The Pharma Innovation Journal 2021; 10(5): 1096-1098

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(5): 1096-1098

www.thepharmajournal.com
Received: 12-03-2021
Accepted: 21-04-2021

Dasari Gopal
M.Sc. Student, Department of Soil Science and Agriculture Chemistry, College of Agriculture, Imphal, CAU, Manipur, India

Indira Sarangtham
Professor and Head, Department of Soil Science and Agriculture Chemistry, College of Agriculture, Imphal, CAU, Manipur, India

Corresponding Author:
Dasari Gopal
M.Sc. Student, Department of Soil Science and Agriculture Chemistry, College of Agriculture, Imphal, CAU, Manipur, India

Effect of boron on the yield of tomato (*Solanum lycopersicum*) in acid soil

Dasari Gopal and Indira Sarangtham

Abstract
The field experiment was carried out at Research farm of Central Agricultural University, Imphal, Manipur, during *Rabi* seasons of 2016-17 and 2017-18, respectively to evaluation of the effect of boron on yield of tomato in acid soil. Results revealed in evident from both first and second year, boron showed effect on the yield and yield attributes of tomato. During experimentation, results reported that Soil application of boron at 2.0 kg B/ha (T_4) showed highest number of fruits plant $^{-1}$ and maximum weight of fruits plant^{-1} (27.60 in first year and 29.8 in second year), (1.39 kg in first year and 1.53 kg in second year) and yield ha^{-1} (51.31t ha^{-1} in first year and 56.7t ha^{-1} in second year) respectively, over Boron control (T_1) plot. Hence, it was concluded that, the soil application of Boron at 2.0 B kg/ha effective among all the treatments in the experiment in Tomato under acid soil conditions during Rabi 2016-17 and 2017-18.

Keywords: Boron, tomato, yield attributes, yield, acid soil and *rabi*

1. Introduction
Tomato (*Solanum lycopersicum* Mill.) is a key vegetable crop grown throughout the world (Srividya *et al*., 2014) [10] and a good source of vitamins and minerals (USDA, 2016) [11]. The yield potential of tomato has been reported to range from 60 to 100 tons per hectare (Bok *et al*., 2006) [3]. Boron is important micro nutrient required for good quality and high yield of crops (Dale and Krystyna, 1998) [4]. Boron increases the fruit set percentage by promoting pollen germination and elongation of pollen tube (Abdalla, 2007) [1]. Boron content also influences calcium metabolism and its deficiency declines the calcium associated with pectin constituents (Yamaguchi *et al*. 1986) [12]. Boron deficiency results in wilting and leaf drop (Zekri and Obreza, 2003) [13] and adversely affect the quality and yield of many vegetables especially tomato (Imtiaz *et al*., 2010) [7].
The adsorption of boron varies with the type of clay in determining the amount of adsorption. The reduced level of water in the soil also causes a proportionate decrease in rate of boron diffusion to root (Barber, 1995) [2]. The visible symptoms of deficiency initiated on young leaves as internal chlorosis later leading to necrosis (Sinha *et al.*, 2002) [9]. A positive correlation was observed between boron and flower bud, number of flower and weight of fruit in tomato (Bose and Some, 2002) [5].

2. Materials and Methods
A field trail on effect of Boron on the yield of Tomato (*Solanum lycopersicum* Mill.) in acid soil at Research farm of Central Agricultural University, Imphal, Manipur, during *Rabi* seasons of 2016-17 and 2017-18. The treatments were arranged in Factorial Randomized Block Design (FRBD) replicated three times. The treatments were defined as follows: T1-control, T2-1.0 kg B ha^{-1}; T3-1.5 kg B ha^{-1} and T4- 2.0 kg B ha^{-1} along with recommended fertilizer. Ten plants of each plot of the experimental field were selected randomly for each treatment and their number of fruits plant^{-1}, fruit weight plant^{-1} and fruit yield t ha^{-1} was recorded. The variety of Pusa Ruby is an early cultivar was taken as test crop. Twenty three days seedlings were transplanted on 21 November for both the years of 2016-17 and 2017-18, respectively. A combined blanket dose of N_{100} P_{60} K_{180} kg ha^{-1} and Vermicompost 2 t ha^{-1}, Lime 2 t ha^{-1} (For reclamation of acid soil) were applied before final land preparation. The primary data was subjected to statistically analyze for effective treatment.

3. Results and Discussion
3.1 Effect of boron on number of fruits per plant
Boron had significantly influenced the number of fruits per plant (Table 1 and Fig. 1) in both

the rabi seasons, the maximum number of fruits 27.60 and 29.82 per plant was obtained from T4 treatment (2.0 B kg/ha) simultaneously, minimum number of fruits 23.30 and 19.27 was recorded from the T1 (control) in both the rabi seasons. These results were strongly confirmed with the reports of Davis *et al*. (2003) [6] in tomato.

3.2 Effect of boron on fruits weight per plant

The present investigation results were exhibited in (Table 2 and Fig. 2) and boron exhibited significant effect on the weight of fruits (kg) per plant.

The plant fertilized with T_4 (2.0 B kg/ha) produced the highest weight of fruits 1.39 kg and 1.53 kg per plant was noticed in both the Rabi seasons and consequently the minimum weight of fruits 0.71 kg and 1.14 kg per plant was reported in the T1 (control) in both the consecutive rabi seasons.

These results were strongly confirmed with the reports of Davis *et al*. (2003) [6] in tomato.

3.3 Effect of boron on yield per hectare

The present key objective results were postulated in the Table 3 and Fig. 3 variation in fruit yield (t/ha) was found to be significant due to the application of different levels of boron.

T_4 treatment recorded maximum yields of 51.31 and 56.71 t/ha during two seasons with application of (2.0 B kg/ha) and same time, lowest values recorded 26.39 and 42.18 t/ha in the T_1 (control) in two seasons. These results were purely supported by results findings of Abdalla, 2007 [1].

Table 1: Effect of boron on number of fruits per plant

Boron	2016-17	2017-18	Pooled
B_0	23.30	19.27	21.28
$B_{1.0}$	25.45	23.28	24.36
$B_{1.5}$	26.46	29.70	28.08
$B_{2.0}$	27.60	29.82	28.71
S.E (D)±	0.26	0.53	0.25
C D 5%	0.53	1.08	0.51

Table 2: Effect of boron on weight of fruits per plants (kg/plant)

Boron	2016-17	2017-18	Pooled
B_0	0.71	1.14	0.93
$B_{1.0}$	1.20	1.29	1.25
$B_{1.5}$	1.24	1.43	1.33
$B_{2.0}$	1.39	1.53	1.42
S.E (D)±	0.04	0.04	0.03
C D 5%	0.08	0.08	0.06

Table 3: Effect of boron on yield (t/ha)

Boron	2016-17	2017-18	Pooled
B_0	26.39	42.18	34.29
$B_{1.0}$	44.52	47.66	46.09
$B_{1.5}$	45.76	53.01	49.39
$B_{2.0}$	51.31	56.71	54.01
S.E (D)±	1.43	1.53	0.97
C D 5%	2.93	3.12	1.99

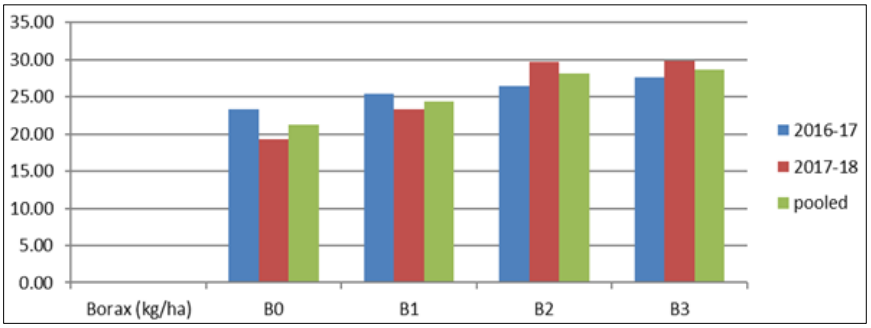

Fig 1: Effect of boron on number of fruits per plant

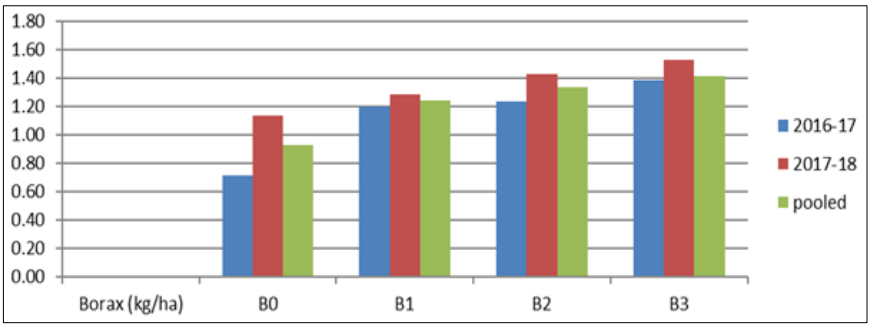

Fig 2: Effect of boron on weight of fruits per plants (kg)

4. Conclusion

The results of the present investigation clearly stated that, the application of Boron 2.0 kg/ha influence increasing the number of fruits per plant, fruit weight per plant and tomato yield.

5. Acknowledgement

The authors acknowledge the financial assistance received from the CAU, Imphal, Manipur fellowship for conducting these studies and research. We are also grateful to the, Dr. Indira sarangtham for development thesis in boron efficacy on tomato crop in Manipur.

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