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Effect of integrated nutrient management (INM) on yield parameters of Brinjal

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Abstract
An experiment was conducted at Research Field, Department of Horticulture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, College of Agriculture, Gwalior (M.P.) during rabi season (2016-2017) to see the effect of INM on yield of Brinjal (*solanum melongena* L.) cv. NDBH-6. Nine treatments of integrated nutrient management viz., 100% RDF (100:60:40 kg/ha) (T_1), 100% FYM (20 t/ha) (T_2), 100% VC (3 t/ha) (T_3), 50% FYM (10 t/ha) + 50 % VC (1.5 t/ha) (T_4), 50% RDF (50:30:20 NPK kg/ha) + 50 % VC (1.5 t/ha) (T_5), 25% RDF (25:15:10 NPK kg/ha) + 75% VC (2.25 t/ha) (T_6), 50% RDF (50:30:20 NPK kg/ha) + 50% FYM(10 t/ha) (T_7), 25% RDF (25:15:10 NPK kg/ha) + 50% FYM(10 t/ha) (T_8) and control (T_9) (no use of fertilizer) were evaluated in Randomized Block Design with three replications with plot sizes of 2 m × 3 m. Significantly higher values of yield attributes such as number of fruits per plant, fruit yield/plant, fruit yield/plot and fruit yield/ha were observed under T_7. However, significantly minimum values of yield attributes were observed under control T_9 (no use of fertilizer). The economic point of view maximum gross and net return was found with treatment T_7. However, the minimum gross and net return was achieved with control T_9 (No use of fertilizer) and the highest B:C ratio of 4.24 was obtained with T_7. Whereas, the lowest B:C ratio of 1.77 was obtained under control T_9 (No use of fertilizer)

Keywords: Brinjal, INM, Organic, chemical fertilizers

Introduction

The eggplant or Brinjal is cultivated as one of the leading and the second major vegetable crops next to tomato, Brinjal (*Solanum melongena* L.) popularly known as eggplant, Aubergine, or Guinea squash is one of the non tuberous species of the night shade belongs to family Solanaceae. The varieties of Brinjal show a wide range of fruit shapes and colors, ranging from oval or egg-shaped to long club shaped; and from white, yellow, green through degrees of purple pigmentation to almost black. It is an economically important crop in Asia, Africa and the sub-tropics (India, Central America) and it is also cultivated in some warm temperate regions of the Mediterranean and South America. India is its center of origin and diversity. It can be grown in almost all states of India, except in the higher altitudes. It is a popular and principle fruit vegetable grown in India and other parts of tropical and subtropical world but in temperate regions, it is grown mainly during warm season. It is highly productive and usually finds a place as "poor man's crop". Major states growing brinjal are West Bengal, Orissa, Bihar and Gujarat. Brinjal is used in a variety of culinary preparations since ancient times. It is a staple vegetable in many tropical countries. Purple fruits have higher amino acid content. Brinjal fruits have medicinal properties. Some medicinal use of eggplant tissues and extract include treatment of diabetes, asthma, cholera, bronchitis and diarrhea, its fruit and leaves are reported to lower certain levels of blood cholesterol. The growth, yield and fruit quality of Brinjal are largely dependent on number of interacting factors.

Now-a-days demand for Brinjal as a fruit vegetable is increasing rapidly among the vegetable consumers in view of its better fruit color, size and taste. Average productivity of brinjal crop is quite low and there exists a good scope to improve its average productivity in India to full fill both domestic and national needs. Only one source of nutrients like chemical fertilizers, organic manures and biofertilizers cannot improve the production or maintain the production sustainability and soil health. The integrated nutrient management is very useful in this context. Integrated plant nutrient management is the intelligent use of optimum combination of organic and inorganic nutrient sources in a specific crop, cropping system and climatic situation so as to achieve and to sustain the optimum yield and to improve or to maintain the soils physical, biological and chemical properties. Such a crop nutrition package has to be technically sound, economically attractive, practically feasible and environmentally safe.

Material and methods

The field experiment was conducted at Department of Horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (M.P.), during rabi season (2016-2017). The soil was sandy loam. The experiment was laid out in Randomized Block Design (RBD) with three replications. Each replication consists of 9 treatments. Treatments were randomized separately in each replication. Each plot measured 2m×3m with distance between plant to plant and row to row was 60×45 cm. The nursery beds was 1m wide, 3m long and 20 cm high from the ground. Different combination of fertilizers, Farmyard manure and Vermicompost were applied with control (no use of fertilizer). Seedlings were transplanted with the spacing of 60 cm row to row and 45 cm plant to plant. Nitrogen, phosphorus and potassium were applied, through urea, single super phosphate and murate of potash respectively. The observations were recorded on yield and yield attributing parameters as Number of fruits per plant, Fruit yield per plot (kg), and Fruit yield per ha. (q). Number of fruits per plant was harvested from five randomly selected plants in each treatment and collected during each picking counted and totaled together and average fruits plant^{-1}was calculated, and Fruit yield per plot (kg) in which weight of fruits of the plot was recorded at each picking and the average weight of the fruits per plot was calculated in kg during the period of experimentation. Nine treatments of integrated nutrient management *viz.*, (T_1) 100% RDF (100:60:40 kg/ha), (T_2) 100% FYM (20 t/ha), (T_3) 100% VC (3 t/ha), (T_4) 50% FYM (10 t/ha) + 50 % VC (1.5 t/ha), (T_5) 50% RDF (50:30:20 NPK kg/ha) + 50 % VC (1.5 t/ha), (T_6) 25% RDF (25:15:10 NPK kg/ha) + 75% VC (2.25 t/ha), (T_7) 50% RDF (50:30:20 NPK kg/ha) + 50% FYM(10 t/ha), (T_8) 25% RDF (25:15:10 NPK kg/ha) + 75% FYM(10 t/ha) and control (T_9) (no use of fertilizer) were evaluated in Randomized Block Design with three replications.

RDF=Recommended dose of fertilizer, FYM= Farmyard manure, VC= Vermicompost, NPK= Nitrogen Phosphorus Potash

Results

Number of fruits/plant

Data presented in Table 1 revealed that **s**ignificantly higher number of fruits/plant (28.22) was observed under T_7 [50% RDF (50:30:20 NPK kg/ha) + 50 % FYM (10 t/ha)], which remained statistically at par with T_5 [50% RDF (50:30:20 NPK kg/ha) + 50 % VC (1.5 t/ha)] (27.27), T_1 [100% RDF (100:60:40 kg/ha)] (26.33), T_2 [100% FYM (20 t/ha)] (25.95) and T_4 [50% FYM (10 t/ha) + 50% VC (1.5 t/ha)] (24.13). While, significantly the lowest number of fruits per plant (18.84) was observed under T_9 [control (No use of fertilizer)] which remained statistically at par with T_6 [25% RDF (25:15:10 NPK kg/ha) + 75 % VC (2.25 t/ha)] (21.44), T_8 [25% RDF (25:15:10 NPK kg/ha) + 75 % FYM (15 t/ha)] (22.33) and T_3 [100% VC (3 t/ha)] (22.44).

Fruit yield / plant

Fruit yield/plant was recorded at harvest i. e. (that is presented in table 1). Significantly higher fruit yield / plant (11.40 kg) was observed under T_7 [50% RDF (50:30:20 NPK kg/ha) + 50 % FYM (10 t/ha)], which remained statistically at par with T_5 [50% RDF (50:30:20 NPK kg/ha) + 50 % VC (1.5 t/ha)] (10.19 kg) and T_1 [100% RDF (100:60:40 kg/ha)] (9.87 kg). While, significantly the lowest fruit yield/plant (4.30 kg) was observed under T_9 [control (No use of fertilizer)] which remained statistically at par with T_6 [25% RDF (25:15:10 NPK kg/ha) + 75 % VC (2.25 t/ha)] (7.23 kg), T_8 [25% RDF (25:15:10 NPK kg/ha) + 75 % FYM (15 t/ha)] (8.00 kg) and T_4 [50 % FYM (10 t/ha) + 50% VC (1.5 t/ha)] (8.08 kg).

Fruit yield/plot (kg)

Significantly higher Fruit yield/plot (342.00 kg) was observed under T_7 [50% RDF (50:30:20 NPK kg/ha) + 50 % FYM (10 t/ha)], which remained statistically at par with T_5 [50% RDF (50:30:20 NPK kg/ha) + 50 % VC (1.5 t/ha)] (305.70 kg) and T_1 [100% RDF (100:60:40 kg/ha)] (296.00 kg). While, significantly the lowest fruit yield/plot (130.00 kg) was observed under T_9 [control (No use of fertilizer)] which remained statistically at par with T_6 [25% RDF (25:15:10 NPK kg/ha) + 75 % VC (2.25 t/ha)] (216.80 kg), T_8 [25% RDF (25:15:10 NPK kg/ha) + 75 % FYM (15 t/ha)] (240.00 kg) and T_4 [50 % FYM (10 t/ha) + 50% VC (1.5 t/ha)] (242.40 kg).

Table 1: Number of fruit/plant, fruit yield/plant, Fruit yield/plot and fruit yield/ha as influenced by INM treatments

Treat.	Treatments	No. of fruits/plant	Fruit yield/plant (kg)	Fruit yield/plot (kg)	Fruit yield/ha. (q)
T_1	100% RDF (100:60:40 kg/ha)	26.33	9.87	296.00	74.00
T_2	100% FYM (20 t/ha)	25.95	9.19	275.60	68.90
T_3	100% VC (3 t/ha)	22.44	8.55	256.40	64.10
T_4	50% FYM (10 t/ha) + 50% VC (1.5 t/ha)	24.13	8.08	242.40	60.60
T_5	50% RDF (50:30:20 NPK kg/ha) + 50 % VC (1.5 t/ha)	27.27	10.19	305.70	76.43
T_6	25% RDF (25:15:10 NPK kg/ha) + 75 % VC (2.25 t/ha)	21.44	7.23	216.80	54.20
T_7	50% RDF (50:30:20 NPK kg/ha) + 50 % FYM (10 t/ha)	28.22	11.40	342.00	85.50
T_8	25% RDF (25:15:10 NPK kg/ha) + 75 % FYM (15 t/ha)	22.33	8.00	240.00	60.00
T_9	Control (No use of fertilizer)	18.84	4.30	130.00	32.50

Fruit yield/ha. (q)

Significantly higher Fruit yield/ha (85.50 q) was observed under T_7 [50% RDF (50:30:20 NPK kg/ha) + 50 % FYM (10 t/ha)], which remained statistically at par with T_5 [50% RDF (50:30:20 NPK kg/ha) + 50 % VC (1.5 t/ha)] was (76.43q) and T_1 [100% RDF (100:60:40 kg/ha)] (74.00). While, significantly the lowest fruit yield/ha (32.50 q) was observed under T_9 [control (No use of fertilizer)] which remained statistically at par with T_6 [25% RDF (25:15:10 NPK kg/ha) + 75 % VC (2.25 t/ha)] (54.20), T_8 [25% RDF (25:15:10 NPK kg/ha) + 75 % FYM (15 t/ha)] (60.00) and T_4 [50 % FYM (10 t/ha) + 50% VC (1.5 t/ha)] (60.60).

Discussion

Significantly higher values of yield parameters *viz*., Number of fruits/plant (28.22), Fruit yield/plant (11.40 kg), Fruit yield/plot (342.00 kg) and Fruit yield/ha. (85.50 q) were observed under 50% RDF (50:30:20 NPK kg/ha) + 50% FYM(10 t/ha) (T_7) which remained statistically at par with 50% RDF (50:30:20 NPK kg/ha) + 50% VC (1.5 t/ha) (T_5) and 100% RDF (100:60:40 kg/ha) (T_1) in most of the cases. However, significantly lower values of yield and yield attributing parameters *viz*., number of fruits per plant (18.84), fruit yield/plant (4.30 kg), fruit yield/plot (130 kg) and fruit yield/ha (32.50) were observed under control (T_9). More number of fruits plant^{-1} is related with the vegetative growth of the plant. When the plants have increased number of leaves (food factory) this will result in vigorous growth of plants. Hence nutrition is responsible for the vigorous growth of plants (vegetative) and resulted in more number of leaves, which gives more number of fruits plant^{-1} ultimately. Similar results have been reported by Aminifard *et al.* (2010) and Biswas *et al.* (2015).

The yield of any crop is the final index of the experiment which indicates the success or failure of any treatment with this view the fruit yield of brinjal was recorded. NPK promotes growth and increases biomass production, and nitrogen fertilization has been used to increase growth and yield of eggplant. In excess, NPK may have adverse effects on the vitality of plants. Extra nitrogen fertilizers cause changes in the shoot/root ratio and reduce mycorrhizal induction in soil. The reduced activity of roots can create a nutrient imbalance. Similar results have been reported by Aminifard *et al.* (2010), Nafiu *et al.* (2011), Agarwal and Sharma (2014), Biswas *et al.* (2015) and Zainub *et al.* (2016).

The probable reason for enhanced fruit yield may be due to cumulative effects of nutrient (macro and micro) on vegetative growth which ultimately lead to more photosynthetic activities while, application of nutrient levels enhance carbohydrate and nitrogen metabolism of pectic substances, as well as improve the water metabolism and water relation in the plants. These findings are in agreement with the findings of Reddy *et al.* (2002), kumar and Gowda (2010), Mujawar (2012), Kashyap *et al.* (2014) and Umalaxmi *et al.* (2015).

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