Biological Forum – An International Journal **13(4): 896-899(2021)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Soil Application and Frequencies of Foliar Spray of Boron and Ethephon on Growth and Yield of Cucumber (*Cucumis sativus* L)

Nguyen Viet Thanh[1*], Rajendra Kumar Panda[1], Kailash Chandra Samal[1], Gouri Shanker Sahu[2] and Rabindra Kumar Nayak[3]

[1]Ph.D. Scholar, Department of Plant Physiology,
College of Agriculture, OUAT, Bhubaneswar, (Odisha), India.
[2]Professor, Department of Vegetable Science,
College of Agriculture, OUAT, Bhubaneswar, (Odisha), India.
[3]Department of Soil Science and Agricultural Chemistry,
College of Agriculture, OUAT, Bhubaneswar, (Odisha), India.

(Corresponding author: Nguyen Viet Thanh)*
(Received 24 September 2021, Accepted 16 November, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABTRACT: The goal of this study was to observe the impact of soil and frequencies of foliar spray of boron and ethephon on growth and yield of Cucumber (*Cucumis sativus* L.) as two years field experiment in Central Farm of OUAT under coastal Odisha during 2020 and 2021. The information combine effect of ethephon and boron application is lacking, though their independent effect is well describe in cucumber cultivation. This is the new approve in this experiment. Cultivar Rohan used as planting material and was sown in rings of experimentally designed completely randomized block plots. Ethephon@300mg/l applied on all the treatments like T1- RDF (150-75-75):: N:P:K kg.ha^{-1} with zero boron (Control), T2- RDF+ B @1.0 kg soil application, T3- RDF+ FS @ 0.25% borax once, T4- RDF+ FS@ 0.5% borax once, T5- RDF+ FS@ 0.75% borax once, T6- RDF+ FS @ 1.0% borax once, T7- RDF+ FS@ 0.25% borax twice, T8- RDF+ FS@ 0.5% borax twice, T9- RDF+ FS @ 0.75% borax twice, and T10- RDF+ FS @ 1.0% borax twice, were used to the crops at two leaf fully grown stage and after 35 days of sowing two B spray in an interval of 7days. Parameters like vine length, number of leaves per plant, primary nodes, leaf area index, number of fruits per plant, average fruit weight (g), yield per plot (kg), yield per ha(ton/ha) were studied. We found that T8- RDF+ FS@ 0.5% borax twice was highest pooled performance in consecutive 2 years with increase in number of node per plant up to 21.7% over control and 15.7% over soil application; vine length increase 30.68% and 14.21 %; number of leaf increase 30.92% and 11.36%; Leaf area index increase 40.93% and 17.54%; number of fruit per plant increase 39.56% and 15.45%; Yield per plot increase 47.55% and 36.5%; yield per ha increase 57.22 % and 40.92% in control and soil application respectively. We suggest that foliar spray of boron has more advantageous than soil application as boron applied through foliage are absorbed right at the site where they are needed as quickly as possible and significant visibility found with boosted dose of ethephon at early seedling stage.

Keywords: Cucumber, Boron, ethephon growth, vine length, yields.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is one of the most important economic cucurbits, cultivated more broadly than any other vegetable species (Staub *et al.*, 2008). In India, it is grown in 0.41 lakh hectares with an annual production of 6.41 lakh tonnes (NHB 2013). In view of the increased demand for the cucumber crop in all seasons, which called for finding alternative solutions, including the cultivation of distinct local varieties in abundant production inside greenhouses, and because the sexual behavior of the varieties spread in local agriculture is characterized by the late appearance of feminine flowers as a result of the high rate of gibberellin/ethylene in plant tissues. This is in agreement with the results of the studies conducted by Abu Dahi and Al-Younis (1988). It was reported that exogenous application of PGRs (ethephon) may shift the sex expression in cucurbits toward femaleness, increasing the number of pistillate flowers, number of fruits/plant, and individual fruit weight as well as yield (Mia *et al.*, 2014). Shireen *et al*., (2018) say that Boron

is of interest whenever micronutrients are more important than any other micronutrient in obtaining high quality crop yields. Boron plays a dynamic role in various plant structural, physiological and biochemical functions such as: cell wall formation and stability, maintenance of structural and functional integrity of biological membranes, carbohydrate metabolism and transport of sugar, plasma membrane electron transport reactions, root elongation and nucleic acid metabolism, phenol and auxin metabolism, nitrogen fixation and nitrate assimilation, water relations stimulated (Al-Rubaie *et al.,* 2013), movement of sugar or starch into growing parts of plants, pollen tube growth and pollen germination, pollination, seed set, fruit, disease resistance and different hormonal regulations. Therefore, this study was carried out to assess the growth pattern, flowering, fruiting, and fruit yield of cucumber if foliar sprayed with boron and ethephon as well as soil application of B in cucumber.

MATERIALS AND METHODS

This experiment was conducted during rabi season of 2020 and 2021 and Cultivar Rohan was used as planting material and was sown in rings of experimentally designed completely randomized block plots in Central farm, College of Agriculture, OUAT. Geographically, it is located at (20°5′N, 85°52′E, 26 msl). Ethephon@300mg/l applied on all the ten treatments at two fully grown leaf stages of crop viz; T1-RDF (150-75-75): N:P:K kg.ha^{-1} with zero boron, T2- RDF+ B @1.0 kg soil application, T3-RDF+ FS @ 0.25% borax once, T4-RDF+ FS@ 0.5% borax once, T5-RDF+ FS@ 0.75% borax once, T6-RDF+ FS @ 1.0% borax once, T7-RDF+ FS@ 0.25% borax twice, T8- RDF+ FS@ 0.5% borax twice, T9- RDF+ FS @ 0.75% borax twice, and T10- RDF+ FS @ 1.0% borax twice and B was applied at 35 days after sowing followed by second application after 7days. Data was generated and was analyzed by excel computer program as suggested by Gomez and Gomez, (1984).

RESULTS AND DISCUSSION

A. Vegetative growth and yield characters

The various growth parameters like vine length, number of leaves, primary nodes, leaf area index of cucumber were found significant among the treatments and the effect of soil and foliar application of boron and ethephon was prominent during the course of investigation. The results presented in Table 1-2 showed that the maximum vine length was highest in T8 over two year's pooled data. Increase in number of node per plant up to 21.7% over control and 15.7% over soil application; vine length increase 30.68% and 14.21%; number of leaf increase 30.92% and 11.36%; Leaf area index increase 40.93% and 17.54%; number of fruit per plant increase 39.56% and 15.45%; Yield per plot increase 47.55% and 36.5%; yield per ha increase 57.22 % and 40.92% in control and soil application respectively. It is known that boron help for an increase in the concentration of IAA leads to increased cell elongation, which may affect the elongation of inter nods and then increase the wine plant (Gharib and Hegazi 2010). The results agree with (Al-Amiri, 2014) and (Mohammed, 2014). Barry and Marentes (2006), boron then increasing cell division, cell elongation, and cell wall develop and expansion in the growth centers gave the highest opportunity for growth. Ethephon induced a strong female tendency, while in contrast gibberellin treatment resulted in fewer female flowers, higher female node, and delay in the first female flower.

Table 1: Soil application and frequencies of foliar spray of boron and ethephon on vegetative growth characters.

Treatments	Vine length (cm)			Number of node			Number of leaf			Leaf area index		
	2020	2021	Pool	2020	2021	Pool	2020	2021	Pool	2020	2021	Pool
T1	157.00	152.67	154.83	29.33	29.00	29.17	46.33	41.00	43.67	5.39	5.79	5.59
T2	186.33	168.00	177.17	30.00	31.33	30.67	51.67	51.00	51.33	6.67	6.73	6.70
T3	177.33	159.33	168.33	29.67	29.67	29.67	49.00	44.67	46.83	5.94	6.47	6.21
T4	189.67	177.67	183.67	32.00	33.67	32.83	53.33	56.00	54.67	7.41	7.11	7.26
T5	160.33	167.67	164.00	30.67	32.00	31.33	46.00	48.00	47.00	6.23	7.00	6.61
T6	160.00	164.00	162.00	30.33	30.00	30.17	47.00	41.00	44.00	5.67	6.12	5.89
T7	163.00	178.33	170.67	31.33	31.67	31.50	52.67	53.00	52.83	6.31	6.16	6.23
T8	206.33	198.33	202.33	34.67	36.33	35.50	58.33	56.00	57.17	7.75	8.00	7.87
T9	173.67	166.67	170.17	29.33	34.33	31.83	52.67	51.33	52.00	6.55	6.83	6.69
T10	166.67	163.67	165.17	28.33	33.67	31.00	51.67	49.33	50.50	6.34	6.44	6.39
S.Em (±)	7.05	5.29	4.41	1.06	0.73	0.644	2.15	2.48	1.643	0.42	0.31	0.260
C.D.(0.05)	20.9	15.7	12.27	3.16	2.16	1.795	6.39	7.37	4.577	1.25	0.91	0.725
C.V. (%)	**7.2**	**5.40**		**6.03**	**3.92**		**7.32**	**8.75**		**11.3**	**7.94**	

Table 2: Soil application and frequencies of foliar spray of boron and ethephon on yield and its components.

Treatments	Number of fruit per plant			Single of fruit weight (gram)			Yield per plot (kg)			Yield per ha (ton)		
	2020	2021	Pool	2020	2021	Pool	2020	2021	Pool	2020	2021	Pool
T1	15.33	15.00	15.167	190.3	186.0	188.1	29.56	31.89	30.72	35.48	34.66	35.07
T2	18.00	18.67	18.333	189.3	194.0	191.7	32.70	33.72	33.21	38.34	39.92	39.13
T3	16.33	16.33	16.333	194.9	193.0	194.0	30.67	32.93	31.80	36.95	38.13	37.54
T4	18.67	19.67	19.167	188.7	190.3	189.5	35.40	38.29	36.85	44.25	45.79	45.02
T5	17.00	18.33	17.667	189.7	191.0	190.3	33.50	33.45	33.48	41.88	39.45	40.66
T6	16.33	16.00	16.167	190.0	190.0	190.0	31.49	32.45	31.97	36.11	34.93	35.52
T7	18.33	18.00	18.167	189.7	192.0	190.8	30.55	35.34	32.95	39.37	39.20	39.28
T8	20.00	22.33	21.167	190.3	188.0	189.2	44.85	45.81	45.33	56.07	54.21	55.14
T9	18.67	18.00	18.333	185.3	194.0	189.7	34.65	35.18	34.91	43.31	44.33	43.82
T10	17.33	17.67	17.500	190.6	191.0	190.8	32.70	33.03	32.87	40.87	43.65	42.26
S.Em (±)	0.587	1.166	0.651	1.670	0.211	0.842	1.48	1.92	1.21	1.72	2.51	1.52
C.D.(0.05)	1.744	3.464	1.813	NS	NS	NS	4.38	5.70	3.37	5.10	7.45	4.23
C.V. (%)	**5.69**	**11.2**		**1.52**	**0.19**		7.60	9.43		**7.21**	**10.48**	

Vine length: The treatment (T8) in which RDF+ FS@ 0.5% borax sprayed twice was highest in pool data (202.33 cm) followed by T4- RDF+-FS 0.5% once (183.67 cm) and T2- RDF+ -Soil Application (177.17). Number of node per plant was highest in T8 (35.50) followed by T4 (32.83). Number of leaf was significantly highest (57.17) in T8 followed by T4 (54.67). Leaf area index was following the same pattern in T8 and T4. The results agree with (Al-Amiri, 2014); (Mohammed, 2014). This agrees with what is found El-Masri *et al.,* (2002); Gamrod (2003), who stated that boron spraying on the shoot of squash plant led to a significant increase in vegetative growth measurements compared to the control treatment. Barry and Marentes (2006), boron then increasing cell division, cell elongation, and cell wall develop and expansion in the growth centers gave the highest opportunity for growth. Number of fruits per plant (21.167), yield per plot (45.33kg) and yield per ha (55.14 ton) was also highest in the treatment combination of T8- RDF+ FS@ 0.5% borax twice. Single fruit weight per plant range from 188g to194g in two years mean data but was found not significant but was correlated with Vine length (r=0.891*), Number of node (r = 0.967**), Number of leaf ($r=0.850^{ns}$), Leaf area index (r=0.937*). Ethephon induced a strong female tendency, while in contrast gibberellin treatment resulted in fewer female flowers, higher female node, and delay in the first female flower. These results are in general agreement with those reported and agreed with (Sharaf *et al*., 2009), Gupta and Philip (2006) as boron has play role in hormonal regulation in plant. It is known that boron help for an increase in the concentration of IAA leads to increased cell elongation, which may affect the elongation of inter nods and then increase the wine plant (Gharib and Hegazi 2010). These results are in general agreement with those reported and agreed with (Sharaf *et al*., 2009); Gupta and Philip (2006) as boron has play role in hormonal regulation in plant. Movalia *et al.,* (2018); Praveena *et al.,* (2018); Karthik *et al.,* (2021) reported that Boron was required more at reproductive stage and foliar applied was instantly present for plant in compare to soil applied boron. Foliar applied boron increased the biomass yield over the control. Balai *et al*., (2017); Lokhande (2018) was also reported number of branches/plant, vegetative development creates too many sites for photosynthetic translocation; it will be help for increasing in the number of yield characteristics.

Table 3: Correlation analysis of yield and morphological traits.

	Yield per ha (ton)	Vine length	Number of node	Number of leaf	Leaf area index
Yield per ha (ton)	1				
Vine length	0.891*	1			
Number of node	0.967**	0.907*	1		
Number of leaf	0.850^{ns}	0.873*	0.866^{ns}	1	
Leaf area index	0.937*	0.938*	0.933*	0.871^{ns}	1

*Signifies correlated at t value of 0.05; ** Signifies highly correlated at t value of 0.01

CONCLUSION

Foliar spray of boron has more benefit than soil application as boron applied through foliage are absorbed right at the site where they are needed as quickly as possible and significant visibility found with boosted dose of ethephon at early seedling stage. We conclude that T8- RDF+ FS@ 0.5% borax twice may be recommended as best nutrients combinations and concentrations that can be used for the farmer practices to get better female flower and cucumber production.

FUTURE SCOPE

More experiments may be necessary to explore the role of ethephon and boron in encouraging and improving flowering and increasing fertility.

Acknowledgement. The author would like to express gratitude to ICCR, Government of India and Odisha University of Agriculture & Technology, Bhubaneswar, India for providing funds and their continuous support to conduct this experiment.
Conflict of interest. Nil.

REFERENCES

Abu Dahi, Y. M., & Al-Younis, M. (1988). Guide to Plant Nutrition. *The Ministry of Higher Education and Scientific Research, University of Mosul – Iraq.*

Al-Amiri, A. S. U. (2014). Effect. Foliar fertilizers in growth and yield of leguminous crops *Vicia faba* L. Thesis, Master Degree, *Faculty of Agriculture, University Baghdad, Iraq.*

Al-Rubaie, B. J. H., M.Al-Ardi, T., Muften, M. T., &. Hassan, H. S. (2013). Effect of foliar spraying with different materials and nickel levels on some natural characteristics of tree seedlings. *Cucurbita pepo* L. Al-Muthanna *Journal of Agricultural Sciences, 1*(2): 5-13.

Balai, K., Sharma, Y., Deewan, P., &Verma, R. (2017). Effect of phosphorus and zinc on growth and yield and economics of chickpea (*Cicer arietinum* L.). *International Journal of Current Microbiology and Applied Sciences*, *6*(3): 1174-1181.

El-Masri, M. F., Amberger, A., El-Fouly, M. M., & Rezk, A. I. (2002). Zn increased flowering and pod setting in faba beans and its interaction with Fe in relation to their contents in different plant parts. *Pak. J. Biol. Sci.*, *5*(2), 143-145.

Shireen, F., Nawaz, M. A., Chen, C., Zhang, Q., Zheng, Z., Sohail, H., ... & Bie, Z. (2018). Boron: functions and approaches to enhance its availability in plants for sustainable agriculture. *International Journal of Molecular Sciences*, *19*(7), 1856.

Gamrod, E. E. (2003). Flowering control and production of *Strobilanthes dyerianus* Mast. (Persian Shield). MSc. of science in Horticulture. *Virginia State University.*

Gharib, F. A., & Hegazi, A. Z. (2010). Salicylic acid ameliorates germination, seedling growth, phytohormone and enzymes activity in bean (*Phaseolus vulgaris* L.) under cold stress. *Journal of American Science*, *6*(10), 675-683.

Gomez, K. A., & Gomez, A. A. (1984). Statics Producers for Agriculture Research.

Gupta, U. C., & Philip, S. M. (2006). In: Plant Nutrition. Prince Edward Island, Canada, pp: 241-268.

Karthik, B., Umesha C., Sanodiya, L. K., Mahesh, K., & Priyadarshini, A. S. (2021). Impact of Nitrogen Levels and Application of Boron on Yield and Growth of Greengram (*Vigna radiata* L.). *Biological Forum – An International Journal*, *13*(3): 08-11.

Lokhande, P. B. (2018). Effect of phosphorus and zinc on yield and quality of greengram (*Vigna radiata* L.) in Inceptisol. *International Journal of Engineering Sciences and Computing*, *8*(7): 18647-18649.

Mia, M. B., Islam, M. S., & Shamsuddin, Z. H. (2014). Altered sex expression by plant growth regulators: An overview in medicinal vegetable bitter gourd (*Momordica charantia* L.). *Journal of Medicinal Plants Research*, *8*(8), 361-367.

Mohammed, H. A. (2014). The effect of complementary irrigation and potassium and boron spraying on the quantitative and qualitative traits of the leguminous plant *Vicia faba* L.: *Diyala Journal of Agricultural Sciences*, *6*(1): 201-187.

Movalia Janaki, A., Parmar, K. B., & Vekaria, L. C. (2018). Effect of boron and molybdenum on yield and yield attributes of summer green gram (*Vigna radiata* L.) under medium black calcareous soils. *International Journal of Chemical Studies*, *6*(1): 321-323.

NHB (2013). Natonal Horticulture Bosrd, Department of Agriculture and Co-operation Govt India.

Praveena, R., Ghosh, G., & Singh, V. (2018). Effect of foliar spray of boron and different zinc levels on growth and yield of kharif greengram (*Vigna radiata*). *International Journal of Current Microbiology and Applied Sciences*, *7*(8): 1422-1428.

Sharaf, A. E. M., Farghal, I. I. and Sofy, M. R. (2009). Response of broad bean and lupin plants to foliar treatment with boron and zinc. *Aus. J. Basic Appl. Sci*., *3*(3): 2226-2231.

Staub, J. E., Robbins, M. D., & Wehner, T. C., (2008). Cucumber, Asteraceae, Brassicaceae, Chenopodicaceae and Cucurbitaceae. *Springer, New York, NY*. P 241-282.

How to cite this article: Thanh, N.V.; Panda, R.K.; Samal, K.C.; Sahu, G.S. and Nayak, R.K. (2021). Soil Application and Frequencies of Foliar Spray of Boron and Ethephon on Growth and Yield of Cucumber (*Cucumis sativus* L). *Biological Forum – An International Journal*, *13*(4): 896-899.