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Effect of organic manures and varieties on growth, yield and quality traits of garlic (*Allium sativum* L.)

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Abstract

A field study was conducted on Horticultural Research Farm of the Department of Applied Plant Sciences, Babasaheb Bhimrao Ambedkar University, Lucknow during the year 2014-15 to study the effect of organic manures and varieties on growth, yield and quality traits of Garlic (*Allium sativum* L.). The sowing was done on November with a spacing of 15×10cm. The experiment was laid out in randomized block design with twelve treatments replicated thrice. Result indicated that the maximum height of the plant (19.54, 38.85 and 59.91cm) and leaves/plant (4.93, 7.73 and 10.73) were recorded at 30, 60 and 90 DAS with treatment RDF + 20 tons/ha vermin-compost + Bhima Purple varieties followed by treatment RDF + 25 tons/ha press mud + Bhima Purple varieties and minimize in treatment RDF 100: 60: 50 kg/ha + Yamuna Safed-5 variety. Bulb diameter at polar (3.01cm) and bulb diameter at equatorial (3.35cm) were recorded maximum in treatment RDF + 20 tons/ha vermi-compost + Bhima Purple varieties. The maximum clove/bulb (20.20) and bulb weight (20.95g) were recorded with treatment RDF + 20 tons/ha vermi-compost + G-282 varieties. Maximum yield/plot (1.00kg) and yield/ha (100.59 q) was recorded in treatment RDF + 20 tons/ha vermin-compost + G-282 varieties. The maximum TSS (41.16 °Brix) were recorded with treatment RDF + 20 tons/ha vermin-compost + Bhima Purple varieties and maximum ascorbic acid (12.46 mg/100g) were recorded with treatment RDF + 20 tons/ha vermi-compost + G-282 varieties.

Keywords: Organic manures, varieties, growth characters, yield characters and quality characters

Introduction

Garlic (*Allium sativum* L.) a plant of family *Alliaceae*, genus *Allium* and species *sativum*. Garlic is the second most important bulb crop after onion. Plant is herbaceous and annual for the bulb production and biennial for the seed production. It is the native of the Central Asia and Southern Europe especially Mediterranean region (Thompson and Kelly, 1957) [10]. Garlic is used in flavouring foods, preparing chutneys, pickles, curry powder and tomato ketchup etc. It has higher nutritive value than other bulb crop. About 142 calories of energy is obtained from 100 gram of garlic. Extract of garlic along with chilli and ginger has beneficial action against soil nematodes. Beneficial use of garlic extract has been found against many fungi and bacteria (Pandey, 1997) [6]. Besides the nutritive value of garlic and its used in various forms, it is included in Indian system of medicines (Ayurvedic, Unani and Siddha) as carminative and gastric stimulant to help in digestion and absorption of food. Allicin present in aqueous extract of garlic reduces blood cholesterol concentration (Shankaracharya, 1974). Garlic oil or its juice is recommended to inhale in cases of pulmonary tuberculosis, rheumatism, sterility, impotency, cough and redness of eyes (Pruthi, 1979) [7].

Organic manure has the capability of supplying a range of nutrients and improving the physical, chemical and biological properties of soil. In traditional agriculture farmer's use of organic manures like cow dung, compost, poultry manure, vermi-compost and farmyard manure etc. The system of low nutrient supply can only sustain low productivity of crop increasing needs for enhanced crop productivity due to the even increasing population necessitate the high amount of nutrition. Excreta of earthworm are called vermin-compost, which has several plant growth promoters. Vermicompost is a rich mixture of major and minor plant nutrient increase total microbial population of nitrogen fixing bacteria. Vermicompost plays a significant role in improving the fertility of top soil and in boosting the productivity of the crop.

Farmyard manure is (FYM) one of the oldest manure used by the farmers in growing crops because of its easy availability and presence of all the nutrients required by the plants.

Farmyard manure refers to the decomposed mixture of dung and urine of farm animals along with their litter and left over material from roughages or fodder fed to the cattle

Materials and Methods

The present study was conducted at Horticultural Research Farm of the Department of Applied Plant Sciences, Babasaheb Bhimrao Ambedkar University, Lucknow during the year 2014-15 at the spacing of plant to plant (10 cm) and row to row (15 cm) and sowing was done on November, respectively. The three varieties of garlic viz. Bhima Purple, G-282 (Yamuna safed-3) and Yamuna safed-5 and organic manure were selected for the present study. The planting materials were obtained from the National Horticulture Research Development Foundation (NHRDF) house no. D-574, near kargil petrol pump, barra-8, kanpur-208027 (U.P).

Garlic was fertilized with recommended dose (100%) of integrated sources of nutrients viz., NPK @ 100, 60 and 50 kg/ha and organic manure (Vermicompost, press mud and farm yard manure). Geographically, Lucknow is situated at 26°50' N latitude, 80°52' E longitude and an altitude of (129) meter above mean sea level (MSL). The climate of the experimental site is subtropical with maximum temperature ranging from 22 °C to 45 °C in summer and 3.5 °C to 15 °C in winter and related humidity ranging from 60-80% in different season of the year. In general, the climate of Lucknow is characterized as sub-tropical climate with hot dry summer and cold winter the average annual rainfall is 750 mm is and 85% rain total received during the monsoon.

Symbol	Treatment code	Details of variety	Details of treatments combination
T ₁	V ₁ T ₁	Bhima Purple	RDF (control) 100: 60: 50 kg/ha (100%)
T ₂	V ₁ T ₂	Bhima Purple	RDF + 20 tons/ha Vermicompost
T ₃	V ₁ T ₃	Bhima Purple	RDF + 25 tons/ha Press mud
T ₄	V ₁ T ₄	Bhima Purple	RDF + 30 tons/ha FYM
T ₅	V ₂ T ₁	G-282	RDF (control) 100: 60: 50 kg/ha (100%)
T ₆	V ₂ T ₂	G-282	RDF + 20 tons/ha Vermicompost
T ₇	V ₂ T ₃	G-282	RDF + 25 tons/ha Press mud
T ₈	V ₂ T ₄	G-282	RDF + 30 tons/ha FYM
T ₉	V ₃ T ₁	Yamuna Safed-5	RDF (control) 100: 60: 50 kg/ha (100%)
T ₁₀	V ₃ T ₂	Yamuna Safed-5	RDF + 20 tons/ha Vermicompost
T ₁₁	V ₃ T ₃	Yamuna Safed-5	RDF + 25 tons/ha Press mud
T ₁₂	V ₃ T ₄	Yamuna Safed-5	RDF + 30 tons/ha FYM

The required quantity of organic manures as per treatment combination was applied at the time of land preparation. Urea was applied in two splits before planting and flowering stages while the full dose of phosphorus and potash was given before planting. Garlic clove were sown in well prepared field with the spacing plant to plant 10cm and row to row 15cm. Other cultural practices like weeding, hoeing, irrigation, insect pest and disease management were done as and when required. Observations on vegetative growth parameters were recorded at 30 days interval whereas numbers of clove per bulb was recorded after final harvesting of the plant.

Results and Discussion

The data (Table-1) revealed that maximum height of the plant were found in T₂ (19.54, 38.85 and 59.91cm) followed by T₃ (19.40, 38.63 and 59.59cm) and T₄ (19.30, 38.53 and 59.59cm) and maximum number of leaves/plant were recorded in T₂ (4.93, 7.73 and 10.73) followed by T₃ (4.73, 7.53 and 10.71) and T₄ (4.13, 7.33 and 10.26). Whereas, minimum height of plant was found in T₉ (16.27, 35.36 and 54.37cm) and minimum number of leaves/plant were recorded in T₉ (3.22, 5.39 and 8.33) at 30, 60 and 90 DAS.

The data (Table-2) showed that maximum bulb diameter at polar were recorded in T₂ (3.01cm) followed by T₃ (2.89cm) at par with T₄ (2.80cm) and maximum bulb diameter at equatorial was found in T₂ (3.35cm) followed by T₃ (3.26cm) and T₄ (3.19cm) while minimum bulb diameter at polar (2.07cm) were found in Treatment 9 and minimum bulb diameter at equatorial (2.17) encountered in Treatment 1. Where the maximum number of clove/bulb were recorded in T₆ (20.20) followed by T₇ (19.13) which are at par with T₈ (18.33) while minimum number of clove/bulb was found in T₉ (15.19). The maximum bulb weight was found in T₆ (20.95g) followed by T₇ (20.52g) and T₈ (19.92g) where the minimum bulb weight were recorded in T₉ (15.11g). These findings are in line with the Islah, M. E. (2010) ^[4] and Mohd *et al.* (2010) ^[5] in garlic. The maximum yield/plot was found in T₆ (1.00 kg) followed by T₇ (0.98 kg) at par with T₈ (0.95

kg) and maximum yield/ha were recorded in T₆ (100.59 q) followed by T₇ (98.49 q) and T₈ (95.61 q), whereas the minimum yield/plot (0.72 kg) and yield/ha (72.54 q) was recorded in treatment 9. These findings are in line with the Singh *et al.* (2012) ^[9] in garlic and Reddy and Reddy (2005) ^[8] in onion. The total soluble solids ranged from 36.84 to 41.16 °Brix. The maximum total soluble solids was recorded in T₂ (41.16 °Brix) followed by T₃ (40.50 °Brix) and at par with T₄ (40.36 °Brix), while minimum total soluble solids was recorded in T₉ (36.84 °Brix). Ascorbic acid the major constituent of garlic ranged from 9.80 to 12.46 mg/100 g of clove pulp. The maximum amount of ascorbic acid was recorded in T₆ (12.46 mg/100g) followed with T₇ (12.37 mg/100g) and T₈ (12.32 mg/100g). The minimum amount of ascorbic acid was observed in T₉ (9.80 mg/100 g). These findings are in line with the Choudhary *et al.* (2012) ^[2] and Chander *et al.* (2005) ^[1] in onion and garlic.

The vermi-compost, press mud and farmyard manure along with some combinations of varieties were applied in field crop of the garlic to evaluate various parameter viz. Growth, yield and quality with the varieties. There was excellent plant growth as well as yield in garlic plants that received vermi-compost as nutrient supplier in field. The results indicated evaluate that the advantage of vermi-compost in such field crop production, but here such effect could be attributed to the nutritional status of vermi-compost and to a three varieties some other factors (soil microbial structure and activity, mineralization and soil enzymatic factors). The data clearly indicated that vermin-compost may be an efficient plant growth media for sustainable plant production, if applied with varieties in order of merits i.e. G-282, Bhima Purple and Yamuna Safed-5 respectively. On the basis of above investigations it can be concluded that the combination of organic manures and chemical fertilizers applied (100%NPK +100% Vermicompost/ha) followed by the varieties (Bhima Purple, G-282, Yamuna Safed-5) can be recommended for garlic growers to achieve the better growth, higher and qualitative yield under the Lucknow conditions.

Table 1: Effect of organic manures and varieties on heights of plant and number of leaves/plant of garlic at 30, 60, 90 DAS

Treatments	Heights of plant DAS			Number of leaves/plant DAS		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T ₁	16.25	35.10	54.10	3.25	5.54	8.85
T ₂	19.54	38.85	59.91	4.93	7.73	10.73
T ₃	19.40	38.63	59.59	4.73	7.53	10.71
T ₄	19.30	38.53	59.43	4.13	7.33	10.26
T ₅	16.34	35.28	54.52	3.22	5.47	8.73
T ₆	17.75	36.66	57.53	3.80	7.26	10.20
T ₇	17.65	36.45	57.28	3.73	7.12	9.96
T ₈	17.59	36.34	57.18	3.66	6.93	9.74
T ₉	16.27	35.36	54.37	3.22	5.39	8.33
T ₁₀	17.53	36.23	57.12	3.53	6.79	9.73
T ₁₁	17.47	36.31	57.07	3.48	6.77	9.40
T ₁₂	17.38	36.11	56.92	3.41	6.71	9.20
CD P=0.05	0.096	0.121	0.125	0.336	0.785	0.798

Table 2: Effect of organic manures and varieties on bulb diameter at polar (cm), bulb diameter at equatorial (cm), number of cloves/bulb, bulb weight (g), yield/plot (kg), yield/ha (q), TSS (^oBrix) and ascorbic acid (mg/100g)

a	Bulb diameter at polar (cm)	Bulb diameter at equatorial (cm)	Number of clove/bulb	Bulb weight (g)	Yield/plot (kg)	Yield/ha (q)	T.S.S. (^o Brix)	Ascorbic acid (mg/100g)
T ₁	2.15	2.17	15.38	15.58	0.75	74.80	37.43	9.98
T ₂	3.01	3.35	18.13	19.44	0.93	93.34	41.16	12.21
T ₃	2.89	3.26	17.93	19.27	0.92	92.51	40.50	12.17
T ₄	2.80	3.19	17.53	18.96	0.91	91.02	40.36	12.11
T ₅	2.17	2.84	15.25	15.35	0.74	73.69	37.63	10.11
T ₆	2.69	3.11	20.20	20.95	1.00	100.59	39.90	12.46
T ₇	2.61	3.04	19.13	20.52	0.98	98.49	39.33	12.37
T ₈	2.52	3.00	18.33	19.92	0.95	95.61	39.06	12.32
T ₉	2.07	2.80	15.19	15.11	0.72	72.54	36.84	9.80
T ₁₀	2.44	2.96	17.13	18.77	0.90	90.13	38.90	12.04
T ₁₁	2.35	2.92	16.60	18.19	0.87	87.31	38.40	12.17
T ₁₂	2.24	2.88	16.33	17.87	0.85	85.79	37.86	12.11
CD P=0.05	0.056	0.044	0.355	0.374	0.019	1.794	0.797	N/A

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