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Improvement in Yield and Yield Parameters of Sweet Sorghum Cultivars after Boron Treatment

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ABSTRACT

Yield contributing characters are directly related with economic yield of the plant. It attributes viz. panicle length, weight of grains; biological index, harvest index etc. are combining useful characters for determination of yield potential of sweet Sorghum. Yield is the ultimate reflection of the various yield components as it is important and combined effect of various morphological, environmental, physiological and growth characters, which are showing differences in cultivars. Sweet Sorghum is a very important crop as a food, fodder, fuel and fertilizer. Boron is important micronutrient which plays role in pollen germination and pollen tube formation which leads to improve yield. In the present investigation the effect of different boron concentrations like 0 ppm (Control), 10 ppm, 50 ppm and 100 ppm on sweet Sorghum var. RSSV-9 and Madhura has been studied. The pot culture technique was used for this investigation. The objective was to identify the correct dose of boron to improve yield in sweet Sorghum which is a semi-arid crop. The data was collected after the full growth of plant. The results are showing that the lower doses of boron like 10 ppm and 50 ppm have positively influenced the yield parameters and yield components. Both the varieties show increased grains per panicle, weight of seeds, grain yield, biological yield and harvest index due to 50 ppm boron concentration.

Key words: *Yield; Sweet Sorghum; Boron; Concentration; Micronutrient*

Introduction

There are various factors in the nature that have direct or indirect influence on the crop yield. These factors include water deficit, mineral imbalance, and non-availability of macro or micro nutrients in soil, environmental factors along with this excess availability or use of a particular or more macro/ micro fertilizers and or water in the crop field. The amount of soil moisture available to plants in arid and semiarid regions is also one of the major limiting factors for crop yield.

Boron is one of the microelements required for healthy crop growth and development of reproductive tissues. It is required in very small amount. However, the deficiency and excess use of boron may affect crop growth. Boron is important micronutrient which plays role in pollen germination and pollen tube formation which leads to improve yield [1]. As boron is important micronutrient required for plant growth and yield [2] which play vital function in cell wall formation, nitrogen fixation, nucleic acid, membrane stability, sugar transport, carbohydrate and Indol Acetic Acid metabolism. Due to all these roles, boron leads to an increase in plant height and production [3,4].

Sorghum bicolor is an important dry land annual cereal crop grown in India. In semiarid tropics when other plants fail to survive, sweet Sorghum can grow successfully. Sweet Sorghum is said to be valued for 4-F's. These 4-F's are Food, Feed, Fuel and Fertilizer. It can produce along with grains, a sugary juice that is useful to produce ethanol, jaggery, syrup and flour. As sweet Sorghum produces food as well as fuel so it can help to meet the countries fuel needs without compromising our food supply.

Materials and methods

The sweet Sorghum variety RSSV-9 and Madhura were grown in individual pots which were treated with 10 ppm, 50 ppm and 100 ppm boron along with one pot untreated i.e. 0 ppm named as control. These treatments were given at 15 days old seedlings and the treatment was repeated at 40 days and 70 days old plant after sowing [Figure 1]. At maturity, plants from each treatment and control were harvested and various components namely length of ear-head, weight of 100 grains, biological yield, harvest index, total yield were calculated.

The plant height was measured simply by adding root length and shoot length together. Plant height along with root and shoot, length was expressed in cm. Average number of leaves per plant was determined by counting total number of leaves developed on selected plants from the pots. Length of panicle and number of grains were measured from selected ear-heads.

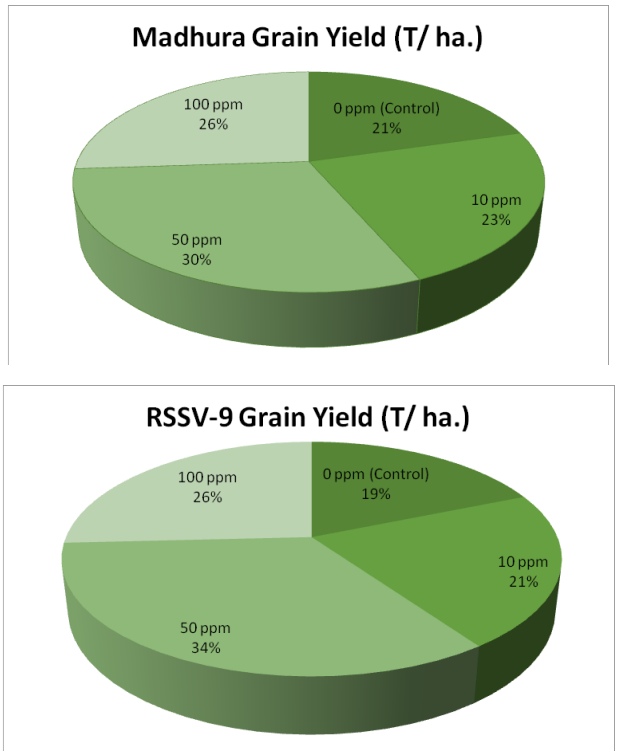

Figure 1: Effect of boron on grain yield of sweet Sorghum var. RSSV-9 and Madhura.

Table 1: Effect of different boron concentrations on yield and yield parameters of sweet Sorghumcultivars.

Madhura						
Treatment (ppm)	**Length of earhead (cm)**	**No. of grains panicle^{-1}**	**Weight of 100 seeds (gms)**	**Grain Yield (T/ ha.)**	**Biological yield (T/ ha.)**	**Harvest Index (%)**
control	16.9	240	3.26	1.403	9.283	17.8
10 ppm	21.6	268	3.28	1.576	8.826	21.73
50 ppm	18.6	318	3.64	2.084	10.244	25.53
100 ppm	10.6	298	3.34	1.785	9.045	24.58
RSSV-9						
Treatment (ppm)	**Length of earhead (cm)**	**No. of grains per panicle^{-1}**	**Weight of 100 seeds (gms)**	**Grain Yield (T/ ha.)**	**Biological yield (T/ ha.)**	**Harvest Index (%)**
control	9.9	236	2.32	0.982	11.872	9.017
10 ppm	16.4	256	2.44	1.12	20.187	5.87
50 ppm	10.1	321	3.08	1.777	11.347	18.56
100 ppm	11.1	289	2.60	1.348	8.528	18.77

Result and Discussion

The effect of soil application of different boron concentrations on yield and different yield parameters like length of earhead, number of grains per panicle, weight of 100 grains, grain yield, biological yield and harvest index is shown in table 1. In both the varieties studied under this investigation shows remarkable increase in yield and yield parameters. The lower doses of boron like 10 and 50 ppm positively influenced the yield parameters and yield components in both the varieties under investigation. Madhura shows promising results with respect to all parameters like number of grains, weight of 100 seeds, grain yield, biological yield and harvest index with 50 ppm boron treatment. Similar response was also noticed with c. v. RSSV-9. But higher dose of 100 ppm boron reported to decrease in biological yield in both varieties.

There are various reports of effect of boron on yield and yield components. A study of boron requirement on sugar-beet plant by Hellal et al. [5] shows increased root and shoot length due to boron at 50 ppm concentration when compared with other non-boron treatments which ultimately increases total height of the plant. Similar results were obtained in the present investigation where total height was increased due to 50 ppm boron treatment. According to Moniruzzaman et al. [6] significant increase in number of leaves per plant, length and width of highest leaf in broccoli plant treated with 1.5 kg boron ha-1. Number of leaves is increased in onion when plant treated with 0.1 % to 0.5 % of boron [7,8]. Our results are showing increased leaf number due to all the boron treatments. Mehdi et al. [9] in an experiment on rice under saline sodic soil found that residual boron increased plant height, straw yield, number of tillers and panicles per plant.

Singh et al. [10] revealed that in cauliflower increased levels of boron from 1.0 kg ha-1 to 2.5 kg ha-1 shows increase in all the yield parameters but boron at 3.0 kg ha-1 was not superior to control. Higher grain weight and more grains per panicle due to boron application in rice is reported by Rehman et al. [11]. He was of the opinion that increased stimulatory effect might be due to involvement of boron in reproductive growth as boron improves the panicle fertility[12,13] studied wheat plant and reported that foliar and soil application of boron resulted in increased number of grains per spike. Increased panicle length in rice due to boron application was depicted by Ahmad [14]. Report of Sathya et al. [15] suggests that fertilizer application of boron at 20 kg as borax ha-1 shows better yield. Recently Muthanna et al. [16] reported that application of boron along with sulphur increases yield of potato plant. Mahadule and Sale [17] reported foliar application of boron on legumes improved yield and yield parameters. While the results of Hossain [18] indicated that yield and yield attributes of mustard were significantly influenced by boron application. Our findings in the present investigation were in correlation with the previous reports of various workers [19].

Conclusion

The enhancement in total height, diameter of stem, number of nodes and leaves per plant and number of grains per plant ultimately increases biological yield and harvest index of the sweet Sorghum var. RSSV-9 and Madhura showing that boron application is required for improvising yield and yield parameters. These results are due to role of boron in reproductive growth as well as in panicle fertility, carbohydrate translocation which helped in better seed or fruit setting. Number of grains is found more when plants are applied with boron through soil. Our findings are showing boron application is required for improvising yield and yield parameters.

References

1. Ahmad A, Tahir M, Ullah E, Naeem M, Ayub M, et al. Effect of silicon and boron foliar application on yield and quality of rice. *Pak J Life Soc Sci.* **2012**, 10(2): 161-165.
2. Ali E A. Effect of iron nutrient care sprayed on foliage at different physiological stages on yield and quality of some durum wheat (*Triticum durum* L.) varieties in sandy soil. *Asian J Crop Sci.* **2012**, 4(4):139-149.
3. Dake SD, Hiwale BG, Patil VK,Naik PG. Effect of micronutrients on growth, yield and quality of onion (Allium cepa L.) cv. Baswant 780. National symposium on Alliums: current Scenario and Emerging Trends, 12-14 March, **2011**, Pune. pp-205.
4. Hellal FA, Taalab AS, Safaa AM. Influence of nitrogen and boron nutrition on nutrient balance and sugar beet yield grown in calcareous soil. *Ozean J Applied sci.* **2009**, 2(1):1-10.

5. Hossain, MdSazzad. Effect of boron fertilization on yield and yield attributes of mustard var. BARI Sarisha, **2019**.
6. Mahadule PA, Sale RB. Effect of foliar sprays of boron on growth, yield, nutrient uptake and quality of French bean (*Phaseolus vulgaris* L.) in Entisol: A review. *J Pharma Phytochem.* **2018**, 7(5): 74-78.
7. Manna D. Growth, yield and bulb quality of onion (Allium cepa L.) in response to foliar application of boron and zinc. *J Plant Nutri.* **2016**, 39(3): 438-441.
8. MasoudBameri, Abdolshahi R, Mohammadi-Nejad G, Yousefi K and Sayed M. Tabatabaie. Effect of different microelement treatment on wheat (*Triticumaestivum*L.) growth and yield. *Int Res J Appl Basic Sci.* **2012***,* 3(1): 219-223.
9. Mehdi SM, Sarfraz M, Hassan NM, SadiqM. Rice and wheat yield improvement by the application of boron in salt affected soils. *SciInter*.**2006**, 4: 112-115.
10. Moniruzzaman M, Rahman SML, KibriaMG, Rahman MA, Hossain MM. Effect of boron and nitrogen on yield and hollow stem of broccoli. *JSoilNature.* **2007***,*1(3): 24-29.
11. MuthannaMA, Singh AK, Tiwari A, Jain VK,Padhi M. Effect of boron and sulphur application on plant growth and yield attributes of potato (*Solanum tuberosum* L.).*IntJCurrMicrobiolAppSci.***2017**, 6(10): 399-404.
12. Nadim MA, Awan IU, Baloch MS, Khan EA, Naveed K, et al. Response of wheat (*Triticumaestivum*L.) to different micronutrients and their application methods. *JAnimPlant Sci*. **2012**, 22(1): 113-119.
13. Rehman A, Farooq M, Cheema ZA, Wahid A. Seed priming with boron improves growth and yield of fine grain aromatic rice. *Plant Growth Regul*. **2012**, 68:189-201.
14. Sathya S, Mahendran PP,Arulmozhiselvan K. Influence of soil and foliar application of borax on fractions of boron under tomato cultivation in boron deficient soil of typicHaplustalf. *Afri J AgriRes.* **2013**,8(21): 2567-2571.
15. Singh KP, Singh VK, Kamalkant, Roy RK.Effect of different levels of boron and its methods of application on growth and yield of cauliflower (*Brassica oleracea* var. botrytis L.).*Veg Sci.* **2011***,* **3**8 (1): 76-78.
16. Sisler EC, Dagger WM, Gauch HG. The role of Boron in translocation of organic compounds in plants. *Plant Physical*.**1956**, 13: 11-17.
17. Soomro Z H, Baloch PA, Gandhai AW. Comparative effects of foliar and soil applied boron on growth and fodder yield of maize, *Pak JAgriEngg Vet Sci.***2011**,27(1): 18-26.
18. Tahir M, Tanveer A, Shah TH, Fiaz N, Wasaya A. Yield response of wheat (*Triticumaestivum* L.) to boron application to different growth stages. *Pak J life Soc Sci.***2009**, **7**: 39-42.
19. Wojcik M, Klamkowski K. Response of apple trees to boron fertilization under conditions of low soil boron availability. *Sci Hort.***2008**, 116:58-64.