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Effect of vermicompost and sulphur on quality of garlic (*Allium sativum* L.) under semi arid conditions.

S. Verma, M. R. Choudhary*, O.P. Garhwal and P. Ujjainiya
Department of Horticulture, S.K.N. College of Agriculture, Jobner, Rajasthan
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Abstract

An experiment was carried out to study the suitable dose of vermicompost and sulphur for obtaining good quality bulbs of garlic (*Allium sativum* L.) cv. G-41. The experiment comprised of 16 treatment combinations with four levels of each vermicompost (0, 2.5, 5.0 and 7.5 t ha^{-1}) and sulphur (0, 30, 60 and 90 kg ha^{-1}). The application of 5.0 t vermicompost ha^{-1} and 60 kg sulphur ha^{-1} was found suitable in terms of quality and resulted in saving of 2.5 t/ha of vermicompost and 30 kg of S ha^{-1}. Thus, application of 5.0 t vermicompost and 60 kg S ha^{-1} to garlic crop was found significantly better for quality production of bulbs in respect to nitrogen, phosphorus, potassium, sulphur, TSS, ascorbic acid, crude protein and volatile oil content.

Key words*: Bulb, volatile oil, nutrients, TSS, ascorbic acid*

Introduction

Garlic (*Allium sativum)* is the second important bulb crop after onion which belongs to the family amaryllidaceae. It is also included in Indian system of medicines (Ayurvedic, Unani and Siddha) as carminative and gastric stimulant to help in digestion and absorption of food. It is rich in protein, carbohydrate and ascorbic acid and about 142 calories of energy can be obtained from 100 g of garlic. The present experiment was conducted to produce better quality garlic bulb with regard to nutritive, pharmaceutical and flavouring properties. Garlic responds very well to organic manures as well as inorganic fertilizers. The low quality production of garlic bulb might be due to imbalanced fertilization and Poor management practices. Keeping the fact in mind a field experiment was conducted at Horticulture farm, S K N College of Agriculture, Jobner.

Materials and methods

A field experiment was conducted in rabi season during 2010-11 to study the suitable dose of vermicompost and sulphur for obtaining good quality bulbs of garlic (*Allium sativum* L.) cv. G-41. Sixteen treatment combinations with four levels of vermicompost (control, 2.5, 5.0 and 7.5 t ha^{-1}) and four levels of sulphur (control, 30, 60 and 90 kg ha^{-1}) were undertaken in sandy loam soil at horticulture research farm, S.K.N. College of Agriculture, Jobner (Rajasthan). The experiment was laid out in randomized block design with three replications. The soil of experimental plot had 8.2 pH, 0.92dSm^{-1} electrical conductivity, 133.80 kg ha^{-1} available nitrogen, 8.14 kg ha^{-1} phosphorus, 148.15 kg ha^{-1} potash and 8.40 mg kg^{-1} sulphur. Vermicompost and sulphur were applied as basal doses. Sulphur was applied in its elemental form. Besides the treatments, the recommended dose of NPK for garlic (120: 40: 100 kg ha^{-1}) was also applied through urea, single super phosphate and muriate of potash. Full dose of phosphorus and potassium and half dose of nitrogen were applied as basal dose just before sowing and rest half dose of nitrogen was applied 30 days after planting as top dressing. Garlic cloves were sown manually on 15th November having a seed rate of 500 kg ha^{-1} with a spacing of 15 cm X 10 cm.

Five plants were selected randomly from each plot for recording observations on TSS, ascorbic acid content, crude protein, volatile oil and NPKS content in bulbs. The TSS, ascorbic acid, crude protein and volatile oil content in garlic bulb were determined as per methodology suggested by A.O.A.C. (1990). Nitrogen, phosphorus, potassium and sulphur content were estimated as per methods described by Snell and Snell (1949), Jackson (1973), Bhargava and Raghupathi (1993) and Tabatabi and Bremner (1970), respectively.

Results and Discussion

Effect of vermicompost

The findings of present experiment showed that nitrogen, phosphorus, potassium**,** total soluble solids, sulphur and crude protein content of bulb increased significantly with increasing levels of vermicompost up to 5.0 t ha^{-1} (Table 1 & 2) but the ascorbic acid content in bulbs increased significantly up to application of highest dose (7.5 t ha^{-1}) of vermicompost. However, the volatile oil content increased significantly higher up to 2.5 t ha^{-1}

* Corresponding author's email:
mrchoudhary.horti@sknau.ac.in

vermicompost over control. Application of vermicompost might have the ability to increase the availability of nutrients like nitrogen, phosphorus, potassium and sulphur, probably due to higher rate of mineralization and favourable conditions for microbial and chemical activity, which in turn increased the N, P, K and S content in garlic bulbs. Application of vermicompost also helped in vigorous vegetative growth and imparted deep green colour to the foliage which favoured photosynthesis activity of the plants & greater accumulation of food material *i.e.* carbohydrates & more synthesis of TSS content. The increase in protein content might be due to application of vermicompost & increasing availability of N. They also increased the proportion of proteinous substances in the sink. Another reason might be the increased activity of nitrate reductase which helped in synthesis of certain amino acid and protein in bulb (Chinaswamy and Mariakulandi, 1966). The ascorbic acid and volatile content in bulb increased significantly with increasing levels of vermicompost might be due to improved nutritional environment in the rhizosphere as well as its utilization in the plant system. This leads to enhance translocation of nutrients, vitamins and proteins in the bulb, which are required for the synthesis of ascorbic acid and volatile oils. These results are in close agreement with those of Shreeniwas *et al.* (2000) and Yadav and Vijyakumari (2004).

Effect of sulphur

Nitrogen, phosphorus, potassium, sulphur, TSS, ascorbic acid and crude protein content & other quality attributes were increased the in garlic bulbs with increasing levels of sulphur up to 60 kg/ha under the study (Table 1 & 2). However, volatile oil content increased significantly up to 30 kg S ha^{-1}. It is observed that sulphur deficiency prevents utilization of nitrogen and brought about accumulation of soluble nitrogen in the plant leaves. Further, sulphur being an integral constituent of certain amino acids, of which nitrogen is also an essential constituent, might have helped in increasing net assimilation rate of nitrogen. Thus, the application of sulphur significantly increased the nitrogen, crude protein, TSS and ascorbic acid content in garlic bulbs. These results are in close conformity with those of Kumar and Singh (1992). However, the increase in levels of sulphur fertilization might be resulted in higher rate of mineralization and favourable conditions for microbial and chemical activity which ultimately resulted in higher concentration of phosphorus, potassium and sulphur in soil & increased P, K and S content in garlic bulbs. Similar results were also reported by Singh and Srivastava (1993) on potato. As sulphur is directly involved in the metabolism of volatile oil content, there was an increase in volatile oil content with increasing level of sulphur application. These results are in accordance with the findings of Khalaf and Taha (1988), and Srinidhi (2000).

On the basis of experiment results, it could be concluded that the combined application of 5.0 t vermicompost ha^{-1} and 60 kg sulphur ha^{-1} was found suitable in terms of quality and resulted in saving of 2.5 t of vermicompost and 30 kg of S ha^{-1}. Thus, application of 5.0 t vermicompost and 60 kg S ha^{-1} to garlic crop was found overall best treatment from quality point of view.

Table 1. Effect of vermicompost and sulphur on nitrogen, phosphorus, potassium and sulphur content of bulb

Treatments	Nitrogen content (%)	Phosphorus content (%)	Potassium content (%)	Sulphur content (%)
VC levels (t/ha)				
Control (V_0)	2.310	0.275	0.041	1.26
2.5 ($V_{2.5}$)	2.600	0.320	0.047	1.37
5.0 ($V_{5.0}$)	3.070	0.342	0.052	1.43
7.5 ($V_{7.5}$)	3.120	0.357	0.056	1.44
SEm±	0.043	0.005	0.002	0.02
CD at 5%	0.124	0.016	0.004	0.05
S levels (kg/ha)				
Control (S_0)	2.230	0.286	0.039	1.22
30 (S_{30})	2.570	0.316	0.048	1.37
60 (S_{60})	3.100	0.340	0.053	1.44
90 (S_{90})	3.200	0.352	0.056	1.47
SEm±	0.043	0.005	0.002	0.02
CD at 5%	0.124	0.016	0.004	0.05

Table 2. Effect of vermicompost and sulphur on total soluble solids, crude protein, ascorbic acid and volatile oil content of bulb

Treatments	Total soluble solids (%)	Crude protein (%)	Ascorbic acid (mg/100 g)	Volatile oil content (%)
VC levels (t/ha)				
Control (V_0)	37.20	14.44	9.87	0.533
2.5 ($V_{2.5}$)	37.30	16.25	10.02	0.560
5.0 ($V_{5.0}$)	38.20	19.19	10.30	0.572
7.5 ($V_{7.5}$)	38.70	19.50	10.88	0.574
SEm±	0.48	0.23	0.13	0.009
CD at 5%	1.37	0.66	0.37	0.027
S levels (kg/ha)				
Control (S_0)	36.90	13.94	9.70	0.522
30 (S_{30})	37.10	16.06	10.20	0.562
60 (S_{60})	38.50	19.38	10.50	0.576
90 (S_{90})	38.90	20.00	10.67	0.579
SEm±	0.48	0.23	0.13	0.009
CD at 5%	1.37	0.66	0.37	0.027

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