable genotype collection.

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.

MATERIAL AND METHODS

The current study was carried out with 23 genotypes during the 2018–19 rabi season at the Instructional Farm, Department of Vegetable Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS). The topography of the area was uniform and fairly level. A medium black soil with a consistent texture and structure and excellent drainage was chosen for the field. Three replications were used in the randomised block design (RBD) trial. Each genotype was housed on a flatbed in a plot measuring 1.8 × 1.5 metres, with a space of 15 × 10 centimetres between each pair of rows and plants. Five plants were chosen at random from each plot, and observations were made on them for the following factors: number of leaves per plant, plant height (cm), leaf length (cm), leaf area (cm^2), neck thickness (cm), bulb diameter (cm), bulb weight (g), TSS (^oBrix), yield per plot (kg), and yield per hectare (t). The 23 onion genotypes that made up the study's material i.e. AKON-1, AKON-2, AKON-3, AKON-4, AKON-5, AKON-6, AKON-7, AKON-8, AKON-9, AKON-10, AKON-11, AKON-12, AKON-13, AKON-14, MLO-1, MLO-1-1, MLO-2, MLO-4, MLO-4-1, Selection-1, Arka Kalyan, Arka Kirtiman, Akola Safed.

RESULT AND DISCUSSION

A. Correlation Coefficients Analysis

In order to find out the degree and direction of association between bulb yield contributing traits, genotypic and phenotypic correlation coefficient

estimate are presented in the Table 1. Correlation studies provide information on the nature and extent of association between only two pairs of metric characters. Character association of correlation is a measure of the degree of association between two characters. The phenotypic correlation indicated the extent of the observed relationship between two characters. This does not give true genetic picture of the relationship because it includes hereditary as well as environmental influences. Genotypic correlation provides as estimate of inherent association between genes controlling any two characters.

The present discussion is mostly concentrated on genotypic correlation because they provide an idea of association at genotypic level of inherent association between two traits and they help in carrying out reliable selection in situation where phenotypic and genotypic association is closer one.

In the present study yield per hectare is positively correlated to all the characters under study and correlation was found to be significant at genotypic (G) level for the characters *viz*., number of leaves per plant (0.853), plant height (0.953), leaf length (0.801), leaf area (0.687), neck thickness (0.270), bulb diameter (0.776), bulb weight (0.989), yield per plot (1.000) and total soluble solids (378). Also yield per hectare is positively correlated to all the characters under study and correlation was found to be significant at phenotypic (P) level for the characters *viz.*, number of leaves per plant (0.748), plant height (0.673), leaf length (0.598), leaf area (0.501), bulb diameter (0.713), bulb weight (0.822), yield per plot (0.987) and total soluble solids (0.340). Whereas yield per hectare was positively significantly and positively non-significantly correlated with neck thickness (0.072^{NS}). In genotypic Bulb yield per hectare had very high and positive significant correlation with yield per plot, followed by bulb weight, and low was found in neck thickness, similar was revealed by Pal *et al.* (1998).

The estimates of phenotypic and genotypic correlation coefficients revealed that the genotypic correlations were of higher magnitude than the corresponding phenotypes for all character combinations, there by establishing strong inherent relationship among the attributes studied, and the same was revealed by Rahman *et al.* (2002); Gurjar and Singhania *et al.* (2006); Ram *et al.* (2011).

B. Path coefficient analysis

The correlation coefficient indicated the relationship existing between pair of characters. But a dependent character is an interaction of product of many mutually association component characters and change in any one component will disturb whole network of cause and effect system. The path coefficient analysis, a statistical device developed by Wright (1921), which takes into account the cause and effect relationship between the variables which in unique in partitioning then association into direct and indirect effects through other dependent variables.

Yield per plot had positive maximum direct effect on yield per hectare followed by number of leaves per plant, leaf area and negative direct effect on yield per hectare maximum in TSS followed by neck thickness, bulb diameter. Number of leaves was maximum indirect effect is via bulb weight (0.51426) followed by bulb diameter (0.46720). Plant height was maximum indirect effect is via TSS (-0.32999) followed by neck thickness (-0.38942), Leaf length was maximum indirect effect is via plant height (0.24157) followed by leaf area (0.22064), Leaf area was maximum indirect effect is via neck thickness (0.47172) followed by TSS (0.37911), Neck thickness was maximum indirect effect is via yield per plot (0.05382) followed by bulb diameter (0.05735), bulb diameter was maximum indirect effect is via neck thickness (-0.07657) followed by TSS (-0.09125), bulb weight was maximum indirect effect is via neck thickness (-0.19121) followed by leaf area (-0.20482), yield per plot was maximum indirect effect is via bulb weight (1.47514) followed by plant height (1.43839), TSS was maximum indirect effect is via bulb diameter (-0.05812) followed by yield per plot (-0.06513). This was confirmed by the findings of Gurjar and Singhania (2006); Dhotre *et al.* (2010).

Table 1: Genotypic and phenotypic coefficient of ten quantitative traits in onion.

Character			No. of leaves	Plant height	Leaf length	Leaf area	Neck thickness	Bulb dia.	Bulb weight	Yield/plot	TSS	Yield/ha.
No. of leaves /plant	G	1	0.831**	0.760**	0.611**	0.386**	0.877**	0.965**	0.857**	0.460**	0.853**
	P	1	0.693**	0.618**	0.536**	0.081^{NS}	0.704**	0.745**	0.742**	0.349**	0.748**
Plant height (cm)	G		1	0.995**	0.826**	0.778**	0.875**	0.805**	0.970**	0.664**	0.953**
	P		1	0.831**	0.818**	0.069^{NS}	0.661**	0.660**	0.653**	0.375**	0.673**
Leaf length (cm)	G			1	0.909**	0.830**	0.763**	0.645**	0.805**	0.724**	0.801**
	P			1	0.855**	0.105^{NS}	0.659**	0.538**	0.593**	0.453**	0.598**
Leaf area (cm^2)	G				1	0.999**	0.548**	0.369**	0.692**	0.999**	0.687**
	P				1	0.190^{NS}	0.543**	0.531**	0.495**	0.565**	0.501**
Neck thick. (cm)	G					1	0.281*	0.344**	0.264*	0.824**	0.270*
	P					1	-0.066^{NS}	-0.180^{NS}	0.080^{NS}	0.632**	0.072^{NS}
Bulb dia. (cm)	G						1	0.740**	0.787**	0.335**	0.776**
	P						1	0.648**	0.696**	0.245*	0.713**
Bulb weight (g)	G							1	0.995**	0.391**	0.989**
	P							1	0.800**	0.239*	0.822**
Yield/plot (kg)	G								1	0.376**	1.000**
	P								1	0.343**	0.987**
TSS	G									1	0.378**
	P									1	0.340**
Yield/ha. (tan)	G										1
	P										1

* -significance at 5% (0.250) ** -significance at 1% (0.325)

Table 2: Direct and indirect effects of different characters on yield.

Character	No. of leaves	Plant height	Leaf length	Leaf area	Neck thickness	Bulb dia.	Bulb weight	Yield/plot	TSS	Yield/ha.
No. of leaves /plant	0.53284	-0.41310	0.18455	0.21126	-0.07856	-0.23852	-0.53629	1.27081	-0.07971	0.853
Plant height (cm)	0.44295	-0.49693	0.24157	0.28580	-0.15844	-0.23808	-0.44731	1.43839	-0.11506	0.953
Leaf length (cm)	0.40501	-0.49442	0.24280	0.31440	-0.16910	-0.20764	-0.35841	1.19332	-0.12540	0.801
Leaf area (cm^2)	0.32536	-0.41050	0.22064	0.34598	-0.27781	-0.14913	-0.20482	1.02684	-0.18086	0.687
Neck thick. (cm)	0.20545	-0.38942	0.20151	0.47172	-0.20376	-0.07657	-0.19121	0.39176	-0.14285	0.270
Bulb dia. (cm)	0.46720	-0.43490	0.18533	0.18966	-0.05735	-0.27204	-0.41123	1.16771	-0.05812	0.776
Bulb weight (g)	0.51426	-0.40002	0.15661	0.12753	-0.07011	-0.20132	-0.55567	1.47514	-0.06778	0.989
Yield/plot (kg)	0.45654	-0.48192	0.19535	0.23952	-0.05382	-0.21417	-0.55265	1.48320	-0.06513	1.000
TSS	0.24512	-0.32999	0.17572	0.37911	-0.16798	-0.09125	-0.21737	0.55753	-0.17327	0.378

Residual effect =0.843

CONCLUSIONS

The total yield of bulb per hectare recorded significant correlation with number of leaves, height of plant, leaf length, leaf area, neck thickness, bulb diameter, bulb weight, yield per plot, TSS indicating that the superior yielding ability was associated with these yield contributing characters. Based on direct and indirect effects of different yield components on yield it appears that it would be rewarding to lay stress number of leaves, height of plant, leaf length, leaf area, neck thickness, bulb diameter, bulb weight, will be useful in identifying the genotypes as parents for further improvement in onion.

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