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Viability of *Crassocephalum crepidioides* seeds due to Boron application

To cite this article: M W Lestari *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **475** 012027

Viability of *Crassocephalum crepidioides* seeds due to Boron application

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Abstract. Boron (B) is a microelement that is needed in plant growth, because it plays an important role in the production of grain, increases carbohydrate transport and increases enzyme activity, if it is given in the appropriate amount. This study aimed to determine the concentration of Boron to obtain the best viability of the seeds of *Crassocephalum crepidioides*. The research was conducted at the greenhouse, using Random Block Design. The treatment was the concentration level of Boron, consisting of four levels (0%, 50 mg/L, 100 mg/L, and 150 mg/L), carried out in triplicate. The observed variables included the number of flowers (florets), number of seeds per flower, seed germination (%), speed of seed germination, and growth potential (%). The results showed that the number of flowers and the number of seeds per floret was not significantly different for all treatments tested. Boron concentration of 150 mg/L produces better performance in seed germination, speed of seed germination, and growth potential.

1. Introduction

In Indonesia, *Crassocephalum crepidioides* is known as a weed plant, and nobody has developed it as an indigenous vegetable plant. *Crassocephalum crepidioides* leaves, besides fresh vegetables, are also useful for treating various types of diseases. *Crassocephalum crepidioides* has chemical properties of saponins, flavonoids, and polyphenols, which are efficacious as drugs and other diseases. The content of the *Crassocephalum crepidioides* leaves are flavonoids, polyphenol, and saponins. Stumps also have vitamins A, D, and K. *Crassocephalum crepidioides* is regularly found in plantation lands and grows wild on the edges of the streets. *Crassocephalum crepidioides* Produces seeds in large quantities yet has a low in viability. During the life cycle, the process of seed germination is an important event, which ensures better plant development and survival [1].

Boron (B) is a microelement needed by plants to increase seed viability. Boron is necessary for plants in tiny concentrations [2]. Boron plays a vital role in grain production, increases carbohydrate transportation, flowering, fruit development, increases enzymatic activity, pollen tube germination, cell division, meristematic tissue expansion, flower organ, male flower fertility and seed/fruit formation [3]. Plants that lack boron can cause roots and shoots to stop growing and not form flowers [1,4,5]. Boron application can increase flower production and fruit sets at Solanum L [6]; and tomatoes [7]. Increased boron element given can increase the viability and vigor of soybean and sugarcane seeds [8, 9]. The required boron concentration varies between plant species and even between cultivars of the same species [10, 11].

Boron deficiency and toxicity in the soil causes morphological and physiological changes in plants. Applications 10, 14, 16 and 20 mg B/Kg gave 98 to 100% germination but produced abnormal seeds of 26, 14, 5 and 7%, respectively [12]. The mechanism involved in the tolerance and toxicity of boron, especially in the *Crassocephalum crepidioides*, is still unknown. The purpose of this study was to determine the best of boron concentration to obtain the best viability of the seeds of *Crassocephalum crepidioides.* It is hoped that after obtaining the best viability of the seeds of *Crassocephalum crepidioides.* There will be no more obstacles in the cultivation of *Crassocephalum crepidioides.*

2. Materials and Method

The study was conducted in the greenhouse of Agriculture Faculty, University of Islam Malang, East Java, Indonesia. from July 2018 to November 2018, 550 m above sea level, temperature 20^{o} – 29^{o} C, 112^{o}06’ – 112^{o}07’ East longitude and 7^{o}06’ – 8^{o}02’ North latitude.

2.1. Materials

Seeds of *Crassocephalum crepidioides* were purchased from a local seed distributor and Boron was added as H_3BO_3. The *Crassocephalum crepidioides* were planted in 10 kg polybags size. *Crassocephalum crepidioides* seeds were sown in a medium consisting of a mixture of soil and compost in a ratio of 1:1 until the plant has four leaves, after which the plants were transplanted in a polybag. Boron was applied by spraying leaves in the morning to avoid evaporation. Spraying was done twice, especially when the plant was 2 Week After Planting (WAP) and 4 WAP with the same spray volume for all plant samples.

2.2. Experimental design

The experimental was design using Random Block Design, with factor of the concentration level of Boron, consisting of four levels (0%, 50 mg/L, 100 mg/L, and 150 mg/L). All the treatments were replicated three times. The observed variables included the number of flowers (florets), number of seeds per flower, seed germination (%), speed of seed germination, and growth potential (%).

2.3. Statsitical analysis

The statistical analysis was performed using SPSS v17 statistical software (SPSS Inc., Chicago, IL, USA). The data were expressed as means ± standard error, and means were statistically compared by Duncan’s multiple range test (DMRT) at the $p < 0.05$ % level.

3. Results and Discussion

The boron application did not have a significant effect on the number of flowers and the number of seeds per flower. However, the percentage of seed germination, germination rate, and percentage of potential growth were influenced by boron doses (Figure 1). But on percentage of seed germination, speed of germination, and percentage of growth potential have a significant effect due to various doses of boron (Figure 2).

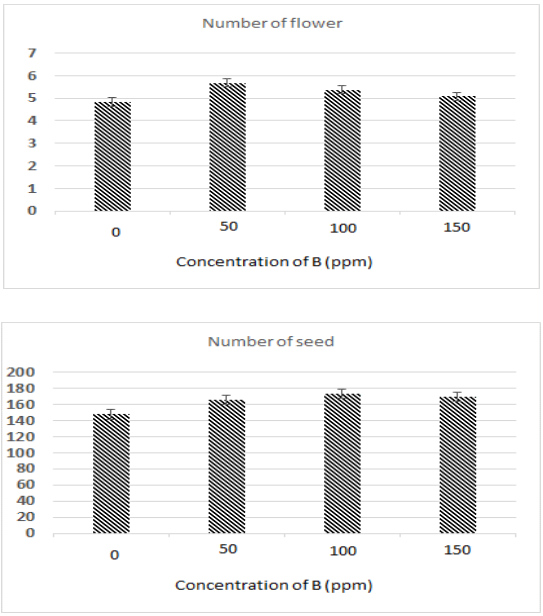

Figure 1. Seed quality (number of flower and number of seed) of *Crassocephalum crepidioides* due to various doses of boron

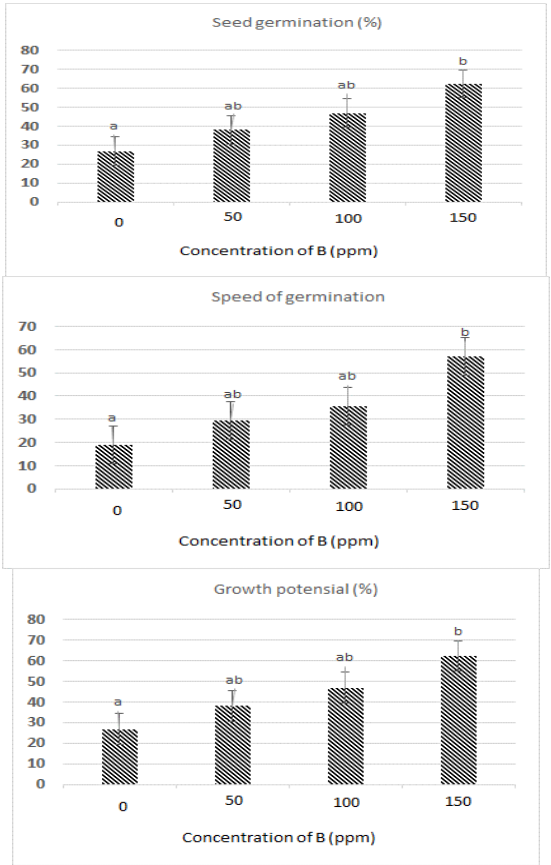

Figure 2. Seed quality (seed germination, speed of germination, and percentage of growth potential) of *Crassocephalum crepidioides* due to various doses of boron

The application of boron shows the percentage of seed germination, the best germination rate, and the percentage of growth potential compared to control. Increased boron doses are followed by an increase in the observed variables. The control treatment (0 ppm) to the dose of boron at 100 ppm showed the percentage of seed germination, germination rate, and percentage of growth potential that were not significantly different. That indicates that a 150 ppm boron dose is sufficient for the development and growth of new cells in the plant meristem. In line with the findings of Yau and Saxena [13] and Muhammad [14], which state that high concentrations of boron reduce the percentage of germination of wheat and corn. Bonilla et al. [15] and Farr [16] report that low boron concentrations can stimulate seed germination and seedling growth, while high levels show inhibitory effects on these parameters [17]. Mirshekari [18] and Cokkizgin [19] reported similar findings, which looked at the *Phaseolus vulgaris* seed vigor index due to the application of high concentrations of boron. Ivanova et al. [20] also reported a decrease in the radish seed bud index with increasing concentrations of boron. Farag and Fang [21] applied 0, 10, 25, 50 and 100 mg B/L for watermelons and found that high boron levels did not significantly affect the seed germination percentage, but increased the time of average germination and germination index.

Boron is an essential micronutrient that regulates various physiological processes in the life cycle of vascular plants, such as cell wall development, carbohydrate metabolism, and RNA [22]. Also, it modulates germination and tube germination growth, plasma membrane integrity, flower fertility, anthers development, and seed development as well [23]. Deficiency of B can cause the failure of grain regulation without affecting its vegetative growth [24]. Therefore, a sufficient amount of B for healthy vegetative growth in wheat can cause inadequate development of anther and pollen during reproductive growth [12]. Figure 3 shows the viability of *Crassocephalum crepidioides* due to various doses of boron.

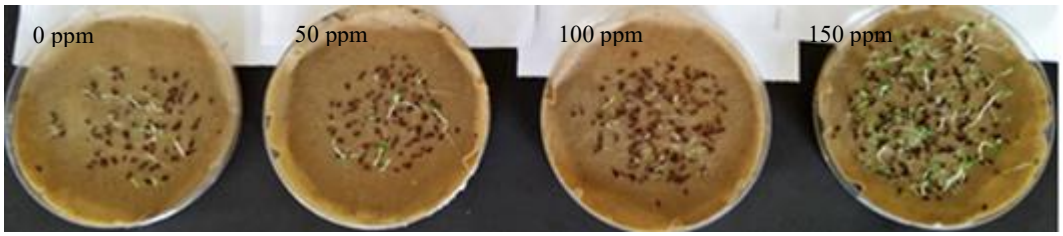

Figure 3. Viability of *Crassocephalum crepidioides* due to various doses of boron

4. Conclusions

The results showed that the number of flowers and the number of seeds per floret was not significantly different for all treatments tested. The application of boron at a dose of 150 mg/L is effective for increasing the viability of the seeds of *Crassocephalum crepidioides* This treatment produces superior performance in seed germination, speed of seed germination, and growth potential.

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