Ann. Agric. Res. New Series Vol. 34 (3) : 210-213 (2013)

Growth, yield and quality of garlic (*Allium sativum* L.) as influenced by different nutrient management practices

Bhagwan Singh Choudhary, A.K. Soni and S.L. Khaswan*

Department of Horticulture, S.K.N. College of Agriculture, Jobner-303 329
**e-mail: khaswanshanker07@gmail.com*

Received : June 2012; Revised accepted : July 2013

ABSTRACT

Field experiment was carried out on loamy sand soil at Jobner (Jaipur), during *rabi* season of 2006-07 to study the effect of fertility levels and organic manures on growth, yield and quality of garlic (*Allium sativum* L.). The result indicates that recommended dose of fertilizers (100% RDF) achieved the maximum growth and yield attributes, resulting in 41.7%, 17.7% and 6.3% higher bulb yield over control (9.78 t ha^{-1}), 50, and 75% RDF respectively. The application of vermicompost @ 5 t/ha induced significantly higher growth, yield and quality character over other treatments and at par with poultry manure @ 5 t/ha and yielded 56.9%, 13.3% and 19.1% more bulb yield over control (8.94 t ha^{-1}), vermicompost @ 2.5 t ha^{-1} and poultry manure @ 2.5 t ha^{-1}, respectively.

Key words: Garlic, nutrient management, organic, quality.

Garlic is the second most important bulb crop after onion. India ranks second after China in area (0.2 mha) and third in production (1.06 mt) of garlic with an average productivity of 5.28 t ha^{-1} (Anonymous, 2012). It is used in flavouring foods, preparing chutneys, pickles, curry powder, tomato ketchup, etc. Garlic possesses insecticidal properties. This crop is commercially important and export oriented.

Integrated nutrient supply approach is only the liable way for obtaining fairly high productivity with substantial fertilizer leading to sustainable agriculture. In recent years, use of vermicompost and poultry manure has been advocated in Integrated Nutrient Management system in vegetable crops. Vermicompost is a slow releasing organic manure which have most of the macro as well as micronutrients in chelated from and fulfill the nutrient requirement of plants longer period. Vermicompost helps in reducing C:N ratio, increased humic acid content and provide nutrient in the readily available form to the plants such as nitrate, exchangeable phosphorus, soluble potassium, calcium and magnesium (Talashilkar *et al.*, 1999). Poultry manure also contains traces of micronutrients in addition to major nutrients which are generally not supplied by the commercial fertilizer but essential for plant growth. It is well documented that it is an excellent source of organic manure which increases nutrient uptake (Abusaleha, 1992).

In spite of these advantages, still low productivity of this crop is due to its unscientific cultivation and insufficient research information regarding its nutrient management and moreover, the unawareness among farmers to the judicious use of chemical fertilizers in combination with organic manure. Therefore, there is a need for optimum mineral nutrition to this crop for higher productivity and quality. Keeping these views in mind, the present study was undertaken.

MATERIALS AND METHOD

A field experiment was conducted during *Rabi*, 2006-07 at Horticulture Farm, S.K.N.

College of Agriculture, Jobner (Rajasthan). The experimental soil was loamy sand in texture, having low organic carbon (0.13%), available N (132.75 kg ha^{-1}), medium in available P (17.84 kg ha^{-1}) and K (161.50 kg ha^{-1}). It was slightly alkaline in reaction (pH 8.1). The experiment consists of 20 treatments having combination of 4 levels of fertilizers (control, 50%, 75% and 100% RDF) and 5 levels of organic manures (control, 2.5 t ha^{-1}, 5.0 t ha^{-1} vermicompost and 2.5 t ha^{-1} and 5.0 t ha^{-1} poultry manure). These treatments were evaluated in randomized block design with three replications. As per the treatment, vermicompost (VC) and poultry manure (PM) were incorporated 2 weeks before sowing. The recommended dose of fertilizers (RDF) for this region is 120 kg N, 40 kg P_2O_5 and 100 kg K_2O ha^{-1}. The N, P and K were applied through urea, SSP and muriate of potash, respectively. Half of the N with full dose of P and K was applied as per treatment just before sowing, remaining half in two equal splits at 30 and 50 days after sowing. The garlic variety 'G-1' was sown on 8th November, 2006 using seed rate of 500 kg ha^{-1} at inter and intra row spacing of 15 cm x 10 cm, respectively. Total soluble solids (TSS) were determined by using hand refractometer, volatile oil content and ascorbic acid content were determined by using the standard method recommended by A.O.A.C. (1970) and A.O.A.C. (1990), respectively. The data were statistically analyzed as per method given by Gomez and Gomez (1984).

Results and Discussion

Growth attributes

Significant differences were observed in plant height, leaves per plant, neck thickness and bulb diameter with the application of fertilizers and organic manures (Table 1). Maximum plant height, number of leaves per plant, neck thickness and bulb diameter were observed under 100 % RDF, which were significantly higher over other doses. Such increase in growth attributes were due to increased availability of nutrients. Similar result was also reported by Kumar *et al.* (2002).

Application of vermicompost (VC) @ 2.5 and 5.0 t ha^{-1} being at par with same level of poultry manure (PM) significantly improved the plant height, number of leaves per plant, neck thickness and bulb diameter over no manure. Higher dose of VC and PM were superior over lower doses. The favorable effect of manures on chemical, physical and biological properties of soil might have resulted in higher growth parameters (Thanunathan et al., 1997).

Yield attributes and yield

Successive levels of fertilizers significantly increased the weight of bulb, number of cloves per bulb and bulb yield. Maximum bulb yield (13.86 t ha^{-1}) was obtained with application of 100 % RDF, which is 41.7 % higher over control. Similar result of gradual increase in bulb yield with fertilizer levels was also observed by Singh and Singh (2006).

Application of VC and PM significantly increased the weight of bulb, number of cloves per bulb and bulb yield over no organic manure. However, both the organic manure with same levels was statistically at par with each other. The increase in bulb yield due to application of VC and PM @ 5.0 t ha^{-1} was 56.9 and 51.2% over control and 13.3 and 14.8% over 2.5 t ha^{-1}, respectively. This might be due to the facts that organic manure supplied to balanced nutrition to the crop, improved soil condition and thereby resulting in better growth and development leading to higher yield attributes and yield. The results are in line with those of Shashidhar *et al.* (2005).

Interaction effect of different fertility levels and organic manures was found to be significant on bulb yield (Table 2). The maximum yield of garlic bulb (15.40 t ha^{-1}) was recorded with 100% RDF + 5.0 t ha^{-1} VC treatment combination. These were at par with 75% RDF + 2.5 t ha^{-1} VC, 75% RDF + 5 t ha^{-1} VC, 75% RDF + 2.5 t ha^{-1} PM, 75% RDF + 5.0 t ha^{-1} PM.

Quality parameters

The response of fertilizers on volatile oil and ascorbic acid content was found upto 50% and 75% RDF, respectively. Whereas total soluble solids (TSS) content in bulb did not differ significantly. These results are in proximity with Verma *et al.* (1996).

Table 1. Effect of different fertility levels and organic manures on growth, yield and quality of garlic

Treatments	Plant Height (cm)	Leaves per plant at harvest	Neck thickness (cm)	Bulb diameter Polar (cm)	Weight of bulb (gm)	Cloves per bulb	Bulb yield (t ha^{-1})	Total soluble solids(%)	Volatile oil content (%)	Ascorbic acid content (mg/100gm)
Fertility levels										
Control	32.11	6.55	0.71	2.48	21.06	22.04	9.78	38.12	0.536	9.75
50% RDF	40.24	8.27	0.84	3.11	27.65	25.75	11.78	38.58	0.557	10.52
75% RDF	44.86	9.31	0.91	3.39	31.32	28.27	13.09	38.87	0.568	10.98
100% RDF	47.67	9.94	0.94	3.56	33.54	30.64	13.86	38.98	0.574	11.26
SEm+	0.96	0.21	0.02	0.08	0.63	0.65	0.23	0.46	0.007	0.14
CD (P=0.05)	2.74	0.61	0.05	0.22	1.79	1.87	0.66	NS	0.020	0.40
Organic manures										
Control	31.97	6.60	0.67	2.47	20.99	21.04	8.94	38.14	0.520	9.90
2.5 t ha^{-1} VC	41.49	8.58	0.85	3.16	29.01	26.82	12.38	38.65	0.563	10.67
5.0 t ha^{-1} VC	46.91	9.70	0.96	3.55	32.82	30.37	14.02	39.57	0.576	11.02
2.5 t ha^{-1} PM	40.10	8.29	0.83	3.06	27.57	25.97	11.78	37.62	0.561	10.63
5.0 t ha^{-1} PM	45.63	9.42	0.94	3.43	31.57	29.18	13.51	39.20	0.574	10.93
SEm+	1.07	0.24	0.02	0.08	0.70	0.73	0.26	0.51	0.008	0.16
CD (P=0.05)	3.06	0.68	0.06	0.24	2.01	2.09	0.74	NS	0.022	0.45

Table 2. Interaction effect of different fertility levels and organic manures on bulb yield (t ha^{-1})

Treatments	Control	2.5 t ha^{-1} VC	5.0 t ha^{-1} VC	2.5 t ha^{-1} PM	5.0 t ha^{-1} PM
Control	7.81	9.88	11.30	9.71	10.20
50% RDF	8.33	10.78	14.36	10.83	14.57
75% RDF	9.55	14.23	15.03	12.04	14.58
100% RDF	10.06	14.63	15.40	14.52	14.70
SEm+	0.52				
CD (P=0.05)	1.48				

Application of VC and PM significantly increased volatile oil content and ascorbic acid content over no organic manure, whereas total soluble solids did not differ significantly (Table 1). This might be due to increased activity of nitrate reductase, which helped in synthesis of certain amino acids and protein as reported by Yadav and Vijayakumari (2004).

In view of these findings, it may be concluded that for higher productivity garlic should be fertilized with 75% RDF in conjunction with 2.5 t ha^{-1} vermicompost. Application of vermicompost and poultry manure improves quality of garlic.

References

A.O.A.C. 1970. Official and Tentative methods of analysis. 10th Edn., Washington, D.C.

A.O.A.C. 1990. Official methods of analysis, 18th Edn. Association of Official Agricultural Chemists, Washington.

Abusaleha and Shanmugavelu, K.G. 1988. Studies on the effect of organic v/s inorganic source of nitrogen on growth, yield and quality of okra [*Abelmoschus esculentus* (L.) Monech]. *Ind. J. Hortic.* **45** : 312-318.

Anonymous. 2012. Horticulture Division, Ministry of Agriculture, Government of India.

Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedure for Agricultural Research. John Wiley and Sons, 2nd edition. P. 680.

Kumar, R., Singh, S.S., Rao, V.K. and Kumar, R. 2002. Response of garlic (Allium sativum) to various levels of nitrogen, phosphorus and potassium. *Prog. Hortic.* **34** : 218-22.

Shashidhar, T.R., Charmatti, P.R., Chavan, M.L. and Mannikeri, I.M. 2005. Nutrient uptake and yield of garlic with different organic manures. *Karnataka J. Hortic.* **1** : 98-101.

Singh, A.K. and Singh, S.P. 2006. Effect of levels of nitrogen and phosphorus in conjunction with varying plant densities on some important bulb characters and yield of garlic (*Allium sativum* L.). *Int. J. Agric. Sci.* **2** : 490-492.

Talashilkar, S.C., Bhangarath, P.P. and Mehta, V.B. 1999. Changes in chemical properties during composting of organic residues as influenced by earthworm activity. *J. Indian Soc. Soil Sci.* **47** : 50-53.

Thanunathan, K., Natarajan, S., Senthilkumar, R. and Arulmurugan, 1997. Effect of different sources of organic amendments on growth and yield of onion in mine spoil. *Madras agric. J.* **84** : 382-384.

Verma, D.P., Sharma, B.R., Chanda, A.R.S., Bajpai, H.K. and Bhadauria, U.P.S. 1996. Response of garlic to N, P and K levels. *Adv. Plant Sci.* **9** : 37-41.

Yadav, R.H. and Vijayakumari, B. 2004. Impact of vermicompost on biochemical characters of Chilli (*Capsicum annuum*). *J. Ecotoxicol. Environ. Monit.* **14** : 51-56.