



Impact of different levels of organic and inorganic fertilizers on growth and yield of garlic (*Allium sativum* L.)

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Abstract: The experiment was laid out in randomized block design with three replications and eight treatments. It was recorded that the maximum plant height (31.32cm, 43.75cm, 72.26cm), number of leaves per plant (4.78, 5.62, 6.89), diameter of stem (5.05cm, 6.89 cm and 16.77cm), Leaf length of garlic (18.07 cm, 30.95 cm, 42.71 cm) and leaf width of garlic (0.54 cm, 0.96 cm, 1.75 cm) at 30, 60 and 90 days after sowing was found with the treatment T₃ (60 kg N+40 kg P₂O₅ +60 kg K₂O+20 tones vermicompost/ha), and diameter of bulb (5.32 cm), Weight of bulb (32.88 g), Cloves per bulb (40.12 cloves), Weight of 50 cloves (45.44g) and Yield 328.83 q/ha with the treatment T₃, was found at the time of harvest.

Key words: Garlic, FYM, Vermicompost, N, P, K, Growth and yield

Introduction

Garlic (*Allium sativum* L.) a plant of family Alliaceae, genus *Allium* and species *sativum*. Plant is herbaceous and annual for the bulb production and biennial for the seed production. It is the native of central Asia and southern Europe especially Mediterranean region (Thomson and Kelly, 1957). The economic yields obtain from its underground part known as bulb. Organic manure has the capability of supplying a range of nutrients and improving the physical, chemical and biological properties of soil. Talware *et al.*, 2012) reported maximum growth and yield in garlic with the application of reduced dose of fertilizers along with the application of FYM and biofertilizers. The role of farm yard manure (FYM) in enhancing efficient use of chemical fertilizers is well documented. Singh and Attrey (2002) reported that the organic farming makes positive contribution not only to the soil and environment but human health also. So, to eliminate all these bad effects, integrated plant nutrient farming is best alternative. Excreta of earthworm are called vermicompost, 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 widely used in horticulture crop production and has all the characteristics to use as most valuable organic manure (Kale and Bano, 1986). The importance of nitrogen application in onion crop has been advocated in garlic crop by similarly phosphorus plays an important role in energy formation and metabolic process of plant. The deficiency of phosphorus result in disturbing the N metabolism, which is evident by an accumulation of soluble organic nitrogenous compound such as free amino acid and amides and decrease in protein content. Potassium is known to increase disease assistance of plant as also resistant to the moisture of the heat and diseases. Potassium increases the colour, flavour and size of bulb. Due to some of the well-known advantage of organic manure and some possible areas

in the use of chemical fertilizer, the combined use organic and inorganic fertilizer is the best alternative available now. Keeping the above points, the present investigation entitled "Efficacy of different levels of organic and inorganic fertilizer on growth and yield of garlic (*Allium sativum* L.)" was undertaken with the objectives: (1) To find out the effect of organic and inorganic fertilizers on growth of garlic. (2) To assess the effect of organic and inorganic fertilizers on yield of garlic.

Materials and Methods

One variety of garlic viz. G-323 (Yamuna Safed -4) was selected for the present study. The eight treatments with three replications were compared in randomized Block Design. Treatments are T₀ (Control), T₁ (120 kg N + 80 kg P₂O₅ + 120 kg K₂O /ha), T₂ (60 kg N + 40 kg P₂O₅ + 60 kg K₂O + 15 tones V.C. /ha), T₃ (60 kg N + 40 kg P₂O₅ + 60 kg K₂O + 20 tones V.C. /ha), T₄ (50 kg N + 30 kg P₂O₅ + 50 kg K₂O + 20 tones V.C. /ha), T₅ (60 kg N + 40 kg P₂O₅ + 60 kg K₂O + 30 tones FYM /ha), T₆ (60 kg N + 40 kg P₂O₅ + 60 kg K₂O + 40 tones FYM /ha), T₇ (50 kg N + 30 kg P₂O₅ + 50 kg K₂O + 40 tones FYM /ha). All the organic manures were applied and shared thoroughly all over the experimental plot and reset of the inorganic Fertilizer was also applied as per principles. The half dose of Nitrogen & full dose of P&K were applied as basal dressing before transplanting and remaining half dose of Nitrogen was applied into two split doses at 25 days and 50 days after transplanting respectively. The fertilizers were given in the form of urea, SSP& MOP. And the manure was vermicompost and FYM.

The cloves were separated from the bulbs and single cloves were sown at the spacing of 10x10cm in each plot at uniform depth of 2 to 3 cm. The neck of the cloves were kept pointing to words the soil surface. After planting the cloves were covered with the soil. The sowing was done in 28 Nov. To Find out the relative performance five plant at randomly for the recording the following observation. The observation were recorded at 30, 60, 90 days interval after

sowing dates and last observation recorded at the time of harvest. Observations were made on different vegetative and reproductive parameters. Observations of various growth parameters like plant height of garlic, number of leaves of garlic, stem diameter, length of leaf, leaf width of garlic, bulb diameter, bulb weight, number of cloves per bulb of garlic, weight of 50 cloves of garlic and yield of garlic were recorded. The data were analyzed statistically and results were interpreted by using methods suggested by (Panse and Sukhatme, 1985).

Results and Discussion

Data presented in table 1, 2 and 3 revealed that, various treatments differed significantly in respect of vegetative and reproductive characters like plant height, number of leaves, Stem diameter of garlic, leaf length of garlic and leaf width of garlic, bulb diameter, bulb weight, number of cloves per bulb of garlic, weight of 50 cloves of garlic and yield of garlic were recorded.

Plant height: The maximum plant height T₃ (60 kg N+40 kg P₂O₅ + 60 kg K₂O + 20 tones V.C. / ha) increased the plant height at 30, 60 and 90 DAP (31.32cm, 43.75 cm, 72.26cm) respectively which was significantly higher over the rest of the treatments, followed by T₆ (60 kg N+40 kg P₂O₅+60 kg K₂O) which were significantly superior over control (Table 1). The reason for increase in the plant height at different stages of growth may be due to the fact that the vermicompost with a relatively high content of humus like compounds, active micro organisms and enzymes, greatly contribute to the enhancement of the biochemical fertility of the soils degraded by intensive cultivation, pollution and natural causes. Vermicompost contains a good range of some very essential micronutrient other than NPK fertilizers, required for healthy plant growth observed by Singh *et al.* (1995) in garlic crop. (Kore *et al.*, 2006) reported maximum plant height, number of leaves and yield in treatment having 10 t FYM + 3 kg Azt + 3 kg PSB + 75 % RDF, while studying response of garlic to the application of organic, inorganic and biofertilizers in various combinations.

Number of leaves per plant: The treatment T₃ (60 kg N+40 kg P₂O₅ + 60 kg K₂O + 20 tones V.C. / ha) has maximum number of leaves per plant at 30, 60 and 90 DAP (4.78, 5.62, 6.89) followed by T₆ (60 kg N+40 kg P₂O₅+60 kg K₂O) which were significantly superior over the control (Table 1). The reason for maximum number of leaves due to the higher N found in experimental plant than control, NPK nutrient resulting in increased to the number of leaves. The results of this study are agreements with the Suthar (2009), Singh *et al.* (1994), Setty *et al.* (1989) and Kore *et al.* (2006) in garlic crop.

Diameter of stem: Different organic and inorganic fertilizers significantly higher diameter of stem (Table 1) recorded in the treatment N, P and K along with the Vermicompost application was given. It is clearly indicates that maximum diameter of stem at 30, 60 and 90 days after sowing was found 5.05cm , 6.89 cm and 16.77cm with the treatment T₃ (60 kgN+40 kg P₂O₅ +60 kg K₂O+20 tones vermicompost/ha) followed by T₆ (60 kg N+40 kg P₂O₅+60 kg K₂O+40 tones FYM / ha) and T₂ (60kgN+40kgP₂O₅+60kg K₂O+15 tones vermicompost/ha) respectively, while minimum diameter of stem was recorded under the control treatment. The reason for

Table-1: Impact of organic and inorganic fertilizers at different days after sowing dates on plant height, number of leaves and stem diameter of garlic

Symbols used	Plant height (cm)			Number of leaves			Stem Diameter of garlic(cm)		
	30	60	90	30	60	90	30	60	90
	DAP	DAP	DAP	DAP	DAP	DAP	DAP	DAP	DAP
T ₀	23.29	36.49	58.72	3.70	4.08	4.54	3.69	5.35	9.62
T ₁	27.27	39.61	64.27	4.22	5.15	6.28	4.63	6.29	11.39
T ₂	28.84	40.56	67.85	4.43	5.22	6.42	4.78	6.38	12.06
T ₃	31.32	43.75	72.26	4.78	5.62	6.89	5.05	6.89	16.77
T ₄	30.93	41.45	68.76	4.57	5.41	6.43	4.86	6.52	14.88
T ₅	29.31	40.59	67.79	4.52	5.14	6.34	4.43	6.25	14.30
T ₆	30.07	42.06	70.72	4.67	5.52	6.75	4.93	6.67	16.12
T ₇	29.15	39.43	69.47	4.57	5.35	6.39	4.62	6.34	14.90
S.E. (diff.)±	0.64	0.64	0.71	0.12	0.09	0.08	0.11	0.06	0.35
C.D.at 5%	1.96	1.94	2.15	0.35	0.27	0.24	0.34	0.18	1.05

Table-2: Impact of organic and inorganic fertilizers at different days after sowing dates on leaf length of garlic (cm) and leaf width (mm) of garlic

Symbols used	Leaf length of garlic (cm)			Leaf width of garlic (mm)		
	30	60	90	30	60	90
	DAP	DAP	DAP	DAP	DAP	DAP
T ₀	13.61	20.52	26.65	0.39	0.79	1.01
T ₁	15.93	25.51	36.46	0.48	0.90	1.43
T ₂	16.38	26.77	38.46	0.51	0.91	1.50
T ₃	18.07	30.95	42.71	0.54	0.96	1.75
T ₄	17.04	28.42	39.26	0.48	0.89	1.61
T ₅	16.47	27.25	37.47	0.50	0.90	1.53
T ₆	17.45	29.46	41.46	0.54	0.93	1.67
T ₇	16.95	27.63	38.53	0.44	0.88	1.61
S.E. (diff.)±	0.43	0.61	0.60	0.01	0.02	0.04
C.D.at 5%	1.31	1.86	1.82	0.05	0.06	0.13

Table-3: Impact of organic and inorganic fertilizers at the time of harvest on diameter of bulb(cm), weight of bulb (g), cloves per bulb, weight of 50 cloves (g) and yield (q/ha) of garlic

Symbols used	Diameter of bulb (cm)	Weight of bulb (g)	Cloves per bulb	Weight of 50 cloves (g)	Yield (q/ha)
T ₀	3.57	20.55	25.81	30.45	205.53
T ₁	4.48	27.19	31.13	35.14	271.93
T ₂	4.60	29.06	34.13	38.57	290.60
T ₃	5.32	32.88	40.12	45.44	328.83
T ₄	4.93	30.02	38.09	42.60	300.23
T ₅	4.73	28.72	36.26	39.94	287.20
T ₆	5.04	31.47	39.51	44.41	314.70
T ₇	4.87	29.65	37.71	40.59	296.53
S.E. (diff.)±	0.16	0.69	0.88	0.68	6.88
C.D.at 5%	0.50	2.09	2.67	2.07	20.87

maximum diameter of stem due to the higher concentration of soil enzymes, soil organic matter and soil for rapid mineralization and transformation of plant nutrients in soil, application of Vermicompost, NPK nutrient resulting in increased to the diameter of stem. The result of this study are agreements with the Mandloi *et al.* (2008), Ali *et al.* (1998) and Naidu *et al.* (2000) in garlic crop.

Leaf length: It is clearly indicates that maximum leaf length 18.07 cm, 30.95 cm and 42.71 (Table 2) at 30, 60 and 90 days after sowing were found with the treatment T₃ (60 kg N+40 kg P₂O₅ +60

kg K₂O+20 tones vermicompost/ha) followed by T₆ (60 kg N+40 kg P₂O₅+60 kg K₂O+40 tones FYM / ha) and T₂ (60 kg N+40 kg P₂O₅+60 kg K₂O+15 tones vermicompost/ha) respectively, while minimum leaf length was recorded under the control treatment. The reason for maximum leaf length due to the earthworm casts application there was an increase in number of tillers and of leaves application of Vermicompost with NPK nutrient resulting in increased to the leaf length. The results of this study are agreements with the Singh *et al.* (1994) and Naidu *et al.* (2000) in garlic crop.

Leaf width: It is clearly indicates from Table 2 that maximum leaf width at 30, 60 and 90 days after sowing were found (0.54 cm, 0.96 cm, 1.75 cm) with the treatment T₃ followed by T₆ and T₂ respectively, while minimum leaf width was recorded under the control treatment. The reason for maximum leaf width because in the form of traditional inorganic NPK and in the form of Vermicompost, brings an excellent biochemical changes in soil structure, which ultimately promotes plant growth. The results of this study are agreements with the Naidu *et al.* (2000) and Suthar (2009).

Diameter of bulb: It is clearly indicates that maximum diameter (5.32 cm) of bulb at harvesting time was found with the treatment T₃ (60kg N+40kg P₂O₅+60 kg K₂O +20 tones V.C. /ha) followed by T₆ (60kg N+40kg P₂O₅+60 kg K₂O+40 tones FYM/ha), and T₂ (60kg N+40kg P₂O₅+60 kg K₂O +15 tones V.C. /ha) respectively, while minimum diameter of bulb was recorded under the control treatment (Table 3). The probable reason for maximum diameter of bulb is may be due to the application of vermicompost which enhanced the activity of some microbial population vermicompost along with NPK nutrient resulting in increase to the diameter of bulb. The results of this study are agreements with the Bhati *et al.* (2002), Verma *et al.* (1996) and Yadav (2003) in garlic crop.

Weight of bulb: The maximum weight of bulb (32.88 g) at harvesting time was found (Table 3) with the T₃ (60 kgN+40 kg P₂O₅ +60 kg K₂O+20 tones vermicompost/ha), while minimum weight of bulb was recorded under the control treatment. The reason for maximum weight of bulb due to the Vermicompost application in the soil enhances the biochemical potential of soil and consequently effect plant production. The results of this study are agreements with the Suther (2009), Jahangir *et al.* (2005) and Abdel *et al.* (2002) in garlic crop.

Clove per bulb: It is clearly indicates that maximum number of cloves per bulb (Table 3) at harvesting time were found (40.12) with the treatment T₃ (60kg N+40kg P₂O₅+60 kg K₂O +20 tones V.C. /ha) followed (36.91) by T₆ and with T₂ (34.13) respectively, while minimum number of cloves per bulb was recorded under the control treatment. The reason for maximum number of clove per bulb due to the vermicompost application in the soil enhances the biochemical potential of soil and consequently effect plant production. Application of vermicompost, NPK nutrient resulting in increase to the number of cloves per bulb. The results of this study are agreements with the Yadav (2003), Reddy *et al.* (2000), Ali *et al.* (1998) and Verma *et al.* (1996) in garlic crop.

Weight of 50 cloves: It is clearly indicates that maximum weight of 50 cloves (Table 3) were found (45.44g) with the treatment T₃ (60kg N+40kg P₂O₅+60 kg K₂O +20 tones V.C. /ha) and minimum weight of 50 cloves was recorded under the control treatment. The

reason for maximum weight of 50 cloves because the cast of earthworm is one of the most useful and active agent bin introducing suitable chemical, physical and microbiological change in the soil and thereby, directly increasing the fertility and crop producing power in soil. The results of this study are agreements with the Ali *et al.* (1998) and Suthar (2009) in garlic crop.

Yield q/ha: It is clearly indicates (Table 3) that maximum yield q/ha was found 328.83 q/ha with the treatment T₃ (60kg N+40kg P₂O₅+60 kg K₂O +20 tones V.C. /ha) followed by T₆ and T₂ respectively, while minimum yield q/ha was recorded under the control treatment. The application of vermicompost, NPK and micro nutrients setting are affected the soil ability and balancing nutrient supply to the plant increase with the result with the study are agreement with the findings of Yadav (2003), Patil *et al.* (2007), Sharma (1988), Singh *et al.* (1994), Jahangir *et al.* (2005) and Bhagwan Singh Choudhary *et al.*, (2013) in garlic crop.

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