5th International Eurasian Congress on

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Effect of Boron Applications on Soil Enzyme Activity

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Abstract: The fertility of the soil is significantly influenced by the biological properties of the soil apart from the physical and chemical properties of the soil. The enzymes secreted by microorganisms in the soil constitute the biochemical activity of the soil. Microorganism activity in the soil depends on the amount of plant nutrients. For this purpose, acid and alkaline phosphatase enzyme activity in soil were investigated by applying different doses of boron fertilizer. Four different boron doses (0, 0.30, 0.60 and 0.9 kg da^{-1}) were applied to the soils and allowed to incubate for 3 months. As a result of the study, the amount of acid and alkaline phosphatase enzyme in the soil showed significant differences depending on the application dose. The highest alkaline phosphatase was obtained from 0.60 kg da^{-1}, while the highest acid phosphatase enzyme activity was obtained in the control group.

Key words: Boron, enzyme, alkaline phosphatase

1. Introduction

Turkey, due to its geographical location and climate zone in which it found clay and lime content is high, the low organic matter content, places, buildings have broken ground. Such physical, chemical and biological undesirable properties of soils lead to low useful concentrations of nutrients in plants. One of the micro nutrients required for the plant is boron. Significant yield losses occur in boron deficiency.

Boron is more important in terms of generative development than vegetative development in plants. On the other hand, when there is not enough boron in the environment, it is observed that the root elongation declines or stops and the root system becomes dwarf and shrubby. It is also directly related to cell wall synthesis, particularly stem elongation and cell division (Moore and Hirsch, 1983; Ali and Jarvis, 1988).

Taban and Erdal (2000), on the development of different types of wheat boron and boron distribution on plant parts in their greenhouse experiment, 4 different types of bread and durum wheat of boron responses were different, while some of the varieties were found to increase dry weight of some varieties have decreased. In addition, the maximum boron content of all wheat varieties was determined at the leaf tips.

Abid et al. (2014) applied 50, 100 and 200 g boron per hectare and 2.5 ppm boron to the soil in their study to reduce the effect of salinity in calcareous soil conditions. Foliar application of 2.5 ppm boron significantly increased seed yield. 100 and 200 gr da^{-1} B application applied to soil increased seed yield again. In addition, B application reduced the negative effect of salinity.

Şatana (2011) used four different boron and zinc doses (0, 100, 200 and 300 ml da^{-1}) in his study to investigate the effect of boron and zinc fertilization on sugar beet at different times. The highest sugar content (18.8%) was obtained from 200 ml da^{-1} Zn and 100 ml da^{-1} B application on the 180th day and the highest beet yield from 200 ml da^{-1} Zn and B application.

Öztürk et al. (2010) reported that; the amount of boron in soil varies between 10-300 mg kg^{-1} depending on soil type, amount of organic matter and precipitation. Boron significantly increases the yield of some plants. However, the high boron content in irrigation waters, heavily textured clay and high $CaCO_3$ soils leads to decreases in yield.

Therefore, the effects of different doses of boron in the soil on acid and alkaline phosphatase enzyme activity, which have an effect on plant nutrient use, avaliability especially phosphorus avaliability, have been tried to determine.

2. Materials and Methods

The enzymes secreted by microorganisms in the soil constitute the biochemical activity of the soil. For this purpose, acid and alkaline phosphatase enzyme activity in soil were investigated by applying different doses of boron fertilizer. Four different boron doses (0, 0.30, 0.60 and 0.9 kg da^{-1}) were applied to the soils and allowed to incubate for 3 months. At the end of the incubation period, soil samples were taken from each pot and acid phosphatase and alkaline phosphatase enzyme activity were determined.

3. Results and Discussion

The acid and alkaline phosphatase enzyme activity of the soils varied significantly depending on the amount of boron applied at different doses. The highest acid phosphatase enzyme activity was obtained in the control group. Acid phosphatase enzyme activity decreased due to increasing boron doses (Table 1).

When compared with the control group, acid phosphatase enzyme activity decreased by 20% at the highest boron dose.

The highest alkaline phosphatase enzyme activity was obtained from 0.60 kg da^{-1} boron application dose. After this dose, alkaline phosphatase enzyme activity decreased due to increasing boron doses.

When compared with the control group, the alkaline phosphatase enzyme activity increased by 9% at the 0.60 kg da^{-1} boron dose, where the highest alkaline phosphatase enzyme activity was obtained.

Table 1. Effects of different boron doses on acid and alkaline phosphatase enzyme activity

Boron application doses kg da^{-1}	Acid phosphatase	Alkaline phosphatase
	mmol PNP kg^{-1}	
0,00	0,45	0,78
0,30	0,41	0,81
0,60	0,40	0,85
0,90	0,36	0,77

4. Conclusion

In this study, the effect of boron application at different doses on acid and alkaline phosphatase enzyme activity, which is important for phosphorus availability in soil, was determined. Alkaline phosphatase enzyme activity increased due to the amount of boron to be given in the soils where boron deficiency was observed and it was determined that the availability of some plant nutrients in the soil could increase. However, the results of the study should be calibrated with field studies and these studies should be carried out in soils with different characteristics.

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