# Effect of Boron on flower and fruit setting, and yield of ratoon Brinjal crop

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**ABSTRACT**

This experiment was undertaken to study the effect of boron on flower and fruit setting, and yield of ratoon crop of brinjal (*Solanum melongina L)* in the Eastern region of Sri Lanka during the period January to March 2014, with the variety of brinjal ''Thinnavelli purple.'' The treatments were arranged in a Randomized Complete Design (RCBD) replicated three times. The treatments were defined as follows: T1-50 ppm, T2-100 ppm; T3-150 ppm and T4- Control along with recommended fertilizer. All other agronomic practices were in accordance with the Department of Agriculture. The results showed that foliar application of boron ($H_3BO_3$) at 150 ppm increased the number of flower buds/plant (70%), number of flowers/cluster (141%), number of flower clusters/plant (48%), total number of flowers/plant (122%), Percentage of flower-set (30%), percentage of fruit-set (46%), number of fruits/plant (216%) and fresh weight of fruits/plant (88 %) than that of control. It was, therefore, concluded that foliar application of $H_3BO_3$ at150 ppm (at flowering stage) could increase flowering, fruit set percentage and fruit yield per plant of ratoon crop of brinjal in the regosol of Batticaloa district.

**Key words:** Brinjal, flower-set, fruit-set.

## 1.INTRODUCTION

Brinjal is known as eggplant (*Solanum melongina L)* belongs to the Family Solanaceae. It is one of the most popular and widely used low country vegetable in Sri Lanka and tropical countries as well. It is native to Sri Lanka and India. In Sri Lanka, total production of brinjal is 127,163 MT in an extent of 11760 ha in year 2012 [1]. In Batticaloa district brinjal is grown in an extent of about 169 ha in year 2012 [1].

It is a hardy plant compared to other vegetables cultivated in Sri-Lanka, due to this ability; it can be grown in very dry areas under rain-fed conditions or with minimum irrigation facilities. Eggplant can be maintained for more than one year in production by pruning at the end of the harvesting season. Then the crop is fertilized and maintained as main crop and this is known as ''ratoon crop.'' Nonetheless, the yield of ratoon crop is far lower than the main crop, but in terms of cost of production it is cost effective.

Nutritionally, brinjal is low in energy (30 kcal/100g), protein (1.2%) and vitamin C (5 mg/100g), but is a very good source of dietary fiber, potassium, calcium, manganese, copper and vitamin also possess antioxidant ability [2]. The yield potential and quality of a crop could be improved by maintaining proper fertilizer application. Nutrients play an important role in production of brinjal. It is clearly evident that chemical fertilizers ameliorate plant growth directly [3].

Micronutrients such as boron had great influence on plant growth and development. The main function of boron related to cell wall strength and development, RNA metabolism, sugar transport, hormones development, respiration, cell division, Indole acetic acid (IAA) metabolism and as part of the cell membranes [4]. Boron deficiency halts flowering, fruit setting by retarding pollen germination and pollen tube development [5]. Further, macronutrients are quickly absorbed and utilized by the tissues of the plants by the catalyzing effect of micronutrients [6]. Foliar spray of micronutrients is the common practice to overcome the deficiencies in order to improve the fruit quality. Nutrients are generally quickly available to the plants by the foliar application than the soil application [7], [8].

Boron also plays an important role in flowering and fruit formation [9].There have been many studies conducted on effect of boron on flowering and fruit setting in tomato and potato which are belong to the same Family Solanaceae, nevertheless it is very rare to find studies on brinjal that also come under same family.

Most of the ratoon crops are raised as main crop. However, the yields are very low. Foliar application of boron may be able to improve flowering, fruit sett and yield of ratoon crop. To date no systematic study has been carried out to test the effect of foliar application of boron on flowering, fruit sett and yield of ratoon crop of brinjal and no evidence is available on the response of boron application in the sandy regosols. Hence, this investigation was undertaken to study the effect of boron on flowering, fruit sett and yield of ratoon crop brinjal (variety Thinnavelli purple) in the regosol in Batticaloa district.

## 2.MATERIAL AND METHODS

The study was carried out during the period Jan-March 2013 on a sandy soil at the Crop Farm of the Eastern University, Chenkalady, Sri Lanka(Latitude between $7^0$ 43' and $7^0$ 431/2' N and the Longitude between $81^0$ 42' and $81^0$ 43' E) which falls within dry zone of Sri Lanka and DL2 agro-ecological zone. The texture of the soil was sandy with structure less single grain.

The experiment was carried out in a Randomized Complete Block Design (RCBD) replicated three times. There were twelve treatment combinations.

The ratoon brinjal crop (variety Thinnavelly Purple) was allowed to grow as main crop with the addition of recommended fertilizer. All other agronomic practices were done as recommended by the Department of Agriculture.

The treatments were comprised of 0, 50, 100 and 150 ppm of boron ($H_3BO_3$). Plants were sprayed 3 times at full bloom and other two were given at an interval of 10 days. Foliar sprays were applied using a hand sprayer.

Data were collected on number of flower buds, flowers/ axil, number of flowers plant$^{-1}$, number of flower clusters/plant, flower setting percentage, number of pods and fruit set percentage. Total yield(g) was measured using digital balance. Data were reported as mean of six plants of each replicate of a treatment.The data were analyzed using SAS software and the mean comparison was done by using LSD at 5% level.

## 3. RESULTS AND DISCUSSION

### Number Of Flower Buds Per Plant

Number of flower buds is the prime factor which determines the ultimate yield of a plant. Foliar application of boron had an effect on number of flower buds per plant (Table 1). It was found that the application of 150 ppm of boron ($H_3BO_3$) produced maximum number of flower buds (47), followed by foliar application of 50ppm (34) and control (28). This might be due to adequate amount of boron present to foliage is used for development and growth of new cell in the plant meristem.. It is believed that boron retain significant amount of carbohydrate mobility to flowering meristematic cells from senescing foliage region [10].

### Number Of Flowers /Cluster

Number of flowers on an axil is an important parameter that determines yield of a plant. Highest number of flowers/axil was recorded in plants receiving 150 ppm of $H_3BO_3$ than other treatment tested (table1). The number of flowers/cluster was similar in the foliar application of $H_3BO_3$ at 50 and100 ppm and control. Therefore, higher the boron concentration were necessary to increase the number of flowers/cluster. There was no evidence to support this finding. Therefore, it was concluded that foliar application of $H_3BO_3$ enhanced the number of flowers/cluster by 2.4 times compared to control treatment.

**Table 1:** Effect of different concentration of B number of flower buds/plant and number of flower/axil

| Treatment (Boron ppm) | Number of flower buds per plant | Number of flowers/ cluster |
|---|---|---|
| 50 | $34.33^b$ | $3.3^b$ |
| 100 | $38.67^{ab}$ | $3.3^b$ |
| 150 | $47.00^a$ | $5.3^a$ |
| Control | $27.67^b$ | $2.2^b$ |
| F Test | 0.0218 | 0.0152 |
| LSD | 11.059 | 1.66 |

*Means followed by the same letter in each column are not significantly different to Least significant different at 5% level*

### Total Number Of Flower Clusters/Plant And Total Number Of Flowers/Plant

Total number of flower clusters/plant and total number of flowers/plant are presented in Table2. Maximum number of flower cluster per plant (16.33) was obtained in plants receiving 150ppm of $H_3BO_3$, followed by 100 ppm (13), and control (11) (Table 2). Therefore, foliar application of 150 ppm increased the number of flower cluster/plant by 48.45 % compared to that of control.

In total number of flowers, highest total number of flowers per plant was obtained with 150 ppm of boron while lowest was obtained with control treatment. Therefore, application of boron increased the total number of flowers by 122% than control treatment tested. It may be attributed to the effect of boron in IAA metabolism which increases flower number and stimulation of phosphorus uptake by roots of plants that in turn promoted flower clusters development [11]. This is in contrast to studies where total number of clusters/plant of tomato increased withincreased concentration of $H_3BO_3$at 1250 ppm [12].

[13]noted that application of B at 2 ppm to tomato plants increased the number of flowers. However, in this experiment, the concentration of boric acid used was 75 times greater than that used by [13].

[14] documented in the tomato that plants treated with boron yielded higher number of flower clusters than control treatments.

**Table 2:** Effect of different concentration of B on total number of flowers/plant and number of flower cluster/ plant

| Treatments (Boron ppm) | Total number of flower clusters/plant | Total number of flowers/plant |
|---|---|---|
| 50 | $11.67^{b}$ | $25.00^{bc}$ |
| 100 | $13.0^{ab}$ | $33.67^{b}$ |
| 150 | $16.33^{a}$ | $43.67^{a}$ |
| Control | $11.00^{b}$ | $19.67^{c}$ |
| F Test | 0.0437 | 0.0018 |
| LSD | 3.72 | 9.367 |

*Means followed by the same letter in each column are not significantly different to Least significant different at 5% level*

**Percentage Of Flower Set**

Maximum percentage of flower set (93.03 %) was attained with the foliar application of 150 ppm of $H_3BO_3$, followed by 50 ppm (74.04 %), and control (71.31 %). It is clear that boron treated plants showed higher percentage of flower set than untreated plants (Fig.1). This is due to effect of boron that stimulate phosphorus uptake which promotes flowering directly.Boric acid spray had favorable effect on retention of flowers.

[15] reported that too low levels in root zone may cause a considerable fraction of flowers abscises and B concentration of 0.16 mg $L^{-1}$(160 ppm) seemed to be optimal for tomato growth and performance. This was in agreement with this finding.

**Percentage Of Fruit-Set**

The percentage of fruit-set is represented by Fig-2. Maximum percentage of fruit-set was attained with the foliar application of 150 ppm (91.4%), followed by 50 ppm (68.23 %), and control (62.77 %). It is evident from the result boron treated plants showed higher percentage of fruit set than untreated control. This may be attributed to imperative role of B in maintaining

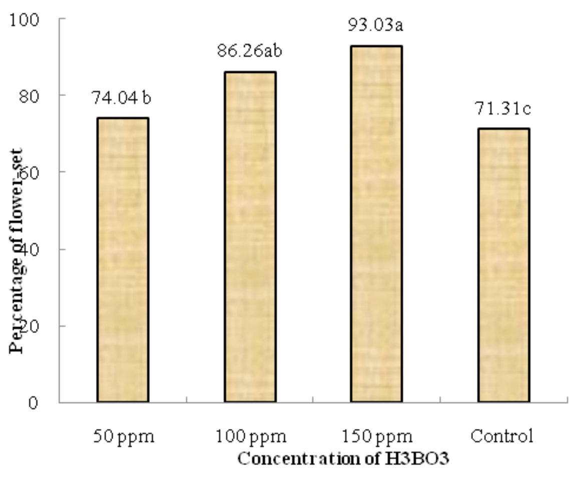


**Fig 1:** Effect of different concentration of B on percentage of flower-set of brinjal

Means followed by the same letter in each column are not significantly different to Least significant different at 5% level

of cell integrity, enhancing respiration rate, increasing uptake of certain nutrients and metabolic activities such as IAA which increases the fruit set [12]. [16] reported that boron deficiency cause abnormal development of reproductive organ. A suboptimal boron supply may considerably reduce fruit set, especially if no other means for pollination are applied [17].

[14] reported that application of B increases the percentage of fruit set in tomato plant which is also come under Family Solonaceae. [18] reported that 60 % of fruit setting percentage with 5 x $10^{6}$ ppm of boron in plant of Solanaceae family and [9] also attained similar findings. However, in this study 41.6 % of fruit setting percentage was obtained with 150 ppm than that of control, it may due to genetic variability and micro and macro environmental condition.

**Number Of Fruits Per Plant**

Significant difference was observed in the average number of fruits per plant of boron treated plots (Table 3). Highest number of fruits/plant was recorded at the foliar application of 150 ppm than the other treatments tested. Number of fruits/plant obtained at the foliar application of 100 ppm was significantly greater than that of control. Application of B at 150 and 100 ppm increased number of fruits per plant by

216% and 94.7% respectively.

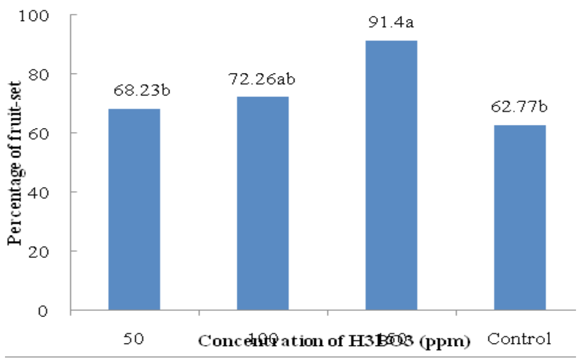


**Fig2:** Effect of different concentration of B on fruit set percentage of brinjal

This attributed to the accessibility of boron by foliar feeding and boron on cell integrity, sugar transport, RNA metabolism and enhancing respiration rate, increasing uptake of certain nutrients and metabolic activities. [18] documented that boron increases the number of fruits in tomato (30 fruits at 5x $10^6$ ppm). [12] reported higher number of fruits/plant at 1250ppm of boron in tomato. However, in this finding higher number of fruits was recorded at the foliar application of 150 ppm which was 8.3 times lesser than the concentration used by [12].

**Weight Of Fruits/Plant**

Weight of fruits/plant was significantly affected by the foliar application of $H_3BO_3$ (table 3). Highest weight of fruits/ plant was recorded in the plants receiving 150 ppm of $H_3BO_3$, followed by plants receiving 100 ppm of $H_3BO_3$ and lowest weight was recorded in the treatments 50 ppm of $H_3BO_3$ and control. Foliar application $H_3BO_3$ at 150 and 100 ppm of $H_3BO_3$ increased weight of fruits by 88% and 49%respectively. This may be attributed to greater photosynthetic activity, resulting into the increased production and accumulation of carbohydrates and favorable effect on vegetative growth and retention of flowers and fruits, which might have increased number and weight of fruits. The results of this finding is in agreement with studies done by [20], [21], [22] and [23] in tomato.

**Table 3**: Effect of different concentration of B on number of fruits/plant and weight of fruits/plant

| Treatment (Boron ppm) | Number of fruits/plant | Weight of fruits/ plant |
|---|---|---|
| 50 | 16.67 $^{bc}$ | 552.50$^{c}$ |
| 100 | 24.67 $^{b}$ | 815.28$^{b}$ |
| 150 | 40.10$^{a}$ | 1030.83$^{a}$ |
| Control | 12.67 $^{c}$ | 548.33$^{c}$ |
| F Test | 0.0006 | 0.001 |
| LSD | 9.17 | 191.57 |

Means followed by the same letter in each column are not significantly different to Least significant different at 5% level

## 4. CONCLUSION

It is clear from the results that foliar application of boron ($H_3BO_3$) at 150 ppm enhanced the number of flower buds/plant (70%), number of flowers/cluster (141%), number of flower clusters/plant (48%), total number of flowers/plant (122%), percentage of flower-set (30%), percentage of fruit-set (46%) number of fruits/plant (216%) and fresh weight of fruits/plant (88 %) of cv 'Thinnavelli purple.'' Application of 150 ppm showed a significant response in all the parameters tested than that of other levels tested. It was, therefore, concluded that 150 ppm of $H_3BO_3$ as foliar application could be used to increase the flowering, fruit set percentage and fruit yield per plant of ratoon crop of brinjal.

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