RESEARCH ARTICLE

Genotypes Performance of Garlic (*Allium sativum* L.) on Growth and Yield attributes

Siddappa R[*1,2], M. Ananthan[3], A. Ramar[4], N. K. Hegde[5], S. Rajeswari[6], Krishna Surendar[7] and G.Karthikeyan[8]

[1]Department of Spice and Plantation crops, HC&RI, Tamil Nadu Agricultural University, Coimbatore – 641003, India

[2]COHM, University of Horticultural Sciences, Bagalkot, India

[3]Open and Distance learning, Tamil Nadu Agricultural University, Coimbatore – 641003, India

[4]Department of PSMAC ,College of Horticulture, Sirsi, University of Horticultural Sciences, Bagalkot, Karnataka- 581402, India

[5]Department of Spices and Plantation Crops, HCRI, Tamil Nadu Agricultural University, Coimbatore – 641003, India

[6]Department of Cotton, Tamil Nadu Agricultural University, Coimbatore – 641003, India

[7]Department of Rice, Tamil Nadu Agricultural University, Coimbatore – 641003, India

[8]Department of Plant Pathology Tamil Nadu Agricultural University, Coimbatore– 641003, India

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Corresponding Author:
Siddappa R
sidduhorti3@gmail.com

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ABSTRACT

The present investigation was carried out to evaluate the garlic genotypes for growth and yield attributes among 52 genotypes/varieties for 12 characters comprised of bulb yield and its attributing characters. These genotypes/varieties were planted in RBD design during Rabi-2019 at HREC, Arsikere, and UHS Bagalkot. On the basis of mean performances, the genotypes GS-38, GS-36,Yamuna Safed, GS-35 were identified as high yielder for bulb yield. These genotypes may be further utilized in breeding programme aimed at improving bulb yield in garlic. On the basis of mean performance the genotypes GS-38 was recorded significantly highest yielder followed by GS-38, GS-50, GS-35, GS-36. The Maximum bulb weight, number of cloves, length, width weight was recorded with GS-36, GS-50,GS-35 and the minimum remained with GS-44. The result indicated that the genotypes differed significantly from the different morphological attributes in yield traits. The highest plant height varied from 73.62 cm to 38cm. The length and breadth of leaves also showed significant variation among different genotypes. The number of cloves per bulb and individual clove weight varied significantly and they ranged between 21.7 to7.0 and 2.52 to 0.60 gram respectively. Considering high yield potential and other yield attributing characters, it may be concluded that genotypes in GS-38, GS-36, GS-50,GS-35 were found to be promising with respect to yield attributing characters.

Keywords: *Bulb yield, Genotypes, Varieties, Growth, Allivum sativum L*

INTRODUCTION

Garlic (*Allium sativum* L.) is the second most widely cultivated spice crop after onion, under the genus *Allium* and belongs to the family Alliaceae having chromosome number 2n (2X) = 16. It is an essential bulbous Vegetable, Spice or condiments with the medicinal value used throughout the world [13-14]. It is multiple or compound bulb consisting of 10-20 bulblets or segments called clove covered by a parchment membrane. The genus *Allium* is one of the largest genera of the Alliaceae family. It comprises 450 species, most of which are biannual plants bearing underground storage bulbs and bulbils [10] [19;20] which are of high economic significance [6]. India is the largest producer of garlic in the world after China. However, the productivity (8.16 t/ha) is very low compared to other garlic producing countries where, they grow long day types (China, 23.53 t/ha), which gives higher productivity. Whereas, in Indian tropical plains, short day types with small size bulbs with more

number of cloves are relatively low yielder. However, in hilly regions long day types are grown which gives a higher bulb yield per unit area, but the hilly terrain area is limited in India. Besides, large scale production of local cultivars are accompanied by the high incidence of insect pests, diseases, shortage of irrigation water at critical growth period and post-harvest factors namely curing, grading, packaging and transportation are also main factors affecting the quality of garlic and render the crop to low production and productivity [15-18]. The productivity of garlic in India is poor as compared to other countries. This may be attributed to poor availability of quality and genuine planting material, lack of high yielding and disease tolerance varieties and inadequate crop management practices. Keeping the above facts in view the experiment was conducted to determine the genetic diversity of 52 garlic accession using morph-agronomic traits. This result of the study will provide reproducible data to identify the variety with growth, yield to replace or be used with low yielding local variety.

MATERIALS AND METHODS

Fifty two diverse garlic genotypes/varieties were collected from different parts of the country. This genotypes and released verities were planted in RBD with 3 replication at HREC Arsikere in collaboration with TNAU, Coimbatore during the first week of October 2019. Planting of individual cloves was done at a spacing of 15X10cm. The recommended agronomic practices were followed to ensure a healthy crop growth and development. The soil of the experimental block was black with medium organic matter. The area is located in 800 mt MSL, mean minimum of temperature 13.84^0 C, the mean maximum temperature 34.62^0 C with average rainfall 694 mm peak in May-June and September-October. Observations were recorded for growth and yield characteristics on randomly selected 5 plants in each replication for the all the characters viz., plant height(cm), number of leaves per plant, pseudo stem height (cm), leaf length(cm) and leaf breadth(cm). The yield characters viz., weight of the bulb (gram), bulb diameter(cm), number of cloves per bulb, clove weight (gram), length of clove(cm), bulb yield per hectare(kg per hactre) and days to maturity were recorded. The data of different genotypes and varieties characters were statistically analyzed as stated by [9].

Table: Source of collection of genotypes under study

Sl no	Genotypes name	Source of collection
01	GS-1,GS-2,GS-3,GS-4,GS-5,GS-6	Mandya Pradesh
02	GS-7,GS-8,GS-9,GS-10,GS-11	Uttar Pradesh
03	GS-12,GS-13	Jammu
04	GS-14,GS-15	Tamil Nadu
05	GS-16,GS-17,GS-18,GS-19,GS-20,GS-21,GS-22,GS-23	DOGR, Pune, Maha-rastra
06	GS-24,GS-25,GS-26,GS-27,GS-28	Karnataka
07	GS-29, GS-30,GS-31,GS-32,GS-33,GS-34	Gujarat
08	GS-35, GS-36,GS-37,GS-38,GS-39,GS-40	Haryana
09	GS-41,GS-42,GS-43	Rajasthan
10	GS-44,GS-45	New Delhi
11	GS -46(DWG-1)	UAS, Darwad
12	GS -47(DWG-2)	UAS, Darwad
13	GS -48 (Swetha)	MPKV, Rahuri
14	GS -49(Bhima purple)	DOGR, Pune, Maha-rastra
15	GS -50 (Yamanasafed)	NHRDF, Nasik
16	GS -51 (Oty -1)	TNAU, Coimbatore
17	AAS-2	UHS, Bagalkot

RESULTS AND DISCUSSION

The present investigation revealed that significant variations were observed for different characters. The significant variations were observed in morphological characters are presented in table number 01. The maximum plant height was recorded in GS-38 (73.67cm) followed by GS-35 (72.15cm), GS-36 (71.67cm), GS-27 (70cm), GS-50 (66.33cm). The shortest plant height was recorded GS-23(38cm). These results are similar findings of [5] and [11]. The genotypes exhibited considerable variation in the number of leaves per plant. The number of leaves per plant was recorded significantly higher in GS-38 (11.43) followed by GS-35 (11), GS-31 (10.60), GS-45 (10.10) against the mean population of 7.75. It was found that the maximum leaf length was recorded significantly higher in GS-50 (46.67cm) followed by GS-27 (42.03cm), GS-35 (41.53cm), GS-25 (42.27 cm), while the minimum in GS-43 (24.60). The width of the leaf was showed highest in GS-19 (2.11cm) followed by GS-35 (1.81cm), GS-31 (1.77cm), GS-36 (1.74cm), while minimum in GS-43 (0.68cm) against the population mean of 1.39 cm. Present findings are observed accordance with [7]. These results are also similar to the findings of [8], who showed all the morphological characters are different in garlic genotypes.

Yield traits

The data with respect to yield traits were presented in table 2 and 3. The results revealed that the average bulb weight ranged from 7.60 grams to 19.60 grams. It was noted that bulb weight was highest recorded

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Table 1: Morphological characters of different genotypes of Garlic

Sl.no.	Genotypes	Plant height (cm)	Number of leaves/plant	Pseudo stem height (cm)	Leaf length (cm)	Leaf breadth (cm)
1	**GS -1**	48.67	6.87	4.90	32.60	0.84
2	**GS-2**	53.33	7.67	5.60	35.27	0.99
3	**GS-3**	53.00	7.00	5.37	36.37	1.19
4	**GS-4**	61.00	8.93	6.13	40.93	1.61
5	**GS-5**	52.67	8.20	4.83	37.23	1.27
6	**GS-6**	60.33	7.30	7.20	37.93	1.21
7	**GS-7**	50.33	7.23	8.03	31.03	1.25
8	**GS-8**	64.33	8.30	9.37	37.20	1.20
9	**GS-9**	52.33	8.20	6.20	27.20	2.11
10	**GS-10**	46.67	7.53	4.83	29.90	1.40
11	**GS-11**	53.00	6.33	5.17	33.40	1.21
12	**GS-12**	61.00	9.10	6.20	42.00	1.57
13	**GS-13**	59.67	7.67	6.17	36.20	1.37
14	**GS-14**	57.33	8.47	5.93	41.13	1.43
15	**GS-15**	55.67	6.50	5.80	42.00	1.20
16	**GS-16**	62.33	8.30	5.70	36.40	1.63
17	**GS-17**	52.67	6.77	5.83	33.70	1.73
18	**GS-18**	45.00	6.83	5.50	36.37	1.62
19	**GS-19**	42.33	8.53	5.07	37.30	1.54
20	**GS-20**	42.00	6.33	4.90	31.97	1.67
21	**GS-21**	40.67	7.07	4.63	32.80	1.65
22	**GS-22**	40.00	6.13	5.30	30.90	1.40
23	**GS-23**	38.00	5.07	4.07	28.07	1.45
24	**GS-24**	44.33	7.43	4.60	30.53	0.99
25	**GS-25**	56.67	5.87	6.10	42.27	1.33
26	**GS-26**	64.00	8.53	7.03	38.37	1.63
27	**GS -27**	70.00	9.17	6.80	42.03	1.58
28	**GS-28**	60.00	7.07	5.23	33.93	1.38
29	**GS-29**	52.33	8.23	11.97	31.47	1.93
30	**GS-30**	45.00	7.03	13.63	27.80	1.60
31	**GS-31**	52.00	10.60	14.07	30.07	1.77
32	**GS-32**	42.00	8.07	16.27	26.67	1.67
33	**GS-33**	41.67	7.10	15.43	27.00	1.20
34	**GS-34**	38.00	6.30	18.93	25.67	1.24
35	**GS-35**	72.15	11.00	16.43	41.53	1.81
36	**GS-36**	71.67	9.27	7.50	38.20	1.74
37	**GS-37**	68.00	9.10	6.93	34.47	1.57
38	**GS-38**	73.62	11.43	6.60	26.73	1.11
39	**GS-39**	58.67	7.17	6.43	31.67	0.97
40	**GS-40**	50.00	6.07	4.97	25.33	0.72
41	**GS-41**	51.67	8.33	7.10	31.83	1.13
42	**GS-42**	50.00	7.20	4.67	27.20	1.10
43	**GS-43**	45.67	7.20	5.60	24.60	0.68
44	**GS-44**	40.33	8.63	4.67	32.67	1.73
45	**GS-45**	50.00	10.10	6.70	33.00	1.90
46	**GS -46 (DWG-1)**	56.33	7.37	7.07	34.33	1.01
47	**GS -47 (DWG-2)**	55.00	8.27	3.03	38.33	1.34

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48	**GS -48 (Swetha)**	31.67	4.87	5.83	23.73	1.02
49	**GS -49 (Bhima purple)**	51.33	9.10	6.93	37.33	1.67
50	**GS -50 (Yamana-safed)**	66.33	8.43	6.37	46.67	1.33
51	**GS -51 (Oty -1)**	60.33	9.07	7.07	41.33	1.47
52	**GS -52 (AAS-2)**	38.00	4.80	6.80	25.00	0.95
Mean		**52.48**	**7.75**	**7.10**	**33.80**	**1.39**
SEm±		**1.51**	**0.31**	**0.49**	**1.31**	**0.11**
CD at 5%		**4.23**	**0.86**	**1.38**	**3.67**	**0.31**
CV %		**4.97**	**6.86**	**11.94**	**6.68**	**13.96**

Table 2: Yield characters of different genotypes of Garlic

SL.NO.	Genotypes	Bulb weight (cm)	Bulb diame-ter(cm)	Number of cloves/bulb	Clove weight (gram)	Clove length(cm)
1	**GS -1**	10.37	2.17	15.0	0.89	1.70
2	**GS-2**	12.33	2.70	15.7	0.86	1.85
3	**GS-3**	16.03	2.67	16.6	0.95	1.84
4	**GS-4**	16.23	3.03	21.0	0.80	1.79
5	**GS-5**	11.40	2.87	14.3	0.74	2.10
6	**GS-6**	16.27	2.90	18.7	1.20	2.16
7	**GS-7**	10.13	3.93	20.4	1.93	1.07
8	**GS-8**	11.17	4.01	11.30	1.76	1.01
9	**GS-9**	9.60	3.24	13.7	1.65	1.05
10	**GS-10**	8.40	3.65	18.1	0.98	1.15
11	**GS-11**	7.70	2.69	20.1	1.64	1.61
12	**GS-12**	8.63	2.73	14.0	1.76	1.07
13	**GS-13**	7.93	2.40	11.0	1.62	0.99
14	**GS-14**	16.20	4.20	13.5	1.50	2.18
15	**GS-15**	17.17	3.27	19.10	1.61	1.82
16	**GS-16**	15.40	4.60	15.7	1.73	2.13
17	**GS-17**	17.90	4.27	11.0	1.63	2.25
18	**GS-18**	15.70	4.17	11.7	1.61	1.92
19	**GS-19**	16.13	4.27	10.0	1.20	1.74
20	**GS-20**	16.50	4.33	9.2	1.32	2.17
21	**GS-21**	13.47	4.07	9.3	0.92	2.20
22	**GS-22**	13.60	4.27	10.5	0.81	1.70
23	**GS-23**	11.07	4.20	9.0	0.85	1.51
24	**GS-24**	13.50	2.13	9.3	0.82	1.95
25	**GS-25**	10.07	3.00	17.7	0.57	1.84
26	**GS-26**	12.13	3.20	16.7	0.69	2.02
27	**GS -27**	17.23	4.17	18.10	1.78	2.16
28	**GS-28**	15.07	2.67	12.5	0.77	1.61
29	**GS-29**	13.10	3.20	13.2	0.69	1.93
30	**GS-30**	12.73	2.67	8.0	0.54	1.80
31	**GS-31**	12.07	3.03	13.7	0.67	1.82
32	**GS-32**	11.53	3.31	7.2	0.48	1.80
33	**GS-33**	10.87	2.63	7.0	0.60	1.60
34	**GS-34**	9.23	2.00	8.4	0.69	1.65

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35	**GS-35**	18.10	5.00	22.10	2.31	1.73
36	**GS-36**	18.40	4.96	21.0	2.36	2.70
37	**GS-37**	12.07	4.27	10.0	0.61	1.65
38	**GS-38**	19.60	3.50	21.70	2.52	2.81
39	**GS-39**	13.83	3.40	10.7	0.60	1.21
40	**GS-40**	11.77	2.40	9.6	0.62	1.21
41	**GS-41**	13.87	3.40	15.0	1.08	1.34
42	**GS-42**	12.57	3.60	11.0	0.73	1.23
43	**GS-43**	12.17	2.50	10.7	0.61	1.20
44	**GS-44**	7.60	2.40	18.0	0.63	1.25
45	**GS-45**	16.77	2.17	15.7	0.64	1.18
46	**GS -46(DWG-1)**	9.60	3.33	17.0	0.65	2.04
47	**GS -47(DWG-2)**	10.40	3.03	18.10	0.76	1.58
48	**GS -48 (Swetha)**	7.10	4.23	15.3	0.59	1.76
49	**GS -49(Bhima purple)**	18.33	3.50	14.0	1.45	2.23
50	**GS -50 (Yamana-safed)**	19.60	4.07	20.70	2.18	2.25
51	**GS -51 (Oty -1)**	16.00	3.90	17.0	1.72	1.81
52	**GS -52 (AAS-2)**	10.17	4.96	20.0	0.67	1.50
Mean		**12.96**	**3.42**	**13.9**	**1.07**	**1.73**
SEm±		**0.75**	**0.16**	**0.70**	**0.11**	**0.06**
CD at 5%		**2.12**	**0.45**	**2.00**	**0.32**	**0.17**
CV %		**10.08**	**8.12**	**8.70**	**18.15**	**6.19**

significantly in GS-38 (19.62gram) followed by GS-50 (19.60gram), GS-36 (18.40 gram), GS-35 (18.10 gram) GS-27 (17.23gram), while minimum bulb weight was observed in the genotypes GS-48 (7.10 gram). These results might be due to the genetic variation among garlic genotypes and their ability to explore environmental sources [2]. The diameter of the bulb ranged from 2.0 cm to 5.00 cm against the population mean of 3.42 cm. The diameter of the bulb was maximum in GS-35 (5.00cm) followed by GS-36 (4.96cm), GS-37 (4.32 cm), while the minimum diameter of the bulb was observed in the garlic genotypes GS-34 (2.0 cm).

The same trend was found in the number of cloves per bulb. The maximum number of cloves per bulb was recorded with GS-35 (22.10) which was significantly superior to all other genotypes and followed by GS-38 (21.70), GS-36 (21.0), GS-50 (20.7), while minimum in GS-33 (7.0) .These findings are similar to those of [1] and [3]. It seems that the number of cloves per bulb may be an essential trait in increasing yield.

The average weight of clove was significantly recorded higher in GS-38 (2.52 gram) followed by GS-36 (2.36 gram), GS-50 (2.18 gram), GS-35 (2.31 gram) GS-27 (1.78 gram), while minimum in GS-25 (0.57 gram).The highest length of clove was recorded GS-38 (2.81 cm) followed by GS-36 (2.70cm), GS-50 (2.25 cm), GS-25 (2.25), while length of clove was minimum in GS-13 (0.99 cm).

These findings results are also following the findings of [4] and [12], who reported significant difference for bulb yield in different garlic varieties. The present investigation shows that GS-38, GS-36, GS-50, GS-35 emerged as superior overall other genotypes/variety for garlic yield and quality under the Karnataka region's central dry zones.

CONCLUSION

Based on the present investigation, it can be concluded that analysis of variance revealed highly significant differences among genotypes for all the characters showing a thereby considerable amount of genetic variability for all the characters. The bulb weight, number of cloves, diameter of the bulb had a positive and desirable association with bulb yield and selection of these traits would be effective for yield improvement in garlic.

Future Scope

Performance of the identified superior genotypes could be confirmed by large scale performance trial at different locations for yield stability and the best genotypes could be adopted for commercial cultivation.

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Table 3: Yield and days to maturity of different genotypes of Garlic

Sl.no.	Genotypes	Bulb yield(t/ha)	Days to maturity
1	**GS -1**	5.41	146.33
2	**GS-2**	5.73	146.67
3	**GS-3**	5.27	143.67
4	**GS-4**	6.27	138.00
5	**GS-5**	6.42	141.33
6	**GS-6**	6.50	142.67
7	**GS-7**	4.83	146.00
8	**GS-8**	6.40	129.00
9	**GS-9**	5.80	149.33
10	**GS-10**	6.13	138.00
11	**GS-11**	5.50	130.00
12	**GS-12**	5.28	151.00
13	**GS-13**	6.72	148.00
14	**GS-14**	7.07	130.00
15	**GS-15**	8.42	136.00
16	**GS-16**	8.39	143.33
17	**GS-17**	8.12	152.00
18	**GS-18**	7.90	150.67
19	**GS-19**	7.23	153.67
20	**GS-20**	6.00	156.33
21	**GS-21**	6.60	158.67
22	**GS-22**	5.49	160.00
23	**GS-23**	5.10	149.00
24	**GS-24**	5.87	106.00
25	**GS-25**	6.20	132.00
26	**GS-26**	6.02	122.00
27	**GS -27**	9.13	124.33
28	**GS-28**	5.13	132.00
29	**GS-29**	8.10	115.33
30	**GS-30**	7.27	114.00
31	**GS-31**	6.13	113.33
32	**GS-32**	6.20	129.00
33	**GS-33**	5.10	121.00
34	**GS-34**	4.00	132.00
35	**GS-35**	9.30	131.67
36	**GS-36**	9.72	130.00
37	**GS-37**	8.60	128.00
38	**GS-38**	9.83	128.67
39	**GS-39**	6.10	131.00
40	**GS-40**	5.93	130.33
41	**GS-41**	6.51	131.00
42	**GS-42**	6.13	129.33
43	**GS-43**	6.10	142.00
44	**GS-44**	4.06	146.00
45	**GS-45**	4.73	141.00
46	**GS -46 (DWG-1)**	4.33	120.00
47	**GS -47(DWG-2)**	6.12	133.67
48	**GS -48 (Swetha)**	5.41	125.33
49	**GS -49(Bhima purple)**	6.19	132.67
50	**GS -50 (Yamanasafed)**	9.53	145.67
51	**GS -51 (Oty -1)**	9.20	129.00
52	**GS -52** (AAS-2)	6.13	107.00
Mean		**6.53**	**135.80**
SEm±		**0.30**	**1.36**
CD at 5%		**0.83**	**3.82**
CV %		**7.83**	**1.74**

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