Agricultural Research & Technology:
Open Access Journal

Review Article
Volume 1 Issue 3 - February 2016

Agri Res & Tech: Open Access J

Integrated Nutrient Management in Brinjal- A Review Study

Umalaxmi Thingujam[1]*, Dipa Kundu[1], Rubina Khanam[1], Dipa Manik[1] and Victor Thingujam[2]

[1]*Department of Agricultural Chemistry & Soil Science, Bidhan Chandra Krishi Viswavidyalaya, India*

[2]*Department of Forest Product and Utilisation, Orissa University of Agriculture and Technology, India*

Submission: January 14, 2016; **Published:** February 19, 2016

***Corresponding author:** Umalaxmi Thingujam, Department of Agricultural Chemistry & Soil Science, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal – 741252, India, Tel: 9002582245; Email: thingujam9@gmail.com

Abstract

Brinjal (*Solanum melongena L.*) popularly known as egg plant belongs to family Solanaceae and India is its center of origin and diversity. It is highly productive and usually finds a place as "poor man's crop". The growth, yield and fruit quality of brinjal are largely dependent on number of interacting factors. On the other hand egg plant is a long duration crop with high yield which removes large quantities of nutrients from the soil. An egg-plant crop yielding 60t ha^{-1} of fruit removes 190 kg N, 10.9 kg P and 12 8kg K from soil. Now-a-days demands for brinjal as a fruit vegetable is increasing rapidly among the vegetable consumers in view of its better fruit color, size and taste 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, inorganic and biological 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 soil's physical, biological and chemical properties. Such a crop nutrition package has to be technically sound, economically attractive, practically feasible and environmentally safe.

Keywords: Brinjal; Biofertilizers; Integrated nutrient management; Micronutrients; Fertilizers

Introduction

The egg plant 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 egg plant belongs to family Solanaceae and India is its center of origin and diversity [1]. 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 [2]. 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 Rajan and Markose [3]. Some medicinal use of eggplant tissues and extract include treatment of diabetes, asthma, cholera, bronchitis and diarrhoea, 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. On the other hand egg plant is a long duration crop with high yield which removes large quantities of nutrients from the soil. An egg-plant crop yielding 60t ha^{-1} of fruit removes 190kg N, 10.9kg P and 128kg K from soil [4]. 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, inorganic and biological 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 soil's physical, biological and chemical properties. Such a crop nutrition package has to be technically sound, economically attractive, practically feasible and environmentally safe [5].

Bio-Fertilizers in Brinjal Cultivation

Inoculation with *A. awamori* and *A. fumigatus* along with rock phosphate recorded maximum increase in dry matter (33.24% and 27.34%, respectively), N uptake (50.71% and 43.82%, respectively), P uptake (62.65% and 60.20%, respectively) and fruit yield (35.96% and 32.94%, respectively) over uninoculated control. Inoculants either with single superphosphate or rock phosphate increased the fruit yield of brinjal in the range of 3.00 to 39.25% over uninoculated control [6].

The highest yield of 36.94 t per ha was recorded in the plots treated with 100% NPK + FYM + *Azospirillum* + phosphobacteria which was closely followed by 36.48 tonnes per ha with application of 75:75:100 kg NPK per ha + FYM + *Azospirillum* + phosphobacteria. The lowest yield of 20.13 t per ha was obtained from application of 75:75:100 kg NPK per ha alone in brinjal cv. Palur-1 [7].

Azotobacter when applied to nursery seedling and field soil resulted in maximum values with respect to number of fruits per plant, fruit yield per plant, seed yield per plant in tomato. At the harvesting stage, K content was higher in the treatments involving organic manure + inorganic fertilizers + biofertilizers than the treatments with different levels of inorganic fertilizers alone while working with brinjal cv. Palur [8]. A 74% increase in yield of brinjal was obtained over the recommended rate of N fertilizer due to inoculation with mixture of Azotobacter + *Azospirillum* and followed by application of 75 kg N per ha. 25 per cent of N was saved through the use of biofertilizers with increase in yield over recommended 100 kg N per ha [9].

N-fixing biofertilizers could reduce the use of inorganic nitrogen by 25-50%. The performance of inoculants as biological tool for combating pollution due to agro-chemicals merits adequate attention. In case of biofertilizers, combined inoculation of Azotobacter + phosphorus solubilizing bacteria (PSB-*Bacillus polymyxa*) was found most effective over their sole inoculation and control [10].

Micronutrients and Brinjal

In brinjal cv. Bhagyamathi, soil application of 12.5 kg $ZnSO_4$ ha^{-1} along with 3 sprays of 0.2% $ZnSO_4$ and 0.5% $FeSO_4$ thrice at weekly interval at later stages recorded significantly highest fruit yield of 37.7 t ha^{-1} with 23.6% increased over control [11]. A maximum yield (21.90 t ha^{-1}) was obtained under the combined application of NPK (100: 50: 50 kg ha^{-1}) + $ZnSO_4$ @ 25 kg ha^{-1} + $FeSO_4$ @ 50 kg ha^{-1} + organic product over NPK (100: 50: 50 kg ha^{-1}) application alone (16.28 t ha^{-1}) and control (12.90 t ha^{-1}) in brinjal cv. 'CVK (Coimbatore Var Kathiri)'. He also recorded that the 'Fe' uptake ranged from 2.16 to 3.49 kg ha^{-1} as well as 'Fe' content in brinjal fruit ranged from 313 to 401ppm. They concluded that brinjal responded well to the application of micronutrient alone and in combination with NPK and other organic sources [12]. Application of 0.3 per cent borax as foliar spray improved the fruit size, ascorbic acid content, TSS and also reduced the fruit cracking [13].

Growth and Yield of Brinjal Supported by Inm

Plant height and basal girth

Significant improvement in vegetative characters such as plant height and number of leaves per plant in brinjal over the recommended rate of N fertilizer due to inoculation with mixture of Azotobacter + *Azospirillum* and followed by application of 75 kg N ha^{-1} [14]. Increase in the N rate increased the number of fruits, fruit weight and yield per plant and fruit circumference and fruit volume in summer brinjal [9].

FYM + PM (pressmud) at 12.5 t ha^{-1} each along with 100% NPK (100:50:50) + biofertilizers recorded the highest values for plant height (108.90 cm), number of primary branches (11.66) and number of leaves (94.05), whereas FYM at 25 t ha^{-1} along with 100% NPK + biofertilizers recorded the highest values for stem girth (3.71 cm), number of secondary branches (15.58) and leaf area (68.62 cm^2) [15].

Fruit yield

FYM at 25 t ha^{-1} along with 100% NPK (100:50:50) + biofertilizers recorded the highest fruit set percentage (65%), number of fruits (26.64), fruit yield per plot (62.92 kg) and estimated fruit yield (31.67 t ha^{-1}) Anburani and Manivannan [16].

Combining organic fertilizers, namely 12.5 t ha^{-1} of farmyard manure, and 2 kg each of *Azospirillum* and phosphobacteria, with inorganic fertilizers at 75% of the recommended dose of N and P, and 100% of K (namely 75 kg N, 37.5 kg P and 22.5 kg K ha^{-1}) favourably influenced the growth parameters with a maximum yield of 36.48 t ha^{-1} Nanthakumar and Veeraragavathatham [8].

Application of 25 t FYM ha^{-1} + 100 : 50 : 50 kg NPK ha^{-1} + bio fertilizers resulted in the maximum number of fruits (26.64 per plant), fruit length (10.77 cm), fruit girth (10.03 cm), fruit weight (54.11 g) and fruit yield of brinjal (1.43 kg per plant in brinjal cv. Annamalai [17].

Foliar application of borax (0.5%) at 35, 50 and 65 DAT was found to be best in terms of number of flowers per plant, number of productive flowers per plant, number of fruits per plant, individual fruit weight and yield (32.15 t ha^{-1}), followed by copper sulphate (0.5%) and zinc sulphate (0.5%) sprayed at 35, 50 and 65 DAT in brinjal cv. Annamalai [18].

How to cite this article: Umalaxmi T, Dipa K, Rubina K, Dipa M, Victor T. Integrated Nutrient Management in Brinjal- A Review Study. Agri Res & Tech: Open Access J. 2016; 1(3): 555562.

The number of fruits per plant and fruit yield per ha were recorded statistically higher when the crop was transplanted in 10th June and supplied with 125:62.5:62.5:25 kg N: P: K: Zn per ha in brinjal cv. BR-112 [19]. Application of either 100 per cent of recommended dose of nitrogen and phosphorus (100:80 kg NP/ha)+ FYM @ 20 t ha^{-1} or 75 per cent of recommended dose of N and P+ FYM @ 20 t ha^{-1} was found to be more beneficial for sustaining growth and yield of brinjal crop [11].

Inm and Quality Parameters of Brinjal

Maximum number of fruits per plant (12.9), percentage of fruit set (32.5) and means weight of fruit (68.8 g) with the treatment receiving 75 kg N, 20 kg P_2O_5 and 25 kg K_2O ha^{-1} in brinjal cv. 'Surya' [20]. The plant height, number of branches $plant^{-1}$ and other growth parameters were significantly increased due to the application of N through organic and inorganic combinations [21].

Maximum ascorbic acid, carbohydrate and crude protein contents were recorded in 100% NPK (100:50:30 kg ha^{-1}) + FYM + *Azospirillum* + phosphobacteria treatment [7]. Increased N and P rates increased the root lengths when N: P at 200:100 kg per ha was applied in brinjal hybrid COBH-1 [22].

Combined application of farmyard manure at 25 t ha^{-1} along with 100:50:50 kg of NPK per ha and biofertilizers was the best in increasing the quality of fruits [17]. Applying additional trace elements to the soil increased growth and flowering compared with NPK alone [18]. application of 100% recommended dose of N, P and K (80:80:60 kg ha^{-1}) +5 t ha^{-1} vermicompost with 125% recommended dose of N, P and K+ 5 t ha^{-1} vermicompost [23]. It was at par with 125% recommended dose of N, P and K+5 tones ha^{-1} of vermicompost and exhibited maximum of nitrogen, phosphorus, potassium, iron and crude protein content in brinjal fruit.

Inm and Nutrient Content and Uptake in Brinjal

Application of 25 t FYM ha^{-1} + 75 % N + 100 % P + 100 % K resulted in the highest available N (299.9 kg ha^{-1}), P_2O_5 (44.2 kg ha^{-1}) and K_2O (321.9 kg ha^{-1}) and the highest uptake of N, P and K at harvest tomato cv. 'Megha' [24].

The content of 'Zn' in brinjal fruit ranged from 112.8 to 154.4 ppm and the 'Zn' uptake ranged from 278 to 493 g ha^{-1}. It was also recorded that the 'Fe' uptake ranged from 2.16 to 3.49 kg ha^{-1} as well as 'Fe' content in brinjal fruit ranged from 313 to 401 ppm in brinjal cv. 'CVK' in Coimbatore They also concluded that brinjal responded well to the application of micronutrient alone and in combination with NPK and other organic source [13].

The highest N and P uptake during the kharif and rabi seasons. These treatments also recorded the highest fruit yields of 58.51 and 58.42 t ha^{-1} during the kharif season and 55.29 and 55.14 t ha^{-1} during the rabi season, respectively [25].

Inm and Dry Matter Content in Brinjal

In 'Palur-1' cv. of brinjal root length and dry matter production were significantly higher from the plants receiving the fertilizer level of 200: 100: 60 kg NPK ha^{-1} [26].

Application of 100% RDF (150 : 75 : 75 kg ha^{-1} N:P_2O_5:K_2O) together with FYM @ 5 t ha^{-1} increased dry pod yield (mean 639 kg ha^{-1}) significantly over 50 % RDF (558 kg ha^{-1}). The highest plant height, dry matter accumulation and nutrient uptake were decreased at 200 kg N and 100 kg P_2O_5 ha^{-1} [22].

The effects of manures on leaf number, leaf area index, dry matter production and other growth and yield characters were significantly better in those inorganic fertilizer like FYM + NPK. Manure treatment was equally effective compared to NPK treatment in the induction of early flowering in brinjal, the highest fruit yield was obtained (12.31 t per ha) with the treatment FYM + vermicompost, followed by neem cake Rao and Sankar [27].

K at 20 kg ha^{-1} in brinjal resulted in the highest fruit yield (103.57 t ha^{-1}), fruit weight (1317.40 g), number of fruits per plant (34.71), fruit length (13.81 cm), fruit diameter (8.40 cm), fruit dry matter (23.16 g), and biomass per plant (140.40 g) [28].

Conclusion

The role of integrated management of nutrients in vertical expansion of vegetable production in a resource poor situation is quite imperative, as emerged through the outcome of the present investigation. Bio-fertilizers and micronutrients have been observed to excel in promoting vegetable yields and restoring soil fertility in a sustainable way. The emerging agenda of exhaustive use of mineral fertilizers to meet the food needs of human populations by the year 2020, especially in the developing countries, even though organic sources can and should make a larger contribution to supply plant nutrients. In future vegetable production will be influenced by decreasing natural resources like land, water and nutrients. However there have been reports of either no response to higher doses of nutrients or stagnation in the yield upon sole application of chemical fertilizers. Furthermore, the use of expensive chemical fertilizers as per the requirement of the crop is not affordable to the average farmers in developing countries and complete reliance on the use of fertilizers ignoring bio-organic materials affect the soil environment. This calls for judicious management of natural resources and evolving cost-efficient technologies which can push up vegetable production at a lesser cost rather than expanding the area. Nutrient management research in the next decade should basically help to maintain the soil productivity and to enhance and fertilizer use efficiency for a sustainable production without harming the environment.

How to cite this article: Umalaxmi T, Dipa K, Rubina K, Dipa M, Victor T. Integrated Nutrient Management in Brinjal- A Review Study. Agri Res & Tech: Open Access J. 2016; 1(3): 555562.

References

1. Saravaiya SN, Patel NB, Ahir MP, Patel NM, Desai KD, et al. (2010) Integrated Nutrient Management (INM) Approach for Brinjal (*solanum melongena* l.) and othersolanaceous vegetables -a review. Agric Rev 31(2): 79-92.
2. Rai M (1995) Catalogue on Eggplant (*Solanum melongena* L.) germplasms part–I. National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi, India, pp. 1-3.
3. Rajan S, Markose BL (2002) Propagation of Horticultural Crops. Horticultural Sci Series 6: 94.
4. Hedge DM (1997) Nutrient requirement of solanaceous vegetable crops. Food Fert Tech Technical Bull p. 9.
5. Hedge R, Rudragouda (2003) Integrated plant nutrient Management. Principle and Practices. Employment News 3: 21-27.
6. Gaikwad RM, Wani PV (2001) Response of brinjal (cv. Krishna) to phosphate solubilizing biofertilizers. J Maharashtra Agric Univ 26(1): 29-32.
7. Nanthakumar S, Veeraragavathatham D (2001) Effect of integrated nutrient management on yield and quality attributes of brinjal (*Solanum melongena*.) cv. PLR 1. South Indian Hort 49(Special): 195-198.
8. Nanthakumar S, Veeraragavathatham D (2003) Role of integrated nutrient management on the nutrient content of plant tissues in brinjal (*Solanum melongena* L.) cv. PLR.1. South Indian Hort 51(1/6): 163-167.
9. Wange SS, Kale RH (2004) Effect of biofertilizers under graded nitrogen levels on brinjal crop. J Soils and Crops 14(1): 9-11.
10. Khan MA, Zargar MY, Ara S (2008) Performance of carrier-based inoculants in some vegetable crops grown in Srinagar, Kashmir. J Plant Sci Res 24(2): 215-217.
11. Singh D, Mukherjee S (2010) Effect of farm yard manure, chemical and biofertilizers on growth parameters and yield of brinjal (*Solanum melongena* L). Green-Farming 1(2):155-157.
12. Raj GB, Patnaik MC, Reddy IP, Rao AP (2001) Response of brinjal (*Solanum melongena* L.) to zinc and iron. Veg Sci 28(1): 80-81.
13. Selvi D, Thiageshwari S, Santhy P, Kannan BR (2004) Fruit yield and nutrient uptake by brinjal due to integrated nutrient management in an Inceptisol. J Maharastra Agric Uni 29(2): 220-223.
14. Paithankar DH, Sadawarte KT, Mahorkar VK, Dipali D (2004) Effect of foliar application of boron and DAP fertilization on quality of tomato. J Soils and Crops 14(1): 46-49.
15. Chauhan KS, Bhadoria SKS, Nagaich KN (2007) Effect of different levels of nitrogen and phosphorus with NAA concentration on quality characters of summer brinjal. Bhartiya Krishi Anusandhan Patrika 22(2): 167-170.
16. Anburani A, Manivannan K (2002) Effect of integrated nutrient management on growth in brinjal (*Solanum melongena* L.) cv. Annamalai. South Indian Hort 50(4/6): 377-386.
17. Anburani A, Manivannan K, Shakila A (2003) Integrated nutrient and weed management on yield and yield parameters in brinjal (*Solanum melongena* L.) cv. Annamalai. Plant Archives 3(1): 85-88.
18. Karuppaiah P (2005) Foliar application of micronutrients on growth, flowering and yield characters of brinjal cv. Annamalai. Plant Archives 5(2): 605-608.
19. Suthar MR, Singh GP, Rana MK, Makhanlal (2005) Growth and fruit yield of brinjal (*Solanum melongena* L.) as influenced by planting dates and fertility levels. Crop Res Hisar 30(1): 77-79.
20. Philip J (1995) Effect of graded doses of N, P and K on yield of brinjal (*Solanum melongena* LINN). J Trop Agric 33: 167-170.
21. Shelke SR, Adsule RN, Amrutsagar VM (1999) Nitrogen management through organics and inorganics in brinjal. J Maharastra Agric Univ 24(3): 297-298.
22. Prabhu M, Veeraraghavathatham D, Srinivasan K (2003) Effect of nitrogen and phosphorus on growth and yield of brinjal hybrid COBH-1. South Indian Hort 51(1-6): 152-156.
23. Choudhary M, Soni AK, Jat G (2007) Effects of organic and inorganic sources of nutrients on quality of brinjal (*Solanum melongena* L.) cv. Pusa Uttam. Haryana J Hort Sci 36(1/2): 118-119.
24. Harikrishna BL, Channal HT, Hebsur NS, Dharmatti PR, Sarangamath PA (2002) Yield and economic analysis of tomato as influenced by integrated nutrient management. Karnataka J Agric Sci 15: 373-374.
25. Prabhu M, Veeraragavathatham D, Srinivasan K, Pugalendhi L, Rajangam J (2004) Studies on the uptake of nutrients by brinjal hybrid COBH 1. South Indian Hort 52(1/6): 122-127.
26. Vijayakumar A, Arunachalam M, Suthanthirapandian IR (1995) Influence of mother crop nutrition and spacing on yield and quality in brinjal. South Indian Hort 43(5/6): 152-153.
27. Rao TSS, Sankar CR (2001) Effect of organic manures on growth and yield of brinjal. South Indian Hort 49: 288-291.
28. Sarraf A, Hedau NK, Kumar M (2002) Effect of potassium on fruit yield and yield-contributing characters in brinjal (*Solanum melongena*). Annals Agric Res 23(2): 256-258.

How to cite this article: Umalaxmi T, Dipa K, Rubina K, Dipa M, Victor T. Integrated Nutrient Management in Brinjal- A Review Study. Agri Res & Tech: Open Access J. 2016; 1(3): 555562.