

Original Research Article

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Influence of Integrated Nutrient Management for Garlic under Nilgiris Condition

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ABSTRACT

Keywords

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The present investigation was carried out during the year 2010 -2013 to study the influence of Integrated Nutrient Management module for garlic under Nilgiris condition. The experiment was conducted in Horticultural Research Station, Tamil Nadu Agricultural University, The Nilgiris. Among the nine treatments, the treatment combination of N:P:K:S 75:40:40:40 Kg/ha + 5 t of FYM / ha + 2.5 t of Poultry manure + 2.5 t of Vermicompost / ha performed better in terms of vegetative and yield characters for Garlic under Nilgiris condition and significantly increased the plant height (64.11 cm), number of leaves (9.0), leaf length (41.25 cm), neck thickness(3.6 cm), polar diameter (3.69 cm), equatorial diameter(4.31cm), average weight of 10 bulbs(227 g). A grade bulbs (5.20 %), B grade bulbs (2.50%), C grade bulbs (1.57%), marketable yield (79.38 q/ ha) and total yield (89.10 q/ ha).

Introduction

Garlic (*Allium sativum* L.) has been cultivated since ancient times all over the world especially in Asia. It ranks second in the Alliaceae family. Garlic has medicinal properties and it is an important ingredient of the most spice cooking around the world. Garlic as a spice it is utilized in both fresh and dehydrated state in the food industry. It is dehydrated into different products such as flakes, slices and powders. Garlic bulbs contain alliin, colourless, odourless and water-soluble amino acids. On crushing the garlic bulbs the enzyme allinase breaks down into allin to produce alliin of which the principal ingredient is odoriferous diallyl

disulphide. Garlic is grown worldwide in 14.66 lakh hectares, with a total production of 248.37 lakh tons and productivity of 16.94 tons/ha during the year 2012 as per FAO. China is the world leader in area (8.50 lakh ha) as well as in production (200.00 lakh tons), followed by India (2.02 lakh ha and 11.50 lakh tons). Other major garlic-growing countries are Egypt, Republic of Korea, Russian Federation, Myanmar, Bangladesh, USA, Argentina, Ukraine, Brazil, Spain, Ethiopia, and Iran. India ranks the second leading country in the world for garlic production (1221.88 MT) after China (NHB, 2015). In Tamil Nadu the garlic is cultivated

in an area of 25.74 ('000 ha) with a production of 259.63 ('000mt) and productivity of 10.09 t/ha.

In vegetable crops for obtaining the higher yield excessive amounts of inorganic fertilizers are applied (Steward *et al.*, 2005). The excessive use of chemical fertilizers resulted in deficiency of nutrients other than applied and caused and decline in organic carbon in the soil (Singh *et al.*, 2001). Organic inputs are often proposed as alternatives to mineral fertilizers. However organic inputs, crop residues and animal manures cannot meet crop nutrient demand over large areas because of the limited quantities available (Diriba Shiferaw, 2016). Intensive cropping, imbalanced fertilization and absence of application of micronutrients, less or no use of organic manures could result in the depletion of soil fertility (Palm *et al.*, 1997). Complementary use of chemical fertilizers and organic manures has assumed great importance now days to maintain as well as sustain a higher level of soil fertility and crop productivity (Shalini *et al.*, 2002). Considering the above results application of balanced sources of nutrients to obtain high yield and good quality in garlic. Thus, this research was concentrated more on integrated nutrient management in garlic for obtaining better quality bulbs.

Materials and Methods

The present investigation was carried out during the year 2010 -2013 to study the influence of Integrated Nutrient Management module for garlic under Nilgiris condition. The experiment was conducted in Horticultural Research Station, TNAU, The Nilgiris which is located at 11.4025'N Latitude, 76.735' E Longitude and at an Altitude of 2635 m above Mean Sea Level. The mean annual rainfall of The Nilgiris is 1632 mm. The average maximum and

minimum temperature is 26.0°C and 2°C respectively. The average relative humidity is 75 per cent. The experiment was laid out in a Randomized Block Design (RBD) with twenty seven treatments replicated thrice and treatment details are furnished in Table 1. The garlic bulbs were sown in the plot area of 12 m² and spacing of 15 x 10 cm. All organic manures like Farm Yard Manure (FYM), Vermicompost (VC) and Poultry manure (PM) and bio-fertilizers *viz.*, *Azospirillum* and phosphorus solubilizing bacteria each @ 5 kg each/ ha applied as a basal as per the treatment. 50 % N applied as basal at the time of planting and remaining 50 % N was applied in two equal splits during 30 and 45 days after planting. Full dose of P, K and S applied at the time of planting as per the treatments. In each replication five plants were selected for recording biometrics observations on plant height (cm), number of leaves, leaf length (cm), leaf breadth (cm), neck thickness (cm), polar diameter (cm), equatorial diameter (cm), average weight of 10 bulbs (g). A grade bulbs (%), B grade bulbs (2%), C grade bulbs (1%), marketable yield (q/ ha) and total yield (q/ ha). The data generated during the course of study was subjected to statistical analysis as prescribed by Panse and Sukhatme (2000).

Results and Discussion

The vegetative characters of garlic are very much important as they play a key role in deciding the ultimate crop yield. These parameters significantly differed among the various treatments and the results indicated that significant variation was observed among the treatments for all the characters studied and the results are presented in Table 2.

The application of different treatments had significantly influenced the vegetative growth and thus progressively increased the yield, it is mainly due to the overall treatments effect.

The plant height ranged from 64.11 to 34.71 cm. The highest plant height (64.11cm) was noticed in T₉ followed by T₆ (62.60 cm) and T₂ (60.58 cm). The increased plant height may be attributed due to accumulation of greater photosynthates leading to better growth parameters. These findings are in accordance with the findings of Nain Wal *et al.*, (2015). Number of leaves per plant is one of the most important characters, since it has an important role in photosynthetic capacity for carbohydrate metabolism and photosynthates accumulation and partitioning. Higher number of leaves per plant were noticed in T₉ (9.0 nos), followed by T₆ (8.7 nos) and T₂ (8.3nos). Increase in number of leaves was seen under integrated application of inorganic and organic manures. This might be due to steady release of nutrients throughout the crop growth period. The above finding is in conformity with the reports of Farooqui *et al.*, (2009). Higher leaf length of 41.25 cm was observed in T₉, followed by T₄ which registered 40.10 cm and the lowest leaf length of 25.30 cm was recorded in the treatment T₁. With respect to leaf width, the lowest value was recorded in the treatment T₂ (1.31cm) and the highest was recorded in T₃ (2.14 cm).The increase in leaf breadth is due to

enhanced levels of nutrients and application of *Azospirillum* and Phosphorus Solubilising Bacteria enhanced the leaf length and width. Similar results were recorded by Jawadagi *et al.*, (2012), Naruka and singh (2002) in garlic.

With regard to the neck thickness, T₉ recorded highest neck thickness (3.6 cm) followed by T₂ (3.1 cm) and T₆ (3.0 cm). The lowest neck thickness was recorded in T₈ (2.3 cm). Similarly, maximum polar diameter was recorded in T₉ (3.69 cm) followed by T₆ (3.40 cm) and T₄ (3.20cm). Similar trend was observed in equatorial diameter of garlic bulbs. Maximum equatorial diameter of bulb (4.31 cm) was recorded in the T₉ and the lowest was recorded in the T₂ (2.19cm). Sankar *et al.*, (2005) reported that enhanced vegetative parameters might be due to the major nutrients supplied by the inorganic fertilizers would be utilized quickly by the crop and all other micro and macro nutrients available in organic manures would be released slowly. Hence, the combination of these manures helped to increase the availability of major nutrients which is being the constituent of protein and protoplasm, vigorously inducing the vegetative development of the plants.

Table.1 Treatment details

T₁	100:50:50 kg N:P:K + FYM 20 t /ha (as per TNAU recommendation)
T₂	100:50:50:50 kg NPKS + FYM 20 t / ha (DOGR recommendation)
T₃	75:40:40:40 kg NPKS + FYM 15 t / ha
T₄	75:40:40:40 kg NPKS + poultry manure 7.5 t /ha
T₅	75:40:40:40 kg NPKS + vermicompost 7.5 t / ha
T₆	75:40:40:40 kg NPKS + 7.5 t FYM / ha + poultry Manure 3.75 t / ha
T₇	75:40:40:40 kg NPKS + FYM 7.5 t / ha + vermicompost 3.75 t / ha
T₈	75:40:40:40 kg NPKS + poultry manure 3.75 t / ha +vermicompost 3.75 t / ha
T₉	75:40:40:40 kg NPKS + 5 t FYM / ha + poultry manure 2.5t + vermicompost 2.5 t / ha

Table.2 The effect of integrated nutrient management on growth characteristics of garlic

Treatment details	Plant height (cm)	No. of leaves	Leaf length (cm)	Leaf width (cm)	Polar diameter (cm)	Equatorial diameter (cm)	Neck thickness (cm)
T ₁	57.36	7.2	25.30	1.46	1.64	2.50	2.8
T ₂	60.58	8.3	34.68	1.31	1.90	2.19	3.1
T ₃	59.41	7.9	33.30	2.14	2.45	2.71	2.9
T ₄	57.35	8.1	40.10	1.90	3.20	3.43	2.7
T ₅	34.71	7.4	36.56	2.01	2.15	2.77	2.4
T ₆	62.60	8.7	37.40	1.87	3.40	4.17	3.0
T ₇	59.60	7.4	33.15	1.71	2.17	2.69	2.4
T ₈	55.64	8.1	37.10	1.60	1.75	2.85	2.3
T ₉	64.11	9.0	41.25	1.85	3.69	4.31	3.6
SEd	4.56	0.375	1.67	0.11	0.28	0.232	0.91
Cd (%)	9.71	0.796	3.76	0.21	0.57	0.492	1.58

Table.3 The effect of integrated nutrient management on yield contributing characteristics of garlic

Treatment details	Average bulb weight (g)	A grade bulbs (%)	B grade bulbs (%)	C grade bulbs (%)	Marketable yield (q/ ha ⁻¹)	Total yield (q/ ha ⁻¹)	B:C ratio
T ₁	175.44	4.08	2.19	1.29	50.36	66.40	1: 1.58
T ₂	181.00	4.11	2.59	1.50	62.70	79.55	1: 1.94
T ₃	184.31	4.25	2.10	1.39	64.50	76.02	1: 2.01
T ₄	204.00	4.55	2.25	1.47	68.50	80.45	1: 2.10
T ₅	221.00	4.21	2.69	1.01	61.20	70.02	1: 1.80
T ₆	217.50	5.01	2.70	1.60	70.10	81.35	1: 2.13
T ₇	202.60	4.40	1.85	1.54	62.40	75.41	1: 1.84
T ₈	205.60	3.79	2.00	1.27	60.55	75.08	1: 1.82
T ₉	227.00	5.20	2.50	1.57	79.38	89.10	1: 2.35
SEd	11.01	1.01	0.84	0.07	0.53	0.67	-
Cd (0.05%)	23.62	2.05	1.90	0.15	1.12	1.43	-

The yield characters like average bulb weight (g), A grade bulbs (%), B grade bulbs (%), C grade bulbs (%), marketable yield (q/ha) and total yield (q/ha) were significantly influenced by the application of organic and inorganic manures and the results were presented in Table 3. The data registered on maximum average bulb weight (227.0g) was found in T₉ whereas the minimum average bulb weight in treatment T₁ (175.44g). The size of bulb was directly influenced by the enhanced

vegetative growth *i.e.* increase in height and number of green leaves (Kore *et al.*, 2006; Gaiki *et al.*, 2006). The increased availability of nutrients and production of growth promoting substances might have caused faster cell elongation and multiplication in turn increased size of the bulb. It was also reported by Kuldeep Sevak *et al.*, (2012) and Dalal and Nandkar (2010). In the present study, maximum percentage of A grade bulbs (5.20%), B grade bulbs (2.50%) and C grade

bulbs (1.57%) was recorded in T₉. Similar trend was also observed for total bulb yield per ha was recorded in the treatment T₉ (89.10 q/ha) followed by the treatment T₆ (81.35 q/ha) and treatment T₄ (80.45 q/ha), which were significantly superior over to rest of the treatments under study. The lowest total bulb yield per ha (66.40 q/ha) was recorded in the treatment T₁.

With respect to the marketable yield highest was observed in T₉ (79.38 q/ha) followed by T₆ (70.1 q/ha) and lowest marketable yield was observed in T₁ (50.36 q/ha). Biometric observations as well as bulb characters and yield of garlic were significantly influenced by the combined use of inorganic chemical fertilizers with organic sources of nutrients. This might be due to gradual and steady release of nutrients during the growth period as well as enhanced biological activity and proper nutrition to the crop (Vijay Kumar Singh *et al.*, 2015 and Patil *et al.*, 2007). The cost of garlic cultivation among the treatments includes human labour, land preparation, seed, manures, fertilizers, insecticides, irrigation, etc. were calculated on per hectare basis. Among the treatments, the highest net return was obtained in the T₉ (1:2.35) followed by T₆ (1: 2.13) from garlic cultivation. It could be concluded from the present investigation that N: P: K: S 75:40:40:40 Kg/ha + 5 t of FYM / ha + 2.5 t of Poultry manure + 2.5 t of Vermicompost / ha have performed better in terms of vegetative and yield characters for Garlic under Nilgiris condition

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