

EVALUATION OF GARLIC VARIETIES FOR GROWTH, YIELD AND YIELD COMPONENTS UNDER MALWA REGION OF MADHYA PRADESH

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ABSTRACT

A field experiment was conducted to evaluate the growth, yield, and yield components of different Garlic varieties at research farm, College of Agriculture, Indore (Madhya Pradesh) during 2014 -15. The study consisted of ten garlic varieties viz. G-1, G-41, G-189, G282, G-283, G-323, Amletha, Jamnagar, Malkapuri, Local-1 in RCB design with 3 replications. Results revealed that varieties differed significantly in plant height, leaves / plant, dry weight /plant, neck thickness, LAI, NAR, CGR, bulb diameter, bulb fresh weight, bulb length, cloves / bulb, clove length, neck and bulb thickness ratio on fresh and dry weight basis, root length, total bulb yield of the crop. Among the different varieties of garlic, Amletha recorded maximum growth (plant height 64.96 cm, leaves / plant (6.98), dry weight / plant (18.23g), neck thickness (0.99 cm), LAI (1.23), NAR (0.00969), CGR (0.105) yield (152.21qha⁻¹), as well as yield attributes (bulb diameter 4.98 cm, bulb fresh wt. 36.94g, bulb length 3.99 cm, cloves per plant 26.50, clove length 2.99cm, neck and bulb thickness ratio fresh basis 0.044, dry basis 0.292, root length 10.58 cm, bulb yield 152.21q ha⁻¹) over other varieties. The G-282 and Jamnagar performed almost equally under prevailing condition. Amletha recorded the maximum net income (Rs.3,68,590 ha⁻¹) with B: C ratio 5.18 followed by G-282 and Jamnagar. The lowest net income (Rs. 243730 ha⁻¹ and B: C ratio 1:3.76) were obtained from G-41 variety.

Key words: Garlic, varieties, growth, B:C ratio, yield

INTRODUCTION

Garlic (*Allium sativum* L.) is the second important bulb crop after onion. It belongs to family *Amaryllidaceae*. It is one of the most important vegetables cum spice crop. Garlic is hardy plant requires cool and moist period during growth and relatively dry period during maturity of bulbs. The edible part, which is composed of several bulb lets or segment, is called "Clove". Garlic has strong flavor and nutritive value and is used for flavouring the seasonal vegetables. The uninjured bulb contains colorless, odorless water soluble amino called Allin. On crushing the garlic bulb, the enzyme allinase breaks down Allin to produce Allicin the antibacterial substance in garlic of which the principle ingredient is the odoriferous diallyl- diasulphide reported to be major flavoring component in garlic. Garlic has higher nutritive values than other bulb crops. It is rich in protein, phosphorus, potassium, calcium, magnesium and carbohydrates. The fresh peeled garlic contain approximately 63% water, 28% carbohydrate, 7% protein, 0.2% fat, 0.8% fibre and a large number of sulphur compounds which contribute to the pungent and taste of garlic. It also contains approximately 1% mineral matter, 1% total ash, 0.03% calcium,

0.31% phosphorus, 0.0001% iron, 0.4% mg/100g nicotinic acid and 13 mg/100g vitamin 'C'. Oils are often flavoured with garlic cloves. Diallyl disulphide is said to possess true garlic odour. Garlic is claimed to prevent heart diseases, high cholesterol, high blood pressure, cancer, common cold and plaque. Garlic has some antifungal, antimicrobial, insecticidal and other medicinal properties also. Garlic therapy has also been suggested in flatulence, constipation, faulty digestion, inadequate food intake, chronic coughs, leprosy and many other diseases (Adegoke *et al.*, 1998). Supplementation with garlic extract inhibited vascular calcification in human patients with high blood cholesterol (Durak *et al.*, 2004). The high yielding varieties are available in local market but their performance has not been tested under Malwa agro-climatic conditions so far. The garlic growers of this region are suffering to a great extent not only due to poor production but also poor keeping quality of bulbs. The present study was therefore, carried out to identify the suitable varieties/local cultivars (races) of garlic for Malwa region and to determine the morphological, growth, and development and yield attributing characters in different varieties of garlic.

MATERIALS AND METHODS

The field experiment was conducted at the Research Farm College of Agriculture, Indore, during rabi season in 2014-15. The site is located at latitude 22.43° N and longitude of 75.66° E with an altitude of 555.5 meters above mean sea level (MSL). It has subtropical climate having a temperature ranges from 20°C to 45°C and 60°C to 31°C in summer and winter seasons, respectively. The mean annual average rainfall is 964 mm. The total rainfall received during crop growth period was 78.5 mm. The minimum and maximum temperature during crop growth period varied 5.3°C to 18.79°C and from 17.2°C to 34.1°C, with season's average values of 10.9°C and 25.59°C respectively. The relative humidity and wind speed ranged between 65.2 to 82.0 % and 1.3 to 4.7 km hrs⁻¹ with season's average of 77.55% and 2.60 km hrs⁻¹. The soil of experimental site was predominantly clayey in texture containing 10.6% sand, 35.9% silt and 53.0% clay. The organic carbon content (7.4g kg⁻¹) and available nitrogen (213 kg ha⁻¹) were low. The available phosphorus (13.6 kg ha⁻¹) and potassium (412 kg ha⁻¹) were medium and high, respectively. The soil pH was 7.7 and electrical conductivity (0.35 dS m⁻¹) of soil was found normal. The experiment was laid out in randomized block design with three replications. Each replication consisted of 10 varieties namely G-1, G-41, G-189, G-282, G-283, G-323, Amletha, Jamnagar, Malkapuri, Local-1. All the varieties were randomized separately in each replication. The individual plot size was 1.5m×1.8m with intra and inter spacing of 7.5×15cm. Pre-planting clove treatment was done with thiram @ 3.0 g kg⁻¹ clove to avoid fungal infection. Healthy and uniform sized garlic clove at the rate of 5.75 q ha⁻¹ was used for sowing. Shallow furrows were opened 15 cm apart with the help of pickaxe manually and cloves were dibbled at a distance of 7.5 cm within rows. The bulb growth, yield and yield related agronomic traits of garlic were recorded from each plot by taking ten random plants. These traits includes plant height, leaves per plant, dry weight per plant, leaf area index, neck thickness of the bulb, NAR, CGR, fresh weight of the bulb per plant, diameter of the bulb, length of the bulb, no. of cloves per bulb, length of the

clove, neck thickness and bulb ratio on fresh and dry weight basis, root length and bulb yield. The economics of the different varieties was worked out on the basis of prevailing market price of input and produce.

RESULTS AND DISCUSSION

Growth characters

Varieties significantly varied with respect to the plant height, number of leaves /plant, dry weight /plant and neck thickness at different plant growth intervals (Table-1). Maximum plant height (64.96 cm) was recorded in variety Amletha over other varieties. While, the variety G – 41 recorded minimum plant height (47.44 cm). Amletha recorded highest leaves /plant (6.98) followed by G -282 (6.83), Jamnagar (6.26) and G-189 (6.24). While, lowest number of leaves /plant was recorded in variety G-41(5.72). The variety Amletha (18.23 g) recorded maximum dry weight as compared to other varieties. While, minimum dry weight /plant (10.65 g) was recorded in variety G - 41. The variety Amletha (0.992cm) recorded maximum neck thickness of the bulb followed by G -282 (0.89 cm). The variety G – 41 recorded the minimum neck thickness (0.78 cm). Maximum LAI was recorded in variety Amletha (1.23) followed by G-282 (1.17). However, minimum leaf area Index was observed in variety G - 41 (0.79). The highest value of NAR was found in Amletha (0.0096 g/cm²/day) as compared to other varieties. The lowest value of NAR was observed in G-41 (0.0011 g/cm²/day). The highest CGR was observed in the variety Amletha (0.105 g/day) as compared to other varieties. However, the lowest value of CGR was found in G-41 (2.806 g/day). The differential behavior of garlic varieties with respect to morphological characters could be explained solely by the variation in their genetic makeup and adaptability to soil and climatic conditions i.e. genotypic and phenotypic interaction. These findings are in agreement with Singh *et al.*, (2013). The results are also in close conformity with the findings of Tiwari *et al.*, (2002) who reported that varieties showed a high range of variability for all the morphological characters. Panse *et al.*, (2013) has also stated that genetic variability is responsible for variation among different treatments.

Table 1: Morphological characters and growth analysis parameters of different garlic varieties

Varieties	Plant height (cm) 120 DAP	Leaves / plant 120 DAP	Dry weight/ Plant (g) 120 DAP	Neck thickness of bulb (cm) 120 DAP	Leaf area Index 120 DAP	N A R (g/cm ² /d ay) 90-120 DAP	Crop growth rate (g/day) 90-120 DAP
G - 1	53.59	6.21	13.93	0.82	0.89	0.0021	0.070
G -189	52.11	6.24	15.16	0.88	0.99	0.0082	0.086
G - 282	54.73	6.83	17.21	0.89	1.17	0.0081	0.098
G - 283	53.58	6.02	13.53	0.81	0.87	0.0069	0.069
G - 323	51.12	5.89	13.32	0.80	0.95	0.0062	0.072
Amletha	64.96	6.98	18.23	0.99	1.23	0.0096	0.105
Jamnagar	54.68	6.26	16.33	0.88	1.06	0.0079	0.097
Malkapuri	53.90	5.78	14.18	0.86	0.97	0.0076	0.080
Local-1	53.50	6.09	11.94	0.80	0.82	0.0049	0.067
SEm±	1.02	0.25	0.028	0.036	0.023	0.00020	0.0016
C.D (P=0.05)	3.02	0.75	0.085	0.106	0.070	0.00059	0.004

Yield attributes

The various yield and yield attributing characters of garlic varied with its different varieties (Table 2). The variety Amletha (36.94g) recorded maximum fresh weight of bulb /plant followed by and G-282 (34.26 g) and Jamnagar (33.58 g). On the other hand, the minimum value of fresh weight of bulb /plant was observed in variety Local-1 (27.08g). Maximum diameter of bulb was exhibited in the variety Amletha (4.98 cm) and minimum in variety G- 41 (3.59 cm). The maximum

length of bulb was recorded in variety Amletha (3.99 cm) followed by G-282 (3.85 cm), Jamnagar (3.82 cm), Malkapuri (3.78 cm), G-1 (3.76 cm) and G-189 (3.49 cm). The variety Amletha (26.50) recorded maximum cloves /bulb which was followed by G-282 (24.68 cloves). However, the number of cloves /bulb was observed lowest in variety G-41(15.58). The length of cloves was significantly influenced by the different varieties in garlic and Amletha (2.99 cm) recorded maximum length of cloves.

Table 2: Yield attributing characters and economics of different garlic varieties

Varieties	Fresh weight of bulb (g)	Diameter of bulb (cm)	Length of bulb (cm)	Number of cloves/ bulb	Length of clove (cm)	Neck and bulb thickness ratio (fresh basis)	Neck and bulb thickness ratio (dry basis)	Root length (cm)	Bulb yield (q ha ⁻¹)	Net income (' ha ⁻¹)	B:C Ratio
G-1	32.51	4.02	3.76	21.33	2.19	0.022	0.148	9.21	120.46	273340	4.10
G-41	29.43	3.59	2.95	15.58	1.96	0.031	0.102	7.50	110.59	243730	3.76
G-189	28.54	4.67	3.49	22.01	2.08	0.025	0.105	8.78	145.49	348430	4.95
G-282	34.26	4.88	3.85	24.68	2.88	0.038	0.217	9.91	149.82	361420	5.10
G-283	27.78	4.12	3.25	16.29	2.12	0.012	0.104	8.57	119.32	269920	4.06
G-323	28.62	3.96	3.09	17.69	2.15	0.028	0.181	8.52	128.91	298690	4.39
Amletha	36.94	4.98	3.99	26.50	2.99	0.044	0.292	10.58	152.21	368590	5.18
Jamnagar	33.58	4.78	3.82	22.59	2.68	0.035	0.199	9.88	148.61	357790	5.06
Malkapuri	29.46	3.98	3.78	20.08	2.29	0.025	0.180	9.56	132.28	308800	4.50
Local-1	27.08	3.92	3.01	18.29	1.98	0.019	0.169	7.52	117.21	263590	3.99
SEm±	1.26	0.19	0.18	1.12	0.22	0.004	0.014	0.63	7.93		
C.D. (P=0.05)	3.76	0.57	0.55	3.33	0.68	0.012	0.04	1.87	23.58		

The lowest value of length of cloves was recorded in variety G-41 (1.96 cm). Variety Amletha (0.044) recorded maximum neck thickness and bulb ratio (fresh basis) which was followed by G-282 (0.038). However, the value of neck and bulb thickness ratio (fresh basis)

was observed lowest in G-283 (0.012). Variety Amletha observed maximum (0.292) neck and bulb thickness ratio (dry basis) as compared to other varieties. However, the ratio of neck and bulb thickness (dry basis) was observed lowest in G-41(0.102). Similarly varieties

Amletha (10.58 cm) recorded maximum root length followed by G-282 (9.91cm). The lowest value of root length was recorded in variety G-41(7.50 cm). The maximum, bulb yield were recorded in the varieties Amletha (152.21 q ha⁻¹) followed by G-282 (149.82 q ha⁻¹). However the minimum value of bulb yield was recorded in variety G-41(110.59 q ha⁻¹). The higher yield attributes in Amletha may be owing to the maximum increase in growth parameters as well as growth parameters. The present findings on varietal differences are in consequence with those of Agarwal and Tiwari

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- Economics**
- Amletha recorded the maximum net income of `3,68,590 ha⁻¹ with B: C ratio of 5.18 followed by G-282 and Jamnagar. The lowest net income of ` 2,43,730 ha⁻¹ and B: C ratio of 3.76 were obtained from G-41 variety. The net economical gain secured was in accordance with yield of the varieties.
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