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MEAN PERFORMANCE AND CHARACTER ASSOCIATION STUDY IN GARLIC (*ALLIUM SATIVUM* L.)

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ABSTRACT

Performance as well as character association study was done on twenty five genotypes of garlic collected locally as well as from different research centres and universities of the country. They were evaluated for yield and morphological traits. The work was done at Permanent Experiment Area of The Department of Horticulture, Bihar Agriculture College, Sabour in 2000-2001.Design of experiment was RBD and observations were recorded on three randomly selected competitive plants per replication for each entry on yield and morphological traits, viz. plant height, collar thickness, number of leaves per plant, length of leaves, breadth of leaves, diameter of bulb, length of clove, diameter of clove, average weight of cloves and yield per plant or average weight of bulb. The results indicated that the germplasms differed significantly with respect to the different morphological, yield and yield attributes in different environments. Genotype Bombay White Garlic was the best performer with respect to yield and yield attributing characters while Farka Pink performed poorly in these respects. Positive and significant genotypic and phenotypic correlation of yield per plant with most of the yield attributing characters was observed. It was also noted that both phenotypic and genotypic correlation almost followed similar trend.

Key words : *Mean performance, character association, garlic.*

Garlic is important underground vegetable crop used as an adjunct in various recipes throughout the world. It has its origin in in Central Asia and Southern Europe especially the Mediterranean region. Garlic (*Allium sativum* L., 2n=16) belongs to the family Amaryllidaceae and is the second most widely used Allium next to onion. Garlic is propagated vegetatively by single clovebut bulbs are also used occasionally. Garlic is among the earliest domesticated plants and is cropped world-wide. Garlic enjoys almost universal cultivation for its valuable bulb. It is well-known for its health benefits. Numerous therapeuticproperties have been reported, i.e. antifungal, antibacterial, antiviral, antithrombotic, antitumor, hypotensive, hypoglycaemic, hypolipidemic (Sato, 2000). Moreover, therapeutic value related to cardiovascular diseases, cholesterol metabolism, atherosclerosis (Kik *et al.,* 2001) was recently described.

Thus garlic being very important crop, breeding for its improvement becomes imperative.In the case of vegetatively reproducing plant species, existing genotypic variability among plants is considered an important parameter. Large variation occurs all over the world among garlic genotype including its wild relatives in terms of shape, size etc. and for quality parameters. A successful breeding programme with different objectives rely on the nature and extent of variability, role of environmental factors in the expression of such variables and interrelationship between yield and its attributing traits. But proper characterization of the genotypes is the primary requirement for such kind of breeding programmes. The development of an effective improvement programme depends not only upon the existence of genetic variability but also upon the knowledge of genotypic and phenotypic correlation of yield components. The selection based only upon variability study does not lead to expected genetic gain because of the association of characters with yield. Unfavorable association among the yield attributes under selection may leadto genetic slippage and limit the genetic advance. The knowledge of association of different characters and their correlation with yield is, therefore very essential in formulating selection indices in crop improvement programme. However, correlation measures the level of dependence of traits and out of numerous correlation coefficients it is difficult to determine the actual mutual effects among traits. But since the pattern of inheritance of quantitative character is complex, therefore the present investigation was planned.

MATERIALS AND METHODS

The present study was conducted at Permanent

Table-1 : Mean performance of garlic over different nutritional environment for morphological characters in the year 2001-2002.

Genotypes	Plant height (cm)	Collar thick-ness (cm)	No. of Leaves / plant	Lengt h of leaf (cm)	Breadth of leaf (cm)	Av. Dia. of Bulb (cm)	No. of cloves/ bulb	Length of clove (cm)	Width of clove (cm)	Weight of clove (g)	Wt. of bulb/Yi eld per plant (g)
Faizabad Garlc-6/2	46.54	1.1	5.00	32.07	1.00	3.22	23.17	2.74	0.76	0.50	15.30
Faizabad Garlc-5	43.03	0.94	4.33	28.99	0.94	2.42	18.07	2.61	0.64	0.36	13.43
Faizabad Garlc-6/11	46.04	1.08	5.00	31.73	0.99	3.20	19.53	2.73	0.74	0.47	15.13
Faizabad Garlc-20/2	49.63	1.18	5.67	33.65	1.06	3.33	24.43	2.79	0.81	0.55	16.00
Faizabad Garlc-6	42.50	0.93	4.33	28.40	0.93	2.40	15.37	2.59	0.62	0.34	11.97
Akola Garlic-46	53.44	1.25	6.67	34.00	1.11	3.50	28.03	2.83	0.87	0.61	16.73
Bombay White Garlic	58.72	1.38	8.33	40.00	1.33	4.25	41.53	3.53	1.07	1.37	26.67
Akola Garlc-43	66.60	1.30	7.33	34.74	1.17	3.65	31.07	3.03	0.93	0.80	18.95
Dholi Garlic-9	44.47	1.01	4.33	29.44	0.93	2.70	17.93	2.65	0.69	0.40	14.23
Dholi Garlc-8	48.73	1.16	5.73	33.03	1.04	3.32	23.77	2.77	0.78	0.53	15.82
Dholi Garlic-6	47.93	1.12	5.00	32.53	1.03	3.25	23.27	2.76	0.77	0.53	15.37
Dholi Garlic-3	45.73	1.07	4.67	31.96	0.97	3.18	18.63	2.73	0.73	0.46	15.00
Dholi Garlic-1	56.80	1.40	8.00	36.76	1.23	3.93	33.33	3.40	1,04	0.94	26.00
Dholi Garlic-2	44.03	0.98	4.33	29.31	0.90	2.60	17.20	2.63	0.67	0.39	14.10
Dholi Garlic-11	55.07	1.28	7.33	34.60	1.14	3.58	30.87	2,97	0.91	0.79	18.33
Dholi Garlic-10	51.93	1.21	6.00	33.70	1.07	3.37	25.03	2.80	0.83	0.57	16.03
Dholi Garlic-5	52.27	1.23	6.33	33.95	1.10	3.44	27.57	2.82	0.85	0.59	16.33
Badshah Garlic	43.53	0.97	4.33	29.06	0.90	2.50	16.73	2.63	0.65	0.37	14.00
Dholi Garlic-7	42.03	0.91	4.00	28.04	0.91	2.30	11.67	2.26	1.40	0.33	10.33
Jamuna Safed	45.32	1.06	4.67	30.03	0.96	3.05	18.23	2.70	0.72	0.44	14.92
Farka White	54.32	1.27	7.00	34.20	1.13	3.57	28.53	2.87	0.88	0.64	18.10
Farka Pink	41.23	0.88	4.00	27.55	0.89	2.24	5.77	2.10	0.61	0.27	9.00
Munger Garlic White	55.93	1.33	7.67	35.23	1.20	3.68	32.73	3.30	0.94	0.83	21.87
Surajgarha Garlic Pink	56.53	1.34	8.00	36.22	1.20	3.78	32.77	3.33	1.00	0.87	22.60

Experiment Area of The Department of Horticulture Bihar Agriculture College, Sabour in the year 2001-2002. The experimental material consisted of twenty five genotypes of garlic. The genotypes were collected locally as well as from different research centres and universities of the country. All the genotypes were grown with fertility package, N:P:K: :125:50:70. Other package of practice, adopted was as recommended. There were hundred plants in each plot having area of 1.5 m× 1.5 m planted at 15 cm distance between the row and 10 cm. distance within row in a Randomised Block Design, with three replications. Observations were recorded on three randomly selected competitive plants per replication for each entry on eleven yield and yield attributing traits viz. plant height (cm) collar thickness (cm) number of leaves per plant, length of leaves (cm) breadth of leaves (cm), diameter of bulb (cm), number of cloves per bulb, length of clove (cm), width of clove (cm), average weight of clove (g) and yield per plant/ average weight of bulb (g). The data regarding above mentioned characters were averaged and subjected to analysis of variance as per procedure suggested by Panse and Sukhatme (1967). Simple correlation was calculated from variance and covariance components according to the method suggested by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Mean Performance : Results indicated that all the treatments differed significantly among themselves with respect to plant height, number of leaves, length of leaves, breadth of leaf, neck thickness, equatorial

Table-2 : Correlation coefficients for different characters in different of garlic during the year 2001-2002.

	Pheno (P) Geno (G)	Plant height (cm)	Collar thickness (cm)	No. of leaves/ plant	Length of leaf (cm)	Breadth of leaf (cm)	Diameter of bulb (cm)	No. of cloves/ bulb (cm)	Length of cloves (cm)	Width of cloves (cm)	Average weight of cloves (g)	Average weight of bulbs (g)
Plant height (cm)	P		0.7046**	0.7643**	0.5962**	0.2062	0.7275**	0.9525**	0.5148**	0.2596	0.5226**	0.9921**
	G		0.9889**	0.9991**	0.8523**	0.8291**	0.7790**	-0.4052**	0.8368**	0.8637**	0.7466**	0.8478**
Collar thickness (cm)	P			0.8894**	0.9501**	0.5822**	0.9595**	.2204**	0.8800**	0.4013*	0.6357**	0.1227**
	G			0.8963**	0.9994**	0.5170**	0.9845**	0.5218**	0.9931**	0.7903**	0.9913**	0.3241
No. of leaves/plant	P				0.7912**	0.2211	0.8691**	.9768**	0.8077**	0.5000*	0.7580**	0.3381
	G				0.8642**	0.8400*	0.9438**	0.2371	0.9602**	0.9080**	-0.5003*	0.8576**
Length of leaf (cm)	P					0.6912**	0.9116**	.6367**	0.8645**	0.3631	0.6554**	0.3317**
	G					0.3418	0.9908**	0.7494**	0.9625**	0.8461**	-0.9537**	0.7919**
Breadth of leaf (cm)	P						0.3878	.3180	0.7115**	0.8361**	0.8171**	0.4781**
	G						0.6742*	-0.5732**	0.1863	0.9927**	-0.9914**	0.6032**
Diameter of bulb (cm)	P							.0597	0.8646**	0.3809	0.6928**	0.6822**
	G							-0.6635**	0.0019	0.9234**	0.9267**	0.8057**
No. of cloves/bulb (cm)	P								0.2821	0.5557**	0.8613**	0.7211**
	G								0.5237**	0.0129	0.8056**	0.1523
Length of cloves (cm)	P									0.2991	0.6105**	0.6802**
	G									0.9649**	0.8523**	0.8449**
Width of cloves (cm)	P										0.3657	0.5709**
	G										0.7611**	0.8009**
Average weight of cloves (g)	P											0.8620**
												0.6635**

diameter of bulb, polar diameter of bulb, length of clove, weight of clove, width of clove,number of cloves andyield of bulb per plant (weight of bulb).

Perusal of the data (Table-1) revealed that the maximum plant height was recorded in genotype, Akola Garlc-43 and the minimum was observed in Farka Pink.The maximum collar thickness was observed in line Dholi Garlic-1 andthe lowest collar thickness was noted in Farka Pink. The maximum leaf length was observed in line Bombay White Garlic but the lowest leaf length was noted in Farka Pink.The highest number of leaves per plant was exhibited in the genotype Bombay White Garlic, while it was the lowest, in Farka Pink and Dholi Garlic-7. The highest leaf width was found in genotype, Bombay White Garlic and Farka Pink had the most narrow leaves. Similar observations have been earlier reported by Nurzynska Wierdak (1997), Kohli and Prabal (2000), Jogdande *et al.* (2004) and Sengupta *et al.* (2007) in garlic

The line Bombay White Garlic was recorded maximum average diameter of bulbwhile the minimum average diameter of bulb was found in line Farka Pink. The maximum number of cloves per bulb was recorded in genotype Bombay White Garlic and minimum was in Farka Pink. The maximum average length of cloves and weight of cloves was recorded in Bombay White Garlic, while the minimum average length of cloves and width of cloves as well as weight of cloves was exhibited in Farka Pink. The higher bulb yield per plant was obtained in line Bombay White Garlic and, while the lowest bulb yield was found in Farka Pink. Higher bulb yield may be attributed to cumulative effects of number of leaves per plant, polar and equatorial diameter of bulb, number of cloves per bulb and average weight of cloves. Similar observations have been earlier reported by Lommerink (1989), Pandey *et al.* (1996), Nurzynska Wierdak (1997), Kohli and Prabal (2000), Sood *et al*. (2000), Singh *et al. (*2002), Jogdande *et al.* (2004), Shrivastava *et al.* (2004) and Sengupta *et al.* (2007) in garlic.

Correlation studies : Correlation coefficient was estimated between yield and its attributes at genotypic and phenotypic levels to know the inter-relationship among the characters. It provides information about the nature, extent and direction of selection pressure to be applied for practical consideration.

The perusal of data pertaining to correlation studies (Table-2) showed almost close agreement between genotypic and phenotypic correlation coefficient. Further genotypic correlation coefficient in general was almost higher than the corresponding phenotypic correlation coefficient. Yield being a complex quantitative trait, depends upon various characters. The relationship between source and sink component revealed strong and positive and significant association of plant height with collar thickness, number of leaves per plant, length of leaf, breadth of leaf, diameter of bulb, length of cloves, weight of bulb and yield of bulb at both genotypic and phenotypic level. Collar thickness was positively and significantly associated with number of leaves per plant, length of leaf, breadth of leaf, diameter of bulb, number of cloves per bulb, width of clove, length of cloves, weight of bulb and yield of bulb. Number of leaves per plant exhibited significant positive association with length of leaf, diameter of bulb, length of cloves and width of cloves. Length of leaf exhibited significant positive association with breadth of leaf, diameter of bulb, number of cloves per bulb, length of clove and average weight of bulb. Breadth of leaf showed significant and positive association with width of clove and average weight of bulb both genotypically and phenotypically. Diameter of bulb showed significant and positive correlation with length of clove, average weight of clove and average weight of bulb in all environments. Number of cloves per bulb had significant and positive correlation with width of clove and average weight of clove. Length of cloves showed significant and positive correlation with average weight of clove and yield per plant or the average weight of bulb. Width of clove was positively and significantly correlated with average weight of bulb. Average weight of clove had strong significant and positive association with average weight of bulb or the yield per plant. It was also observed that both phenotypic correlation and genotypic correlation almost followed similar trend.Similar correlation trend was also observed by Kalloo *et al.* (1982), Barman *et al.*(1988), Lokhande and Pawar (1988), Thakur *et al.*(1997), Sharma *et al.* (1998), Kohli and Prabal (2000), Wani (2004), Shrivastava *et al.*(2004) and Singh *et al*. (2004) in garlic. It may be concluded that plant height, collar thickness, breadth of leaf, diameter of bulb, number of cloves per bulb, length of clove, width of clove, and average weight of clove are correlated to one another and are helpful in increasing the yield as reported earlier by Dhar (2002) and Naruka and Dhaka (2004).

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