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Correlation Assessment for Bulb Yield and its components in Garlic (*Allium sativum* L.) Genotypes

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ABSTRACT: The present investigation was conducted to estimate correlation coefficients analysis among 24 genotypes of garlic for fifteen characters comprised of bulb yield and its contributing characters. These genotypes were planted in Randomized Block Design with three replications during *Rabi* season, 2019-20 at SKN College of Agriculture, Jobner. The result from correlation coefficients indicated that bulb yield showed significant and positive correlation with bulb weight, clove weight, pyruvic acid, equatorial diameter, leaves per plant, clove girth, cloves per bulb, polar diameter and TSS. Results obtained from the present study based correlation analysis revealed that selection programme based on bulb weight, clove weight, equatorial diameter, clove girth, polar diameter might prove effective in enhancing productivity level in garlic.

Keywords: *Allium sativum*, Garlic, Correlation coefficients, Bulb.

INTRODUCTION

Garlic (*Allium sativum* L.), is an asexually propagated and most widely cultivated bulb crop after onion with diploid chromosome number 16 (2n = 2x = 16) belongs to family Amaryllidaceae (Allen, 2009). The primary centre of origin of garlic is Central Asia whereas Mediterranean region is considered as its secondary centre of origin (Brewster, 1994). The progenitor of cultivated garlic is *Allium longicuspis* which is a herbaceous annual for the bulb production. Botanically, economic part of garlic is a compound bulb made up of numerous smaller bulbs called cloves. Garlic bulb does not store food, instead matures as dry scales enclosing cloves which are well developed axillary buds within foliage leaves.

The significance of garlic enhances due to its multiple uses and better nutritive value than other bulb crops. A fresh peeled garlic clove contains moisture (62.8%), carbohydrate (29%), protein (6.3%), minerals (1.0%), fiber (0.8%), fat (0.1%), calcium (0.03%), phosphorus (0.31%), iron (0.001%), vitamin-'C' (13 mg/100g) and nicotinic acid (0.4 mg/100g). The chief constituents of garlic oil are diallyl disulphide (60%), diallyl trisulphide (20%), allyl propyl disulphide (6%), a small quantity of a diethyl disulphide and probably diallyl polysulphide.

Correlation estimates between yield and its components are also useful in developing suitable selection criteria for selecting desired plant types or developing high yielding cultivars. Evaluation of different garlic genotypes and identification of high yielding genotypes for a specific agro-climatic region will be beneficial for realizing more yield and income assessing to growers.

MATERIALS AND METHODS

The experiment was laid out at Horticulture farm, SKN College of Agriculture, Jobner (Jaipur) (Rajasthan). during "*rabi*" season of 2019-20.

Twenty-four genotypes of garlic used in the present experiment were collected from NHRDE, Karnal, HAU, Hissar and CHF, Jhalawar. The experiment was laid out in randomized complete block design with three replications and each replication consisting of twenty-four genotypes. The seeds material (cloves) were planted in row at 15 cm apart by hand dibbling method and spacing within the row was maintained, 10 cm. The standard cultural practices as mentioned in package of Practices for Vegetables crops were followed to raise the healthy crop stand. Five plants were randomly selected from each genotype and following observations were recorded for plant height, leaves per plant, chlorophyll content, equatorial diameter, polar diameter, neck thickness, clove length, clove girth, cloves per bulb, clove weight, bulb weight, days to maturity, bulb yield, TSS & pyruvic acid content in garlic bulb. The phenotypic, genotypic and environmental correlation coefficients were calculated from the phenotypic, genotypic and environmental components of variances and co-variances as described by Singh and Choudhary (1985).

RESULTS AND DISCUSSION

The phenotypic and genotypic correlation coefficients were calculated for fifteen quantitative and qualitative characters in all possible combinations and presented in the Table 1 and 2. The characters included in the present investigation were plant height at 75 DAP (cm), leaves per plant at 75 DAP, chlorophyll content at 60 DAP (mg/g), equatorial diameter (cm), polar diameter (cm), neck thickness (cm), clove length (cm), clove girth (cm), cloves per bulb, clove weight (g), bulb weight (g), days to maturity, bulb yield (q/ha), TSS (%) & Pyruvic acid content (µ moles/g). In general for most of the characters, genotypic correlation coefficient was found to be higher in magnitude than phenotypic correlation coefficient indicating a strong inherent association among various characters.

Bulb yield showed significant positive correlation with bulb weight (r_p = 0.757, r_g = 0.929),), clove weight (rp = 0.466, rg = 0.597), equatorial diameter (rp = 0.362, rg = 0.407), leaves per plant (rp = 0.282, rg = 0.301), clove girth (r_p = 0.258, r_g = 0.332), cloves per bulb (rp = 0.213, rg = 0.248) polar diameter (rp = 0.144, rg = 0.148), TSS (rp = 0.232, rg = 0.246), and significant negative correlation with days to maturity (rp = -0.166, rg= -0.273).

Plant height showed significant positive correlation with chlorophyll content (rg = 0.417, rp = 0.399), leaves per plant (rg = 0.334, rp = 0.307) and negative significant correlation with clove girth (rg = -0.240, rp = -0.219). The character like leaves per plant showed significant positive correlation with polar diameter (rg = 0.419, rp = 0.343), chlorophyll content (rg = 0.266, rp = 0.249), neck thickness (rg = 0.253), equatorial diameter (rg = 0.238). Chlorophyll content showed significant positive correlation with polar diameter (rg = 0.498, rp = 0.454). Equatorial diameter had significant positive correlation with bulb weight (rg = 0.481, rp = 0.412), polar diameter (rg = 0.416, rp = 0.410), neck thickness (rg = 0.355, rp = 0.339), cloves girth (rg = 0.243). Polar diameter had significant positive correlation with bulb weight (rg = 0.576, rp = 0.474), clove length (rg = 0.389, rp = 0.352), clove girth (rg = 0.380, r_p = 352), cloves per bulb (rg = 0.368, rp = 0.326). Neck thickness showed significant positive correlation with clove girth (rg = 0.449, rp = 0.364), clove length (rg = 0.301, rp = 0.304), TSS content (rg = 0.253). Clove length had significant positive correlation with clove girth (rg = 0.529, rp = 0.507), bulb weight (rg = 0.419, rp = 0.331), TSS (rg = 0.405, rp = 0.327), pyruvic acid (rg = 0.340, rp = 0.322) and significant negative correlation with days to maturity (rg = -0.238) . Clove girth had significant positive correlation with bulb weight (rg = 0.620, rp = 0.535), clove weight (rg = 0.426, rp = 0.342), pyruvic acid (rg = 0.240), TSS content (rg = 0.401, rp = 0.302). Cloves per bulb had significant positive correlation with bulb weight (rg = 0.364, rp = 0.323) TSS (rg = 0.285) and significant negative correlation with clove weight (rg = -0.702, rp = -0.571), pyruvic acid (rg = -0.311, rp = -0.275). Clove weight had significant positive correlation with bulb weight (rg = 0.517, rp = 0.403), pyruvic acid (rg = 0.485, rp = 0.465). Bulb weight had significant positive correlation with TSS content (rg = 0.403, rp = 0.303), pyruvic acid (rg = 0.254) and significant negative correlation with days to maturity (rp = -0.257). Days to maturity significant negative correlation with TSS (rg = -0.387, rp = -0.329). TSS had significant positive correlation with pyruvic acid (rg = 0.475, rp= 0.392).

The bulb yield showed positive and significant correlation with bulb weight, clove weight, equatorial diameter, leaves per plant, clove girth, polar diameter, TSS content. Similar results of significant and positive correlation with bulb weight, clove weight, bulb polar diameter, clove length, pyruvic acid and neck diameter were also reported by Agarwal and Tiwari (2009), Dhotre, *et al.* (2010), Hosamani *et al.* (2010); for plant height, clove weight, clove diameter and TSS content by Solanki *et al*.(2015), Prajapati *et al.* (2016), Sharma *et al.* (2016), Chotaliya and Kulkarni (2017), Kumar *et al.* (2017), Zakari *et al.* (2017), Raja *et al*. (2018) and Yadav *et al*. (2018).

Table 1: Phenotypic correlation coefficient between different characters of garlic genotypes.

Characters	PH	LP	CC	ED	PD	NT	CL	CG	CPB	CW	BW	DM	TSS	PA	BY
PH	1.00	0.307**	0.399**	0.067	0.152	-0.068	0.068	-0.219	-0.155	0.092	-0.097	0.008	-0.035	0.139	0.048
LP		1.00	0.249*	0.206	0.343**	0.187	0.139	-0.008	-0.077	-0.017	-0.049	0.088	0.028	-0.062	0.282*
CC			1.00	0.183	0.454**	-0.116	0.054	0.066	0.012	0.081	0.060	-0.008	0.118	0.113	0.198
ED				1.00	0.410**	0.339**	0.200	0.160	0.201	0.164	0.412**	-0.052	0.231	-0.057	0.362**
PD					1.00	0.221	0.352**	0.352**	0.326**	0.120	0.474**	0.082	0.032	0.205	0.144*
NT						1.00	0.304**	0.364**	0.208	0.041	0.221	0.022	0.204	-0.117	0.170
CL							1.00	0.507**	0.214	0.094	0.331**	-0.149	0.327**	0.322**	-0.066
CG								1.00	0.061	0.342**	0.535**	0.003	0.302**	0.217	0.258*
CPB									1.00	-0.571**	0.323**	0.026	0.083	-0.275*	0.213*
CW										1.00	0.403**	-0.109	0.083	0.465**	0.466**
BW											1.00	-0.150	0.303**	0.202	0.757**
DM												1.00	-0.329**	-0.115	-0.166
TSS													1.00	-0.032	0.232
PA														1.00	-0.126
BY															1.00

* and ** refers to significant at P = 0.05 and P = 0.01, respectively.

PH-Plant Height at 75 DAP (cm); LP-Leaves per Plant at 75 DAP; CC-Chlorophyll Content (mg/g) at 60 DAP; ED- Equatorial Diameter (cm); PD- Polar Diameter (cm); NT-Neck Thickness (cm); CL-Clove Length (cm); CG-Clove Girth (cm); CPB-Cloves Per Bulb; CW-Clove Weight (g); BW-Bulb Weight (g); DM-Days to Maturity; TSS-Total Soluble Solid (%); PA-Pyruvic Acid (µ moles/g); BY-Bulb Yield (q/ha)

Table 2: Genotypic correlation coefficient between different characters of garlic genotypes.

Characters	PH	LP	CC	ED	PD	NT	CL	CG	CPB	CW	BW	DM	TSS	PA	BY
PH	1.00	0.334**	0.417**	0.066	0.161	-0.082	0.079	-0.240*	-0.197	0.098	-0.127	-0.017	-0.038	0.146	0.052
LP		1.00	0.266*	0.238*	0.419**	0.253*	0.176	0.039	-0.060	-0.008	-0.032	0.224	0.030	-0.060	0.301*
CC			1.00	0.199	0.498**	-0.131	0.065	0.038	0.031	0.077	0.063	0.016	0.126	0.117	0.256*
ED				1.00	0.416**	0.355**	0.225	0.243*	0.219	0.184	0.481**	-0.110	0.228	-0.073	0.407**
PD					1.00	0.218	0.389**	0.380**	0.368**	0.115	0.576**	0.042	0.070	0.223	0.148*
NT						1.00	0.301*	0.449**	0.156	0.026	0.222	-0.097	0.253*	-0.135	0.126
CL							1.00	0.529**	0.201	0.098	0.419**	-0.238*	0.405**	0.340**	-0.113
CG								1.00	0.081	0.426**	0.620**	-0.030	0.401**	0.240*	0.332**
CPB									1.00	-0.702**	0.364**	0.011	0.285*	-0.311*	0.248*
CW										1.00	0.517**	-0.269*	0.147	0.485**	0.597**
BW											1.00	-0.257*	0.403**	0.254*	0.929**
DM												1.00	-0.387**	-0.156	-0.273*
TSS													1.00	-0.054	0.246*
PA														1.00	-0.139
BY															1.00

* and ** refers to significant at P = 0.05 and P = 0.01, respectively.

PH-Plant Height at 75 DAP (cm); LP-Leaves per Plant at 75 DAP; CC-Chlorophyll Content (mg/g) at 60 DAP; ED- Equatorial Diameter (cm); PD- Polar Diameter (cm); NT-Neck Thickness (cm); CL-Clove Length (cm); CG-Clove Girth (cm); CPB-Cloves Per Bulb; CW-Clove Weight (g): BW-Bulb Weight (g): DM-Days to Maturity: TSS-Total Soluble Solid (%); PA-Pyruvic Acid (µ moles/g); BY-Bulb Yield (q/ha).

CONCLUSION

The association analysis revealed that bulb yield was positively and significantly correlated with bulb weight, clove weight, equatorial diameter, leaves per plant, clove girth, polar diameter and TSS. Results obtained from the present study based on correlation analysis revealed that selection programme based on bulb weight, clove weight, equatorial diameter, clove girth, polar diameter might prove effective in enhancing productivity level in garlic.

FUTURE SCOPE

Correlation estimates between yield and its components are also useful in developing suitable selection criteria for selecting desired plant types or developing high yielding cultivars. Evaluation of different garlic genotypes and identification of high yielding genotypes for a specific agro-climatic region will be beneficial for realizing more yield and income assessing to growers.

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Conflict of Interest. None.

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